SURFACE WATER DRIANAGE CALCULATIONS

UPON

FORMER BELL INN

CHURCH STREET, PINCHBECK,

SPALDING, LINCOLNSHIRE

PROJECT No: SW 21-199

REVISION: A

DOCUMENT REF: SW 21-199-CAL-01A



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SUMMARY

The following set of calculations cover the design of the surface water drainage system for the proposed 9 plot residential development on the site of a former pub standing off Church Lane, Pinchbeck.

The system follows the principles of the SuDS hierarchy.

Infiltration has been considered, however onsite testing highlighted infiltration to be an unsuitable technique for surface water disposal due to the clay strata encountered and unmeasurable soakaway testing.

The site is bound on the East and South by an existing riparian watercourse, which discharges into Welland and Deepings IDB system downstream. Therefore, it is proposed to discharge surface water from the site into the watercourse on the Eastern boundary at a restricted rate.

Source control features are to be used to improve water quality discharging to the existing watercourse. Permeable paving will be utilised to collect runoff from the driveways and parking areas, prior to discharge into a carrier sewer maintained by the Management Company beneath the road.

As the site is small, approximately 0.54ha, the QBar rate will be an unachievable flow for the proposed restriction off site. Therefore, to provide a robust drainage system the proposed discharge rate is to be 5 litres per second, this rate will not create indue risk of blockage as the orifice size will be approximately 100mm diameter.

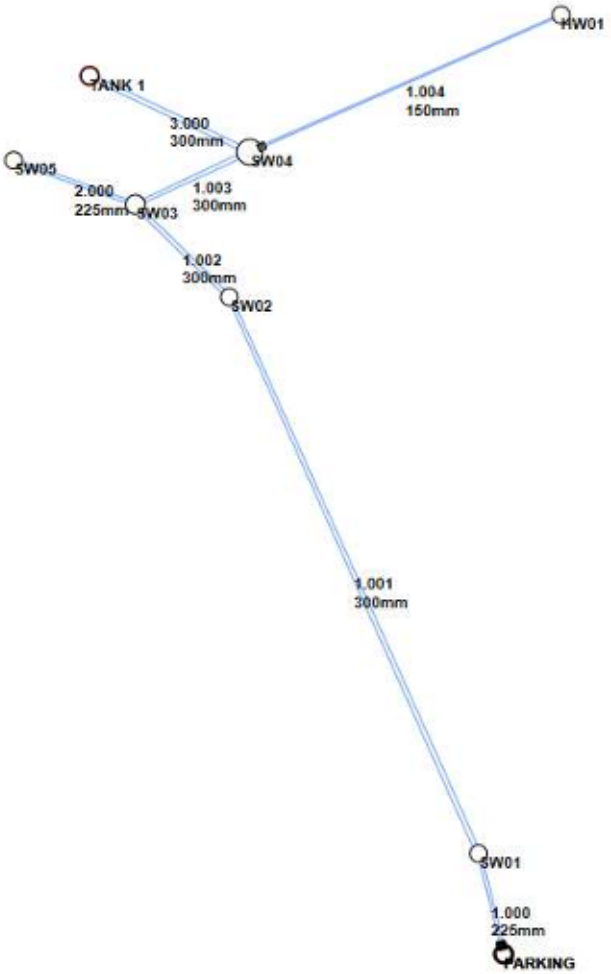
Attenuation is to be provided in the form of tanks under the shared parking areas and the stone media. The proposals are shown on our drawing, 21-199-100.

Contained in the following document are hydraulic modelling calculations. The calculations have been undertaken using both FSR and FEH rainfall data for the site, both outputs are included.

A 10% allowance has been made for Urban Creep for all the simulations modelled.

The outputs demonstrate that there is no surface water flooding for any of the storm events including the 1:100 year plus 40% allowance for climate change.

