

Drainage Calculations

Project:	P24-054 Indurent Park, Newport - Units 15-18		
Subject:	Technical Note – Drainage Calculations		
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1 Surface Water Drainage

1.1 Outfall Restrictions and Attenuation

The development phase considered is part of a wider scheme and will have an unrestricted discharge to the as-constructed reën system adjacent to the phase boundary. This is in accordance with the approved “Llanwern Regeneration Site Drainage Strategy” (Halcrow, 2005) and the “Site Wide Surface water Drainage Strategy Addendum” (RLL, 2016). There is no requirement for additional surface water attenuation.

Three surface water networks are proposed to serve the development. One network serves Units 15 and 17, and discharges to the Reen west of the site. A second network serves Units 16 and the proposed access road, and also discharges to the Reen west of the site. The final network serves Unit 18, and discharges to the Reen north of the site.

This technical note should be read in conjunction with Proposed Drainage Strategy Plan (24054-RLL-25-XX-DR-C-0051).

1.2 Design Events

The below ground systems have been assessed for rainfall events up to the 1 in 100 year return period (1% annual exceedance probability event (AEP)) with an additional 40% allowance for climate change. Network modelling indicates there is no surcharge of pipework for the 1 in 2 year return period (50% AEP events) and no flooding at the 1 in 30 year return period (3.3% AEP event). Modelling indicates limited flooding within the site without risk to people or property will occur at the 100 year return period (1% AEP event).

A copy of the hydraulic network modelling results can be found in Appendix A.

1.3 Pollution Prevention

To minimise the risk of contamination from oil and silt in surface water run off from the developed site, enhanced silt removal (ESR) type class 1 separators are specified for the systems which serve service yard and car parking areas.

1.4 Surcharged Outfall

The as-constructed re-en, which is the outfall destination for the surface water system, is designed to surcharge during peak rainfall events. The drainage model calculations appended to this note allow for a surcharged outfall at the level of the 1 in 100 year return period (1% AEP event) of 5.25mAOD.

The outfall structures will include a non-return flap valve and safety grill to prevent unauthorised access.

2 Foul Water Drainage

The proposed foul water drainage will be connected to the existing foul water network installed below the access road adjacent to Units 8-10, in accordance with the sitewide strategy.

Appendix A

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.447	5.00	7.100	1350	336973.677	186825.445	1.350
2			7.100	1350	337009.370	186822.499	1.497
3	0.087	5.00	7.400	1350	337036.206	186820.284	1.907
4			7.400	1350	337034.749	186801.421	1.985
5			7.500	1350	337051.202	186800.063	2.153
6	0.207	5.00	7.600	1500	337050.551	186791.630	2.438
7	0.402	5.00	7.600	1500	337047.688	186754.542	2.531
8	0.207	5.00	7.600	1800	337044.806	186717.205	2.775
9			7.600	1800	337043.984	186706.557	2.802
10			7.400	1800	336984.214	186711.491	2.752
11	0.097	5.00	7.400	1200	337018.358	186704.131	1.425
12	0.099	5.00	7.400	1200	336949.167	186709.843	1.834
13			7.400	1200	336936.204	186710.913	1.911
14			7.400	1800	336936.577	186715.423	2.871
15	0.223	5.00	7.650	1200	336931.396	186800.724	1.450
17	0.122	5.00	7.650	1200	336926.792	186744.981	2.009
18			7.650	1800	336924.444	186716.425	3.151
19	0.233	5.00	7.100	1200	336898.263	186721.133	1.500
20	0.052	5.00	7.100	1200	336867.132	186723.703	1.684
21			7.500	1200	336834.817	186726.370	2.275
22	0.167	5.00	7.500	1350	336836.048	186741.284	2.439
23			7.450	1350	336815.058	186743.004	2.475
24			7.450	1800	336813.604	186725.574	3.173
OUT			6.500	1800	336797.290	186726.921	2.256
16	0.237	5.00	7.650	1200	336929.165	186773.706	1.721

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	1	2	35.814	0.600	5.750	5.603	0.147	243.6	450	5.46	44.0
1.001	2	3	26.927	0.600	5.603	5.493	0.110	244.8	450	5.81	42.8
1.002	3	4	18.919	0.600	5.493	5.415	0.078	242.6	450	6.05	42.0
1.003	4	5	16.509	0.600	5.415	5.347	0.068	242.8	450	6.26	41.4

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	1.298	206.4	53.3	0.900	1.047	0.447	0.0	155	1.095
1.001	1.295	205.9	51.9	1.047	1.457	0.447	0.0	153	1.086
1.002	1.301	206.9	60.7	1.457	1.535	0.534	0.0	167	1.136
1.003	1.300	206.8	59.9	1.535	1.703	0.534	0.0	165	1.130

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)
1.004	5	6	8.458	0.600	5.347	5.312	0.035	241.7	450	6.37	41.1
1.005	6	7	37.198	0.600	5.162	5.069	0.093	400.0	600	6.88	39.6
1.006	7	8	37.448	0.600	5.069	4.975	0.094	400.0	600	7.40	38.3
1.007	8	9	10.680	0.600	4.825	4.798	0.027	400.0	750	7.52	38.0
1.008	9	10	59.973	0.600	4.798	4.648	0.150	400.0	750	8.24	36.3
1.009	10	14	47.799	0.600	4.648	4.529	0.119	400.0	750	8.81	35.1
2.000	11	12	69.426	0.600	5.975	5.566	0.409	169.7	225	6.16	41.7
2.001	12	13	13.007	0.600	5.566	5.489	0.077	168.9	225	6.37	41.1
2.002	13	14	4.525	0.600	5.489	5.054	0.435	10.4	225	6.39	41.0
1.010	14	18	12.174	0.600	4.529	4.499	0.030	400.0	750	8.96	34.8
3.000	15	16	27.110	0.600	6.200	5.929	0.271	100.0	300	5.29	44.6
3.001	16	17	28.823	0.600	5.929	5.641	0.288	100.0	300	5.59	43.5
3.002	17	18	28.652	0.600	5.641	4.949	0.692	41.4	300	5.79	42.9
1.011	18	24	111.217	0.600	4.499	4.277	0.222	500.0	750	10.45	32.2
4.000	19	20	31.237	0.600	5.600	5.416	0.184	169.8	300	5.43	44.1
4.001	20	21	32.425	0.600	5.416	5.225	0.191	169.8	300	5.88	42.5
4.002	21	22	14.965	0.600	5.225	5.136	0.089	168.1	300	6.09	41.9
4.003	22	23	21.060	0.600	5.061	4.975	0.086	244.9	375	6.39	41.0
4.004	23	24	17.491	0.600	4.975	4.652	0.323	54.2	375	6.51	40.7
1.012	24	OUT	16.370	0.600	4.277	4.244	0.033	500.0	750	10.67	31.8

