



Project Name : Land West of Kingfisher Grove, Three Mile Cross

Job No : 23-117

Note Title : Drainage Strategy Addendum 2

Author : CR

Checked : NM

Approved : GG

Date : February 2025

1.0 INTRODUCTION

1.1.1 Odyssey has been commissioned by Sovereign Network Group to undertake a surface water and foul drainage strategy, as part of a reserved matters application for a proposed development at Land West of Kingfisher Grove, Three Mile Cross.

1.1.2 The proposals comprise a residential development of up to 49 dwellings including the creation of new vehicular access, public open space, landscape planting, surface water attenuation and associated infrastructure.

1.1.3 Outline planning permission, subject to conditions, was granted on 31st January 2023 following an inquiry held in November 2022 (Wokingham Borough Council planning application number 201002).

1.1.4 Odyssey prepared a drainage strategy technical note (report reference 23-117-02D) to support the application for approval of reserved matters. This addendum has been produced to respond to comments received from Wokingham Borough Council's Green Infrastructure Delivery Officer and it should be read in conjunction with the drainage strategy technical note and Drainage Strategy Addendum 1. The comment has been included in **Appendix A**.

1.1.5 In response to comments from Wokingham Borough Council, the proposed site layout has been updated. The Engineering Layout has been updated to reflect this and is shown in drawing **23-116-001I**. The updated hydraulic calculations are included in **Appendix B**.



2.0 RESPONSE TO WOKINGHAM BOROUGH COUNCIL COMMENTS

2.1.1 Wokingham Borough Council provided the following comment (*in bold italics*) in January 2025.

Sustainable Drainage Systems (SuDS) – Condition 11

The proposed SuDS strategy relies solely on end-of-pipe solutions, such as detention basins and closed pipe systems, without incorporating a more holistic and integrated approach to surface water management. Given the ample space available within the site, there is a missed opportunity to implement a more sustainable, visually appealing, and multi-functional drainage strategy.

A well designed SuDS scheme should prioritise naturalistic and multi-benefit solutions that contribute to biodiversity, public amenity, and the overall landscape character. The scheme should explore the use of swales, tree pits, and rain gardens, which can provide effective water management while also enhancing ecological value and visual interest. These features should be designed to feed into a series of naturalistic basins that integrate seamlessly with the wider landscape, offering aesthetic value, informal recreation opportunities, and ecological function. A revised proposal should demonstrate how surface water management can be fully integrated into the development's landscape strategy to deliver both functional and placemaking benefits.

2.1.2 The proposed drainage strategy incorporates a series of elongated basins with surface water runoff being conveyed following treatment train from the most upstream basin to the last one before discharging to the outfall. The treatment train ensures that the holistic set of basins provides not only volumetric surface water attenuation but also water quality treatment and cleansing. This was agreed with the Lead Local Flood Authority (LLFA) at both the outline planning stage and as part of the reserved matters application.

2.1.3 The agreed outline drainage strategy proposed that surface water generated by the development would be attenuated in an elongated SuDS feature prior to discharging to a ditch that runs near to the west boundary of the site.

2.1.4 In line with the drainage hierarchy set out in the Planning Practice Guidance (PPG), infiltration was initially considered but determined to be unviable due to the underlying bedrock on site comprising London Clay Formation.



2.1.5 However, there is no route to connect flows from the site to the ditch without crossing third party land, therefore discharging surface water to this location would not be viable. In line with the drainage hierarchy, the next preferred option is for surface water to be discharged to a sewer. Surface water from the site would be conveyed to an existing Thames Water public sewer near the site access. This sewer network ultimately discharges into a watercourse to the north of the site. Thames Water has confirmed that they do have capacity to receive the flows from the site.

2.1.6 The proposal to attenuate surface water flows using elongated basins is consistent with the approved outline strategy. However, the shape and formation of these has been redesigned to suit the updated site layout and existing topography. **Figure 2.1** shows the outline SuDS landscape plan (left) side by side with the current one (right), demonstrating that the approved drainage principles have been maintained in the current design. No sizing and 3D design of the SuDS features was undertaken at the outline planning stage. The basins have now been fully designed taking into account the topography as well as the total volume of surface water to be attenuated at the site up to the 1 in 100 year plus an allowance for climate change. A 10% increase in roof areas to account for urban creep has also been included in the calculations.

Figure 2.1: Outline Approved SuDS Landscape Plan (Left) vs Current (Right).





2.1.7 The SuDS features suggested at outline planning stage but not incorporated into the outline concept proposals pending detailed review included permeable paving, detention basins, swales, filter strips, and filter drains, however due to the steep gradients across the site, only the detention basin was suitable. This is outlined in **Table 2.2**:

Table 2.2: SuDS Component Suitability

SuDS Component	Suitability / Use
Permeable Pavements	Not suitable due to steep gradients.
Detention Basins	Suitable, to be utilised to attenuate surface water and provide, ecological and biodiversity benefits.
Filter Strips	Not suitable due to limited developable area, and steep site gradient increasing risk of flow channelling and erosion.
Filter Drains	Not suitable due to steep site gradient leading to high flow velocity, causing unstable flow through filter material and limited pollutant removal.
Swales	Not suitable due to steep site gradient.
Trees	Not suitable due to impact on proposed tree types.

