JACKSON
CONSULTING ENGINEERS

Proposed Drainage Strategy

Project:

Proposed Residential Development, Barrier Bank, Cowbit, Lincolnshire

Client:

Scenic Wilson Developments Ltd Ltd

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Introduction

Jackson consulting engineers have been appointed by Scenic Wilson Developments Ltd, to undertake a drainage strategy forming part of the supporting evidence for the planning submission of the proposed residential development to land off Barrier Bank, Cowbit, approximate postcode – PE12 6AN. The following document is to assist the planners in demonstrating that the development is acceptable in terms of sustainable drainage strategy and post development flood risk as a result of the development.

Existing Site

The site lies to the north east of South Drove, Spalding. An aerial location plan, with approximate site boundary is shown in figure 1.



Figure 1 - Site Location

The site is currently brownfield, generally laid to hardstanding and agricultural type buildings. The proposed site has an approximate total site area of approximately 0.29 hectares.

A topographical survey has been embedded into the site plan. The site has the following characteristics:

The site has a substantial fall across it, in part as it is access off of an old flood defence. The levels at Barrier bank (the entrance), sit at around 5.8m AOD, dropping down to 2.20m AOD. The site generally falls from south west, top north east.

The north and south boundaries are fenced. The west boundary fronts Barrier Bank footway/path. The eastern boundary has a substantial ditch which flows to the south. It is assumed that the ditch is riparian. The ditch was visually inspected in May 2022, and it was overgrown and dry.

The is an existing Anglian Water sewer running through the site, which has been taken into consideration during the design of the site.

Flood Risk Mitigation

The proposed dwellings have been positioned at a minimum FFL of 2.70m AOD, or 300mm above existing average ground levels, whichever is higher. This assessment has been made by another consultant, and this is just reported as an observation.

Flood Risk Offsite

The scheme will be designed so that the risk of flooding to offsite properties will not be increased as a result of the development.

Development Proposals

The re-development involves clearing the existing brownfield site, with the creation of up to 5 proposed dwellings, associated car parking and associated infrastructure. An indicative site layout is shown in the figure below.

