



X781 – Land at Coldharbour Farm Road, Emsworth

Response to Hampshire County Council comments SWM/2020/0048

For Telstar Ltd

25th February 2020

This note and accompanying drawing and calculations address comments made by Hampshire County Council in their consultation response to Havant Borough Council planning application reference APP/19/01226.

Flooding from the West Brook

The Environment Agency (EA) has provided a positive response to the planning application and recommended a suggested condition (their reference HA/2020/121974/01-01).

Existing drain

The feature identified as a drain on some mapping is not evident as an open or flowing watercourse (the topographical survey lists the feature as a culvert, but this may be an assumption based on the lack of an open feature being present). As discussed in the FRA there is no visible connection between the drain/channel and the West Brook. The feature ends/peters out several metres from the southern site boundary. Historical mapping suggests that prior to it being severed (by the A27) it may have performed a local land drainage and/or field boundary function.

Notwithstanding the above, the increase in potential storage volume of 1,700 m³ being achieved with the proposed flood management works will offset any loss in volume associated with removing the potential storage volume offered in the drain.

Surface water management calculations

If the outfall were to be locked for the entire duration of the 1 in 100 design storm plus 40 % it would surcharge at the lowest point of the system (at approximately 6.75 m AOD) and flow eastwards, into the floodplain. For information, the proposed scheme provides enough storage for the 2160 minute duration 1 in 100 storm plus 40 % assuming no outfall.

The proposal treats the Q1 rate (the annual greenfield rate) as the maximum discharge rate during the 1 in 100 annual probability event plus 40 % climate change. More common storms would therefore be limited to less than the annual greenfield rate. The appended Flow report includes runs of the 1 in 100 plus 40 %, the 1 in 30, and the 1 in 2 (the 1 in 2 being the lowest return period supported by Flow when using FEH13 data).

Taking this opportunity to rationalise the system, the submitted calculations use taller crates (3 layers of 520 mm high units instead of 400 mm units). This allows for fewer crate locations. The appended revised surface water drawing reflects the change.

Flood water entry through the outlet will be prevented with a flap valve.



Storage location

The removal of permeable paving at a later date would not decrease the amount of modelled surface water storage. Neither set of calculations (i.e. those originally submitted or the revised set appended to this note) allows for any storage within the make-up of the permeable paving.

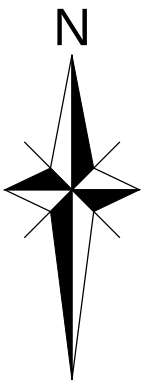
The crate storage will form part of the shared maintenance regime for the scheme with no individual home-owner being solely responsible for any one facility. The presence of crates, the surface water management scheme as a whole (as well as information about the flood management basin, modelled flood levels etc) will be identified as part of the sales pack for each home.

Appended information

Drawing X781-PL-SK-304 P02

Causeway Flow results

Causeway Flow results – locked outfall 2160 minute storm



- KEY
- APPROXIMATE SITE BOUNDARY
 - 3 x 0.5m HIGH STORMCELL
CELLULAR STORAGE OR SIMILAR
APPROVED
 - 2 x 0.5m HIGH STORMCELL
CELLULAR STORAGE OR SIMILAR
APPROVED
 - 450mm TANK SEWER AT 1:500
 - ORIFICE CONTROL CHAMBER
 - HEADWALL & FLAP VALVE
 - CHANNEL/SLOT DRAIN
 - SHALLOW CHANNEL (200mm
APPROXIMATE) TO WEST BROOK

NOTES

P02	CELLULAR STORAGE REVISED	-	DP	-	02/2020
P01	NEW MASTERPLAN ADDED	-	DP	-	07/2019
REV	DESCRIPTION	DE	DR	CH	DATE
DESIGNED BY		DRAWN BY		CHECKED BY	
-		DP		-	
SCALE @ A1 SIZE		DATE			
D.N.S.		28/06/2019			