2.1.8 The drainage scheme maximises the use of the public open space and basins have gentle side slopes hence offering great aesthetic value. One of the basins is designed to accommodate permanent water within it, this further increases the ecological and biodiversity benefits.

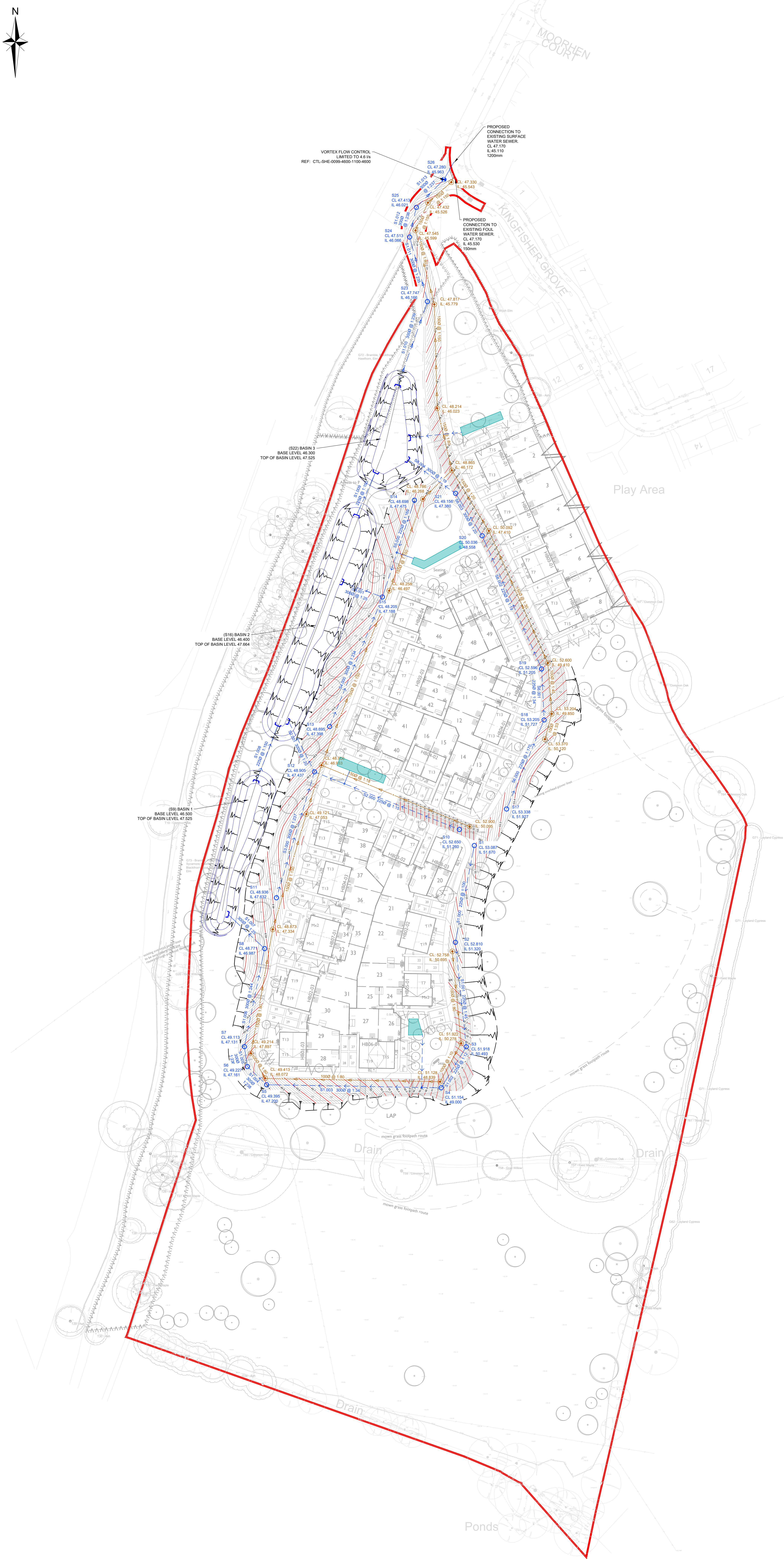
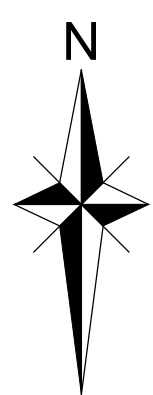
2.1.9 The rest of the areas designated as public open space to the east and south are too steep to incorporate conveyance features such as swales. The routes running east to west are too steep to include baffles to the swales. This is in conjunction with the proposed landscape plan.

