Site Servicing and Stormwater Management Report Hazeldean Crossing

Type of Document
Site Plan Submission

Project Name
Hazeldean Crossing

Project Number
OTT-00250806-B0

Prepared By: J. Fitzpatrick, P.Eng.
Reviewed By: B. Thomas, P.Eng.

exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

Date Submitted
January 22, 2020

Hazeldean Crossing Inc.

Site Servicing and Stormwater Management Report
Hazeldean Crossing – 5924 Hazeldean Road

Type of Document:
Site Plan Submission

Project Name:
Hazeldean Crossing

Client:
Hazeldean Crossing Inc.

Project Number:
OTT-00250806-B0

Site Plan Control File Number:
D07-12-18-0084

Prepared By:
exp
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Canada
T: 613 688-1899
F: 613 225-7337
www.exp.com

LICENSED PROFESSIONAL ENGINEER
J.L. FITZPATRICK
2020-01-22
PROVINCE OF ONTARIO

Jason Fitzpatrick, P.Eng.
Project Engineer
Infrastructure Services

Bruce Thomas

Bruce Thomas, P.Eng.
Senior Project Manager
Infrastructure Services

Date Submitted:
January 22, 2020

Legal Notification

This report was prepared by EXP Services Inc. for the account of **Hazeldean Crossing Inc.**

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

Table of Contents

List of Tables

List of Figures

List of Appendices

1 Introduction

1.1 Site Description and Proposed Development

Hazeldean Crossing Inc. retained EXP Services Inc. (EXP) to prepare a site servicing and stormwater management report for a proposed residential infill development.

The 0.9641-hectare development site is situated at the corner of Hazeldean Road and Victor Street in the City of Ottawa, Ontario as shown on Figure A1 in Appendix A. The site is within Ward 6 or Stittsville Ward.

The proposed site development consists of two (2) property parcels located in Lots 25 and 26, Concession 11, Geographic Township of Goulbourn, City of Ottawa. The following describes the two properties:

- 5924 Hazeldean Road. PIN 04462-0476, Part of Lot 26, on Registered Plan 4R-7332
- 5938 Hazeldean Road. PIN 04462-0475, Parts 1 & 2 on Registered Plan 4R-10078

The proposed development will be comprised of 76 stacked townhome units, and 10 traditional townhomes. Access to the properties will be from a single access off Victor Street. A copy of the topographic survey and the proposed site plan are provided in Appendix J.

This report will discuss the adequacy of the adjacent municipal storm sewers, sanitary sewers and watermains to convey the storm runoff, sewage flows and provide the water demands that will result from the proposed development. This report provides a design brief for submission, along with the engineering drawings, for City approval.

1.2 Background Documents

Various design guidelines were referred to in preparing the current report including:

- Sewer Design Guidelines, Second Edition, Document SDG002, October 2012, City of Ottawa including:
    - Technical Bulletin ISDTB-2012-4 (20 June 2012)
    - Technical Bulletin ISDTB-2014-01 (05 February 2014)
    - Technical Bulletin PIEDTB-2016-01 (September 6, 2016)
    - Technical Bulletin ISDTB-2018-01 (21 March 2018)
    - Technical Bulletin ISDTB-2018-04 (27 June 2018)
- Ottawa Design Guidelines – Water Distribution, July 2010 (WDG001), including:
    - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
    - Technical Bulletin ISTB-2018-02 (21 March 2018)
- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment and Climate Change, March 2003 (SMPDM).

- Design Guidelines for Drinking-Water Systems, Ontario Ministry of the Environment and Climate Change, 2008 (GDWS).
- Fire Underwriters Survey, Water Supply for Public Fire Protection (FUS), 1999.
- Ontario Building Code 2012 (OBC), Ministry of Municipal Affairs and Housing.
- Ontario Ministry of Transportation (MTO) Drainage Manual, 1995-1997.

1.3 Existing Infrastructure

For the purpose of this report, reference is made to the two properties as: Site #1 and Site #2. The following summarizes the areas of each.

- Site # 1 (eastern) at 5924 Hazeldean Road. Area 0.4995 hectares.
- Site # 2 (western) at 5938 Hazeldean Road. Area 0.4646 hectares.

Site # 1 is a vacant parcel located at the corner of Victor and Hazeldean Road. The site appears to have never been developed based on City of Ottawa aerial images to as far back as 1976. The overall topography of Site # 1 is directed in a northerly direction and ranges from elevation ±115.0m to ±112.75m. The exiting ground cover within this property consists of grass with some mature trees along the eastern boundary of the property.

Site #2 contains a gas station and service garage that is abandoned and will be demolished for the redevelopment of the site. The following summarizes the onsite and offsite existing utilities:

Within Site #1

- 450mm storm sewer and catchbasin stubbed just inside property (off Victor Street)
- 150mm watermain c/w Valve & Valve Box stubbed just inside property (off Victor Street)
- 200mm sanitary sewer and manhole stubbed just inside property (off Victor Street)

Within Site #2

- The services for the former gas station will need to be abandon prior to demolition.

On Victor Street Along Frontage of Site #1

- 375mm storm sewers
- 250mm sanitary sewer
- 200mm watermain
- Underground Bell & Rogers
- 50mm Enbridge Gas main
- Overhead and underground Hydro
- Underground Streetlighting

On Hazeldean Road Along Frontage of Site #1 & Site @2

- 525mm & 2400mmx1800mm storm sewer
- 300mm & 450mm sanitary sewers
- 305mm & 762mm watermains
- Bell / Hydro / Telecom Ottawa/ Traffic. Status to be confirmed with the utility providers
- Underground 150mm & 300mm Gas

- Underground Bell & Rogers
- Underground Traffic plant
- Underground Streetlighting

The as-built drawings for both Victor Street and Hazeldean Road were obtained from the City Vault, and are included in Appendix I for reference.

1.4 Consultation and Permits

A pre-consultation meeting was held between Hazeldean Crossing Inc. and the City on November 8, 2018. This meeting outlined the submission requirements and provided information to assist with the development proposal.

For the onsite stormwater system, generally an ECA would be required for any stormwater management facilities. Stormwater Management (or SWM) Facilities are defined by any stormwater works used for the treatment, retention, infiltration or control of stormwater. However, an Approval Exemption under Ontario Regulation 525/98 can be applied. Under Section 3 of O'Reg 525/98, Section 53 (1) and (3) do not apply to the alteration, extension, replacement or a change to a stormwater management facility that 1) is designed to service one lot or parcel of land, b) discharges into a storm sewer that is not a combined sewer, c) does not service industrial land or a structure located on industrial land, and finally d) is not located on industrial land. If the property parcels noted in Section 1.1 are merged into one property parcel, this would satisfy the Approval Exemptions under O'Reg 525/98, and not require a stormwater ECA. Therefore, the ECA application should apply to the onsite storm and sanitary sewers only.

A small section of new sanitary sewer on Victor Street will be required to service the townhomes fronting the municipal street. In this case an ECA will be required for the municipal sewage works, which are owned by the City of Ottawa. This ECA will be filled under the Transfer of Review (TofR) process.

Prior to City signoff on the infrastructure design a pre-consultation meeting will be held with the local MECP, to confirm ECA requirements.

The proposed site is located within the Mississippi Valley Conservation Authority (MVCA) jurisdiction, therefore signoff from the MVCA will be required prior to Site Plan approval. The MVCA has been contacted to discuss the stormwater management quality control requirements.

2 Geotechnical Considerations

A geotechnical investigation was completed by EXP and was prepared to establish the subsurface and groundwater conditions and to provide recommendations related to excavation, foundation design, backfilling requirements, site grading, pipe bedding, pavement structure.

Within Site # 1 a thin layer of topsoil ranging from 0.0m to 0.9m is underlaid by bedrock. Some areas of the site have rock exposed at the surface. It appears that the overburden on most of the site has been removed.

Within Site # 2, thicker amounts of overburden ranging between 0.8 and 3.6m existing sand/till backfill.

Eleven boreholes were drilled. Within Site # 1 the groundwater table is expected at between 2.1 metres and 3.9 metres below existing grade. For site # 2 the groundwater table is expected at between 1.5 metres and 3.0 metres. A summary of the groundwater table elevations, as taken from the geotechnical report are illustrated on the grading plan.

A maximum grade raise requirement of 2.0m was established for the site. The recommended pavement structure was established at: 40mm + 50mm of asphalt, 150mm granular "A" and a maximum 400mm depth of Granular "B".

3 Deviations

There are no noted deviations from the City Design Standards (SDG002).

4 Watermain Servicing

4.1 Methodology

The water service for the proposed site is designed in accordance with the City Design Guidelines (July 2010). The following steps indicate the basic methodology that was used in the hydraulic analysis:

- Estimated water demands under average day, maximum day and peak hour conditions. As the total site population was below 500, residential peaking factors were interpolated based on MOE Table 3-3.
- Estimated the required fire flow (RFF) for each building block based on the Fire Underwriters Survey (FUS).
- Obtained hydraulic boundary conditions (HGL) from the City, based on the above water demands and required fire flows.
- Boundary condition data and water demands were used to estimate the pressure at the proposed site, and this was compared to the City's of Ottawa's design criteria.

4.2 Design Criteria

We estimated the domestic water demands as shown below, using parameters from the WDG001 as follows:

Pressure Zone

Proposed site located in zone = 3W

Number of Units

Stacked townhomes = 76
Traditional townhomes = 10

Densities

2-bedroom units (persons per unit) = 2.1
Townhomes = 3.7

Residential Populations

76, 2-bedroom units (@ 2.1 persons per unit) = 159.6
10, Townhomes (@ 2.7 persons per unit) = 27.0
= 186.6

Demand Rates

Average Residential Demands (L/person/day) = 350

Peaking Factors

Max Day Residential Peaking Factor (as per MOE Table 3-3) = 4.58 x avg. day
Peak Hour Residential Peaking Factor (as per MOE Table 3-3) = 6.91 x avg. day

Watermain Design

C factor (200 mm – 300 mm) = 110
Minimum Allowable Pressure = 275 kPa (40 psi)
Maximum Allowable Pressure = 690 kPa (100 psi)
Minimum Static Pressure (Under Fire Flow Conditions) = 140 kPa (20 psi)

Residential Water Demands

Average Residential Demands
186.6 persons x 350 L/person/day x (1/86,400 sec/day) = 0.76 L/sec

Total Water Demands

Avg Day Demands = = 0.76 L/sec

Maximum Day Demands = 0.76 x 4.58 = 3.46 L/sec

Peak Hour Demands = 0.76 x 6.91 = 5.22 L/sec

The average day, maximum day, and peak hourly demands for the proposed site at 5924 Hazeldean are 0.76 L/sec 3.46 L/sec, 5.22 L/sec, respectively. Please note that the maximum day and peak hour factors, noted above, were determined based on MOECC GDWS Table 3-3 as the population of the proposed development is less than 500 persons.

This requirement is noted in Section 4.2.8 of the City's WDG001. Detailed calculations of the domestic water demands are provided in Table B1 in Appendix B. The distribution of demands (or allocation) is illustrated in Figure A3.

4.3 Fire Flow Requirements

Water for fire protection will be available utilizing the proposed fire hydrants located along the adjacent roadways: Victor Street, and Hazeldean Road. The required fire flows for the proposed site were calculated based on typical values as established by the Fire Underwriters Survey 1999 (FUS).

The following equation from the Fire Underwriters document “Water Supply for Public Fire Protection”, 1991, was used for calculation of the on-site supply rates required to be supplied by the hydrants:

$F = 200 * C * \sqrt{(A)}$

where

F = Required Fire flow in Litres per minute
C = Coefficient related to type of Construction
A = Total Floor Area in square metres

A reduction for low hazard occupancy of -15% for residential dwellings, and an increase for fire area exposure of was used. Calculations of the Required Fire Flows (RFF), based on the FUS Method, for each residential block is provided in Appendix B.

The following details the fire flow requirements for the most critical residential block (Block 4).

Type of Construction = Wood Framed Construction
Coeff Related to Construction = 1.5
Basement (more than 50% above ground) = 310 m^2
1st to 3rd Floor Area = 310 m^2

Number of Floors = 4

Fire Flow Requirement, FF = $200 * 1.5 * \sqrt{(A)}$
= $200 * 1.5 * \sqrt{(4 \times 310m^2)}$
= 11,620 L/min or 12,000 L/min (rounded up)

Occupancy Class = Limited Combustible

Occupancy Charge = -15%

Fire Flow Requirement, FF = 12,000 *-15%
(with reduction due to occupancy) = -1,200 L/min
= 10,200 L/min

Reductions due to Sprinklers = No reduction.

Charges Due to Exposures = sum for all sides
= 18% + 8% + 5% + 12% = 43%

Required Fire Flow (RFF) = 10,200 L/min + 4,386 L/min
= 14,586 L/min
= 15,000 L/min (rounded to closest 1,000) = 250 L/sec

The following table summarizes the required fire flows for all buildings, which include the reductions, and/or increases due to occupancy, sprinklers systems and exposures. These fire flows have been calculated based on the FUS method and the City of Ottawa Water Distribution Guidelines (WDG001), and the latest Technical Bulletin.

Table 4-1: Summary of Fire Flow Requirements for All Buildings

Block	Description	[1]No of Storeys	Fire Flow, (L/min)	[2]Type of Constr. Coeff, C	[3]Reduction Due to Occupancy (%)	[4]Total Increase from Exposures	[5,6]Req's Fire Flow	
							(L/min)	(L/sec)
1	Townhomes	2+	11,000	1.5	-15%	45%	14,000	233
2	Stacked townhomes	3+	9,000	1.5	-15%	49%	11,000	183
3	Stacked townhomes	3+	7,000	1.5	-15%	40%	8,000	133
4	Stacked townhomes	3+	12,000	1.5	-15%	43%	15,000	250
5	Stacked townhomes	3+	9,000	1.5	-15%	67%	13,000	217
6	Stacked townhomes	3+	7,000	1.5	-15%	52%	9,000	150
7	Stacked townhomes	3+	9,000	1.5	-15%	48%	11,000	183
8	Stacked townhomes	3+	9,000	1.5	-15%	51%	12,000	200
9	Stacked townhomes	3+	7,000	1.5	-15%	51%	9,000	150
10	Stacked townhomes	3+	9,000	1.5	-15%	62%	12,000	200
11	Stacked townhomes	3+	9,000	1.5	-15%	36%	10,000	167
12	Stacked townhomes	3+	7,000	1.5	-15%	25%	7,000	117

1 - If basements are included (<50% below grade) then denoted as +.
2 -Types of constructions: 0.8 for non-combustible, 1.0 for ordinary construction,1.5 for wood frame construction.
3 - Reductions due to Occupancy are -25% for non-combustible or -15% for limited combustible.
4 - Increase due to exposures were calculated based on FUS and technical bulletin ISTB-2018-02.
5 - Required Fire Flows are rounded to nearest 1,000 L/min.

4.4 Boundary Conditions

Hydraulic Grade Line (HGL) boundary conditions were obtained from the City for design purposes. A copy of the correspondence received from the City is provided in Appendix F. Boundary conditions at three (3) connection locations were requested from the City. Connections # 1 & 3 were used for modelling as it represents the closest junction to the boundary conditions. The following hydraulic grade line (HGL) boundary condition was provided:

Demand Condition	HGL Connection #1	HGL Connection #3
Maximum =	160.9 m	160.8 m
Max Day + Fire Flow =	135.4 m	158.3 m
Peak Hour =	157.2 m	157.3 m

The above noted HGL's are based on a ground elevation of approximately 114.0 m and 114.3 m at boundary conditions #1 and #3 respectively. This results in a system water pressure of 43.2 m (or 61.4 psi) and 43.0m (or 61.2 psi) at the connection points during peak hour conditions.

4.5 Proposed Servicing and Calculations

4.5.1 Watermain Design

Since the average day demands of 65.3 m^3 per day exceed 50 m^3 per day, two separate watermain connections for the site will be necessary as per Section 4.31 of the WDG001.

4.5.2 Modelling Scenarios

A total of five (4) scenarios were analyzed. The performance of the proposed water distribution system within the development was analyzed under each scenario. The following summarizes the modelling scenarios that were analyzed. Please refer to Figure A2 in Appendix A which illustrates the water distribution layout.

Scenario 1A	Peak Hour (using connection #1)
Scenario 1B	Peak Hour (using connection #3)
Scenario 2A	Max Day Plus Fire Flow (using connection #1)
Scenario 2B	Max Day Plus Fire Flow (using connection #3)

4.6 Simulation Results

4.6.1 Modelling Results

The results of the WaterCAD modelling under maximum day plus fire flow and peak hourly conditions are summarized in Table 4-2 and Table 4-3 below for Scenarios 1 and 2. These results are based on a hydraulic boundary condition on Victor Street where the private watermain connect to the municipal 200mm diameter watermain. The complete results for all scenarios are provided in Appendix C.

Table 4-2: Summary of Results of Scenario 1A for Peak Hour

Junction	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-1	114.36	0.38	157.20	60.8
J-2	114.00	0.00	157.20	61.3
J-3	114.00	0.62	157.20	61.3
J-4	113.95	1.17	157.19	61.4
J-5	114.36	0.00	157.20	60.8
J-6	114.50	1.76	157.19	60.6
J-7	114.32	0.82	157.19	60.9
J-8	113.90	0.00	157.19	61.5
J-9	115.45	0.47	156.84	58.8
J-10	113.20	0.00	157.20	62.5
J-12	114.00	0.00	157.20	61.3

Table 4-3: Summary of Results of Scenario 1B for Peak Hour

Junction	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-1	114.36	0.38	157.30	60.9
J-2	114.00	0.00	157.29	61.5
J-3	114.00	0.62	157.29	61.5
J-4	113.95	1.17	157.29	61.5
J-5	114.36	0.00	157.30	61.0
J-6	114.50	1.76	157.30	60.7
J-7	114.32	0.82	157.29	61.0
J-8	113.90	0.00	157.29	61.6
J-9	115.45	0.47	156.95	58.9
J-10	113.20	0.00	157.30	62.6
J-12	114.00	0.00	157.30	61.5

The calculated minimum and maximum working pressures anticipated within the development range from 58 psi to 62.6 psi under peak hour conditions. This meet the minimum 40 psi as per City of Ottawa Guidelines. Table 4-4 below provides the results of scenarios 2 under maximum day plus fire flow conditions. It should be noted that for Scenario 2A, onsite fire hydrants H-1, and H-2 were only able to provide 171 and 201 L/sec. This scenario was used to confirm if a single watermain feed from connection #1 (Victor Street / Denham Way) would be able to deliver appropriate fire flows. It was determined that a feed from Hazeldean Rd (Connection #3) would be necessary. Complete fire flow results are provided in Appendix C.

Table 4-4: Summary Results of Scenario 2B for Maximum Day Plus Fire Flow

Hydrant Node	Fire Flow Required (L/sec)	Total Flow Available Based on Model Results (L/sec)	Satisfies Fire Flow Constraints?
H-1	250	>250	Yes
H-2	250	>250	Yes
H-3	250	>250	Yes

Under Maximum Day + Fire Flow conditions the available fire flows are in excess of the required fire flows (RFF) at all junctions, and therefore meeting the City of Ottawa watermain design criteria. Additional information on the available fire flows from each hydrant based on the City's Technical Bulletin 2018-02 is provided Table B2 of Appendix B, and the proceeding section.

4.7 Review of Hydrant Spacing

A review of the hydrant spacing was completed to ensure compliance with Appendix I of Technical Bulletin ISTB-2018-02. As per Section 3 of Appendix I all hydrants within 150 metres were reviewed to assess the total possible contribution of flow from these contributing hydrants. For each hydrant the distance to the proposed site was determined to arrive at the contribution of fire flow from each. All hydrants are expected to be of Class AA as per Section 5.1 of Appendix I.

Table B2 in Appendix C summarizes all fire hydrants within a 150m distance from the proposed site. For each hydrant the straight-line distance, distance measured along a fire route or roadway, whether its location is accessible, and its contribution to the required fire flow. Figure A4 in Appendix A illustrates the hydrant locations in proximity to the site. Only the hydrants that are accessible, as per Appendix I of ISTB-2018-02, were used.

For the critical Block 4, the total available contribution of flow from all hydrants was estimated as 15,200 L/min, which exceeds the required fire flow of 15,000 L/min as identified in Appendix I of Technical Bulletin ISTB-2018-02. All other Blocks will also receive enough fire flow contribution from the newly proposed and existing surrounding hydrants. Three onsite fire hydrants will be necessary to meet the require fire flows based on the City's guidelines.

5 Sanitary Sewer Design

The sanitary sewer system is designed based on a population flow and an area-based infiltration allowance. The flows were calculated using City sewer design guidelines (SDG002) as follows:

Area

Gross site area = 0.9641 ha

Number of Units

2-bedroom units = 76
Townhomes = 10

Densities

2-bedroom units (persons per unit) = 2.1
Townhomes (persons per unit) = 2.7

Residential Populations

76, 2-bedroom units (@ 2.1 persons per unit) = 159.6
10, Townhomes (@ 2.7 persons per unit) = 27.0
= 186.6

Residential Peaking Factor

Peak Factor = 1 + 14 / (4 + (P/1000)$^{0.5}$)* K, where K = 0.8
Peak Factor = 1 + 14 / (4 + (186.6/1000)$^{0.5}$) x 0.8 = 3.53

Domestic Sewage Flow

Average Domestic Flow (186.6 x 280 L/cap/day x (1/86,400 sec/day) = 0.605 L/sec
Peak Domestic Flow (3.53 x 0.605) = 2.13 L/sec

Infiltration

Infiltration Allowance = 0.33 L/ha/sec
Infiltration Flow (0.9641 ha x 0.33 L/ha/sec) = 0.32 L/sec

Total Peak Sewage Flow

Peak Sanitary Flow = 2.13 + 0.32 **= 2.45 L/sec**

The estimated peak sanitary flow rate from the proposed development at is **2.45 L/sec** based on City Design Guidelines.

The proposed development will have a sanitary sewer connection to the existing 250mm sanitary sewer on Victor Street. The proposed connection point is just south of the location of Manhole MHSA9001. It is proposed that the location of MHSA9001 will be adjusted slightly to accommodate the sanitary sewer from the site. The 200mm sanitary sewer through the site is proposed with a minimum 0.35% slope, having a capacity of 19.7 L/sec based on Manning's Equation under full flow conditions.

5.1 Offsite Sanitary Sewer Analysis

The proposed sanitary sewer within the development site will discharge to a 250mm sanitary sewer on Victor Street. An analysis of the existing sanitary infrastructure was conducted to determine the capacity of the existing system and determine if the existing infrastructure could handle the anticipated additional flows to the overall system due to the new development proposed at 5924 Hazeldean.

Existing Conditions

Area = 12.113 hectares
Residential Density for Townhome = 2.7 person/unit
Residential Density for 2-bedroom apartment = 2.1 person/unit

Residential Density for Single home = 3.4 person/unit
Residential Density for Semi-detached home = 3.4 person/unit

Average Residential Flow Allowance = 280 L/per/day
Residential Peaking Factor = Harmon Formula

Commercial Flow Allowance = 28,000 L/ha/fay
Commercial Peaking Factor = 1.5

To confirm adequate capacity is available in the downstream system a review of the as-constructed conditions was completed and the peak sewage rates were re-calculated based on current City Guidelines.

Figure A4 in Appendix A illustrates the off-site sanitary sewers and tributary drainage area. It consists of only residential homes. Using the City's urban site GIS layer, it was determined that there is approximately 12.113 hectares (250 homes) of residential lands tributary to the outlet sewer (sanitary manhole # 09013). The proposed development at 5924 Hazeldean Road will contain 76 2-bedroom suites, and 10 townhomes. The sewage flows, based on current City Guidelines, were re-calculated as follows:

Townhomes = 10
2-bedroom apartment = 76
Single home = 158
Semi-detached home = 6

10-Townhomes x 2.7 person/unit = 27 persons
76-2 Bedroom apartments x 2.1 person/unit = 159.6 persons
158-Residential Density for Single Home x 3.4 person/unit = 537.2 persons
6-Residential Density for Single Home x 2.7 person/unit = 16.2 persons

Residential Population = 27 + 159.6 + 537.2 + 16.2 = 740 persons

<u>Residential Sewage Flow</u>

Residential Flow Allowance = 280 L/person/day
Correction Factor, K = 0.8
Peak Factor = 1 + (14 / (4 + $(P/1000)^{0.5}$)) * K
Peak Factor = 1 + (14 / (4 + $(740/1000)^{0.5}$)) * 0.8
Peak Factor = 1 + (2.88) * 0.8 = 3.30

Avg. Domestic Flow = 740 x 280 L/person/day x (1/86,400 sec/day) = 2.398 L/sec
Peak Domestic Flow = 2.398 L/sec x 3.30 = 7.91 L/sec

<u>Extraneous Flows</u>

Total Area = 12.113 hectares
Extraneous Flow Allowance = 0.33 L/ha/sec
Extraneous Flows = (0.33 x 12.113) = 4.0 L/sec

<u>Total Sewage Flow</u>

Total Sanitary Flow (at last manhole from design sheet) = 12.20 L/sec

The calculated peak sewage flows under full build-out conditions within the existing system is calculated to be 12.20 L/sec including the proposed development at 5294 Hazeldean. It should be noted that the residential sanitary flow allowance is now 280 L/person/day as per Technical Bulletin ISTB-2018-01, and therefore the existing infrastructure is conservatively designed in accordance with today's standard guidelines.

The maximum percent (%) full capacity within with sanitary sewer system was determinized to be 36% between sewer runs 09012 and 09013, two sewer sections downstream of the proposed sewer connection from site. Existing sanitary sewer invert elevation data was taken from the City's website. It can be concluded that the existing sanitary sewer system can support the proposed development.

6 Stormwater Management

6.1 Pre-Development Conditions

6.1.1 Estimation of Time of Concentration

The time of concentration for the pre-development subcatchments were determined using both the Airport Method (Federal Aviation Administration), and the Bransby-Williams Method. The Airport Formula is suited well for undisturbed land and is typically used for drainage areas with a runoff coefficient of less than 0.40. The Bansby-Williams Method applies more for catchments with a runoff coefficient is grater than 0.40.

From the MTO Drainage Manual the Airport Formula and the Bansby-Williams Methods used are as follows:

T_C = $3.26^*\ (1.1-C)^*\ L^{0.5}/\ S_W^{0.33}$ Federal Aviation Method (Airport Method)

T_C = $0.057^*L\ /\ (S_W^{0.2*}A^{0.1})$ Bansby-Williams Method

where:

Tc = Time of Concentration (minutes)
C = Runoff Coefficient
Sw = Watershed Slope (%)
L = Watershed Length (m)

The watershed length and slope that were used were determined by using the topographic survey and the 85/10 Slope Method. Detailed calculations for each catchment are provided in Table E1 of Appendix E for reference.

The calculation of the tie of concentrations were used simply for comparison with standards design values only. The use of short time of concentrations will result in higher peak flows. General practice would be to use a consistent time of concentration of 10 minutes under pre and post development conditions.

6.1.2 Runoff Coefficients

Runoff coefficients used for pre-development conditions were based on actual areas. Runoff coefficients for impervious surfaces (roofs, asphalt, and concrete) were taken as 0.90, whereas those for pervious surfaces (grass/landscaping) were taken as 0.20. Average runoff coefficients for all catchments (both pre-development and post-development) were calculated using PCSWMM's area weighting routine.

This modelling software has a GIS engine which allows for catchment (or polygon) definition including attributes. The runoff coefficients for all catchments were area weighted to derive at average runoff coefficients based on hard surfaces (concrete or asphalt) having an imperviousness of 100%, soft surfaces (landscaping surfaces) having a zero percent imperviousness. The conversion from an imperviousness percent to a runoff coefficient was taken as C = (IMP*0.70) / 100 + 0.20, with the imperviousness (IMP) as a percentage. Additional information is provided in Appendix E.

The pre-development and post-development average runoff coefficients for each site property is summarized in the following table.

Table 6-1: Summary of Pre-Development Average Runoff Coefficients – Pre-Development

Location	Area (hectares)	Imperviousness (%)	Avg. Runoff Coefficient (C_{AVG})
Site 1 (east)	0.4995	0	0.20
Site 2 (west)	0.4645	48.4	0.54
Total or average	0.9640	22.8	0.36

6.1.3 Pre-Development Peak Flows

The combined 0.9642-hectare sites are currently vacant, with the exception of a small former gas station building within the western property. From the existing ground elevations shown on the grading plan, there are two overland flow routes which discharge runoff to both Hazeldean Road and Victor Street.

Pre-development subcatchments are derived from PCSWMM using the watershed Delineation Tool. Subcatchments tributary to each OUTFALL were delineated into PRE_S01, PRE_S02 and PRE_S03 as shown FIGURE A8. The pre-development runoff coefficient for the entire development site was determined to be 0.36. From Figure A8, a small portion of the runoff from the site is directed northerly to catchbasins on Hazeldean Road, whereas the majority is easterly directed to Victor Street.

The time of concentration for each pre-development subcatchment was determined to range from 1.2 to 5.1 minutes. However, since the time of concentration under post-development was set at standard 10min as per City Guidelines, the allowable discharge release rates from the site were established using the peak flows derived with a standard time of concentration of 10 minutes. Using the lower calculated time of concentrations under pre-development conditions would artificially raise the peak flows.

For comparison, the pre-development peak flows, based on a calculated time of concentration were determined for the 2-year, 5-year and 100-year storms using the Rational Method. Detailed calculations for each drainage area (or catchment) is provided in Appendix E.

Q_{PRE} = 2.78 C I A

where:

Q_{PRE} = Peak Discharge (L/sec)
C = Runoff Coefficient (increase by 25% for 100-year)
I = Average Rainfall Intensity for return period (mm/hr)
= $732.951/ (T_C+6.199)^{0.810}$ (2-year)
= $998.071/ (T_C+6.053)^{0.814}$ (5-year)
= $1735.688/ (T_C+6.014)^{0.820}$ (100-year)
Tc = Time of concentration (mins)
A = Drainage Area (hectares)

Table E2 summarizes the pre-development peak flows based on a calculated time of concentration, determined using either the Airport Formula or the Bransby Williams formula. Table 6-2 below summarizes these pre-development peak flows tributary to the storm sewers on Hazeldean Road and Victor Street.

Table 6-2: Summary of Pre-Development Peak Flows

Return Period Storm	Peak Flow to Victor Street Storm Sewers (L/sec)	Peak Flow to Hazeldean Road Storm Sewers (L/sec)	Total Peak Flows (L/sec)
2-year	76.6	46.1	122.7
5-year	104.9	63.1	168.0
100-year	226.1	135.8	361.9

6.2 Calculation of Allowable Release Rate

As previously mentioned, the allowable discharge release rates from the site were established using the peak flows derived with a standard time of concentration of 10 minutes as per City Guidelines. The allowable release rates from the proposed site were estimated using the Rational Formula are follows:

Q_{ALL} = $2.78\ C_{AVG}\ I_T\ A$

where:

Q_{ALL} = Peak Allowable Discharge (L/sec)
C_{AVG} = Average Runoff Coefficient (25% increase for 100-yr storm)
I_T = Average Rainfall Intensity (mm/h) for Return Period
A = Drainage Area (hectares)

Based on the consultation with the City of Ottawa, the post-development flows are to be controlled to the 5-year pre-development rate for all storms up to the 100-year event. Using a time of concentration (T_C) of 10 minutes and a maximum runoff coefficient of 0.50 or the pre-development value. The allowable release rates from the site were determined for the 2-year, and 5-year storms as follows:

To Victor Street

Q_{2ALL} = 2.78 (0.28) ($I_{2\text{-year}}$) (0.7828 ha)
= 2.78 (0.28) (732.951/(10+6.199)^0.810) (0.7828 ha) = 46.7 L/sec

Q_{5ALL} = 2.78 (0.28) ($I_{5\text{-year}}$) (0.7828 ha)
= 2.78 (0.28) (998.071/(10+6.035)^0.814) (0.7828 ha) = 63.5 L/sec
*Further reduced based on modelling of downstream storm = **50.0 L/sec**

To Hazeldean Road

Q_{2ALL} = 2.78 (0.50) ($I_{2\text{-year}}$) (0.1814 ha)
= 2.78 (0.50) (732.951/(10+6.199)^0.810) (0.1814 ha) = 19.4 L/sec

Q_{5ALL} = 2.78 (0.50) ($I_{5\text{-year}}$) (0.1814 ha)
= 2.78 (0.50) (998.071/(10+6.035)^0.814) (0.1814 ha) = 26.3 L/sec

Therefore, the allowable release rate from the proposed site is will be 50 L/sec. This 50 L/sec represents the minor system (or piped) flow to the storm sewer on Victor Street. In addition, the allowable discharge rate to the storm sewers on Hazeldean Road is 26.3 L/sec, however this will only include overland flows that discharge northerly on the roadway.

6.3 Post-Development Conditions

6.4 Design Criteria

We designed the stormwater system in conformance with the latest version of the City of Ottawa Design Guidelines (October 2012). Section 5 “Storm and Combined Sewer Design” and Section 8 “Stormwater Management”. A summary of the design criteria that relates to this design report is listed below.

6.4.1 Minor System Design Criteria

- The storm sewer was sized based on the Rational Method and Manning’s Equation under free flow conditions for the 2-year storm using a 10-minute inlet time.
- Since a detailed site plan was available for the site, including building footprints, calculations of the average runoff coefficients for each drainage area was completed. Average runoff coefficients were calculated for each inlet drainage area.
- Minimum sewer slopes to be based on minimum velocities for storm sewers of 0.80 m/sec.

6.4.2 Major System Design Criteria

- The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the 100-year design storm. On-site storage is calculated based on the 100-year design storm with on-site detention storage provided in underground storage chambers.
- On site storage is provided and calculated for up to the 100-year design storm. There is no surface ponding proposed on the ground surface for up to the 100-year event.
- Calculation of the 100-year storage requirements was completed based on a dynamic stormwater model completed with PCSWMM.
- Overland flow routes are provided.
- The vertical distance from the spill elevation on the street and the ground elevation at the buildings is at least 150mm.
- The emergency overflow spill elevation is at least 30 cm below the lowest building opening.

6.5 Runoff Coefficients

Runoff coefficients were derived the same way under post development conditions. Average runoff coefficients for all catchments were calculated using PCSWMM’s area weighting routine. The runoff coefficients for all catchments were area weighted to derive at average runoff coefficients based on hard surfaces (concrete or asphalt) having an imperviousness of 100%, soft surfaces (landscaping surfaces) having a zero percent imperviousness. Again, the conversion from an imperviousness percent to a runoff coefficient was taken as C = (IMP*0.70) / 100 + 0.20, with the imperviousness (IMP) as a percentage.

The average runoff coefficients for both pre-development and post-development conditions were calculated. Under both conditions, the runoff coefficients for each subcatchment and site boundaries were determined. The runoff coefficients for pre-development and post-development catchments are provided in Appendix E.

The post-development average runoff coefficients for each site property is summarized in the following table.

Table 6-3: Summary of Average Runoff Coefficients – Post-Development

Location	Area (hectares)	Imperviousness (%)	Avg Runoff Coefficient (C_{AVG})
Site 1 (east)	0.4995	76.2	0.70
Site 2 (west)	0.4645	66.1	0.67
Totals	0.9640	71.4	0.70

6.6 Minor System (Storm Sewer) Design

A storm drainage plan is illustrated on drawing C400 located in Appendix A. A total ten (10) subcatchments (or drainage areas) within the development site are shown on this drawing with average runoff coefficients calculated for each drainage area.

Average runoff coefficients were calculated for all drainage areas for sizing of the storm sewers. A starting inlet times of 10 minutes were used for uppermost storm sewers. Design sheets for the 2-year sizing of the storm sewer system is included for reference in Appendix E.

Under the 2-year storm event adequate capacity is provided within the storm sewer system.

6.6.1 Allowance for Foundation Drainage

Foundation drainage was also considered based on City of Ottawa guidelines, that each foundation is assumed to drain at 0.45 L/sec. Therefore, the assumed foundation drainage was calculated as shown below and incorporated in the PCSWMM modeling as a constant inflow in addition to the flow resulting from rainfall events.

Number of foundations = 12
Constant flow per foundation = 0.45 L/sec
Assumed Foundation Flow = 12 x 0.45L/sec
= 5.4 L/sec

Therefore, a constant 5.4 L/sec will be taken into consideration for designing the storm sewer.

6.7 Stormwater Management Modelling

As a result of the City of Ottawa's previous submission review it was necessary to complete a full dual drainage stormwater model which would include the downstream storm sewer system. The previous design submission only accounted for the onsite storm sewer system within the subject property, however after discussions with the City of Ottawa staff, it was necessary to expand the stormwater (SWM) model all the way to Poole Creek, which is approx. 650m downstream of the site.

A dynamic stormwater model was used for this analysis, with all minor and major system components being included in the PCSWMM model, including inlet control devices (ICDs) in catchbasins and storage for underground chambers. Rating curves were developed for ICD's based on manufactures specifications.

