

400 Longwater
Green Park



Designed by CMB
Checked by

Network 2015.1

- Indicates pipe length does not match coordinates

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Play (mm)	4*Hyd Radius (m)	XSect Area (m ²)
-1	∕	3000	1000			1.664	1.500
-2	∕	2880	720			1.288	1.037

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Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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100.005	39.130	38.591	0.000	0	0
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Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	4	Number of Storage Structures	4
		Number of Real Time Controls	0

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.900	Storm Duration (mins)	30
Ratio R	0.400		

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Online Controls for NORTHERN

Orifice Manhole: 102, DS/PN: 100.002, Volume (m³): 2.0

Diameter (m) 0.130 Discharge Coefficient 0.600 Invert Level (m) 39.040

Hydro-Brake Optimum® Manhole: 105, DS/PN: 101.001, Volume (m³): 3.2

Unit Reference	MD-SHE-0071-2000-0725-2000
Design Head (m)	0.725
Design Flow (l/s)	2.0
Flush-Flow™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	71
Invert Level (m)	39.210
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.725	2.0	Kick-Flow®	0.464	1.6
Flush-Flow™	0.215	2.0	Mean Flow over Head Range	-	1.7

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)	Depth (m)	Flow (l/s)
0.100	1.8	0.800	2.1	2.000	3.2	4.000	4.4	7.000	5.7
0.200	2.0	1.000	2.3	2.200	3.3	4.500	4.6	7.500	5.9
0.300	2.0	1.200	2.5	2.400	3.5	5.000	4.9	8.000	6.1
0.400	1.8	1.400	2.7	2.600	3.6	5.500	5.1	8.500	6.3
0.500	1.7	1.600	2.9	3.000	3.8	6.000	5.3	9.000	6.4
0.600	1.8	1.800	3.0	3.500	4.1	6.500	5.5	9.500	6.6

Hydro-Brake Optimum® Manhole: 111, DS/PN: 101.003, Volume (m³): 3.3

Unit Reference	MD-SHE-0109-4600-0450-4600
Design Head (m)	0.450
Design Flow (l/s)	4.6
Flush-Flow™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	109
Invert Level (m)	39.040
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)
Design Point (Calculated)		0.450	4.6		Kick-Flow®	0.339	4.0
	Flush-Flow™	0.168	4.6	Mean Flow over Head Range		-	3.8

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)	Depth (m)	Flow (l/s)
0.100	3.7	0.800	6.0	2.000	9.2	4.000	12.8	7.000	16.8
0.200	4.6	1.000	6.7	2.200	9.6	4.500	13.6	7.500	17.4
0.300	4.3	1.200	7.2	2.400	10.1	5.000	14.2	8.000	18.0
0.400	4.3	1.400	7.8	2.600	10.4	5.500	14.9	8.500	18.6
0.500	4.8	1.600	8.3	3.000	11.2	6.000	15.6	9.000	19.1
0.600	5.2	1.800	8.8	3.500	12.0	6.500	16.2	9.500	19.6

Peter Brett Associates LLP		Page 4																																																																						
Caversham Bridge House Waterman Place Reading Berkshire RG1 8DN	400 Longwater Green Park																																																																							
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Micro Drainage	Network 2015.1																																																																							
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Design Head (m) 0.650																																																																								
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Peter Brett Associates LLP		Page 5
Caversham Bridge House Waterman Place Reading Berkshire RG1 8DN	400 Longwater Green Park	
Date 01.04.2016 File 27159_2007 - SW NETWORK_REV1.mdx	Designed by CMB Checked by	
Micro Drainage	Network 2015.1	

Storage Structures for NORTHERN

Infiltration Trench Manhole: 101, DS/PN: 100.001

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	0.6
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	69.2
Safety Factor	2.0	Slope (1:X)	250.0
Porosity	0.30	Cap Volume Depth (m)	0.650
Invert Level (m)	39.075	Cap Infiltration Depth (m)	0.000

Infiltration Trench Manhole: 102, DS/PN: 100.002

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	0.6
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	7.9
Safety Factor	2.0	Slope (1:X)	250.0
Porosity	0.30	Cap Volume Depth (m)	0.650
Invert Level (m)	39.040	Cap Infiltration Depth (m)	0.000

Porous Car Park Manhole: 105, DS/PN: 101.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	28.0
Membrane Percolation (mm/hr)	1000	Length (m)	42.0
Max Percolation (l/s)	326.7	Slope (1:X)	250.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	39.435	Cap Volume Depth (m)	0.500