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)
1.004	1.303	207.2	59.4	1.703	1.838	0.534	0.0	164	1.130
1.005	1.211	342.4	79.5	1.838	1.931	0.740	0.0	195	0.994
1.006	1.211	342.4	118.6	1.931	2.025	1.142	0.0	243	1.105
1.007	1.393	615.3	138.9	2.025	2.052	1.349	0.0	241	1.136
1.008	1.393	615.3	132.8	2.052	2.002	1.349	0.0	235	1.121
1.009	1.393	615.3	128.4	2.002	2.121	1.349	0.0	231	1.112
2.000	1.000	39.8	11.0	1.200	1.609	0.097	0.0	80	0.856
2.001	1.003	39.9	21.9	1.609	1.686	0.196	0.0	119	1.026
2.002	4.080	162.2	21.8	1.686	2.121	0.196	0.0	56	2.877
1.010	1.393	615.3	145.8	2.121	2.401	1.545	0.0	247	1.151
3.000	1.572	111.1	27.0	1.150	1.421	0.223	0.0	100	1.304
3.001	1.572	111.1	54.3	1.421	1.709	0.460	0.0	148	1.563
3.002	2.450	173.2	67.7	1.709	2.401	0.582	0.0	130	2.302
1.011	1.244	549.7	185.6	2.401	2.423	2.128	0.0	299	1.128
4.000	1.204	85.1	27.8	1.200	1.384	0.233	0.0	118	1.082
4.001	1.204	85.1	32.8	1.384	1.975	0.284	0.0	129	1.128
4.002	1.209	85.5	32.3	1.975	2.064	0.284	0.0	127	1.127
4.003	1.153	127.4	50.2	2.064	2.100	0.451	0.0	163	1.086
4.004	2.466	272.4	49.8	2.100	2.423	0.451	0.0	108	1.895
1.012	1.244	549.7	222.5	2.423	1.506	2.579	0.0	331	1.182

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US IL (m)	US Depth (m)	DS IL (m)	DS Depth (m)
1.000	35.814	243.6	450	5.750	0.900	5.603	1.047
1.001	26.927	244.8	450	5.603	1.047	5.493	1.457
1.002	18.919	242.6	450	5.493	1.457	5.415	1.535
1.003	16.509	242.8	450	5.415	1.535	5.347	1.703
1.004	8.458	241.7	450	5.347	1.703	5.312	1.838
1.005	37.198	400.0	600	5.162	1.838	5.069	1.931
1.006	37.448	400.0	600	5.069	1.931	4.975	2.025
1.007	10.680	400.0	750	4.825	2.025	4.798	2.052
1.008	59.973	400.0	750	4.798	2.052	4.648	2.002
1.009	47.799	400.0	750	4.648	2.002	4.529	2.121
2.000	69.426	169.7	225	5.975	1.200	5.566	1.609
2.001	13.007	168.9	225	5.566	1.609	5.489	1.686
2.002	4.525	10.4	225	5.489	1.686	5.054	2.121
1.010	12.174	400.0	750	4.529	2.121	4.499	2.401
3.000	27.110	100.0	300	6.200	1.150	5.929	1.421
3.001	28.823	100.0	300	5.929	1.421	5.641	1.709
3.002	28.652	41.4	300	5.641	1.709	4.949	2.401
1.011	111.217	500.0	750	4.499	2.401	4.277	2.423
4.000	31.237	169.8	300	5.600	1.200	5.416	1.384
4.001	32.425	169.8	300	5.416	1.384	5.225	1.975
4.002	14.965	168.1	300	5.225	1.975	5.136	2.064
4.003	21.060	244.9	375	5.061	2.064	4.975	2.100
4.004	17.491	54.2	375	4.975	2.100	4.652	2.423
1.012	16.370	500.0	750	4.277	2.423	4.244	1.506

Link	US Node	DS Node
1.000	1	2
1.001	2	3
1.002	3	4
1.003	4	5
1.004	5	6
1.005	6	7
1.006	7	8
1.007	8	9
1.008	9	10
1.009	10	14
2.000	11	12
2.001	12	13
2.002	13	14
1.010	14	18
3.000	15	16
3.001	16	17
3.002	17	18
1.011	18	24
4.000	19	20
4.001	20	21
4.002	21	22
4.003	22	23
4.004	23	24
1.012	24	OUT

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	0.0		

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 720 | 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 OUT Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to 100yr+40% CC 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 minute storms

Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	1.006	1440	1.006

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	93.298	26.400	30 year 120 minute summer	75.400	19.926
2 year 15 minute winter	65.472	26.400	30 year 120 minute winter	50.094	19.926
2 year 30 minute summer	61.492	17.400	30 year 180 minute summer	59.020	15.188
2 year 30 minute winter	43.152	17.400	30 year 180 minute winter	38.365	15.188
2 year 60 minute summer	42.002	11.100	30 year 240 minute summer	47.046	12.433
2 year 60 minute winter	27.905	11.100	30 year 240 minute winter	31.256	12.433
2 year 120 minute summer	32.350	8.549	30 year 360 minute summer	35.993	9.262
2 year 120 minute winter	21.493	8.549	30 year 360 minute winter	23.397	9.262
2 year 180 minute summer	27.339	7.035	30 year 480 minute summer	28.217	7.457
2 year 180 minute winter	17.771	7.035	30 year 480 minute winter	18.746	7.457
2 year 240 minute summer	22.762	6.015	30 year 720 minute summer	20.341	5.452
2 year 240 minute winter	15.122	6.015	30 year 720 minute winter	13.671	5.452
2 year 360 minute summer	18.229	4.691	30 year 1440 minute summer	11.796	3.161
2 year 360 minute winter	11.849	4.691	30 year 1440 minute winter	7.928	3.161
2 year 480 minute summer	14.688	3.882	100 year +40% CC 15 minute summer	444.919	125.897
2 year 480 minute winter	9.758	3.882	100 year +40% CC 15 minute winter	312.224	125.897
2 year 720 minute summer	10.928	2.929	100 year +40% CC 30 minute summer	301.513	85.318
2 year 720 minute winter	7.345	2.929	100 year +40% CC 30 minute winter	211.588	85.318
2 year 1440 minute summer	6.605	1.770	100 year +40% CC 60 minute summer	208.447	55.086
2 year 1440 minute winter	4.439	1.770	100 year +40% CC 60 minute winter	138.487	55.086
30 year 15 minute summer	254.469	72.006	100 year +40% CC 120 minute summer	130.437	34.471
30 year 15 minute winter	178.574	72.006	100 year +40% CC 120 minute winter	86.660	34.471
30 year 30 minute summer	170.181	48.155	100 year +40% CC 180 minute summer	100.766	25.930
30 year 30 minute winter	119.425	48.155	100 year +40% CC 180 minute winter	65.500	25.930
30 year 60 minute summer	116.894	30.892	100 year +40% CC 240 minute summer	79.783	21.084
30 year 60 minute winter	77.661	30.892	100 year +40% CC 240 minute winter	53.006	21.084

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +40% CC 360 minute summer	60.738	15.630	100 year +40% CC 720 minute summer	34.314	9.197
100 year +40% CC 360 minute winter	39.481	15.630	100 year +40% CC 720 minute winter	23.061	9.197
100 year +40% CC 480 minute summer	47.563	12.570	100 year +40% CC 1440 minute summer	19.977	5.354
100 year +40% CC 480 minute winter	31.600	12.570	100 year +40% CC 1440 minute winter	13.426	5.354

