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Project title	Pinewood Studios	Job number	239026 Pinewood Studios
cc		File reference	
Prepared by	Anna Collins	Date	19 November 2014
Subject	Pinewood Studios Storm and Foul water strategy – additional information		

1 Introduction

This technical note has been prepared as an additional note to the Storm and Foul drainage strategy report prepared for Pinewood Studios Ltd to support the submission of the first Reserved Matters application for the Pinewood Studios Development Framework (PDSF). This technical note provides additional information with regards to the hydraulic modelling undertaken and the proposed storm drainage strategy for the development.

2 Design Standards

On-site storm drainage will be designed to adoptable standards, although it is expected that it will not be adopted.

The storm water drainage will be assessed and designed in accordance with, but not limited to, the following key design standards and industry guidance:

- Sewers for Adoption - 7th Edition
- Rainfall Runoff Management for Developments Report SC030219
- BS EN 752: Drain and Sewer Systems Outside Buildings
- R&D Technical Report W5-074/A – Preliminary Rainfall Runoff Management for Developments
- Flood Estimation Handbook (Institute of Hydrology 1999)

3 Hydraulic Model

3.1 Introduction

A drainage model was created using the urban drainage software package Microdrainage by XP Solutions which demonstrates how the pipe network, attenuation ponds and flow control devices behave during rainfall events of different duration and frequency. The peak rate of runoff from the site for the critical duration storm was then checked against the equivalent greenfield runoff rates used to define discharge compliance limits namely the 100% (1 year), 3.33% (30 year) and the 1% (100 year) events.

Results from the initial analysis showed that at each basin the developed rates of discharge for the 30 year and the 100 year events would not exceed the estimated undeveloped (greenfield) rates but that for the 1 year event, discharge would exceed the estimated undeveloped runoff rate. This note details the proposed solutions so that the 1 year event developed discharge rate would not exceed the corresponding peak greenfield runoff rate.

Technical Note

239026 Pinewood Studios 19 November 2014

3.2 Attenuation Basin 1

Attenuation Basin 1 has a large contributing catchment area and so the peak runoff rates for different frequency storm events are vary significantly. The flow control (Hydrobrake) device was initially sized based on the critical duration (6 hour), 100 year greenfield runoff rate. However during the long duration 1 year storm events the flow control device allowed a greater discharge than the 1 year peak greenfield runoff rate.

The proposed solution is to provide a low level and high level outlet to the basin. The low level outfall will discharge at no greater than the 1 year peak greenfield runoff rate using an orifice plate and the high level outfall will discharge at no greater than the 100 year peak greenfield runoff rate using a Hydrobrake flow control device with a linear discharge profile. The combined discharge from the orifice and the Hydrobrake when the pond is full is not greater than the 100 year greenfield discharge.

These flow control devices have been modelled in Microdrainage and the resulting peak rate of runoff and volume of storage required for the developed site recalculated for the 1 year, 30 year and 100 year flows, with climate change allowance included.

3.3 Attenuation Basin 2

Attenuation basin 2 has a much smaller contributing catchment area and therefore peak runoff rates between the different storm events are not significantly different. For Attenuation basin 2, it is not proposed to provide two outfalls and two control devices at different levels because the greenfield discharge limit for the 1 in 1 year event is small (12 l/s).

The proposed solution is to lower the design flow for the flow control device to a discharge rate similar to the greenfield runoff rate for the 30 year event and increase the storage volume as required. The flow control device has been modelled in Microdrainage and the resulting peak rate of runoff and volume of storage required recalculated for the 1 year, 30 year and 100 year flows with climate change allowance included.

4 Proposed Infrastructure

4.1 Attenuation Basin 1

Runoff from the site is collected and delivered to Attenuation basin 1 via a network of large diameter pipes.

It is proposed to have two inlets set at a level of 64.0mAOD outfalling to Attenuation basin 1 which is 0.5m above the permanent water level. This will help limit the surcharging of the upstream conveyance system. A concrete outlet headwall with a steel grate will be provided. A gabion mattress will be placed to provide erosion protection to the bottom of the basin. Inlet structures will be provided on both the east and west end of the ponds to avoid short-circuiting and dead storage areas.

Attenuation Basin 1 will have a low level outfall with an invert of 63.2m AOD and a high level outfall with an invert of 64.4m AOD. Both outfalls will be designed to be easy to construct and maintain and limit the risk of blockages. An emergency overflow spillway will be set at the maximum flood storage level for the basin of 66.0m AOD.

4.2 Attenuation Basin 2

Runoff from the site is collected and delivered to Attenuation basin 2 via a network of large diameter pipes.

Technical Note

239026 Pinewood Studios 19 November 2014

It is proposed to have one inlet set at a level of 64.5mAOD which is 0.5m above the permanent water level. Attenuation basin 2 will have one outlet controlled by a Hydrobrake flow control device with a linear discharge curve. Downstream of the outlet the flow will discharge into a grassed swale with a gradient following the existing ground contours and connecting with the existing field ditch. An emergency overflow spillway will be set at the maximum flood storage level of 66.5m AOD.

5 Volume of Attenuation Storage

The results of the modelling demonstrate that for attenuation basin 1 (north basin) the storage volume required to handle the 1 in 100 year critical duration event plus 30% climate change is less than 10,000m³ and for attenuation basin 2 (south basin) the required storage volume is less than 3000m³. For events in excess of the 100 year event including climate change, a high level overflow will restrict any further rise in water level in each basin by discharging excess flow overland towards the receiving ditches.

6 Check on Runoff Rates

Developed surface water runoff rates have been modelled for each of the critical storm events and the peak rates have been compared against the greenfield runoff rate. The results are shown in Table 1 below.

Table 1 Comparison of Peak Runoff Rates for Critical Duration Storms and Different Frequency Events



Annual flow rate probability	Attenuation Basin 1		Attenuation Basin 2	
	Greenfield runoff rate (l/s)	Developed Runoff Rate (l/s)	Greenfield runoff rate (l/s)	Developed Runoff Rate (l/s)
1% (100 Yr)	201	193	43	25
3.33% (30 Yr)	145	145	31	18
100% (1 Yr)	54	49	12	12

The Table shows that the peak discharges for the developed site are less than or equal to the greenfield peak runoff rates for each event.

7 Results of Analysis

The key modelling inputs and outputs and a schematic of the surface water drainage system are included in Appendix A.

DOCUMENT CHECKING (not mandatory for File Note)


	Prepared by	Checked by	Approved by
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Signature	[AC]		

Technical Note

239026 Pinewood Studios 19 November 2014

A1 Appendix A

Results of Surface Water Drainage System Analysis (Updated 19-11-2014)

Ove Arup & Partners International Ltd		Page 1
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 19/11/2014 14:43 File 16092014 PINWOOD STUDI...	Designed by Anna.Collins Checked by	
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	2
Site Location	Pinewood
C (1km)	-0.025
D1 (1km)	0.277
D2 (1km)	0.312
D3 (1km)	0.226
E (1km)	0.301
F (1km)	2.674
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	300