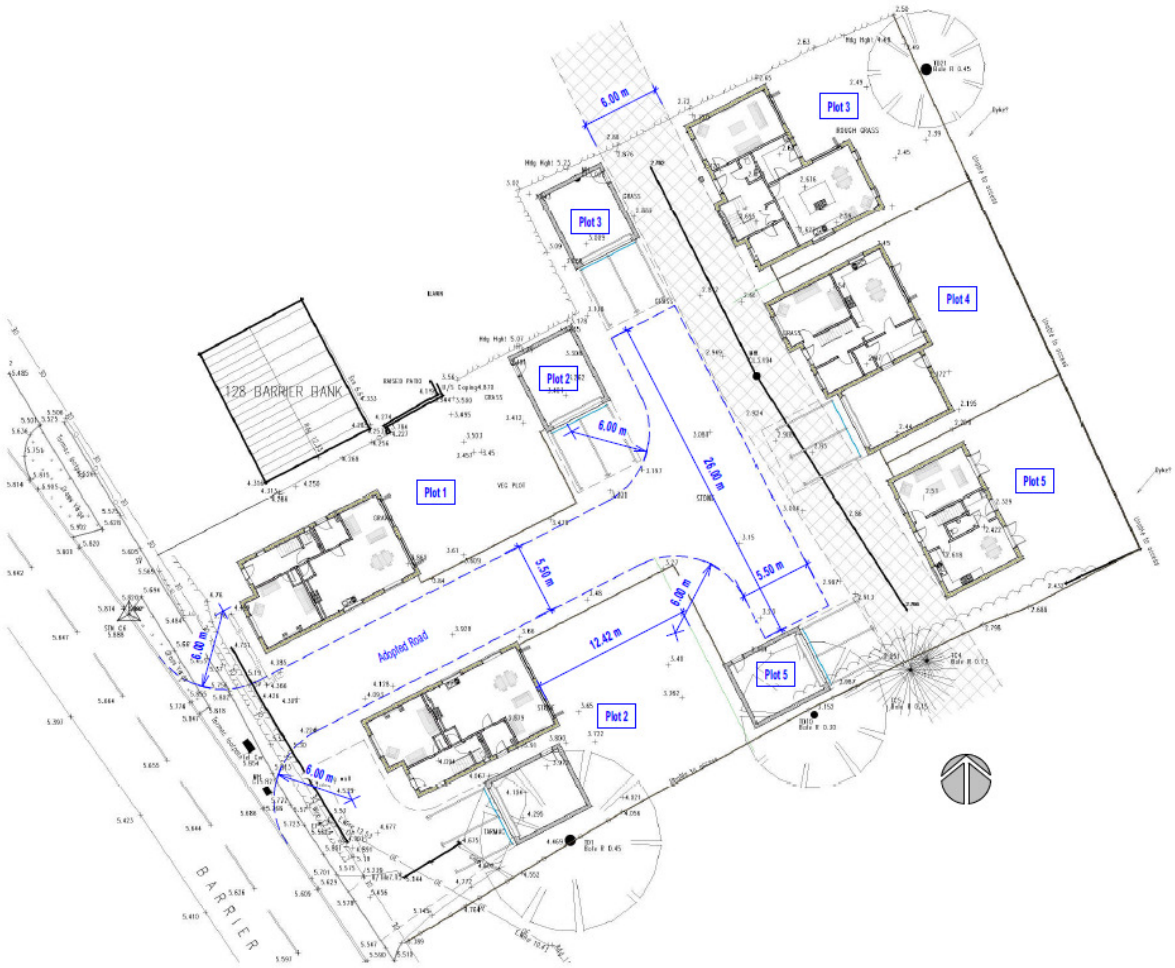


Figure 2 - Indicative Site Layout

Proposed Drainage Strategy

The following section provides narrative on the principles behind the drainage strategy and has been carried out in general accordance with Lincolnshire County Councils SUDS Guidance, "CIRIA's C753 – the SUDS Manual", and national technical standards where appropriate. Please note that as this development is for less than 10 dwellings, it is considered as a minor development, and will not be fully design in accordance with LCC's guidelines.

Surface Water Drainage

For new developments there is a requirement to apply sustainable drainage principles (SuDS) to the disposal of surface water from the site where practicable. As required by Building Regulations and PPG, surface water must discharge to the following, listed in priority.

1. To ground – in an adequate soakaway or some other adequate infiltration system.
2. To a watercourse.
3. To a surface water sewer, highway drain or other drainage system.
4. To a combined sewer.

Infiltration

Infiltration testing was planned to be undertaken by JCE in May 2022. During the site appraisal, the original trial logs undertaken as part of the structural engineering pack were reviewed. This review showed that the water table was within 1m of the ground levels, and therefore infiltration has been ruled out for the site.

Watercourse

The site falls within the catchment of South Holland Internal Drainage Board, specifically Wisemans South Catchment, as shown in the figure below. The exact drain reference known as DRN193P2103. This watercourse appears to flow to the south and although overgrown, appeared to be in a good condition during the site inspection. Given the size, capacity will not be a concern.