6.7.1 Hydrologic/Hydraulic Analysis

PCSWMM was used to create a dual drainage hydrologic/hydraulic model of the storm sewer system. The model accounts for both the minor system (storm sewer) and the major system (roads). Catchbasins were modelled in either a flow-by condition or in a ponding condition. For catchbasins in flow-by conditions inlet capture curves were developed based on the type of curbs used (mountable curb in this case), and the inlet type (surface inlet catchbasins in this case). Ponding areas were modelled as storage nodes with surface ponding represented by area-depth curves above the inlet control devices (ICDs) located at the outlet pipe invert. Calculations of runoff was completed based on the PCSWMM's EPA SWM 5 engine. Catchment parameters were taken from City of Ottawa's SDG002 Design parameters. The following design parameters and assumptions are noted as follows:

- Infiltration losses based on Horton Equation as per City of Ottawa SDG002.
- Impervious and pervious depression storage as per City of Ottawa SDG002.
- 5-year, 3-hour Chicago storm used to review minor system design based on Rational Method.
- 100-year, 3-hour Chicago storm used assess impact of major event and determine peak flows and depth of runoff.
- Runoff coefficient for all subcatchments were determined using area weighting routine and based on actual hard and soft surface areas. Runoff coefficients were calculated from the impervious levels using the relationship C = (IMP x 0.7) + 0.20.
- Subcatchment areas were derived tributary to each surface inlet (catchbasin).
- Subcatchment widths are equal to the subcatchment area divided by the overland flow path length. As per City Guidelines, the subcatchment width is equal to 2 x length for two-sided catchments.
- The volume of surface ponding at low-points were calculated using the prism-formula (V=1/3*A*H).

6.7.2 Subcatchment Parameters

Drawing C400 illustrate the post-development storm drainage system. Flow path lengths for each subcatchment was determined based on the average overland flow path length, with the catchment width being the area/length. Subcatchment slopes were set at 1%. The following table below summarizes the general subcatchment parameters used:

Table 6-4: General Subcatchment Parameters

Parameter	PCSWMM Parameter	Value
Infiltration Loss Method		Horton
Maximum Infiltration Rate	Max. Infil. Rate	76 mm/hr
Minimum Infiltration Rate	Min. Infil. Rate	13.2 mm/hr
Decay Constant (1/hr)	Decay Constant	4.14
Manning N (Impervious)	N Impev	0.013
Manning N (Pervious)	N Perv	0.40
Depression Storage – Pervious Surfaces	Dstore Imperv	1.57 mm
Depression Storage – Impervious Surfaces	Dstore Perv	4.67 mm
Zero Percent Impervious	Zero Imper	10% & 20%
Subcatchment Slopes	Slope	0.5% - 2%

The table below presents the individual onsite subcatchment parameters that were developed and used in the PCSWMM model. A complete list of subcatchments, including offsite subcatchments is included in Appendix G.

Table 6-5: Post-Development Subcatchment Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Path Length (m)	Slope (%)	IMP (%)	Cavg
S01	CB06	0.1752	58	30.2	1	80.668	0.76
S02	CB01	0.1483	51.7	28.7	1	88.226	0.82
S03	CB01	0.0178	80.9	2.2	1	14.522	0.3
S04	CB03	0.2001	70.2	28.5	1	79.11	0.75
S05	218	0.1264	53.1	23.8	1	73.958	0.72
S06	CBT03	0.0617	52.3	11.8	1	35.843	0.45
S07	CBE01	0.0415	54.6	7.6	1	37.942	0.47
S08_1	CBT14	0.0405	57.8	7	1	59.421	0.62
S08_2	CBE04	0.0548	78.2	7	1	54.842	0.58
S09	IN103407	0.0806	94.8	8.5	1	71.197	0.7

6.7.3 Storage Node Parameters for Underground Chambers

The modelling of underground storage components in the PCSWMM was achieved using area-depth curves. Since PCSWMM uses an area-depth functional curve for determining storage, an equivalent area based on the number of chambers and endcaps was derived to obtain the total volume at the various storage depths. The following table summarizes the number of chambers and endcaps used at each location. The volumes within each underground chamber locations were based on storage-depth data provided by the Manufacturer. Additional information on the number of chambers is provided in Appendix E.

Table 6-6: Volumes of Underground Chambers

Name	Number of Chambers	Number of Endcaps	Total Volume (m^3)
CHAMBERS-1 (east)	28	8	152.5
CHAMBERS-2 (west)	28	10	155.2

Table 6-6 below summarizes the storage nodes used in the PCSWMM model, the associated invert and rim elevations, the curves type and name, the type of storage and the number of inlets.

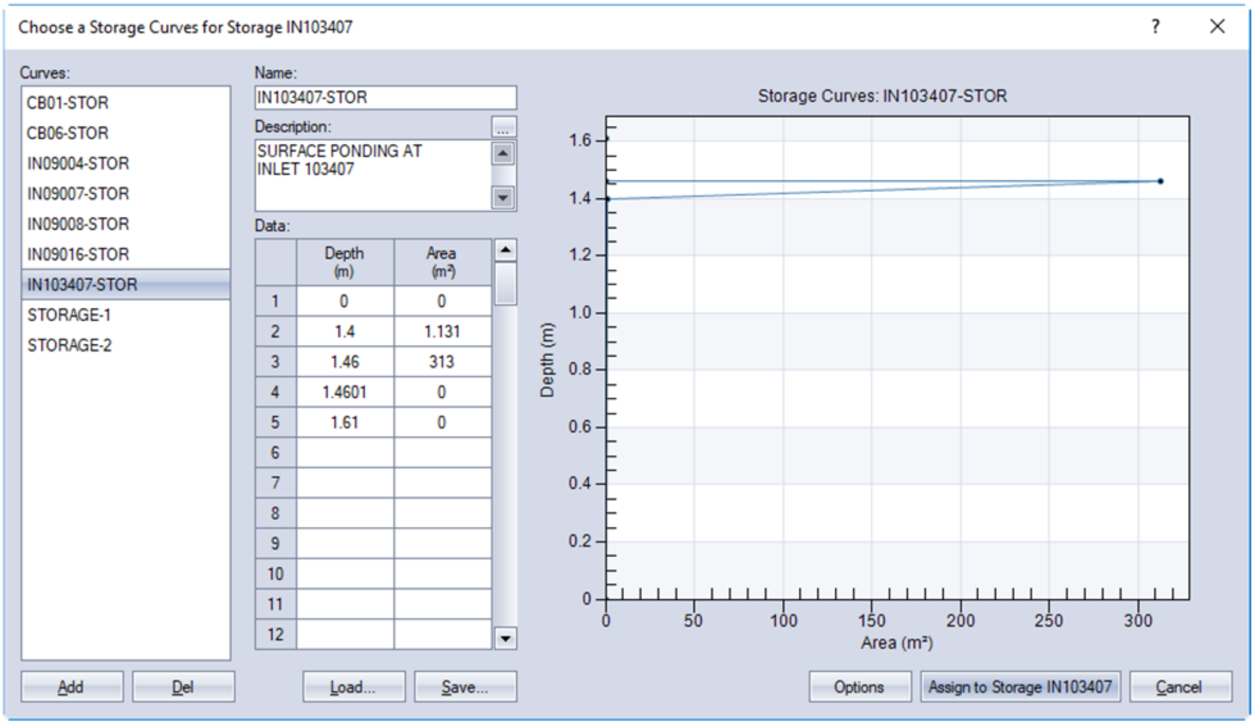
Table 6-7: Storage Node Parameters for Underground Chambers

Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Storage Curve	Curve Name	TYPE
CHAMBERS-1	111.516	114.1	2.58	TABULAR	STORAGE-1	STORAGE_CHAMBERS
CHAMBERS-2	112.296	114.5	2.20	TABULAR	STORAGE-2	STORAGE_CHAMBERS

6.7.4 Storage Node Parameters for Surface Ponding Areas (Offsite)

At ponding locations, the storage nodes were defined based on the depth to the ICD. At all locations the depth from the top of grate to the outlet pipe is 1.4m, therefore the storage of stormwater will only occur starting at a 1.4m depth. The storage rating curves at each catchbasin was modeled like the illustration in the figure below. There are a total of ten (10 ponding areas, four onsite and six (6) offsite.

Figure 1 – Representation of Rating Curves for Modelling of Storage at Ponding Locations



Choose a Storage Curves for Storage IN103407

Curves:
- CB01-STOR
- CB06-STOR
- IN09004-STOR
- IN09007-STOR
- IN09008-STOR
- IN09016-STOR
- IN103407-STOR
- STORAGE-1
- STORAGE-2

Name: IN103407-STOR

Description: SURFACE PONDING AT INLET 103407

Data:

	Depth (m)	Area (m²)
1	0	0
2	1.4	1.131
3	1.46	313
4	1.4601	0
5	1.61	0
6		
7		
8		
9		
10		
11		
12		

6.7.5 Outlet Node Parameters

In PCSWMM, OUTLETS are flow control devices used to control the outflow from storage units. OUTLETS are defined using rating curves, that relate head versus discharge. OUTLETS are represented by a link connecting two nodes. In this analysis OUTLETS were used to model ICDs located downstream of the underground chambers. Rating curves for IPEX Tempest inlet control devices is provided for reference in Appendix H. The proceeding table below summarizes the inlet control devices used in the catchbasin or manholes.

Table 6-8: Outlet (ICD) Node Parameters for Chambers

Name	Outlet Node	Type	Inlet Elev. (m)	Rating Curve	Curve Name	100-yr Flow (L/s)
212-ICD	216	ICD	111.42	TABULAR/DEPTH	IPEX-MHF-TYPEA	21.32
215-ICD	205	ICD	112.24	TABULAR/DEPTH	IPEX-MHF-TYPEA	24.49

6.7.6 Inlet Control at Flow-By Conditions

The flow-by capture curves are used when an inlet is not located in a ponding area. In this case only a portion of the overland flow is captured, while the remaining flow continues downstream (bypassed). Although the City of Ottawa does not specifically provide rating curves for catchbasins under flow-by conditions, they do provide gutter flow rate curves for either barrier curbs (SC1.1 or OPSD600.110) or mountable curb and gutter (SC1.3 or OPSD 600.020).

The gutter flow rates are provided at longitudinal road slopes of 2%, 4%, 6%, and 8% for flow spreads ranging between 0m to 3m. Along with the gutter flow rates, the inlet capacities of the surface inlets are provided at various spreads.

The inlet capacities of the curb inlet catchbasins were derived from Appendix 7-A.14 through 7-A.17. These pages provide the capture rates (Qc) of the inlets at various approach flows (Qt). Both rating curves for surface type inlets and curb-inlet type catchbasins were based on a roadway with a 3.0% cross fall and longitudinal slopes of 2%. The following Table 6-6 below summarizes the rating curves used for the curb inlet catchbasins in a flow-by condition.

The following Table 6-9 below summarizes the rating curves used for the surface catchbasins with a curb & gutter type curb in a flow-by condition.

Table 6-9: Rating Curves for Surface Catchbasin with Mountable Curb & Gutter in Flow-By Condition (3% cross fall, 2% slope)

Approach Flow (L/sec)	Total Spread, T (m)	Depth of Flow at Gutter (m)	Inlet Capture Rate (L/sec)
0	0.000	0.006	0
5	0.818	0.026	7
10	1.064	0.033	12
50	1.954	0.060	15
100	2.535	0.078	34
125	2.757	0.084	47
150	2.952	0.090	51
200	3.128	0.095	54
250	3.289	0.100	55

Tables E14 in Appendix E provides additional information on the development of the rating curves for the catchbasin in flow-by conditions. This exercise was completed since PCSWMM does not have the ability to provide Approach Flow versus Capture Flow at flow-by conditions. PCSWMM requires a depth versus captured flow rate instead.

6.8 Dual Drainage Modelling

The Figure below, captured from the PCSWMM model demonstrates the object connectivity. The subcatchment are illustrated as white polygons, with their area number, area in hectares and percent imperviousness labelled. The yellow lines and yellow circles represent the storm sewer system and manholes, with purple lines representing the OUTLET links (or ICDs). Catch basins storage nodes are shown as green squares.

Figure 2 - Model Schematic Illustrating Subcatchments, Links, Nodes, Outlets (ICDs)

6.9 Storm Events Modelled

Seven (7) storm events were modelled as follows: 3-hour 2-year Chicago storm (timestep 10 mins)

- 3-hour 2-year Chicago storm (timestep 10 mins)
- 3-hour 5-year Chicago storm (timestep 10 mins)
- 3-hour 100-year Chicago storm (timestep 10 mins)
- 3-hour 100-year + 20% Chicago storm (timestep 10 mins)
- Historical storms occurring July 1, 1979, Aug 4, 1988, August 08, 1996

6.9.1 Modelling Results

The following summarizes the results of various storm events to ensure the design criteria is met. This includes the following:

- Peak flows for all storms up to the 100-year event shall meet the allowable rate of 50 L/sec to the storm sewer on Victor Street based on City of Ottawa requirements
- Hydraulic grade line in all storm sewers to be 300mm below the USF elevation of adjacent residential units.

The following table summarizes the modelling results for all storm events.

Table 6-10: Peak Flows at Outfalls

Storm Event	Max. Flow (L/sec) to Victor Street		
	Uncontrolled Overland Flow (see note 1)	Minor System Controlled Flows (see note 2)	Total
Chicago_3h_2yr	12.7	32.8	45.4
Chicago_3h_5yr	20.3	38.1	58.4
Chicago_3h_100yr	38.2	50.5	88.7
Historic_Jul1-79	46.4	52.8	99.2
Chicago_3h_100yr + 20%	22.9	52.5	75.5
Historic_Aug4-88	33.7	51.3	85.0
Historic_Aug8-96	24.6	42.6	67.1

Notes
1-Overland Flows from subcatchment S09. Discharges to ROW and captured by twin DCBs in ponding condition
2-Minor System Capture Rate to not exceed 50 L/sec in 100-yr event. Conduit C10. Includes 5.4 L/sec of constant inflow from foundations

Table 6-11: Comparison of Pre-Development and Post-Development Peak Flows

Return Period Storm	Total Peak Flow (L/sec)	
	Pre-Dev	Post-Dev
2-year	122.7	45.4
5-year	168.0	58.4
100-year	361.9	88.7

6.9.2 Underground Storage

The total storage occurring during all storm events is presented in the table below. These results as based on the maximum volumes occurring in each PCSWMM STORAGE node.

Table 6-12: Summary of Storage Based on Modelling Results

Storm Event	Storage Location				Total Storage (m3)
	Chambers - 1		Chambers - 2		
	Volume (m^3)	Depth (m)	Volume (m^3)	Depth (m)	
Chicago_3h_2yr	41	111.96	54	112.88	95
Chicago_3h_5yr	60	112.18	80	113.16	140
Chicago_3h_100yr	118	112.81	155	114.08	273
Chicago_3h_100yr + 20%	148	113.14	155	114.36	303
Historic_Jul1-79	142	113.08	155	114.17	297
Historic_Aug4-88	125	112.89	155	114.28	280
Historic_Aug8-96	76	112.35	114	113.52	190

6.10 Hydraulics

6.10.1 Hydraulic Grade Line Analysis

The HGL was plotted from PCSWMM for the 2-year, 5-year, 100-year, 100-year + 20% and the three Historical Storm events. A profile through the complete storm sewer systems is shown below in Figure 3 below. It is shown that during the 100-yr event the maximum water surface elevations remain within the storm sewer system and does not surcharge.

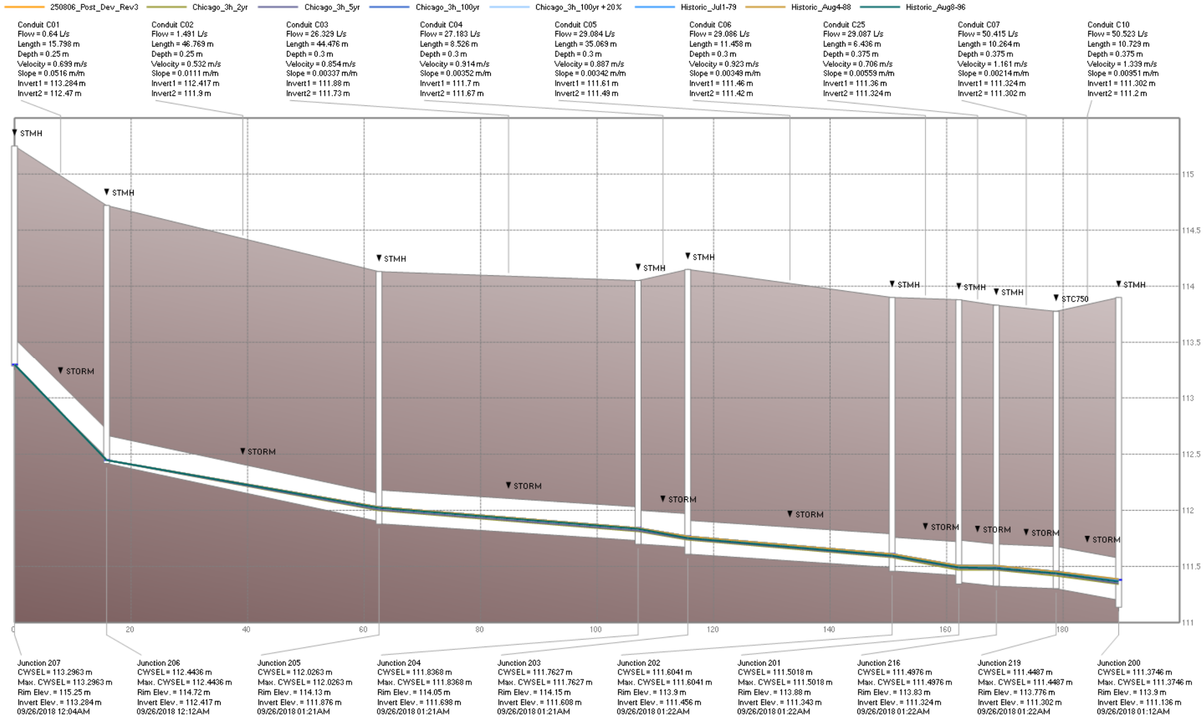


Figure 3 – 100-year HGL (Main Storm Sewer)

The 100-year HGL within both the onsite storm sewers and the offsite storm sewers are shown in the PCSWMM report provided in Appendix G.

From the 100-yr profiles it appears that minor surcharging in the 100-year event will occur in on Victor Street and Savage Drive, with slightly higher surcharging on Denham Way. This can be attributed to the larger rear yard areas contributing runoff to the storm sewer on Denham in relation to Victor St.

6.10.2 Offsite Inlet Control Devices

For modelling the offsite storm system, inlet control devices (ICDs) were used in all roadway CBs. For the rear yards catchbasins 200mm diameter leads at 1% were used. All ICDs were modeled as IPEX Type A for 20 L/sec at 1.2m head. A complete list of OUTLETS used in the model please refer to the PCSWMM report in Appendix G. Please refer to Figure A9 in Appendix A which identifies the ICD types modelled in the downstream storm system.

6.11 Quality Control Measures

It was established at the pre-consultation meeting with the City of Ottawa that the Water Quality (WQ) objective for the site is 80% TSS removal.

As a total suspended solids (TSS) removal efficiency of 80% is required, it is proposed to provide an oil grit separator for quality control. The following summarizes the design parameters used in the sizing of the Stormceptor manhole:

Table 6-13: Design Parameters Used for Oil Grit Separator Sizing

Parameter	Value Used
Drainage Area	0.866 hectares
Imperviousness	71.3 %
TSS Removal Requirements	80 %
Runoff Volume Capture	85%
Particle distribution	fine
Flow attenuation upstream of OG separator	Flow (m3/s) Storage (ha.m) 0.00000 0.00000 0.02760 0.00945 0.03290 0.01400 0.04520 0.02734

Output from the PCSWMM for Stormceptor program is provided in Appendix F for reference. A Stormceptor model EF6 is necessary to meet the required TSS removal of 80%. The EF6 will provide an approximate TSS removal of 82%.

The Stormceptor Manhole is located within the subject property. It is identified as OGS on the drawings and manhole 219 in the PCSWMM model.

6.12 Water Balance

A review of the water balance method, as noted in section 3.2.3 of the MECP's SMPDM was competed to estimate the anticipated change in infiltration that will occur as a result of development of the subject property.

From Table 3.1 of the Ministry's SMPDM the total yearly pre-development and post-development infiltration amounts we estimated based on the site area and corresponding percent pervious. Using an infiltration allowance of 276 mm for fine sand within urban lawns (Table 3.1), the following infiltration amounts were estimated as follows:

- total yearly infiltration (pre-development) = 276 mm x 0.9641 ha x 77.2% = 2,054 m^3
- total yearly infiltration (post-development) = 276 mm x 0.9641 ha x 28.6% = 761 m^3

Discussion with the MVCA has indicated that an infiltration target of 104 mm/year is desired for the site. Based on the area of the site and a yearly infiltration target of 104 mm/year, the infiltration requirement would be: 104 mm/year x 0.9641 = 1,002.7 m^3.

From above the total yearly infiltration under post-development conditions is estimated at 761 m^3, therefore additional infiltration practises of 241.7 m^3 is proposed to provide the additional volume storage.

In order to assist with infiltration, additional onsite servicing methods such as dry swales c/w perforated pipes and perforated underground chambers are proposed. The following briefly summarizes the infiltration practises proposed:

- (195.4 + 201.3) = 396.7 m^2 footprint area of the StormTech Chambers. These chambers are 1.14m in high arch pipes having open bottoms to promote infiltration.
- 210m of 250mm perforates pipes and swales in rear-yard swales. (1.2m wide, 0.15m Gran A)

The subject site contains shallow bedrock depths which is not favourable for infiltration practises. As a result of the need for rock blasting of services, it is proposed (and necessary) to over-blast below the bottom of the infiltration trenches. Therefore, an additional 0.6m of over-blasting depth is proposed. The following summarizes the total estimated volumes that will be available based on a minimum void ratio of 0.40.

- Infiltration volume below chambers = 396.7 m^2 x (0.23m + 0.6m) x 0.40 = 131.7 m^3
- Infiltration volume below swales = 210m x 1.2m * (0.15m + 0.6m) x 0.40 = 75.6 m^3

= 207.3 m^3

Using these additional features, the revised infiltration rate would be 761 m^3 + 207.3 m^3 or 968.3 m^3. This is the yearly infiltration rate that is expected. Based on the site area this would result in a unit rate of 100.4 mm/hectare per year. This rate would be just 3.6 mm/year short of the target.

Additionally, a review of other areas in the City of Ottawa where runoff volume reduction is necessary was undertaken to determine if the onsite infiltration could meet other similar standards. For areas within the Pinecrest Creek watershed a volume reduction of the 10mm storm is required for erosion control. Under post-development conditions with an area of 0.9641 ha, 71.4% level of imperviousness (28.6% pervious), the estimated volume required for volume control (or infiltration of 10mm storm) is:

- Impervious Area x (10mm – IAimperv) + Pervious Area x (10mmm-IAperv)
- 0.9641 ha x 71.4% x (10mm - 1.57mm) + 0.9641 x 28.6% x (10mm-4.67mm)
- 5.80 ha.mm + 1.47 ha.mm = 72.7 m^3

Based on Pinecrest Creek watershed criteria of 10mm retention for infiltration, the proposed site servicing would provide approximately 142.2 m^3, which would exceed the infiltration volume requirement of 72.7m^3.

7 Erosion and Sediment Control

During all construction activities, erosion and sedimentation shall be controlled by the following techniques:

- Filter cloth shall be installed between the frame and cover of all adjacent catch basins and catch basin manhole structures. The filter cloth shall consist of a filter bag that this placed within the catchbasin, just beneath the lid. These Siltsacks shall be Geo-Synthetics or equivalent. Installation details are provided on the Erosion and Sediment Control Plan.
- Light duty silt fencing will be used to control runoff around the construction area. Silt fencing locations are identified on the site grading and erosion control plan.
- Visual inspection shall be completed daily on sediment control barriers and any damage repaired immediately. Care will be taken to prevent damage during construction operations.
- In some cases barriers may be removed temporarily to accommodate the construction operations. The affected barriers will be reinstated at night when construction is completed.
- Sediment control devices will be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract.
- During the course of construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer.
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) OPSS 805 and City specifications.

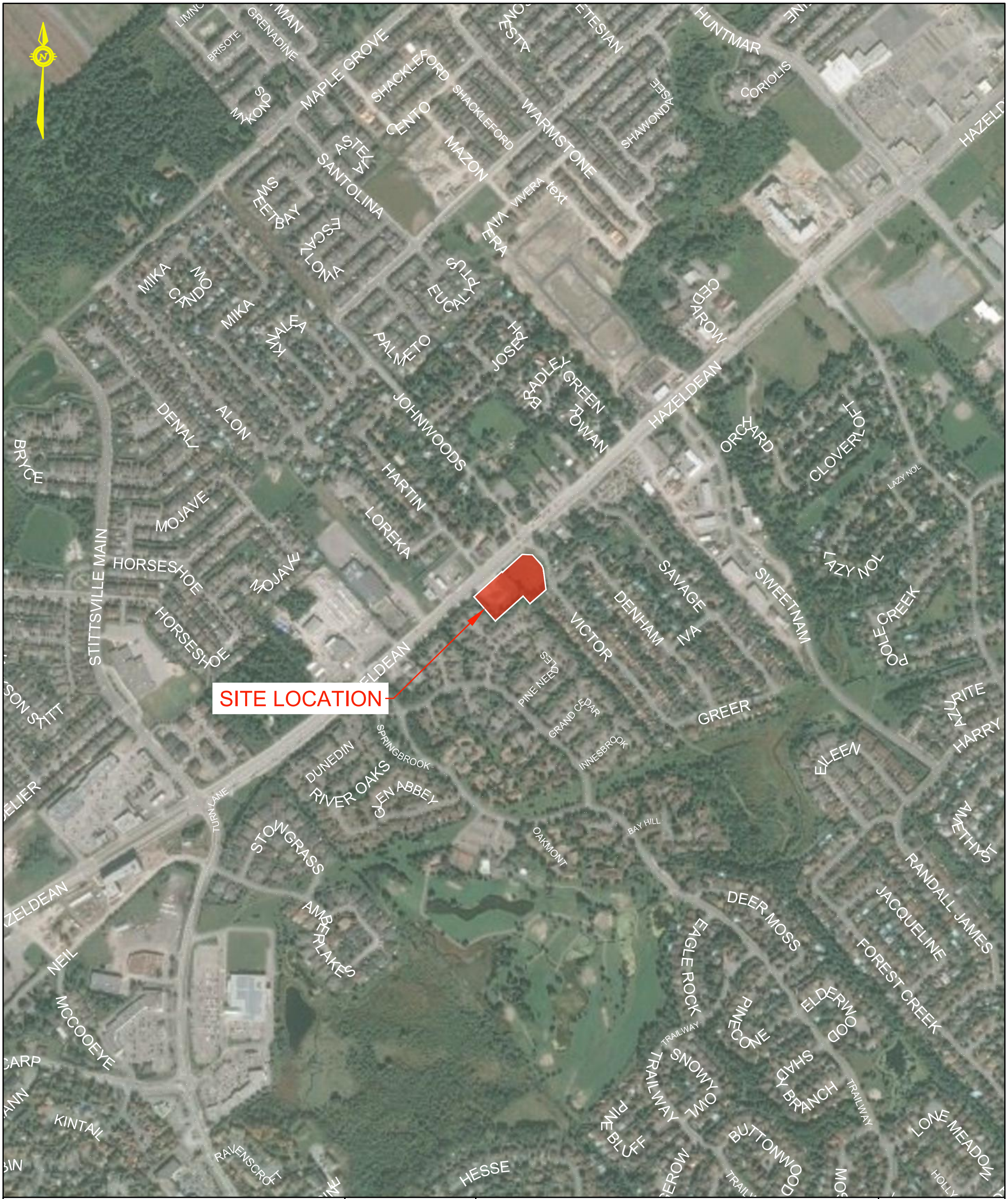
8 Conclusions

This report addresses site servicing and stormwater runoff from the proposed development located at the 5924 Hazeldean Road in the City of Ottawa. The proposed 0.964-hectare development by Hazeldean Crossing Inc. consists of 12 residential blocks, which is comprised of 76 stacked town homes, and 10 traditional back to back town homes.

The following summarizes the servicing requirements for the site:

- For the water, the estimated peak hour pressures ranged from 58 psi to 62.6 psi. This meet the City of Ottawa's minimum pressure requirement of 40 psi. Therefore, the existing municipal watermains along Victor Street and Hazeldean Road have adequate capacity to service the proposed site for both domestic and fire protection.
- The estimated fire flow requirement of 250 L/sec was completed based on the FUS. A review of the total combined flow from hydrants within a 150m distance from the site was completed to confirm that adequate fire flows are available.
- The site will be serviced by a 200mm diameter PVC watermain. The watermain will be connected at two separate locations, one on Victor Street, and one on Hazeldean Road. The use of two connections is required as the water demand is greater than 50 m^3/day as noted in Section 4.3.1 of the City's Water Distribution Guidelines.
- An estimated peak sewage flow of 2.3 L/sec for the site and 12.2 L/sec for the system, based on City Guidelines. An onsite 200mm sewer will be installed with a minimum slope of 0.35% having a full flow capacity of 19.7 L/sec.
- A review of the offsite sanitary system was completed to confirm that adequate capacity is available based on the proposed uses onsite. It was determined that adequate reserve capacity is available in the downstream sewer system to service the proposed development. A total peak sewage flow of 1.2 L/sec was estimated, with a maximum percent of capacity used of 36%.
- The allowable rate is based on the 5-yr predevelopment peak flow using the lower of C=0.50 or the pre-development rate. The allowable rate was estimated at 63.5 L/sec, however a lower rate of 50 L/sec was established by the City of Ottawa. The 50 L/sec represents the allowable minor system release rate (piped flow) from the subject property to the storm sewer on Victor Street.
- To meet the stormwater requirements, underground chambers will be used which will have a single outlet manhole and flow control devices (ICDs). IPEX Type A ICDs will be used to control outflows from CHAMBERS-1 (within MH215) to 24.1 L/sec at 1.77m head, and to 21.2 L/sec at 1.39m head from CHAMBERS-2 (within MH212). The total 100-year storage volume for the site was estimated at 271.3 m^3 using the Modified Rational Method. The actual combined volume occurring within the underground chambers during the 100-year event is 273.4 m^3. Based on Manufactures' specifications, and the number of chambers selected the total combined volume available in the chambers would be 307.7 m^3.
- The total combined 2-year, 5-year and 100-year peak flows from the site (including uncontrolled overland flow) was estimated at 45.4 L/sec, 58.4 L/sec, and 88.7 L/sec respectively. The piped 100-year flow from the proposed property is ±50 L/sec.

Appendix A – Figures



exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

www.exp.com

exp.

DESIGN	MZG
DRAWN	MZG
DATE	NOV 2019
FILE NO	250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

SITE LOCATION
PLAN

SCALE
1:10000

SKETCH NO

FIG A1

exp Services Inc.
100, 2650 Queensview Drive
Ottawa, ON K2B 8H6
www.exp.com

DESIGN	JLF
DRAWN	SAB
DATE	NOV 2019
FILE NO	250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

WATER DISTRIBUTION
PLAN

SCALE
1:750

FIGURE NO
FIG A2

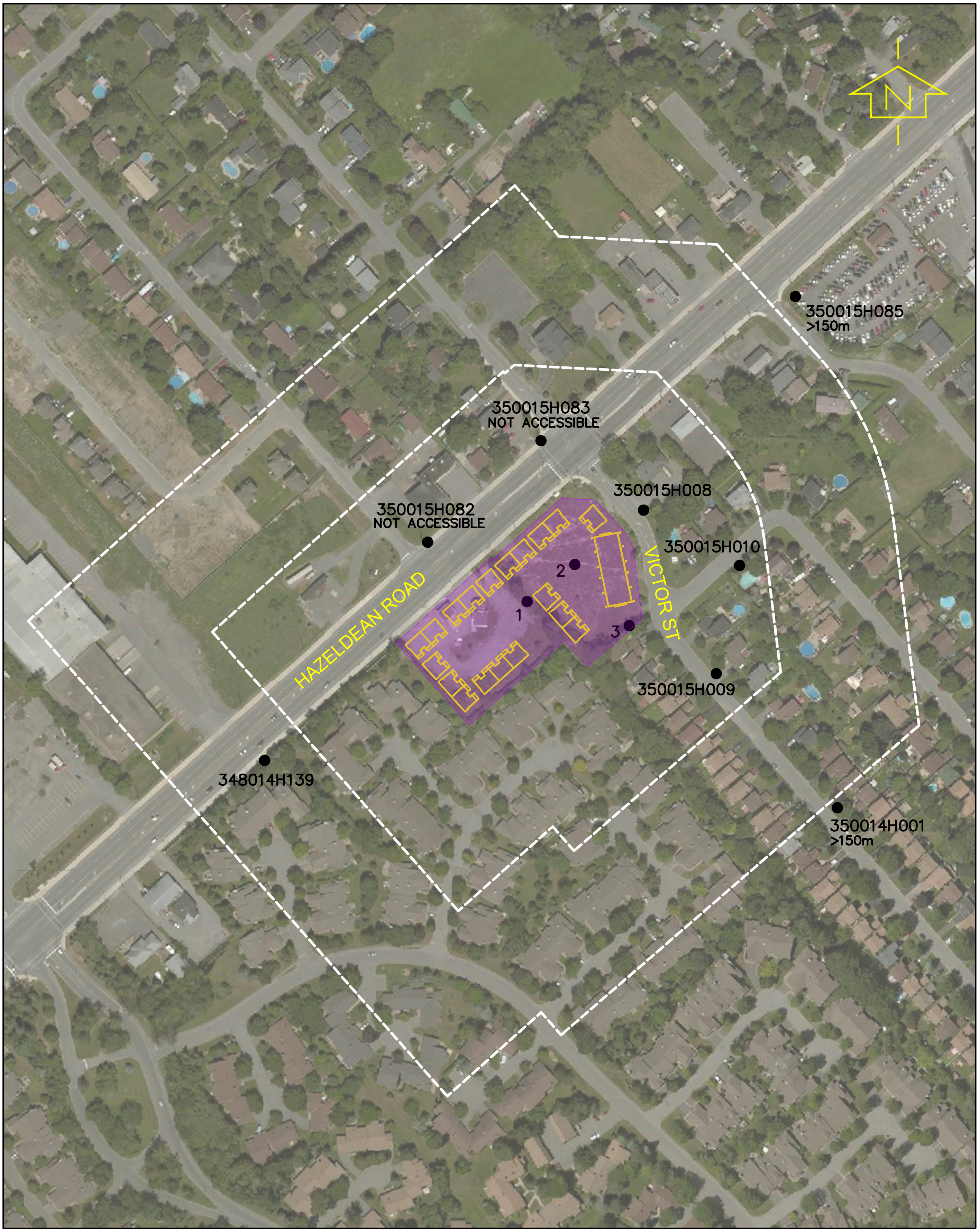
exp Services Inc.
100, 2650 Queensview Drive
Ottawa, ON K2B 8H6
www.exp.com

DESIGN JLF
DRAWN SAB
DATE NOV 2019
FILE NO 250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