Designed with Level Soffits

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	450	1.0	68.500	66.800	1.250	Open Manhole	1350
1.001	o	450	1.1	68.400	66.385	1.565	Open Manhole	1350
1.002	o	600	1.2	68.250	66.108	1.542	Open Manhole	1500
1.003	o	600	1.3	68.000	65.897	1.503	Open Manhole	1500
2.000	o	450	2.0	68.500	67.000	1.050	Open Manhole	1350
3.000	o	300	3.0	68.500	66.900	1.300	Open Manhole	1050
2.001	o	450	2.1	68.250	66.228	1.572	Open Manhole	1350
1.004	o	900	1.4	67.500	64.931	1.669	Open Manhole	1800
4.000	o	450	4.0	72.000	70.000	1.550	Open Manhole	1350
4.001	o	450	4.1	71.000	68.500	2.050	Open Manhole	1350
4.002	o	600	4.2	70.000	67.200	2.200	Open Manhole	1500
5.000	o	525	5.0	68.500	66.700	1.275	Open Manhole	1500
5.001	o	525	5.1	68.500	66.425	1.550	Open Manhole	1500
4.003	o	675	4.3	69.000	66.129	2.196	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	41.079	99.0	1.1	68.400	66.385	1.565	Open Manhole	1350
1.001	25.486	200.7	1.2	68.250	66.258	1.542	Open Manhole	1500
1.002	42.126	199.6	1.3	68.000	65.897	1.503	Open Manhole	1500
1.003	63.121	199.8	1.4	67.500	65.581	1.319	Open Manhole	1800
2.000	60.641	150.5	2.1	68.250	66.597	1.203	Open Manhole	1350
3.000	78.289	150.0	2.1	68.250	66.378	1.572	Open Manhole	1350
2.001	84.709	100.0	1.4	67.500	65.381	1.669	Open Manhole	1800
1.004	90.693	200.2	1.5	68.750	64.478	3.372	Open Manhole	1800
4.000	56.581	37.7	4.1	71.000	68.500	2.050	Open Manhole	1350
4.001	85.848	74.7	4.2	70.000	67.350	2.200	Open Manhole	1500
4.002	22.764	111.0	4.3	69.000	66.995	1.405	Open Manhole	1500
5.000	40.777	148.3	5.1	68.500	66.425	1.550	Open Manhole	1500
5.001	29.182	199.9	4.3	69.000	66.279	2.196	Open Manhole	1500
4.003	69.833	149.9	4.4	69.250	65.663	2.912	Open Manhole	1800


PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.004	o	750	4.4	69.250	65.588	2.912	Open Manhole	1800
4.005	o	750	4.5	69.250	65.335	3.165	Open Manhole	1800
6.000	o	450	6.0	69.500	67.850	1.200	Open Manhole	1350
6.001	o	450	6.1	69.000	66.694	1.856	Open Manhole	1350
6.002	o	450	6.2	68.750	65.538	2.762	Open Manhole	1350
6.003	o	450	6.3	68.750	65.739	2.561	Open Manhole	1350
1.005	o	900	1.5	68.750	64.478	3.372	Open Manhole	1800
7.000	o	300	7.0	68.000	66.500	1.200	Open Manhole	1050
1.006	o	900	1.6	68.700	64.379	3.421	Open Manhole	1800
1.007	o	900	1.7	68.500	64.274	3.326	Open Manhole	1800
1.008	o	900	1.8	68.300	64.196	3.204	Open Manhole	1800
1.009	o	900	1.9	68.000	64.079	3.021	Open Manhole	1800
8.000	o	450	8.0	69.000	67.200	1.350	Open Manhole	1350
8.001	o	450	8.1	68.750	66.496	1.804	Open Manhole	1350
9.000	o	450	9.0	70.500	68.500	1.550	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.004	37.926	149.9	4.5	69.250	65.335	3.165	Open Manhole	1800
4.005	37.926	149.9	1.5	68.750	65.082	2.918	Open Manhole	1800
6.000	81.512	70.5	6.1	69.000	66.694	1.856	Open Manhole	1350
6.001	64.190	55.5	6.2	68.750	65.538	2.762	Open Manhole	1350
6.002	9.251	125.0	6.3	68.750	65.464	2.836	Open Manhole	1350
6.003	4.689	151.3	1.5	68.750	65.708	2.592	Open Manhole	1800
1.005	29.817	301.2	1.6	68.700	64.379	3.421	Open Manhole	1800
7.000	19.862	20.0	1.6	68.700	65.507	2.893	Open Manhole	1800
1.006	31.404	299.1	1.7	68.500	64.274	3.326	Open Manhole	1800
1.007	23.536	301.7	1.8	68.300	64.196	3.204	Open Manhole	1800
1.008	35.047	299.5	1.9	68.000	64.079	3.021	Open Manhole	1800
1.009	46.336	80.0	1.10	66.500	63.500	2.100	Open Manhole	1800
8.000	70.428	100.0	8.1	68.750	66.496	1.804	Open Manhole	1350
8.001	79.653	99.9	8.2	68.500	65.699	2.351	Open Manhole	1800
9.000	38.247	76.5	9.1	70.000	68.000	1.550	Open Manhole	1350

Ove Arup & Partners International Ltd		Page 4
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 19/11/2014 14:43 File 16092014 PINWOOD STUDI...	Designed by Anna.Collins Checked by	
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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.001	o	450	9.1	70.000	68.000	1.550	Open Manhole	1350
10.000	o	300	10.0	70.000	68.400	1.300	Open Manhole	1050
9.002	o	600	9.2	69.800	67.359	1.841	Open Manhole	1500
9.003	o	600	9.3	69.500	66.817	2.083	Open Manhole	1500
9.004	o	750	9.4	69.500	66.446	2.304	Open Manhole	1800
9.005	o	750	9.5	69.500	66.129	2.621	Open Manhole	1800
11.000	o	450	11.0	71.500	69.800	1.250	Open Manhole	1350
11.001	o	600	11.1	70.000	68.150	1.250	Open Manhole	1500
11.002	o	600	11.2	69.500	67.700	1.200	Open Manhole	1500
12.000	o	300	12.0	69.500	67.700	1.500	Open Manhole	1050
13.000	o	450	13.0	69.500	67.700	1.350	Open Manhole	1350
13.001	o	450	13.1	69.500	67.270	1.780	Open Manhole	1350
11.003	o	750	11.3	69.500	66.390	2.360	Open Manhole	1800
9.006	o	800	9.6	69.000	65.771	2.429	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.001	39.316	80.1	9.2	69.800	67.509	1.841	Open Manhole	1500
10.000	52.751	71.2	9.2	69.800	67.659	1.841	Open Manhole	1500
9.002	81.279	150.0	9.3	69.500	66.817	2.083	Open Manhole	1500
9.003	33.155	150.0	9.4	69.500	66.596	2.304	Open Manhole	1800
9.004	47.479	149.8	9.5	69.500	66.129	2.621	Open Manhole	1800
9.005	43.921	142.6	9.6	69.000	65.821	2.429	Open Manhole	1800
11.000	81.287	54.2	11.1	70.000	68.300	1.250	Open Manhole	1500
11.001	50.562	112.4	11.2	69.500	67.700	1.200	Open Manhole	1500
11.002	56.181	199.9	11.3	69.500	67.419	1.481	Open Manhole	1800
12.000	70.428	81.9	11.3	69.500	66.840	2.360	Open Manhole	1800
13.000	28.237	65.7	13.1	69.500	67.270	1.780	Open Manhole	1350
13.001	58.716	101.2	11.3	69.500	66.690	2.360	Open Manhole	1800
11.003	64.445	113.3	9.6	69.000	65.821	2.429	Open Manhole	1800
9.006	39.688	200.4	9.7	68.500	65.573	2.127	Open Manhole	1800

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.007	o	900	9.7	68.500	65.473	2.127	Open Manhole	1800
14.000	o	300	14.0	68.500	66.850	1.350	Open Manhole	1050
14.001	o	300	14.1	68.500	66.643	1.557	Open Manhole	1200
14.002	o	450	14.2	68.500	66.237	1.813	Open Manhole	1350
14.003	o	450	14.3	68.957	65.889	2.618	Open Manhole	1350
9.008	o	900	9.8	69.000	65.155	2.945	Open Manhole	1800
15.000	o	450	15.0	68.000	67.300	0.250	Open Manhole	1350
15.001	o	450	15.1	68.168	66.967	0.751	Open Manhole	1350
15.002	o	450	15.2	68.500	66.284	1.766	Open Manhole	1350
8.002	o	900	8.2	68.500	64.577	3.023	Open Manhole	1800
8.003	o	900	8.3	66.500	64.308	1.292	Open Manhole	1800
1.010	o	450	1.10	66.500	63.200	2.850	Open Manhole	1800
1.011	o	450	1.11	66.500	62.910	3.140	Open Manhole	1350
1.012	o	450	1.12	64.000	62.708	0.842	Open Manhole	1350
16.000	o	375	16.0	68.500	66.900	1.225	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.007	45.746	143.9	9.8	69.000	65.155	2.945	Open Manhole	1800
14.000	20.748	100.2	14.1	68.500	66.643	1.557	Open Manhole	1200
14.001	38.414	150.1	14.2	68.500	66.387	1.813	Open Manhole	1350
14.002	52.160	149.9	14.3	68.957	65.889	2.618	Open Manhole	1350
14.003	42.644	150.2	9.8	69.000	65.605	2.945	Open Manhole	1800
9.008	59.104	199.7	8.2	68.500	64.859	2.741	Open Manhole	1800
15.000	33.264	99.9	15.1	68.168	66.967	0.751	Open Manhole	1350
15.001	53.263	99.9	15.2	68.500	66.434	1.616	Open Manhole	1350
15.002	39.236	100.1	8.2	68.500	65.892	2.158	Open Manhole	1800
8.002	53.898	200.4	8.3	66.500	64.308	1.292	Open Manhole	1800
8.003	161.682	200.6	1.10	66.500	63.502	2.098	Open Manhole	1800
1.010	37.453	200.0	1.11	66.500	63.013	3.037	Open Manhole	1350
1.011	21.787	108.0	1.12	64.000	62.708	0.842	Open Manhole	1350
1.012	5.750	108.0	55	63.400	62.655	0.295	Open Manhole	1200
16.000	30.793	147.3	16.1	68.500	66.691	1.434	Open Manhole	1350


PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
16.001	o	450	16.1	68.500	66.616	1.434	Open Manhole	1350
16.002	o	450	16.2	68.500	66.377	1.673	Open Manhole	1350
16.003	o	450	16.3	68.152	66.103	1.599	Open Manhole	1350
17.000	o	375	17.0	68.500	66.900	1.225	Open Manhole	1350
17.001	o	375	17.1	68.500	66.582	1.543	Open Manhole	1350
17.002	o	375	17.2	68.500	66.442	1.683	Open Manhole	1350
17.003	o	375	17.3	68.500	66.352	1.773	Open Manhole	1350
16.004	o	450	16.4	68.500	65.570	2.480	Open Manhole	1350
18.000	o	600	18.0	67.500	66.000	0.900	Open Manhole	1500
18.001	o	600	18.1	67.500	65.555	1.345	Open Manhole	1500
16.005	o	900	16.5	67.500	64.887	1.713	Open Manhole	1800
16.006	o	900	16.6	67.500	64.683	1.917	Open Manhole	1800
16.007	o	900	16.7	66.500	64.528	1.072	Open Manhole	1800
16.008	o	225	16.8	66.500	64.000	2.275	Open Manhole	1800
16.009	o	225	16.9	66.500	63.700	2.575	Open Manhole	1200
16.010	3 \=/	1000	16.10	64.000	63.500	0.000	Junction	
16.011	3 \=/	1000	16.11	63.161	62.961	0.000	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
16.001	36.821	154.1	16.2	68.500	66.377	1.673	Open Manhole	1350
16.002	28.874	105.4	16.3	68.152	66.103	1.599	Open Manhole	1350
16.003	79.921	149.9	16.4	68.500	65.570	2.480	Open Manhole	1350
17.000	46.721	146.9	17.1	68.500	66.582	1.543	Open Manhole	1350
17.001	28.077	200.6	17.2	68.500	66.442	1.683	Open Manhole	1350
17.002	18.041	200.5	17.3	68.500	66.352	1.773	Open Manhole	1350
17.003	20.097	201.0	16.4	68.500	66.252	1.873	Open Manhole	1350
16.004	40.190	172.5	16.5	67.500	65.337	1.713	Open Manhole	1800
18.000	88.922	199.8	18.1	67.500	65.555	1.345	Open Manhole	1500
18.001	35.827	301.1	16.5	67.500	65.436	1.464	Open Manhole	1800
16.005	61.177	299.9	16.6	67.500	64.683	1.917	Open Manhole	1800
16.006	46.372	299.2	16.7	66.500	64.528	1.072	Open Manhole	1800
16.007	49.107	94.3	16.8	66.500	64.007	1.593	Open Manhole	1800
16.008	52.835	300.0	16.9	66.500	63.824	2.451	Open Manhole	1200
16.009	43.018	300.0	16.10	64.000	63.557	0.218	Junction	
16.010	29.661	55.0	16.11	63.161	62.961	-0.300	Junction	
16.011	30.430	55.0	16.12	62.620	62.408	0.012	Open Manhole	1000

Ove Arup & Partners International Ltd		Page 7
The Arup Campus Blyth Gate Solihull B90 8AE		
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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
16.012	3 \=/	1000	16.12	62.620	62.408	0.012	Open Manhole	1000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
16.012	3.962	67.0		62.562	62.349	0.013	Open Manhole	0

Online Controls for Storm

Complex Manhole: 1.10, DS/PN: 1.010, Volume (m³): 138.4

Orifice

Diameter (m) 0.154 Discharge Coefficient 0.600 Invert Level (m) 63.300

Hydro-Brake Optimum®

Unit Reference	MD-SCU-0320-1250-1600-1250
Design Head (m)	1.600
Design Flow (l/s)	125.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Diameter (mm)	320
Invert Level (m)	64.500
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	1800

Control Points Head (m) Flow (l/s)


Design Point (Calculated)	1.600	125.0
Flush-Flo™	0.362	72.0
Kick-Flo®	0.476	69.5
Mean Flow over Head Range	-	82.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.6	1.200	108.7	3.000	169.9	7.000	257.3
0.200	36.1	1.400	117.1	3.500	183.2	7.500	266.1
0.300	63.3	1.600	125.0	4.000	195.5	8.000	274.7
0.400	71.7	1.800	132.4	4.500	207.1	8.500	283.0
0.500	71.1	2.000	139.4	5.000	218.1	9.000	291.1
0.600	77.7	2.200	146.0	5.500	228.6	9.500	298.9
0.800	89.3	2.400	152.3	6.000	238.5		
1.000	99.5	2.600	158.4	6.500	248.1		

Hydro-Brake Optimum® Manhole: 16.8, DS/PN: 16.008, Volume (m³): 36.5

Unit Reference	MD-SCU-0126-2500-2500-2500
Design Head (m)	2.500
Design Flow (l/s)	25.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Diameter (mm)	126

Ove Arup & Partners International Ltd		Page 9
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 19/11/2014 14:43 File 16092014 PINEWOOD STUDI...	Designed by Anna.Collins Checked by	
XP Solutions	Network 2014.1.1	


Hydro-Brake Optimum® Manhole: 16.8, DS/PN: 16.008, Volume (m³): 36.5

Invert Level (m) 64.000
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.500	25.0
Flush-Flo™	0.151	7.6
Kick-Flo®	0.191	7.4
Mean Flow over Head Range	-	16.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.0	1.200	17.6	3.000	27.3	7.000	41.1
0.200	7.6	1.400	18.9	3.500	29.4	7.500	42.5
0.300	9.1	1.600	20.2	4.000	31.4	8.000	43.9
0.400	10.5	1.800	21.4	4.500	33.2	8.500	45.2
0.500	11.6	2.000	22.5	5.000	34.9	9.000	46.5
0.600	12.7	2.200	23.5	5.500	36.6	9.500	47.7
0.800	14.5	2.400	24.5	6.000	38.2		
1.000	16.1	2.600	25.5	6.500	39.7		

Ove Arup & Partners International Ltd		Page 10
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 19/11/2014 14:43	Designed by Anna.Collins	
File 16092014 PINWOOD STUDI...	Checked by	
XP Solutions		Network 2014.1.1

Storage Structures for Storm

Tank or Pond Manhole: 1.10, DS/PN: 1.010

Invert Level (m) 63.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1464.0	0.700	3076.0	2.700	6176.0
0.500	2479.0	1.700	4500.0	3.000	7766.0

Tank or Pond Manhole: 16.8, DS/PN: 16.008

Invert Level (m) 64.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1000.0	2.500	2000.0

Swale Manhole: 16.10, DS/PN: 16.010

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	29.7
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	60.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	63.500	Cap Infiltration Depth (m)	0.000
Base Width (m)	1.0	Include Swale Volume	No

Swale Manhole: 16.11, DS/PN: 16.011


Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	30.4
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	50.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	62.961	Cap Infiltration Depth (m)	0.000
Base Width (m)	1.0	Include Swale Volume	No