PROJECT TITLE
LAND WEST OF
COLDHARBOUR FARM

DRAWING TITLE
SURFACE WATER MANAGEMENT
STRATEGY - BELOW GROUND

CLIENT
TELSTAR LTD

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DRAWING NUMBER	REV.
X781 - PL - SK - 304	P02

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.950	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	x
Maximum Time of Concentration (mins)	500.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	500.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.052	5.00	8.100	1350	2.810
2	0.052	5.00	7.050	1350	1.880
3	0.052	5.00	7.150	1350	1.990
4	0.052	5.00	7.250	1350	2.110
5	0.052	5.00	7.350	1350	2.240
6	0.052	5.00	7.300	1350	2.210
7	0.052	5.00	7.200	1350	2.130
8	0.052	5.00	7.100	1350	2.050
9	0.052	5.00	6.900	1350	1.890
A1	0.052	5.00	8.250	1350	2.940
A2	0.052	5.00	8.050	1350	2.770
A3	0.052	5.00	7.900	1350	2.640
A4	0.052	5.00	7.500	1350	2.290
A5	0.052	5.00	7.400	1350	2.210
A6	0.052	5.00	7.050	1350	1.940
A7	0.052	5.00	6.750	1350	1.720
10			6.900	1350	1.900

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	1	2	56.920	0.600	5.290	5.170	0.120	474.3	450	6.02	149.8
2	2	3	11.470	0.600	5.170	5.160	0.010	1147.0	450	6.35	147.0
3	3	4	7.790	0.600	5.160	5.140	0.020	389.5	450	6.47	145.8
4	4	5	13.340	0.600	5.140	5.110	0.030	444.7	450	6.71	143.8
5	5	6	6.080	0.600	5.110	5.090	0.020	304.0	450	6.79	143.0
6	6	7	9.025	0.600	5.090	5.070	0.020	451.3	450	6.95	141.6
7	7	8	7.180	0.600	5.070	5.050	0.020	359.0	450	7.06	140.7
8	8	9	17.430	0.600	5.050	5.010	0.040	435.8	450	7.36	138.4

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	0.927	147.4	26.7	2.360	1.430	0.052	0.0	129	0.709
2	0.592	94.1	52.5	1.430	1.540	0.104	0.0	240	0.607
3	1.024	162.8	78.1	1.540	1.660	0.156	0.0	219	1.013
4	0.957	152.3	102.7	1.660	1.790	0.208	0.0	271	1.025
5	1.160	184.6	127.7	1.790	1.760	0.260	0.0	276	1.249
6	0.950	151.1	151.7	1.760	1.680	0.312	0.0	373	1.076
7	1.067	169.7	175.9	1.680	1.600	0.364	0.0	389	1.203
8	0.967	153.8	197.7	1.600	1.440	0.416	0.0	450	0.980

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)
A1	A1	A2	12.660	0.600	5.310	5.280	0.030	422.0	450	5.21	157.6
A2	A2	A3	12.140	0.600	5.280	5.260	0.020	607.0	450	5.46	155.2
A3	A3	A4	25.710	0.600	5.260	5.210	0.050	514.2	450	5.94	150.6
A4	A4	A5	6.700	0.600	5.210	5.190	0.020	335.0	450	6.04	149.6
A5	A5	A6	39.540	0.600	5.190	5.110	0.080	494.3	450	6.77	143.2
A6	A6	A7	39.480	0.600	5.110	5.030	0.080	493.5	450	7.50	137.4
A7	A7	9	9.380	0.600	5.030	5.010	0.020	469.0	450	7.66	136.1
9	9	10	5.000	0.600	5.010	5.000	0.010	500.0	450	7.76	135.3

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)
A1	0.983	156.4	28.1	2.490	2.320	0.052	0.0	129	0.752
A2	0.818	130.1	55.4	2.320	2.190	0.104	0.0	205	0.787
A3	0.889	141.5	80.6	2.190	1.840	0.156	0.0	244	0.918
A4	1.105	175.7	106.8	1.840	1.760	0.208	0.0	254	1.156
A5	0.907	144.3	127.9	1.760	1.490	0.260	0.0	331	1.019
A6	0.908	144.4	147.1	1.490	1.270	0.312	0.0	380	1.027
A7	0.932	148.2	170.0	1.270	1.440	0.364	0.0	450	0.944
9	0.902	143.5	386.6	1.440	1.450	0.832	0.0	450	0.914