WATER DISTRIBUTION
DEMAND ALLOCATION

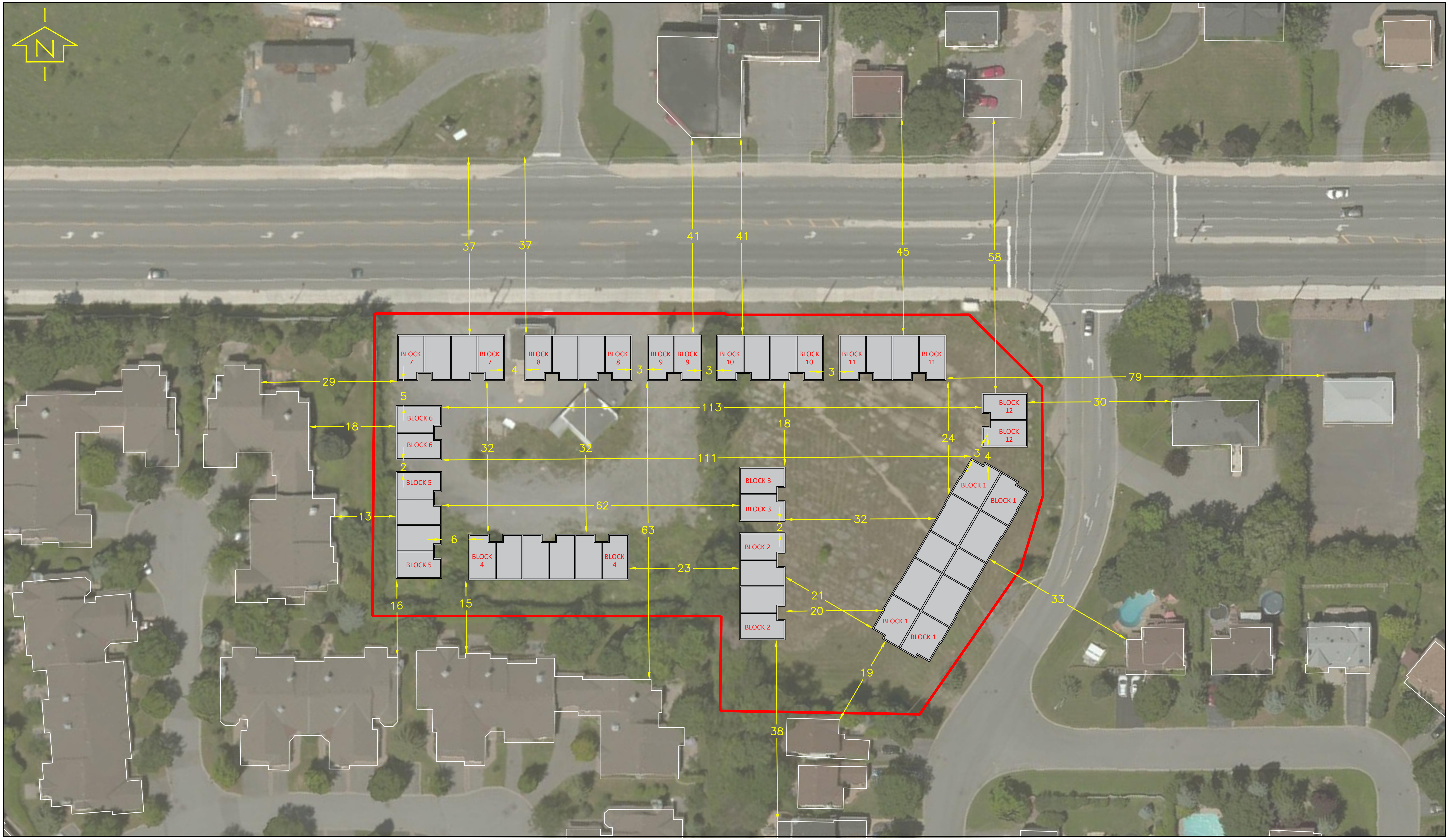
SCALE 1:750
FIGURE NO
FIG A3



exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

www.exp.com

DESIGN JLF	HAZELDEAN CROSSING 5924 HAZELDEAN ROAD	SCALE 1:3000	
DRAWN SAB		SKETCH NO	
DATE NOV 2019	HYDRANT LOCATION PLAN	FIG A4	
FILE NO 250806			



exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

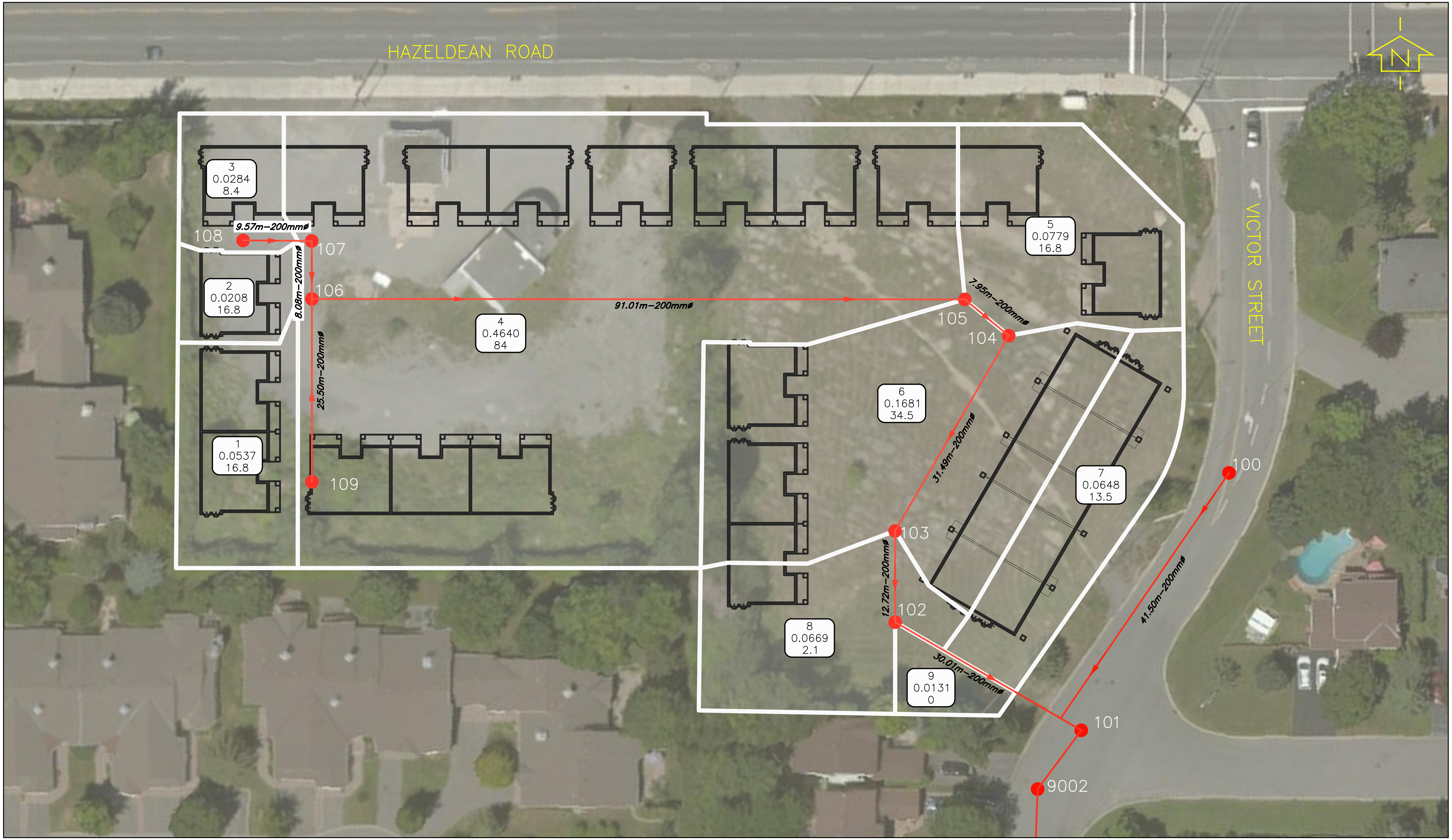
www.exp.com

DESIGN MZG
DRAWN MZG
DATE NOV 2019
FILE NO 250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

FUS EXPOSURE
DISTANCES

SCALE 1:750
FIGURE NO
FIG A5



exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

www.exp.com

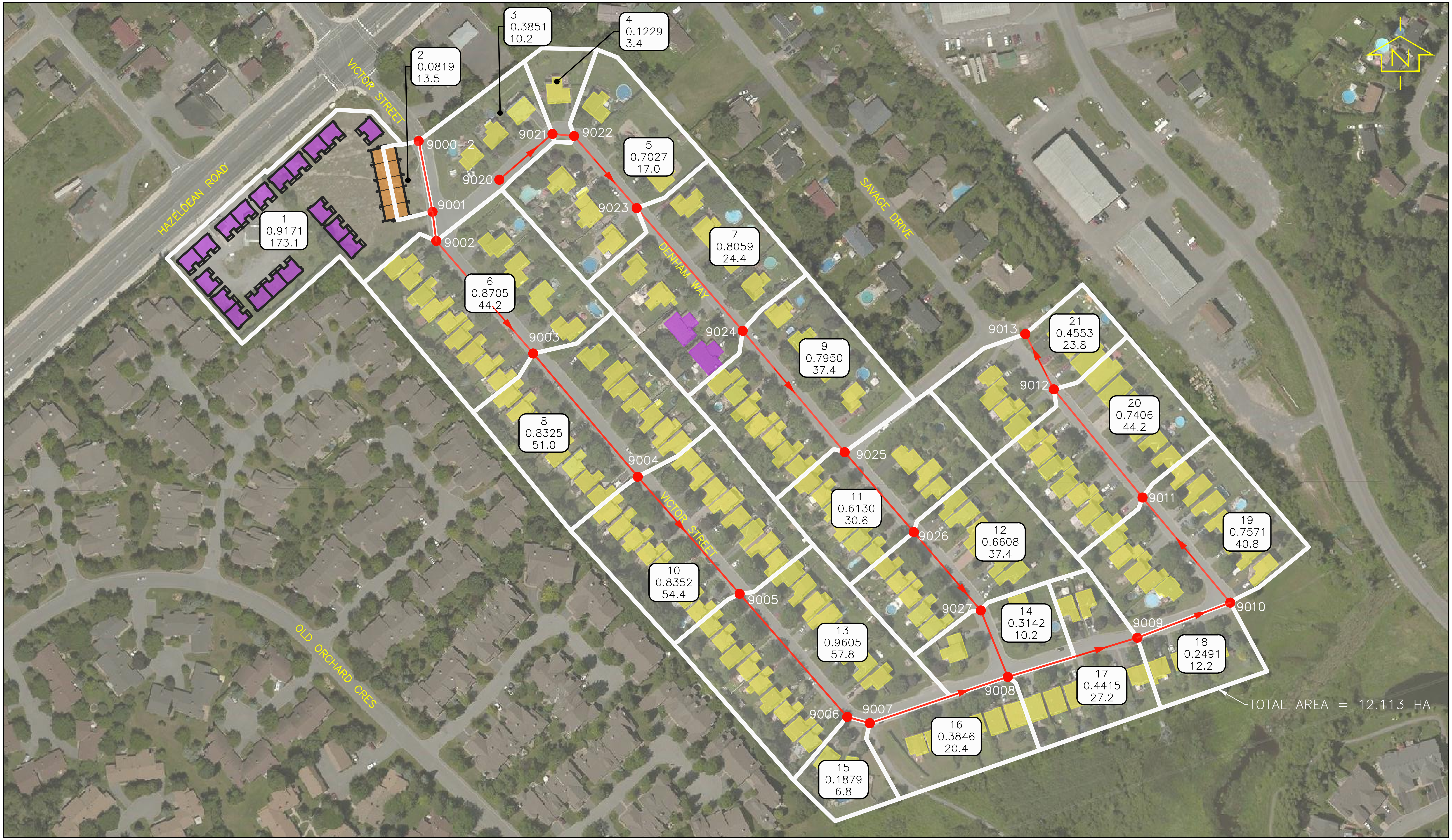
🟪 TOWN HOMES

🟧 BACK TO BACK TOWN HOMES

1	AREA NUMBER
0.0537	AREA (HECTARES)
16.8	POPULATION

→ FLOW DIRECTION

DESIGN	MZG	HAZELDEAN CROSSING 5924 HAZELDEAN ROAD	SCALE 1:500
DRAWN	MZG		FIGURE NO
DATE	NOV 2019	SANITARY SEWERS	FIG A6
FILE NO	250806		



exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

www.exp.com

🟨 SINGLES

🟪 TOWN HOMES

🟧 BACK TO BACK TOWN HOMES

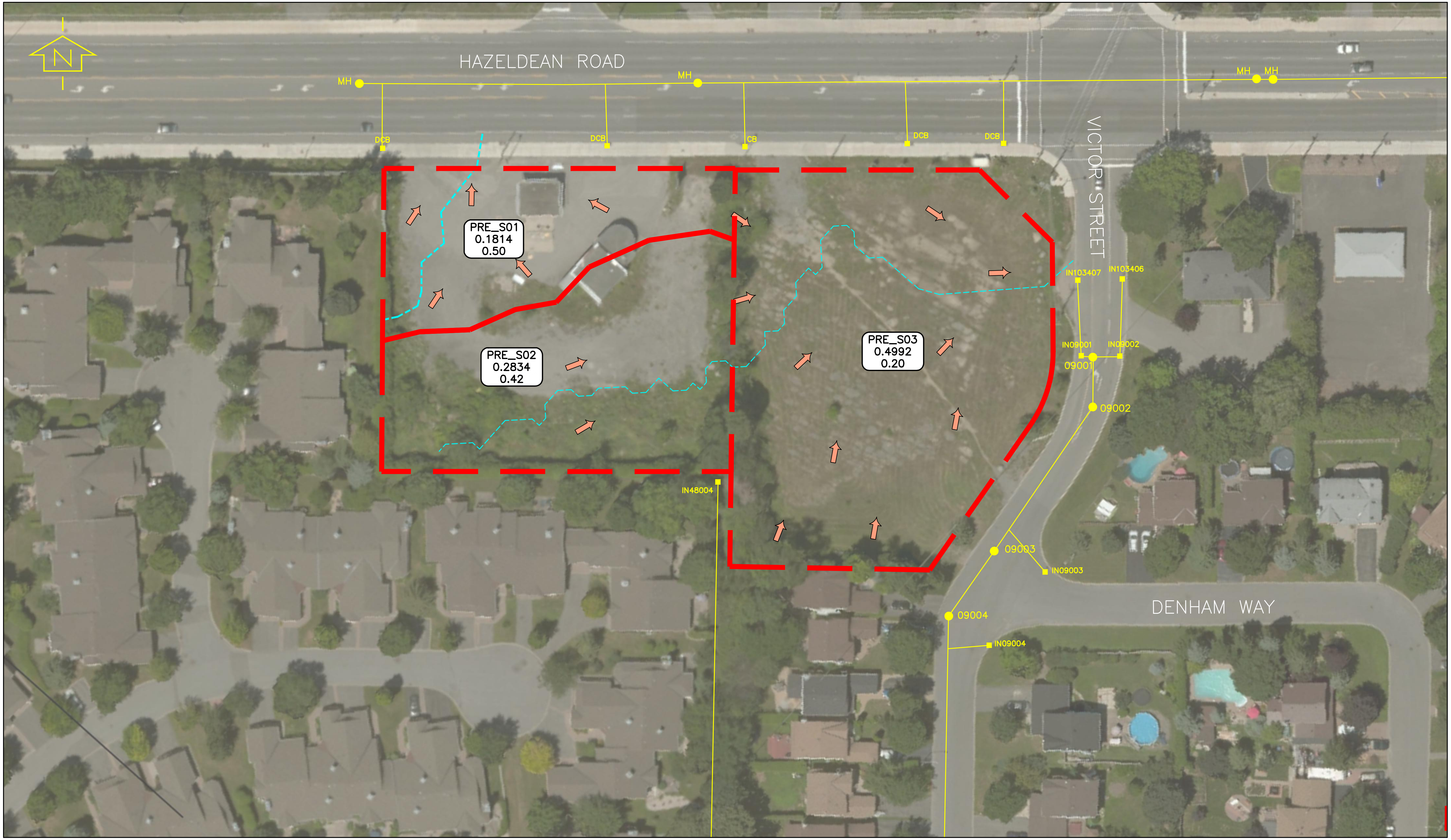
15 0.1879 6.8	AREA NUMBER AREA (HECTARES) POPULATION
→	FLOW DIRECTION

DESIGN MZG
DRAWN MZG
DATE NOV 2019
FILE NO 250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

OFFSITE SANITARY
SEWERS

SCALE 1: 2000
FIGURE NO
FIG A7



exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

www.exp.com

🡐	OVERLAND FLOW DIRECTION
- - - -	OVERLAND FLOW PATH
PRE_S01 0.1814 0.50	AREA NUMBER AREA (HECTARES) POPULATION

DESIGN	MZG
DRAWN	MZG
DATE	NOV 2019
FILE NO	250806

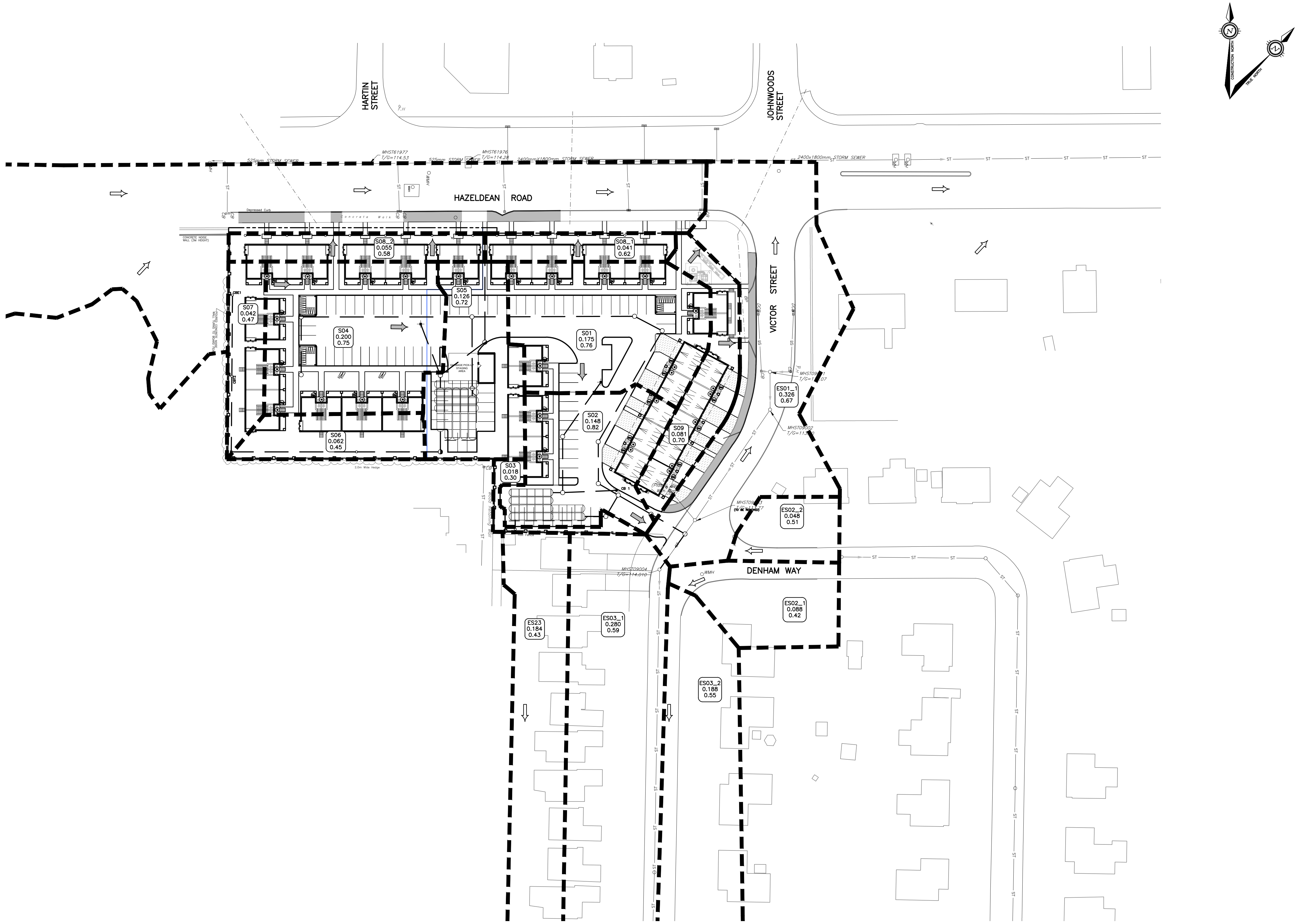
HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

PRE–DEVELOPMENT
CATCHMENTS

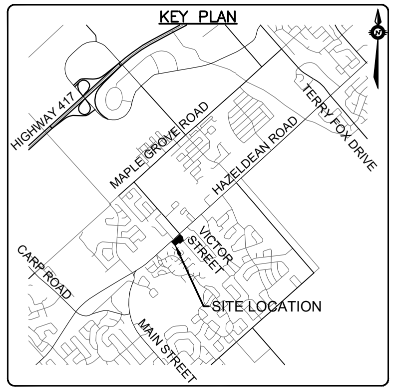
SCALE
1: 750

FIGURE NO
FIG A8

FIGURE A9 - INLET CONTROL DEVICES (ICDs) IN OFFSITE CATCHBASINS



KEY PLAN



PROPOSED LEGEND

— - - —	PROPERTY LINE
➡	ONSITE OVERLAND FLOW ROUTE
⇨	EXTERNAL OVERLAND FLOW ROUTE
S01 0.184 0.79	AREA NO AREA IN HECTARES RUNOFF COEFFICIENT
▬ ▬ ▬	CATCHMENT AREA

Filename: \\pottfsg002\data\projects\civil\250000\ott-00250806-b0 - 5924 hazeldean road, ottawa - gncr\60-execution\64-dwg\c400-stm.dwg
Last Saved: 11/5/2019 4:20:04 PM
Pen Table:: exp-64.ctb
References: xref-arch.dwg; xref-ucc.dwg; xref-FMW-TOPO2.dwg; xref-PROP.dwg; xref-tb.dwg

CAUTION

THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

REV	REVISION DESCRIPTION	DATE	BY	APPD
3	REVISED AS PER CITY COMMENTS	01/11/19	SAB	BMT
2	ISSUED FOR SITE PLAN APPROVAL	21/05/19	SAB	BMT
1	ISSUED FOR REVIEW	18/04/19	AO	BMT

SCALE
0 5m 10m 22m
HORIZONTAL 1:500

DESIGNED BY

REVIEWED BY

CLIENT
HAZELDEAN CROSSING INC.
521 KILSPINDIE RIDGE
OTTAWA, ON.

exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7330
2650 Queensview Drive, Unit 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

BASEPLAN SAB
DESIGN JLF
CHECKED BMT
CAD SAB
PROJECT MANAGER BMT
APPROVED BMT

PROJECT
HAZELDEAN CROSSING TOWNS
5924 HAZELDEAN ROAD
OTTAWA, ONTARIO.

TITLE
POST–DEVELOPMENT STORM DRAINAGE PLAN

PROJECT No. OTT–00250806–B0
SURVEY FSD
DATE APRIL 2019
DRAWING No. C400

D07-12-19-0089

#18003

Appendix B – Water Servicing Design Tables

TABLE B1: Water Demand Chart

Location: 5924 Hazeldean Road
Project No: OTT-00250806
Designed by: M. Ghadban
Checked By: J.Fitzpatrick
Date Revised: Nov 2019

Water Consumption
Residential = **350** L/cap/day

Population Densities		
Single Family	3.4	person/unit
Semi-Detached	2.7	person/unit
Duplex	2.3	person/unit
Townhome (Row)	2.7	person/unit
Bachelor Apartment	1.4	person/unit
1 Bedroom Apartment	1.4	person/unit
2 Bedroom Apartment	2.1	person/unit
3 Bedroom Apartment	3.1	person/unit
Avg. Aptartment	1.8	person/unit

	No. of Units										Demands in (L/sec)					
	Singles/Semis/Towns				Apartments							Maximum Demand (L/day)	Peak Hourly Demand (L/day)			
Proposed Buildings	Single Family	Semi-Detached	Duplex	Townhome	Bachelor	1 Bedroom	2 Bedroom	4 Bedroom	Avg Apt.	Total Persons (pop)	Average Demand (L/day)	4.58 x Avg Day	6.91 x Avg Day	Avg Day (L/s)	Max Day (L/s)	Peak Hour (L/s)
J-1				5						13.5	4,725	21,654	32,659	0.05	0.25	0.38
J-3				2			8			22.2	7,770	35,608	53,706	0.09	0.41	0.62
J-4				3			16			41.7	14,595	66,886	100,881	0.17	0.77	1.17
J-5																
J-6							30			63.0	22,050	101,051	152,410	0.26	1.17	1.76
J-7							14			29.4	10,290	47,157	71,124	0.12	0.55	0.82
J-8																
J-9							8			16.8	5,880	26,947	40,643	0.07	0.31	0.47
J-10																
Totals =				10			76			186.6	65,310	299,303	451,423	0.76	3.46	5.22

FROM MOECC TABLE 3-3 (Peaking Factors for Water Systems Servicing Fewer Than 500 persons

Dwelling Units Serviced	Equivalent Population	Night Min Factor	Maximum Day Factor	Peak Hour Factor
10	30	0.10	9.50	14.30
50	150	0.10	4.90	7.40
100	300	0.20	3.60	5.40
150	450	0.30	3.00	4.50
167	500	0.40	2.90	4.30

TABLE B2: FIRE FLOW CONTRIBUTIONS BASED ON HYDRANT SPACING

Hydrant #	Block 1		Block 2		Block 3		Block 4		Block 5		Block 6		Block 7		Block 8		Block 9		Block 10		Block 11		Block 12		Fire Flow Available at Hydrant Based on Model Results	
	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	[1]Dist (m)	[2]Fire Flow Contr. (L/min)	L/min	(L/sec)
FH-1	60	5,700	66	5,700	17	5,700	46	5,700	72	5,700	65	5,700	66	5,700	37	5,700	22	5,700	18	5,700	44	5,700	62	5,700	>15,000	> 250
FH-2	14	5,700	32	5,700	20	5,700	35	5,700	105	3,800	100	3,800	103	3,800	74	5,700	60	5,700	33	5,700	29	5,700	28	5,700	>15,000	> 250
FH-3	9	5,700	31	5,700	56	5,700	115	3,800	147	3,800	146	3,800	145	3,800	117	3,800	103	3,800	77	3,800	71	5,700	73	5,700	>15,000	> 250
350015H008	25	5,700	113	105	138	129	200	0	200	0	>150	0	>150	0	>150	0	>150	0	>150	0	146	3,800	30	5,700	>15,000	> 250
350015H010	80	3,800	105	3,800	129	3,800	>150	0	>150	0	>150	0	>150	0	>150	0	>150	0	>150	0	146	3,800	132	3,800	>15,000	> 250
350015H009	80	3,800	103	3,800	128	3,800	>150	0	>150	0	>150	0	>150	0	>150	0	>150	0	149	3,800	145	3,800	>150	0	>15,000	> 250
348014H139	>150	0	>150	0	>150	0	>150	0	>150	0	>150	0	120	3,800	149	3,800	>150	0	>150	0	>150	0	>150	0	>15,000	> 250
Total FirEflow Avail in L/min (L/sec)	30,400 (507)		24,805 (413)		24,829 (414)		15,200 (253)		13,300 (222)		13,300 (222)		17,100 (285)		19,000 (317)		15,200 (253)		19,000 (317)		28,500 (475)		26,600 (443)			
FUS RFF in L/min (L/sec)	13,980 (233)		10,980 (183)		7,980 (133)		15,000 (250)		13,020 (217)		9,000 (150)		10,980 (183)		12,000 (200)		9,000 (150)		12,000 (200)		10,020 (167)		7,020 (117)			
Meets Requreiment (Yes/No)	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes			

Notes:

[1] Distance is measured along a road or fire route.

[2] Fire Flow Contribution for Class AA Hydrant from Table 1 of Appendix I, ISTB-2018-02

TABLE B3
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
LOCATION: **Block 1**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:
F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	1150.0 m²	
	Floor 3		0	100%	0		
	Floor 2		575	100%	575		
	Floor 1 (Ground Floor Commercial)		575	100%	575		
	Basement (At least 50% below grade, not included)		0	100%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						11,191
Fire Flow (F)	Rounded to nearest 1,000						**11,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier			Input						Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%			Limited Combustible						-15%	-1,650	9,350
	Limited Combustible	-15%											
	Combustible	0%											
	Free Burning	15%											
	Rapid Burning	25%											
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%			No Sprinkler						0%	0	9,350
	No Sprinkler	0%											
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%			Not Standard Water Supply or Unavailable						0%	0	9,350
	Not Standard Water Supply or Unavailable	0%											
	Fully Supervised Sprinkler System	-10%			Not Fully Supervised or N/A						0%	0	9,350
	Not Fully Supervised or N/A	0%											
Choose Structure Exposure Distance						Exposed Wall Length							
	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
	Side 1 (west)	32	5	30.1 to 45	Type A	41	4	164	5E	5%	45%	4,208	13,558
	Side 2 (east)	33	5	30.1 to 45	Type A	15	2	30	5A	5%			
	Side 3 (north)	3	1	0 to 3	Type A	11	4	44	1B	23%			
	Side 4 (south)	19	3	10.1 to 20	Type A	14	4	30	3A	12%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**14,000**
	Total Required Fire Flow, L/s =												**233**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =												**No**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =												**233**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	**Condition**
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B4
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999

LOCATION: **Block 2**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:

F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	828.0 m²	
	Floor 3		207	100%	207		
	Floor 2		207	100%	207		
	Floor 1 (Ground Floor Commercial)		207	100%	207		
	Basement (At least 50% below grade, not included)		207	100%	207		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,496
Fire Flow (F)	Rounded to nearest 1,000						**9,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,350	7,650
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	7,650
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length							
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1 (west)	25	4	20.1 to 30	Type A	10	4	40	4B	8%	49%	3,749	11,399
	Side 2 (east)	20	3	10.1 to 20	Type A	22	2	44	3B	13%			
	Side 3 (north)	2	1	0 to 3	Type A	10	4	40	1B	23%			
	Side 4 (south)	38	5	30.1 to 45	Type A	1	2	30	5A	5%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**11,000**
	Total Required Fire Flow, L/s =												**183**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =												**No**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =												**183**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	**Condition**
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B5
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
LOCATION: **Block 3**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:
F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	420.0 m²	
	Floor 3		105	100%	105		
	Floor 2		105	100%	105		
	Floor 1 (Ground Floor Commercial)		105	100%	105		
	Basement (At least 50% below grade, not included)		105	100%	105		
Fire Flow (F)	F = 220 * C * SQRT(A)						6,763
Fire Flow (F)	Rounded to nearest 1,000						7,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,050	5,950
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	5,950
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	5,950
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	5,950
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length							
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1 (west)	64	6	> 45.1	Type A	11	4	44	6	0%	40%	2,380	8,330
	Side 2 (east)	32	5	30.1 to 45	Type A	11	4	44	5B	5%			
	Side 3 (north)	18	3	10.1 to 20	Type A	10	4	40	3B	13%			
	Side 4 (south)	2	1	0 to 3	Type A	10	4	30	1A	22%			

Task		
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	8,000
	Total Required Fire Flow, L/s =	133
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	No
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	133

<u>**Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)**</u>

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

<u>**Conditons for Separation**</u>

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B6
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
LOCATION: **Block 4**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:

F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	1240.0 m²	
	Floor 3		310	100%	310		
	Floor 2		310	100%	310		
	Floor 1 (Ground Floor Commercial)		310	100%	310		
	Basement (At least 50% below grade, not included)		310	100%	310		
Fire Flow (F)	F = 220 * C * SQRT(A)						11,620
Fire Flow (F)	Rounded to nearest 1,000						12,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,800	10,200
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	10,200
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	10,200
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	10,200
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length							
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1 (west)	6	2	3.1 to 10	Type A	10	4	40	2B	18%	43%	4,386	14,586
	Side 2 (east)	25	4	20.1 to 30	Type A	10	4	40	4B	8%			
	Side 3 (north)	32	5	30.1 to 45	Type A	29	4	116	5D	5%			
	Side 4 (south)	15	3	10.1 to 20	Type A	34	2	30	3A	12%			

Obtain Required Fire Flow		
	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	15,000
	Total Required Fire Flow, L/s =	250
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	No
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	250

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B7
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999

LOCATION: **Block 5**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:

F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input				Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame				1.5	
	Ordinary Construction	1						
	Non-combustible Construction	0.8						
	Fire Resistive Construction	0.6						
Input Building Floor Areas (A)			Area	% Used	Area Used		828.0 m²	
	Floor 3		207	100%	207			
	Floor 2		207	100%	207			
	Floor 1 (Ground Floor Commercial)		207	100%	207			
	Basement (At least 50% below grade, not included)		207	100%	207			
Fire Flow (F)	F = 220 * C * SQRT(A)							9,496
Fire Flow (F)	Rounded to nearest 1,000							**9,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,350	7,650
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	7,650
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length					Total Charge (%)	Total Exposure Charge (L/min)	
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)			
Choose Structure Exposure Distance	Side 1 (west)	11	3	10.1 to 20	Type A	22	2	44	3B	13%	67%	5,126	12,776
	Side 2 (east)	6	2	3.1 to 10	Type A	22	4	88	2C	19%			
	Side 3 (north)	2	1	0 to 3	Type A	10	4	40	1B	23%			
	Side 4 (south)	16	3	10.1 to 20	Type A	6	2	30	3A	12%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**13,000**
	Total Required Fire Flow, L/s =												**217**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =												**No**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =												**217**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B8
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
LOCATION: Block 6

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:

F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	436.0 m²	
	Floor 3		109	100%	109		
	Floor 2		109	100%	109		
	Floor 1 (Ground Floor Commercial)		109	100%	109		
	Basement (At least 50% below grade, not included)		109	100%	109		
Fire Flow (F)	F = 220 * C * SQRT(A)						6,891
Fire Flow (F)	Rounded to nearest 1,000						7,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,050	5,950
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	5,950
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	5,950
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	5,950
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length							
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1 (west)	17	3	10.1 to 20	Type A	11	2	22	3A	12%	52%	3,094	9,044
	Side 2 (east)	112	6	> 45.1	Type A	11	4	44	6	0%			
	Side 3 (north)	6	2	3.1 to 10	Type A	10	4	40	2B	18%			
	Side 4 (south)	2	1	0 to 3	Type A	10	4	30	1A	22%			

Task		
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	9,000
	Total Required Fire Flow, L/s =	150
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	No
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	150

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B9
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
LOCATION: **Block 7**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:

F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	828.0 m²	
	Floor 3		207	100%	207		
	Floor 2		207	100%	207		
	Floor 1 (Ground Floor Commercial)		207	100%	207		
	Basement (At least 50% below grade, not included)		207	100%	207		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,496
Fire Flow (F)	Rounded to nearest 1,000						9,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,350	7,650
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	7,650
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length					Total Charge (%)	Total Exposure Charge (L/min)	
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)			
Choose Structure Exposure Distance	Side 1 (west)	27	4	20.1 to 30	Type A	3	2	6	4A	8%	48%	3,672	11,322
	Side 2 (east)	6	2	3.1 to 10	Type A	10	4	40	2B	18%			
	Side 3 (north)	37	5	30.1 to 45	Type A	22	1	22	5A	5%			
	Side 4 (south)	6	2	3.1 to 10	Type A	16	4	30	2A	17%			

Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	11,000
	Total Required Fire Flow, L/s =	183
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	No
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	183

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B10
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999

LOCATION: **Block 8**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:
F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	828.0 m²	
	Floor 3		207	100%	207		
	Floor 2		207	100%	207		
	Floor 1 (Ground Floor Commercial)		207	100%	207		
	Basement (At least 50% below grade, not included)		207	100%	207		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,496
Fire Flow (F)	Rounded to nearest 1,000						**9,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,350	7,650
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	7,650
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length							
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1 (west)	6	2	3.1 to 10	Type A	10	4	40	2B	18%	51%	3,902	11,552
	Side 2 (east)	3	1	0 to 3	Type A	10	4	40	1B	23%			
	Side 3 (north)	37	5	30.1 to 45	Type A	7	1	7	5A	5%			
	Side 4 (south)	32	5	30.1 to 45	Type A	20	4	30	5A	5%			

Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**12,000**
	Total Required Fire Flow, L/s =	**200**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	**No**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	**200**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B11
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
LOCATION: **Block 9**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:
F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	420.0 m²	
	Floor 3		105	100%	105		
	Floor 2		105	100%	105		
	Floor 1 (Ground Floor Commercial)		105	100%	105		
	Basement (At least 50% below grade, not included)		105	100%	105		
Fire Flow (F)	F = 220 * C * SQRT(A)						6,763
Fire Flow (F)	Rounded to nearest 1,000						**7,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,050	5,950
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	5,950
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	5,950
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	5,950
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length							
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1 (west)	3	1	0 to 3	Type A	10	4	40	1B	23%	51%	3,035	8,985
	Side 2 (east)	3	1	0 to 3	Type A	10	4	40	1B	23%			
	Side 3 (north)	41	5	30.1 to 45	Type A	8	2	16	5A	5%			
	Side 4 (south)	63	6	> 45.1	Type A	8	4	30	6	0%			

Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**9,000**
	Total Required Fire Flow, L/s =	**150**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	**No**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	**150**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B12
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999

LOCATION: **Block 10**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:

F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	828.0 m²	
	Floor 3		207	100%	207		
	Floor 2		207	100%	207		
	Floor 1 (Ground Floor Commercial)		207	100%	207		
	Basement (At least 50% below grade, not included)		207	100%	207		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,496
Fire Flow (F)	Rounded to nearest 1,000						**9,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,350	7,650
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	7,650
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length					Total Charge (%)	Total Exposure Charge (L/min)	
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)			
Choose Structure Exposure Distance	Side 1 (west)	3	1	0 to 3	Type A	10	4	40	1B	23%	62%	4,743	12,393
	Side 2 (east)	3	1	0 to 3	Type A	1	4	4	1A	22%			
	Side 3 (north)	45	5	30.1 to 45	Type A	10	2	20	5A	5%			
	Side 4 (south)	18	3	10.1 to 20	Type A	22	4	30	3A	12%			

Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**12,000**
	Total Required Fire Flow, L/s =	**200**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	**No**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	**200**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B13
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
LOCATION: Block 11

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:

F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	828.0 m²	
	Floor 3		207	100%	207		
	Floor 2		207	100%	207		
	Floor 1 (Ground Floor Commercial)		207	100%	207		
	Basement (At least 50% below grade, not included)		207	100%	207		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,496
Fire Flow (F)	Rounded to nearest 1,000						**9,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,350	7,650
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	7,650
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
						Exposed Wall Length							
Choose Structure Exposure Distance	Side 1 (west)	3	1	0 to 3	Type A	10	4	40	1B	23%	36%	2,754	10,404
	Side 2 (east)	79	6	> 45.1	Type A	22	2	44	6	0%			
	Side 3 (north)	45	5	30.1 to 45	Type A	1	2	2	5A	5%			
	Side 4 (south)	24	4	20.1 to 30	Type A	10	4	30	4A	8%			

Task		
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**10,000**
	Total Required Fire Flow, L/s =	**167**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	**No**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	**167**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B14
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
LOCATION: Block 12