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.04%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	5.912	0.162	53.7	0.2319	0.0000	OK
15 minute winter	2	11	5.767	0.164	52.9	0.2351	0.0000	OK
15 minute winter	3	11	5.680	0.187	62.6	0.2672	0.0000	OK
15 minute winter	4	11	5.603	0.188	62.8	0.2692	0.0000	OK
15 minute winter	5	11	5.532	0.185	62.5	0.2654	0.0000	OK
15 minute winter	6	11	5.382	0.220	85.2	0.3886	0.0000	OK
15 minute winter	7	11	5.329	0.260	129.4	0.4598	0.0000	OK
15 minute winter	8	12	5.106	0.281	148.6	0.7141	0.0000	OK
15 minute winter	9	12	5.057	0.259	147.4	0.6587	0.0000	OK
15 minute winter	10	13	4.916	0.268	149.3	0.6826	0.0000	OK
15 minute winter	11	11	6.056	0.081	11.7	0.0917	0.0000	OK
15 minute winter	12	11	5.692	0.126	23.1	0.1423	0.0000	OK
15 minute winter	13	11	5.554	0.065	22.7	0.0734	0.0000	OK
15 minute winter	14	13	4.861	0.332	162.3	0.8441	0.0000	OK
15 minute winter	15	10	6.299	0.099	26.8	0.1119	0.0000	OK
15 minute winter	17	10	5.779	0.138	68.8	0.1558	0.0000	OK
15 minute winter	18	13	4.828	0.329	215.9	0.8383	0.0000	OK
15 minute winter	19	10	5.722	0.122	28.0	0.1379	0.0000	OK
15 minute winter	20	10	5.551	0.135	33.8	0.1528	0.0000	OK
15 minute winter	21	11	5.365	0.140	33.4	0.1582	0.0000	OK
15 minute winter	22	11	5.230	0.169	52.5	0.2424	0.0000	OK
15 minute winter	23	11	5.094	0.119	52.6	0.1710	0.0000	OK
15 minute winter	24	13	4.639	0.362	258.1	0.9204	0.0000	OK
15 minute winter	OUT	13	4.550	0.306	254.4	0.0000	0.0000	OK
15 minute winter	16	10	6.086	0.157	54.9	0.1775	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	1	1.000	2	52.9	1.025	0.256	1.8499	
15 minute winter	2	1.001	3	52.8	0.923	0.256	1.5411	
15 minute winter	3	1.002	4	62.8	1.006	0.304	1.1816	
15 minute winter	4	1.003	5	62.5	1.005	0.302	1.0264	
15 minute winter	5	1.004	6	61.8	1.086	0.298	0.4835	
15 minute winter	6	1.005	7	84.0	0.803	0.245	3.9177	
15 minute winter	7	1.006	8	126.8	1.185	0.370	4.0149	
15 minute winter	8	1.007	9	147.4	1.046	0.240	1.5209	
15 minute winter	9	1.008	10	149.3	1.106	0.243	8.2081	
15 minute winter	10	1.009	14	144.5	0.880	0.235	7.8646	
15 minute winter	11	2.000	12	11.2	0.636	0.283	1.2390	
15 minute winter	12	2.001	13	22.7	1.420	0.570	0.2100	
15 minute winter	13	2.002	14	22.7	2.632	0.140	0.0391	
15 minute winter	14	1.010	18	163.7	0.879	0.266	2.2754	
15 minute winter	15	3.000	16	26.6	0.927	0.239	0.7798	
15 minute winter	17	3.002	18	68.1	2.250	0.393	0.8677	
15 minute winter	18	1.011	24	215.6	1.089	0.392	22.0298	
15 minute winter	19	4.000	20	27.6	0.959	0.325	0.9001	
15 minute winter	20	4.001	21	33.4	1.069	0.393	1.0192	
15 minute winter	21	4.002	22	33.6	1.099	0.393	0.4575	
15 minute winter	22	4.003	23	52.6	1.346	0.413	0.8264	
15 minute winter	23	4.004	24	52.5	1.839	0.193	0.4997	
15 minute winter	24	1.012	OUT	254.4	1.344	0.463	3.1031	142.9
15 minute winter	16	3.001	17	54.1	1.573	0.487	0.9924	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.04%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	6.057	0.307	146.4	0.4397	0.0000	OK
15 minute winter	2	11	5.936	0.333	144.0	0.4766	0.0000	OK
15 minute winter	3	11	5.869	0.376	167.8	0.5375	0.0000	OK
15 minute winter	4	11	5.784	0.369	167.8	0.5286	0.0000	OK
15 minute winter	5	11	5.698	0.351	166.9	0.5027	0.0000	OK
15 minute winter	6	11	5.615	0.453	229.7	0.8003	0.0000	OK
15 minute winter	7	11	5.555	0.486	351.8	0.8594	0.0000	OK
15 minute winter	8	12	5.365	0.540	412.6	1.3749	0.0000	OK
15 minute winter	9	12	5.312	0.514	410.2	1.3069	0.0000	OK
15 minute winter	10	13	5.259	0.611	395.4	1.5537	0.0000	OK
15 minute winter	11	11	6.123	0.148	31.9	0.1679	0.0000	OK
15 minute winter	12	11	5.914	0.348	63.4	0.3938	0.0000	SURCHARGED
15 minute winter	13	11	5.610	0.121	61.6	0.1372	0.0000	OK
15 minute winter	14	13	5.215	0.686	422.7	1.7454	0.0000	OK
15 minute winter	15	11	6.873	0.673	73.2	0.7607	0.0000	SURCHARGED
15 minute winter	17	11	6.153	0.512	180.3	0.5793	0.0000	SURCHARGED
15 minute winter	18	13	5.178	0.679	581.9	1.7279	0.0000	OK
15 minute winter	19	11	5.899	0.299	76.3	0.3378	0.0000	OK
15 minute winter	20	11	5.743	0.327	91.3	0.3703	0.0000	SURCHARGED
15 minute winter	21	11	5.507	0.282	87.1	0.3192	0.0000	OK
15 minute winter	22	10	5.368	0.307	139.6	0.4397	0.0000	OK
15 minute winter	23	11	5.189	0.214	138.9	0.3064	0.0000	OK
15 minute winter	24	13	4.933	0.656	695.5	1.6690	0.0000	OK
15 minute winter	OUT	13	4.762	0.518	697.6	0.0000	0.0000	OK
15 minute winter	16	11	6.739	0.810	145.9	0.9166	0.0000	SURCHARGED
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	1	1.000	2	144.0	1.226	0.698	4.2598	
15 minute winter	2	1.001	3	141.1	1.072	0.685	3.5969	
15 minute winter	3	1.002	4	167.8	1.210	0.811	2.6544	
15 minute winter	4	1.003	5	166.9	1.238	0.807	2.2453	
15 minute winter	5	1.004	6	166.0	1.401	0.801	1.0414	
15 minute winter	6	1.005	7	227.8	0.980	0.665	8.7966	
15 minute winter	7	1.006	8	348.9	1.588	1.019	8.1802	
15 minute winter	8	1.007	9	410.2	1.306	0.667	3.5292	
15 minute winter	9	1.008	10	395.4	1.282	0.643	21.1309	
15 minute winter	10	1.009	14	364.5	0.950	0.592	19.2611	
15 minute winter	11	2.000	12	31.0	0.839	0.780	2.3449	
15 minute winter	12	2.001	13	61.6	1.765	1.544	0.4005	
15 minute winter	13	2.002	14	61.6	3.255	0.380	0.1079	
15 minute winter	14	1.010	18	413.3	1.022	0.672	5.1206	
15 minute winter	15	3.000	16	68.5	1.068	0.616	1.9091	
15 minute winter	17	3.002	18	177.9	2.606	1.027	2.0172	
15 minute winter	18	1.011	24	574.6	1.388	1.045	46.0158	
15 minute winter	19	4.000	20	74.4	1.145	0.874	2.1986	
15 minute winter	20	4.001	21	87.1	1.270	1.023	2.2564	
15 minute winter	21	4.002	22	86.8	1.359	1.015	0.9504	
15 minute winter	22	4.003	23	138.9	1.702	1.090	1.6990	
15 minute winter	23	4.004	24	139.4	2.291	0.512	1.3017	
15 minute winter	24	1.012	OUT	697.6	1.887	1.269	5.9993	388.0
15 minute winter	16	3.001	17	140.6	1.997	1.265	2.0297	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.04%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	7.100	1.350	255.5	1.9319	26.3732	FLOOD
15 minute summer	2	10	7.100	1.497	217.4	2.1422	2.2240	FLOOD
15 minute winter	3	10	7.087	1.594	201.9	2.2815	0.0000	SURCHARGED
15 minute winter	4	10	7.051	1.636	191.1	2.3406	0.0000	SURCHARGED
15 minute summer	5	10	7.026	1.679	214.8	2.4030	0.0000	SURCHARGED
15 minute summer	6	10	7.007	1.845	305.5	3.2609	0.0000	SURCHARGED
15 minute summer	7	10	6.956	1.887	475.1	3.3344	0.0000	SURCHARGED
15 minute summer	8	10	6.718	1.893	571.2	4.8170	0.0000	SURCHARGED
15 minute summer	9	10	6.650	1.852	568.9	4.7123	0.0000	SURCHARGED
15 minute winter	10	10	6.448	1.800	584.8	4.5799	0.0000	SURCHARGED
15 minute winter	11	10	7.400	1.425	55.7	1.6117	2.4753	FLOOD
15 minute winter	12	10	7.083	1.517	91.7	1.7159	0.0000	SURCHARGED
15 minute winter	13	10	6.558	1.069	89.4	1.2085	0.0000	SURCHARGED
15 minute winter	14	10	6.298	1.769	674.6	4.5022	0.0000	SURCHARGED
15 minute winter	15	9	7.650	1.450	127.7	1.6400	24.6636	FLOOD
15 minute winter	17	10	7.242	1.601	207.3	1.8112	0.0000	SURCHARGED
15 minute winter	18	10	6.202	1.703	864.9	4.3346	0.0000	SURCHARGED
15 minute winter	19	9	7.100	1.500	133.1	1.6965	6.2711	FLOOD
15 minute winter	20	10	6.853	1.437	135.2	1.6256	0.0000	FLOOD RISK
15 minute winter	21	10	6.401	1.176	125.3	1.3305	0.0000	SURCHARGED
15 minute winter	22	10	6.158	1.097	212.8	1.5691	0.0000	SURCHARGED
15 minute winter	23	10	5.823	0.848	211.4	1.2129	0.0000	SURCHARGED
15 minute winter	24	10	5.529	1.252	1076.9	3.1875	0.0000	SURCHARGED
15 minute summer	OUT	1	5.250	1.006	1066.9	0.0000	0.0000	OK
15 minute winter	16	9	7.650	1.721	179.1	1.9465	3.1050	FLOOD