2.1.10 Proposed rain gardens are shown indicatively adjacent to plots 1, 47, and 48. Other SuDS features such as downpipe planters, and additional small scale rain gardens will be utilised where possible.



DRAWINGS

23-117-001I Engineering Layout



NOTES

1. DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.

2. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.

3. PROPOSALS ARE INDICATIVE ONLY TO DEMONSTRATE DRAINAGE STRATEGY AND ARE SUBJECT TO EVOLVE THROUGH DETAILED DESIGN

4. TOPOGRAPHICAL SURVEY HAS BEEN PROVIDED BY GROUND SURVEYS LTD. DRAWING REFERENCE 7280-01A. DATED JANUARY 2020.

5. SITE LAYOUT AS PER DWG ARCHITECTS DRAWING 24009-DWC-SP003-01-DR-A-0010-P

6. DOWNPIPE PLANTERS AND RAIN GARDEN FEATURES ARE TO BE UTILISED WHERE APPROPRIATE.

LEGEND

SITE BOUNDARY

WATERCOURSE

PROPOSED SURFACE WATER SEWER AND MANHOLE

VORTEX FLOW CONTROL

PROPOSED HEADWALL

PROPOSED FOUL WATER SEWER AND MANHOLE

EXISTING FOUL WATER SEWER AND MANHOLE

EXISTING SURFACE WATER SEWER AND MANHOLE

EXISTING DECOMMISSIONED SEWER

PROPOSED BASIN, FIRST 300mm DEPTH BELOW SURFACE AT 1 IN 6 GRADIENT, 1 IN 3 GRADIENT BELOW THIS.

EXISTING THAMES WATER FOUL PUMPING STATION

PROPOSED HIGHWAY CONTOURS (SHOWN AT 20mm INTERVALS)

INDICATIVE BIORETENTION (RAIN GARDEN) SUDS FEATURE

I	LAYOUT, DRAINAGE UPDATED	CN	CR	GG	20.02.25
H	LAYOUT UPDATED	CN	CR	GG	07.02.25
G	LEVELS, TITLE AMENDED	CR	GG	GG	16.10.24
F	DRAINAGE UPDATED AS PER NEW LEVELS	CR	NM	GG	07.10.24
E	DRAINAGE UPDATED TO AVOID CLASH	CR	NM	GG	11.07.24
D	DRAINAGE LEVEL INFORMATION ADDED	CR	NM	GG	05.07.24
C	UPDATED TO REFLECT LAYOUT CHANGES	CR	NM	GG	07.06.24
B	UPDATED TO REFLECT LAYOUT CHANGES	CR	NM	GG	26.04.24
A	UPDATED FOR FOUL STRATEGY	JWA	JWA	RA	27.07.23
Rev	Amendments	Drn	Chn	App	Date

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Job Title

LAND WEST OF KINGFISHER GROVE, THREE MILE CROSS

Drawing Title

PRELIMINARY ENGINEERING LAYOUT

Client

SOVEREIGN

Scale	Date	Designed
1:500 @A0	JUL 23	HM
Drawn	Checked	Approved
HM	JW	GG
Job No	Drawing No	Rev
23-117	23-117-001	I



APPENDIX A

Wokingham Borough Council Comments

MEMORANDUM

From:	Raymond Barry Green Infrastructure Delivery Officer		
Service	WBC Infrastructure	Green	App No: 242665
Address:	Land west of Kingfisher Grove, Three Mile Cross.		
Proposal:	Application for approval of Reserved Matters pursuant to Outline Planning Consent 201002 (approved under appeal ref. APP/X0360/W/22/3304042 dated 31/01/2023) for the erection of 49 no. affordable dwellings with associated drainage and attenuation, open space and landscaping. Details of appearance, landscaping, layout and scale to be considered, plus details for discharge of conditions 11, 12, 13, 15 and 16 from the Outline permission.		
Type of Development:	Major Dwellings (10+)		
Site Visit Made:	No		

Summary Of Recommendations

- ☐ No comment
- ☐ No objection
- ☐ No objection subject to conditions (and reasons) **stated below**
- ☒ Request further information before determination as **stated below**
- ☐ Objection due to the reason(s) **stated below**

Comments On Proposal

Sustainable Drainage Systems (SuDS) – Condition 11

The proposed SuDS strategy relies solely on end-of-pipe solutions, such as detention basins and closed pipe systems, without incorporating a more holistic and integrated approach to surface water management. Given the ample space available within the site, there is a missed opportunity to implement a more sustainable, visually appealing, and multi-functional drainage strategy.

A well designed SuDS scheme should prioritise naturalistic and multi-benefit solutions that contribute to biodiversity, public amenity, and the overall landscape character. The scheme should explore the use of swales, tree pits, and rain gardens, which can provide effective water management while also enhancing ecological value and visual interest. These features should be designed to feed into a series of naturalistic basins that integrate seamlessly with the wider landscape, offering aesthetic value, informal recreation opportunities, and ecological function. A revised proposal should demonstrate how surface water management can be fully integrated into the development's landscape strategy to deliver both functional and placemaking benefits.