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Network Model Graphic

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FSR RAINFALL DATA HYDRAULIC MODEL OUTPUT

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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	0.400	Preferred Cover Depth (m)	0.900
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
PARKING	0.083	5.00	3.250	1200	524232.776	325676.822	1.080
SW01	0.043	5.00	3.285	1200	524231.033	325683.836	1.235
SW02	0.057	5.00	3.000	1200	524213.816	325722.624	1.120
SW05	0.029	5.00	3.075	1200	524198.904	325732.149	1.100
SW03	0.021	5.00	2.955	1350	524207.311	325729.077	1.110
TANK 1	0.014	5.00	3.200	1200	524204.160	325738.041	1.340
SW04	0.024	5.00	2.925	1800	524215.227	325732.733	1.115
HW01			2.750	1200	524236.741	325742.294	1.100

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	PARKING	SW01	7.227	0.600	2.170	2.125	0.045	160.6	225	5.12	50.0
1.001	SW01	SW02	42.437	0.600	2.050	1.880	0.170	249.6	300	5.83	50.0
1.002	SW02	SW03	9.163	0.600	1.880	1.845	0.035	261.8	300	5.99	50.0
2.000	SW05	SW03	8.951	0.600	1.975	1.920	0.055	162.7	225	5.15	50.0
1.003	SW03	SW04	8.719	0.600	1.845	1.810	0.035	249.1	300	6.14	50.0
3.000	TANK 1	SW04	12.274	0.600	1.860	1.810	0.050	245.5	300	5.20	50.0
1.004	SW04	HW01	23.543	0.600	1.810	1.650	0.160	147.1	150	6.61	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	1.029	40.9	11.2	0.855	0.935	0.083	0.0	80	0.881
1.001	0.990	70.0	17.1	0.935	0.820	0.126	0.0	100	0.821
1.002	0.967	68.3	24.7	0.820	0.810	0.182	0.0	125	0.891
2.000	1.022	40.6	3.9	0.875	0.810	0.029	0.0	47	0.650
1.003	0.991	70.1	31.4	0.810	0.815	0.232	0.0	141	0.966
3.000	0.999	70.6	1.9	1.040	0.815	0.014	0.0	34	0.436
1.004	0.826	14.6	36.6	0.965	0.950	0.270	0.0	150	0.842

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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	7.227	160.6	225	Circular	3.250	2.170	0.855	3.285	2.125	0.935
1.001	42.437	249.6	300	Circular	3.285	2.050	0.935	3.000	1.880	0.820
1.002	9.163	261.8	300	Circular	3.000	1.880	0.820	2.955	1.845	0.810
2.000	8.951	162.7	225	Circular	3.075	1.975	0.875	2.955	1.920	0.810
1.003	8.719	249.1	300	Circular	2.955	1.845	0.810	2.925	1.810	0.815
3.000	12.274	245.5	300	Circular	3.200	1.860	1.040	2.925	1.810	0.815
1.004	23.543	147.1	150	Circular	2.925	1.810	0.965	2.750	1.650	0.950

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	PARKING	1200	Manhole	Adoptable	SW01	1200	Manhole	Adoptable
1.001	SW01	1200	Manhole	Adoptable	SW02	1200	Manhole	Adoptable
1.002	SW02	1200	Manhole	Adoptable	SW03	1350	Manhole	Adoptable
2.000	SW05	1200	Manhole	Adoptable	SW03	1350	Manhole	Adoptable
1.003	SW03	1350	Manhole	Adoptable	SW04	1800	Manhole	Adoptable
3.000	TANK 1	1200	Manhole	Adoptable	SW04	1800	Manhole	Adoptable
1.004	SW04	1800	Manhole	Adoptable	HW01	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
PARKING	524232.776	325676.822	3.250	1.080	1200		0	1.000	2.170	225
SW01	524231.033	325683.836	3.285	1.235	1200		1 0	1.000 1.001	2.125 2.050	225 300
SW02	524213.816	325722.624	3.000	1.120	1200		1 0	1.001 1.002	1.880 1.880	300 300
SW05	524198.904	325732.149	3.075	1.100	1200		0	2.000	1.975	225
SW03	524207.311	325729.077	2.955	1.110	1350		1 2 0	2.000 1.002 1.003	1.920 1.845 1.845	225 300 300
TANK 1	524204.160	325738.041	3.200	1.340	1200		0	3.000	1.860	300
SW04	524215.227	325732.733	2.925	1.115	1800		1 2 0	3.000 1.003 1.004	1.810 1.810 1.810	300 300 150

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
HW01	524236.741	325742.294	2.750	1.100	1200	1	1.004	1.650	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	0.400	Additional Storage (m³/ha)	0.0
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	10	0
30	0	10	0
100	0	10	0
100	40	10	0