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	56.920	474.3	450	Circular	8.100	5.290	2.360	7.050	5.170	1.430
2	11.470	1147.0	450	Circular	7.050	5.170	1.430	7.150	5.160	1.540
3	7.790	389.5	450	Circular	7.150	5.160	1.540	7.250	5.140	1.660
4	13.340	444.7	450	Circular	7.250	5.140	1.660	7.350	5.110	1.790
5	6.080	304.0	450	Circular	7.350	5.110	1.790	7.300	5.090	1.760
6	9.025	451.3	450	Circular	7.300	5.090	1.760	7.200	5.070	1.680
7	7.180	359.0	450	Circular	7.200	5.070	1.680	7.100	5.050	1.600
8	17.430	435.8	450	Circular	7.100	5.050	1.600	6.900	5.010	1.440
A1	12.660	422.0	450	Circular	8.250	5.310	2.490	8.050	5.280	2.320
A2	12.140	607.0	450	Circular	8.050	5.280	2.320	7.900	5.260	2.190
A3	25.710	514.2	450	Circular	7.900	5.260	2.190	7.500	5.210	1.840
A4	6.700	335.0	450	Circular	7.500	5.210	1.840	7.400	5.190	1.760

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1	1	1350	Manhole	Adoptable	2	1350	Manhole	Adoptable
2	2	1350	Manhole	Adoptable	3	1350	Manhole	Adoptable
3	3	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable
4	4	1350	Manhole	Adoptable	5	1350	Manhole	Adoptable
5	5	1350	Manhole	Adoptable	6	1350	Manhole	Adoptable
6	6	1350	Manhole	Adoptable	7	1350	Manhole	Adoptable
7	7	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable
8	8	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
A1	A1	1350	Manhole	Adoptable	A2	1350	Manhole	Adoptable
A2	A2	1350	Manhole	Adoptable	A3	1350	Manhole	Adoptable
A3	A3	1350	Manhole	Adoptable	A4	1350	Manhole	Adoptable
A4	A4	1350	Manhole	Adoptable	A5	1350	Manhole	Adoptable

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)
A5	39.540	494.3	450	Circular	7.400	5.190	1.760	7.050	5.110	1.490
A6	39.480	493.5	450	Circular	7.050	5.110	1.490	6.750	5.030	1.270
A7	9.380	469.0	450	Circular	6.750	5.030	1.270	6.900	5.010	1.440
9	5.000	500.0	450	Circular	6.900	5.010	1.440	6.900	5.000	1.450

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
A5	A5	1350	Manhole	Adoptable	A6	1350	Manhole	Adoptable
A6	A6	1350	Manhole	Adoptable	A7	1350	Manhole	Adoptable
A7	A7	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
9	9	1350	Manhole	Adoptable	10	1350	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	8.100	2.810	1350				
				0	1	5.290	450
2	7.050	1.880	1350		1	5.170	450
				0	2	5.170	450
3	7.150	1.990	1350		1	5.160	450
				0	3	5.160	450
4	7.250	2.110	1350		1	5.140	450
				0	4	5.140	450
5	7.350	2.240	1350		1	5.110	450
				0	5	5.110	450
6	7.300	2.210	1350		1	5.090	450
				0	6	5.090	450
7	7.200	2.130	1350		1	5.070	450
				0	7	5.070	450
8	7.100	2.050	1350		1	5.050	450
				0	8	5.050	450
9	6.900	1.890	1350		1	5.010	450
				2	A7	5.010	450
				0	9	5.010	450