Swale Manhole: 16.12, DS/PN: 16.012


Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Invert Level (m)	62.408
Infiltration Coefficient Side (m/hr)	0.00000	Base Width (m)	1.0
Safety Factor	2.0	Length (m)	4.0
Porosity	1.00	Side Slope (1:X)	3.0

Ove Arup & Partners International Ltd		Page 11
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 19/11/2014 14:43 File 16092014 PINWOOD STUDI...	Designed by Anna.Collins Checked by	
XP Solutions	Network 2014.1.1	

Swale Manhole: 16.12, DS/PN: 16.012

Slope (1:X) 67.0 Cap Infiltration Depth (m) 0.000
 Cap Volume Depth (m) 0.000 Include Swale Volume Yes

Ove Arup & Partners International Ltd		Page 12
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 19/11/2014 14:43 File 16092014 PINWOOD STUDI...	Designed by Anna.Collins Checked by	
XP Solutions	Network 2014.1.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.600
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 5
Number of Online Controls 2 Number of Time/Area Diagrams 12
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH D2 (1km) 0.312 Cv (Summer) 0.750
Site Location Pinewood D3 (1km) 0.226 Cv (Winter) 0.840
C (1km) -0.025 E (1km) 0.301
D1 (1km) 0.277 F (1km) 2.674

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 30

PN	Storm	Return Period	Climate Change	First X SurchARGE	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			1
1.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			1
1.002	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
1.003	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
2.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
3.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
2.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
1.004	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
4.000	15 Winter	30	0%	100/15 Winter				
4.001	15 Winter	30	0%	100/15 Winter	100/15 Winter			1
4.002	15 Winter	30	0%	30/15 Winter				
5.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
5.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
4.003	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
4.004	15 Winter	30	0%	30/15 Winter				
4.005	15 Winter	30	0%	30/15 Winter				
6.000	15 Winter	30	0%	100/15 Winter	100/15 Winter			1
6.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			1
6.002	15 Winter	30	0%	2/15 Winter				
6.003	15 Winter	30	0%	30/15 Winter				

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	Storm	Return Period	Climate Change	First X SurchARGE	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.005	15 Winter	30	0%	30/15 Winter				
7.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
1.006	15 Winter	30	0%	30/15 Winter				
1.007	15 Winter	30	0%	30/15 Winter				
1.008	15 Winter	30	0%	30/15 Winter				
1.009	240 Winter	30	0%	30/120 Winter				
8.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
8.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
9.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
9.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
10.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
9.002	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
9.003	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
9.004	15 Winter	30	0%	30/15 Winter	100/15 Winter			
9.005	15 Winter	30	0%	30/15 Winter				
11.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
11.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
11.002	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
12.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
13.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
13.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
11.003	15 Winter	30	0%	30/15 Winter				
9.006	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
9.007	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
14.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
14.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
14.002	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
14.003	15 Winter	30	0%	30/15 Winter				
9.008	15 Winter	30	0%	30/15 Winter				
15.000	15 Winter	30	0%	100/15 Winter	100/15 Winter			3
15.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
15.002	15 Winter	30	0%	30/15 Winter	100/15 Winter			1
8.002	15 Winter	30	0%	30/15 Winter				
8.003	15 Winter	30	0%	30/15 Winter	100/30 Winter			2
1.010	240 Winter	30	0%	1/15 Winter				
1.011	240 Winter	30	0%	100/15 Winter				
1.012	240 Winter	30	0%	30/30 Winter				
16.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
16.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
16.002	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
16.003	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
17.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			3
17.001	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
17.002	15 Winter	30	0%	30/15 Winter	100/15 Winter			1
17.003	15 Winter	30	0%	30/15 Winter				
16.004	15 Winter	30	0%	30/15 Winter				
18.000	15 Winter	30	0%	30/15 Winter	100/15 Winter			2
18.001	15 Winter	30	0%	30/15 Winter				
16.005	15 Winter	30	0%	30/15 Winter				
16.006	15 Winter	30	0%	30/15 Winter				

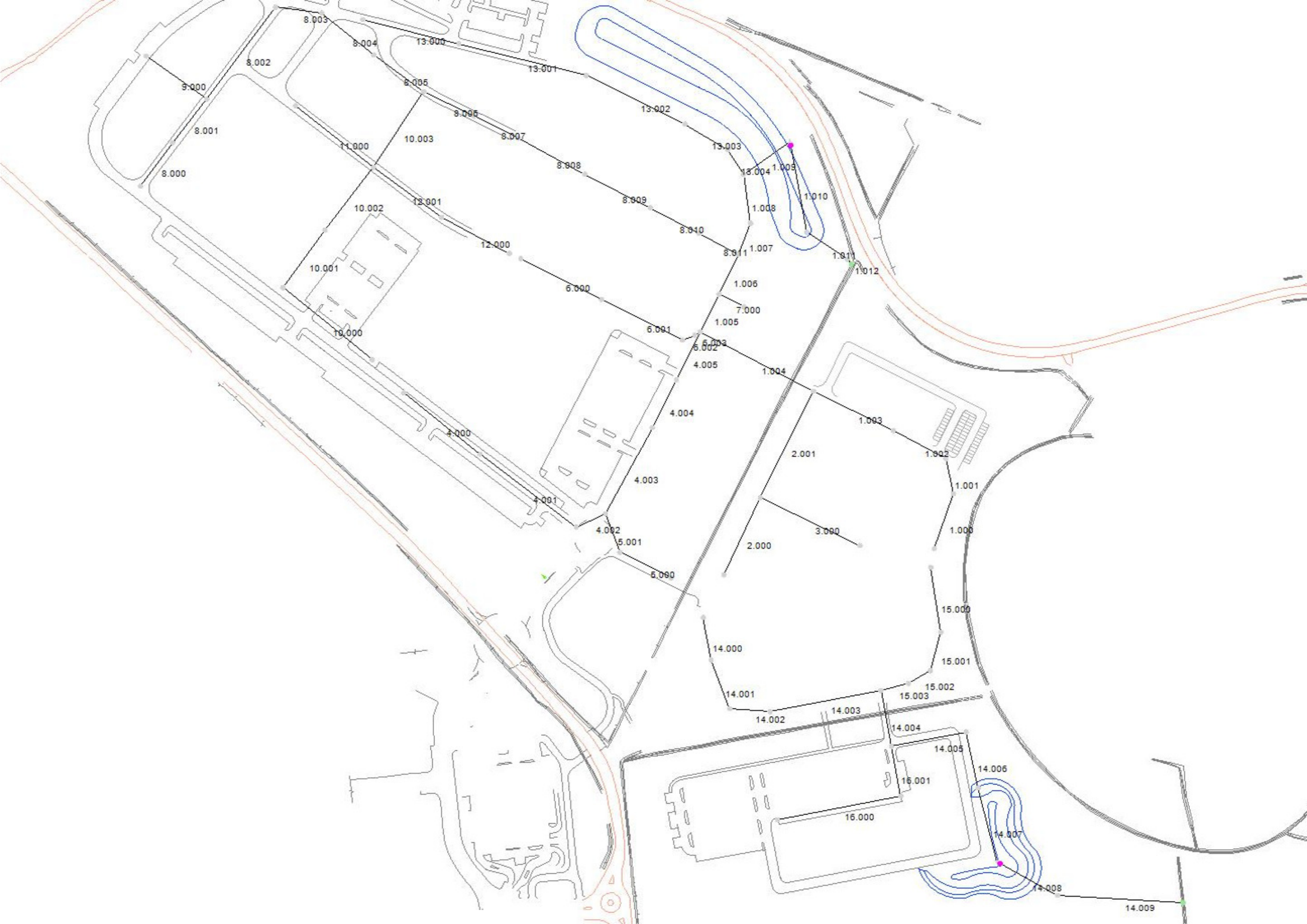
30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	Storm	Return Period	Climate Change	First X SurchARGE	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
16.007	600 Winter	30	0%	100/15 Winter				
16.008	600 Winter	30	0%	1/15 Winter				
16.009	600 Winter	30	0%					
16.010	600 Winter	30	0%					
16.011	600 Winter	30	0%					
16.012	600 Winter	30	0%					