Node SW04 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	1.810	Product Number	CTL-SHE-0104-5000-1115-5000
Design Depth (m)	1.115	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node PARKING Online Orifice Control

Flap Valve	x	Design Depth (m)	1.080	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	3.0		
Invert Level (m)	2.170	Diameter (m)	0.037		

Node TANK 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.860
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	156

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	146.3	0.0	1.000	146.3	0.0	1.001	0.0	0.0

Node PARKING Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.540
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	178

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Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	125.0	0.0	0.300	125.0	0.0	0.301	0.0	0.0

Node PARKING Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.540
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	178

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	114.0	0.0	0.300	114.0	0.0	0.301	0.0	0.0

Node PARKING Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.840
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	239.0	0.0	0.300	239.0	0.0	0.301	0.0	0.0

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Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	PARKING	50	2.585	0.415	8.4	7.0551	0.0000	SURCHARGED
15 minute winter	SW01	10	2.126	0.076	10.4	0.0865	0.0000	OK
15 minute winter	SW02	11	2.100	0.220	21.5	0.2493	0.0000	OK
15 minute winter	SW05	11	2.096	0.121	5.8	0.1367	0.0000	OK
15 minute winter	SW03	11	2.093	0.248	32.6	0.3556	0.0000	OK
120 minute winter	TANK 1	94	1.987	0.127	8.8	17.7583	0.0000	OK
15 minute winter	SW04	10	2.082	0.272	39.3	0.6928	0.0000	SURCHARGED
15 minute summer	HW01	1	1.650	0.000	4.9	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)
60 minute winter	PARKING	Orifice	SW01	1.8				
15 minute winter	SW01	1.001	SW02	10.2	0.438	0.145	1.4752	
15 minute winter	SW02	1.002	SW03	23.6	0.476	0.345	0.5400	
15 minute winter	SW05	2.000	SW03	6.1	0.523	0.151	0.2442	
15 minute winter	SW03	1.003	SW04	35.6	0.626	0.508	0.5634	
120 minute winter	TANK 1	3.000	SW04	-7.9	-0.379	-0.112	0.4384	
15 minute winter	SW04	Hydro-Brake®	HW01	4.9				23.9

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Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	PARKING	60	2.654	0.484	16.0	17.3030	0.0000	SURCHARGED
15 minute summer	SW01	10	2.224	0.174	17.3	0.1967	0.0000	OK
15 minute winter	SW02	10	2.196	0.316	43.5	0.3579	0.0000	SURCHARGED
15 minute winter	SW05	9	2.182	0.207	11.0	0.2337	0.0000	OK
15 minute winter	SW03	9	2.174	0.329	61.2	0.4704	0.0000	SURCHARGED
120 minute winter	TANK 1	116	2.150	0.290	17.4	40.5837	0.0000	OK
120 minute winter	SW04	116	2.150	0.340	21.0	0.8643	0.0000	SURCHARGED
15 minute summer	HW01	1	1.650	0.000	5.0	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)
60 minute winter	PARKING	Orifice	SW01	2.0				
15 minute summer	SW01	1.001	SW02	20.1	0.440	0.287	2.3925	
15 minute winter	SW02	1.002	SW03	42.4	0.603	0.621	0.6453	
15 minute winter	SW05	2.000	SW03	11.4	0.560	0.281	0.3490	
15 minute winter	SW03	1.003	SW04	62.1	0.882	0.886	0.6140	
120 minute winter	TANK 1	3.000	SW04	-15.7	-0.433	-0.222	0.8598	
120 minute winter	SW04	Hydro-Brake®	HW01	5.0				89.9

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Results for 100 year +10% A Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	PARKING	116	2.707	0.537	12.9	25.0981	0.0000	SURCHARGED
15 minute winter	SW01	10	2.286	0.236	22.9	0.2668	0.0000	OK
180 minute winter	SW02	172	2.278	0.398	13.4	0.4506	0.0000	SURCHARGED
180 minute winter	SW05	172	2.278	0.303	3.3	0.3430	0.0000	SURCHARGED
180 minute winter	SW03	168	2.278	0.433	17.9	0.6199	0.0000	SURCHARGED
180 minute winter	TANK 1	172	2.278	0.418	16.3	58.5725	0.0000	SURCHARGED
180 minute winter	SW04	172	2.278	0.468	20.2	1.1912	0.0000	SURCHARGED
15 minute summer	HW01	1	1.650	0.000	5.0	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)
120 minute winter	PARKING	Orifice	SW01	2.0				
15 minute winter	SW01	1.001	SW02	25.1	0.444	0.358	2.7553	
180 minute winter	SW02	1.002	SW03	12.5	0.432	0.182	0.6453	
180 minute winter	SW05	2.000	SW03	3.1	0.489	0.076	0.3560	
180 minute winter	SW03	1.003	SW04	17.5	0.367	0.249	0.6140	
180 minute winter	TANK 1	3.000	SW04	-14.7	-0.315	-0.209	0.8643	
180 minute winter	SW04	Hydro-Brake®	HW01	5.0				115.4