Management Plan – Condition 16

It is premature to assess and approve a management plan at this stage, as any subsequent changes to the site layout, design, or landscape strategy would require revisions to how the landscape is managed. Submitting a management plan before the design is finalised risks unnecessary and abortive work. A more appropriate approach would be to ensure that the design is fully developed and agreed upon before the management plan is prepared.

Formal and Informal Open Space

The current landscape design lacks functionality and a clear vision for how residents will engage with and benefit from the open spaces. A well-designed landscape should create meaningful, inviting, and multifunctional spaces that encourage social interaction, recreation, and well-being.

There needs to be a stronger emphasis on placemaking, with a clear hierarchy of spaces that cater to different uses ranging from structured formal areas to more naturalistic, informal spaces that support biodiversity and passive recreation. Thought should be given to pedestrian circulation, accessibility, and the integration of seating, planting, and other landscape features that enhance the user experience. Additionally, consideration should be given to how these spaces will be activated and programmed to ensure they serve a genuine purpose within the community. A mown grass path around a field is not acceptable.

Play Area

The illustrative plan does not provide sufficient detail regarding the provision of play within the landscape scheme. Play should be an integral component of the open space strategy, not an afterthought. The design should incorporate high-quality, imaginative play features that blend seamlessly with the surrounding landscape, creating an engaging and inclusive environment for children of all ages. A well-designed play area should go beyond standard equipment and consider opportunities for natural play, sensory experiences, and creative engagement with the landscape. This could include elements such as sculptural play features and nature-based play structures that encourage exploration and imaginative play (i.e. an LLAP).

I would suggest the applicant (with landscape architect) set up a series of design workshops with the Council to work out how the landscape can be design effectively.

Conditions & Reasons (if required)

Please use this section to detail any conditions that are required to make this development acceptable in planning terms. All conditions should be accompanied by reasons.

Date:	30.01.25	Signed:	Raymond Barry
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APPENDIX B

Drainage Strategy Hydraulic Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	5	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)	4.00	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)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Notes
✓ 1	0.013	4.00	53.087	Manhole	Adoptable	1200	470955.392	167282.150	1.417	
✓ 9			47.525	Manhole	Adoptable	1200	470869.203	167279.471	1.168	Auto-design is off
✓ 16			47.664	Manhole	Adoptable	1200	470898.680	167352.957	1.264	Auto-design is off
✓ 22	0.053	4.00	47.525	Manhole	Adoptable	1200	470923.614	167424.108	1.225	Auto-design is off
✓ 23	0.009	4.00	47.747	Manhole	Adoptable	1200	470938.941	167472.947	1.581	
✓ 2	0.059	4.00	52.810	Manhole	Adoptable	1200	470948.773	167248.215	1.490	
✓ 3	0.044	4.00	51.918	Manhole	Adoptable	1200	470952.584	167211.569	1.425	
✓ 5	0.081	4.00	49.395	Manhole	Adoptable	1200	470882.542	167198.256	2.195	
✓ 7	0.006	4.00	49.113	Manhole	Adoptable	1200	470874.751	167211.625	1.982	
✓ 8	0.098	4.00	48.771	Manhole	Adoptable	1200	470881.854	167245.998	1.784	
✓ 11	0.017	4.00	48.936	Manhole	Adoptable	1200	470885.989	167263.833	1.304	
✓ 12	0.169	4.00	48.905	Manhole	Adoptable	1200	470899.429	167308.008	1.468	
✓ 10	0.005	4.00	52.650	Manhole	Adoptable	1200	470950.170	167287.786	1.390	
✓ 17	0.009	4.00	53.338	Manhole	Adoptable	1200	470966.716	167294.966	1.411	
✓ 18	0.055	4.00	53.205	Manhole	Adoptable	1200	470979.889	167326.206	1.478	
✓ 19	0.031	4.00	52.596	Manhole	Adoptable	1200	470979.002	167344.100	1.391	
✓ 20	0.115	4.00	50.036	Manhole	Adoptable	1200	470958.160	167390.811	1.553	
✓ 21	0.050	4.00	49.156	Manhole	Adoptable	1200	470948.825	167405.679	1.776	
✓ 13	0.017	4.00	48.695	Manhole	Adoptable	1200	470904.647	167323.903	1.297	
✓ 15	0.183	4.00	48.205	Manhole	Adoptable	1200	470923.156	167369.313	1.017	
✓ 14	0.011	4.00	48.698	Manhole	Adoptable	1200	470934.385	167403.274	1.223	
✓ 24	0.014	4.00	47.513	Manhole	Adoptable	1200	470932.671	167495.575	1.447	
✓ 25	0.007	4.00	47.413	Manhole	Adoptable	1200	470935.063	167506.001	1.392	
✓ 26	0.014	4.00	47.280	Manhole	Adoptable	1200	470944.738	167515.780	1.317	
✓ 26_OUT			47.200	Manhole	Adoptable	1200	470950.799	167520.605	1.316	
✓ 4	0.021	4.00	51.154	Manhole	Adoptable	1200	470943.774	167197.192	2.154	
✓ 6	0.006	4.00	49.227	Manhole	Adoptable	1200	470875.797	167204.638	2.066	