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
A1	8.250	2.940	1350					
				0	A1	5.310	450	
A2	8.050	2.770	1350		1	A1	5.280	450
				0	A2	5.280	450	
A3	7.900	2.640	1350		1	A2	5.260	450
				0	A3	5.260	450	
A4	7.500	2.290	1350		1	A3	5.210	450
				0	A4	5.210	450	
A5	7.400	2.210	1350		1	A4	5.190	450
				0	A5	5.190	450	
A6	7.050	1.940	1350		1	A5	5.110	450
				0	A6	5.110	450	
A7	6.750	1.720	1350		1	A6	5.030	450
				0	A7	5.030	450	
10	6.900	1.900	1350		1	9	5.000	450

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Detailed	Additional Storage (m ³ /ha)	0.0
Summer CV	0.950	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.950	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

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 10 Online Orifice Control

Flap Valve	✓	Invert Level (m)	5.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.030		

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.170
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	165.0	0.0	1.560	165.0	0.0	1.561	0.0	0.0

Node 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.140
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	20.0	0.0	1.560	20.0	0.0	1.561	0.0	0.0

Node 5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.110
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	40.0	0.0	1.560	40.0	0.0	1.561	0.0	0.0

Node 8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.050
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	40.0	0.0	1.040	40.0	0.0	1.041	0.0	0.0

Node A3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.260
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	120.5	0.0	1.560	120.5	0.0	1.561	0.0	0.0

Node A4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.210
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	52.0	0.0	1.560	52.0	0.0	1.561	0.0	0.0

Node A5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.190
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	120.0	0.0	1.560	120.0	0.0	1.561	0.0	0.0

Node A6 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.110
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	60.0	0.0	1.560	60.0	0.0	1.561	0.0	0.0

Node 7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.070
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	18.0	0.0	1.560	18.0	0.0	1.561	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute summer	1	2160	5.523	0.233	0.6	0.3333	0.0000	OK
2160 minute summer	2	2160	5.523	0.353	2.0	55.8211	0.0000	OK
2160 minute summer	3	2160	5.523	0.363	1.0	0.5193	0.0000	OK
2160 minute summer	4	2160	5.523	0.383	0.7	7.8229	0.0000	OK
2160 minute summer	5	2160	5.523	0.413	0.6	16.2808	0.0000	OK
2160 minute summer	6	2160	5.523	0.433	0.7	0.6195	0.0000	OK
2160 minute summer	7	2160	5.523	0.453	1.2	8.3926	0.0000	SURCHARGED
2160 minute summer	8	2160	5.523	0.473	1.6	18.6466	0.0000	SURCHARGED
2160 minute summer	9	2160	5.523	0.513	1.7	0.7339	0.0000	SURCHARGED
2160 minute summer	A1	2160	5.523	0.213	0.6	0.3047	0.0000	OK
2160 minute summer	A2	2160	5.523	0.243	1.2	0.3476	0.0000	OK
2160 minute summer	A3	2160	5.523	0.263	1.7	30.4710	0.0000	OK
2160 minute summer	A4	2160	5.523	0.313	1.5	15.9047	0.0000	OK
2160 minute summer	A5	2160	5.523	0.333	1.4	38.4262	0.0000	OK
2160 minute summer	A6	2160	5.523	0.413	1.5	24.1257	0.0000	OK
2160 minute summer	A7	2160	5.523	0.493	1.0	0.7053	0.0000	SURCHARGED
2160 minute summer	10	2160	5.523	0.523	1.3	0.7483	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1	2	9.0	0.870	0.061	0.6596	
180 minute summer	2	2	3	-11.4	-0.395	-0.121	0.8677	
120 minute summer	3	3	4	-9.7	0.364	-0.059	0.5393	
15 minute summer	4	4	5	12.2	0.597	0.080	0.4575	
120 minute summer	5	5	6	-9.9	0.286	-0.054	0.5564	
15 minute summer	6	6	7	15.3	0.490	0.102	0.4781	
15 minute summer	7	7	8	16.0	0.624	0.094	0.4431	
15 minute summer	8	8	9	12.5	-0.329	0.081	1.3087	
15 minute summer	9	9	10	2.0	0.356	0.014	0.4314	
15 minute summer	A1	A1	A2	8.9	0.396	0.057	0.2859	
15 minute summer	A2	A2	A3	17.8	1.182	0.137	0.2228	
120 minute summer	A3	A3	A4	9.6	0.477	0.068	0.8524	
60 minute summer	A4	A4	A5	10.7	0.772	0.061	0.1928	
60 minute summer	A5	A5	A6	8.6	0.208	0.060	1.9571	
30 minute summer	A6	A6	A7	-17.5	-0.367	-0.121	2.8012	
30 minute summer	A7	A7	9	-14.0	0.179	-0.094	0.8741	
2160 minute summer	10	Orifice		1.3				147.8