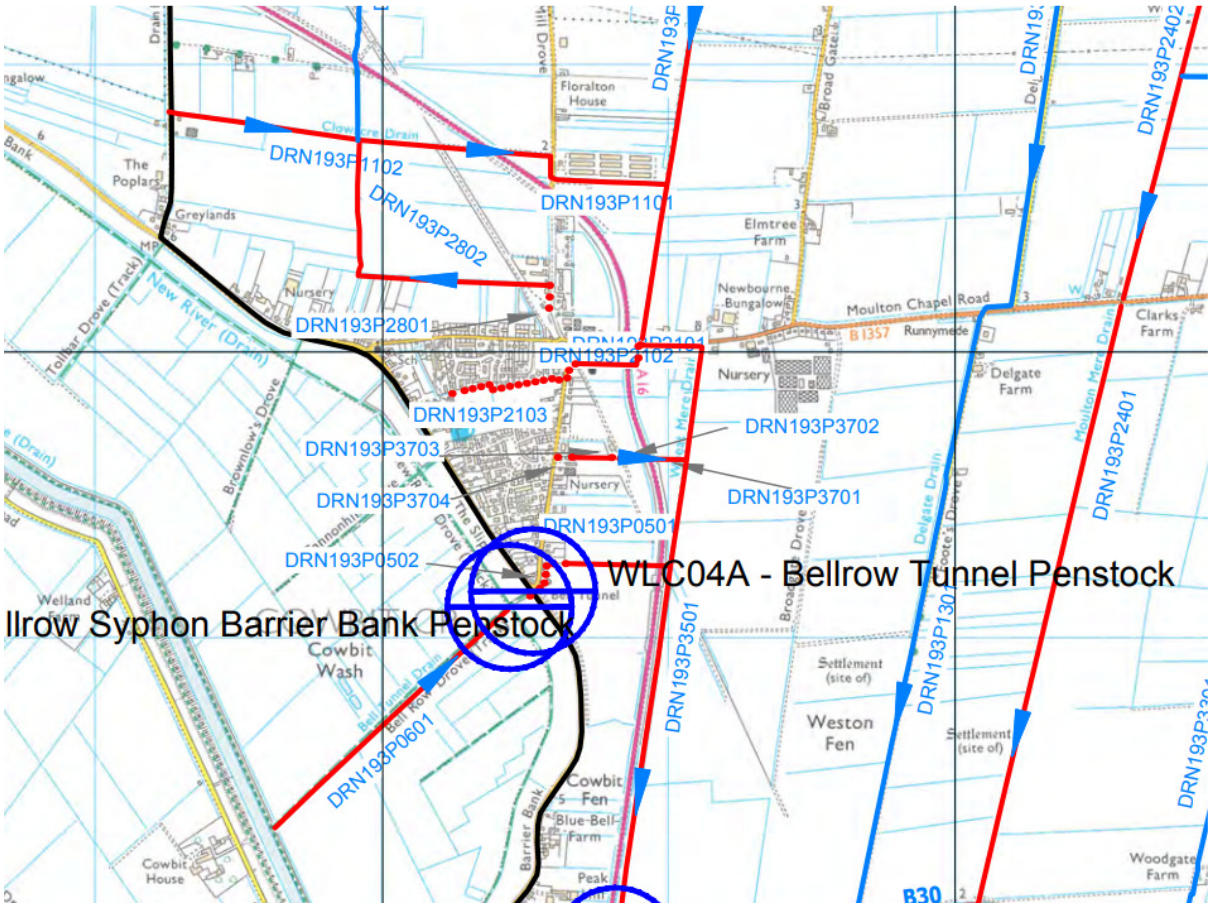


Figure 3 - SHIDB: Wisemans South Catchment

The Internal Drainage Board have a number of bylaws specific to this site, namely;

- Byelaw 3: Control of Introduction of Water and Increase in Flow or Volume of Water
- Byelaw 10: "No Obstruction within 9 metres of the Edge of the Watercourse

Full details of these byelaws can be found on Welland and Deepings IDB's website.

The site will need to apply for byelaw 3 consent. The IDB generally has an allowable 'pumped catchment' rate of 1.4l/s which does not necessary relate to the greenfield run-off or flood risk. As the total area will be relatively small in comparison to the pumped catchment rate, the 'free' discharge will also be low. Therefore, subject to board approval, it will be proposed that the discharge rate from the site is increased above the pumped catchment rate. It is proposed that the discharge rate from the site will be 5l/s, to mitigate the risk of blockage.

Surface Water Sewer

No surface water sewers have been identified in the proximity of the site, and as a connection into a watercourse is viable, no further consideration for a connection into a surface water sewer is needed.

Combined Water Sewer

No combined water sewers have been identified in the proximity of the site, and as a connection into a watercourse is viable, no further consideration for a connection into a surface water sewer is needed.

Proposed Surface Water Drainage Design

The proposed drainage layout is shown on JCE drawing 0214-JCE-00-SI-DR-C-3000.

All drainage models has been simulated for the 1 in 1, 30, 100 and 100 + 40% climate change events using FSR data.

A full copy of the drainage calculations can be found in appendix A of this document, and a graphical representation of the model is shown in the figure below.