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	34.574	0.600	51.670	51.320	0.350	98.8	225	4.44	50.0
1.001	2	3	36.844	0.600	51.320	50.493	0.827	44.6	225	4.75	50.0
1.002	3	4	16.862	0.600	50.493	49.075	1.418	11.9	225	4.82	50.0
1.003	4	5	61.241	0.600	49.000	47.200	1.800	34.0	300	5.20	50.0
1.004	5	6	9.286	0.600	47.200	47.161	0.039	238.1	300	5.35	50.0
1.005	6	7	7.065	0.600	47.161	47.131	0.030	235.5	300	5.47	50.0
1.006	7	8	35.099	0.600	47.131	46.987	0.144	243.7	300	6.05	50.0
1.007	8	9	15.750	0.600	46.987	46.357	0.630	25.0	300	6.14	50.0
1.008	9	16	15.000	0.600	46.500	46.400	0.100	150.0	225	6.37	50.0
1.009	16	22	15.000	0.600	46.400	46.300	0.100	150.0	225	4.87	50.0

Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
? 1.000	1	2	1.315	52.3	1.8	1.192	1.265	1.192	1.265	0.013	0.0	29	0.618
? 1.001	2	3	1.965	78.1	9.8	1.265	1.200	1.200	1.265	0.072	0.0	53	1.346
? 1.002	3	4	3.815	151.7	15.7	1.200	1.854	1.200	1.854	0.116	0.0	49	2.492
✓ 1.003	4	5	2.704	191.1	18.6	1.854	1.895	1.854	1.895	0.137	0.0	62	1.730
✓ 1.004	5	6	1.014	71.7	29.5	1.895	1.766	1.766	1.895	0.218	0.0	134	0.966
✓ 1.005	6	7	1.020	72.1	30.4	1.766	1.682	1.682	1.766	0.224	0.0	136	0.977
✓ 1.006	7	8	1.002	70.9	31.2	1.682	1.484	1.484	1.682	0.230	0.0	139	0.971
? 1.007	8	9	3.157	223.1	44.5	1.484	0.868	0.868	1.484	0.328	0.0	91	2.483
? 1.008	9	16	1.065	42.3	44.5	0.800	1.039	0.800	1.039	0.328	0.0	198	1.199
? 1.009	16	22	1.065	42.3	98.9	1.039	1.000	1.000	1.039	0.730	0.0	225	1.085

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)
1.010	22	23	32.000	0.600	46.300	46.166	0.134	238.8	300	5.68	50.0
1.011	23	24	23.481	0.600	46.166	46.066	0.100	234.8	300	6.06	50.0
1.012	24	25	10.697	0.600	46.066	46.021	0.045	237.7	300	6.24	50.0
1.013	25	26	13.756	0.600	46.021	45.963	0.058	237.2	300	6.46	50.0
1.014	26	26_OUT	7.747	0.600	45.963	45.884	0.079	98.1	150	6.59	50.0
2.000	10	12	54.622	0.600	51.260	47.512	3.748	14.6	225	4.26	50.0
2.001	12	16	20.100	0.600	47.437	46.432	1.005	20.0	300	4.85	50.0
3.000	11	12	46.174	0.600	47.632	47.437	0.195	236.8	300	4.76	50.0
4.000	13	15	49.037	0.600	47.398	47.188	0.210	233.5	300	4.80	50.0
4.001	15	16	14.000	0.600	47.188	46.628	0.560	25.0	300	4.87	50.0
5.000	14	15	35.769	0.600	47.475	47.263	0.212	168.7	225	4.59	50.0
6.000	17	18	33.904	0.600	51.927	51.727	0.200	169.5	225	4.56	50.0
6.001	18	19	17.916	0.600	51.727	51.205	0.522	34.3	225	4.70	50.0
6.002	19	20	51.150	0.600	51.205	48.483	2.722	18.8	225	4.98	50.0
6.003	20	21	17.556	0.600	48.558	47.656	0.902	19.5	300	5.06	50.0
6.004	21	22	20.100	0.600	47.380	46.300	1.080	18.6	300	5.15	50.0

Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
? 1.010	22	23	1.013	71.6	141.4	0.925	1.281	0.925	1.281	1.043	0.0	300	1.026
? 1.011	23	24	1.022	72.2	142.6	1.281	1.147	1.147	1.281	1.052	0.0	300	1.035
? 1.012	24	25	1.015	71.8	144.5	1.147	1.092	1.092	1.147	1.066	0.0	300	1.028
? 1.013	25	26	1.016	71.8	145.4	1.092	1.017	1.017	1.092	1.073	0.0	300	1.029
? 1.014	26	26_OUT	1.015	17.9	147.3	1.167	1.166	1.166	1.167	1.087	0.0	150	1.034
? 2.000	10	12	3.445	137.0	0.7	1.165	1.168	1.165	1.168	0.005	0.0	11	0.869
? 2.001	12	16	3.531	249.6	25.9	1.168	0.932	0.932	1.168	0.191	0.0	65	2.309
? 3.000	11	12	1.017	71.9	2.3	1.004	1.168	1.004	1.168	0.017	0.0	37	0.468
? 4.000	13	15	1.024	72.4	2.3	0.997	0.717	0.717	0.997	0.017	0.0	37	0.472
? 4.001	15	16	3.157	223.1	28.6	0.717	0.736	0.717	0.736	0.211	0.0	72	2.188
? 5.000	14	15	1.003	39.9	1.5	0.998	0.717	0.717	0.998	0.011	0.0	29	0.479
? 6.000	17	18	1.001	39.8	1.2	1.186	1.253	1.186	1.253	0.009	0.0	27	0.450
? 6.001	18	19	2.240	89.1	8.7	1.253	1.166	1.166	1.253	0.064	0.0	47	1.431
? 6.002	19	20	3.032	120.6	12.9	1.166	1.328	1.166	1.328	0.095	0.0	50	2.000
? 6.003	20	21	3.579	253.0	28.5	1.178	1.200	1.178	1.200	0.210	0.0	68	2.401
? 6.004	21	22	3.661	258.8	35.2	1.476	0.925	0.925	1.476	0.260	0.0	74	2.584

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	34.574	98.8	225	Circular	53.087	51.670	1.192	52.810	51.320	1.265
1.001	36.844	44.6	225	Circular	52.810	51.320	1.265	51.918	50.493	1.200
1.002	16.862	11.9	225	Circular	51.918	50.493	1.200	51.154	49.075	1.854
1.003	61.241	34.0	300	Circular	51.154	49.000	1.854	49.395	47.200	1.895
1.004	9.286	238.1	300	Circular	49.395	47.200	1.895	49.227	47.161	1.766
1.005	7.065	235.5	300	Circular	49.227	47.161	1.766	49.113	47.131	1.682
1.006	35.099	243.7	300	Circular	49.113	47.131	1.682	48.771	46.987	1.484
1.007	15.750	25.0	300	Circular	48.771	46.987	1.484	47.525	46.357	0.868
1.008	15.000	150.0	225	Circular	47.525	46.500	0.800	47.664	46.400	1.039
1.009	15.000	150.0	225	Circular	47.664	46.400	1.039	47.525	46.300	1.000
1.010	32.000	238.8	300	Circular	47.525	46.300	0.925	47.747	46.166	1.281

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.004	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.005	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.006	7	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
1.007	8	1200	Manhole	Adoptable	9	1200	Manhole	Adoptable
1.008	9	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
1.009	16	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable
1.010	22	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable

Pipeline Schedule

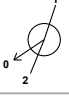
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.011	23.481	234.8	300	Circular	47.747	46.166	1.281	47.513	46.066	1.147
1.012	10.697	237.7	300	Circular	47.513	46.066	1.147	47.413	46.021	1.092
1.013	13.756	237.2	300	Circular	47.413	46.021	1.092	47.280	45.963	1.017
1.014	7.747	98.1	150	Circular	47.280	45.963	1.167	47.200	45.884	1.166
2.000	54.622	14.6	225	Circular	52.650	51.260	1.165	48.905	47.512	1.168
2.001	20.100	20.0	300	Circular	48.905	47.437	1.168	47.664	46.432	0.932
3.000	46.174	236.8	300	Circular	48.936	47.632	1.004	48.905	47.437	1.168
4.000	49.037	233.5	300	Circular	48.695	47.398	0.997	48.205	47.188	0.717
4.001	14.000	25.0	300	Circular	48.205	47.188	0.717	47.664	46.628	0.736
5.000	35.769	168.7	225	Circular	48.698	47.475	0.998	48.205	47.263	0.717
6.000	33.904	169.5	225	Circular	53.338	51.927	1.186	53.205	51.727	1.253
6.001	17.916	34.3	225	Circular	53.205	51.727	1.253	52.596	51.205	1.166
6.002	51.150	18.8	225	Circular	52.596	51.205	1.166	50.036	48.483	1.328
6.003	17.556	19.5	300	Circular	50.036	48.558	1.178	49.156	47.656	1.200
6.004	20.100	18.6	300	Circular	49.156	47.380	1.476	47.525	46.300	0.925