Cellular Storage Manhole: 111, DS/PN: 101.003

Invert Level (m)	39.040	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	756.0	756.0	0.450	756.0	813.0	0.451	0.0	813.0

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<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for NORTHERN</u>																																																																																																																																																																																																	
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Hot Start (mins)				0		MADD Factor * 10m³/ha Storage				2.000																																																																																																																																																																																							
Hot Start Level (mm)				0		Inlet Coefficient				0.800																																																																																																																																																																																							
Manhole Headloss Coeff (Global)				0.500		Flow per Person per Day (l/per/day)				0.000																																																																																																																																																																																							
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Rainfall Model				FSR M5-60 (mm)				18.900 Cv (Summer)		0.750																																																																																																																																																																																							
Region England and Wales				Ratio R				0.400 Cv (Winter)		0.840																																																																																																																																																																																							
Margin for Flood Risk Warning (mm)								300.0																																																																																																																																																																																									
Analysis Timestep				2.5 Second Increment (Extended)																																																																																																																																																																																													
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Duration(s) (mins)				15, 30, 60, 120, 240, 360, 480, 960, 1440																																																																																																																																																																																													
Return Period(s) (years)								1, 30, 100																																																																																																																																																																																									
Climate Change (%)								0, 0, 30																																																																																																																																																																																									
<table><tr><th>PN</th><th>US/MH Name</th><th>Storm</th><th>Return Period</th><th>Climate Change</th><th>First (X) Surge</th><th>First (Y) Flood</th><th>First (Z) Overflow</th><th>Overflow Act.</th><th>Water Level (m)</th><th>Surcharged Depth (m)</th><th>Flooded Volume (m³)</th></tr><tr><td>100.000</td><td>100</td><td>15 Winter</td><td>1</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>39.424</td><td>-0.151</td><td>0.000</td></tr><tr><td>100.001</td><td>101</td><td>15 Winter</td><td>1</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>39.248</td><td>-0.052</td><td>0.000</td></tr><tr><td>100.002</td><td>102</td><td>15 Winter</td><td>1</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>39.240</td><td>-0.025</td><td>0.000</td></tr><tr><td>100.003</td><td>103</td><td>30 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.042</td><td>-0.643</td><td>0.000</td></tr><tr><td>101.000</td><td>104</td><td>240 Winter</td><td>1</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>39.537</td><td>-0.048</td><td>0.000</td></tr><tr><td>101.001</td><td>105</td><td>240 Winter</td><td>1</td><td>+0%</td><td>1/15 Summer</td><td></td><td></td><td></td><td>39.536</td><td>0.101</td><td>0.000</td></tr><tr><td>102.000</td><td>106</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.195</td><td>-0.985</td><td>0.000</td></tr><tr><td>101.002</td><td>107</td><td>960 Winter</td><td>1</td><td>+0%</td><td>100/60 Winter</td><td></td><td></td><td></td><td>39.150</td><td>-0.165</td><td>0.000</td></tr><tr><td>103.000</td><td>108</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.689</td><td>-0.176</td><td>0.000</td></tr><tr><td>103.001</td><td>109</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.516</td><td>-0.159</td><td>0.000</td></tr><tr><td>103.002</td><td>110</td><td>15 Winter</td><td>1</td><td>+0%</td><td>100/360 Winter</td><td></td><td></td><td></td><td>39.293</td><td>-0.152</td><td>0.000</td></tr><tr><td>101.003</td><td>111</td><td>960 Winter</td><td>1</td><td>+0%</td><td>30/240 Winter</td><td></td><td></td><td></td><td>39.147</td><td>-0.118</td><td>0.000</td></tr><tr><td>100.004</td><td>112</td><td>30 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.022</td><td>-0.638</td><td>0.000</td></tr><tr><td>100.005</td><td>113</td><td>30 Winter</td><td>1</td><td>+0%</td><td>1/15 Summer</td><td></td><td></td><td></td><td>38.961</td><td>0.056</td><td>0.000</td></tr></table>														PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	100.000	100	15 Winter	1	+0%	100/15 Summer				39.424	-0.151	0.000	100.001	101	15 Winter	1	+0%	30/15 Summer				39.248	-0.052	0.000	100.002	102	15 Winter	1	+0%	30/15 Summer				39.240	-0.025	0.000	100.003	103	30 Winter	1	+0%					39.042	-0.643	0.000	101.000	104	240 Winter	1	+0%	30/15 Summer				39.537	-0.048	0.000	101.001	105	240 Winter	1	+0%	1/15 Summer				39.536	0.101	0.000	102.000	106	15 Winter	1	+0%					39.195	-0.985	0.000	101.002	107	960 Winter	1	+0%	100/60 Winter				39.150	-0.165	0.000	103.000	108	15 Winter	1	+0%					39.689	-0.176	0.000	103.001	109	15 Winter	1	+0%					39.516	-0.159	0.000	103.002	110	15 Winter	1	+0%	100/360 Winter				39.293	-0.152	0.000	101.003	111	960 Winter	1	+0%	30/240 Winter				39.147	-0.118	0.000	100.004	112	30 Winter	1	+0%					39.022	-0.638	0.000	100.005	113	30 Winter	1	+0%	1/15 Summer				38.961	0.056	0.000