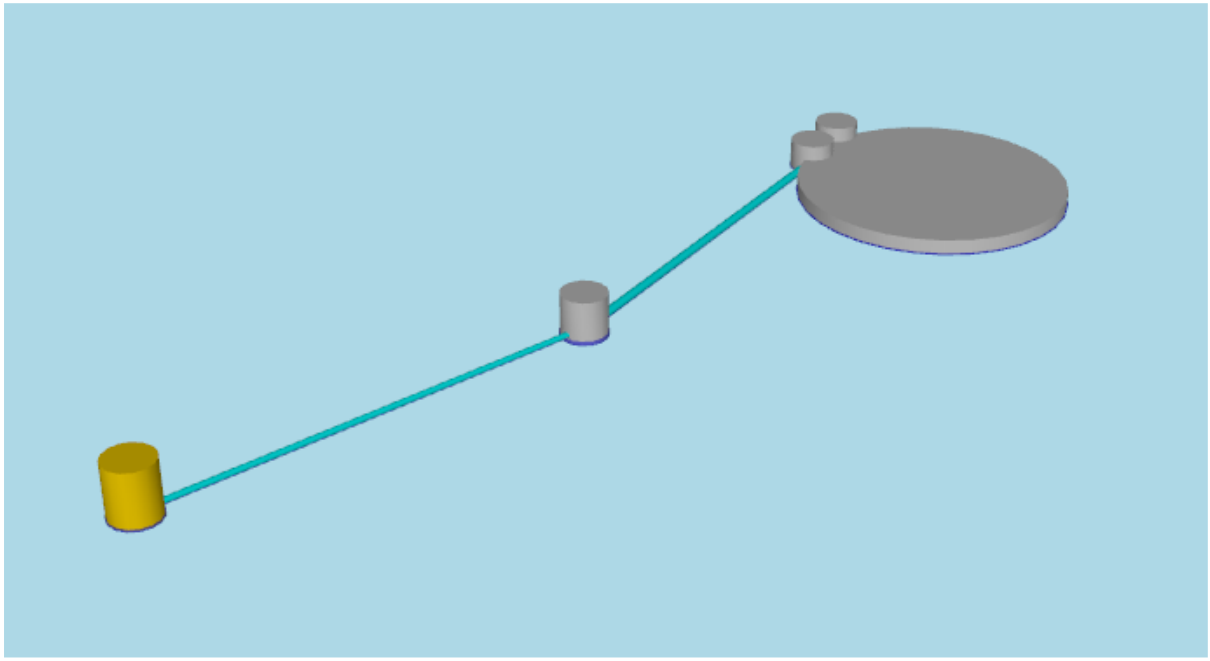


Figure 4 – Drainage Model

Flood Routing

The scheme has been designed so that no above ground flooding is created in the 1 in 100 year + 40% climate change critical storm, and therefore a plan is not required to represent the volumes, depths, velocities or extents of flooding.

The finished floor levels are positioned well above existing ground levels and the flood risk assessment shows that this is not at risk of flooding. Exceedance flooding will safely discharge around the proposed properties, towards the rear riparian drain, along the route of the proposed access road.

Maintenance

It is crucial that the elements mentioned in the drainage elements and water quality are maintained to a sufficient standard to ensure that the devices can still function as designed. Generally, the maintenance requirements are either from CIRIA 753, or manufacturer guidance.

Hydrobrake Maintenance

Maintenance

Normally, little maintenance is required as there are no moving parts within the Flow Control. Experience has shown that if blockages occur they do so at the intake, and the cause on such occasions has been due to a lack of attention to engineering detail such as approach velocities being too low, inadequate benching, or the use of units below the minimum recommended size. The Flow Control (where applicable) is fitted with a pivoting bypass door, which allows the manhole chamber to be drained down should blockage occur. The smaller conical units, below the minimum recommended size, are also supplied with rodding facilities or vortex suppressor pipes as standard.

Following installation of the Flow Control it is vitally important that any extraneous material i.e. building materials are removed from the unit and the chamber. After the system is made live, and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. If problems are experienced, please do not hesitate to contact the company so that an investigation may be made.

All Flow Control units are typically manufactured from grade 304 Stainless Steel, and if required they can also be manufactured in grade 316 Stainless Steel. Both materials have an estimated life span in excess of the design life of drainage systems.

Attenuation Tank

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Catchpits

Catchpits are utilised to help prevent the ingress of heavy sediment and other debris from entering the system. Maintenance requirements are low, and it is recommended that catchpits are inspected every six months and any build-up of sediment removed.

Pipework

If sediment in the catchpits are above the incoming pipes, or if performance of the site is hampered, then the pipes are to be inspect and jetted as necessary. The condition of the pipes shall generally be checked at the catchpit inspections.

Foul Proposals

There is a sewer located within the site, and it is proposed that the new dwellings will connect directly into this existing sewer. At present it is proposed that 3 connections will be made, one directly into the existing manhole, and two into junction connections, although this will be confirmed with AW.

Conclusion

- The above drainage strategy demonstrates that the site can be drained through the use of a Sustainable Drainage System at an appropriate level for the development.
- The flow offsite will be restricted to rate agreed with by the IDB.
- No above ground flooding is present for the 1 in 100 year + 40% climate change event.
- A preliminary drainage layout can be found on JCE's Preliminary Drainage Strategy drawing: 0214-JCE-00-SI-DR-C-3000.
- Finished floor levels will be set at a minimum of 2.7m AOD, or 300mm above existing average ground levels – in accordance with the architects layout.