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	1	1.000	2	199.2	1.299	0.965	5.6745	
15 minute summer	2	1.001	3	195.0	1.231	0.947	4.2664	
15 minute winter	3	1.002	4	191.1	1.266	0.924	2.9976	
15 minute winter	4	1.003	5	195.0	1.242	0.943	2.6157	
15 minute summer	5	1.004	6	212.1	1.339	1.024	1.3401	
15 minute summer	6	1.005	7	279.2	0.991	0.815	10.4778	
15 minute summer	7	1.006	8	458.8	1.629	1.340	10.5483	
15 minute summer	8	1.007	9	568.9	1.334	0.925	4.7005	
15 minute summer	9	1.008	10	572.3	1.324	0.930	26.3954	
15 minute winter	10	1.009	14	587.7	1.336	0.955	21.0373	
15 minute winter	11	2.000	12	41.4	1.040	1.040	2.7611	
15 minute winter	12	2.001	13	89.4	2.247	2.241	0.5173	
15 minute winter	13	2.002	14	90.6	3.097	0.558	0.1800	
15 minute winter	14	1.010	18	676.7	1.538	1.100	5.3580	
15 minute winter	15	3.000	16	73.2	1.057	0.659	1.9091	
15 minute winter	17	3.002	18	198.2	2.815	1.145	2.0177	
15 minute winter	18	1.011	24	866.6	1.969	1.576	48.9489	
15 minute winter	19	4.000	20	107.4	1.526	1.263	2.1997	
15 minute winter	20	4.001	21	125.3	1.780	1.473	2.2833	
15 minute winter	21	4.002	22	122.3	1.736	1.430	1.0538	
15 minute winter	22	4.003	23	211.4	1.917	1.660	2.3229	
15 minute winter	23	4.004	24	210.3	1.952	0.772	1.9292	
15 minute winter	24	1.012	OUT	1076.3	2.446	1.958	7.2048	493.2
15 minute winter	16	3.001	17	150.6	2.139	1.355	2.0297	

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.186	5.00	7.650	1200	336932.029	186808.381	1.500
2	0.255	5.00	7.650	1200	336936.172	186858.538	2.003
3			7.350	1200	336940.663	186874.955	1.816
4	0.071	5.00	7.400	1350	336942.799	186900.819	2.071
6	0.123	5.00	7.350	1350	336860.518	186907.609	2.351
7			7.400	1350	336858.778	186887.058	2.483
8	0.222	5.00	7.500	1200	336904.843	186889.393	1.500
12			7.500	1200	336821.590	186896.263	2.385
13			7.400	1350	336821.087	186890.168	2.709
OUT			6.500	1350	336812.970	186890.838	1.836
5	0.055	5.00	7.350	1350	336902.228	186904.167	2.184
10			7.500	1200	336864.702	186892.706	1.953
11	0.052	5.00	7.500	1200	336832.381	186895.373	2.277
9	0.065	5.00	7.500	1200	336863.470	186878.154	1.350

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	1	2	50.328	0.600	6.150	5.647	0.503	100.0	300	5.53	43.8
1.001	2	3	17.020	0.600	5.647	5.534	0.113	150.0	300	5.76	43.0
1.002	3	4	25.952	0.600	5.534	5.404	0.130	200.0	300	6.15	41.7
1.003	4	5	40.709	0.600	5.329	5.166	0.163	250.0	375	6.74	40.0
1.004	5	6	41.852	0.600	5.166	4.999	0.167	250.0	375	7.35	38.4
1.005	6	7	20.625	0.600	4.999	4.917	0.082	250.0	375	7.65	37.7
1.006	7	13	37.819	0.600	4.917	4.766	0.151	250.0	375	8.20	36.4
2.000	8	10	40.277	0.600	6.000	5.597	0.403	100.0	300	5.43	44.1
3.000	9	10	14.604	0.600	6.150	5.747	0.403	36.2	100	5.19	44.9

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	1.572	111.1	22.1	1.200	1.703	0.186	0.0	91	1.235
1.001	1.281	90.6	51.4	1.703	1.516	0.441	0.0	162	1.320
1.002	1.108	78.3	49.9	1.516	1.696	0.441	0.0	174	1.172
1.003	1.141	126.0	55.6	1.696	1.809	0.512	0.0	174	1.106
1.004	1.141	126.0	59.0	1.809	1.976	0.567	0.0	181	1.123
1.005	1.141	126.0	70.5	1.976	2.108	0.690	0.0	200	1.171
1.006	1.141	126.0	68.1	2.108	2.259	0.690	0.0	197	1.163
2.000	1.572	111.1	26.5	1.200	1.603	0.222	0.0	99	1.297
3.000	1.285	10.1	7.9	1.250	1.653	0.065	0.0	67	1.422