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	
1.000	1.0	67.621	0.371	0.000	0.31	0.0	85.0	SURCHARGED
1.001	1.1	67.605	0.770	0.000	0.61	0.0	92.5	SURCHARGED
1.002	1.2	67.590	0.882	0.000	0.93	0.0	321.1	SURCHARGED
1.003	1.3	67.539	1.042	0.000	0.70	0.0	297.4	SURCHARGED
2.000	2.0	67.828	0.378	0.000	0.81	0.0	197.0	SURCHARGED
3.000	3.0	67.892	0.692	0.000	1.01	0.0	87.7	SURCHARGED
2.001	2.1	67.781	1.103	0.000	0.79	0.0	239.6	SURCHARGED
1.004	1.4	67.464	1.633	0.000	0.38	0.0	430.9	FLOOD RISK
4.000	4.0	70.196	-0.254	0.000	0.40	0.0	191.3	OK
4.001	4.1	68.918	-0.032	0.000	0.78	0.0	274.8	OK
4.002	4.2	68.483	0.683	0.000	0.85	0.0	288.1	SURCHARGED
5.000	5.0	68.479	1.254	0.000	0.49	0.0	148.1	FLOOD RISK
5.001	5.1	68.457	1.507	0.000	0.52	0.0	114.7	FLOOD RISK
4.003	4.3	68.437	1.633	0.000	1.09	0.0	710.3	SURCHARGED
4.004	4.4	68.048	1.710	0.000	1.10	0.0	648.4	SURCHARGED
4.005	4.5	67.748	1.663	0.000	1.16	0.0	686.9	SURCHARGED
6.000	6.0	68.054	-0.246	0.000	0.42	0.0	154.1	OK
6.001	6.1	67.769	0.625	0.000	0.45	0.0	179.9	SURCHARGED
6.002	6.2	67.617	1.629	0.000	1.27	0.0	161.2	SURCHARGED
6.003	6.3	67.503	1.314	0.000	1.32	0.0	167.7	SURCHARGED
1.005	1.5	67.407	2.029	0.000	1.78	0.0	1274.3	SURCHARGED
7.000	7.0	67.043	0.243	0.000	0.95	0.0	178.5	SURCHARGED
1.006	1.6	66.834	1.555	0.000	1.87	0.0	1341.6	SURCHARGED
1.007	1.7	66.222	1.048	0.000	1.87	0.0	1341.3	SURCHARGED
1.008	1.8	65.601	0.505	0.000	1.87	0.0	1338.9	SURCHARGED
1.009	1.9	65.158	0.179	0.000	0.31	0.0	404.8	SURCHARGED
8.000	8.0	68.228	0.578	0.000	0.49	0.0	149.0	SURCHARGED
8.001	8.1	68.081	1.135	0.000	1.33	0.0	403.4	SURCHARGED
9.000	9.0	69.748	0.798	0.000	0.86	0.0	257.8	SURCHARGED
9.001	9.1	69.680	1.230	0.000	0.71	0.0	209.1	SURCHARGED
10.000	10.0	69.617	0.917	0.000	0.62	0.0	77.6	SURCHARGED
9.002	9.2	69.568	1.609	0.000	0.84	0.0	433.9	FLOOD RISK
9.003	9.3	69.322	1.905	0.000	1.60	0.0	566.4	FLOOD RISK
9.004	9.4	69.015	1.819	0.000	0.82	0.0	543.4	SURCHARGED
9.005	9.5	68.944	2.065	0.000	0.80	0.0	524.6	SURCHARGED
11.000	11.0	70.903	0.653	0.000	1.02	0.0	423.4	SURCHARGED
11.001	11.1	69.631	0.881	0.000	0.86	0.0	434.4	SURCHARGED
11.002	11.2	69.366	1.066	0.000	1.25	0.0	499.4	FLOOD RISK
12.000	12.0	69.067	1.067	0.000	0.82	0.0	96.1	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm


PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
13.000	13.0	69.113	0.963	0.000	0.27	0.0	74.9	SURCHARGED
13.001	13.1	69.083	1.363	0.000	0.67	0.0	197.4	SURCHARGED
11.003	11.3	69.023	1.883	0.000	0.70	0.0	619.6	SURCHARGED
9.006	9.6	68.787	2.216	0.000	1.95	0.0	1160.8	FLOOD RISK
9.007	9.7	68.118	1.745	0.000	1.20	0.0	1139.5	SURCHARGED
14.000	14.0	67.939	0.789	0.000	0.78	0.0	66.8	SURCHARGED
14.001	14.1	67.922	0.979	0.000	0.80	0.0	67.5	SURCHARGED
14.002	14.2	67.804	1.117	0.000	0.73	0.0	176.0	SURCHARGED
14.003	14.3	67.761	1.422	0.000	0.73	0.0	163.5	SURCHARGED
9.008	9.8	67.662	1.607	0.000	1.39	0.0	1282.6	SURCHARGED
15.000	15.0	67.646	-0.104	0.000	0.78	0.0	190.9	OK
15.001	15.1	67.546	0.129	0.000	0.64	0.0	188.2	SURCHARGED
15.002	15.2	67.497	0.763	0.000	1.54	0.0	407.8	SURCHARGED
8.002	8.2	67.098	1.621	0.000	2.08	0.0	1827.0	SURCHARGED
8.003	8.3	65.931	0.723	0.000	1.37	0.0	1793.6	SURCHARGED
1.010	1.10	65.153	1.503	0.000	0.79	0.0	145.4	SURCHARGED
1.011	1.11	63.319	-0.041	0.000	0.77	0.0	145.4	OK
1.012	1.12	63.201	0.043	0.000	1.15	0.0	145.4	SURCHARGED
16.000	16.0	67.750	0.475	0.000	1.41	0.0	188.8	SURCHARGED
16.001	16.1	67.614	0.548	0.000	0.77	0.0	159.3	SURCHARGED
16.002	16.2	67.490	0.663	0.000	1.04	0.0	229.8	SURCHARGED
16.003	16.3	67.280	0.727	0.000	0.83	0.0	205.4	SURCHARGED
17.000	17.0	67.789	0.514	0.000	0.87	0.0	131.7	SURCHARGED
17.001	17.1	67.693	0.736	0.000	1.21	0.0	133.2	SURCHARGED
17.002	17.2	67.507	0.690	0.000	1.83	0.0	160.9	SURCHARGED
17.003	17.3	67.230	0.503	0.000	1.79	0.0	166.4	SURCHARGED
16.004	16.4	66.910	0.890	0.000	1.84	0.0	376.1	SURCHARGED
18.000	18.0	67.456	0.856	0.000	1.32	0.0	592.6	FLOOD RISK
18.001	18.1	66.688	0.533	0.000	2.21	0.0	574.8	SURCHARGED
16.005	16.5	66.126	0.339	0.000	1.33	0.0	1013.3	SURCHARGED
16.006	16.6	65.750	0.167	0.000	1.39	0.0	1000.6	SURCHARGED
16.007	16.7	65.203	-0.225	0.000	0.10	0.0	121.9	OK
16.008	16.8	65.201	0.976	0.000	0.61	0.0	17.6	SURCHARGED
16.009	16.9	63.828	-0.097	0.000	0.62	0.0	17.6	OK
16.010	16.10	63.545	-0.455	0.000	0.01	0.0	17.6	OK
16.011	16.11	63.005	-0.156	0.000	0.07	0.0	17.6	FLOOD RISK*
16.012	16.12	62.456	-0.164	0.000	0.08	0.0	17.6	FLOOD RISK