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute summer	1	6120	5.811	0.521	0.4	0.7452	0.0000	SURCHARGED
10080 minute summer	2	6120	5.811	0.641	1.2	101.3580	0.0000	SURCHARGED
10080 minute summer	3	6120	5.811	0.651	0.6	0.9313	0.0000	SURCHARGED
10080 minute summer	4	6120	5.811	0.671	0.4	13.7045	0.0000	SURCHARGED
10080 minute summer	5	6120	5.811	0.701	0.6	27.6321	0.0000	SURCHARGED
10080 minute summer	6	6120	5.811	0.721	0.7	1.0314	0.0000	SURCHARGED
10080 minute summer	7	6120	5.811	0.741	1.0	13.7272	0.0000	SURCHARGED
10080 minute summer	8	6120	5.811	0.761	1.3	29.9979	0.0000	SURCHARGED
10080 minute summer	9	6120	5.811	0.801	1.7	1.1459	0.0000	SURCHARGED
10080 minute summer	A1	6120	5.811	0.501	0.4	0.7166	0.0000	SURCHARGED
10080 minute summer	A2	6120	5.811	0.531	0.8	0.7595	0.0000	SURCHARGED
10080 minute summer	A3	6120	5.811	0.551	1.1	63.8380	0.0000	SURCHARGED
10080 minute summer	A4	6120	5.811	0.601	0.6	30.5379	0.0000	SURCHARGED
10080 minute summer	A5	6120	5.811	0.621	0.9	71.6564	0.0000	SURCHARGED
10080 minute summer	A6	6120	5.811	0.701	0.8	40.9467	0.0000	SURCHARGED
10080 minute summer	A7	6120	5.811	0.781	0.9	1.1173	0.0000	SURCHARGED
10080 minute summer	10	6120	5.811	0.811	1.7	1.1602	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1	2	22.1	1.035	0.150	2.8785	
30 minute summer	2	2	3	-47.0	-0.824	-0.499	1.2088	
30 minute summer	3	3	4	-34.2	0.524	-0.210	0.8682	
30 minute summer	4	4	5	-24.6	0.525	-0.161	1.6236	
30 minute summer	5	5	6	-22.2	0.259	-0.120	0.7993	
15 minute summer	6	6	7	24.7	0.551	0.163	1.0276	
15 minute summer	7	7	8	26.6	0.651	0.157	0.8761	
15 minute summer	8	8	9	25.3	-0.350	0.164	2.3212	
15 minute winter	9	9	10	4.2	0.409	0.029	0.7099	
15 minute summer	A1	A1	A2	21.8	0.498	0.140	0.5690	
15 minute summer	A2	A2	A3	43.2	1.365	0.332	0.5554	
30 minute summer	A3	A3	A4	33.8	0.701	0.239	1.9213	
15 minute summer	A4	A4	A5	31.2	1.124	0.178	0.4339	
30 minute summer	A5	A5	A6	-31.5	-0.427	-0.218	4.3942	
15 minute summer	A6	A6	A7	-51.1	-0.583	-0.354	4.6271	
15 minute summer	A7	A7	9	-36.5	-0.287	-0.246	1.2851	
10080 minute summer	10	Orifice		1.7				635.2