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)
2.001	10	11	32.431	0.600	5.547	5.223	0.324	100.0	300	5.77	42.9
2.002	11	12	10.828	0.600	5.223	5.115	0.108	100.0	300	5.89	42.5
2.003	12	13	6.116	0.600	5.115	4.841	0.274	22.3	300	5.92	42.4
1.007	13	OUT	8.145	0.600	4.691	4.664	0.027	300.0	450	8.32	36.2

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)
2.001	1.572	111.1	33.4	1.653	1.977	0.287	0.0	112	1.379
2.002	1.572	111.1	39.1	1.977	2.085	0.339	0.0	123	1.439
2.003	3.342	236.2	39.0	2.085	2.259	0.339	0.0	82	2.489
1.007	1.168	185.8	100.8	2.259	1.386	1.029	0.0	236	1.190

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US IL (m)	US Depth (m)	DS IL (m)	DS Depth (m)
1.000	50.328	100.0	300	6.150	1.200	5.647	1.703
1.001	17.020	150.0	300	5.647	1.703	5.534	1.516
1.002	25.952	200.0	300	5.534	1.516	5.404	1.696
1.003	40.709	250.0	375	5.329	1.696	5.166	1.809
1.004	41.852	250.0	375	5.166	1.809	4.999	1.976
1.005	20.625	250.0	375	4.999	1.976	4.917	2.108
1.006	37.819	250.0	375	4.917	2.108	4.766	2.259
2.000	40.277	100.0	300	6.000	1.200	5.597	1.603
3.000	14.604	36.2	100	6.150	1.250	5.747	1.653
2.001	32.431	100.0	300	5.547	1.653	5.223	1.977
2.002	10.828	100.0	300	5.223	1.977	5.115	2.085
2.003	6.116	22.3	300	5.115	2.085	4.841	2.259
1.007	8.145	300.0	450	4.691	2.259	4.664	1.386

Link	US Node	DS Node
1.000	1	2
1.001	2	3
1.002	3	4
1.003	4	5
1.004	5	6
1.005	6	7
1.006	7	13
2.000	8	10
3.000	9	10
2.001	10	11
2.002	11	12
2.003	12	13
1.007	13	OUT

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	0.0		

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 720 | 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 OUT Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m ²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to 100yr+40% CC 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 minute storms

Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.586	1440	0.586

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	93.298	26.400	30 year 240 minute summer	47.046	12.433
2 year 15 minute winter	65.472	26.400	30 year 240 minute winter	31.256	12.433
2 year 30 minute summer	61.492	17.400	30 year 360 minute summer	35.993	9.262
2 year 30 minute winter	43.152	17.400	30 year 360 minute winter	23.397	9.262
2 year 60 minute summer	42.002	11.100	30 year 480 minute summer	28.217	7.457
2 year 60 minute winter	27.905	11.100	30 year 480 minute winter	18.746	7.457
2 year 120 minute summer	32.350	8.549	30 year 720 minute summer	20.341	5.452
2 year 120 minute winter	21.493	8.549	30 year 720 minute winter	13.671	5.452
2 year 180 minute summer	27.339	7.035	30 year 1440 minute summer	11.796	3.161
2 year 180 minute winter	17.771	7.035	30 year 1440 minute winter	7.928	3.161
2 year 240 minute summer	22.762	6.015	100 year +40% CC 15 minute summer	444.919	125.897
2 year 240 minute winter	15.122	6.015	100 year +40% CC 15 minute winter	312.224	125.897
2 year 360 minute summer	18.229	4.691	100 year +40% CC 30 minute summer	301.513	85.318
2 year 360 minute winter	11.849	4.691	100 year +40% CC 30 minute winter	211.588	85.318
2 year 480 minute summer	14.688	3.882	100 year +40% CC 60 minute summer	208.447	55.086
2 year 480 minute winter	9.758	3.882	100 year +40% CC 60 minute winter	138.487	55.086
2 year 720 minute summer	10.928	2.929	100 year +40% CC 120 minute summer	130.437	34.471
2 year 720 minute winter	7.345	2.929	100 year +40% CC 120 minute winter	86.660	34.471
2 year 1440 minute summer	6.605	1.770	100 year +40% CC 180 minute summer	100.766	25.930
2 year 1440 minute winter	4.439	1.770	100 year +40% CC 180 minute winter	65.500	25.930
30 year 15 minute summer	254.469	72.006	100 year +40% CC 240 minute summer	79.783	21.084
30 year 15 minute winter	178.574	72.006	100 year +40% CC 240 minute winter	53.006	21.084
30 year 30 minute summer	170.181	48.155	100 year +40% CC 360 minute summer	60.738	15.630
30 year 30 minute winter	119.425	48.155	100 year +40% CC 360 minute winter	39.481	15.630
30 year 60 minute summer	116.894	30.892	100 year +40% CC 480 minute summer	47.563	12.570
30 year 60 minute winter	77.661	30.892	100 year +40% CC 480 minute winter	31.600	12.570
30 year 120 minute summer	75.400	19.926	100 year +40% CC 720 minute summer	34.314	9.197
30 year 120 minute winter	50.094	19.926	100 year +40% CC 720 minute winter	23.061	9.197
30 year 180 minute summer	59.020	15.188	100 year +40% CC 1440 minute summer	19.977	5.354
30 year 180 minute winter	38.365	15.188	100 year +40% CC 1440 minute winter	13.426	5.354

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	6.240	0.090	22.4	0.1015	0.0000	OK
15 minute winter	2	11	5.827	0.180	52.6	0.2038	0.0000	OK
15 minute winter	3	11	5.722	0.188	51.2	0.2131	0.0000	OK
15 minute winter	4	11	5.518	0.189	59.6	0.2705	0.0000	OK
15 minute winter	6	12	5.232	0.233	77.8	0.3337	0.0000	OK
15 minute winter	7	12	5.139	0.222	77.3	0.3175	0.0000	OK
15 minute winter	8	10	6.101	0.101	26.7	0.1145	0.0000	OK
15 minute winter	12	11	5.208	0.093	39.9	0.1053	0.0000	OK
15 minute winter	13	12	4.966	0.275	114.0	0.3940	0.0000	OK
15 minute winter	OUT	12	4.900	0.236	114.2	0.0000	0.0000	OK
15 minute winter	5	11	5.363	0.197	65.7	0.2819	0.0000	OK
15 minute winter	10	10	5.662	0.115	33.6	0.1300	0.0000	OK
15 minute winter	11	11	5.359	0.136	39.5	0.1536	0.0000	OK
15 minute winter	9	10	6.219	0.069	7.8	0.0779	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	1	1.000	2	22.0	0.717	0.198	1.5556	
15 minute winter	2	1.001	3	51.2	1.142	0.566	0.7724	
15 minute winter	3	1.002	4	51.6	1.156	0.659	1.1577	
15 minute winter	4	1.003	5	59.5	1.042	0.472	2.3262	
15 minute winter	6	1.005	7	77.3	1.107	0.613	1.4425	
15 minute winter	7	1.006	13	77.0	1.198	0.611	2.4332	
15 minute winter	8	2.000	10	26.0	1.278	0.234	0.8214	
15 minute winter	12	2.003	13	40.1	2.142	0.170	0.1375	
15 minute winter	13	1.007	OUT	114.2	1.229	0.615	0.7564	57.1
15 minute winter	5	1.004	6	64.7	0.992	0.514	2.7281	
15 minute winter	10	2.001	11	33.6	1.208	0.303	0.9032	
15 minute winter	11	2.002	12	39.9	1.618	0.359	0.2684	
15 minute winter	9	3.000	10	7.7	1.372	0.759	0.0815	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	7.266	1.116	61.0	1.2625	0.0000	SURCHARGED
15 minute winter	2	12	7.145	1.498	131.1	1.6944	0.0000	SURCHARGED
15 minute winter	3	12	6.870	1.336	125.6	1.5114	0.0000	SURCHARGED
15 minute winter	4	12	6.472	1.143	142.2	1.6358	0.0000	SURCHARGED
15 minute winter	6	12	5.907	0.908	188.7	1.2999	0.0000	SURCHARGED
15 minute winter	7	12	5.643	0.726	189.8	1.0394	0.0000	SURCHARGED
15 minute winter	8	10	6.184	0.184	72.7	0.2079	0.0000	OK
15 minute winter	12	11	5.321	0.206	104.6	0.2330	0.0000	OK
15 minute winter	13	12	5.217	0.526	289.5	0.7529	0.0000	SURCHARGED
15 minute winter	OUT	12	5.040	0.376	290.1	0.0000	0.0000	OK
15 minute winter	5	12	6.223	1.057	155.8	1.5123	0.0000	SURCHARGED
15 minute winter	10	11	5.764	0.217	87.6	0.2460	0.0000	OK
15 minute winter	11	11	5.486	0.263	104.4	0.2976	0.0000	OK
15 minute winter	9	12	7.261	1.111	21.2	1.2562	0.0000	FLOOD RISK