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.011	23	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
1.012	24	1200	Manhole	Adoptable	25	1200	Manhole	Adoptable
1.013	25	1200	Manhole	Adoptable	26	1200	Manhole	Adoptable
1.014	26	1200	Manhole	Adoptable	26_OUT	1200	Manhole	Adoptable
2.000	10	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
2.001	12	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
3.000	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
4.000	13	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
4.001	15	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
5.000	14	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
6.000	17	1200	Manhole	Adoptable	18	1200	Manhole	Adoptable
6.001	18	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
6.002	19	1200	Manhole	Adoptable	20	1200	Manhole	Adoptable
6.003	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
6.004	21	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
1	470955.392	167282.150	53.087	1.417	1200	Manhole	Adoptable		0	1.000	51.670	225 Circular
9	470869.203	167279.471	47.525	1.168	1200	Manhole	Adoptable		1	1.007	46.357	300 Circular
16	470898.680	167352.957	47.664	1.264	1200	Manhole	Adoptable		0	1.008	46.500	225 Circular
									1	4.001	46.628	300 Circular
									2	2.001	46.432	300 Circular
									3	1.008	46.400	225 Circular
									0	1.009	46.400	225 Circular
22	470923.614	167424.108	47.525	1.225	1200	Manhole	Adoptable		1	6.004	46.300	300 Circular
									2	1.009	46.300	225 Circular
									0	1.010	46.300	300 Circular
23	470938.941	167472.947	47.747	1.581	1200	Manhole	Adoptable		1	1.010	46.166	300 Circular
									0	1.011	46.166	300 Circular
2	470948.773	167248.215	52.810	1.490	1200	Manhole	Adoptable		1	1.000	51.320	225 Circular
									0	1.001	51.320	225 Circular
3	470952.584	167211.569	51.918	1.425	1200	Manhole	Adoptable		1	1.001	50.493	225 Circular
									0	1.002	50.493	225 Circular

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type	
5	470882.542	167198.256	49.395	2.195	1200	Manhole	Adoptable		1	1.003	47.200	300	Circular
									0	1.004	47.200	300	Circular
7	470874.751	167211.625	49.113	1.982	1200	Manhole	Adoptable		1	1.005	47.131	300	Circular
									0	1.006	47.131	300	Circular
8	470881.854	167245.998	48.771	1.784	1200	Manhole	Adoptable		1	1.006	46.987	300	Circular
									0	1.007	46.987	300	Circular
11	470885.989	167263.833	48.936	1.304	1200	Manhole	Adoptable						
									0	3.000	47.632	300	Circular
12	470899.429	167308.008	48.905	1.468	1200	Manhole	Adoptable		1	3.000	47.437	300	Circular
									2	2.000	47.512	225	Circular
									0	2.001	47.437	300	Circular
10	470950.170	167287.786	52.650	1.390	1200	Manhole	Adoptable						
									0	2.000	51.260	225	Circular
17	470966.716	167294.966	53.338	1.411	1200	Manhole	Adoptable						
									0	6.000	51.927	225	Circular
18	470979.889	167326.206	53.205	1.478	1200	Manhole	Adoptable		1	6.000	51.727	225	Circular
									0	6.001	51.727	225	Circular
19	470979.002	167344.100	52.596	1.391	1200	Manhole	Adoptable		1	6.001	51.205	225	Circular
									0	6.002	51.205	225	Circular
20	470958.160	167390.811	50.036	1.553	1200	Manhole	Adoptable		1	6.002	48.483	225	Circular
									0	6.003	48.558	300	Circular
21	470948.825	167405.679	49.156	1.776	1200	Manhole	Adoptable		1	6.003	47.656	300	Circular
									0	6.004	47.380	300	Circular
13	470904.647	167323.903	48.695	1.297	1200	Manhole	Adoptable						
									0	4.000	47.398	300	Circular
15	470923.156	167369.313	48.205	1.017	1200	Manhole	Adoptable		1	5.000	47.263	225	Circular
									2	4.000	47.188	300	Circular
									0	4.001	47.188	300	Circular
14	470934.385	167403.274	48.698	1.223	1200	Manhole	Adoptable						
									0	5.000	47.475	225	Circular
24	470932.671	167495.575	47.513	1.447	1200	Manhole	Adoptable		1	1.011	46.066	300	Circular
									0	1.012	46.066	300	Circular
25	470935.063	167506.001	47.413	1.392	1200	Manhole	Adoptable		1	1.012	46.021	300	Circular
									0	1.013	46.021	300	Circular

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type	
26	470944.738	167515.780	47.280	1.317	1200	Manhole	Adoptable		1	1.013	45.963	300	Circular
									0	1.014	45.963	150	Circular
26_OUT	470950.799	167520.605	47.200	1.316	1200	Manhole	Adoptable		1	1.014	45.884	150	Circular
4	470943.774	167197.192	51.154	2.154	1200	Manhole	Adoptable		1	1.002	49.075	225	Circular
									0	1.003	49.000	300	Circular
6	470875.797	167204.638	49.227	2.066	1200	Manhole	Adoptable		1	1.004	47.161	300	Circular
									0	1.005	47.161	300	Circular

Simulation Settings

Rainfall Methodology	FEH-22	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
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node 26 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	45.963	Product Number	CTL-SHE-0099-4600-1200-4600
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.6	Min Node Diameter (mm)	1200