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute summer	1	6600	6.480	1.190	0.6	1.7032	0.0000	SURCHARGED
10080 minute summer	2	6600	6.480	1.310	2.0	207.2469	0.0000	SURCHARGED
10080 minute summer	3	6600	6.480	1.320	0.8	1.8892	0.0000	SURCHARGED
10080 minute summer	4	6600	6.480	1.340	0.6	27.3814	0.0000	SURCHARGED
10080 minute summer	5	6600	6.480	1.370	0.8	54.0278	0.0000	SURCHARGED
10080 minute summer	6	6600	6.480	1.390	0.9	1.9894	0.0000	SURCHARGED
10080 minute summer	7	6600	6.480	1.410	1.5	26.1321	0.0000	SURCHARGED
10080 minute summer	8	6600	6.480	1.430	1.8	41.5856	0.0000	SURCHARGED
10080 minute summer	9	6600	6.480	1.470	2.3	2.1038	0.0000	SURCHARGED
10080 minute summer	A1	6600	6.480	1.170	0.6	1.6745	0.0000	SURCHARGED
10080 minute summer	A2	6600	6.480	1.200	1.2	1.7175	0.0000	SURCHARGED
10080 minute summer	A3	6600	6.480	1.220	1.8	141.4277	0.0000	SURCHARGED
10080 minute summer	A4	6600	6.480	1.270	0.9	64.5651	0.0000	SURCHARGED
10080 minute summer	A5	6600	6.480	1.290	1.5	148.9281	0.0000	SURCHARGED
10080 minute summer	A6	6600	6.480	1.370	1.3	80.0614	0.0000	SURCHARGED
10080 minute summer	A7	6600	6.480	1.450	1.2	2.0752	0.0000	FLOOD RISK
10080 minute summer	10	6600	6.480	1.480	2.3	2.1181	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1	2	39.0	1.086	0.265	6.7723	
30 minute summer	2	2	3	-106.2	-1.032	-1.129	1.8173	
30 minute summer	3	3	4	-76.7	0.592	-0.471	1.2343	
30 minute summer	4	4	5	-58.1	0.587	-0.382	2.1136	
30 minute summer	5	5	6	-46.0	-0.295	-0.249	0.9633	
15 minute summer	6	6	7	27.6	0.583	0.182	1.4298	
15 minute summer	7	7	8	32.4	0.699	0.191	1.1376	
15 minute summer	8	8	9	30.6	-0.364	0.199	2.7617	
15 minute summer	9	9	10	5.4	0.489	0.038	0.7922	
15 minute summer	A1	A1	A2	37.9	0.567	0.243	1.1350	
15 minute summer	A2	A2	A3	74.8	1.472	0.575	1.2198	
15 minute summer	A3	A3	A4	61.1	0.825	0.432	2.9381	
15 minute summer	A4	A4	A5	55.2	1.263	0.314	0.8695	
15 minute summer	A5	A5	A6	-66.5	-0.621	-0.460	5.7432	
15 minute summer	A6	A6	A7	-91.6	-0.715	-0.634	6.2203	
15 minute summer	A7	A7	9	-60.8	-0.384	-0.410	1.4862	
10080 minute summer	10	Orifice		2.3				998.4

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.950	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	x
Maximum Time of Concentration (mins)	500.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	500.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.052	5.00	8.100	1350	2.810
2	0.052	5.00	7.050	1350	1.880
3	0.052	5.00	7.150	1350	1.990
4	0.052	5.00	7.250	1350	2.110
5	0.052	5.00	7.350	1350	2.240
6	0.052	5.00	7.300	1350	2.210
7	0.052	5.00	7.200	1350	2.130
8	0.052	5.00	7.100	1350	2.050
9	0.052	5.00	6.900	1350	1.890
A1	0.052	5.00	8.250	1350	2.940
A2	0.052	5.00	8.050	1350	2.770
A3	0.052	5.00	7.900	1350	2.640
A4	0.052	5.00	7.500	1350	2.290
A5	0.052	5.00	7.400	1350	2.210
A6	0.052	5.00	7.050	1350	1.940
A7	0.052	5.00	6.750	1350	1.720
10			6.900	1350	1.900