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	1	1.000	2	52.5	0.819	0.473	3.5441	
15 minute winter	2	1.001	3	125.6	1.784	1.387	1.1985	
15 minute winter	3	1.002	4	121.8	1.729	1.555	1.8275	
15 minute winter	4	1.003	5	141.8	1.286	1.125	4.4901	
15 minute winter	6	1.005	7	189.8	1.721	1.506	2.2749	
15 minute winter	7	1.006	13	190.5	1.728	1.512	4.1713	
15 minute winter	8	2.000	10	71.1	1.640	0.640	1.7540	
15 minute winter	12	2.003	13	104.0	2.263	0.440	0.3731	
15 minute winter	13	1.007	OUT	290.1	1.848	1.561	1.2222	155.4
15 minute winter	5	1.004	6	157.2	1.425	1.247	4.6162	
15 minute winter	10	2.001	11	88.3	1.460	0.795	1.9490	
15 minute winter	11	2.002	12	104.6	1.832	0.941	0.6338	
15 minute winter	9	3.000	10	17.7	2.267	1.757	0.1131	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	15	7.650	1.500	85.3	1.6965	23.1737	FLOOD
15 minute winter	2	9	7.650	2.003	171.1	2.2654	5.2386	FLOOD
15 minute winter	3	9	7.350	1.816	142.4	2.0539	5.8459	FLOOD
15 minute winter	4	10	7.119	1.790	150.1	2.5622	0.0000	FLOOD RISK
15 minute winter	6	10	6.560	1.561	234.0	2.2334	0.0000	SURCHARGED
15 minute winter	7	10	6.159	1.242	233.0	1.7775	0.0000	SURCHARGED
15 minute winter	8	11	7.343	1.343	126.8	1.5192	0.0000	FLOOD RISK
15 minute winter	12	11	5.805	0.690	163.1	0.7806	0.0000	SURCHARGED
15 minute winter	13	11	5.531	0.840	394.1	1.2019	0.0000	SURCHARGED
15 minute summer	OUT	1	5.250	0.586	386.2	0.0000	0.0000	OK
15 minute winter	5	10	6.901	1.735	170.3	2.4822	0.0000	SURCHARGED
15 minute winter	10	11	6.772	1.225	134.4	1.3856	0.0000	SURCHARGED
15 minute winter	11	11	6.185	0.962	162.6	1.0876	0.0000	SURCHARGED
15 minute winter	9	9	7.500	1.350	37.0	1.5269	5.1664	FLOOD

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.000	2	52.2	0.801	0.469	3.5441	
15 minute winter	2	1.001	3	142.4	2.022	1.572	1.1985	
15 minute winter	3	1.002	4	123.6	1.755	1.578	1.8275	
15 minute winter	4	1.003	5	145.3	1.318	1.153	4.4901	
15 minute winter	6	1.005	7	233.0	2.113	1.849	2.2749	
15 minute winter	7	1.006	13	232.1	2.104	1.841	4.1713	
15 minute winter	8	2.000	10	121.4	1.724	1.093	2.8363	
15 minute winter	12	2.003	13	163.2	2.318	0.691	0.4307	
15 minute winter	13	1.007	OUT	394.5	2.490	2.123	1.2905	221.6
15 minute winter	5	1.004	6	167.1	1.515	1.326	4.6162	
15 minute winter	10	2.001	11	134.5	1.910	1.211	2.2838	
15 minute winter	11	2.002	12	163.1	2.316	1.468	0.7625	
15 minute winter	9	3.000	10	17.6	2.245	1.740	0.1143	

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.173	5.00	7.500	1200	337036.913	186856.932	1.600
3			7.500	1350	336958.055	186863.452	2.114
5	0.059	5.00	7.500	1350	336962.735	186920.057	2.447
6	0.467	5.00	7.400	1350	336958.515	186953.315	2.459
7	0.125	5.00	7.400	1350	336962.846	187005.698	2.634
8			7.400	1350	336963.981	187019.425	2.680
9	0.291	5.00	7.550	1350	337055.061	186861.053	1.800
10	0.567	5.00	7.550	1500	337022.678	186863.680	2.098
11	0.291	5.00	7.700	1500	336987.972	186866.495	2.364
12			7.550	1500	336961.028	186868.680	2.304
13			7.100	1500	336967.228	186943.662	2.105
14			7.100	1800	336973.428	187018.644	2.712
15			7.150	1800	336983.225	187028.894	2.797
OUT			6.500	1800	336984.641	187046.016	2.190
2			7.500	1200	337001.516	186859.859	1.797
4	0.129	5.00	7.450	1350	336959.882	186885.557	2.165

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	1	2	35.518	0.600	5.900	5.703	0.197	180.3	300	5.51	43.8
1.001	2	3	43.609	0.600	5.703	5.461	0.242	180.2	300	6.13	41.8
1.002	3	4	22.180	0.600	5.386	5.285	0.101	219.6	375	6.43	40.9
1.003	4	5	34.618	0.600	5.285	5.128	0.157	220.5	375	6.91	39.5
1.004	5	6	33.525	0.600	5.053	4.941	0.112	299.3	450	7.39	38.3
1.005	6	7	52.562	0.600	4.941	4.766	0.175	300.4	450	8.14	36.5
1.006	7	8	13.774	0.600	4.766	4.720	0.046	299.4	450	8.33	36.1
1.007	8	14	9.479	0.600	4.720	4.688	0.032	296.2	450	8.47	35.9

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	1.168	82.5	20.5	1.300	1.497	0.173	0.0	102	0.974
1.001	1.168	82.5	19.6	1.497	1.739	0.173	0.0	99	0.963
1.002	1.218	134.6	19.2	1.739	1.790	0.173	0.0	95	0.871
1.003	1.216	134.3	32.3	1.790	1.997	0.302	0.0	125	1.007
1.004	1.170	186.0	37.4	1.997	2.009	0.360	0.0	136	0.921
1.005	1.168	185.7	81.9	2.009	2.184	0.827	0.0	209	1.132
1.006	1.169	186.0	93.2	2.184	2.230	0.952	0.0	225	1.170
1.007	1.176	187.0	92.5	2.230	1.962	0.952	0.0	224	1.173