14.009

Summary Wizard of 360 minute 1 year Winter I+0% for Storm

PN	US/MH Name	Rank	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	O'flow (l/s)	Pipe Flow (l/s)	Status
1.005	1.5	46	64.726	-0.652	0.000	0.16	0.0	118.2	OK
7.000	7.0	37	66.539	-0.261	0.000	0.04	0.0	7.5	OK
1.006	1.6	48	64.632	-0.647	0.000	0.18	0.0	126.1	OK
1.007	1.7	49	64.528	-0.646	0.000	0.18	0.0	126.2	OK
1.008	1.8	55	64.450	-0.646	0.000	0.18	0.0	127.3	OK
1.009	1.9	55	64.369	-0.610	0.000	0.10	0.0	127.3	OK
8.000	8.0	37	67.252	-0.398	0.000	0.03	0.0	9.3	OK
8.001	8.1	37	66.583	-0.363	0.000	0.08	0.0	25.6	OK
9.000	9.0	37	68.556	-0.394	0.000	0.04	0.0	11.2	OK
9.001	9.1	38	68.065	-0.385	0.000	0.05	0.0	15.2	OK
10.000	10.0	37	68.433	-0.267	0.000	0.03	0.0	3.4	OK
9.002	9.2	37	67.455	-0.504	0.000	0.06	0.0	31.5	OK
9.003	9.3	37	66.950	-0.467	0.000	0.11	0.0	39.6	OK
9.004	9.4	37	66.566	-0.630	0.000	0.06	0.0	40.8	OK
9.005	9.5	38	66.262	-0.617	0.000	0.07	0.0	47.7	OK
11.000	11.0	37	69.876	-0.374	0.000	0.07	0.0	28.0	OK
11.001	11.1	37	68.243	-0.507	0.000	0.06	0.0	29.2	OK
11.002	11.2	38	67.828	-0.472	0.000	0.10	0.0	41.1	OK
12.000	12.0	37	67.737	-0.263	0.000	0.04	0.0	4.3	OK
13.000	13.0	37	67.737	-0.413	0.000	0.02	0.0	4.8	OK
13.001	13.1	37	67.324	-0.396	0.000	0.03	0.0	10.2	OK
11.003	11.3	38	66.519	-0.621	0.000	0.07	0.0	61.2	OK
9.006	9.6	38	66.015	-0.556	0.000	0.20	0.0	120.2	OK
9.007	9.7	38	65.691	-0.682	0.000	0.13	0.0	128.1	OK
14.000	14.0	37	66.885	-0.265	0.000	0.03	0.0	2.8	OK
14.001	14.1	38	66.709	-0.234	0.000	0.11	0.0	9.2	OK
14.002	14.2	38	66.306	-0.381	0.000	0.06	0.0	13.8	OK
14.003	14.3	38	65.984	-0.355	0.000	0.10	0.0	22.8	OK
9.008	9.8	39	65.400	-0.655	0.000	0.17	0.0	153.2	OK
15.000	15.0	37	67.354	-0.396	0.000	0.03	0.0	8.3	OK
15.001	15.1	37	67.019	-0.398	0.000	0.03	0.0	9.2	OK
15.002	15.2	37	66.369	-0.365	0.000	0.08	0.0	21.3	OK
8.002	8.2	43	64.867	-0.610	0.000	0.23	0.0	199.6	OK
8.003	8.3	49	64.541	-0.667	0.000	0.15	0.0	199.8	OK
1.010	1.10	49	64.368	0.718	0.000	0.27	0.0	49.3	SURCHARGED
1.011	1.11	49	63.065	-0.295	0.000	0.26	0.0	49.3	OK
1.012	1.12	49	62.902	-0.256	0.000	0.39	0.0	49.3	OK
16.000	16.0	37	66.960	-0.315	0.000	0.06	0.0	8.3	OK
16.001	16.1	38	66.693	-0.373	0.000	0.07	0.0	14.2	OK
16.002	16.2	38	66.463	-0.364	0.000	0.08	0.0	18.3	OK
16.003	16.3	38	66.188	-0.365	0.000	0.08	0.0	20.1	OK
17.000	17.0	37	66.949	-0.326	0.000	0.04	0.0	6.4	OK
17.001	17.1	38	66.665	-0.292	0.000	0.11	0.0	12.3	OK
17.002	17.2	38	66.544	-0.273	0.000	0.17	0.0	14.7	OK
17.003	17.3	38	66.458	-0.269	0.000	0.18	0.0	16.5	OK
16.004	16.4	39	65.699	-0.321	0.000	0.18	0.0	37.3	OK
18.000	18.0	37	66.099	-0.501	0.000	0.06	0.0	29.1	OK
18.001	18.1	39	65.688	-0.467	0.000	0.11	0.0	29.1	OK
16.005	16.5	45	65.077	-0.710	0.000	0.10	0.0	76.8	OK
16.006	16.6	48	64.879	-0.704	0.000	0.11	0.0	77.2	OK

Ove Arup & Partners International Ltd		Page 3
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 19/11/2014 14:39 File 16092014 PINWOOD STUDI...	Designed by Anna.Collins Checked by	
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Summary Wizard of 360 minute 1 year Winter I+0% for Storm

PN	US/MH Name	Rank	Water		Flooded		Pipe		Status
			Level (m)	Surch'd Depth (m)	Volume (m ³)	Flow / O'flow Cap. (l/s)	Flow (l/s)		
16.007	16.7	49	64.675	-0.753	0.000	0.06	0.0	77.3	OK
16.008	16.8	54	64.509	0.284	0.000	0.41	0.0	11.7	SURCHARGED
16.009	16.9	54	63.800	-0.125	0.000	0.41	0.0	11.7	OK
16.010	16.10	54	63.535	-0.465	0.000	0.01	0.0	11.7	OK
16.011	16.11	54	62.996	-0.165	0.000	0.05	0.0	11.7	FLOOD RISK*
16.012	16.12	54	62.445	-0.175	0.000	0.05	0.0	11.7	FLOOD RISK

Rainfall Hyetograph for 360 minute 1 year Winter I+0% (Storm)


Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)
6	0.282	78	1.971	150	7.609	222	6.906	294	1.854
12	0.811	84	2.130	156	8.208	228	6.275	300	1.796
18	1.200	90	2.341	162	8.766	234	5.653	306	1.769
24	1.487	96	2.652	168	9.314	240	4.983	312	1.765
30	1.639	102	2.994	174	9.703	246	4.425	318	1.769
36	1.726	108	3.392	180	9.984	252	3.909	324	1.764
42	1.764	114	3.909	186	9.984	258	3.392	330	1.726
48	1.769	120	4.425	192	9.703	264	2.994	336	1.639
54	1.765	126	4.983	198	9.314	270	2.652	342	1.487
60	1.769	132	5.653	204	8.766	276	2.341	348	1.200
66	1.796	138	6.275	210	8.208	282	2.130	354	0.811
72	1.854	144	6.906	216	7.609	288	1.971	360	0.282