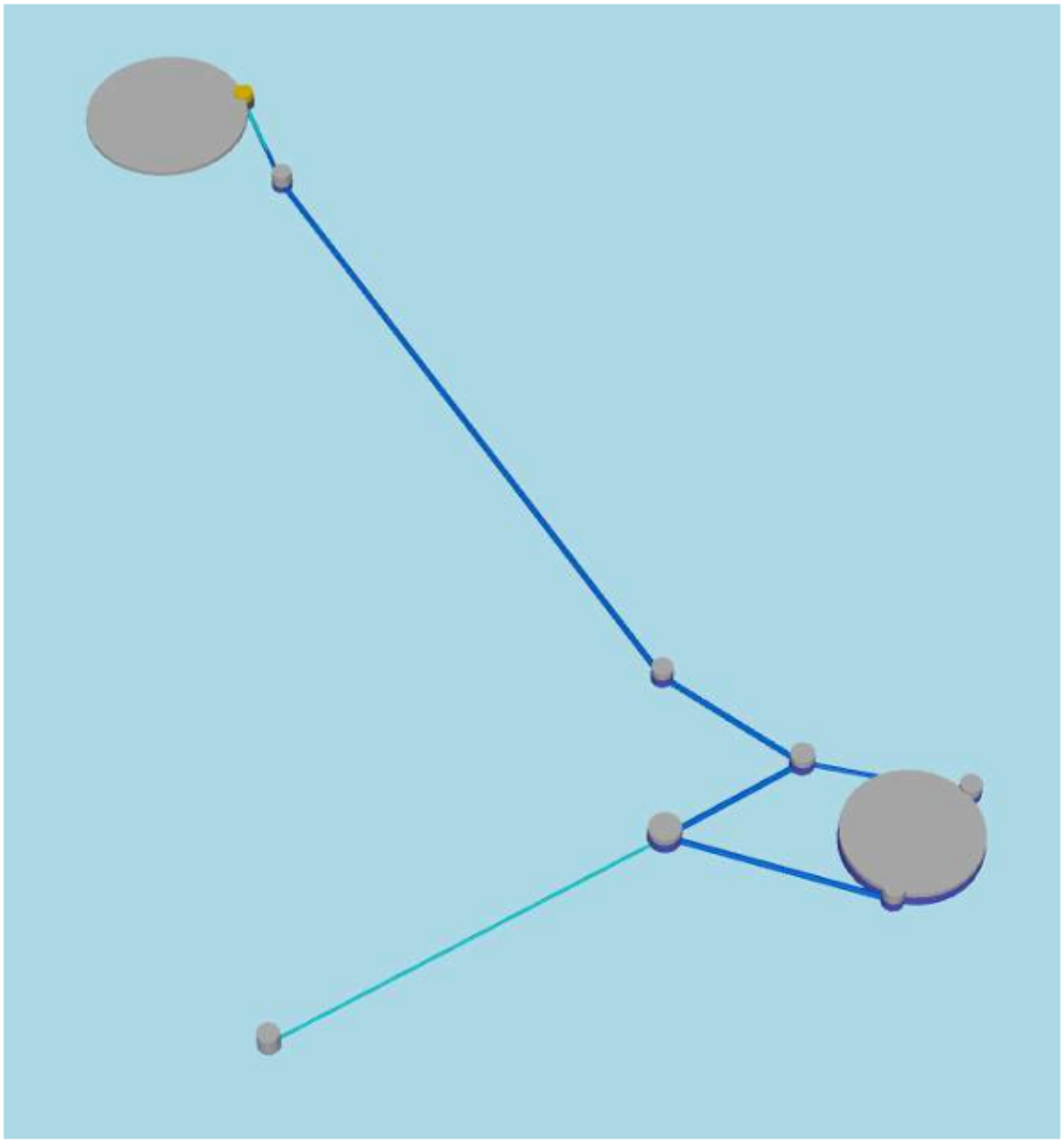
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Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	PARKING	120	2.811	0.641	18.1	40.3093	0.0000	SURCHARGED
240 minute winter	SW01	236	2.532	0.482	7.5	0.5455	0.0000	SURCHARGED
240 minute winter	SW02	236	2.532	0.652	13.9	0.7371	0.0000	SURCHARGED
240 minute winter	SW05	236	2.532	0.557	3.7	0.6299	0.0000	SURCHARGED
240 minute winter	SW03	236	2.533	0.688	19.6	0.9846	0.0000	SURCHARGED
240 minute winter	TANK 1	236	2.532	0.672	19.0	94.1309	0.0000	SURCHARGED
240 minute winter	SW04	236	2.532	0.722	22.5	1.8370	0.0000	SURCHARGED
15 minute summer	HW01	1	1.650	0.000	5.0	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)
120 minute winter	PARKING	Orifice	SW01	2.0				
240 minute winter	SW01	1.001	SW02	6.9	0.410	0.099	2.9884	
240 minute winter	SW02	1.002	SW03	13.4	0.425	0.196	0.6453	
240 minute winter	SW05	2.000	SW03	3.5	0.471	0.087	0.3560	
240 minute winter	SW03	1.003	SW04	19.4	0.346	0.277	0.6140	
240 minute winter	TANK 1	3.000	SW04	-17.2	-0.266	-0.244	0.8643	
240 minute winter	SW04	Hydro-Brake®	HW01	5.0				123.0