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:
F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	420.0 m²	
	Floor 3		105	100%	105		
	Floor 2		105	100%	105		
	Floor 1 (Ground Floor Commercial)		105	100%	105		
	Basement (At least 50% below grade, not included)		105	100%	105		
Fire Flow (F)	F = 220 * C * SQRT(A)						6,763
Fire Flow (F)	Rounded to nearest 1,000						7,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,050	5,950
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	5,950
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	5,950
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	5,950
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length					Total Charge (%)	Total Exposure Charge (L/min)	
						Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)			
Choose Structure Exposure Distance	Side 1 (west)	115	6	> 45.1	Type A	5	4	20	6	0%	25%	1,488	7,438
	Side 2 (east)	30	4	20.1 to 30	Type A	9	4	36	4B	8%			
	Side 3 (north)	58	6	> 45.1	Type A	8	2	16	6	0%			
	Side 4 (south)	4	2	3.1 to 10	Type A	10	4	30	2A	17%			

Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	7,000
	Total Required Fire Flow, L/s =	117
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	No
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	117

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

Appendix C – WaterGems Output Tables

- Scenario 1 Result Tables (Peak Hour)

    - Junction Table
    - Pipe Table
    - Reservoir Table

- Scenario 2 Result Tables (Max Day Plus Fire Flow - 10,000 L/min)

    - Junction Table
    - Pipe Table
    - Reservoir Table
    - Fire Flow Report

5924 & 5938 Hazeldean Road

PEAK HOUR - HGL AT CONNECTION #1 (VICTOR / DENHAM)

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-1	114.36	0.38	157.20	60.8
J-2	114.00	0.00	157.20	61.3
J-3	114.00	0.62	157.20	61.3
J-4	113.95	1.17	157.19	61.4
J-5	114.36	0.00	157.20	60.8
J-6	114.50	1.76	157.19	60.6
J-7	114.32	0.82	157.19	60.9
J-8	113.90	0.00	157.19	61.5
J-9	115.45	0.47	156.84	58.8
J-10	113.20	0.00	157.20	62.5

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Hydraulic Grade (Stop) (m)	Hydraulic Grade (Start) (m)	Velocity (m/s)	Headloss Gradient (m/m)
P-2	J-2	J-3	15	204.0	110.0	2.94	157.20	157.20	0.09	0.000
P-3	J-3	J-8	23	204.0	110.0	2.32	157.19	157.20	0.07	0.000
P-4	J-8	J-4	9	204.0	110.0	2.32	157.19	157.19	0.07	0.000
P-5	J-4	J-7	39	204.0	110.0	1.15	157.19	157.19	0.04	0.000
P-6	J-7	J-6	43	204.0	110.0	0.33	157.19	157.19	0.01	0.000
P-7	J-6	J-5	42	204.0	110.0	-1.90	157.20	157.19	0.06	0.000
P-8	J-9	J-6	29	38.0	100.0	-0.47	157.19	156.84	0.41	0.012
P-9	J-1	J-10	114	204.0	110.0	1.90	157.20	157.20	0.06	0.000
P-10	J-10	J-5	124	297.0	110.0	1.90	157.20	157.20	0.03	0.000
P-11	R-1	J-1	20	600.0	130.0	5.22	157.20	157.20	0.02	0.000
P-12	J-8	H-2	3	155.0	100.0	0.00	157.19	157.19	0.00	0.000
P-13	H-1	J-7	4	155.0	100.0	0.00	157.19	157.19	0.00	0.000

Reservoir Table - Time: 0.00 hours

ID	Label	Zone	Flow (Out net) (L/s)	Hydraulic Grade (m)
55	R-1	<None>	5.22	157.20

5924 & 5938 Hazeldean Road

MAX DAY PLUS FIREFLOW - HGL AT CONNECTION #1 (VICTOR / DENHAM)

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-1	114.36	0.25	135.40	29.9
J-2	114.00	0.00	135.40	30.4
J-3	114.00	0.41	135.40	30.4
J-4	113.95	0.77	135.40	30.4
J-5	114.36	0.00	135.40	29.9
J-6	114.50	1.17	135.40	29.7
J-7	114.32	0.55	135.40	29.9
J-8	113.90	0.00	135.40	30.5
J-9	115.45	0.31	135.24	28.1
J-10	113.20	0.00	135.40	31.5

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Hydraulic Grade (Stop) (m)	Hydraulic Grade (Start) (m)	Velocity (m/s)	Headloss Gradient (m/m)
P-2	J-2	J-3	15	204.0	110.0	1.95	135.40	135.40	0.06	0.000
P-3	J-3	J-8	23	204.0	110.0	1.54	135.40	135.40	0.05	0.000
P-4	J-8	J-4	9	204.0	110.0	1.54	135.40	135.40	0.05	0.000
P-5	J-4	J-7	39	204.0	110.0	0.77	135.40	135.40	0.02	0.000
P-6	J-7	J-6	43	204.0	110.0	0.22	135.40	135.40	0.01	0.000
P-7	J-6	J-5	42	204.0	110.0	-1.26	135.40	135.40	0.04	0.000
P-8	J-9	J-6	29	38.0	100.0	-0.31	135.40	135.24	0.27	0.006
P-9	J-1	J-10	114	204.0	110.0	1.26	135.40	135.40	0.04	0.000
P-10	J-10	J-5	124	297.0	110.0	1.26	135.40	135.40	0.02	0.000
P-11	R-1	J-1	20	600.0	130.0	3.46	135.40	135.40	0.01	0.000
P-12	J-8	H-2	3	155.0	100.0	0.00	135.40	135.40	0.00	0.000
P-13	H-1	J-7	4	155.0	100.0	0.00	135.40	135.40	0.00	0.000

Reservoir Table - Time: 0.00 hours

ID	Label	Zone	Flow (Out net) (L/s)	Hydraulic Grade (m)
55	R-1	<None>	3.46	135.40

5924 & 5938 Hazeldean Road

MAX DAY PLUS FIREFLOW - HGL AT CONNECTION #1 (VICTOR / DENHAM)

Fire Flow Report - Time: 0.00 hours

Label	Fire Flow (Needed) (L/s)	Flow (Total Needed) (L/s)	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Pressure (Calculated Residual) (psi)	Satisfies Fire Flow Constraints?
H-1	0.00	250.00	170.90	170.90	178.7	False
H-2	0.00	250.00	200.85	200.85	178.1	False
J-1	0.00	250.25	300.00	300.25	29.8	True
J-2	0.00	250.00	260.32	260.32	20.0	True
J-3	0.00	250.41	226.66	227.07	20.0	False
J-4	0.00	250.77	193.31	194.08	20.0	False
J-5	0.00	250.00	168.12	168.12	20.0	False
J-6	0.00	251.17	147.53	148.70	21.6	False
J-7	0.00	250.55	170.90	171.45	20.0	False
J-8	0.00	250.00	200.85	200.85	20.0	False
J-9	0.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J-10	0.00	250.00	181.80	181.80	20.7	False

5924 & 5938 Hazeldean Road

PEAK HOUR - HGL AT CONNECTION #3 (HAZELDEAN)

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-1	114.36	0.38	157.30	60.9
J-2	114.00	0.00	157.29	61.5
J-3	114.00	0.62	157.29	61.5
J-4	113.95	1.17	157.29	61.5
J-5	114.36	0.00	157.30	61.0
J-6	114.50	1.76	157.30	60.7
J-7	114.32	0.82	157.29	61.0
J-8	113.90	0.00	157.29	61.6
J-9	115.45	0.47	156.95	58.9
J-10	113.20	0.00	157.30	62.6

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Hydraulic Grade (Stop) (m)	Hydraulic Grade (Start) (m)	Velocity (m/s)	Headloss Gradient (m/m)
P-2	J-2	J-3	15	204.0	110.0	1.37	157.29	157.29	0.04	0.000
P-3	J-3	J-8	23	204.0	110.0	0.75	157.29	157.29	0.02	0.000
P-4	J-8	J-4	9	204.0	110.0	0.75	157.29	157.29	0.02	0.000
P-5	J-4	J-7	39	204.0	110.0	-0.42	157.29	157.29	0.01	0.000
P-6	J-7	J-6	43	204.0	110.0	-1.24	157.30	157.29	0.04	0.000
P-7	J-6	J-5	42	204.0	110.0	-3.47	157.30	157.30	0.11	0.000
P-8	J-9	J-6	29	38.0	100.0	-0.47	157.30	156.95	0.41	0.012
P-9	J-1	J-10	114	204.0	110.0	-1.75	157.30	157.30	0.05	0.000
P-10	J-10	J-5	124	297.0	110.0	-1.75	157.30	157.30	0.03	0.000
P-11	R-1	J-1	20	600.0	130.0	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
P-12	J-8	H-2	3	155.0	100.0	0.00	157.29	157.29	0.00	0.000
P-13	H-1	J-7	4	155.0	100.0	0.00	157.29	157.29	0.00	0.000

Reservoir Table - Time: 0.00 hours

ID	Label	Zone	Flow (Out net) (L/s)	Hydraulic Grade (m)
55	R-1	<None>	(N/A)	(N/A)

5924 & 5938 Hazeldean Road

MAX DAY PLUS FIREFLOW - HGL AT CONNECTION #3 (HAZELDEAN)

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-1	114.36	0.25	158.30	62.4
J-2	114.00	0.00	158.30	62.9
J-3	114.00	0.41	158.30	62.9
J-4	113.95	0.77	158.30	62.9
J-5	114.36	0.00	158.30	62.4
J-6	114.50	1.17	158.30	62.2
J-7	114.32	0.55	158.30	62.4
J-8	113.90	0.00	158.30	63.0
J-9	115.45	0.31	158.14	60.6
J-10	113.20	0.00	158.30	64.0

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Hydraulic Grade (Stop) (m)	Hydraulic Grade (Start) (m)	Velocity (m/s)	Headloss Gradient (m/m)
P-2	J-2	J-3	15	204.0	110.0	0.91	158.30	158.30	0.03	0.000
P-3	J-3	J-8	23	204.0	110.0	0.50	158.30	158.30	0.02	0.000
P-4	J-8	J-4	9	204.0	110.0	0.50	158.30	158.30	0.02	0.000
P-5	J-4	J-7	39	204.0	110.0	-0.27	158.30	158.30	0.01	0.000
P-6	J-7	J-6	43	204.0	110.0	-0.82	158.30	158.30	0.03	0.000
P-7	J-6	J-5	42	204.0	110.0	-2.30	158.30	158.30	0.07	0.000
P-8	J-9	J-6	29	38.0	100.0	-0.31	158.30	158.14	0.27	0.006
P-9	J-1	J-10	114	204.0	110.0	-1.16	158.30	158.30	0.04	0.000
P-10	J-10	J-5	124	297.0	110.0	-1.16	158.30	158.30	0.02	0.000
P-11	R-1	J-1	20	600.0	130.0	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
P-12	J-8	H-2	3	155.0	100.0	0.00	158.30	158.30	0.00	0.000
P-13	H-1	J-7	4	155.0	100.0	0.00	158.30	158.30	0.00	0.000

Reservoir Table - Time: 0.00 hours

ID	Label	Zone	Flow (Out net) (L/s)	Hydraulic Grade (m)
55	R-1	<None>	(N/A)	(N/A)

5924 & 5938 Hazeldean Road

MAX DAY PLUS FIREFLOW - HGL AT CONNECTION #3 (HAZELDEAN)

Fire Flow Report - Time: 0.00 hours

Label	Fire Flow (Needed) (L/s)	Flow (Total Needed) (L/s)	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Pressure (Calculated Residual) (psi)	Satisfies Fire Flow Constraints?
H-1	0.00	250.00	300.00	300.00	191.0	True
H-2	0.00	250.00	300.00	300.00	188.8	True
J-1	0.00	250.25	300.00	300.25	33.9	True
J-2	0.00	250.00	300.00	300.00	33.3	True
J-3	0.00	250.41	300.00	300.41	33.5	True
J-4	0.00	250.77	300.00	300.77	35.0	True
J-5	0.00	250.00	300.00	300.00	62.3	True
J-6	0.00	251.17	300.00	301.17	46.9	True
J-7	0.00	250.55	300.00	300.55	38.8	True
J-8	0.00	250.00	300.00	300.00	34.5	True
J-9	0.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J-10	0.00	250.00	300.00	300.00	55.4	True

Appendix D – Sanitary Sewer Design Tables

Table D1: Sanitary Sewer Calculation Sheet

Table D1: SANITARY SEWER CALCULATION SHEET

LOCATION				RESEDENTIAL AREAS AND POPULAITONS													COMMERCIAL			INDUSTRIAL			INSTITUTIONAL		INFILTRATION				SEWER DATA						
Street	U/S MH	D/S MH	Area #	Area (ha)		NUMBER OF UNITS							POPULATION		Peak Factor	Peak Flow (L/sec)	AREA (ha)		Peak Flow (L/sec)	AREA (ha)		Peak Factor (per	AREA (Ha)	ACCU AREA (Ha)	AREA (ha)		INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q_{CAP} (%)	Full Velocity (m/s)
				INDIV	ACCUM	Singles	Semis	Towns	1-Bed Apt.	2-Bed Apt.	3-Bed Apt.	4-Bed Apt.	INDIV	ACCU			INDIV	ACCU		INDIV	ACCU				INDIV	ACCUM									
Victor	**SANMH110**	**SANMH101**	**7**	**0.0648**	**0.0648**			**5**					**13.5**	**13.5**	**3.72**	**0.16**									**0.065**	**0.0648**	**0.02**	**0.18**	**200**	**201.20**	**0.65**	**41.50**	**26.9**	**1%**	**0.98**
Private	**SANMH109**	**SANMH106**	**1**	**0.0537**	**0.0537**					**8**			**16.8**	**16.8**	**3.71**	**0.20**									**0.054**	**0.0537**	**0.02**	**0.22**	**200**	**201.20**	**4.28**	**25.50**	**68.9**	**0%**	**2.51**
	SANMH108	**SANMH107**	**3**	**0.0284**	**0.0284**					**4**			**8.4**	**8.4**	**3.74**	**0.10**									**0.028**	**0.0284**	**0.01**	**0.11**	**200**	**201.20**	**1.88**	**9.57**	**45.7**	**0%**	**1.66**
	SANMH107	**SANMH106**	**2**	**0.0208**	**0.0492**					**4**			**8.4**	**16.8**	**3.71**	**0.20**									**0.021**	**0.0492**	**0.02**	**0.22**	**200**	**201.20**	**2.10**	**8.08**	**48.3**	**0%**	**1.76**
	SANMH106	**SANMH105**	**4**	**0.4640**	**0.5669**					**40**			**84**	**117.6**	**3.58**	**1.36**									**0.464**	**0.5669**	**0.19**	**1.55**	**200**	**201.20**	**0.60**	**91.01**	**25.8**	**6%**	**0.94**
	SANMH105	**SANMH104**	**5**	**0.0779**	**0.6448**					**8**			**16.8**	**134.4**	**3.56**	**1.55**									**0.078**	**0.6448**	**0.21**	**1.76**	**200**	**201.20**	**0.35**	**7.95**	**19.7**	**9%**	**0.72**
	SANMH104	**SANMH103**	**6**	**0.1681**	**0.8129**			**5**		**10**			**34.5**	**168.9**	**3.54**	**1.94**									**0.168**	**0.8129**	**0.27**	**2.21**	**200**	**201.20**	**0.35**	**31.49**	**19.7**	**11%**	**0.72**
	SANMH103	**SANMH102**	**8**	**0.0669**	**0.8798**					**2**			**4.2**	**173.1**	**3.54**	**1.99**									**0.067**	**0.8798**	**0.29**	**2.28**	**200**	**201.20**	**0.35**	**12.72**	**19.7**	**12%**	**0.72**
	SANMH102	**SANMH101**	**9**	**0.0131**	**0.8929**									**173.1**	**3.54**	**1.99**									**0.013**	**0.8929**	**0.29**	**2.28**	**200**	**201.20**	**0.35**	**26.68**	**19.7**	**12%**	**0.72**
Victor	**SANMH101**	**SANMH100**			**0.9577**									**186.6**	**3.53**	**2.13**										**0.9577**	**0.32**	**2.45**	**250**	***251.46***	**0.35**	**3.26**	**35.7**	**7%**	**0.72**
	SANMH100	***MHSA09002***		***0.9171***	***1.8748***									***186.6***	***3.53***	***2.13***									***0.917***	***1.8748***	***0.62***	***2.75***	***250***	***251.46***	***0.55***	***10.00***	***44.7***	***6%***	***0.90***
	MHSA09002	*MHSA09003*	*6*	*0.8705*	*2.7453*	*13*							*44.2*	*230.8*	*3.50*	*2.62*									*0.871*	*2.7453*	*0.91*	*3.52*	*250*	*251.46*	*0.62*	*82.90*	*47.4*	*7%*	*0.95*
	MHSA09003	*MHSA09004*	*8*	*0.8325*	*3.5778*	*15*							*51*	*281.8*	*3.47*	*3.17*									*0.833*	*3.5778*	*1.18*	*4.35*	*250*	*251.46*	*0.40*	*90.10*	*38.2*	*11%*	*0.77*
	MHSA09004	*MHSA09005*	*10*	*0.8352*	*4.4130*	*16*							*54.4*	*336.2*	*3.45*	*3.76*									*0.835*	*4.4130*	*1.46*	*5.22*	*250*	*251.46*	*0.47*	*86.60*	*41.6*	*13%*	*0.83*
	MHSA09005	*MHSA09006*	*13*	*0.9605*	*5.3735*	*17*							*57.8*	*394*	*3.42*	*4.37*									*0.961*	*5.3735*	*1.77*	*6.14*	*250*	*251.46*	*0.42*	*91.20*	*39.0*	*16%*	*0.78*
	MHSA09006	*MHSA09007*	*15*	*0.1879*	*5.5614*	*2*							*6.8*	*400.8*	*3.42*	*4.44*									*0.188*	*5.5614*	*1.84*	*6.28*	*250*	*251.46*	*0.15*	*13.10*	*23.6*	*27%*	*0.47*
	MHSA09007	*MHSA09008*	*16*	*0.3846*	*5.9460*	*6*							*20.4*	*421.2*	*3.41*	*4.65*									*0.385*	*5.9460*	*1.96*	*6.62*	*250*	*251.46*	*0.42*	*81.20*	*39.1*	*17%*	*0.79*
Denham	*MHSA09020*	*MHSA09021*	*3*	*0.3851*	*0.3851*	*3*							*10.2*	*10.2*	*3.73*	*0.12*									*0.385*	*0.3851*	*0.13*	*0.25*	*250*	*251.46*	*0.41*	*39.20*	*38.6*	*1%*	*0.78*
	MHSA09021	*MHSA09022*	*4*	*0.1229*	*0.5080*	*1*							*3.4*	*13.6*	*3.72*	*0.16*									*0.123*	*0.5080*	*0.17*	*0.33*	*250*	*251.46*	*1.07*	*12.10*	*62.6*	*1%*	*1.26*
	MHSA09022	*MHSA09023*	*5*	*0.7027*	*1.2107*	*5*							*17*	*30.6*	*3.68*	*0.36*									*0.703*	*1.2107*	*0.40*	*0.76*	*250*	*251.46*	*1.03*	*53.20*	*61.4*	*1%*	*1.23*
	MHSA09023	*MHSA09024*	*7*	*0.8059*	*2.0166*	*4*	*4*						*24.4*	*55*	*3.64*	*0.65*									*0.806*	*2.0166*	*0.67*	*1.31*	*250*	*251.46*	*0.40*	*90.50*	*38.1*	*3%*	*0.77*
	MHSA09024	*MHSA09025*	*9*	*0.7950*	*2.8116*	*11*							*37.4*	*92.4*	*3.60*	*1.08*									*0.795*	*2.8116*	*0.93*	*2.01*	*250*	*251.46*	*0.41*	*88.40*	*38.5*	*5%*	*0.77*
	MHSA09025	*MHSA09026*	*11*	*0.6130*	*3.4246*	*9*							*30.6*	*123*	*3.57*	*1.42*									*0.613*	*3.4246*	*1.13*	*2.55*	*250*	*251.46*	*0.41*	*59.00*	*38.5*	*7%*	*0.77*
	MHSA09026	*MHSA09027*	*12*	*0.6608*	*4.0854*	*11*							*37.4*	*160.4*	*3.55*	*1.85*									*0.661*	*4.0854*	*1.35*	*3.19*	*250*	*251.46*	*0.38*	*57.50*	*37.4*	*9%*	*0.75*
	MHSA09027	*MHSA09008*	*14*	*0.3142*	*4.3996*	*3*							*10.2*	*170.6*	*3.54*	*1.96*									*0.314*	*4.3996*	*1.45*	*3.41*	*250*	*251.46*	*0.47*	*40.00*	*41.6*	*8%*	*0.84*
Victor	*MHSA09008*	*MHSA09009*	*17*	*0.4415*	*10.7871*	*8*							*27.2*	*619*	*3.34*	*6.70*									*0.442*	*10.7871*	*3.56*	*10.26*	*250*	*251.46*	*0.40*	*75.50*	*38.1*	*27%*	*0.76*
	MHSA09009	*MHSA09010*	*18*	*0.2491*	*11.0362*	*2*	*2*						*12.2*	*631.2*	*3.34*	*6.83*									*0.249*	*11.0362*	*3.64*	*10.47*	*250*	*251.46*	*0.42*	*55.40*	*38.9*	*27%*	*0.78*
	MHSA09010	*MHSA09011*	*19*	*0.7571*	*11.7933*	*12*							*40.8*	*672*	*3.32*	*7.23*									*0.757*	*11.7933*	*3.89*	*11.12*	*250*	*251.46*	*0.37*	*76.40*	*36.6*	*30%*	*0.73*
	MHSA09011	*MHSA09012*	*20*	*0.7406*	*12.5339*	*13*							*44.2*	*716.2*	*3.31*	*7.68*									*0.741*	*12.5339*	*4.14*	*11.82*	*250*	*251.46*	*0.37*	*78.00*	*36.8*	*32%*	*0.74*
	MHSA09012	*MHSA09013*	*21*	*0.4553*	*12.9892*	*7*							*23.8*	*740.0*	*3.30*	*7.91*									*0.455*	*12.9892*	*4.29*	*12.20*	*250*	*251.46*	*0.32*	*34.70*	*34.0*	*36%*	*0.68*
				12.9892		**158**	**6**	**10**		**76**			**740.0**												**12.989**										

Residential Avg. Daily Flow, q (L/p/day) = 280
Commercial Avg. Daily Flow (L/gross ha/day) = 28,000
or L/gross ha/sec = 0.324
Institutianal Avg. Daily Flow (L/s/ha) = 28,000
or L/gross ha/sec = 0.324
Light Industrial Flow (L/gross ha/day) = 35,000
or L/gross ha/sec = 0.40509
Light Industrial Flow (L/gross ha/day) = 55,000
or L/gross ha/sec = 0.637

Commercial Peak Factor = 1.5 (when area >20%)
1.0 (when area <20%)
Institutional Peak Factor = 1.5 (when area >20%)
1.0 (when area <20%)
Residential Correction Factor, K = 0.80
Manning N = 0.013
Peak extraneous flow, I (L/s/ha) = 0.33 (Total I/I)

Peak Population Flow, (L/sec) = P*q*M/86.4
Peak Extraneous Flow, (L/sec) = I*Ac
Residential Peaking Factor, M = 1 + (14/(4+P^0.5)) * K
A_c = Cumulative Area (hectares)
P = Population (thousands)
Sewer Capacity, Qcap (L/sec) = $1/N \ S^{1/2} \ R^{2/3} \ A_c$
(Manning's Equation)

Unti Type	Persons/Unit
Singles	3.4
Semi-Detached	2.7
Townhomes	2.7
Single Apt. Unit	1.4
2-bed Apt. Unit	2.1
3-bed Apt. Unit	3.1
4-bed Apt. Unit	4.1

Designed:	Project:
J. Fitzpatrick, P.Eng.	5924 Hazeldean Road
Checked:	Location:
B. Thomas, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
250806 Sanitary Design Sheet, Nov 2019.xlsx	**1 of 1**

Appendix E – Stormwater Design Tables

TABLE E1: ESTIMATION OF CATCHMENT TIME OF CONCENTRATION (PRE-DEVELOPMENT CONDITIONS)

Catchment No.	Area (ha)	Outlet Location	High Elev (m)	Low Elev (m)	Flow Path Length (m)	Indiv Slope	Avg. C	Time of Conc. Tc	Description
PRE_S02	0.2835	Victor	114.6	114.3	20.0	1.5	0.42	1.19	See Note 1
PRE_S03	0.4993	Victor	114.0	113.0	75.0	1.3	0.20	5.06	See Note 1
PRE_S01	0.1814	Hazeldean	116.0	115.5	41.0	1.2	**0.73**	2.66	See Note 2
Totals	0.9642								

Notes

1) For Catchments with Runoff Coefficient less than C=0.40, Time of Concentration Based on Federal Aviation Formula (Airport Method), from MTO Drainage Manual Equation 8.16, where: $T_C = 3.26^* (1.1\text{-}C)^* L^{0.5} / S_W{}^{0.33}$

2) For Catchments with Runoff Coefficient greater than C=0.40, Time of Concentration Based on Bransby Williams Equation, from MTO Drainage Manual Equation 8.15, where: $T_C = 0.057^*L / (S_W{}^{0.2}{}^*A^{0.1})$

TABLE E2: ESTIMATION OF PEAK FLOWS (PRE-DEVELOPMENT CONDITIONS) USING CALACUTLED TIME OF CONCENTRATIONS

Catchment No.	Area (ha)	Outlet Location	Time of Conc, Tc (min)	Storm = 2 yr			Storm = 5 yr			Storm = 100 yr		
				I_2 (mm/hr)	Cavg	Q_{5PRE} (L/sec)	I_5 (mm/hr)	Cavg	Q_{5PRE} (L/sec)	I_{100} (mm/hr)	Cavg	Q_{100PRE} (L/sec)
PRE_S02	0.2835	Victor	1.19	145.01	0.42	48.0	199.10	0.42	65.9	343.67	0.53	142.2
PRE_S03	0.4993	Victor	5.06	103.16	0.20	28.6	140.60	0.20	39.0	241.71	0.25	83.9
PRE_S01	0.1814	Hazeldean	2.66	125.18	0.73	46.1	171.28	0.73	63.1	295.09	0.91	135.8
Totals	0.9642					122.7			168.0			361.9

Notes

1) Intensity, $I = 732.951/(Tc+6.199)^{0.810}$ (2-year, City of 0ttawa)

2) Intensity, $I = 998.071/(Tc+6.035)^{0.814}$ (5-year, City of 0ttawa)

3) Intensity, $I = 1735.688/(Tc+6.014)^{0.820}$ (100-year, City of Ottawa)

4) Cavg for 100-year is increased by 25% to a maximum of 1.0

TABLE E3: ESTIMATION OF ALLOWABLE PEAK FLOWS (Based on 5 year Pre-Development Rates and Max C=0.50 & Tc=10mins)

Catchment No.	Area (ha)	Outlet Location	Time of Conc, Tc (min)	Storm = 2 yr			Storm = 5 yr		
				I_2 (mm/hr)	Cavg	Q_{ALLOW} (L/sec)	I_5 (mm/hr)	Cavg	Q_{ALLOW} (L/sec)
PRE_S02	0.2835	Victor	10	76.81	0.42	25.4	104.29	0.42	**34.5**
PRE_S03	0.4993	Victor	10	76.81	0.20	21.3	104.29	0.20	**29.0**
Total to Victor St					**0.28**	**46.7**			**63.5**
PRE_S01	0.1814	Hazeldean	10	76.81	**0.50**	19.4	104.29	0.50	26.3
Total to Hazeldean Rd						**19.4**			**26.3**
Total to Both =						**66.1**			**89.8**

<--- Allowable Minior System Discharge Rate of 50 L/sec Used as per City

<--- Max C = 0.50 Used to establish allowable peak flow

Notes

1) Allowable Capture Rates are based on meeting pre-development peak flows for all storms up to 100-year event. Allowable runoff coefficent to meet pre-deveopment Cavg or C = 0.50 (maximum)

2) Time of Concentration (Tc) is based on the standard 10 minutes as per City Guidelines. The higher time of 10 minutes was used as it results in lower (more stringent) peak runoff rate used to establish allowable discharge rates

TABLE E4: AVERAGE RUNOFF COEFFICIENTS (Post-Development)

Runoff Coeffients $C_{ASPH/CONC}$ = 0.90 C_{ROOF} = 0.90 C_{GRASS} = 0.20

Area No.	Asphalt & Conc Areas (m^2)	A * C_{ASPH}	Roof Areas (m^2)	A * C_{ROOF}	Grassed Areas (m^2)	A * C_{GRASS}	Sum AC	Total Area (m^2)	C_{AVG} (see note)	Comment
S01							1331.5	1752	0.76	Surface Areas
S02							1216.1	1483	0.82	Surface Areas
S03							53.4	178	0.3	Surface Areas
S04							1500.8	2001	0.75	Surface Areas
S05							910.1	1264	0.72	Surface Areas
S06							277.7	617	0.45	Surface Areas
S07							195.1	415	0.47	Surface Areas
S08_1							251.1	405	0.62	Surface Areas
S08_2							317.8	548	0.58	Surface Areas
S09							564.2	806	0.7	Surface Areas
Totals							6617.7	9,469	0.70	

Notes

1) Cavg derived with area-weighting command in PCSWMM

TABLE E5: SUMMARY OF POST-DEVELOPMENT PEAK FLOWS (Uncontrolled and Controlled)

Area No	Area (ha)	Time of Conc, Tc (min)	Storm = 2 yr				Storm = 5 yr				Storm = 100 yr				Comments
			C_{AVG}	I_2 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_5 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_{100} (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	
S01	0.1752	10	0.76	76.81	28.4	(13.18)	0.76	104.19	38.6	(15.60)	0.95	178.56	82.6	(21.16)	Controlled at MH215 (CHAMBERS 1 - EAST)
S02	0.1483	10	0.82	76.81	26.0		0.82	104.19	35.2		1.00	178.56	73.6		
S03	0.0178	10	0.30	76.81	1.1		0.30	104.19	1.5		0.38	178.56	3.3		
S04	0.2001	10	0.75	76.81	32.0	(14.40)	0.75	104.19	43.5	(17.27)	0.94	178.56	93.1	(24.01)	Controlled at MH212 (CHAMBERS 2 - WEST)
S05	0.1264	10	0.72	76.81	19.4		0.72	104.19	26.4		0.90	178.56	56.5		
S06	0.0617	10	0.45	76.81	5.9		0.45	104.19	8.0		0.56	178.56	17.2		
S07	0.0415	10	0.47	76.81	4.2		0.47	104.19	5.6		0.59	178.56	12.1		
S08_1	0.0405	10	0.62	76.81	5.4		0.62	104.19	7.3		0.78	178.56	15.6		
S08_2	0.0548	10	0.58	76.81	6.8		0.58	104.19	9.2		0.73	178.56	19.7		
Foundation					0.0	5.4			5.4	5.4			5.4	5.4	Foundation Drainage
Total to Victor St Storm Sewers (piped)=						**(33.0)**				**(38.3)**				**(50.6)**	
S09	0.0806	10	0.70	76.81	12.0	12.7	0.70	104.19	16.3	20.3	0.88	178.56	35.0	38.2	Uncontrolled - Victor
Total to Victor St Storm Sewers (overland) =						**(12.7)**				**(20.3)**				**(38.2)**	
Totals	0.9469				141.3	**45.7**			197.1	**58.6**			414.2	**88.8**	
Total allowable rates for comparison						*66.1*				*89.8*				*89.8*	

Notes

2-yr Storm Intensity, I = 732.951/(Tc+6.199)^0.810 (City of Ottawa)

5-yr Storm Intensity, I = 998.071/(Tc+6.035)^0.814 (City of Ottawa)

100-yr Storm Intensity, I = 1735.688/(Tc+6.014)&^0.820 (City of Ottawa)

Time of Concentration (min), Tc = ***10***

For Flows under column Qcap which are shown in brackets ***(0.0)*** *, denotes flows that are controlled*

from PCSWMM **<---Uncontrolled rate**

From PCSWMM **<--- Controlled rate**

TABLE E6: SUMMARY OF POST DEVELOPMENT STORAGE

Area No.	Area (ha)	Release Rate (L/s)			^{1} Storage Required (m^3)				Storage Provided (m^3)					Control Method
		2-yr	5-yr	100-yr	2-yr (MRM)	5-yr (MRM)	100-yr (MRM)	100-yr (PCSWMM)	Roof	Surface Ponding	UG Chambers	UG CB/MHs	Total	
S01	0.1752	13.2	15.6	21.2	29.4	42.7	112.4	118.2			152.5		152.5	ICD - TEMPEST MHF TYPE A (Downstream of Chambers 1)
S02	0.1483													
S03	0.0178													
S04	0.2001	14.4	17.3	24.0	43.5	62.1	158.9	155.2			155.2		155.2	ICD - TEMPEST MHF TYPE A (Downstream of Chambers 2)
S05	0.1264													
S06	0.0617													
S07	0.0415													
S08_1	0.0405													
S08_2	0.0548													
S09	0.0806													
Totals (all)=	**0.947**	**27.6**	**32.9**	**45.2**	**72.8**	**104.7**	**271.3**	**273.4**	**0.0**	**0.0**	**307.7**	**0.0**	**307.7**	

Notes

1) Storage Requried Based on the Modified Rational Method (MRM) for the relase rates noted.