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Detailed	Additional Storage (m³/ha)	0.0
Summer CV	0.950	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.950	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

2160

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

Node 10 Online Orifice Control

Flap Valve	✓	Invert Level (m)	6.800	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.030		

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.170
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	165.0	0.0	1.560	165.0	0.0	1.561	0.0	0.0

Node 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.140
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	20.0	0.0	1.560	20.0	0.0	1.561	0.0	0.0

Node 5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.110
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	40.0	0.0	1.560	40.0	0.0	1.561	0.0	0.0

Node 8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.050
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	40.0	0.0	1.040	40.0	0.0	1.041	0.0	0.0

Node A3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.260
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	120.5	0.0	1.560	120.5	0.0	1.561	0.0	0.0

Node A4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.210
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	52.0	0.0	1.560	52.0	0.0	1.561	0.0	0.0

Node A5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.190
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	120.0	0.0	1.560	120.0	0.0	1.561	0.0	0.0

Node A6 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.110
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	60.0	0.0	1.560	60.0	0.0	1.561	0.0	0.0

Node 7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.070
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	18.0	0.0	1.560	18.0	0.0	1.561	0.0	0.0

Results for 100 year +40% CC 2160 minute summer. 2400 minute analysis at 60 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute summer	1	2280	6.693	1.403	1.7	2.0081	0.0000	SURCHARGED
2160 minute summer	2	2400	6.693	1.523	6.9	240.9415	0.0000	SURCHARGED
2160 minute summer	3	2400	6.693	1.533	3.6	2.1940	0.0000	SURCHARGED
2160 minute summer	4	2400	6.693	1.553	2.8	31.7328	0.0000	SURCHARGED
2160 minute summer	5	2400	6.693	1.583	2.8	61.5646	0.0000	SURCHARGED
2160 minute summer	6	2400	6.693	1.603	1.7	2.2942	0.0000	SURCHARGED
2160 minute summer	7	2340	6.693	1.623	2.3	29.0074	0.0000	SURCHARGED
2160 minute summer	8	2340	6.693	1.643	3.2	41.8905	0.0000	SURCHARGED
2160 minute summer	9	2340	6.693	1.683	3.2	2.4087	0.0000	FLOOD RISK
2160 minute summer	A1	2280	6.693	1.383	1.7	1.9794	0.0000	SURCHARGED
2160 minute summer	A2	2280	6.693	1.413	3.3	2.0223	0.0000	SURCHARGED
2160 minute summer	A3	2280	6.693	1.433	5.0	166.1122	0.0000	SURCHARGED
2160 minute summer	A4	2280	6.693	1.483	2.2	75.3909	0.0000	SURCHARGED
2160 minute summer	A5	2280	6.693	1.503	5.5	173.5114	0.0000	SURCHARGED
2160 minute summer	A6	2400	6.693	1.583	6.4	91.2141	0.0000	SURCHARGED
2160 minute summer	A7	2220	6.693	1.663	4.7	2.3802	0.0000	FLOOD RISK
2160 minute summer	10	2400	6.693	1.693	0.1	2.4231	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute summer	1	1	2	1.6	0.190	0.011	9.0186	
2160 minute summer	2	2	3	-3.5	-0.126	-0.037	1.8173	
2160 minute summer	3	3	4	-1.9	0.183	-0.012	1.2343	
2160 minute summer	4	4	5	-1.1	0.208	-0.007	2.1136	
2160 minute summer	5	5	6	-1.1	0.223	-0.006	0.9633	
2160 minute summer	6	6	7	0.8	0.152	0.005	1.4300	
2160 minute summer	7	7	8	1.5	0.056	0.009	1.1376	
2160 minute summer	8	8	9	1.5	-0.012	0.009	2.7617	
2160 minute summer	9	9	10	0.1	0.002	0.000	0.7922	
2160 minute summer	A1	A1	A2	1.6	0.124	0.010	2.0059	
2160 minute summer	A2	A2	A3	3.3	0.205	0.025	1.9235	
2160 minute summer	A3	A3	A4	0.6	0.220	0.004	4.0736	
2160 minute summer	A4	A4	A5	0.8	0.287	0.005	1.0616	
2160 minute summer	A5	A5	A6	-3.8	0.108	-0.027	6.2649	
2160 minute summer	A6	A6	A7	-4.7	-0.029	-0.032	6.2553	
2160 minute summer	A7	A7	9	-3.0	-0.019	-0.020	1.4862	
2160 minute summer	10	Orifice		0.0				0.0