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FSR MODEL – 1 IN 100 Year + 10% + 40% - No Flooding

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FEH RAINFALL DATA HYDRAULIC MODEL OUTPUT

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Design Settings

Rainfall Methodology	FEH-13	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)	0.900
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)
PARKING	0.083	5.00	3.250	1200	524232.776	325676.822	1.080
SW01	0.043	5.00	3.285	1200	524231.033	325683.836	1.235
SW02	0.057	5.00	3.000	1200	524213.816	325722.624	1.120
SW05	0.029	5.00	3.075	1200	524198.904	325732.149	1.100
SW03	0.021	5.00	2.955	1350	524207.311	325729.077	1.110
TANK 1	0.014	5.00	3.200	1200	524204.160	325738.041	1.340
SW04	0.024	5.00	2.925	1800	524215.227	325732.733	1.115
HW01			2.750	1200	524236.741	325742.294	1.100

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	PARKING	SW01	7.227	0.600	2.170	2.125	0.045	160.6	225	5.12	50.0
1.001	SW01	SW02	42.437	0.600	2.050	1.880	0.170	249.6	300	5.83	50.0
1.002	SW02	SW03	9.163	0.600	1.880	1.845	0.035	261.8	300	5.99	50.0
2.000	SW05	SW03	8.951	0.600	1.975	1.920	0.055	162.7	225	5.15	50.0
1.003	SW03	SW04	8.719	0.600	1.845	1.810	0.035	249.1	300	6.14	50.0
3.000	TANK 1	SW04	12.274	0.600	1.860	1.810	0.050	245.5	300	5.20	50.0
1.004	SW04	HW01	23.543	0.600	1.810	1.650	0.160	147.1	150	6.61	49.9

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	1.029	40.9	11.2	0.855	0.935	0.083	0.0	80	0.881
1.001	0.990	70.0	17.1	0.935	0.820	0.126	0.0	100	0.821
1.002	0.967	68.3	24.7	0.820	0.810	0.182	0.0	125	0.891
2.000	1.022	40.6	3.9	0.875	0.810	0.029	0.0	47	0.650
1.003	0.991	70.1	31.4	0.810	0.815	0.232	0.0	141	0.966
3.000	0.999	70.6	1.9	1.040	0.815	0.014	0.0	34	0.436
1.004	0.826	14.6	36.5	0.965	0.950	0.270	0.0	150	0.842