Appendices

Appendix A – Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
PS1	0.035	5.00	4.210	1200	1.350
PS2	0.061	5.00	3.050	1200	1.115
PS3	0.034	5.00	2.500	1200	0.800
HW			2.500	1200	0.830

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	PS1	PS2	25.654	0.600	2.860	2.010	0.850	30.2	150	5.23	50.0
1.001	PS2	PS3	24.124	0.600	1.935	1.700	0.235	102.7	225	5.54	50.0
1.002	PS3	HW	3.022	0.600	1.700	1.670	0.030	100.7	225	5.58	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	1.839	32.5	4.7	1.200	0.890	0.035	0.0	38	1.312
1.001	1.290	51.3	13.0	0.890	0.575	0.096	0.0	77	1.080
1.002	1.302	51.8	17.6	0.575	0.605	0.130	0.0	90	1.179

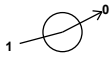
Pipeline Schedule

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	25.654	30.2	150	Circular	4.210	2.860	1.200	3.050	2.010	0.890
1.001	24.124	102.7	225	Circular	3.050	1.935	0.890	2.500	1.700	0.575
1.002	3.022	100.7	225	Circular	2.500	1.700	0.575	2.500	1.670	0.605

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	PS1	1200	Manhole	1 Adoptable	PS2	1200	Manhole	1 Adoptable
1.001	PS2	1200	Manhole	1 Adoptable	PS3	1200	Manhole	1 Adoptable
1.002	PS3	1200	Manhole	1 Adoptable	HW	1200	Manhole	1 Adoptable

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Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
PS1	4.210	1.350	1200				
				0	1.000	2.860	150
PS2	3.050	1.115	1200	1	1.000	2.010	150
							
				0	1.001	1.935	225
PS3	2.500	0.800	1200	1	1.001	1.700	225
							
				0	1.002	1.700	225
HW	2.500	0.830	1200	1	1.002	1.670	225
							

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	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 %)
1	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node PS3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	1.700	Product Number	CTL-SHE-0112-5000-0500-5000
Design Depth (m)	0.500	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node PS3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	98

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	134.0	0.0	0.400	134.0	0.0	0.401	0.0	0.0

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PS1	10	2.900	0.040	4.9	0.0449	0.0000	OK
15 minute winter	PS2	10	2.026	0.091	13.4	0.1031	0.0000	OK
120 minute winter	PS3	84	1.778	0.078	6.0	10.0116	0.0000	OK
15 minute summer	HW	1	1.670	0.000	1.4	0.0000	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 winter	PS1	1.000	PS2	4.8	1.306	0.148	0.0943	
15 minute winter	PS2	1.001	PS3	13.4	1.599	0.262	0.2212	
120 minute winter	PS3	Hydro-Brake®	HW	2.8				15.8

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PS1	10	2.924	0.064	12.1	0.0719	0.0000	OK
15 minute winter	PS2	10	2.080	0.145	33.1	0.1644	0.0000	OK
60 minute winter	PS3	50	1.882	0.182	23.0	23.4343	0.0000	OK
15 minute summer	HW	1	1.670	0.000	4.8	0.0000	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 winter	PS1	1.000	PS2	12.0	1.630	0.369	0.1952	
15 minute winter	PS2	1.001	PS3	33.0	1.820	0.643	0.4908	
60 minute winter	PS3	Hydro-Brake®	HW	5.0				31.6

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PS1	10	2.933	0.073	15.7	0.0829	0.0000	OK
15 minute winter	PS2	10	2.107	0.172	43.0	0.1948	0.0000	OK
120 minute winter	PS3	92	1.954	0.254	18.5	32.6166	0.0000	SURCHARGED
15 minute summer	HW	1	1.670	0.000	5.0	0.0000	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 winter	PS1	1.000	PS2	15.6	1.642	0.480	0.2646	
15 minute winter	PS2	1.001	PS3	42.8	1.871	0.833	0.6360	
60 minute winter	PS3	Hydro-Brake®	HW	5.0				41.8

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PS1	10	2.950	0.090	22.0	0.1020	0.0000	OK
15 minute winter	PS2	11	2.253	0.318	60.1	0.3599	0.0000	SURCHARGED
120 minute winter	PS3	112	2.093	0.393	25.9	50.4932	0.0000	SURCHARGED
15 minute summer	HW	1	1.670	0.000	5.0	0.0000	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 winter	PS1	1.000	PS2	21.8	1.655	0.672	0.3677	
15 minute winter	PS2	1.001	PS3	58.6	1.902	1.143	0.9180	
120 minute summer	PS3	Hydro-Brake®	HW	5.0				63.7

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