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)																																																																																																																																																																																						
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101.002	107	960 Winter	1	+0%	100/60 Winter				39.150	-0.165	0.000																																																																																																																																																																																						
103.000	108	15 Winter	1	+0%					39.689	-0.176	0.000																																																																																																																																																																																						
103.001	109	15 Winter	1	+0%					39.516	-0.159	0.000																																																																																																																																																																																						
103.002	110	15 Winter	1	+0%	100/360 Winter				39.293	-0.152	0.000																																																																																																																																																																																						
101.003	111	960 Winter	1	+0%	30/240 Winter				39.147	-0.118	0.000																																																																																																																																																																																						
100.004	112	30 Winter	1	+0%					39.022	-0.638	0.000																																																																																																																																																																																						
100.005	113	30 Winter	1	+0%	1/15 Summer				38.961	0.056	0.000																																																																																																																																																																																						
<table><tr><th>PN</th><th>US/MH Name</th><th>Flow / Cap.</th><th>Overflow (l/s)</th><th>Pipe Flow (l/s)</th><th>Status</th><th>Level Exceeded</th></tr><tr><td>100.000</td><td>100</td><td>0.21</td><td></td><td>6.7</td><td>OK</td><td></td></tr><tr><td>100.001</td><td>101</td><td>0.30</td><td></td><td>8.4</td><td>OK</td><td></td></tr><tr><td>100.002</td><td>102</td><td>0.30</td><td></td><td>7.5</td><td>OK</td><td></td></tr><tr><td>100.003</td><td>103</td><td>0.01</td><td></td><td>7.1</td><td>OK</td><td></td></tr><tr><td>101.000</td><td>104</td><td>0.04</td><td></td><td>1.4</td><td>OK</td><td></td></tr><tr><td>101.001</td><td>105</td><td>0.06</td><td></td><td>2.0</td><td>SURCHARGED</td><td></td></tr><tr><td>102.000</td><td>106</td><td>0.00</td><td></td><td>1.3</td><td>OK</td><td></td></tr><tr><td>101.002</td><td>107</td><td>0.07</td><td></td><td>2.1</td><td>OK*</td><td></td></tr><tr><td>103.000</td><td>108</td><td>0.11</td><td></td><td>3.9</td><td>OK</td><td></td></tr><tr><td>103.001</td><td>109</td><td>0.19</td><td></td><td>7.1</td><td>OK</td><td></td></tr><tr><td>103.002</td><td>110</td><td>0.23</td><td></td><td>8.4</td><td>OK</td><td></td></tr><tr><td>101.003</td><td>111</td><td>0.13</td><td></td><td>4.0</td><td>OK</td><td></td></tr><tr><td>100.004</td><td>112</td><td>0.00</td><td></td><td>8.7</td><td>OK</td><td></td></tr><tr><td>100.005</td><td>113</td><td>0.14</td><td></td><td>5.0</td><td>SURCHARGED</td><td></td></tr></table>														PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded	100.000	100	0.21		6.7	OK		100.001	101	0.30		8.4	OK		100.002	102	0.30		7.5	OK		100.003	103	0.01		7.1	OK		101.000	104	0.04		1.4	OK		101.001	105	0.06		2.0	SURCHARGED		102.000	106	0.00		1.3	OK		101.002	107	0.07		2.1	OK*		103.000	108	0.11		3.9	OK		103.001	109	0.19		7.1	OK		103.002	110	0.23		8.4	OK		101.003	111	0.13		4.0	OK		100.004	112	0.00		8.7	OK		100.005	113	0.14		5.0	SURCHARGED																																																																												
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100.003	103	0.01		7.1	OK																																																																																																																																																																																												
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101.002	107	0.07		2.1	OK*																																																																																																																																																																																												
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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	0.800
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 Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	4	Number of Storage Structures	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Synthetic Rainfall Details						
Rainfall Model		FSR	M5-60 (mm)	18.900	Cv (Summer)	0.750
Region	England and Wales	Ratio R	0.400	Cv (Winter)	0.840	