Summary Wizard of 360 minute 30 year Winter I+0% for Storm

PN	US/MH Name	Rank	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	O'flow (l/s)	Pipe Flow (l/s)	Status
1.005	1.5	21	65.192	-0.186	0.000	0.39	0.0	279.8	OK
7.000	7.0	23	66.562	-0.238	0.000	0.10	0.0	18.0	OK
1.006	1.6	20	65.186	-0.093	0.000	0.41	0.0	297.4	OK
1.007	1.7	18	65.174	0.000	0.000	0.41	0.0	294.6	OK
1.008	1.8	19	65.158	0.062	0.000	0.41	0.0	293.7	SURCHARGED
1.009	1.9	16	65.154	0.175	0.000	0.22	0.0	287.2	SURCHARGED
8.000	8.0	23	67.280	-0.370	0.000	0.07	0.0	22.2	OK
8.001	8.1	23	66.632	-0.314	0.000	0.20	0.0	61.0	OK
9.000	9.0	23	68.590	-0.360	0.000	0.09	0.0	26.6	OK
9.001	9.1	24	68.104	-0.346	0.000	0.12	0.0	36.2	OK
10.000	10.0	23	68.449	-0.251	0.000	0.06	0.0	8.0	OK
9.002	9.2	24	67.510	-0.449	0.000	0.15	0.0	74.9	OK
9.003	9.3	24	67.027	-0.390	0.000	0.27	0.0	94.2	OK
9.004	9.4	24	66.637	-0.559	0.000	0.15	0.0	97.2	OK
9.005	9.5	24	66.339	-0.540	0.000	0.17	0.0	113.7	OK
11.000	11.0	23	69.920	-0.330	0.000	0.16	0.0	66.6	OK
11.001	11.1	23	68.298	-0.452	0.000	0.14	0.0	69.6	OK
11.002	11.2	24	67.901	-0.399	0.000	0.25	0.0	97.8	OK
12.000	12.0	23	67.759	-0.241	0.000	0.09	0.0	10.1	OK
13.000	13.0	23	67.759	-0.391	0.000	0.04	0.0	11.5	OK
13.001	13.1	23	67.356	-0.364	0.000	0.08	0.0	24.2	OK
11.003	11.3	24	66.593	-0.547	0.000	0.16	0.0	145.7	OK
9.006	9.6	24	66.163	-0.408	0.000	0.48	0.0	286.2	OK
9.007	9.7	26	65.822	-0.551	0.000	0.32	0.0	304.7	OK
14.000	14.0	23	66.906	-0.244	0.000	0.08	0.0	6.8	OK
14.001	14.1	19	66.746	-0.197	0.000	0.26	0.0	21.8	OK
14.002	14.2	22	66.347	-0.340	0.000	0.14	0.0	32.9	OK
14.003	14.3	19	66.038	-0.301	0.000	0.24	0.0	54.1	OK
9.008	9.8	26	65.548	-0.507	0.000	0.40	0.0	364.5	OK
15.000	15.0	23	67.385	-0.365	0.000	0.08	0.0	19.7	OK
15.001	15.1	23	67.048	-0.369	0.000	0.07	0.0	22.0	OK
15.002	15.2	23	66.417	-0.317	0.000	0.19	0.0	50.7	OK
8.002	8.2	24	65.218	-0.259	0.000	0.54	0.0	474.8	OK
8.003	8.3	18	65.208	0.000	0.000	0.36	0.0	470.3	OK
1.010	1.10	16	65.149	1.499	0.000	0.79	0.0	145.1	SURCHARGED
1.011	1.11	16	63.318	-0.042	0.000	0.76	0.0	145.1	OK
1.012	1.12	16	63.200	0.042	0.000	1.14	0.0	145.1	SURCHARGED
16.000	16.0	23	66.995	-0.280	0.000	0.15	0.0	19.8	OK
16.001	16.1	23	66.737	-0.329	0.000	0.16	0.0	33.8	OK
16.002	16.2	23	66.512	-0.315	0.000	0.20	0.0	43.7	OK
16.003	16.3	23	66.237	-0.316	0.000	0.19	0.0	47.9	OK
17.000	17.0	23	66.979	-0.296	0.000	0.10	0.0	15.2	OK
17.001	17.1	22	66.713	-0.244	0.000	0.27	0.0	29.2	OK
17.002	17.2	23	66.606	-0.211	0.000	0.40	0.0	35.0	OK
17.003	17.3	22	66.522	-0.205	0.000	0.42	0.0	39.3	OK
16.004	16.4	26	65.777	-0.243	0.000	0.43	0.0	88.7	OK
18.000	18.0	23	66.156	-0.444	0.000	0.15	0.0	69.3	OK
18.001	18.1	28	65.764	-0.391	0.000	0.27	0.0	69.3	OK
16.005	16.5	33	65.194	-0.593	0.000	0.24	0.0	182.7	OK
16.006	16.6	25	65.190	-0.393	0.000	0.26	0.0	183.7	OK

Summary Wizard of 360 minute 30 year Winter I+0% for Storm

PN	US/MH		Water	Flooded			Pipe		Status
	Name	Rank	Level (m)	Surch'd Depth (m)	Volume (m ³)	Flow / O'flow Cap. (l/s)	Flow (l/s)		
16.007	16.7	22	65.188	-0.240	0.000	0.15	0.0	181.8	OK
16.008	16.8	22	65.186	0.961	0.000	0.61	0.0	17.5	SURCHARGED
16.009	16.9	22	63.828	-0.097	0.000	0.62	0.0	17.5	OK
16.010	16.10	22	63.544	-0.456	0.000	0.01	0.0	17.5	OK
16.011	16.11	22	63.005	-0.156	0.000	0.07	0.0	17.5	FLOOD RISK*
16.012	16.12	22	62.456	-0.164	0.000	0.08	0.0	17.5	FLOOD RISK

Ove Arup & Partners International Ltd		Page 4
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 19/11/2014 14:40 File 16092014 PINWOOD STUDI...	Designed by Anna.Collins Checked by	
XP Solutions		Network 2014.1.1

Rainfall Hyetograph for 360 minute 30 year Winter I+0% (Storm)

Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)
6	0.672	78	4.690	150	18.108	222	16.435	294	4.412
12	1.931	84	5.069	156	19.534	228	14.933	300	4.274
18	2.855	90	5.572	162	20.863	234	13.454	306	4.210
24	3.538	96	6.311	168	22.168	240	11.858	312	4.201
30	3.901	102	7.125	174	23.093	246	10.531	318	4.210
36	4.107	108	8.072	180	23.761	252	9.304	324	4.198
42	4.198	114	9.304	186	23.761	258	8.072	330	4.107
48	4.210	120	10.531	192	23.093	264	7.125	336	3.901
54	4.201	126	11.858	198	22.168	270	6.311	342	3.538
60	4.210	132	13.454	204	20.863	276	5.572	348	2.855
66	4.274	138	14.933	210	19.534	282	5.069	354	1.931
72	4.412	144	16.435	216	18.108	288	4.690	360	0.671

Summary Wizard of 360 minute 100 year Winter I+30% for Storm

PN	US/MH Name	Rank	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	O'flow (l/s)	Pipe Flow (l/s)	Status
1.005	1.5	10	66.089	0.711	0.000	0.66	0.0	475.4	SURCHARGED
7.000	7.0	16	66.583	-0.217	0.000	0.17	0.0	31.9	OK
1.006	1.6	9	66.083	0.804	0.000	0.70	0.0	505.5	SURCHARGED
1.007	1.7	6	66.076	0.902	0.000	0.70	0.0	504.9	SURCHARGED
1.008	1.8	3	66.069	0.973	0.000	0.71	0.0	508.0	SURCHARGED
1.009	1.9	1	66.063	1.084	0.000	0.39	0.0	507.2	SURCHARGED
8.000	8.0	15	67.308	-0.342	0.000	0.13	0.0	39.4	OK
8.001	8.1	15	66.681	-0.265	0.000	0.36	0.0	108.3	OK
9.000	9.0	16	68.619	-0.331	0.000	0.16	0.0	47.3	OK
9.001	9.1	14	68.141	-0.309	0.000	0.22	0.0	64.2	OK
10.000	10.0	16	68.467	-0.233	0.000	0.11	0.0	14.3	OK
9.002	9.2	15	67.565	-0.394	0.000	0.26	0.0	132.9	OK
9.003	9.3	15	67.107	-0.310	0.000	0.47	0.0	167.3	OK
9.004	9.4	15	66.705	-0.491	0.000	0.26	0.0	172.6	OK
9.005	9.5	14	66.445	-0.434	0.000	0.31	0.0	201.6	OK
11.000	11.0	15	69.963	-0.287	0.000	0.29	0.0	118.2	OK
11.001	11.1	15	68.351	-0.399	0.000	0.25	0.0	123.6	OK
11.002	11.2	12	67.977	-0.323	0.000	0.44	0.0	173.6	OK
12.000	12.0	16	67.778	-0.222	0.000	0.15	0.0	18.0	OK
13.000	13.0	15	67.780	-0.370	0.000	0.07	0.0	20.4	OK
13.001	13.1	15	67.384	-0.336	0.000	0.15	0.0	43.0	OK
11.003	11.3	14	66.666	-0.474	0.000	0.29	0.0	258.7	OK
9.006	9.6	14	66.343	-0.228	0.000	0.85	0.0	507.6	OK
9.007	9.7	10	66.109	-0.264	0.000	0.56	0.0	537.8	OK
14.000	14.0	16	66.924	-0.226	0.000	0.14	0.0	12.0	OK
14.001	14.1	11	66.786	-0.157	0.000	0.46	0.0	38.7	OK
14.002	14.2	12	66.387	-0.300	0.000	0.24	0.0	58.5	OK
14.003	14.3	10	66.115	-0.224	0.000	0.43	0.0	96.1	OK
9.008	9.8	10	66.100	0.045	0.000	0.69	0.0	631.2	SURCHARGED
15.000	15.0	16	67.413	-0.337	0.000	0.14	0.0	35.0	OK
15.001	15.1	16	67.075	-0.342	0.000	0.13	0.0	39.1	OK
15.002	15.2	16	66.465	-0.269	0.000	0.34	0.0	89.9	OK
8.002	8.2	9	66.089	0.612	0.000	0.93	0.0	816.7	SURCHARGED
8.003	8.3	7	66.075	0.867	0.000	0.62	0.0	815.7	SURCHARGED
1.010	1.10	1	66.056	2.406	0.000	1.06	0.0	193.3	SURCHARGED
1.011	1.11	1	63.500	0.140	0.000	1.02	0.0	193.3	SURCHARGED
1.012	1.12	1	63.291	0.133	0.000	1.52	0.0	193.3	SURCHARGED
16.000	16.0	16	67.030	-0.245	0.000	0.26	0.0	35.1	OK
16.001	16.1	13	66.781	-0.285	0.000	0.29	0.0	60.0	OK
16.002	16.2	14	66.561	-0.266	0.000	0.35	0.0	77.5	OK
16.003	16.3	13	66.285	-0.268	0.000	0.34	0.0	85.0	OK
17.000	17.0	16	67.006	-0.269	0.000	0.18	0.0	27.0	OK
17.001	17.1	12	66.763	-0.194	0.000	0.47	0.0	51.8	OK
17.002	17.2	12	66.675	-0.142	0.000	0.70	0.0	62.0	OK
17.003	17.3	12	66.596	-0.131	0.000	0.75	0.0	69.8	OK
16.004	16.4	14	65.981	-0.039	0.000	0.77	0.0	157.4	OK
18.000	18.0	16	66.213	-0.387	0.000	0.27	0.0	123.0	OK
18.001	18.1	14	65.973	-0.182	0.000	0.47	0.0	123.0	OK
16.005	16.5	9	65.971	0.184	0.000	0.42	0.0	323.8	SURCHARGED
16.006	16.6	6	65.967	0.384	0.000	0.44	0.0	317.0	SURCHARGED