Table E7 - Storage Volumes for 2-year, 5-Year and 100-Year Storms

Area No: **Chamber 1 (east)**

C_{AVG} = 0.76 (2-yr)

C_{AVG} = 0.76 (5-yr)

C_{AVG} = 0.95 (100-yr, Max 1.0)

Time Interval = 2.00 (mins)

Drainage Area = 0.3413 (hectares)

Duration (min)	Release Rate = 13.2 (L/sec)					Release Rate = 15.6 (L/sec)					Release Rate = 21.2 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951			, B =	0.810	IDF Parameters, A = 998.071				0.814	IDF Parameters, A = 1735.688				0.820
	(I = A/(T_c+C)			, C =	6.199	(I = A/(T_c+C)			, C =	6.053	(I = A/(T_c+C)			, C =	6.014
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	120.9	13.18	107.7	0.00	230.5	166.7	15.600	151.1	0.00	398.6	360.3	21.160	339.1	0.00
2	133.3	96.4	13.18	83.2	9.99	182.7	132.1	15.600	116.5	13.98	315.0	284.7	21.160	263.6	31.63
4	111.7	80.8	13.18	67.6	16.22	152.5	110.3	15.600	94.7	22.72	262.4	237.2	21.160	216.0	51.84
6	96.6	69.9	13.18	56.7	20.41	131.6	95.1	15.600	79.5	28.63	226.0	204.3	21.160	183.1	65.92
8	85.5	61.8	13.18	48.6	23.33	116.1	84.0	15.600	68.4	32.81	199.2	180.0	21.160	158.9	76.27
10	76.8	55.5	13.18	42.4	25.41	104.2	75.3	15.600	59.7	35.84	178.6	161.4	21.160	140.2	84.14
12	69.9	50.5	13.18	37.4	26.90	94.7	68.5	15.600	52.9	38.07	162.1	146.5	21.160	125.4	90.28
14	64.2	46.4	13.18	33.3	27.94	86.9	62.9	15.600	47.3	39.70	148.7	134.4	21.160	113.3	95.14
16	59.5	43.0	13.18	29.8	28.65	80.5	58.2	15.600	42.6	40.88	137.5	124.3	21.160	103.2	99.04
18	55.5	40.1	13.18	26.9	29.10	75.0	54.2	15.600	38.6	41.70	128.1	115.8	21.160	94.6	102.17
20	52.0	37.6	13.18	24.4	29.33	70.3	50.8	15.600	35.2	42.24	120.0	108.4	21.160	87.3	104.71
22	49.0	35.4	13.18	22.3	29.39	66.1	47.8	15.600	32.2	42.54	112.9	102.0	21.160	80.9	106.74
24	46.4	33.5	13.18	20.4	29.31	62.5	45.2	15.600	29.6	42.65	106.7	96.4	21.160	75.3	108.37
26	44.0	31.8	13.18	18.7	29.10	59.3	42.9	15.600	27.3	42.60	101.2	91.5	21.160	70.3	109.65
28	41.9	30.3	13.18	17.1	28.79	56.5	40.8	15.600	25.2	42.42	96.3	87.0	21.160	65.9	110.64
30	40.0	29.0	13.18	15.8	28.39	53.9	39.0	15.600	23.4	42.11	91.9	83.0	21.160	61.9	111.37
32	38.3	27.7	13.18	14.5	27.92	51.6	37.3	15.600	21.7	41.70	87.9	79.4	21.160	58.3	111.89
34	36.8	26.6	13.18	13.4	27.37	49.5	35.8	15.600	20.2	41.19	84.3	76.2	21.160	55.0	112.21
36	35.4	25.6	13.18	12.4	26.77	47.6	34.4	15.600	18.8	40.61	81.0	73.2	21.160	52.0	112.36
38	34.1	24.6	13.18	11.5	26.11	45.8	33.1	15.600	17.5	39.96	77.9	70.4	21.160	49.3	112.36
40	32.9	23.8	13.18	10.6	25.40	44.2	31.9	15.600	16.3	39.24	75.1	67.9	21.160	46.8	112.22
Max =					**29.39**					**42.65**					**112.36**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, I = A/(Tc+C)^B

3) Release Rate = Min (Release Rate, Peak Flow)

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

7) Parameters a,b,c are for City of Ottawa

Table E7 - Storage Volumes for 2-year, 5-Year and 100-Year Storms

Area No: Chamber 2 (west)
C_{AVG} = 0.66 (2-yr)
C_{AVG} = 0.66 (5-yr)
C_{AVG} = 0.82 (100-yr, Max 1.0)
Time Interval = 3.00 (mins)
Drainage Area = 0.5250 (hectares)

Duration (min)	Release Rate = 14.4 (L/sec) Return Period = 2 (years) IDF Parameters, A = 732.951 , B = 0.810 (I = A/(T_c+C) , C = 6.199					Release Rate = 17.3 (L/sec) Return Period = 5 (years) IDF Parameters, A = 998.071 0.814 (I = A/(T_c+C) , C = 6.053					Release Rate = 24.0 (L/sec) Return Period = 100 (years) IDF Parameters, A = 1735.688 0.820 (I = A/(T_c+C) , C = 6.014				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	160.5	14.40	146.1	0.00	230.5	221.2	17.270	203.9	0.00	398.6	478.2	24.010	454.2	0.00
3	121.5	116.6	14.40	102.2	18.39	166.1	159.4	17.270	142.1	25.58	286.0	343.2	24.010	319.2	57.45
6	96.6	92.8	14.40	78.4	28.21	131.6	126.3	17.270	109.0	39.24	226.0	271.2	24.010	247.1	88.97
9	80.9	77.6	14.40	63.2	34.14	109.8	105.4	17.270	88.1	47.58	188.3	225.9	24.010	201.8	109.00
12	69.9	67.1	14.40	52.7	37.93	94.7	90.9	17.270	73.6	53.00	162.1	194.5	24.010	170.5	122.76
15	61.8	59.3	14.40	44.9	40.40	83.6	80.2	17.270	62.9	56.63	142.9	171.4	24.010	147.4	132.68
18	55.5	53.3	14.40	38.9	41.97	75.0	72.0	17.270	54.7	59.06	128.1	153.7	24.010	129.7	140.03
21	50.5	48.4	14.40	34.0	42.90	68.1	65.4	17.270	48.1	60.63	116.3	139.5	24.010	115.5	145.55
24	46.4	44.5	14.40	30.1	43.36	62.5	60.0	17.270	42.8	61.57	106.7	128.0	24.010	104.0	149.72
27	43.0	41.2	14.40	26.8	43.45	57.9	55.6	17.270	38.3	62.02	98.7	118.4	24.010	94.4	152.86
30	40.0	38.4	14.40	24.0	43.26	53.9	51.8	17.270	34.5	62.08	91.9	110.2	24.010	86.2	155.17
33	37.5	36.0	14.40	21.6	42.83	50.5	48.5	17.270	31.2	61.83	86.0	103.2	24.010	79.2	156.83
36	35.4	33.9	14.40	19.5	42.21	47.6	45.7	17.270	28.4	61.33	81.0	97.1	24.010	73.1	157.95
39	33.5	32.1	14.40	17.7	41.43	45.0	43.2	17.270	25.9	60.61	76.5	91.8	24.010	67.8	158.61
42	31.8	30.5	14.40	16.1	40.52	42.7	41.0	17.270	23.7	59.71	72.6	87.1	24.010	63.1	158.89
45	30.2	29.0	14.40	14.6	39.48	40.6	39.0	17.270	21.7	58.66	69.1	82.8	24.010	58.8	158.85
48	28.9	27.7	14.40	13.3	38.35	38.8	37.2	17.270	20.0	57.47	65.9	79.0	24.010	55.0	158.51
51	27.6	26.5	14.40	12.1	37.12	37.1	35.6	17.270	18.4	56.16	63.0	75.6	24.010	51.6	157.93
54	26.5	25.5	14.40	11.1	35.82	35.6	34.2	17.270	16.9	54.75	60.4	72.5	24.010	48.5	157.14
57	25.5	24.5	14.40	10.1	34.45	34.2	32.8	17.270	15.6	53.24	58.1	69.7	24.010	45.7	156.14
60	24.6	23.6	14.40	9.2	33.01	32.9	31.6	17.270	14.3	51.66	55.9	67.1	24.010	43.0	154.98
Max =					**43.45**					**62.08**					**158.89**

Notes
1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, I = A/(Tc+C)^B
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration
7) Parameters a,b,c are for City of Ottawa

TABLE E10: 2-YEAR STORM SEWER CALCULATION SHEET (Uncontrolled Site)

Return Period Storm =	**2-year**	(2-year, 5-year, 100-year)
Default Inlet Time=	10	(minutes)
Manning Coefficient =	0.013	(dimensionless)

From Node	To Node	AREA INFO				FLOW (UNRESTRICTED)										SEWER DATA										
		Area No.	Area (ha)	∑ Area (ha)	Average R	Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow	Return Period	No. of Units	Accum. No. of Units	Foundation Q (L/s)	Q (L/s)	Dia (mm) Actual	Dia (mm) Nominal	Type	Slope (%)	Length (m)	Capacity, Q_{CAP} (L/sec)	Velocity (m/s)		Time in Pipe, Tt (min)	Hydraulic Ratios	
																						Vf	Va		Q/Q_{CAP}	Va/Vf
STMMH 207	STMMH 206											2	2	0.90	0.9	251.5	250	PVC	3.35	15.82	110.55	2.22	0.67	0.40	0.01	0.30
STMMH 206	STMMH 205											4	6	2.70	2.7	251.5	250	PVC	0.60	46.79	46.78	0.94	0.43	1.81	0.06	0.46
CBE1	CBT2	S07	0.0415	0.0415	0.57	0.0658	0.0658	10.00	76.81	5.1	2-year				5.1	250	250	HDPE	0.45	22.23	39.89	0.81	0.46	0.80	0.13	0.57
CBT2	CB5			0.0415			0.0658	10.80	73.86		2-year				4.9	250	250	HDPE	0.46	20.70	40.33	0.82	0.47	0.74	0.12	0.57
CB5	CBT3			0.0415			0.0658	11.54	71.37		2-year				4.7	250	250	HDPE	0.50	34.30	42.05	0.86	0.48	1.19	0.11	0.56
CBT3	CBMH217	S06	0.0617	0.1032	0.45	0.077	0.1429	12.73	67.71	5.2	2-year				9.7	250	250	HDPE	1.00	22.97	59.47	1.21	0.71	0.54	0.16	0.59
CBMH217	CHMB2-IN-2			0.1032			0.1429	13.26	66.19		2-year				9.5	251.5	250	PVC	10.49	5.54	195.62	3.92	1.22	0.08	0.05	0.31
CB3	STMMH 208	S04	0.2001	0.2001	0.75	0.417	0.4172	10.00	76.81	32.0	2-year				32.0	299.4	300	PVC	0.86	15.05	89.17	1.27	0.89	0.28	0.36	0.70
CBE4	STMMH 213	S08_2	0.0548	0.0548	0.58	0.088	0.0884	10.00	76.81	6.8	2-year				6.8	250.0	250	HDPE	1.00	58.95	59.47	1.21	0.68	1.45	0.11	0.56
CBE14	STMMH 213	S08_1	0.0405	0.0953	0.62	0.070	0.1582	10.00	76.81	5.4	2-year				12.1	250.0	250	HDPE	0.30	38.31	32.57	0.66	0.47	1.36	0.37	0.71
STMMH 213	CBMH218			0.0953			0.1582	11.45	71.66		2-year				11.3	299.4	300	PVC	0.30	29.25	52.66	0.75	0.49	0.99	0.22	0.66
CBMH218	STMMH 208	S05	0.1264	0.2217	0.72	0.253	0.4112	12.43	68.57	17.3	2-year				28.2	299.4	300	PVC	0.30	15.21	52.66	0.75	0.53	0.48	0.54	0.71
STMMH 208	CHMB2-IN-1			0.4218			0.8284	12.91	67.18		2-year				55.6	600.0	600	HDPE	1.20	3.35	672.62	2.38	1.24	0.05	0.08	0.52
CHMB2-OUT	STMMH215			0.5250			0.9713	13.34	65.99		2-year				64.1	299.4	300	PVC	5.50	2.00	225.50	3.21	2.25	0.01	0.28	0.70
STMMH 215	STMMH 205			0.5250			0.9713	13.35	65.95		2-year				64.1	299.4	300	PVC	1.48	19.55	116.97	1.66	1.18	0.28	0.55	0.71
STMMH 205	STMMH 204			0.5250			0.9713	13.63	65.20		2-year	2	8	3.60	66.9	366.4	375	PVC	0.34	44.51	96.11	0.93	0.88	0.84	0.70	0.95
STMMH 204	STMMH 203			0.5250			0.9713	14.48	63.03		2-year	1	9	4.05	65.3	366.4	375	PVC	0.35	8.55	97.75	0.94	0.87	0.16	0.67	0.92
STMMH 203	STMMH 202			0.5250			0.9713	14.64	62.63		2-year	2	11	4.95	65.8	366.4	375	PVC	0.35	35.07	97.52	0.94	0.79	0.74	0.67	0.84
STMMH 202	STMMH 201			0.5250			0.9713	15.38	60.88		2-year		11	4.95	64.1	366.4	375	PVC	0.35	11.46	97.52	0.94	0.86	0.22	0.66	0.92
STMMH 201	STMH216			0.5250			0.9713	15.60	60.38		2-year		11	4.95	63.6	366.4	375	PVC	0.57	6.31	124.45	1.20	0.85	0.12	0.51	0.71
CB6	STMMH 210	S01	0.1752	0.1752	0.76	0.370	0.3702	10.00	76.81	28.4	2-year				28.4	299.4	300	PVC	1.05	18.19	98.53	1.40	0.98	0.31	0.29	0.70
STMMH 210	STMMH 211			0.1752			0.3702	10.31	75.64		2-year				28.0	299.4	300	PVC	1.03	15.33	97.58	1.39	0.97	0.26	0.29	0.70
CB1	STMMH 211	S02	0.1483	0.1483	0.82	0.338	0.3381	10.00	76.81	26.0	2-year				26.0	299.4	300	PVC	0.59	6.74	73.86	1.05	0.74	0.15	0.35	0.70
STMMH 211	CHMB1-IN-1			0.3235			0.7082	10.57	74.68		2-year				52.9	600	600	HDPE	0.77	2.61	538.79	1.91	1.01	0.04	0.10	0.53
CBE16	CHMB1-IN-1	S03	0.0178	0.0178	0.30	0.015	0.0148	10.00	76.81	1.1	2-year															
CHMB1-OUT	STMMH 212			0.3413			0.7231	10.61	74.52		2-year				53.9	300	300	HDPE	0.87	5.72	90.20	1.28	1.15	0.08	0.60	0.90
STMMH 212	STMMH 216			0.3413			0.7231	10.70	74.23		2-year				53.7	299.4	300	PVC	0.59	6.74	73.86	1.05	1.03	0.11	0.73	0.98
STMMH 216	OGS			0.8663			1.6944	15.73	60.11		2-year				101.8	366.4	375	PVC	0.47	10.41	113.01	1.09	1.09	0.16	0.90	1.00
OGS	STMMH 200			0.8663			1.6944	15.89	59.75		2-year				101.2	366.4	375	PVC	0.47	10.73	113.01	1.09	1.09	0.16	0.90	1.00
MHST9001	MHST9002	ES01_1	0.3255	0.3255	0.67	0.6063	0.6063	10.00	76.81	46.6	2-year															
		S09	0.0806	0.4061	0.70	0.1568	0.7631	10.00	76.81	12.0	2-year				58.6	381	375	CONC	0.38	10.40	112.75	0.98	0.69	0.25	0.52	0.71
MHST9002	MHST9003			0.4061			0.7631	10.25	75.86		2-year				57.9	381	375	CONC	0.27	36.60	95.04	0.82	0.74	0.82	0.61	0.90
MHST9003	STMH200			0.4061			0.7631	11.07	72.92		2-year	1	12	5.40	55.6	381	375	CONC	0.30	5.08	100.18	0.87	0.61	0.14	0.56	0.71
STMH200	MHST9004			1.2724			2.45752	16.05	59.40		2-year				146.0	457	450	CONC	0.30	11.52	162.72	0.98	0.98	0.20	0.90	1.00
MHST9004	MHST9005	ES23	0.1837	1.4561	0.43	0.220	2.6771	16.24	58.98	13.0	2-year				157.9	457	450	CONC	0.60	82.95	230.12	1.39	1.31	1.06	0.69	0.94
TOTALS =			**1.4561**			**2.6771**						**12**														

Definitions:

Q = 2.78*AIR, where

Q = Peak Flow in Litres per second (L/s)

A = Watershed Area (hectares)

I = Rainfall Intensity (mm/h)

R = Runoff Coefficients (dimensionless)

Ottawa Rainfall Intensity Values from Sewer Design Guidelines, SDG002

	a	b	c
2-year	732.951	6.199	0.8
5-year	998.071	6.053	0.8
100-year	1735.688	6.014	0.8

Building Foundation Drain Allowance (L/sec) = **0.45** City of Ottawa

Designed:	Project:	
J. Fitzpatrick, P.Eng.	5924 Hazeldean Road	
Checked:	Location:	
B. Thomas, P.Eng.	5924 Hazeldean Road	
Dwg Reference:	File Ref:	Sheet No:
FIGURE A3.1	**250806 Storm Design Sheets, Nov 2019.xlsx**	1 of 1

Project Information:

Project Name: 5294 Hazeldean Chambers Chambers-1
Location: 5294 Hazeldean Chambers
Date: 10/5/2019
Engineer: J Fitzpatrick
StormTech RPM: V Sharma

MC-3500 Site Calculator

System Requirements

Units		Metric	
Required Storage Volume		150	cubic meters
Stone Porosity (Industry Standard = 40%)		40	%
Stone Above Chambers	(305 mm min.)	305	mm
Stone Foundation Depth	(229 mm min.)	229	mm
Average Cover over Chambers	(610 mm min.)	610	mm
Bed size controlled by WIDTH or LENGTH?		WIDTH	
Limiting WIDTH or LENGTH dimension		12	meters
Storage Volume per Chamber		5.0	cubic meters
Storage Volume per End Cap		1.2	cubic meters

System Sizing

Number of Chambers Required	28	each
Number of End Caps Required	10	each
Bed Size (including perimeter stone)	150	square meters
Stone Required (including perimeter stone)	265	metric tonnes
Volume of Excavation	298	cubic meters
Non-woven Filter Fabric Required (20% Safety Factor)	463	square meters
Length of Isolator Row	14.5	meters
Non-woven Isolator Row Fabric (20% Safety Factor)	69	square meters
Woven Isolator Row Fabric (20% Safety Factor)	87	square meters
Installed Storage Volume	152	cubic meters

Controlled by Width (Rows)

Maximum Width = 12 meters

3 rows of 6 chambers
2 row of 5 chambers

Maximum Length = 14.5 meters
Maximum Width = 11.0 meters

610
mm

305
mm

229
mm

Project Information:

Project Name: 5294 Hazeldean Chambers Chambers-2
Location: 5294 Hazeldean Chambers
Date: 10/5/2019
Engineer: J Fitzpatrick
StormTech RPM: V Sharma

MC-3500 Site Calculator

System Requirements

Units		Metric	
Required Storage Volume		155.2	cubic meters
Stone Porosity (Industry Standard = 40%)		40	%
Stone Above Chambers	(305 mm min.)	305	mm
Stone Foundation Depth	(229 mm min.)	229	mm
Average Cover over Chambers	(610 mm min.)	610	mm
Bed size controlled by WIDTH or LENGTH?		LENGTH	
Limiting WIDTH or LENGTH dimension		13	meters
Storage Volume per Chamber		5.0	cubic meters
Storage Volume per End Cap		1.2	cubic meters

System Sizing

Number of Chambers Required	29	each
Number of End Caps Required	12	each
Bed Size (including perimeter stone)	157	square meters
Stone Required (including perimeter stone)	277	metric tonnes
Volume of Excavation	311	cubic meters
Non-woven Filter Fabric Required (20% Safety Factor)	478	square meters
Length of Isolator Row	12.3	meters
Non-woven Isolator Row Fabric (20% Safety Factor)	59	square meters
Woven Isolator Row Fabric (20% Safety Factor)	74	square meters
Installed Storage Volume	159	cubic meters

Controlled by Length

Maximum Length = 13 meters

5 rows of 5 chambers
1 row of 4 chambers

Maximum Length = 12.3 meters
Maximum Width = 13.1 meters

610 mm

305 mm

229 mm

TABLE E11 - MC-3500 CUMULATIVE STORAGE BY DEPTH TABLE (SITE 1 - EAST)

Length per Chamber, From Manufacturer (m)	2.184	No Chamber Req'd	28
End Cap Length, From Manufacturer (m)	0.673	No End Caps Req'd	8
L = Total Length of Chambers (m)			
Bottom Width of Chambers, From Manufacturer (m)	1.803		
Dsit form Chamber to Edge of Trench (m)	0.305		
Bottom Width of Trench Width + 2 x dist to edge, W (m)	2.403		
Total Trench Length (actual) Including End Caps =	75.60		
Maximium Trench Volume (m^3)	152.5		

Water Depth (in)	Water Depth (m)	Total Storage Volume Per Chamber (m3)	Volume Per End Cap (m3)	Total Storage Volume in Trench (m3)
0	0.000	0.000	0.000	0.000
1	0.025	0.048	0.016	1.472
2	0.051	0.097	0.032	2.972
3	0.076	0.145	0.048	4.444
4	0.102	0.194	0.064	5.944
5	0.127	0.242	0.081	7.424
6	0.152	0.291	0.097	8.924
7	0.178	0.339	0.113	10.396
8	0.203	0.388	0.129	11.896
9	0.229	0.436	0.145	13.368
10	0.254	0.544	0.172	16.608
11	0.279	0.652	0.199	19.848
12	0.305	0.759	0.225	23.052
13	0.330	0.866	0.252	26.264
14	0.356	0.973	0.278	29.468
15	0.381	1.079	0.305	32.652
16	0.406	1.184	0.331	35.800
17	0.432	1.290	0.357	38.976
18	0.457	1.395	0.383	42.124
19	0.483	1.499	0.409	45.244
20	0.508	1.603	0.434	48.356
21	0.533	1.706	0.460	51.448
22	0.559	1.809	0.485	54.532
23	0.584	1.911	0.510	57.588
24	0.610	2.013	0.539	60.676
25	0.635	2.114	0.559	63.664
26	0.660	2.214	0.583	66.656
27	0.686	2.314	0.607	69.648
28	0.711	2.416	0.631	72.696
29	0.737	2.511	0.655	75.548
30	0.762	2.608	0.678	78.448
31	0.787	2.705	0.701	81.348
32	0.813	2.800	0.723	84.184
33	0.838	2.895	0.745	87.020
34	0.864	2.989	0.767	89.828
35	0.889	3.081	0.788	92.572
36	0.914	3.173	0.809	95.316
37	0.940	3.263	0.830	98.004
38	0.965	3.352	0.850	100.656
39	0.991	3.440	0.871	103.288
40	1.016	3.526	0.890	105.848
41	1.041	3.611	0.910	108.388
42	1.067	3.694	0.929	110.864
43	1.092	3.775	0.948	113.284
44	1.118	3.855	0.966	115.668
45	1.143	3.932	0.985	117.976
46	1.168	4.007	1.003	120.220
47	1.194	4.080	1.020	122.400
48	1.219	4.150	1.037	124.496
49	1.245	4.216	1.054	126.480
50	1.270	4.276	1.071	128.296
51	1.295	4.331	1.088	129.972
52	1.321	4.385	1.104	131.612
53	1.346	4.436	1.120	133.168
54	1.372	4.486	1.136	134.696
55	1.397	4.534	1.152	136.168
56	1.422	4.583	1.169	137.676
57	1.448	4.631	1.185	139.148
58	1.473	4.680	1.201	140.648
59	1.499	4.728	1.217	142.120
60	1.524	4.777	1.233	143.620
61	1.549	4.825	1.249	145.092
62	1.575	4.874	1.265	146.592
63	1.600	4.922	1.281	148.064
64	1.626	4.971	1.298	149.572
65	1.651	5.019	1.314	151.044
66	1.676	5.068	1.330	152.544

Sorted in Assending Order			Sorted in Assending Order		
Water Depth (in)	Water Depth (m)	Total Storage Volume in Trench (m3)	Water Depth (in)	Water Depth (m)	Total Storage Volume in Trench (m3)
0	0.000	0.000	66	1.676	152.54
1	0.025	1.472	65	1.651	151.04
2	0.051	2.972	64	1.626	149.57
3	0.076	4.444	63	1.600	148.06
4	0.102	5.944	62	1.575	146.59
5	0.127	7.424	61	1.549	145.09
6	0.152	8.924	60	1.524	143.62
7	0.178	10.396	59	1.499	142.12
8	0.203	11.896	58	1.473	140.65
9	0.229	13.368	57	1.448	139.15
10	0.254	16.608	56	1.422	137.68
11	0.279	19.848	55	1.397	136.17
12	0.305	23.052	54	1.372	134.70
13	0.330	26.264	53	1.346	133.17
14	0.356	29.468	52	1.321	131.61
15	0.381	32.652	51	1.295	129.97
16	0.406	35.800	50	1.270	128.30
17	0.432	38.976	49	1.245	126.48
18	0.457	42.124	48	1.219	124.50
19	0.483	45.244	47	1.194	122.40
20	0.508	48.356	46	1.168	120.22
21	0.533	51.448	45	1.143	117.98
22	0.559	54.532	44	1.118	115.67
23	0.584	57.588	43	1.092	113.28
24	0.610	60.676	42	1.067	110.86
25	0.635	63.664	41	1.041	108.39
26	0.660	66.656	40	1.016	105.85
27	0.686	69.648	39	0.991	103.29
28	0.711	72.696	38	0.965	100.66
29	0.737	75.548	37	0.940	98.00
30	0.762	78.448	36	0.914	95.32
31	0.787	81.348	35	0.889	92.57
32	0.813	84.184	34	0.864	89.83
33	0.838	87.020	33	0.838	87.02
34	0.864	89.828	32	0.813	84.18
35	0.889	92.572	31	0.787	81.35
36	0.914	95.316	30	0.762	78.45
37	0.940	98.004	29	0.737	75.55
38	0.965	100.656	28	0.711	72.70
39	0.991	103.288	27	0.686	69.65
40	1.016	105.848	26	0.660	66.66
41	1.041	108.388	25	0.635	63.66
42	1.067	110.864	24	0.610	60.68
43	1.092	113.284	23	0.584	57.59
44	1.118	115.668	22	0.559	54.53
45	1.143	117.976	21	0.533	51.45
46	1.168	120.220	20	0.508	48.36
47	1.194	122.400	19	0.483	45.24
48	1.219	124.496	18	0.457	42.12
49	1.245	126.480	17	0.432	38.98
50	1.270	128.296	16	0.406	35.80
51	1.295	129.972	15	0.381	32.65
52	1.321	131.612	14	0.356	29.47
53	1.346	133.168	13	0.330	26.26
54	1.372	134.696	12	0.305	23.05
55	1.397	136.168	11	0.279	19.85
56	1.422	137.676	10	0.254	16.61
57	1.448	139.148	9	0.229	13.37
58	1.473	140.648	8	0.203	11.90
59	1.499	142.120	7	0.178	10.40
60	1.524	143.620	6	0.152	8.92
61	1.549	145.092	5	0.127	7.42
62	1.575	146.592	4	0.102	5.94
63	1.600	148.064	3	0.076	4.44
64	1.626	149.572	2	0.051	2.97
65	1.651	151.044	1	0.025	1.47
66	1.676	152.544	0	0.000	0.00

TABLE E12 - MC-3500 CUMULATIVE STORAGE BY DEPTH TABLE (SITE 2 - WEST)

Length per Chamber, From Manufacturer (m)	2.184
End Cap Length, From Manufacturer (m)	0.673
L = Total Length of Chambers (m)	
Bottom Width of Chambers, From Manufacturer (m)	1.803
Dsit form Chamber to Edge of Trench (m)	0.305
Bottom Width of Trench Width + 2 x dist to edge, W (m)	2.403
Total Trench Length (actual) Including End Caps =	75.60
Maximium Trench Volume (m^3)	155.2

No Chamber Req'd	28
No End Caps Req'd	10

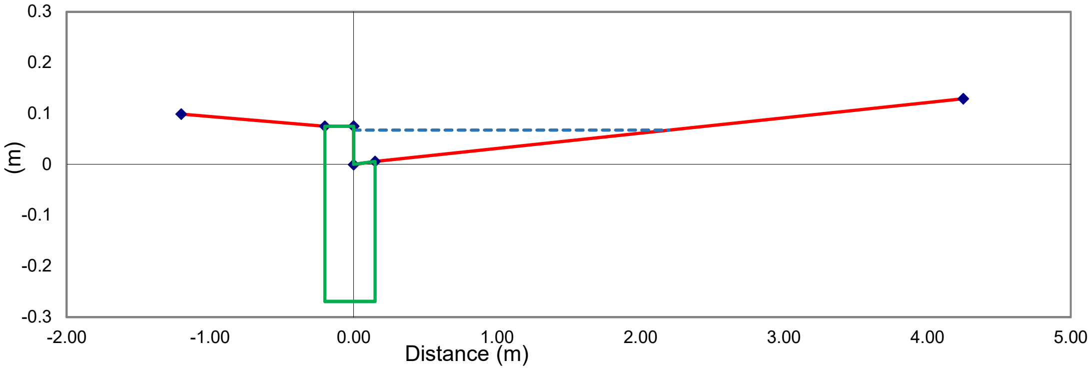
Water Depth (in)	Water Depth (m)	Total Storage Volume Per Chamber (m3)	Volume Per End Cap (m3)	Total Storage Volume in Trench (m3)
0	0.000	0.000	0.000	0.000
1	0.025	0.048	0.016	1.504
2	0.051	0.097	0.032	3.036
3	0.076	0.145	0.048	4.540
4	0.102	0.194	0.064	6.072
5	0.127	0.242	0.081	7.586
6	0.152	0.291	0.097	9.118
7	0.178	0.339	0.113	10.622
8	0.203	0.388	0.129	12.154
9	0.229	0.436	0.145	13.658
10	0.254	0.544	0.172	16.952
11	0.279	0.652	0.199	20.246
12	0.305	0.759	0.225	23.502
13	0.330	0.866	0.252	26.768
14	0.356	0.973	0.278	30.024
15	0.381	1.079	0.305	33.262
16	0.406	1.184	0.331	36.462
17	0.432	1.290	0.357	39.690
18	0.457	1.395	0.383	42.890
19	0.483	1.499	0.409	46.062
20	0.508	1.603	0.434	49.224
21	0.533	1.706	0.460	52.368
22	0.559	1.809	0.485	55.502
23	0.584	1.911	0.510	58.608
24	0.610	2.013	0.539	61.754
25	0.635	2.114	0.559	64.782
26	0.660	2.214	0.583	67.822
27	0.686	2.314	0.607	70.862
28	0.711	2.416	0.631	73.958
29	0.737	2.511	0.655	76.858
30	0.762	2.608	0.678	79.804
31	0.787	2.705	0.701	82.750
32	0.813	2.800	0.723	85.630
33	0.838	2.895	0.745	88.510
34	0.864	2.989	0.767	91.362
35	0.889	3.081	0.788	94.148
36	0.914	3.173	0.809	96.934
37	0.940	3.263	0.830	99.664
38	0.965	3.352	0.850	102.356
39	0.991	3.440	0.871	105.030
40	1.016	3.526	0.890	107.628
41	1.041	3.611	0.910	110.208
42	1.067	3.694	0.929	112.722
43	1.092	3.775	0.948	115.180
44	1.118	3.855	0.966	117.600
45	1.143	3.932	0.985	119.946
46	1.168	4.007	1.003	122.226
47	1.194	4.080	1.020	124.440
48	1.219	4.150	1.037	126.570
49	1.245	4.216	1.054	128.588
50	1.270	4.276	1.071	130.438
51	1.295	4.331	1.088	132.148
52	1.321	4.385	1.104	133.820
53	1.346	4.436	1.120	135.408
54	1.372	4.486	1.136	136.968
55	1.397	4.534	1.152	138.472
56	1.422	4.583	1.169	140.014
57	1.448	4.631	1.185	141.518
58	1.473	4.680	1.201	143.050
59	1.499	4.728	1.217	144.554
60	1.524	4.777	1.233	146.086
61	1.549	4.825	1.249	147.590
62	1.575	4.874	1.265	149.122
63	1.600	4.922	1.281	150.626
64	1.626	4.971	1.298	152.168
65	1.651	5.019	1.314	153.672
66	1.676	5.068	1.330	155.204

Sorted in Assending Order			Sorted in Assending Order		
Water Depth (in)	Water Depth (m)	Total Storage Volume in Trench (m3)	Water Depth (in)	Water Depth (m)	Total Storage Volume in Trench (m3)
0	0.000	0.000	66	1.676	155.20
1	0.025	1.504	65	1.651	153.67
2	0.051	3.036	64	1.626	152.17
3	0.076	4.540	63	1.600	150.63
4	0.102	6.072	62	1.575	149.12
5	0.127	7.586	61	1.549	147.59
6	0.152	9.118	60	1.524	146.09
7	0.178	10.622	59	1.499	144.55
8	0.203	12.154	58	1.473	143.05
9	0.229	13.658	57	1.448	141.52
10	0.254	16.952	56	1.422	140.01
11	0.279	20.246	55	1.397	138.47
12	0.305	23.502	54	1.372	136.97
13	0.330	26.768	53	1.346	135.41
14	0.356	30.024	52	1.321	133.82
15	0.381	33.262	51	1.295	132.15
16	0.406	36.462	50	1.270	130.44
17	0.432	39.690	49	1.245	128.59
18	0.457	42.890	48	1.219	126.57
19	0.483	46.062	47	1.194	124.44
20	0.508	49.224	46	1.168	122.23
21	0.533	52.368	45	1.143	119.95
22	0.559	55.502	44	1.118	117.60
23	0.584	58.608	43	1.092	115.18
24	0.610	61.754	42	1.067	112.72
25	0.635	64.782	41	1.041	110.21
26	0.660	67.822	40	1.016	107.63
27	0.686	70.862	39	0.991	105.03
28	0.711	73.958	38	0.965	102.36
29	0.737	76.858	37	0.940	99.66
30	0.762	79.804	36	0.914	96.93
31	0.787	82.750	35	0.889	94.15
32	0.813	85.630	34	0.864	91.36
33	0.838	88.510	33	0.838	88.51
34	0.864	91.362	32	0.813	85.63
35	0.889	94.148	31	0.787	82.75
36	0.914	96.934	30	0.762	79.80
37	0.940	99.664	29	0.737	76.86
38	0.965	102.356	28	0.711	73.96
39	0.991	105.030	27	0.686	70.86
40	1.016	107.628	26	0.660	67.82
41	1.041	110.208	25	0.635	64.78
42	1.067	112.722	24	0.610	61.75
43	1.092	115.180	23	0.584	58.61
44	1.118	117.600	22	0.559	55.50
45	1.143	119.946	21	0.533	52.37
46	1.168	122.226	20	0.508	49.22
47	1.194	124.440	19	0.483	46.06
48	1.219	126.570	18	0.457	42.89
49	1.245	128.588	17	0.432	39.69
50	1.270	130.438	16	0.406	36.46
51	1.295	132.148	15	0.381	33.26
52	1.321	133.820	14	0.356	30.02
53	1.346	135.408	13	0.330	26.77
54	1.372	136.968	12	0.305	23.50
55	1.397	138.472	11	0.279	20.25
56	1.422	140.014	10	0.254	16.95
57	1.448	141.518	9	0.229	13.66
58	1.473	143.050	8	0.203	12.15
59	1.499	144.554	7	0.178	10.62
60	1.524	146.086	6	0.152	9.12
61	1.549	147.590	5	0.127	7.59
62	1.575	149.122	4	0.102	6.07
63	1.600	150.626	3	0.076	4.54
64	1.626	152.168	2	0.051	3.04
65	1.651	153.672	1	0.025	1.50
66	1.676	155.204	0	0.000	0.00

TABLE E14: MAJOR SYSTEM (STREET SEGMENT) CHARATERISTICS

ROAD AND CURB DATA (For Gutter Grades Up to 8% and Lane Crossfalls Up to 6%)

Asphalt width, W_A (m) =	4.100	*From EOP to CL*
Total Road Width, W_R (m) =	4.250	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.010	*1.0%*
Curb Type =	R-20	*Mountable Curb and Gutter (Former Goulbourn)*
Inlet Type =	S19	*Heavy Duty Fish Type (Round Cover)*
Curb height, H_C (m) =	0.075	
Total curb height, H_T (m) =	0.350	
Curb top width, W_C (m) =	0.200	
Curb bottom width, W (m) =	0.350	
Gutter width, W_G (m) =	0.150	
Gutter slope, S_G (m/m) =	0.040	$S_G = D_G / W_G$
Gutter depth, D_G (m) =	0.006	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.200	*Max Permitted Spread = 1/2 Asphalt width,* $W_A + W_G$
Max Spread on Asphalt, T_{SMAX} (m) =	2.050	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.062	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.068	$D_{MAX} = D_{SMAX} + D_G$



Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.006	0.0001	0.0000	0.0001	0.0000	0.09
5	0.818	0.668	0.020	0.026	0.0043	0.0021	0.0022	0.0028	5.00
10	1.064	0.914	0.027	0.033	0.0084	0.0049	0.0034	0.0066	10.00
50	1.954	1.804	0.054	0.060	0.0399	0.0302	0.0098	0.0402	50.00
100	2.535	2.385	0.072	0.078	0.0788	0.0636	0.0152	0.0848	100.00
125	2.757	2.607	0.078	0.084	0.0981	0.0806	0.0176	0.1074	125.00
150	2.952	2.802	0.084	0.090	0.1174	0.0977	0.0197	0.1303	150.00
175	3.128	2.978	0.089	0.095	0.1367	0.1149	0.0218	0.1532	175.00
200	3.289	3.139	0.094	0.100	0.1559	0.1322	0.0237	0.1763	200.00

**Note: Re-iterate to get Steeet Flow Equal to Q_{A+B} (use Goal Seak Function)*

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = **0.030 m/m**

Gutter Grade = **0.010 m/m**

Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.006	0.000	0
5	0.818	0.668	0.026	0.007	7
10	1.064	0.914	0.033	0.012	12
50	1.954	1.804	0.060	0.015	15
100	2.535	2.385	0.078	0.034	34
125	2.757	2.607	0.084	0.047	47
150	2.952	2.802	0.090	0.051	51
175	3.128	2.978	0.095	0.054	54
200	3.289	3.139	0.100	0.055	55

Note: The Total Spread (T), includes Gutter width, (Wg) plus spread on lane, (Ts) for curb & gutter type curbs

Ponding Information

Ponding Area (trap low) No:	**SP01**
Structure / Inlet No:	**CB1**
Structrue / Inlet Type	**Catcbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600**
Structure Width (mm)	**600**
Max. Ponding Area (m2) =	**269**
Max. Ponding Elev at Spill (m):	**114.00**
Min. Ponding Elev (Lid Elev) (m):	**113.80**
Max. Prism Volume (m3)	17.93
Depth to Inv below ground (m)	**1.400**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	114.15
Inv Elev of Storage Node (m)	112.40
Max Ponding Depth (m) =	0.200

Storage Function for Modelling

Head / Depth (m)	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
0.0000	**0.0000**	0.00	0.00
1.4000	**0.3600**	13.49	13.49
1.6000	**269**	17.93	31.42
1.6001	**0**	0.00	31.42
1.7500	**0**	0.00	31.42
Copy to PCSWMM (depth / area)			

No. of Inlets = 1 catchbasin

Ponding Information

Ponding Area (trap low) No:	**SP02**
Structure / Inlet No:	**CB06**
Structrue / Inlet Type	**Catcbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600**
Structure Width (mm)	**600**
Max. Ponding Area (m2) =	**101**
Max. Ponding Elev at Spill (m):	**114.00**
Min. Ponding Elev (Lid Elev) (m):	**113.90**
Max. Prism Volume (m3)	3.37
Depth to Inv below ground (m)	**1.400**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	114.15
Inv Elev of Storage Node (m)	112.50
Max Ponding Depth (m) =	0.100

Storage Function for Modelling

Head / Depth (m)	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
0.0000	**0.0000**	0.00	0.00
1.4000	**0.3600**	13.50	13.50
1.5000	**101**	3.37	16.87
1.5001	**0**	0.00	16.87
1.6500	**0**	0.00	16.87
Copy to PCSWMM (depth / area)			

No. of Inlets = 1 catchbasin

Ponding Information

Ponding Area (trap low) No:	**SP03**
Structure / Inlet No:	**CBMH218**
Structrue / Inlet Type	**Manhole**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Round**
Structure Length or DIA (mm)	**1200**
Structure Width (mm)	
Max. Ponding Area (m2) =	**173**
Max. Ponding Elev at Spill (m):	**114.20**
Min. Ponding Elev (Lid Elev) (m):	**114.00**
Max. Prism Volume (m3)	11.53
Depth to Inv below ground (m)	**1.400**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	114.35
Inv Elev of Storage Node (m)	112.60
Max Ponding Depth (m) =	0.200