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)
2.000	9	10	32.489	0.600	5.750	5.602	0.148	219.5	450	5.40	44.2
2.001	10	11	34.820	0.600	5.452	5.336	0.116	300.2	600	5.81	42.8
2.002	11	12	27.032	0.600	5.336	5.246	0.090	300.4	600	6.13	41.8
2.003	12	13	75.238	0.600	5.246	4.995	0.251	299.8	600	7.03	39.2
2.004	13	14	75.238	0.600	4.995	4.538	0.457	164.6	600	7.69	37.6
1.008	14	15	14.179	0.600	4.388	4.353	0.035	405.1	750	8.64	35.5
1.009	15	OUT	17.180	0.600	4.353	4.310	0.043	399.5	750	8.84	35.1

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)
2.000	1.368	217.5	34.9	1.350	1.498	0.291	0.0	121	1.012
2.001	1.400	395.8	99.5	1.498	1.764	0.858	0.0	204	1.175
2.002	1.400	395.7	130.1	1.764	1.704	1.149	0.0	236	1.260
2.003	1.401	396.1	122.1	1.704	1.505	1.149	0.0	228	1.240
2.004	1.895	535.8	117.1	1.505	1.962	1.149	0.0	190	1.532
1.008	1.384	611.4	202.1	1.962	2.047	2.101	0.0	296	1.248
1.009	1.394	615.6	199.7	2.047	1.440	2.101	0.0	293	1.251

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US IL (m)	US Depth (m)	DS IL (m)	DS Depth (m)
1.000	35.518	180.3	300	5.900	1.300	5.703	1.497
1.001	43.609	180.2	300	5.703	1.497	5.461	1.739
1.002	22.180	219.6	375	5.386	1.739	5.285	1.790
1.003	34.618	220.5	375	5.285	1.790	5.128	1.997
1.004	33.525	299.3	450	5.053	1.997	4.941	2.009
1.005	52.562	300.4	450	4.941	2.009	4.766	2.184
1.006	13.774	299.4	450	4.766	2.184	4.720	2.230
1.007	9.479	296.2	450	4.720	2.230	4.688	1.962
2.000	32.489	219.5	450	5.750	1.350	5.602	1.498
2.001	34.820	300.2	600	5.452	1.498	5.336	1.764
2.002	27.032	300.4	600	5.336	1.764	5.246	1.704
2.003	75.238	299.8	600	5.246	1.704	4.995	1.505
2.004	75.238	164.6	600	4.995	1.505	4.538	1.962

Link	US Node	DS Node
1.000	1	2
1.001	2	3
1.002	3	4
1.003	4	5
1.004	5	6
1.005	6	7
1.006	7	8
1.007	8	14
2.000	9	10
2.001	10	11
2.002	11	12
2.003	12	13
2.004	13	14

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US IL (m)	US Depth (m)	DS IL (m)	DS Depth (m)
1.008	14.179	405.1	750	4.388	1.962	4.353	2.047
1.009	17.180	399.5	750	4.353	2.047	4.310	1.440

Link	US Node	DS Node
1.008	14	15
1.009	15	OUT

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	0.0		

Storm Durations

15	30	60	120	180	240	360	480	720	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 OUT Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to 100yr+40% CC 15, 30, 60, 120, 180, 240, 360, 480, 720, 1440 minute storms

Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.940	1440	0.940

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	93.298	26.400	2 year 480 minute summer	14.688	3.882
2 year 15 minute winter	65.472	26.400	2 year 480 minute winter	9.758	3.882
2 year 30 minute summer	61.492	17.400	2 year 720 minute summer	10.928	2.929
2 year 30 minute winter	43.152	17.400	2 year 720 minute winter	7.345	2.929
2 year 60 minute summer	42.002	11.100	2 year 1440 minute summer	6.605	1.770
2 year 60 minute winter	27.905	11.100	2 year 1440 minute winter	4.439	1.770
2 year 120 minute summer	32.350	8.549	30 year 15 minute summer	254.469	72.006
2 year 120 minute winter	21.493	8.549	30 year 15 minute winter	178.574	72.006
2 year 180 minute summer	27.339	7.035	30 year 30 minute summer	170.181	48.155
2 year 180 minute winter	17.771	7.035	30 year 30 minute winter	119.425	48.155
2 year 240 minute summer	22.762	6.015	30 year 60 minute summer	116.894	30.892
2 year 240 minute winter	15.122	6.015	30 year 60 minute winter	77.661	30.892
2 year 360 minute summer	18.229	4.691	30 year 120 minute summer	75.400	19.926
2 year 360 minute winter	11.849	4.691	30 year 120 minute winter	50.094	19.926

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 180 minute summer	59.020	15.188	100 year +40% CC 60 minute summer	208.447	55.086
30 year 180 minute winter	38.365	15.188	100 year +40% CC 60 minute winter	138.487	55.086
30 year 240 minute summer	47.046	12.433	100 year +40% CC 120 minute summer	130.437	34.471
30 year 240 minute winter	31.256	12.433	100 year +40% CC 120 minute winter	86.660	34.471
30 year 360 minute summer	35.993	9.262	100 year +40% CC 180 minute summer	100.766	25.930
30 year 360 minute winter	23.397	9.262	100 year +40% CC 180 minute winter	65.500	25.930
30 year 480 minute summer	28.217	7.457	100 year +40% CC 240 minute summer	79.783	21.084
30 year 480 minute winter	18.746	7.457	100 year +40% CC 240 minute winter	53.006	21.084
30 year 720 minute summer	20.341	5.452	100 year +40% CC 360 minute summer	60.738	15.630
30 year 720 minute winter	13.671	5.452	100 year +40% CC 360 minute winter	39.481	15.630
30 year 1440 minute summer	11.796	3.161	100 year +40% CC 480 minute summer	47.563	12.570
30 year 1440 minute winter	7.928	3.161	100 year +40% CC 480 minute winter	31.600	12.570
100 year +40% CC 15 minute summer	444.919	125.897	100 year +40% CC 720 minute summer	34.314	9.197
100 year +40% CC 15 minute winter	312.224	125.897	100 year +40% CC 720 minute winter	23.061	9.197
100 year +40% CC 30 minute summer	301.513	85.318	100 year +40% CC 1440 minute summer	19.977	5.354
100 year +40% CC 30 minute winter	211.588	85.318	100 year +40% CC 1440 minute winter	13.426	5.354