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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	7.227	160.6	225	Circular	3.250	2.170	0.855	3.285	2.125	0.935
1.001	42.437	249.6	300	Circular	3.285	2.050	0.935	3.000	1.880	0.820
1.002	9.163	261.8	300	Circular	3.000	1.880	0.820	2.955	1.845	0.810
2.000	8.951	162.7	225	Circular	3.075	1.975	0.875	2.955	1.920	0.810
1.003	8.719	249.1	300	Circular	2.955	1.845	0.810	2.925	1.810	0.815
3.000	12.274	245.5	300	Circular	3.200	1.860	1.040	2.925	1.810	0.815
1.004	23.543	147.1	150	Circular	2.925	1.810	0.965	2.750	1.650	0.950

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	PARKING	1200	Manhole	Adoptable	SW01	1200	Manhole	Adoptable
1.001	SW01	1200	Manhole	Adoptable	SW02	1200	Manhole	Adoptable
1.002	SW02	1200	Manhole	Adoptable	SW03	1350	Manhole	Adoptable
2.000	SW05	1200	Manhole	Adoptable	SW03	1350	Manhole	Adoptable
1.003	SW03	1350	Manhole	Adoptable	SW04	1800	Manhole	Adoptable
3.000	TANK 1	1200	Manhole	Adoptable	SW04	1800	Manhole	Adoptable
1.004	SW04	1800	Manhole	Adoptable	HW01	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
PARKING	524232.776	325676.822	3.250	1.080	1200		0	1.000	2.170	225
SW01	524231.033	325683.836	3.285	1.235	1200		1 0	1.000 1.001	2.125 2.050	225 300
SW02	524213.816	325722.624	3.000	1.120	1200		1 0	1.001 1.002	1.880 1.880	300 300
SW05	524198.904	325732.149	3.075	1.100	1200		0	2.000	1.975	225
SW03	524207.311	325729.077	2.955	1.110	1350		1 2 0	2.000 1.002 1.003	1.920 1.845 1.845	225 300 300
TANK 1	524204.160	325738.041	3.200	1.340	1200		0	3.000	1.860	300
SW04	524215.227	325732.733	2.925	1.115	1800		1 2 0	3.000 1.003 1.004	1.810 1.810 1.810	300 300 150

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
HW01	524236.741	325742.294	2.750	1.100	1200	1	1.004	1.650	150



Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	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	10	0
30	0	10	0
100	0	10	0
100	40	10	0

Node SW04 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	1.810	Product Number	CTL-SHE-0104-5000-1115-5000
Design Depth (m)	1.115	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node PARKING Online Orifice Control

Flap Valve	x	Design Depth (m)	1.080	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	3.0		
Invert Level (m)	2.170	Diameter (m)	0.037		

Node TANK 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.860
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	146.3	0.0	1.000	146.3	0.0	1.001	0.0	0.0

Node PARKING Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.540
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	125.0	0.0	0.300	125.0	0.0	0.301	0.0	0.0

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Node PARKING Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.540
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	114.0	0.0	0.300	114.0	0.0	0.301	0.0	0.0

Node PARKING Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.840
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	176

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	239.0	0.0	0.300	239.0	0.0	0.301	0.0	0.0

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Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 97.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	PARKING	29	2.571	0.401	9.9	5.0000	0.0000	SURCHARGED
15 minute winter	SW01	10	2.119	0.069	8.5	0.0781	0.0000	OK
15 minute winter	SW02	11	2.071	0.191	17.2	0.2160	0.0000	OK
15 minute winter	SW05	11	2.069	0.094	4.6	0.1063	0.0000	OK
15 minute winter	SW03	11	2.067	0.222	24.9	0.3176	0.0000	OK
180 minute winter	TANK 1	132	1.969	0.109	5.2	15.2094	0.0000	OK
15 minute winter	SW04	11	2.059	0.249	29.9	0.6344	0.0000	SURCHARGED
15 minute summer	HW01	1	1.650	0.000	4.9	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)
30 minute winter	PARKING	Orifice	SW01	1.8				
15 minute winter	SW01	1.001	SW02	8.3	0.431	0.119	1.2627	
15 minute winter	SW02	1.002	SW03	17.9	0.467	0.263	0.4728	
15 minute winter	SW05	2.000	SW03	4.5	0.537	0.111	0.1931	
15 minute winter	SW03	1.003	SW04	26.9	0.564	0.384	0.5164	
180 minute winter	TANK 1	3.000	SW04	-4.6	-0.287	-0.066	0.3726	
15 minute winter	SW04	Hydro-Brake®	HW01	4.9				19.1