Storage Function for Modelling

Head / Depth (m)	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
0.0000	**0.0000**	0.00	0.00
1.4000	**1.1310**	1.58	1.58
1.6000	**173**	11.53	13.12
1.6001	**0**	0.00	13.12
1.7500	**0**	0.00	13.12
Copy to PCSWMM (depth / area)			

No. of Inlets = 1 catchbasin

Ponding Information

Ponding Area (trap low) No:	**SP04**
Structure / Inlet No:	**CB03**
Structrue / Inlet Type	**Catchbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600**
Structure Width (mm)	**600**
Max. Ponding Area (m2) =	**63**
Max. Ponding Elev at Spill (m):	**114.35**
Min. Ponding Elev (Lid Elev) (m):	**114.25**
Max. Prism Volume (m3)	2.10
Depth to Inv below ground (m)	**0.150**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	114.50
Inv Elev of Storage Node (m)	114.10
Max Ponding Depth (m) =	0.100

Storage Function for Modelling

Head / Depth (m)	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
0.0000	**0.0000**	0.00	0.00
0.1500	**0.3600**	0.05	0.05
0.2500	**63**	2.10	2.15
0.2501	**0**	0.00	2.15
0.4000	**0**	0.00	2.15
Copy to PCSWMM (depth / area)			

No. of Inlets = 1 catchbasin

Ponding Information

Ponding Area (trap low) No:	**SP05**
Structure / Inlet No:	**IN103407**
Structrue / Inlet Type	**Catchbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Round**
Structure Length or DIA (mm)	**1200**
Structure Width (mm)	**600**
Max. Ponding Area (m2) =	**313**
Max. Ponding Elev at Spill (m):	**113.10**
Min. Ponding Elev (Lid Elev) (m):	**113.04**
Max. Prism Volume (m3)	6.26
Depth to Inv below ground (m)	**1.400**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	113.25
Inv Elev of Storage Node (m)	111.64
Max Ponding Depth (m) =	0.060

Storage Function for Modelling

Head / Depth (m)	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
0.0000	**0.0000**	0.00	0.00
1.4000	**1.1310**	1.583362697	1.58
1.4600	**313**	6.26	7.84
1.4601	**0**	0.00	7.84
1.6100	**0**	0.00	7.84
Copy to PCSWMM (depth / area)			

No. of Inlets = 1 catchbasin

Ponding Information

Ponding Area (trap low) No:	**SP06A, SP06B**
Structure / Inlet No:	**IN09007, IN09008**
Structrue / Inlet Type	**Catchbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600**
Structure Width (mm)	**600**
Max. Ponding Area (m2) =	**173**
Max. Ponding Elev at Spill (m):	**112.98**
Min. Ponding Elev (Lid Elev) (m):	**112.88**
Max. Prism Volume (m3)	5.77
Depth to Inv below ground (m)	**1.400**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	113.13
Inv Elev of Storage Node (m)	111.48
Max Ponding Depth (m) =	0.100

Storage Function for Modelling

Head / Depth (m)	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
0.0000	**0.0000**	0.00	0.00
1.4000	**0.3600**	0.50	0.50
1.5000	**173**	5.77	6.27
1.5001	**0**	0.00	6.27
1.6500	**0**	0.00	6.27
Copy to PCSWMM (depth / area)			

No. of Inlets = 2 catchbasin

Ponding Information

Ponding Area (trap low) No:	**SP07**
Structure / Inlet No:	**IN09004**
Structrue / Inlet Type	**Catchbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600**
Structure Width (mm)	**600**
Max. Ponding Area (m2) =	**18**
Max. Ponding Elev at Spill (m):	**113.90**
Min. Ponding Elev (Lid Elev) (m):	**113.83**
Max. Prism Volume (m3)	0.42
Depth to Inv below ground (m)	**1.400**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	114.05
Inv Elev of Storage Node (m)	112.43
Max Ponding Depth (m) =	0.070

Storage Function for Modelling

Head / Depth (m)	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
0.0000	**0.0000**	0.00	0.00
1.4000	**0.3600**	0.50	0.50
1.4700	**18**	0.42	0.92
1.4701	**0**	0.00	0.92
1.6200	**0**	0.00	0.92
Copy to PCSWMM (depth / area)			

No. of Inlets = 1 catchbasin

Ponding Information

Ponding Area (trap low) No:	**SP08**
Structure / Inlet No:	**IN09016**
Structrue / Inlet Type	**Catchbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600**
Structure Width (mm)	**600**
Max. Ponding Area (m2) =	**41**
Max. Ponding Elev at Spill (m):	**111.30**
Min. Ponding Elev (Lid Elev) (m):	**111.00**
Max. Prism Volume (m3)	4.10
Depth to Inv below ground (m)	**1.660**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	111.45
Inv Elev of Storage Node (m)	109.34
Max Ponding Depth (m) =	0.300

Storage Function for Modelling

Head / Depth (m)	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
0.0000	**0.0000**	0.00	0.00
1.6600	**0.3600**	0.60	0.60
1.9600	**41**	4.10	4.70
1.9601	**0**	0.00	4.70
2.1100	**0**	0.00	4.70
Copy to PCSWMM (depth / area)			

No. of Inlets = 1 catchbasin

Ponding Information

Ponding Area (trap low) No:	**SP09**
Structure / Inlet No:	**MHST09012**
Structrue / Inlet Type	**Manhole**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Round**
Structure Length or DIA (mm)	**1200**
Structure Width (mm)	
Max. Ponding Area (m2) =	**44**
Max. Ponding Elev at Spill (m):	**111.30**
Min. Ponding Elev (Lid Elev) (m):	**111.00**
Max. Prism Volume (m3)	4.40
Depth to Inv below ground (m)	**3.510**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	111.45
Inv Elev of Storage Node (m)	107.49
Max Ponding Depth (m) =	0.300

Storage Function for Modelling

Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
0.0000	**0.0000**	0.00	0.00
3.5100	**1.1310**	3.97	3.97
3.8100	**44**	4.40	8.37
3.8101	**0**	0.00	8.37
3.9600	**0**	0.00	8.37
Copy to PCSWMM (depth / area)			

No. of Inlets = 1 manhole

Ponding Information

Ponding Area (trap low) No:	**SP10**
Structure / Inlet No:	**AD23**
Structrue / Inlet Type	**Catcbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600**
Structure Width (mm)	**600**
Max. Ponding Area (m2) =	**2927**
Max. Ponding Elev at Spill (m):	**111.50**
Min. Ponding Elev (Lid Elev) (m):	**111.20**
Max. Prism Volume (m3)	292.70
Depth to Inv below ground (m)	**0.150**
Allowance for Overland Flow (m)	**0.150**
Ponding Rim Elevation (m)	111.65
Inv Elev of Storage Node (m)	111.05
Max Ponding Depth (m) =	0.300

Storage Function for Modelling

Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
0.0000	**0.0000**	0.00	0.00
0.1500	**0.3600**	0.05	0.05
0.4500	**2927**	292.70	292.75
0.4501	**0**	0.00	292.75
0.6000	**0**	0.00	292.75
Copy to PCSWMM (depth / area)			

No. of Inlets = 6 catchbasins

Appendix F – Stormceptor Sizing

Detailed Report from PCSWMM for Stormceptor

Product Sheet

Standard Model Detail

Stormceptor®

FORTERRA™

Stormceptor® EF Sizing Report

ESTIMATED NET ANNNUAL SEDIMENT (TSS) LOAD REDUCTION STORMCEPTOR®

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA MACDONALD-CARTIER INT'L AP
NCDC Rainfall Station Id:	6000
Years of Rainfall Data:	37

Project Name:	5924 Hazeldean
Project Number:	20329
Designer Name:	Kent Campbell
Designer Company:	Forterra Pipe & Products
Designer Email/Phone:	kent.campbell@forterrabp.com
EOR Name:	Moe Ghadban
EOR Company:	EXP
EOR Email/Phone:	

Site Name:	EF

Drainage Area (ha):	0.87
% Imperviousness:	71.30

Runoff Coefficient 'c': 0.72

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Require Hydrocarbon Spill Capture?	No
Upstream Flow Control?	No
Required Water Quality Runoff Volume Capture (%):	85.00
Estimated Water Quality Flow Rate (L/s):	16.17
Peak Conveyance (maximum) Flow Rate (L/s):	50.30
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	75
EF6	82
EF8	86
EF10	89
EF12	90

Recommended Stormceptor EF Model:	**EF6**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**82**
Water Quality Runoff Volume Capture (%):	**> 90**

imbrium

THIRD-PARTY TESTING AND VERIFICATION

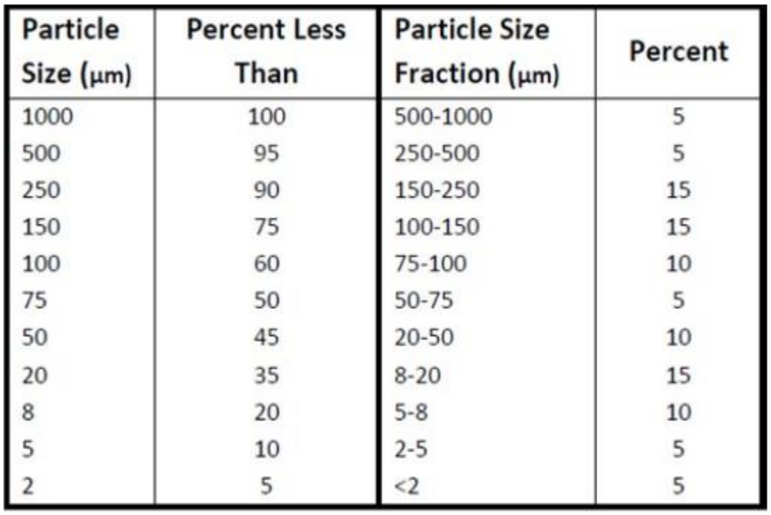
►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

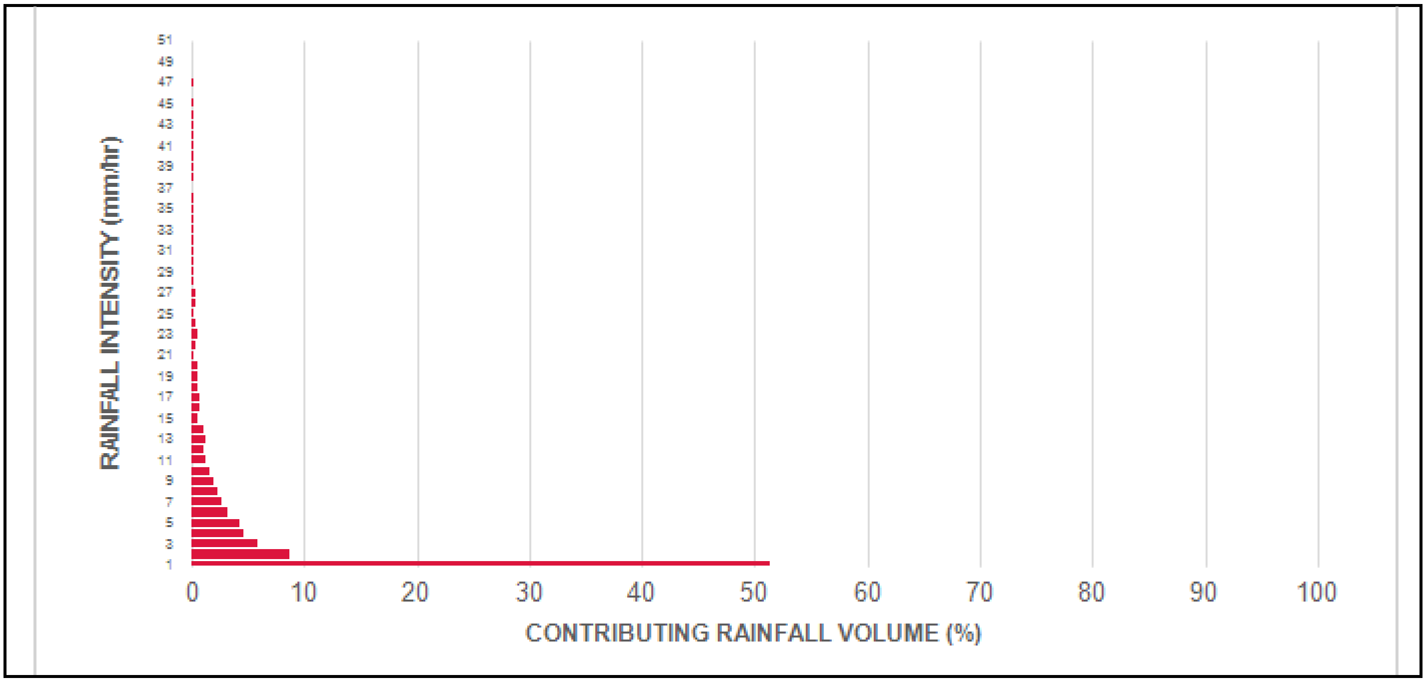


Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

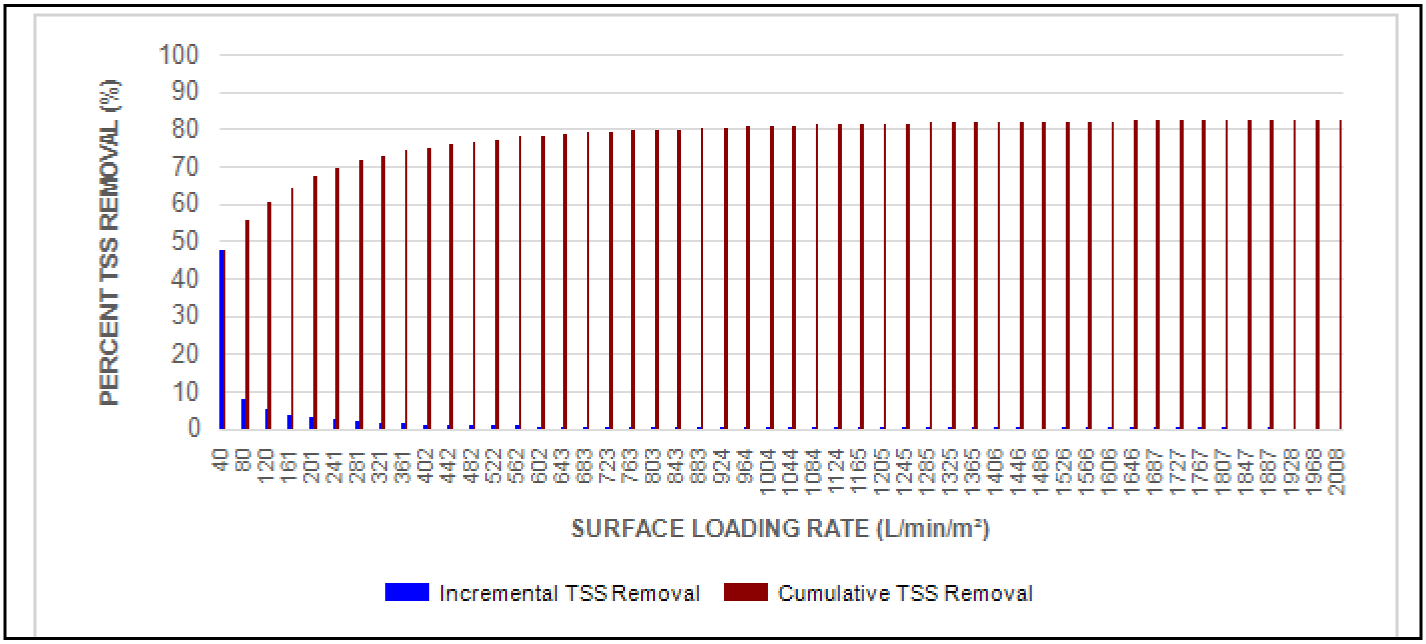
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m^2)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	51.3	51.3	1.76	106.0	40.0	93	47.7	47.7
2	8.7	60.0	3.52	211.0	80.0	89	7.7	55.5
3	5.8	65.8	5.28	317.0	120.0	85	4.9	60.4
4	4.6	70.4	7.04	422.0	161.0	80	3.7	64.1
5	4.2	74.6	8.80	528.0	201.0	76	3.2	67.3
6	3.2	77.8	10.56	634.0	241.0	72	2.3	69.6
7	2.6	80.4	12.32	739.0	281.0	69	1.8	71.4
8	2.4	82.8	14.08	845.0	321.0	65	1.6	72.9
9	1.9	84.7	15.84	951.0	361.0	62	1.2	74.1
10	1.6	86.3	17.60	1056.0	402.0	58	0.9	75.0
11	1.3	87.6	19.36	1162.0	442.0	58	0.7	75.8
12	1.1	88.7	21.12	1267.0	482.0	57	0.6	76.4
13	1.3	90.0	22.88	1373.0	522.0	57	0.7	77.1
14	1.1	91.1	24.64	1479.0	562.0	56	0.6	77.8
15	0.6	91.7	26.40	1584.0	602.0	56	0.3	78.1
16	0.8	92.5	28.16	1690.0	643.0	56	0.4	78.5
17	0.7	93.2	29.92	1795.0	683.0	56	0.4	78.9
18	0.5	93.7	31.68	1901.0	723.0	55	0.3	79.2
19	0.6	94.3	33.44	2007.0	763.0	55	0.3	79.5
20	0.5	94.8	35.21	2112.0	803.0	55	0.3	79.8
21	0.2	95.0	36.97	2218.0	843.0	55	0.1	79.9
22	0.4	95.4	38.73	2324.0	883.0	55	0.2	80.1
23	0.5	95.9	40.49	2429.0	924.0	54	0.3	80.4
24	0.4	96.3	42.25	2535.0	964.0	54	0.2	80.6
25	0.1	96.4	44.01	2640.0	1004.0	54	0.1	80.7

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.3	96.7	45.77	2746.0	1044.0	55	0.2	80.8
27	0.4	97.1	47.53	2852.0	1084.0	55	0.2	81.1
28	0.2	97.3	49.29	2957.0	1124.0	56	0.1	81.2
29	0.2	97.5	51.05	3063.0	1165.0	56	0.1	81.3
30	0.2	97.7	52.81	3168.0	1205.0	57	0.1	81.4
31	0.1	97.8	54.57	3274.0	1245.0	57	0.1	81.5
32	0.2	98.0	56.33	3380.0	1285.0	58	0.1	81.6
33	0.1	98.1	58.09	3485.0	1325.0	58	0.1	81.6
34	0.1	98.2	59.85	3591.0	1365.0	59	0.1	81.7
35	0.1	98.3	61.61	3697.0	1406.0	59	0.1	81.7
36	0.2	98.5	63.37	3802.0	1446.0	57	0.1	81.9
37	0.0	98.5	65.13	3908.0	1486.0	56	0.0	81.9
38	0.1	98.6	66.89	4013.0	1526.0	54	0.1	81.9
39	0.1	98.7	68.65	4119.0	1566.0	53	0.1	82.0
40	0.1	98.8	70.41	4225.0	1606.0	52	0.1	82.0
41	0.1	98.9	72.17	4330.0	1646.0	50	0.1	82.1
42	0.1	99.0	73.93	4436.0	1687.0	49	0.0	82.1
43	0.2	99.2	75.69	4541.0	1727.0	48	0.1	82.2
44	0.1	99.3	77.45	4647.0	1767.0	47	0.0	82.3
45	0.1	99.4	79.21	4753.0	1807.0	46	0.0	82.3
46	0.0	99.4	80.97	4858.0	1847.0	45	0.0	82.3
47	0.1	99.5	82.73	4964.0	1887.0	44	0.0	82.4
48	0.0	99.5	84.49	5070.0	1928.0	43	0.0	82.4
49	0.0	99.5	86.25	5175.0	1968.0	42	0.0	82.4
50	0.0	99.5	88.01	5281.0	2008.0	41	0.0	82.4
Estimated Net Annual Sediment (TSS) Load Reduction =								**82 %**

RAINFALL DATA FROM OTTAWA MACDONALD-CARTIER INT'L AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

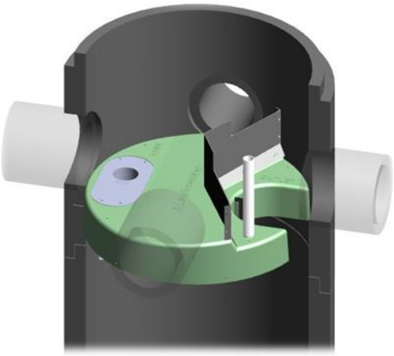
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

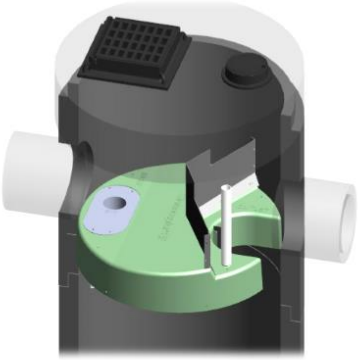
DESIGN FLEXIBILITY

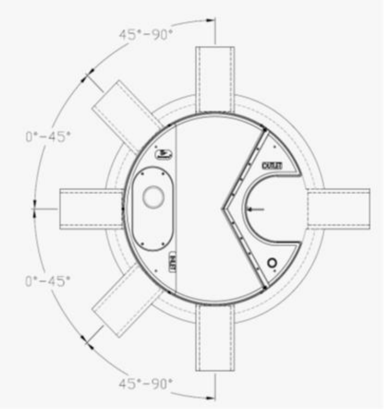
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	197	52	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	348	92	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	545	144	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	874	231	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	1219	322	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

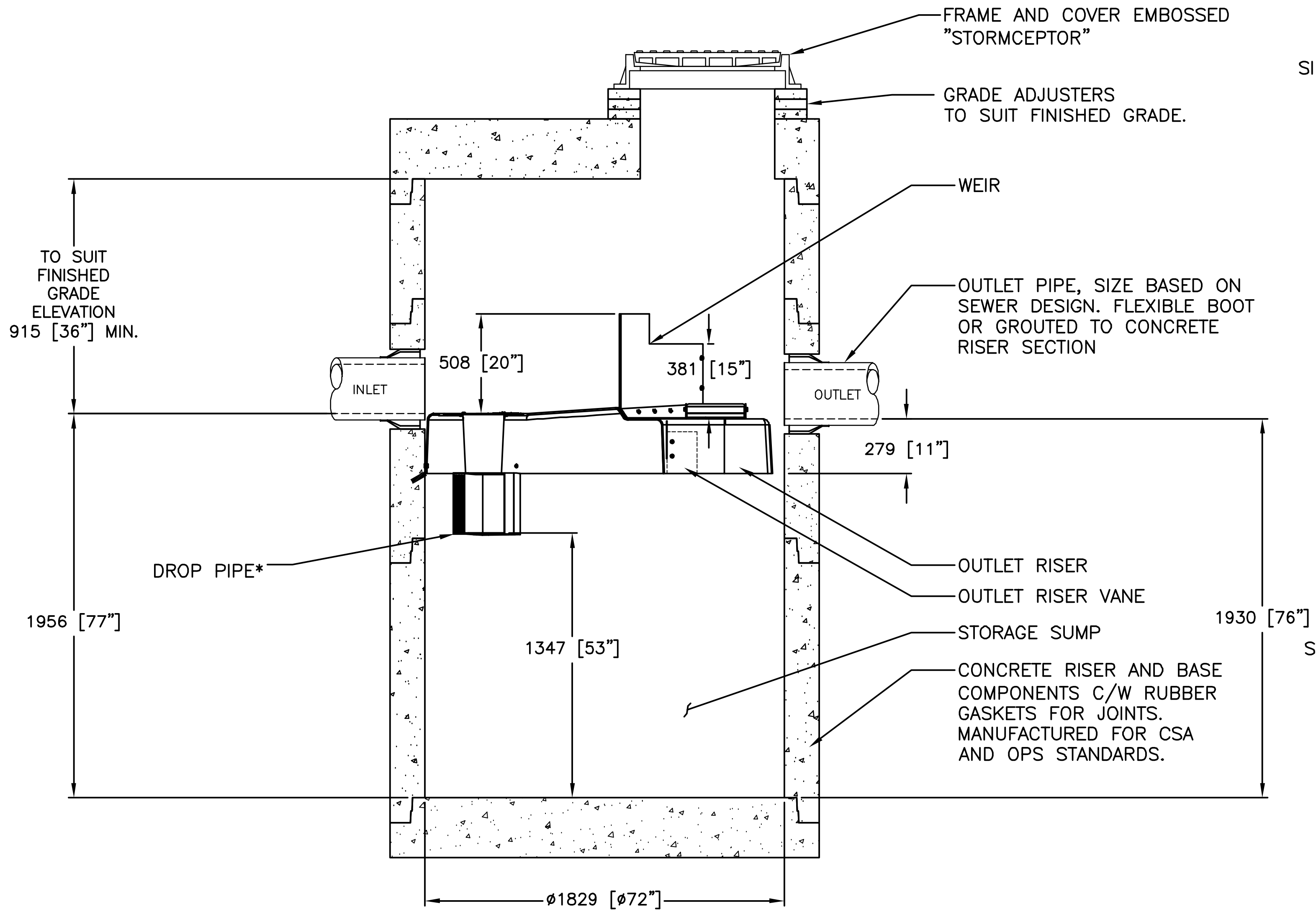
STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

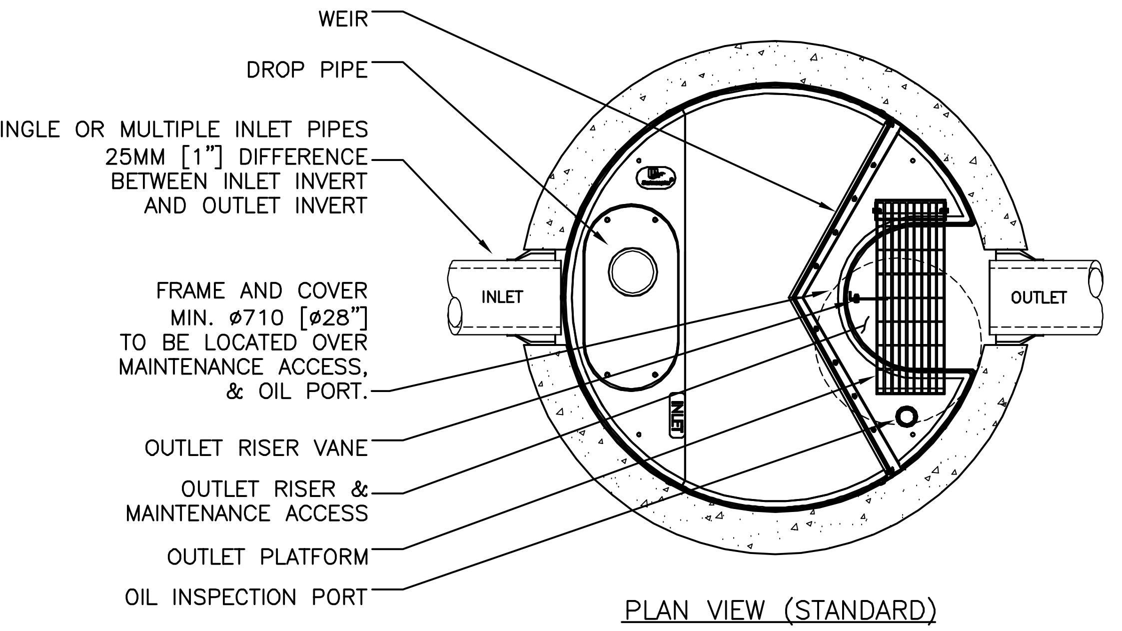
Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EF

SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL
1	70	660	46	1320	48	1980	35
30	70	690	46	1350	48	2010	34
60	67	720	45	1380	49	2040	34
90	63	750	45	1410	49	2070	33
120	61	780	45	1440	48	2100	33
150	58	810	45	1470	47	2130	32
180	56	840	45	1500	46	2160	32
210	54	870	45	1530	45	2190	31
240	53	900	45	1560	44	2220	31
270	52	930	44	1590	43	2250	30
300	51	960	44	1620	42	2280	30
330	50	990	44	1650	42	2310	30
360	49	1020	44	1680	41	2340	29
390	48	1050	45	1710	40	2370	29
420	48	1080	45	1740	39	2400	29
450	48	1110	45	1770	39	2430	28
480	47	1140	46	1800	38	2460	28
510	47	1170	46	1830	37	2490	28
540	47	1200	47	1860	37	2520	27
570	46	1230	47	1890	36	2550	27
600	46	1260	47	1920	36	2580	27
630	46	1290	48	1950	35		

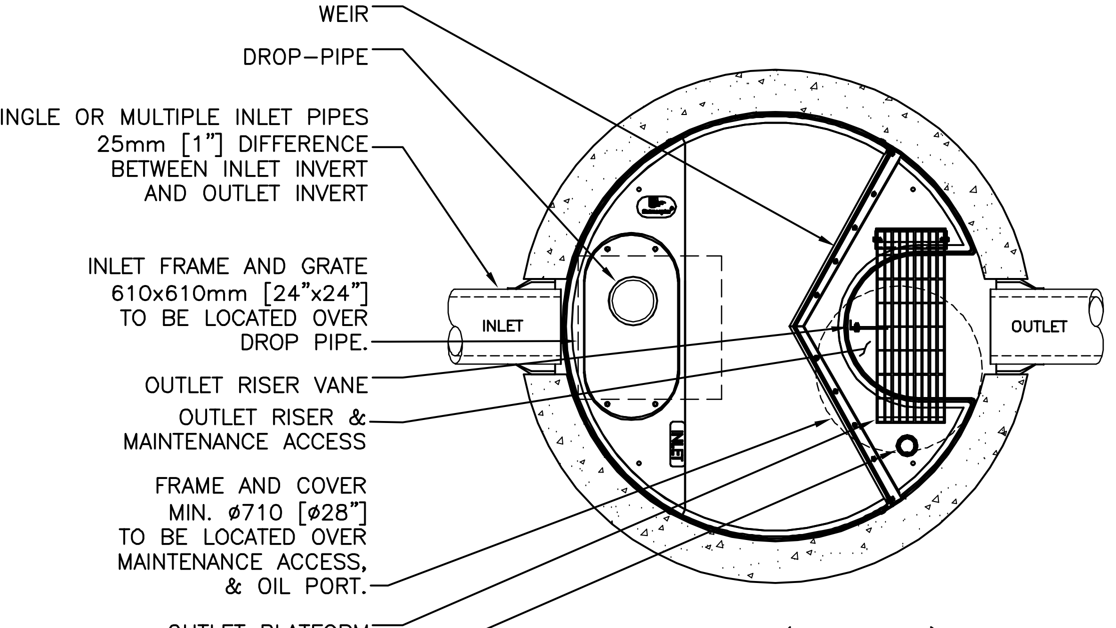
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF6 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO6 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF6
STRUCTURE ID	*
WATER QUALITY FLOW RATE (L/s)	*
PEAK FLOW RATE (L/s)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
DRAINAGE AREA (HA)	*
DRAINAGE AREA IMPERVIOUSNESS (%)	*

PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Imbrium Systems ("Imbrium"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Imbrium. Failure to comply is done at the user's own risk and Imbrium expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Imbrium immediately for re-evaluation of the design. Imbrium accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

MARK	DATE	REVISION DESCRIPTION	BY
0	05/26/17	INITIAL RELEASE	JSK
1	6/8/18	OUTLET PLATFORM	JSK
#####	#####	#####	#####
#####	#####	#####	#####
#####	#####	#####	#####

SCALE = NTS

Stormceptor® EF

imbrium®

407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9
TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS
Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 | Canadian Patent No. 2,009,208 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 | China Patent No. 1,168,439 | Denmark DK 711,879 | German DE 69,534,021 | Indonesian Patent No 16,688 | Japan Patent No. 9-11476 (Pending) | Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. PI9701737 (Pending) | New Zealand Patent No. 314646 | United States Patent No. 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

DATE: 5/26/2017	
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: SP
PROJECT No.: EF6	SEQUENCE No.: *
SHEET: 1 OF 1	