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

									Water	Surcharged	Flooded
	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)
100.000	100	15 Winter	30	+0%	100/15 Summer				39.497	-0.078	0.000
100.001	101	15 Winter	30	+0%	30/15 Summer				39.468	0.168	0.000
100.002	102	15 Winter	30	+0%	30/15 Summer				39.449	0.184	0.000
100.003	103	480 Winter	30	+0%					39.186	-0.499	0.000
101.000	104	240 Winter	30	+0%	30/15 Summer				39.661	0.076	0.000
101.001	105	240 Winter	30	+0%	1/15 Summer				39.660	0.225	0.000
102.000	106	480 Winter	30	+0%					39.288	-0.892	0.000
101.002	107	480 Winter	30	+0%	100/60 Winter				39.288	-0.027	0.000
103.000	108	15 Winter	30	+0%					39.718	-0.147	0.000
103.001	109	15 Winter	30	+0%					39.565	-0.110	0.000
103.002	110	15 Winter	30	+0%	100/360 Winter				39.349	-0.096	0.000
101.003	111	480 Winter	30	+0%	30/240 Winter				39.286	0.021	0.000
100.004	112	480 Winter	30	+0%					39.186	-0.474	0.000
100.005	113	480 Winter	30	+0%	1/15 Summer				39.186	0.281	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
100.000	100	0.52		16.3		OK
100.001	101	0.63		17.4	SURCHARGED	
100.002	102	0.66		16.8	SURCHARGED	
100.003	103	0.00		3.9		OK
101.000	104	0.10		3.2	SURCHARGED	
101.001	105	0.06		2.0	SURCHARGED	
102.000	106	0.00		0.3		OK
101.002	107	0.08		2.5		OK*
103.000	108	0.26		9.7		OK
103.001	109	0.50		19.1		OK
103.002	110	0.61		22.7		OK
101.003	111	0.13		4.2	SURCHARGED	
100.004	112	0.00		7.9		OK
100.005	113	0.14		5.0	FLOOD RISK	

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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	0.800
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 Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	4	Number of Storage Structures	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Synthetic Rainfall Details						
Rainfall Model			FSR	M5-60 (mm)	18.900	Cv (Summer) 0.750
Region	England and Wales		Ratio R	0.400		Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

										Water	Surcharged	Flooded
	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume
PN	Name	Storm	Period	Change		Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)
100.000	100	30 Winter	100	+30%	100/15	Summer				39.844	0.269	0.000
100.001	101	30 Winter	100	+30%	30/15	Summer				39.801	0.501	0.000
100.002	102	30 Winter	100	+30%	30/15	Summer				39.770	0.505	0.000
100.003	103	480 Winter	100	+30%						39.353	-0.332	0.000
101.000	104	360 Winter	100	+30%	30/15	Summer				39.815	0.230	0.000
101.001	105	360 Winter	100	+30%	1/15	Summer				39.814	0.379	0.000
102.000	106	960 Winter	100	+30%						39.487	-0.693	0.000
101.002	107	960 Winter	100	+30%	100/60	Winter				39.487	0.172	0.000
103.000	108	15 Winter	100	+30%						39.745	-0.120	0.000
103.001	109	15 Winter	100	+30%						39.613	-0.062	0.000
103.002	110	960 Winter	100	+30%	100/360	Winter				39.486	0.041	0.000
101.003	111	960 Winter	100	+30%	30/240	Winter				39.485	0.220	0.000
100.004	112	480 Winter	100	+30%						39.353	-0.307	0.000
100.005	113	480 Winter	100	+30%	1/15	Summer				39.353	0.448	0.000

PN	US/MH Name	Flow / Cap.	Overflow (1/s)	Pipe	Status	Level
				Flow (1/s)		Exceeded
100.000	100	0.60		18.8	FLOOD RISK	
100.001	101	0.95		26.3	FLOOD RISK	
100.002	102	1.02		25.9	FLOOD RISK	
100.003	103	0.00		6.6	OK	
101.000	104	0.13		3.9	SURCHARGED	
101.001	105	0.06		2.0	SURCHARGED	
102.000	106	0.00		0.3	OK	
101.002	107	0.07		2.3	SURCHARGED*	
103.000	108	0.44		16.4	OK	
103.001	109	0.84		32.1	OK	
103.002	110	0.07		2.5	SURCHARGED	
101.003	111	0.14		4.3	SURCHARGED	
100.004	112	0.01		9.5	OK	
100.005	113	0.14		5.0	FLOOD RISK	