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Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 97.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	PARKING	114	2.686	0.516	11.8	21.9207	0.0000	SURCHARGED
15 minute summer	SW01	10	2.252	0.202	19.7	0.2280	0.0000	OK
240 minute winter	SW02	204	2.248	0.368	10.8	0.4158	0.0000	SURCHARGED
240 minute winter	SW05	200	2.248	0.273	2.6	0.3085	0.0000	SURCHARGED
240 minute winter	SW03	204	2.247	0.402	14.4	0.5758	0.0000	SURCHARGED
240 minute winter	TANK 1	200	2.247	0.387	12.0	54.2437	0.0000	SURCHARGED
240 minute winter	SW04	204	2.247	0.437	16.1	1.1125	0.0000	SURCHARGED
15 minute summer	HW01	1	1.650	0.000	5.0	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)
120 minute winter	PARKING	Orifice	SW01	2.0				
15 minute summer	SW01	1.001	SW02	24.0	0.440	0.343	2.5622	
240 minute winter	SW02	1.002	SW03	10.1	0.425	0.148	0.6453	
240 minute winter	SW05	2.000	SW03	2.4	0.471	0.060	0.3560	
240 minute winter	SW03	1.003	SW04	14.0	0.344	0.200	0.6140	
240 minute winter	TANK 1	3.000	SW04	-10.7	-0.246	-0.152	0.8643	
240 minute winter	SW04	Hydro-Brake®	HW01	5.0				128.0

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Results for 100 year +10% A Critical Storm Duration. Lowest mass balance: 97.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	PARKING	176	2.792	0.622	12.7	37.4480	0.0000	SURCHARGED
240 minute winter	SW01	236	2.513	0.463	7.4	0.5232	0.0000	SURCHARGED
240 minute winter	SW02	236	2.513	0.633	13.7	0.7154	0.0000	SURCHARGED
240 minute winter	SW05	236	2.512	0.537	3.7	0.6078	0.0000	SURCHARGED
240 minute winter	SW03	232	2.513	0.668	19.3	0.9563	0.0000	SURCHARGED
240 minute winter	TANK 1	236	2.512	0.652	18.6	91.4238	0.0000	SURCHARGED
240 minute winter	SW04	236	2.513	0.703	22.1	1.7880	0.0000	SURCHARGED
15 minute summer	HW01	1	1.650	0.000	5.0	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)
180 minute winter	PARKING	Orifice	SW01	2.0				
240 minute winter	SW01	1.001	SW02	6.8	0.410	0.098	2.9884	
240 minute winter	SW02	1.002	SW03	13.2	0.430	0.193	0.6453	
240 minute winter	SW05	2.000	SW03	3.5	0.462	0.087	0.3560	
240 minute winter	SW03	1.003	SW04	19.1	0.348	0.273	0.6140	
240 minute winter	TANK 1	3.000	SW04	-16.8	-0.261	-0.239	0.8643	
240 minute winter	SW04	Hydro-Brake®	HW01	5.0				124.1