I:\IMBRIUM\PRODUCTS\STORMCEPTOR EF\40 DRAWINGS & DETAILS\STANDARD DETAILS\EF6-DETAIL.DWG 4/12/2019 10:50 AM

Appendix G – PCSWMM Data

Input File (Details) for 100-yr 3hr Chicago Storm

Output File (Status) for 100-yr 3hr Chicago Storm

PCSWMM Report Files

```
[TITLE]
Updated PCSWMM Model to Include offsite Storm Sewer Analysis
Full Dual Drainage Model
J Fitzpatrick
Nov 1, 2019
{Jason Fitzpatrick - 2019.10.25} IN09006-MAJ


[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO
START_DATE           09/26/2018
START_TIME           00:00:00
REPORT_START_DATE    09/26/2018
REPORT_START_TIME    00:00:00
END_DATE             09/26/2018
END_TIME             06:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         5
INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         1.167
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              2

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
Chicago_3h_100yr INTENSITY 0:10   1.0    TIMESERIES Chicago_3h_100yr
Chicago_3h_2year INTENSITY 0:10   1.0    TIMESERIES Chicago_3h_2yr
Chicago_3h_5year INTENSITY 0:10   1.0    TIMESERIES Chicago_3h_5year

[SUBCATCHMENTS]
;;                                                Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
;OFFSITE
ES01_1           Chicago_3h_100yr IN103407         0.3255   67.777   57       1.5      0
;OFFSITE
ES02_1           Chicago_3h_100yr IN09004-MAJ      0.0884   31.285   48.8     1        0
;OFFSITE
ES02_2           Chicago_3h_100yr IN09003-MAJ      0.0477   44.983   36.7     1        0
;OFFSITE
ES03_1           Chicago_3h_100yr IN09005-MAJ      0.2801   55.552   132.1    1        0
;OFFSITE
ES03_2           Chicago_3h_100yr IN09006-MAJ      0.1878   50.126   114.5    1        0
;OFFSITE
ES04_1           Chicago_3h_100yr IN09008          0.2099   59.961   98.1     0.5      0
;OFFSITE
ES04_2           Chicago_3h_100yr IN09007          0.1951   55.139   98       0.5      0
;OFFSITE
ES05_1           Chicago_3h_100yr IN09009-MAJ      0.1906   52.183   91.6     0.5      0
;OFFSITE
ES05_2           Chicago_3h_100yr IN09010-MAJ      0.1843   54.377   89.9     0.5      0
;OFFSITE
ES06_1           Chicago_3h_100yr IN09011-MAJ      0.2778   59.044   134.9    0.5      0
;OFFSITE
ES06_2           Chicago_3h_100yr IN09012-MAJ      0.2407   55.203   123.4    0.5      0
;OFFSITE
ES07             Chicago_3h_100yr IN09013-MAJ      0.2147   55.576   96.7     0.5      0
;OFFSITE
ES08_1           Chicago_3h_100yr IN09022-MAJ      0.1217   44.675   85.1     0.5      0
;OFFSITE
ES08_2           Chicago_3h_100yr IN09023-MAJ      0.0863   29.627   47.2     0.5      0
;OFFSITE
ES09_1           Chicago_3h_100yr IN09024-MAJ      0.1738   53.85    96.6     0.5      0
;OFFSITE
ES09_2           Chicago_3h_100yr IN09025-MAJ      0.1796   40.275   125.6    0.5      0
;OFFSITE
ES10_1           Chicago_3h_100yr IN09026-MAJ      0.2118   50.248   108.1    0.5      0
;OFFSITE
ES10_2           Chicago_3h_100yr IN09027-MAJ      0.1837   48.55    110      0.5      0
;OFFSITE
ES11_1           Chicago_3h_100yr IN09029-MAJ      0.1845   55.004   88.3     0.5      0
;OFFSITE
ES11_2           Chicago_3h_100yr IN09028-MAJ      0.126    44.553   71.2     0.5      0
;OFFSITE
ES12_1           Chicago_3h_100yr MHST09022        0.1929   56.58    92.7     0.5      0
;OFFSITE
ES12_2           Chicago_3h_100yr IN09031-MAJ      0.1553   55.364   77.3     0.5      0
```

```
;OFFSITE
ES13_1           Chicago_3h_100yr MHST09023        0.1559   56.354   69.9     0.5      0
;OFFSITE
ES13_2           Chicago_3h_100yr MHST09023        0.1672   53.557   85.3     0.5      0
;OFFSITE
ES14_1           Chicago_3h_100yr IN09014-MAJ      0.1317   42.85    97.6     0.5      0
;OFFSITE
ES14_2           Chicago_3h_100yr IN09015-MAJ      0.181    60.093   88.7     0.5      0
;OFFSITE
ES15_1           Chicago_3h_100yr IN09016          0.0733   37.055   75.6     0.5      0
;OFFSITE
ES15_2           Chicago_3h_100yr MHST09012        0.1226   57.086   70.5     0.5      0
;OFFSITE
ES16_1           Chicago_3h_100yr IN09034-MAJ      0.1      35.738   107.5    1.5      0
;OFFSITE
ES16_2           Chicago_3h_100yr IN09035-MAJ      0.1733   26.876   100.2    1.5      0
;OFFSITE
ES17             Chicago_3h_100yr IN09034-MAJ      0.135    41.718   78.5     2        0
;OFFSITE
ES18             Chicago_3h_100yr IN09021-MAJ      0.2378   40.757   93.3     2        0
;OFFSITE
ES19             Chicago_3h_100yr IN09019-MAJ      0.0992   63.062   46.4     0.5      0
;OFFSITE
ES20             Chicago_3h_100yr IN09020-MAJ      0.0692   33.177   32.3     0.5      0
;OFFSITE
ES21_1           Chicago_3h_100yr IN09018-MAJ      0.0791   58.867   36.8     0.5      0
;OFFSITE
ES21_3           Chicago_3h_100yr IN09020-MAJ      0.129    42.562   60.8     0.5      0
;OFFSITE
ES21_4           Chicago_3h_100yr IN09019-MAJ      0.1398   62.819   60.3     0.5      0
;OFFSITE
ES21_5           Chicago_3h_100yr IN09017-MAJ      0.0865   54.717   36.2     0.5      0
;OFFSITE
ES22_1           Chicago_3h_100yr IN09016          0.1847   62.634   74.8     0.5      0
;OFFSITE
ES22_2           Chicago_3h_100yr MHST09012        0.218    55.462   100.5    0.5      0
;OFFSITE
ES23             Chicago_3h_100yr IN45587          0.1837   32.553   22.5     1        0
;OFFSITE
ES24             Chicago_3h_100yr IN45588          0.0806   27.007   15.8     1        0
;OFFSITE
ES25             Chicago_3h_100yr IN45589          0.1875   27.249   16.6     1        0
;OFFSITE
ES26             Chicago_3h_100yr IN45590          0.1086   32.212   17.7     1        0
;OFFSITE
ES27             Chicago_3h_100yr IN45575          0.3696   13.466   52.4     1        0
;OFFSITE
ES28             Chicago_3h_100yr IN45570          0.3422   21.796   50.1     1        0
;OFFSITE
ES29             Chicago_3h_100yr IN45569          0.3256   26.731   46       1        0
;OFFSITE
ES30             Chicago_3h_100yr IN45572          0.2289   28.571   47.4     1        0
;OFFSITE
```

```
ES31             Chicago_3h_100yr IN45577          0.1922   24.966   48.3     1        0
;OFFSITE
ES32             Chicago_3h_100yr IN07998          0.7854   19.912   57.1     1        0
;OFFSITE
ES33             Chicago_3h_100yr IN45573          0.1591   31.774   51.3     1        0
;OFFSITE
ES34             Chicago_3h_100yr IN45574          0.4099   10.084   54.3     1        0
;OFFSITE
ES35             Chicago_3h_100yr IN45566          0.967    14.685   66.5     1        0
;OFFSITE
ES36             Chicago_3h_100yr IN09032-MAJ      0.215    32.12    113.8    0.5      0
;ONSITE
S01              Chicago_3h_100yr CB06             0.1752   80.668   58       1        0
;ONSITE
S02              Chicago_3h_100yr CB01             0.1483   88.226   51.7     1        0
;ONSITE
S03              Chicago_3h_100yr CB01             0.0178   14.522   80.9     1        0
;ONSITE
S04              Chicago_3h_100yr CB03             0.2001   79.11    70.2     1        0
;ONSITE
S05              Chicago_3h_100yr 218              0.1264   73.958   53.1     1        0
;ONSITE
S06              Chicago_3h_100yr CBT03            0.0617   35.843   52.3     1        0
;ONSITE
S07              Chicago_3h_100yr CBE01            0.0415   37.942   54.6     1        0
;ONSITE
S08_1            Chicago_3h_100yr CBT14            0.0405   59.421   57.857   1        0
;ONSITE
S08_2            Chicago_3h_100yr CBE04            0.0548   54.842   78.286   1        0
;ONSITE
S09              Chicago_3h_100yr IN103407         0.0806   71.197   94.8     1        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
ES01_1           0.011      0.25       1.57       4.67       10         OUTLET
ES02_1           0.011      0.25       1.57       4.67       10         OUTLET
ES02_2           0.011      0.25       1.57       4.67       10         OUTLET
ES03_1           0.011      0.25       1.57       4.67       10         OUTLET
ES03_2           0.011      0.25       1.57       4.67       10         OUTLET
ES04_1           0.011      0.25       1.57       4.67       10         OUTLET
ES04_2           0.011      0.25       1.57       4.67       10         OUTLET
ES05_1           0.011      0.25       1.57       4.67       10         OUTLET
ES05_2           0.011      0.25       1.57       4.67       10         OUTLET
ES06_1           0.011      0.25       1.57       4.67       10         OUTLET
ES06_2           0.011      0.25       1.57       4.67       10         OUTLET
ES07             0.011      0.25       1.57       4.67       10         OUTLET
ES08_1           0.011      0.25       1.57       4.67       10         OUTLET
ES08_2           0.011      0.25       1.57       4.67       10         OUTLET
ES09_1           0.011      0.25       1.57       4.67       10         OUTLET
ES09_2           0.011      0.25       1.57       4.67       10         OUTLET
ES10_1           0.011      0.25       1.57       4.67       10         OUTLET
ES10_2           0.011      0.25       1.57       4.67       10         OUTLET
```

```
ES11_1           0.011      0.25       1.57       4.67       10         OUTLET
ES11_2           0.011      0.25       1.57       4.67       10         OUTLET
ES12_1           0.011      0.25       1.57       4.67       10         OUTLET
ES12_2           0.011      0.25       1.57       4.67       10         OUTLET
ES13_1           0.011      0.25       1.57       4.67       10         OUTLET
ES13_2           0.011      0.25       1.57       4.67       10         OUTLET
ES14_1           0.011      0.25       1.57       4.67       10         OUTLET
ES14_2           0.011      0.25       1.57       4.67       10         OUTLET
ES15_1           0.011      0.25       1.57       4.67       10         OUTLET
ES15_2           0.011      0.25       1.57       4.67       10         OUTLET
ES16_1           0.011      0.25       1.57       4.67       10         OUTLET
ES16_2           0.011      0.25       1.57       4.67       10         OUTLET
ES17             0.011      0.25       1.57       4.67       10         OUTLET
ES18             0.011      0.25       1.57       4.67       10         OUTLET
ES19             0.011      0.25       1.57       4.67       10         OUTLET
ES20             0.011      0.25       1.57       4.67       10         OUTLET
ES21_1           0.011      0.25       1.57       4.67       10         OUTLET
ES21_3           0.011      0.25       1.57       4.67       10         OUTLET
ES21_4           0.011      0.25       1.57       4.67       10         OUTLET
ES21_5           0.011      0.25       1.57       4.67       10         OUTLET
ES22_1           0.011      0.25       1.57       4.67       10         OUTLET
ES22_2           0.011      0.25       1.57       4.67       10         OUTLET
ES23             0.011      0.25       1.57       4.67       10         OUTLET
ES24             0.011      0.25       1.57       4.67       10         OUTLET
ES25             0.011      0.25       1.57       4.67       10         OUTLET
ES26             0.011      0.25       1.57       4.67       10         OUTLET
ES27             0.011      0.25       1.57       4.67       10         OUTLET
ES28             0.011      0.25       1.57       4.67       10         OUTLET
ES29             0.011      0.25       1.57       4.67       10         OUTLET
ES30             0.011      0.25       1.57       4.67       10         OUTLET
ES31             0.011      0.25       1.57       4.67       10         OUTLET
ES32             0.011      0.25       1.57       4.67       10         OUTLET
ES33             0.011      0.25       1.57       4.67       10         OUTLET
ES34             0.011      0.25       1.57       4.67       10         OUTLET
ES35             0.011      0.25       1.57       4.67       10         OUTLET
ES36             0.011      0.25       1.57       4.67       10         OUTLET
S01              0.011      0.25       1.57       4.67       20         OUTLET
S02              0.011      0.25       1.57       4.67       20         OUTLET
S03              0.011      0.25       1.57       4.67       20         OUTLET
S04              0.011      0.25       1.57       4.67       20         OUTLET
S05              0.011      0.25       1.57       4.67       20         OUTLET
S06              0.011      0.25       1.57       4.67       20         OUTLET
S07              0.011      0.25       1.57       4.67       20         OUTLET
S08_1            0.011      0.25       1.57       4.67       20         OUTLET
S08_2            0.011      0.25       1.57       4.67       20         OUTLET
S09              0.011      0.25       1.57       4.67       20         OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil  
;;-------------- ---------- ---------- ---------- ---------- ----------
ES01_1           76.2       13.2       4.14       7          0         
ES02_1           76.2       13.2       4.14       7          0         
ES02_2           76.2       13.2       4.14       7          0         
```

```
ES03_1           76.2       13.2       4.14       7          0         
ES03_2           76.2       13.2       4.14       7          0         
ES04_1           76.2       13.2       4.14       7          0         
ES04_2           76.2       13.2       4.14       7          0         
ES05_1           76.2       13.2       4.14       7          0         
ES05_2           76.2       13.2       4.14       7          0         
ES06_1           76.2       13.2       4.14       7          0         
ES06_2           76.2       13.2       4.14       7          0         
ES07             76.2       13.2       4.14       7          0         
ES08_1           76.2       13.2       4.14       7          0         
ES08_2           76.2       13.2       4.14       7          0         
ES09_1           76.2       13.2       4.14       7          0         
ES09_2           76.2       13.2       4.14       7          0         
ES10_1           76.2       13.2       4.14       7          0         
ES10_2           76.2       13.2       4.14       7          0         
ES11_1           76.2       13.2       4.14       7          0         
ES11_2           76.2       13.2       4.14       7          0         
ES12_1           76.2       13.2       4.14       7          0         
ES12_2           76.2       13.2       4.14       7          0         
ES13_1           76.2       13.2       4.14       7          0         
ES13_2           76.2       13.2       4.14       7          0         
ES14_1           76.2       13.2       4.14       7          0         
ES14_2           76.2       13.2       4.14       7          0         
ES15_1           76.2       13.2       4.14       7          0         
ES15_2           76.2       13.2       4.14       7          0         
ES16_1           76.2       13.2       4.14       7          0         
ES16_2           76.2       13.2       4.14       7          0         
ES17             76.2       13.2       4.14       7          0         
ES18             76.2       13.2       4.14       7          0         
ES19             76.2       13.2       4.14       7          0         
ES20             76.2       13.2       4.14       7          0         
ES21_1           76.2       13.2       4.14       7          0         
ES21_3           76.2       13.2       4.14       7          0         
ES21_4           76.2       13.2       4.14       7          0         
ES21_5           76.2       13.2       4.14       7          0         
ES22_1           76.2       13.2       4.14       7          0         
ES22_2           76.2       13.2       4.14       7          0         
ES23             76.2       13.2       4.14       7          0         
ES24             76.2       13.2       4.14       7          0         
ES25             76.2       13.2       4.14       7          0         
ES26             76.2       13.2       4.14       7          0         
ES27             76.2       13.2       4.14       7          0         
ES28             76.2       13.2       4.14       7          0         
ES29             76.2       13.2       4.14       7          0         
ES30             76.2       13.2       4.14       7          0         
ES31             76.2       13.2       4.14       7          0         
ES32             76.2       13.2       4.14       7          0         
ES33             76.2       13.2       4.14       7          0         
ES34             76.2       13.2       4.14       7          0         
ES35             76.2       13.2       4.14       7          0         
ES36             76.2       13.2       4.14       7          0         
S01              76.2       13.2       4.14       7          0         
S02              76.2       13.2       4.14       7          0         
```

```
S03              76.2       13.2       4.14       7          0
S04              76.2       13.2       4.14       7          0
S05              76.2       13.2       4.14       7          0
S06              76.2       13.2       4.14       7          0
S07              76.2       13.2       4.14       7          0
S08_1            76.2       13.2       4.14       7          0
S08_2            76.2       13.2       4.14       7          0
S09              76.2       13.2       4.14       7          0

[JUNCTIONS]
;;               Invert     Max.       Init.      Surcharge  Ponded
;;Name           Elev.      Depth      Depth      Depth      Area
;;-------------- ---------- ---------- ---------- ---------- ----------
200              111.136    2.764      0          0          0
201              111.343    2.537      0          0          0
202              111.456    2.444      0          0          0
203              111.608    2.542      0          0          0
204              111.698    2.352      0          0          0
205              111.876    2.254      0          0          0
206              112.417    2.303      0          0          0
207              113.284    1.966      0          0          0
208              112.565    1.935      0          0          0
210              112.16     2.12       0          0          0
211              111.81     2.24       0          0          0
212              111.42     2.7        0          0          0
213              112.824    1.496      0          0          0
215              112.24     2.26       0          0          0
216              111.324    2.506      0          0          0
217              113.462    1.498      0          0          0
218              112.736    1.264      0          0          0
219              111.302    2.474      0          0          0
CB03             113.104    1.146      0          0          0
CB05             114.004    1.056      0          0          0
CBE01            114.25     1.06       0          0          0
CBE04            113.9      1          0          0          0
CBT02            114.113    1.057      0          0          0
CBT03            113.784    1.056      0          0          0
CBT05            113.786    1.024      0          0          0
CBT06            113.68     1.04       0          0          0
CBT07            113.614    1.046      0          0          0
CBT08            113.516    1.164      0          0          0
CBT09            113.388    1.082      0          0          0
CBT10            113.276    1.074      0          0          0
CBT11            112.864    1.436      0          0          0
CBT12            112.886    1.394      0          0          0
CBT13            112.917    1.143      0          0          0
CBT14            112.945    1.075      0          0          0
IN07998          110.43     1.402      0          0          0
IN09003-MAJ      113.93     0.15       0          0          0
IN09004-MAJ      113.83     0.15       0          0          0
IN09005-MAJ      113.22     0.15       0          0          0
IN09006-MAJ      113.22     0.15       0          0          0
IN09009-MAJ      112.75     0.15       0          0          0
```

```
IN09010-MAJ      112.75     0.15       0          0          0
IN09011-MAJ      112.21     0.15       0          0          0
IN09012-MAJ      112.21     0.15       0          0          0
IN09013-MAJ      111.78     0.15       0          0          0
IN09014-MAJ      111.41     0.15       0          0          0
IN09015-MAJ      111.41     0.15       0          0          0
IN09017-MAJ      111.56     0.15       0          0          0
IN09018-MAJ      111.56     0.15       0          0          0
IN09019-MAJ      111.33     0.15       0          0          0
IN09020-MAJ      111.33     0.15       0          0          0
IN09021-MAJ      111        0.15       0          0          0
IN09022-MAJ      113.94     0.15       0          0          0
IN09023-MAJ      113.75     0.15       0          0          0
IN09024-MAJ      113.15     0.15       0          0          0
IN09025-MAJ      113.13     0.15       0          0          0
IN09026-MAJ      112.66     0.15       0          0          0
IN09027-MAJ      112.68     0.15       0          0          0
IN09028-MAJ      112.36     0.15       0          0          0
IN09029-MAJ      112.37     0.15       0          0          0
IN09030-MAJ      111.97     0.15       0          0          0
IN09031-MAJ      111.97     0.15       0          0          0
IN09032-MAJ      111.62     0.15       0          0          0
IN09033-MAJ      111.62     0.15       0          0          0
IN09034-MAJ      111.27     0.15       0          0          0
IN09035-MAJ      111.27     0.15       0          0          0
IN45566          109.82     1.395      0          0          0
;RYCB
IN45569          111.61     1.397      0          0          0
IN45570          111.7      1.404      0          0          0
IN45572          111.51     1.402      0          0          0
IN45573          112.76     1.396      0          0          0
IN45574          111.3      0.3        0          0          0
IN45575          112.17     1.402      0          0          0
IN45577          111.28     1.402      0          0          0
IN45587          112.44     1.405      0          0          0
IN45588          112.52     1.402      0          0          0
IN45589          111.85     1.396      0          0          0
IN45590          111.58     1.402      0          0          0
J1               111.77     0.15       0          0          0
J2               111.2      0.15       0          0          0
MHST09001        111.29     1.851      0          0          0
MHST09002        111.25     1.966      0          0          0
MHST09003        111.15     2.686      0          0          0
MHST09004        111.02     3.007      0          0          0
MHST09005        110.43     3.073      0          0          0
MHST09006        110.07     2.864      0          0          0
MHST09007        109.61     3.224      0          0          0
MHST09008        109.27     3.155      0          0          0
MHST09009        109.21     3.069      0          0          0
MHST09010        108.65     3.324      0          0          0
MHST09011        108.29     3.382      0          0          0
MHST09013        108.16     3.426      0          0          0
MHST09014        108.38     3.116      0          0          0
```

```
MHST09015        108.53     3.268      0          0          0
MHST09016        110.98     3.202      0          0          0
MHST09017        110.75     3.348      0          0          0
MHST09018        110.66     3.211      0          0          0
MHST09019        110.38     2.899      0          0          0
MHST09020        109.94     2.991      0          0          0
MHST09021        109.05     3.481      0          0          0
MHST09022        108.93     3.336      0          0          0
MHST09023        108.79     3.014      0          0          0
MHST09024        108.86     2.531      0          0          0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
OF-CREEK         107.5      FREE                          NO
OF-HAZELDEAN     112.83     FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                                Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                               Frac.    Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- -----------------------
CB01             112.4    1.4      0        TABULAR    CB01-STOR                   0        0
CB06             112.5    1.4      0        TABULAR    CB06-STOR                   0        0
CHAMBERS-1       111.516  2.584    0        TABULAR    STORAGE-1                   0        0
CHAMBERS-2       112.296  2.204    0        TABULAR    STORAGE-2                   0        0
IN09003          112.53   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09004          112.43   1.55     0        TABULAR    IN09004-STOR                0        0
IN09005          111.82   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09006          111.82   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09007          111.58   1.55     0        TABULAR    IN09007-STOR                0        0
IN09008          111.58   1.55     0        TABULAR    IN09008-STOR                0        0
IN09009          111.35   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09010          111.35   1.4      0        FUNCTIONAL 1000     0        0.36     0        0
IN09011          110.81   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09012          110.81   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09013          110.38   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09014          110.01   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09015          110.01   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09016          109.85   1.55     0        TABULAR    IN09016-STOR                0        0
IN09017          110.16   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09018          110.16   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09019          109.93   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09020          109.93   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09021          109.6    1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09022          112.54   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09023          112.35   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09024          111.75   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09025          111.73   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09026          111.26   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09027          111.28   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09028          110.96   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09029          110.97   1.4      0        FUNCTIONAL 0        0        0.36     0        0
```

```
IN09030          110.57   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09031          110.57   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09032          110.22   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09033          110.22   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09034          109.87   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN09035          109.87   1.4      0        FUNCTIONAL 0        0        0.36     0        0
IN103407         111.64   1.61     0        TABULAR    IN103407-STOR               0        0
MHST09012        107.61   3.518    0        FUNCTIONAL 0        0        1.13     0        0

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
C01              207              206              15.798     0.013      113        112.47     0          0
C02              206              205              46.769     0.013      112.3      112.02     0          0
C03              205              204              44.476     0.013      111.88     111.73     0          0
C04              204              203              8.526      0.013      111.7      111.67     0          0
C05              203              202              35.069     0.013      111.61     111.49     0          0
C06              202              201              11.458     0.013      111.46     111.42     0          0
C07              216              219              10.264     0.013      111.324    111.302    0          0
C08              CB03             208              14.991     0.01       113.104    112.565    0          0
C09              208              CHAMBERS-2       1.5        0.013      112.565    112.55     0          0
C1               IN45587          MHST09004        40         0.013      112.44     112.04     0          0
C10              219              200              10.729     0.013      111.302    111.2      0          0
C11              210              211              15.342     0.013      112.28     112.12     0          0
C12              CB01             211              16.041     0.013      112.4      112.19     0          0
C13              IN07998          MHST09011        10         0.013      110.43     110.33     0          0
C14              217              CHAMBERS-2       7.6        0.013      113.462    112.91     0          0
C15              CHAMBERS-1       212              23.7       0.013      111.72     111.68     0          0
C16              211              CHAMBERS-1       2.5        0.013      111.79     111.77     0          0
C17              CBE01            CBT02            22.237     0.013      114.25     114.113    0          0
C18              CBT02            CB05             22.237     0.013      114.113    114.004    0          0
C19              CB05             CBT03            35.089     0.013      114.004    113.784    0          0
C2               IN45588          MHST09005        116.338    0.013      112.52     112.02     0          0
C20              CBT03            217              22.884     0.013      113.784    113.51     0          0
C21              218              208              15.162     0.013      112.736    112.595    0          0
C22              IN45573          MHST09016        40         0.013      112.76     112.26     0          0
C23              CB06             210              11.287     0.013      112.5      112.31     0          0
C24              CHAMBERS-2       215              1.5        0.013      112.48     112.44     0          0
C25              201              216              6.436      0.013      111.356    111.32     0          0
C26              IN45574          MHST09017        40         0.013      111.3      111        0          0
C27              IN45566          MHST09024        10         0.013      109.82     109.72     0          0
C28              CBE04            CBT05            11.405     0.013      113.9      113.786    0          0
C29              CBT05            CBT06            10.537     0.013      113.786    113.68     0          0
C3               IN45589          MHST09007        40         0.013      111.85     111.45     0          0
C30              CBT06            CBT07            6.663      0.013      113.681    113.614    0          0
C31              CBT07            CBT08            9.787      0.013      113.614    113.516    0          0
C32              CBT08            CBT09            12.746     0.013      113.516    113.388    0          0
C33              CBT09            CBT10            11.17      0.013      113.388    113.276    0          0
C34              CBT10            213              3.295      0.013      113.276    113.243    0          0
C35              CBT11            213              3.295      0.013      112.874    112.864    0          0
C36              CBT12            CBT11            9.526      0.013      112.893    112.864    0          0
C37              CBT13            CBT12            12.745     0.013      112.925    112.886    0          0
```

```
C38              CBT14            CBT13            12.745     0.013      112.955    112.917    0          0
C39              IN103407         OF-HAZELDEAN     40.346     0.013      113.04     112.83     0          0
C4               IN45590          MHST09007        40         0.013      111.58     111.08     0          0
C40              213              218              29.265     0.013      112.824    112.736    0          0
C5               IN45575          MHST09019        40         0.013      112.17     111.77     0          0
C6               IN45570          MHST09020        40         0.013      111.7      111.3      0          0
C7               IN45569          MHST09021        40         0.013      111.61     111.41     0          0
C8               IN45572          MHST09021        40         0.013      111.51     111.11     0          0
C9               IN45577          MHST09022        40         0.013      111.28     110.88     0          0
C98              CHAMBERS-1       212              26.513     0.013      111.516    111.42     0          0
C99              CHAMBERS-2       215              28.637     0.013      112.296    112.27     0          0
OF1              IN09016          MHST09012        17.899     0.013      111.4      111.128    0          0
R01              IN09004-MAJ      IN09006-MAJ      92.678     0.013      113.83     113.22     0          0
R02              IN09006-MAJ      IN09007          79.588     0.013      113.22     113.13     0          0
R03              IN09005-MAJ      IN09008          79.205     0.013      113.22     112.98     0          0
R04              IN09007          IN09010-MAJ      71.554     0.013      113.13     112.75     0          0
R05              IN09008          IN09009-MAJ      72.205     0.013      112.98     112.75     0          0
R06              IN09010-MAJ      IN09012-MAJ      101.975    0.013      112.75     112.21     0          0
R07              IN09009-MAJ      IN09011-MAJ      106.231    0.013      112.75     112.21     0          0
R08              IN09012-MAJ      J1               98.186     0.013      112.21     111.77     0          0
R09              IN09033-MAJ      J1               13.729     0.013      111.62     111.77     0          0
R10              IN09032-MAJ      J1               24.181     0.013      0          111.62     0          0
R11              IN09011-MAJ      IN09013-MAJ      91.997     0.013      112.21     111.78     0          0
R12              IN09013-MAJ      IN09015-MAJ      71.755     0.013      111.78     111.41     0          0
R13              IN09015-MAJ      MHST09012        64.056     0.013      111.41     111.128    0          0
R14              IN09014-MAJ      IN09016          54.483     0.013      111.41     111.25     0          0
R15              J1               IN09014-MAJ      59.615     0.013      111.77     111.41     0          0
R16              IN09035-MAJ      J2               17.745     0.013      0          0          0          0
R17              IN09034-MAJ      J2               26.122     0.013      0          0          0          0
R18              IN09021-MAJ      IN09020-MAJ      30.532     0.013      0          0          0          0
R19              J2               IN09019-MAJ      27.476     0.013      0          0          0          0
R20              IN09020-MAJ      IN09018-MAJ      80.609     0.013      0          111.56     0          0
R21              IN09019-MAJ      IN09017-MAJ      81.078     0.013      0          111.56     0          0
R22              IN09018-MAJ      MHST09012        83.592     0.013      111.56     111.128    0          0
R23              IN09017-MAJ      IN09016          67.772     0.013      111.56     111.25     0          0
R24              IN09003-MAJ      IN103407         71.254     0.013      113.93     113.04     0          0
R25              IN09023-MAJ      IN09024-MAJ      81.428     0.013      113.75     113.15     0          0
R26              IN09022-MAJ      IN09025-MAJ      86.482     0.013      113.94     113.13     0          0
R27              IN09025-MAJ      IN09027-MAJ      86.008     0.013      113.13     112.68     0          0
R28              IN09024-MAJ      IN09026-MAJ      85.805     0.013      113.15     112.66     0          0
R29              IN09027-MAJ      IN09028-MAJ      61.833     0.013      112.68     112.36     0          0
R30              IN09026-MAJ      IN09029-MAJ      68.091     0.013      112.66     112.37     0          0
R31              IN09029-MAJ      IN09030-MAJ      72.254     0.013      112.37     111.97     0          0
R32              IN09028-MAJ      IN09034-MAJ      88.109     0.013      112.36     111.27     0          0
R33              IN09030-MAJ      IN09032-MAJ      67.283     0.013      111.97     111.62     0          0
R34              IN09031-MAJ      IN09033-MAJ      69.891     0.013      111.97     111.62     0          0
STM04620         MHST09014        MHST09013        76.347     0.013      108.38     108.22     0          0
STM04621         MHST09013        MHST09012        77.994     0.013      108.16     108        0          0
STM07857         MHST09005        MHST09006        90.117     0.013      110.43     110.07     0          0
STM07870         MHST09015        MHST09014        51.716     0.013      108.53     108.45     0          0
STM07871         MHST09012        OF-CREEK         44.59      0.013      107.61     107.5      0          0
STM07872         MHST09024        MHST09015        65.567     0.013      108.86     108.61     0          0
STM07873         MHST09009        MHST09010        81.53      0.013      109.21     108.93     0          0
```

```
STM07874         MHST09001        MHST09002        10.425     0.013      111.29     111.25     0          0
STM07875         MHST09006        MHST09007        89.989     0.013      110.07     109.71     0          0
STM07876         MHST09016        MHST09017        39.458     0.013      110.98     110.83     0          0
STM45150         MHST09017        MHST09018        13.481     0.013      110.75     110.7      0          0
STM45151         MHST09018        MHST09019        52.811     0.013      110.66     110.45     0          0
STM45152         MHST09019        MHST09020        90.099     0.013      110.38     110.02     0          0
STM45153         MHST09020        MHST09021        89.396     0.013      109.94     109.13     0          0
STM45154         MHST09021        MHST09022        58.932     0.013      109.05     108.93     0          0
STM45155         MHST09022        MHST09023        56.802     0.013      108.93     108.79     0          0
STM45156         MHST09023        MHST09010        41.513     0.013      108.79     108.66     0          0
STM45159         MHST09010        MHST09011        75.08      0.013      108.65     108.29     0          0
STM45160         MHST09011        MHST09012        58.178     0.013      108.29     107.99     0          0
STM45161         MHST09007        MHST09008        88.113     0.013      109.61     109.3      0          0
STM45162         MHST09008        MHST09009        12.683     0.013      109.27     109.25     0          0
STM45163         MHST09002        MHST09003        36.553     0.013      111.25     111.15     0          0
STM45164_1       MHST09003        200              4.698      0.013      111.15     111.136    0          0
STM45164_2       200              MHST09004        11.906     0.013      111.136    111.1      0          0
STM45165         MHST09004        MHST09005        82.915     0.013      111.02     110.51     0          0

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet           Qcoeff/                     Flap
;;Name           Node             Node             Height     Type             QTable           Qexpon     Gate
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ---------- ----
212-ICD          212              216              111.42     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
215-ICD          215              205              112.24     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09003-ICD      IN09003          MHST09003        112.53     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09003-INC      IN09003-MAJ      IN09003          113.93     TABULAR/DEPTH    CB-INC-1%                   NO
IN09004-ICD      IN09004          MHST09004        112.45     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09004-INC      IN09004-MAJ      IN09004          113.83     TABULAR/DEPTH    CB-INC-1%                   NO
IN09005-ICD      IN09005          MHST09005        111.82     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09005-INC      IN09005-MAJ      IN09005          113.22     TABULAR/DEPTH    CB-INC-1%                   NO
IN09006-ICD      IN09006          MHST09005        111.82     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09006-INC      IN09006-MAJ      IN09006          113.22     TABULAR/DEPTH    CB-INC-1%                   NO
IN09007-ICD      IN09007          MHST09006        111.58     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09008-ICD      IN09008          MHST09006        111.58     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09009-ICD      IN09009          MHST09007        111.35     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09009-INC      IN09009-MAJ      IN09009          112.72     TABULAR/DEPTH    CB-INC-1%                   NO
IN09010-ICD      IN09010          MHST09007        111.32     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09010-INC      IN09010-MAJ      IN09010          112.75     TABULAR/DEPTH    CB-INC-1%                   NO
IN09011-ICD      IN09011          MHST09008        110.87     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09011-INC      IN09011-MAJ      IN09011          112.21     TABULAR/DEPTH    CB-INC-1%                   NO
IN09012-ICD      IN09012          MHST09008        110.81     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09012-INC      IN09012-MAJ      IN09012          112.21     TABULAR/DEPTH    CB-INC-1%                   NO
IN09013-ICD      IN09013          MHST09010        110.38     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09013-INC      IN09013-MAJ      IN09013          111.78     TABULAR/DEPTH    CB-INC-1%                   NO
IN09014-ICD      IN09014          MHST09011        110.01     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09014-INC      IN09014-MAJ      IN09014          111.41     TABULAR/DEPTH    CB-INC-1%                   NO
IN09015-ICD      IN09015          MHST09011        110.01     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09015-INC      IN09015-MAJ      IN09015          56.848     TABULAR/DEPTH    CB-INC-1%                   NO
IN09016-ICD      IN09016          MHST09013        109.85     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09017-ICD      IN09017          MHST09013        110.16     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09017-INC      IN09017-MAJ      IN09017          111.56     TABULAR/DEPTH    CB-INC-1%                   NO
IN09018-ICD      IN09018          MHST09013        110.16     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
```

```
IN09018-INC      IN09018-MAJ      IN09018          111.56     TABULAR/DEPTH    CB-INC-1%                   NO
IN09019-ICD      IN09019          MHST09014        109.93     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09019-INC      IN09019-MAJ      IN09019          111.33     TABULAR/DEPTH    CB-INC-1%                   NO
IN09020-ICD      IN09020          MHST09014        109.93     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09020-INC      IN09020-MAJ      IN09020          111.33     TABULAR/DEPTH    CB-INC-1%                   NO
IN09021-ICD      IN09021          MHST09015        109.6      TABULAR/DEPTH    IPEX-MHF-TYPEB              NO
IN09021-INC      IN09021-MAJ      IN09021          111        TABULAR/DEPTH    CB-INC-1%                   NO
IN09022-ICD      IN09022          MHST09017        112.54     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09022-INC      IN09022-MAJ      IN09022          113.94     TABULAR/DEPTH    CB-INC-1%                   NO
IN09023-ICD      IN09023          MHST09017        112.35     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09023-INC      IN09023-MAJ      IN09023          113.75     TABULAR/DEPTH    CB-INC-1%                   NO
IN09024-ICD      IN09024          MHST09019        111.75     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09024-INC      IN09024-MAJ      IN09024          113.15     TABULAR/DEPTH    CB-INC-1%                   NO
IN09025-ICD      IN09025          MHST09019        111.73     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09025-INC      IN09025-MAJ      IN09025          113.13     TABULAR/DEPTH    CB-INC-1%                   NO
IN09026-ICD      IN09026          MHST09020        111.26     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09026-INC      IN09026-MAJ      IN09026          112.66     TABULAR/DEPTH    CB-INC-1%                   NO
IN09027-ICD      IN09027          MHST09020        111.28     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09027-INC      IN09027-MAJ      IN09027          112.68     TABULAR/DEPTH    CB-INC-1%                   NO
IN09028-ICD      IN09028          MHST09021        110.96     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09028-INC      IN09028-MAJ      IN09028          112.36     TABULAR/DEPTH    CB-INC-1%                   NO
IN09029-ICD      IN09029          MHST09021        110.97     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09029-INC      IN09029-MAJ      IN09029          112.37     TABULAR/DEPTH    CB-INC-1%                   NO
IN09030-ICD      IN09030          MHST09022        110.57     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09030-INC      IN09030-MAJ      IN09030          111.97     TABULAR/DEPTH    CB-INC-1%                   NO
IN09031-ICD      IN09031          MHST09022        110.57     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09031-INC      IN09031-MAJ      IN09031          111.97     TABULAR/DEPTH    CB-INC-1%                   NO
IN09032-ICD      IN09032          MHST09023        110.22     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09032-INC      IN09032-MAJ      IN09032          111.62     TABULAR/DEPTH    CB-INC-1%                   NO
IN09033-ICD      IN09033          MHST09023        110.22     TABULAR/DEPTH    IPEX-MHF-TYPEA              NO
IN09033-INC      IN09033-MAJ      IN09033          111.62     TABULAR/DEPTH    CB-INC-1%                   NO
IN09034-ICD      IN09034          MHST09024        109.87     TABULAR/DEPTH    IPEX-MHF-TYPEB              NO
IN09034-INC      IN09034-MAJ      IN09034          111.27     TABULAR/DEPTH    CB-INC-1%                   NO
IN09035-ICD      IN09035          MHST09024        109.87     TABULAR/DEPTH    IPEX-MHF-TYPEB              NO
IN09035-INC      IN09035-MAJ      IN09035          111.27     TABULAR/DEPTH    CB-INC-1%                   NO
IN103407-ICD     IN103407         MHST09001        111.64     TABULAR/DEPTH    IPEX-MHF-TYPEB              NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C01              CIRCULAR     0.25             0          0          0          1
C02              CIRCULAR     0.25             0          0          0          1
C03              CIRCULAR     0.375            0          0          0          1
C04              CIRCULAR     0.375            0          0          0          1
C05              CIRCULAR     0.375            0          0          0          1
C06              CIRCULAR     0.375            0          0          0          1
C07              CIRCULAR     0.375            0          0          0          1
C08              CIRCULAR     0.3              0          0          0          1
C09              CIRCULAR     0.6              0          0          0          1
C1               CIRCULAR     0.2              0          0          0          1
C10              CIRCULAR     0.375            0          0          0          1
C11              CIRCULAR     0.3              0          0          0          1
C12              CIRCULAR     0.3              0          0          0          1
```

```
C13              CIRCULAR     0.2              0          0          0          1
C14              CIRCULAR     0.3              0          0          0          1
C15              CIRCULAR     0.375            0          0          0          1
C16              CIRCULAR     0.6              0          0          0          1
C17              CIRCULAR     0.25             0          0          0          1
C18              CIRCULAR     0.25             0          0          0          1
C19              CIRCULAR     0.25             0          0          0          1
C2               CIRCULAR     0.2              0          0          0          1
C20              CIRCULAR     0.25             0          0          0          1
C21              CIRCULAR     0.3              0          0          0          1
C22              CIRCULAR     0.2              0          0          0          1
C23              CIRCULAR     0.3              0          0          0          1
C24              CIRCULAR     0.375            0          0          0          1
C25              CIRCULAR     0.375            0          0          0          1
C26              CIRCULAR     0.2              0          0          0          1
C27              CIRCULAR     0.2              0          0          0          1
C28              CIRCULAR     0.25             0          0          0          1
C29              CIRCULAR     0.25             0          0          0          1
C3               CIRCULAR     0.2              0          0          0          1
C30              CIRCULAR     0.25             0          0          0          1
C31              CIRCULAR     0.25             0          0          0          1
C32              CIRCULAR     0.25             0          0          0          1
C33              CIRCULAR     0.25             0          0          0          1
C34              CIRCULAR     0.25             0          0          0          1
C35              CIRCULAR     0.25             0          0          0          1
C36              CIRCULAR     0.25             0          0          0          1
C37              CIRCULAR     0.25             0          0          0          1
C38              CIRCULAR     0.25             0          0          0          1
C39              TRAPEZOIDAL  0.3              1          3          3          1
C4               CIRCULAR     0.2              0          0          0          1
C40              CIRCULAR     0.3              0          0          0          1
C5               CIRCULAR     0.2              0          0          0          1
C6               CIRCULAR     0.2              0          0          0          1
C7               CIRCULAR     0.2              0          0          0          1
C8               CIRCULAR     0.2              0          0          0          1
C9               CIRCULAR     0.2              0          0          0          1
C98              CIRCULAR     0.1              0          0          0          1
C99              CIRCULAR     0.1              0          0          0          1
OF1              IRREGULAR    Half_Street_4.25m 0         0          0          1
R01              IRREGULAR    Half_Street_4.25m 0         0          0          1
R02              IRREGULAR    Half_Street_4.25m 0         0          0          1
R03              IRREGULAR    Half_Street_4.25m 0         0          0          1
R04              IRREGULAR    Half_Street_4.25m 0         0          0          1
R05              IRREGULAR    Half_Street_4.25m 0         0          0          1
R06              IRREGULAR    Half_Street_4.25m 0         0          0          1
R07              IRREGULAR    Half_Street_4.25m 0         0          0          1
R08              IRREGULAR    Half_Street_4.25m 0         0          0          1
R09              IRREGULAR    Half_Street_4.25m 0         0          0          1
R10              IRREGULAR    Half_Street_4.25m 0         0          0          1
R11              IRREGULAR    Half_Street_4.25m 0         0          0          1
R12              IRREGULAR    Half_Street_4.25m 0         0          0          1
R13              IRREGULAR    Half_Street_4.25m 0         0          0          1
R14              IRREGULAR    Half_Street_4.25m 0         0          0          1
```

```
R15              IRREGULAR    Half_Street_4.25m 0         0          0          1
R16              IRREGULAR    Half_Street_4.25m 0         0          0          1
R17              IRREGULAR    Half_Street_4.25m 0         0          0          1
R18              IRREGULAR    Half_Street_4.25m 0         0          0          1
R19              IRREGULAR    Half_Street_4.25m 0         0          0          1
R20              IRREGULAR    Half_Street_4.25m 0         0          0          1
R21              IRREGULAR    Half_Street_4.25m 0         0          0          1
R22              IRREGULAR    Half_Street_4.25m 0         0          0          1
R23              IRREGULAR    Half_Street_4.25m 0         0          0          1
R24              IRREGULAR    Half_Street_4.25m 0         0          0          1
R25              IRREGULAR    Half_Street_4.25m 0         0          0          1
R26              IRREGULAR    Half_Street_4.25m 0         0          0          1
R27              IRREGULAR    Half_Street_4.25m 0         0          0          1
R28              IRREGULAR    Half_Street_4.25m 0         0          0          1
R29              IRREGULAR    Half_Street_4.25m 0         0          0          1
R30              IRREGULAR    Half_Street_4.25m 0         0          0          1
R31              IRREGULAR    Half_Street_4.25m 0         0          0          1
R32              IRREGULAR    Half_Street_4.25m 0         0          0          1
R33              IRREGULAR    Half_Street_4.25m 0         0          0          1
R34              IRREGULAR    Half_Street_4.25m 0         0          0          1
STM04620         CIRCULAR     0.525            0          0          0          1
STM04621         CIRCULAR     0.6              0          0          0          1
STM07857         CIRCULAR     0.525            0          0          0          1
STM07870         CIRCULAR     0.45             0          0          0          1
STM07871         CIRCULAR     0.9              0          0          0          1
STM07872         CIRCULAR     0.375            0          0          0          1
STM07873         CIRCULAR     0.6              0          0          0          1
STM07874         CIRCULAR     0.375            0          0          0          1
STM07875         CIRCULAR     0.525            0          0          0          1
STM07876         CIRCULAR     0.3              0          0          0          1
STM45150         CIRCULAR     0.375            0          0          0          1
STM45151         CIRCULAR     0.375            0          0          0          1
STM45152         CIRCULAR     0.45             0          0          0          1
STM45153         CIRCULAR     0.525            0          0          0          1
STM45154         CIRCULAR     0.6              0          0          0          1
STM45155         CIRCULAR     0.6              0          0          0          1
STM45156         CIRCULAR     0.6              0          0          0          1
STM45159         CIRCULAR     0.75             0          0          0          1
STM45160         CIRCULAR     0.75             0          0          0          1
STM45161         CIRCULAR     0.6              0          0          0          1
STM45162         CIRCULAR     0.6              0          0          0          1
STM45163         CIRCULAR     0.375            0          0          0          1
STM45164_1       CIRCULAR     0.375            0          0          0          1
STM45164_2       CIRCULAR     0.375            0          0          0          1
STM45165         CIRCULAR     0.45             0          0          0          1

[TRANSECTS]

;Half street, width = 4.25m, curb = 0.075m , cross-slope = 0.03m/m, bank-slope = 0.03m/m, bank-height = 0.2m.
NC 0.03     0.03     0.013
X1 Half_Street_4.25m 4        0.0      4.25     0.0       0.0       0.0      0.0      0.0
GR 0.13     0        0        4.25     0.08     4.25     0.2      8.42
```

```
[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------

[INFLOWS]
;;                                                 Param    Units    Scale    Baseline Baseline
;;Node           Parameter        Time Series      Type     Factor   Factor   Value    Pattern
;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
203              FLOW             ""               FLOW     1.0      1        1.91
204              FLOW             ""               FLOW     1.0      1        0.85
205              FLOW             ""               FLOW     1.0      1        0.85
206              FLOW             ""               FLOW     1.0      1        0.85
207              FLOW             ""               FLOW     1.0      1        0.64

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
;Inlet Capacity for Standard CB
;with mountable curb & gutter
;3% Crossfall & 1.0% Gutter Slope
;1% Gutter Grade
CB-INC-1%        Rating     0.006      0
CB-INC-1%                   0.026      7
CB-INC-1%                   0.033      12
CB-INC-1%                   0.06       15
CB-INC-1%                   0.078      34
CB-INC-1%                   0.084      47
CB-INC-1%                   0.09       51
CB-INC-1%                   0.095      54
CB-INC-1%                   0.1        55

;Inlet Capacity for Standard CB
;with mountable curb & gutter
;3% Crossfall & 2.0% Gutter Slope
;Inlet Capacity for Standard CB
;with mountable curb & gutter
;3% Crossfall & 3.0% Gutter Slope
;IPEX TEMPEST MHF TYPE A
IPEX-MHF-TYPEA   Rating     0          0
IPEX-MHF-TYPEA              0.2        8.088
IPEX-MHF-TYPEA              0.4        11.438
IPEX-MHF-TYPEA              0.6        14.008
IPEX-MHF-TYPEA              0.8        16.175
IPEX-MHF-TYPEA              1          18.085
IPEX-MHF-TYPEA              1.2        19.811
IPEX-MHF-TYPEA              1.4        21.398
IPEX-MHF-TYPEA              1.6        22.875
IPEX-MHF-TYPEA              1.8        24.263
IPEX-MHF-TYPEA              2          25.575
IPEX-MHF-TYPEA              2.2        26.824
IPEX-MHF-TYPEA              2.4        28.017
IPEX-MHF-TYPEA              2.6        29.16
IPEX-MHF-TYPEA              2.8        30.261
```

```
IPEX-MHF-TYPEA              3          31.323
IPEX-MHF-TYPEA              3.2        32.351
IPEX-MHF-TYPEA              3.4        33.346
IPEX-MHF-TYPEA              3.6        34.313
IPEX-MHF-TYPEA              3.8        35.253

;IPEX TEMPEST MHF TYPE B
IPEX-MHF-TYPEB   Rating     0          0
IPEX-MHF-TYPEB              0.2        11.478
IPEX-MHF-TYPEB              0.4        16.233
IPEX-MHF-TYPEB              0.6        19.881
IPEX-MHF-TYPEB              0.8        22.957
IPEX-MHF-TYPEB              1          25.666
IPEX-MHF-TYPEB              1.2        28.116
IPEX-MHF-TYPEB              1.4        30.369
IPEX-MHF-TYPEB              1.6        32.466
IPEX-MHF-TYPEB              1.8        34.435
IPEX-MHF-TYPEB              2          36.298
IPEX-MHF-TYPEB              2.2        38.069
IPEX-MHF-TYPEB              2.4        39.762
IPEX-MHF-TYPEB              2.6        41.386
IPEX-MHF-TYPEB              2.8        42.948
IPEX-MHF-TYPEB              3          44.455
IPEX-MHF-TYPEB              3.2        45.913
IPEX-MHF-TYPEB              3.4        47.326
IPEX-MHF-TYPEB              3.6        48.698
IPEX-MHF-TYPEB              3.8        50.033

;IPEX TEMPEST MHF TYPE C
IPEX-MHF-TYPEC   Rating     0          0
IPEX-MHF-TYPEC              0.2        14.965
IPEX-MHF-TYPEC              0.4        21.163
IPEX-MHF-TYPEC              0.6        25.92
IPEX-MHF-TYPEC              0.8        29.93
IPEX-MHF-TYPEC              1          33.462
IPEX-MHF-TYPEC              1.2        36.656
IPEX-MHF-TYPEC              1.4        39.593
IPEX-MHF-TYPEC              1.6        42.327
IPEX-MHF-TYPEC              1.8        44.895
IPEX-MHF-TYPEC              2          47.323
IPEX-MHF-TYPEC              2.2        49.633
IPEX-MHF-TYPEC              2.4        51.84
IPEX-MHF-TYPEC              2.6        53.957
IPEX-MHF-TYPEC              2.8        55.993
IPEX-MHF-TYPEC              3          57.959
IPEX-MHF-TYPEC              3.2        59.859
IPEX-MHF-TYPEC              3.4        61.702
IPEX-MHF-TYPEC              3.6        63.49
IPEX-MHF-TYPEC              3.8        65.23

;IPEX TEMPEST MHF TYPE D
IPEX-MHF-TYPED   Rating     0          0
IPEX-MHF-TYPED              0.2        21.883
```

```
IPEX-MHF-TYPED              0.4        30.948
IPEX-MHF-TYPED              0.6        37.903
IPEX-MHF-TYPED              0.8        43.766
IPEX-MHF-TYPED              1          48.932
IPEX-MHF-TYPED              1.2        53.603
IPEX-MHF-TYPED              1.4        57.898
IPEX-MHF-TYPED              1.6        61.895
IPEX-MHF-TYPED              1.8        65.65
IPEX-MHF-TYPED              2          69.201
IPEX-MHF-TYPED              2.2        72.578
IPEX-MHF-TYPED              2.4        75.806
IPEX-MHF-TYPED              2.6        78.901
IPEX-MHF-TYPED              2.8        81.879
IPEX-MHF-TYPED              3          84.753
IPEX-MHF-TYPED              3.2        87.533
IPEX-MHF-TYPED              3.4        90.227
IPEX-MHF-TYPED              3.6        92.843
IPEX-MHF-TYPED              3.8        95.387

;IPEX TEMPEST MHF TYPE F
IPEX-MHF-TYPEF   Rating     0          0
IPEX-MHF-TYPEF              0.2        28.951
IPEX-MHF-TYPEF              0.4        40.943
IPEX-MHF-TYPEF              0.6        50.145
IPEX-MHF-TYPEF              0.8        57.902
IPEX-MHF-TYPEF              1          64.737
IPEX-MHF-TYPEF              1.2        70.916
IPEX-MHF-TYPEF              1.4        76.598
IPEX-MHF-TYPEF              1.6        81.886
IPEX-MHF-TYPEF              1.8        86.854
IPEX-MHF-TYPEF              2          91.552
IPEX-MHF-TYPEF              2.2        96.02
IPEX-MHF-TYPEF              2.4        100.29
IPEX-MHF-TYPEF              2.6        104.385
IPEX-MHF-TYPEF              2.8        108.326
IPEX-MHF-TYPEF              3          112.128
IPEX-MHF-TYPEF              3.2        115.805
IPEX-MHF-TYPEF              3.4        119.369
IPEX-MHF-TYPEF              3.6        122.83
IPEX-MHF-TYPEF              3.8        126.195

;SURFACE PONDING
;AT CB01
CB01-STOR        Storage    0          0
CB01-STOR                   1.4        0.36
CB01-STOR                   1.6        114
CB01-STOR                   1.6001     0
CB01-STOR                   1.75       0

;SURFACE PONDING
;AT CB06
CB06-STOR        Storage    0          0
CB06-STOR                   1.4        0.36
```

```
CB06-STOR                  1.5        101
CB06-STOR                  1.5001     0
CB06-STOR                  1.65       0

;SURFACE PONDING AT
;INLET IN09004
IN09004-STOR     Storage    0          0
IN09004-STOR                1.4        0.36
IN09004-STOR                1.45       18
IN09004-STOR                1.4501     0
IN09004-STOR                1.6        0

;SURFACE POING AT
;IN09007.
;PONDING AREA # SP06A
IN09007-STOR     Storage    0          0
IN09007-STOR                1.4        0.36
IN09007-STOR                1.5        173
IN09007-STOR                1.5001     0
IN09007-STOR                1.65       0

;SURFACE POING AT
;IN09008.
;PONDING AREA # SP06B
IN09008-STOR     Storage    0          0
IN09008-STOR                1.4        0.36
IN09008-STOR                1.5        173
IN09008-STOR                1.5001     0
IN09008-STOR                1.65       0

;SURFACE PONDING AT
;INLET 09016
IN09016-STOR     Storage    0          0
IN09016-STOR                1.66       0.36
IN09016-STOR                1.96       41
IN09016-STOR                1.9601     0
IN09016-STOR                2.11       0

;SURFACE PONDING AT
;INLET 103407
IN103407-STOR    Storage    0          0
IN103407-STOR               1.4        1.131
IN103407-STOR               1.46       313
IN103407-STOR               1.4601     0
IN103407-STOR               1.61       0

;AREA-DEPTH FOR
;MC-3500 CHAMBERS
;22 chambers
;10 end caps
STORAGE-1        Storage    0          91
STORAGE-1                   1.676      91
STORAGE-1                   1.67601    0
```

```
STORAGE-1                   3          0

;AREA-DEPTH FOR
;MC-3500 CHAMBERS
;22 chambers
;10 end caps
STORAGE-2        Storage    0          92.6
STORAGE-2                   1.676      92.6
STORAGE-2                   1.67601    0
STORAGE-2                   3          0

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;Rainfall (mm/hr)
Chicago_3h_100yr 09/26/2018 00:00:00   5.339
Chicago_3h_100yr 09/26/2018 00:10:00   6.376
Chicago_3h_100yr 09/26/2018 00:20:00   7.977
Chicago_3h_100yr 09/26/2018 00:30:00   10.797
Chicago_3h_100yr 09/26/2018 00:40:00   17.136
Chicago_3h_100yr 09/26/2018 00:50:00   44.676
Chicago_3h_100yr 09/26/2018 01:00:00   178.559
Chicago_3h_100yr 09/26/2018 01:10:00   51.056
Chicago_3h_100yr 09/26/2018 01:20:00   26.163
Chicago_3h_100yr 09/26/2018 01:30:00   17.571
Chicago_3h_100yr 09/26/2018 01:40:00   13.277
Chicago_3h_100yr 09/26/2018 01:50:00   10.712
Chicago_3h_100yr 09/26/2018 02:00:00   9.008
Chicago_3h_100yr 09/26/2018 02:10:00   7.793
Chicago_3h_100yr 09/26/2018 02:20:00   6.883
Chicago_3h_100yr 09/26/2018 02:30:00   6.174
Chicago_3h_100yr 09/26/2018 02:40:00   5.607
Chicago_3h_100yr 09/26/2018 02:50:00   5.142
Chicago_3h_100yr 09/26/2018 03:00:00   0

;Chicago design storm, a = 732.951, b = 6.199, c = 0.81, Duration = 180 minutes, r = 0.35, rain units = mm/hr.
Chicago_3h_2yr              0:00       2.491
Chicago_3h_2yr              0:10       2.966
Chicago_3h_2yr              0:20       3.696
Chicago_3h_2yr              0:30       4.976
Chicago_3h_2yr              0:40       7.828
Chicago_3h_2yr              0:50       19.966
Chicago_3h_2yr              1:00       76.805
Chicago_3h_2yr              1:10       22.777
Chicago_3h_2yr              1:20       11.852
Chicago_3h_2yr              1:30       8.025
Chicago_3h_2yr              1:40       6.096
Chicago_3h_2yr              1:50       4.938
Chicago_3h_2yr              2:00       4.165
Chicago_3h_2yr              2:10       3.613
Chicago_3h_2yr              2:20       3.197
Chicago_3h_2yr              2:30       2.873
Chicago_3h_2yr              2:40       2.613
```

```
Chicago_3h_2yr              2:50       2.4
Chicago_3h_2yr              3:00       0

;Chicago design storm, a = 998.071, b = 6.053, c = 0.814, Duration = 180 minutes, r = 0.35, rain units = mm/hr.
Chicago_3h_5year            0:00       3.256
Chicago_3h_5year            0:10       3.881
Chicago_3h_5year            0:20       4.844
Chicago_3h_5year            0:30       6.532
Chicago_3h_5year            0:40       10.308
Chicago_3h_5year            0:50       26.529
Chicago_3h_5year            1:00       104.193
Chicago_3h_5year            1:10       30.286
Chicago_3h_5year            1:20       15.655
Chicago_3h_5year            1:30       10.568
Chicago_3h_5year            1:40       8.013
Chicago_3h_5year            1:50       6.482
Chicago_3h_5year            2:00       5.462
Chicago_3h_5year            2:10       4.733
Chicago_3h_5year            2:20       4.186
Chicago_3h_5year            2:30       3.76
Chicago_3h_5year            2:40       3.418
Chicago_3h_5year            2:50       3.137
Chicago_3h_5year            3:00       0

[REPORT]
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Node       200              STMH
Node       201              STMH
Node       202              STMH
Node       203              STMH
Node       204              STMH
Node       205              STMH
Node       206              STMH
Node       207              STMH
Node       208              STMH
Node       210              STMH
Node       211              STMH
Node       212              STMH
Node       213              STMH
Node       215              STMH
Node       216              STMH
Node       217              CBMH
Node       218              CBMH
Node       219              STC750
Node       CB03             CB
Node       CB05             CB
Node       CBE01            CBE
```

```
Node       CBE04            CBE
Node       CBT02            CBT
Node       CBT03            CBT
Node       CBT05            CBT
Node       CBT06            CBT
Node       CBT07            CBT
Node       CBT08            CBT
Node       CBT09            CBT
Node       CBT10            CBT
Node       CBT11            CBT
Node       CBT12            CBT
Node       CBT13            CBT
Node       CBT14            CBT
Node       IN07998          RYCB
Node       IN09003-MAJ      MAJOR
Node       IN09004-MAJ      MAJOR
Node       IN09005-MAJ      MAJOR
Node       IN09006-MAJ      MAJOR
Node       IN09009-MAJ      MAJOR
Node       IN09010-MAJ      MAJOR
Node       IN09011-MAJ      MAJOR
Node       IN09012-MAJ      MAJOR
Node       IN09013-MAJ      MAJOR
Node       IN09014-MAJ      MAJOR
Node       IN09015-MAJ      MAJOR
Node       IN09017-MAJ      MAJOR
Node       IN09018-MAJ      MAJOR
Node       IN09019-MAJ      MAJOR
Node       IN09020-MAJ      MAJOR
Node       IN09021-MAJ      MAJOR
Node       IN09022-MAJ      MAJOR
Node       IN09023-MAJ      MAJOR
Node       IN09024-MAJ      MAJOR
Node       IN09025-MAJ      MAJOR
Node       IN09026-MAJ      MAJOR
Node       IN09027-MAJ      MAJOR
Node       IN09028-MAJ      MAJOR
Node       IN09029-MAJ      MAJOR
Node       IN09030-MAJ      MAJOR
Node       IN09031-MAJ      MAJOR
Node       IN09032-MAJ      MAJOR
Node       IN09033-MAJ      MAJOR
Node       IN09034-MAJ      MAJOR
Node       IN09035-MAJ      MAJOR
Node       IN45566          RYCB
Node       IN45569          RYCB
Node       IN45570          RYCB
Node       IN45572          RYCB
Node       IN45573          RYCB
Node       IN45574          RYCB
Node       IN45575          RYCB
Node       IN45577          RYCB
Node       IN45587          RYCB
```