Results for 100 year +40% CC 2160 minute winter. 2400 minute analysis at 60 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	1	2340	6.675	1.385	1.2	1.9823	0.0000	SURCHARGED
2160 minute winter	2	2340	6.675	1.505	4.8	238.0816	0.0000	SURCHARGED
2160 minute winter	3	2340	6.675	1.515	2.5	2.1681	0.0000	SURCHARGED
2160 minute winter	4	2340	6.675	1.535	1.9	31.3637	0.0000	SURCHARGED
2160 minute winter	5	2340	6.675	1.565	2.3	61.5387	0.0000	SURCHARGED
2160 minute winter	6	2340	6.675	1.585	1.3	2.2683	0.0000	SURCHARGED
2160 minute winter	7	2340	6.675	1.605	1.6	28.9815	0.0000	SURCHARGED
2160 minute winter	8	2340	6.675	1.625	2.2	41.8645	0.0000	SURCHARGED
2160 minute winter	9	2220	6.675	1.665	2.4	2.3827	0.0000	FLOOD RISK
2160 minute winter	A1	2280	6.675	1.365	1.2	1.9535	0.0000	SURCHARGED
2160 minute winter	A2	2220	6.675	1.395	2.4	1.9964	0.0000	SURCHARGED
2160 minute winter	A3	2220	6.675	1.415	3.5	164.0143	0.0000	SURCHARGED
2160 minute winter	A4	2280	6.675	1.465	1.6	74.4709	0.0000	SURCHARGED
2160 minute winter	A5	2280	6.675	1.485	3.9	171.4223	0.0000	SURCHARGED
2160 minute winter	A6	2220	6.675	1.565	4.5	91.1882	0.0000	SURCHARGED
2160 minute winter	A7	2220	6.675	1.645	3.3	2.3541	0.0000	FLOOD RISK
2160 minute winter	10	2220	6.675	1.675	0.0	2.3970	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute winter	1	1	2	1.2	0.176	0.008	9.0186	
2160 minute winter	2	2	3	-2.5	-0.149	-0.026	1.8173	
2160 minute winter	3	3	4	-1.4	0.160	-0.008	1.2343	
2160 minute winter	4	4	5	-0.9	0.206	-0.006	2.1136	
2160 minute winter	5	5	6	-1.3	0.169	-0.007	0.9633	
2160 minute winter	6	6	7	-0.7	0.195	-0.005	1.4300	
2160 minute winter	7	7	8	1.0	0.151	0.006	1.1376	
2160 minute winter	8	8	9	1.4	-0.014	0.009	2.7617	
2160 minute winter	9	9	10	0.0	0.001	0.000	0.7922	
2160 minute winter	A1	A1	A2	1.2	0.141	0.007	2.0059	
2160 minute winter	A2	A2	A3	2.3	0.196	0.018	1.9235	
2160 minute winter	A3	A3	A4	0.6	0.220	0.004	4.0736	
2160 minute winter	A4	A4	A5	0.8	0.269	0.005	1.0616	
2160 minute winter	A5	A5	A6	-2.7	0.118	-0.019	6.2649	
2160 minute winter	A6	A6	A7	-3.3	-0.046	-0.023	6.2553	
2160 minute winter	A7	A7	9	-2.3	-0.015	-0.016	1.4862	
2160 minute winter	10	Orifice		0.0				0.0