Summary Wizard of 360 minute 100 year Winter I+30% for Storm

PN	US/MH		Water		Flooded		Pipe		Status
	Name	Rank	Level (m)	Surch'd Depth (m)	Volume (m ³)	Flow / O'flow Cap. (l/s)	Flow (l/s)		
16.007	16.7	5	65.965	0.537	0.000	0.25	0.0	307.3	SURCHARGED
16.008	16.8	5	65.963	1.738	0.000	0.78	0.0	22.3	SURCHARGED
16.009	16.9	5	63.851	-0.074	0.000	0.78	0.0	22.3	OK
16.010	16.10	5	63.551	-0.449	0.000	0.01	0.0	22.3	OK
16.011	16.11	5	63.012	-0.149	0.000	0.09	0.0	22.3	FLOOD RISK*
16.012	16.12	5	62.463	-0.157	0.000	0.10	0.0	22.3	FLOOD RISK

Rainfall Hyetograph for 360 minute 100 year Winter I+30% (Storm)

Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)
6	1.192	78	8.326	150	32.145	222	29.174	294	7.831
12	3.427	84	8.998	156	34.675	228	26.509	300	7.588
18	5.068	90	9.892	162	37.034	234	23.883	306	7.474
24	6.281	96	11.203	168	39.351	240	21.050	312	7.457
30	6.924	102	12.648	174	40.993	246	18.695	318	7.473
36	7.291	108	14.329	180	42.178	252	16.515	324	7.453
42	7.453	114	16.515	186	42.178	258	14.329	330	7.291
48	7.473	120	18.695	192	40.993	264	12.648	336	6.924
54	7.457	126	21.050	198	39.351	270	11.203	342	6.281
60	7.474	132	23.883	204	37.034	276	9.892	348	5.068
66	7.588	138	26.509	210	34.675	282	8.999	354	3.427
72	7.831	144	29.174	216	32.145	288	8.326	360	1.192

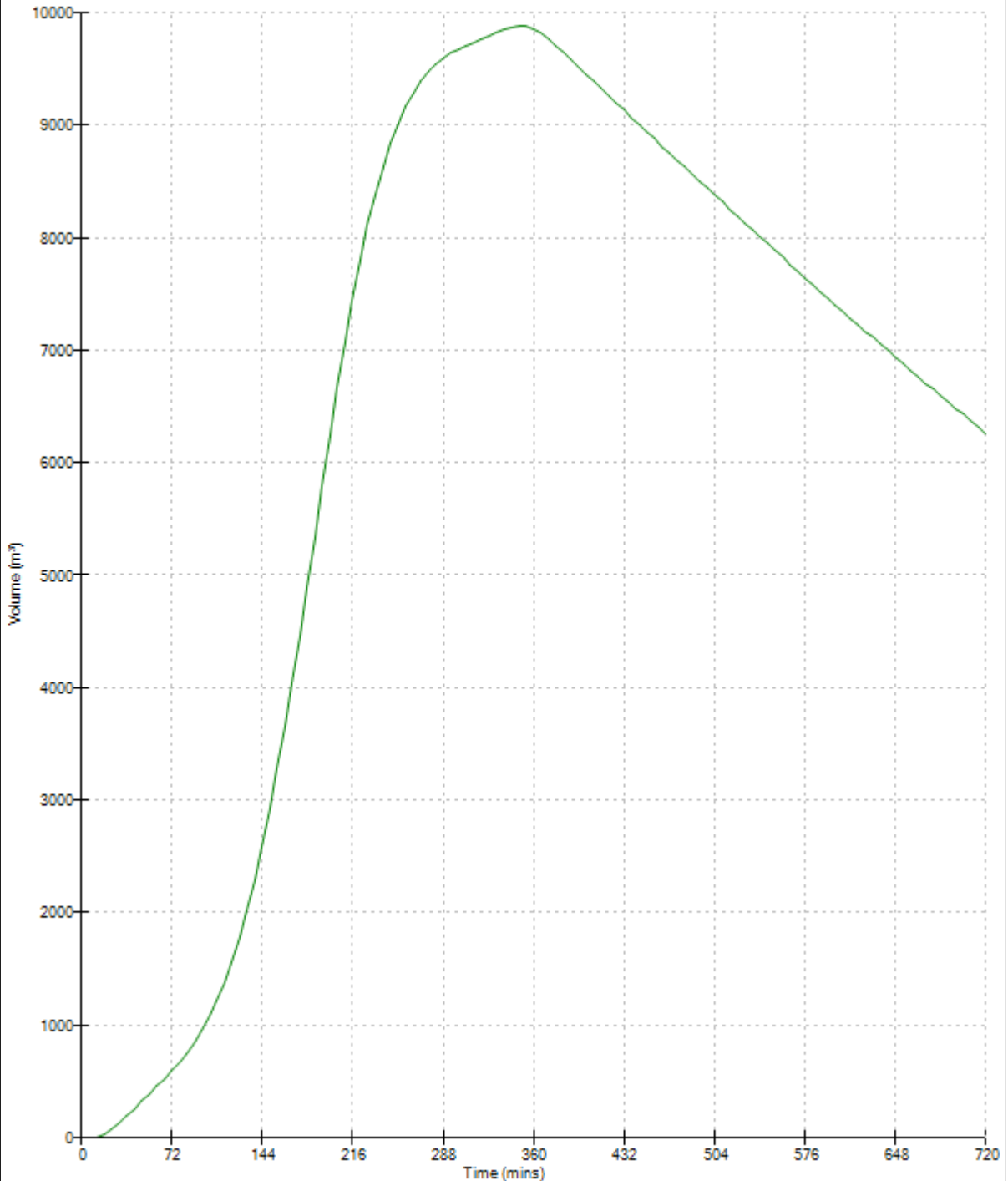
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Graphs for Pipe 1.010 US/MH 1.10 (Storm)
360 minute 100 year Winter I+30%
Status: SURCHARGED



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Graphs for Pipe 16.008 US/MH 16.8 (Storm)
360 minute 100 year Winter I+30%
Status: SURCHARGED