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.78%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	6.005	0.105	20.8	0.1185	0.0000	OK
15 minute winter	3	11	5.484	0.098	20.0	0.1398	0.0000	OK
15 minute winter	5	11	5.198	0.145	40.2	0.2079	0.0000	OK
15 minute winter	6	11	5.171	0.230	92.2	0.3292	0.0000	OK
15 minute winter	7	11	5.041	0.275	105.6	0.3935	0.0000	OK
15 minute winter	8	12	4.979	0.259	103.3	0.3709	0.0000	OK
15 minute winter	9	10	5.874	0.124	35.0	0.1780	0.0000	OK
15 minute winter	10	10	5.674	0.222	102.1	0.3926	0.0000	OK
15 minute winter	11	11	5.595	0.259	135.5	0.4571	0.0000	OK
15 minute winter	12	11	5.491	0.245	134.8	0.4337	0.0000	OK
15 minute winter	13	12	5.203	0.208	135.3	0.3669	0.0000	OK
15 minute winter	14	12	4.758	0.370	239.5	0.9422	0.0000	OK
15 minute winter	15	12	4.694	0.341	238.2	0.8678	0.0000	OK
15 minute winter	OUT	12	4.605	0.295	236.3	0.0000	0.0000	OK
15 minute winter	2	11	5.805	0.102	20.5	0.1159	0.0000	OK
15 minute winter	4	11	5.417	0.132	34.4	0.1890	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	1	1.000	2	20.5	0.971	0.248	0.7509	
15 minute winter	3	1.002	4	19.8	0.700	0.148	0.6366	
15 minute winter	5	1.004	6	40.0	0.677	0.215	2.1076	
15 minute winter	6	1.005	7	91.5	0.999	0.493	4.8089	
15 minute winter	7	1.006	8	103.3	1.058	0.555	1.3471	
15 minute winter	8	1.007	14	104.0	1.198	0.556	0.8226	
15 minute winter	9	2.000	10	34.1	0.998	0.157	1.1185	
15 minute winter	10	2.001	11	100.6	0.958	0.254	3.6578	
15 minute winter	11	2.002	12	134.8	1.201	0.341	3.0362	
15 minute winter	12	2.003	13	135.3	1.419	0.341	7.2772	
15 minute winter	13	2.004	14	135.4	1.512	0.253	6.7787	
15 minute winter	14	1.008	15	238.2	1.159	0.390	2.9153	
15 minute winter	15	1.009	OUT	236.3	1.335	0.384	3.0529	115.8
15 minute winter	2	1.001	3	20.0	0.962	0.243	0.9079	
15 minute winter	4	1.003	5	33.6	1.009	0.250	1.1607	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.78%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	6.091	0.191	56.6	0.2155	0.0000	OK
15 minute winter	3	11	5.874	0.488	53.1	0.6982	0.0000	SURCHARGED
15 minute winter	5	11	5.825	0.772	109.3	1.1046	0.0000	SURCHARGED
15 minute winter	6	11	5.753	0.812	239.5	1.1617	0.0000	SURCHARGED
15 minute winter	7	11	5.408	0.642	273.9	0.9181	0.0000	SURCHARGED
15 minute winter	8	11	5.230	0.510	272.3	0.7292	0.0000	SURCHARGED
15 minute winter	9	10	5.974	0.224	95.4	0.3204	0.0000	OK
15 minute winter	10	11	5.912	0.460	279.4	0.8121	0.0000	OK
15 minute winter	11	11	5.842	0.506	365.2	0.8946	0.0000	OK
15 minute winter	12	11	5.704	0.458	361.6	0.8091	0.0000	OK
15 minute winter	13	11	5.365	0.370	363.1	0.6543	0.0000	OK
15 minute winter	14	12	5.071	0.683	625.4	1.7382	0.0000	OK
15 minute winter	15	12	4.957	0.604	628.5	1.5374	0.0000	OK
15 minute winter	OUT	12	4.803	0.493	630.5	0.0000	0.0000	OK
15 minute winter	2	12	5.953	0.250	55.7	0.2829	0.0000	OK
15 minute winter	4	11	5.898	0.613	94.8	0.8768	0.0000	SURCHARGED
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	1	1.000	2	55.7	1.216	0.675	1.7850	
15 minute winter	3	1.002	4	70.6	0.754	0.525	2.4464	
15 minute winter	5	1.004	6	122.3	0.774	0.657	5.3118	
15 minute winter	6	1.005	7	235.5	1.487	1.268	8.3281	
15 minute winter	7	1.006	8	272.3	1.719	1.464	2.1824	
15 minute winter	8	1.007	14	269.6	1.730	1.442	1.4322	
15 minute winter	9	2.000	10	93.9	1.086	0.432	3.1394	
15 minute winter	10	2.001	11	269.8	1.126	0.682	8.4498	
15 minute winter	11	2.002	12	361.6	1.504	0.914	6.5482	
15 minute winter	12	2.003	13	363.1	1.750	0.917	15.5477	
15 minute winter	13	2.004	14	361.3	1.601	0.674	16.7560	
15 minute winter	14	1.008	15	628.5	1.563	1.028	5.6781	
15 minute winter	15	1.009	OUT	630.5	1.828	1.024	5.8980	316.4
15 minute winter	2	1.001	3	53.1	1.215	0.644	2.9040	
15 minute winter	4	1.003	5	98.3	1.089	0.732	3.8183	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.78%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	7.500	1.600	98.8	1.8096	10.8354	FLOOD
15 minute summer	3	10	7.467	2.081	73.0	2.9783	0.0000	FLOOD RISK
15 minute winter	5	10	7.423	2.370	145.0	3.3914	0.0000	FLOOD RISK
15 minute winter	6	10	7.394	2.453	365.2	3.5105	0.0000	FLOOD RISK
15 minute winter	7	10	6.574	1.808	438.5	2.5874	0.0000	SURCHARGED
15 minute winter	8	10	6.117	1.397	439.1	1.9998	0.0000	SURCHARGED
15 minute winter	9	10	7.550	1.800	166.6	2.5758	7.0478	FLOOD
15 minute winter	10	10	7.515	2.063	438.5	3.6450	0.0000	FLOOD RISK
15 minute summer	11	10	7.334	1.998	579.7	3.5300	0.0000	SURCHARGED
15 minute summer	12	10	7.036	1.790	581.1	3.1634	0.0000	SURCHARGED
15 minute summer	13	10	6.387	1.392	582.5	2.4590	0.0000	SURCHARGED
15 minute winter	14	10	5.741	1.353	1025.2	3.4446	0.0000	SURCHARGED
15 minute winter	15	10	5.506	1.153	1026.5	2.9340	0.0000	SURCHARGED
15 minute summer	OUT	1	5.250	0.940	1003.7	0.0000	0.0000	OK
15 minute summer	2	10	7.482	1.779	67.2	2.0116	0.0000	FLOOD RISK
15 minute winter	4	10	7.450	2.165	117.0	3.0981	3.4880	FLOOD

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	1	1.000	2	73.5	1.248	0.890	2.5012	
15 minute summer	3	1.002	4	87.0	0.789	0.647	2.4464	
15 minute winter	5	1.004	6	155.8	0.983	0.838	5.3118	
15 minute winter	6	1.005	7	367.3	2.319	1.978	8.3281	
15 minute winter	7	1.006	8	439.1	2.772	2.361	2.1824	
15 minute winter	8	1.007	14	439.7	2.776	2.352	1.5019	
15 minute winter	9	2.000	10	141.5	1.079	0.651	5.1477	
15 minute winter	10	2.001	11	421.8	1.498	1.066	9.8080	
15 minute summer	11	2.002	12	581.1	2.063	1.468	7.6143	
15 minute summer	12	2.003	13	582.5	2.068	1.470	21.1928	
15 minute summer	13	2.004	14	581.1	2.063	1.085	21.1928	
15 minute winter	14	1.008	15	1026.5	2.332	1.679	6.2405	
15 minute winter	15	1.009	OUT	1027.2	2.334	1.669	7.5613	487.6
15 minute summer	2	1.001	3	73.0	1.158	0.884	3.0709	
15 minute winter	4	1.003	5	128.1	1.162	0.954	3.8183	