Node 9 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.357
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	151.0	0.0	0.725	396.0	0.0	1.025	586.0	0.0

Node 16 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	242.0	0.0	0.964	737.5	0.0	1.264	938.0	0.0

Node 22 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	229.7	0.0	0.925	457.2	0.0	1.225	594.5	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.74%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	51.736	0.066	10.0	0.0749	0.0000	OK
480 minute winter	9	480	47.112	0.755	23.9	211.3783	0.0000	SURCHARGED
480 minute winter	16	480	47.112	0.712	32.7	303.3867	0.0000	SURCHARGED
480 minute winter	22	480	47.111	0.811	25.2	268.1920	0.0000	SURCHARGED
480 minute winter	23	480	47.111	0.945	7.3	1.0683	0.0000	SURCHARGED
15 minute winter	2	10	51.467	0.147	55.2	0.1658	0.0000	OK
15 minute winter	3	10	50.629	0.136	88.9	0.1542	0.0000	OK
15 minute winter	5	11	48.774	1.574	162.0	1.7799	0.0000	SURCHARGED
15 minute winter	7	11	48.262	1.131	151.0	1.2791	0.0000	SURCHARGED
15 minute winter	8	11	47.473	0.486	214.3	0.5491	0.0000	SURCHARGED
15 minute winter	11	10	47.717	0.085	13.0	0.0963	0.0000	OK
15 minute summer	12	10	47.621	0.184	146.2	0.2083	0.0000	OK
15 minute winter	10	10	51.286	0.026	3.8	0.0292	0.0000	OK
15 minute winter	17	10	51.990	0.063	6.9	0.0710	0.0000	OK
15 minute winter	18	10	51.855	0.128	49.0	0.1448	0.0000	OK
15 minute winter	19	10	51.330	0.125	72.8	0.1418	0.0000	OK
15 minute winter	20	10	48.757	0.274	161.0	0.3097	0.0000	OK
15 minute summer	21	9	47.618	0.238	199.3	0.2688	0.0000	OK
15 minute winter	13	10	47.483	0.085	13.0	0.0959	0.0000	OK
15 minute winter	15	10	47.414	0.226	161.5	0.2558	0.0000	OK
15 minute winter	14	10	47.544	0.069	8.4	0.0785	0.0000	OK
480 minute winter	24	472	47.110	1.044	6.4	1.1809	0.0000	SURCHARGED
480 minute winter	25	472	47.110	1.089	5.5	1.2314	0.0000	SURCHARGED
480 minute winter	26	472	47.109	1.146	5.0	1.2967	0.0000	FLOOD RISK
15 minute summer	26_OUT	1	45.884	0.000	4.6	0.0000	0.0000	OK
15 minute winter	4	11	49.211	0.211	104.9	0.2389	0.0000	OK
15 minute winter	6	11	48.503	1.342	148.1	1.5181	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	10.0	0.541	0.191	0.6416	
480 minute winter	9	1.008	16	11.8	0.572	0.279	0.5966	
480 minute winter	16	1.009	22	10.8	0.589	0.255	0.5966	
480 minute winter	22	1.010	23	7.2	0.624	0.101	2.2534	
480 minute winter	23	1.011	24	6.2	0.552	0.086	1.6535	
15 minute winter	2	1.001	3	55.2	2.108	0.706	0.9679	
15 minute winter	3	1.002	4	88.9	3.752	0.586	0.3992	
15 minute winter	5	1.004	6	144.2	2.048	2.011	0.6539	
15 minute winter	7	1.006	8	151.1	2.145	2.132	2.4716	
15 minute winter	8	1.007	9	214.2	3.607	0.960	1.1091	
15 minute winter	11	3.000	12	12.9	0.451	0.180	1.4193	
15 minute summer	12	2.001	16	146.1	3.456	0.585	0.8962	
15 minute winter	10	2.000	12	3.8	1.095	0.028	0.5836	
15 minute winter	17	6.000	18	6.9	0.430	0.173	0.5485	
15 minute winter	18	6.001	19	49.1	2.131	0.551	0.4125	
15 minute winter	19	6.002	20	72.8	2.068	0.604	1.5984	
15 minute winter	20	6.003	21	161.0	3.523	0.636	0.8018	
15 minute summer	21	6.004	22	200.3	4.214	0.774	1.1228	
15 minute winter	13	4.000	15	12.9	0.356	0.178	1.7976	
15 minute winter	15	4.001	16	161.3	3.119	0.723	0.7219	
15 minute winter	14	5.000	15	8.4	0.605	0.210	0.6931	
480 minute winter	24	1.012	25	5.4	0.495	0.076	0.7533	
480 minute winter	25	1.013	26	4.8	0.248	0.066	0.9687	
480 minute winter	26	Hydro-Brake®	26_OUT	4.6				175.8
15 minute winter	4	1.003	5	100.0	1.541	0.523	3.7795	
15 minute winter	6	1.005	7	147.1	2.089	2.040	0.4975	