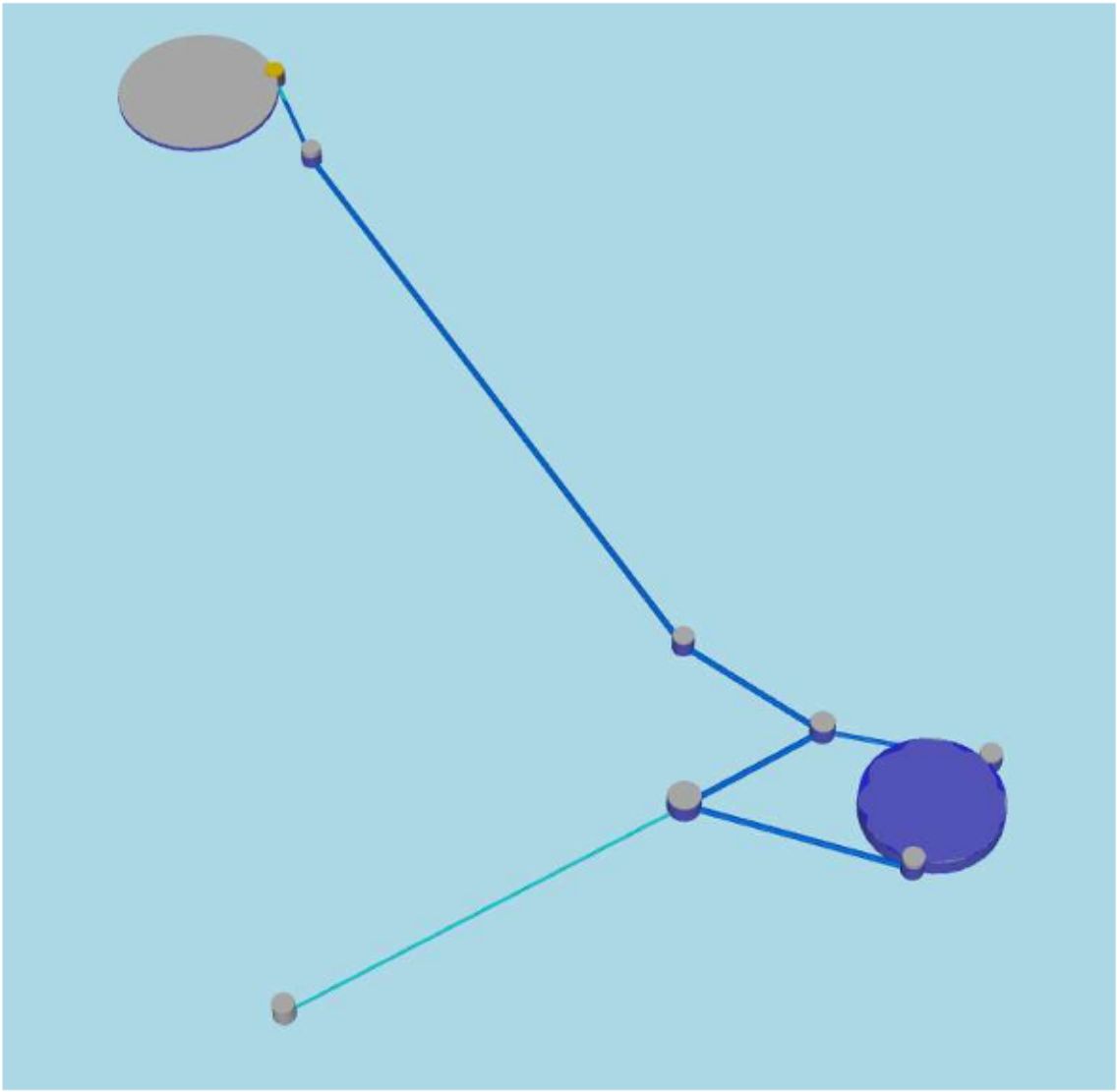
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Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 97.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	PARKING	352	3.085	0.915	11.0	62.5360	0.0000	FLOOD RISK
360 minute winter	SW01	344	2.917	0.867	7.4	0.9808	0.0000	SURCHARGED
360 minute winter	SW02	344	2.917	1.037	14.7	1.1725	0.0000	FLOOD RISK
360 minute winter	SW05	344	2.916	0.941	3.8	1.0645	0.0000	FLOOD RISK
360 minute winter	SW03	344	2.916	1.071	20.6	1.5325	0.0000	FLOOD RISK
360 minute winter	TANK 1	344	2.916	1.056	20.7	140.2486	0.0000	FLOOD RISK
360 minute winter	SW04	344	2.916	1.106	24.0	2.8150	0.0000	FLOOD RISK
15 minute summer	HW01	1	1.650	0.000	5.0	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)
360 minute winter	PARKING	Orifice	SW01	1.9				
360 minute winter	SW01	1.001	SW02	7.2	0.410	0.103	2.9884	
360 minute winter	SW02	1.002	SW03	14.4	0.424	0.210	0.6453	
360 minute winter	SW05	2.000	SW03	3.6	0.415	0.088	0.3560	
360 minute winter	SW03	1.003	SW04	20.8	0.343	0.297	0.6140	
360 minute winter	TANK 1	3.000	SW04	-18.8	-0.267	-0.266	0.8643	
360 minute winter	SW04	Hydro-Brake®	HW01	5.0				157.0

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FEH MODEL – 1 IN 100 Year + 10% + 40% - No Flooding

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