Node	IN45588	RYCB
Node	IN45589	RYCB
Node	IN45590	RYCB
Node	J1	MAJOR
Node	J2	MAJOR
Node	MHST09001	STMH
Node	MHST09002	STMH
Node	MHST09003	STMH
Node	MHST09004	STMH
Node	MHST09005	STMH
Node	MHST09006	STMH
Node	MHST09007	STMH
Node	MHST09008	STMH
Node	MHST09009	STMH
Node	MHST09010	STMH
Node	MHST09011	STMH
Node	MHST09013	STMH
Node	MHST09014	STMH
Node	MHST09015	STMH
Node	MHST09016	STMH
Node	MHST09017	STMH
Node	MHST09018	STMH
Node	MHST09019	STMH
Node	MHST09020	STMH
Node	MHST09021	STMH
Node	MHST09022	STMH
Node	MHST09023	STMH
Node	MHST09024	STMH
Node	CB01	CATCHBASIN
Node	CB06	CATCHBASIN
Node	CHAMBERS-1	STORAGE_CHAMBERS
Node	CHAMBERS-2	STORAGE_CHAMBERS
Node	IN09003	CATCHBASIN
Node	IN09004	CATCHBASIN
Node	IN09005	CATCHBASIN
Node	IN09006	CATCHBASIN
Node	IN09007	CATCHBASIN
Node	IN09008	CATCHBASIN
Node	IN09009	CATCHBASIN
Node	IN09010	CATCHBASIN
Node	IN09011	CATCHBASIN
Node	IN09012	CATCHBASIN
Node	IN09013	CATCHBASIN
Node	IN09014	CATCHBASIN
Node	IN09015	CATCHBASIN
Node	IN09016	CATCHBASIN
Node	IN09017	CATCHBASIN
Node	IN09018	CATCHBASIN
Node	IN09019	CATCHBASIN
Node	IN09020	CATCHBASIN
Node	IN09021	CATCHBASIN
Node	IN09022	CATCHBASIN
Node	IN09023	CATCHBASIN
Node	IN09024	CATCHBASIN
Node	IN09025	CATCHBASIN
Node	IN09026	CATCHBASIN
Node	IN09027	CATCHBASIN
Node	IN09028	CATCHBASIN
Node	IN09029	CATCHBASIN
Node	IN09030	CATCHBASIN
Node	IN09031	CATCHBASIN
Node	IN09032	CATCHBASIN
Node	IN09033	CATCHBASIN
Node	IN09034	CATCHBASIN
Node	IN09035	CATCHBASIN
Node	IN103407	DOUBLE_CATCHBASIN
Node	MHST09012	STMH
Link	C01	STORM
Link	C02	STORM
Link	C03	STORM
Link	C04	STORM
Link	C05	STORM
Link	C06	STORM
Link	C07	STORM
Link	C08	STORM
Link	C09	STORM
Link	C1	RYCB_LEAD
Link	C10	STORM
Link	C11	STORM
Link	C12	STORM
Link	C13	RYCB_LEAD
Link	C14	STORM
Link	C15	STORM
Link	C16	STORM
Link	C17	STORM
Link	C18	STORM
Link	C19	STORM
Link	C2	RYCB_LEAD
Link	C20	STORM
Link	C21	STORM
Link	C22	RYCB_LEAD
Link	C23	STORM
Link	C24	STORM
Link	C25	STORM
Link	C26	RYCB_LEAD
Link	C27	RYCB_LEAD
Link	C28	STORM
Link	C29	STORM
Link	C3	RYCB_LEAD
Link	C30	STORM
Link	C31	STORM
Link	C32	STORM
Link	C33	STORM
Link	C34	STORM
Link	C35	STORM
Link	C36	STORM

Link	C37	STORM
Link	C38	STORM
Link	C39	MAJOR
Link	C4	RYCB_LEAD
Link	C40	STORM
Link	C5	RYCB_LEAD
Link	C6	RYCB_LEAD
Link	C7	RYCB_LEAD
Link	C8	RYCB_LEAD
Link	C9	RYCB_LEAD
Link	C98	SUBDRAIN
Link	C99	SUBDRAIN
Link	OF1	OVERFLOW-ROAD
Link	R01	MAJOR
Link	R02	MAJOR
Link	R03	MAJOR
Link	R04	MAJOR
Link	R05	MAJOR
Link	R06	MAJOR
Link	R07	MAJOR
Link	R08	MAJOR
Link	R09	MAJOR
Link	R10	MAJOR
Link	R11	MAJOR
Link	R12	MAJOR
Link	R13	MAJOR
Link	R14	MAJOR
Link	R15	MAJOR
Link	R16	MAJOR
Link	R17	MAJOR
Link	R18	MAJOR
Link	R19	MAJOR
Link	R20	MAJOR
Link	R21	MAJOR
Link	R22	MAJOR
Link	R23	MAJOR
Link	R24	MAJOR
Link	R25	MAJOR
Link	R26	MAJOR
Link	R27	MAJOR
Link	R28	MAJOR
Link	R29	MAJOR
Link	R30	MAJOR
Link	R31	MAJOR
Link	R32	MAJOR
Link	R33	MAJOR
Link	R34	MAJOR
Link	STM04620	STORM
Link	STM04621	STORM
Link	STM07857	STORM
Link	STM07870	STORM
Link	STM07871	STORM
Link	STM07872	STORM
Link	STM07873	STORM
Link	STM07874	STORM
Link	STM07875	STORM
Link	STM07876	STORM
Link	STM45150	STORM
Link	STM45151	STORM
Link	STM45152	STORM
Link	STM45153	STORM
Link	STM45154	STORM
Link	STM45155	STORM
Link	STM45156	STORM
Link	STM45159	STORM
Link	STM45160	STORM
Link	STM45161	STORM
Link	STM45162	STORM
Link	STM45163	STORM
Link	STM45164_1	STORM
Link	STM45164_2	STORM
Link	STM45165	STORM
Link	212-ICD	ICD
Link	215-ICD	ICD
Link	IN09003-ICD	ICD
Link	IN09003-INC	INC
Link	IN09004-ICD	ICD
Link	IN09004-INC	INC
Link	IN09005-ICD	ICD
Link	IN09005-INC	INC
Link	IN09006-ICD	ICD
Link	IN09006-INC	INC
Link	IN09007-ICD	ICD
Link	IN09008-ICD	ICD
Link	IN09009-ICD	ICD
Link	IN09009-INC	INC
Link	IN09010-ICD	ICD
Link	IN09010-INC	INC
Link	IN09011-ICD	ICD
Link	IN09011-INC	INC
Link	IN09012-ICD	ICD
Link	IN09012-INC	INC
Link	IN09013-ICD	ICD
Link	IN09013-INC	INC
Link	IN09014-ICD	ICD
Link	IN09014-INC	INC
Link	IN09015-ICD	ICD
Link	IN09015-INC	INC
Link	IN09016-ICD	ICD
Link	IN09017-ICD	ICD
Link	IN09017-INC	INC
Link	IN09018-ICD	ICD
Link	IN09018-INC	INC
Link	IN09019-ICD	ICD
Link	IN09019-INC	INC
Link	IN09020-ICD	ICD

```
Link       IN09020-INC      INC
Link       IN09021-ICD      ICD
Link       IN09021-INC      INC
Link       IN09022-ICD      ICD
Link       IN09022-INC      INC
Link       IN09023-ICD      ICD
Link       IN09023-INC      INC
Link       IN09024-ICD      ICD
Link       IN09024-INC      INC
Link       IN09025-ICD      ICD
Link       IN09025-INC      INC
Link       IN09026-ICD      ICD
Link       IN09026-INC      INC
Link       IN09027-ICD      ICD
Link       IN09027-INC      INC
Link       IN09028-ICD      ICD
Link       IN09028-INC      INC
Link       IN09029-ICD      ICD
Link       IN09029-INC      INC
Link       IN09030-ICD      ICD
Link       IN09030-INC      INC
Link       IN09031-ICD      ICD
Link       IN09031-INC      INC
Link       IN09032-ICD      ICD
Link       IN09032-INC      INC
Link       IN09033-ICD      ICD
Link       IN09033-INC      INC
Link       IN09034-ICD      ICD
Link       IN09034-INC      INC
Link       IN09035-ICD      ICD
Link       IN09035-INC      INC
Link       IN103407-ICD     ICD

[MAP]
DIMENSIONS       350056.306251781 5014976.29176218 350757.766320881 5015428.42071167
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
200              350236.22        5015304.609
201              350209.335       5015299.052
202              350201.692       5015307.586
203              350194.468       5015341.9
204              350186.244       5015339.654
205              350153.118       5015309.999
206              350118.272       5015278.782
207              350128.825       5015267
208              350157.244       5015292.366
210              350192.735       5015301.458
211              350203.38        5015290.412
212              350216.879       5015293.723
213              350140.85        5015328.978
```

```
215              350161.778       5015300.394
216              350215.638       5015300.361
217              350171.983       5015275.934
218              350160.358       5015307.194
219              350225.718       5015302.427
CB03             350143.947       5015299.152
CB05             350129.074       5015236.82
CBE01            350099.944       5015270.421
CBE04            350091.977       5015285.221
CBT02            350114.509       5015253.621
CBT03            350155.089       5015260.363
CBT05            350100.476       5015292.825
CBT06            350108.325       5015299.854
CBT07            350113.289       5015304.298
CBT08            350120.579       5015310.827
CBT09            350130.074       5015319.329
CBT10            350138.395       5015326.78
CBT11            350143.305       5015331.176
CBT12            350150.4         5015337.53
CBT13            350159.895       5015346.032
CBT14            350169.389       5015354.533
IN07998          350621.425       5015080.81
IN09003-MAJ      350247.234       5015313.065
IN09004-MAJ      350248.311       5015293.655
IN09005-MAJ      350299.715       5015216.72
IN09006-MAJ      350305.672       5015221.82
IN09009-MAJ      350398.641       5015102.487
IN09010-MAJ      350404.597       5015107.853
IN09011-MAJ      350468.924       5015023.32
IN09012-MAJ      350471.593       5015031.288
IN09013-MAJ      350556.46        5015047.398
IN09014-MAJ      350621.898       5015074.916
IN09015-MAJ      350625.131       5015067.338
IN09017-MAJ      350626.792       5015150.775
IN09018-MAJ      350632.578       5015155.866
IN09019-MAJ      350574.34        5015212.475
IN09020-MAJ      350580.594       5015217.119
IN09021-MAJ      350562.587       5015240.618
IN09022-MAJ      350312.204       5015357.483
IN09023-MAJ      350310.292       5015349.062
IN09024-MAJ      350363.423       5015288.115
IN09025-MAJ      350369.697       5015293.42
IN09026-MAJ      350419.396       5015223.431
IN09027-MAJ      350425.329       5015228.659
IN09028-MAJ      350466.777       5015183.937
IN09029-MAJ      350463.571       5015172.282
IN09030-MAJ      350510.843       5015118.237
IN09031-MAJ      350517.004       5015122.947
IN09032-MAJ      350546.223       5015063.339
IN09033-MAJ      350553.825       5015064.965
IN09034-MAJ      350534.993       5015237.172
IN09035-MAJ      350538.935       5015231.292
IN45566          350496.323       5015216.908
```

```
IN45569          350432.152       5015141.063
IN45570          350384.539       5015198.238
IN45572          350467.839       5015101.558
IN45573          350264.776       5015373.712
IN45574          350326.162       5015397.08
IN45575          350336.094       5015254.524
IN45577          350496.079       5015068.346
IN45587          350257.173       5015210.155
IN45588          350312.141       5015145.597
IN45589          350381.132       5015064.396
IN45590          350423.244       5015015.609
J1               350564.843       5015058.534
J2               350555.207       5015232.098
MHST09001        350224.039       5015353.25
MHST09002        350230.972       5015345.475
MHST09003        350235.708       5015309.242
MHST09004        350237.701       5015292.778
MHST09005        350291.793       5015229.955
MHST09006        350349.966       5015161.147
MHST09007        350409.63        5015093.799
MHST09008        350467.085       5015027.014
MHST09009        350479.295       5015023.595
MHST09010        350556.479       5015049.846
MHST09011        350628.361       5015071.514
MHST09013        350633.137       5015150.737
MHST09014        350584.395       5015209.484
MHST09015        350553.203       5015250.719
MHST09016        350272.391       5015328.497
MHST09017        350302.028       5015354.551
MHST09018        350315.399       5015352.853
MHST09019        350350.045       5015313.01
MHST09020        350408.843       5015244.76
MHST09021        350467.282       5015177.128
MHST09022        350505.694       5015132.451
MHST09023        350541.908       5015088.705
MHST09024        350503.21        5015208.294
OF-CREEK         350725.882       5015078.087
OF-HAZELDEAN     350206.288       5015398.796
CB01             350215.017       5015301.442
CB06             350191.863       5015320.653
CHAMBERS-1       350199.465       5015282.365
CHAMBERS-2       350165.304       5015289.803
IN09003          350246.559       5015313.113
IN09004          350248.307       5015293.832
IN09005          350300.205       5015216.385
IN09006          350306.001       5015221.469
IN09007          350357.814       5015161.87
IN09008          350351.701       5015157.165
IN09009          350398.931       5015102.149
IN09010          350404.886       5015107.563
IN09011          350469.113       5015023.754
IN09012          350471.437       5015030.953
IN09013          350556.355       5015047.722
```

```
IN09014          350621.772       5015075.37
IN09015          350625.099       5015067.459
IN09016          350667.92        5015097.621
IN09017          350626.37        5015150.174
IN09018          350632.086       5015155.363
IN09019          350574.678       5015212.726
IN09020          350581.021       5015217.481
IN09021          350563.395       5015241.028
IN09022          350312.767       5015357.29
IN09023          350310.748       5015348.819
IN09024          350363.662       5015287.797
IN09025          350370.08        5015292.654
IN09026          350419.942       5015222.816
IN09027          350426.026       5015227.901
IN09028          350467.566       5015183.842
IN09029          350464.177       5015171.575
IN09030          350511.332       5015117.665
IN09031          350517.379       5015122.612
IN09032          350546.357       5015062.966
IN09033          350553.994       5015064.494
IN09034          350534.392       5015237.866
IN09035          350539.504       5015231.73
IN103407         350211.409       5015362.487
MHST09012        350683.196       5015090.945

[VERTICES]
;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
C09              350158.069       5015291.377
C09              350161.689       5015287.406
C09              350162.465       5015287.269
C09              350164.94        5015289.654
C1               350283.551       5015232.784
C1               350283.823       5015234.693
C1               350236.873       5015289.803
C13              350625.96        5015079.068
C14              350166.158       5015282.396
C14              350162.639       5015286.345
C14              350162.676       5015287.017
C14              350165.141       5015289.426
C15              350201.493       5015280.024
C15              350210.972       5015288.473
C16              350201.767       5015288.895
C16              350197.282       5015284.87
C2               350339.619       5015168.398
C2               350339.525       5015169.525
C2               350290.333       5015226.561
C2               350290.209       5015228.721
C22              350286.133       5015349.217
C22              350286.33        5015346.558
C22              350271.128       5015332.885
C22              350270.684       5015330.44
C24              350168.372       5015292.427
```

C24	350168.306	5015293.156
C24	350163.135	5015298.874
C26	350311.388	5015361.299
C26	350309.99	5015360.66
C26	350303.634	5015360.85
C26	350301.988	5015359.423
C3	350408.849	5015087.268
C3	350408.812	5015088.586
C3	350407.062	5015090.551
C3	350407.157	5015091.748
C39	350212.499	5015374.507
C39	350205.667	5015381.865
C39	350203.995	5015385.263
C39	350202.762	5015389.296
C39	350203.507	5015393.387
C4	350450.725	5015038.494
C4	350451.008	5015039.812
C4	350407.528	5015090.94
C4	350407.468	5015091.571
C4	350409.167	5015092.902
C5	350366.59	5015280.139
C5	350366.575	5015282.182
C5	350345.57	5015306.319
C5	350345.027	5015308.165
C6	350416.049	5015224.631
C6	350416.095	5015226.037
C6	350403.983	5015239.331
C6	350403.974	5015240.624
C7	350463.644	5015167.655
C7	350463.738	5015169.47
C7	350462.118	5015171.433
C7	350462.095	5015173.744
C7	350465.971	5015177.031
C8	350498.952	5015128.032
C8	350498.914	5015129.691
C8	350462.536	5015172.149
C8	350462.623	5015173.371
C9	350527.085	5015095.748
C9	350527.033	5015097.419
C9	350500.892	5015127.123
C9	350500.675	5015128.385
C98	350199.352	5015281.657
C98	350202.004	5015278.64
C98	350213.16	5015288.415
C98	350213.128	5015289.883
C98	350216.78	5015293.143
C99	350169.532	5015285.118
C99	350173.477	5015288.631
C99	350173.344	5015289.46
C99	350164.378	5015299.47
OF1	350668.269	5015097.373
OF1	350668.301	5015096.929
OF1	350668.318	5015096.23
OF1	350668.425	5015095.836
OF1	350668.712	5015095.22
OF1	350669.211	5015094.672
OF1	350675.211	5015092.864
R01	350248.297	5015293.371
R01	350248.314	5015292.432
R01	350248.549	5015291.416
R01	350248.891	5015289.736
R01	350249.708	5015287.81
R01	350250.612	5015286.497
R01	350252.16	5015284.45
R01	350256.394	5015279.434
R01	350305.531	5015222.39
R02	350306.03	5015221.796
R02	350306.69	5015221.058
R02	350357.668	5015162.212
R03	350299.744	5015216.685
R03	350300.129	5015216.201
R03	350300.728	5015215.875
R03	350351.146	5015157.312
R04	350358.015	5015161.811
R04	350358.078	5015161.734
R04	350358.164	5015161.465
R05	350351.702	5015156.595
R06	350404.615	5015107.599
R06	350404.955	5015107.21
R06	350405.243	5015107.156
R06	350469.133	5015033.143
R06	350470.282	5015032.04
R07	350398.935	5015102.419
R07	350399.322	5015102.012
R07	350399.354	5015101.678
R07	350461.708	5015029.076
R07	350463.642	5015026.888
R07	350466.029	5015025.152
R07	350467.411	5015024.118
R08	350473.766	5015030.316
R08	350476.034	5015029.845
R08	350477.587	5015029.775
R08	350479.122	5015029.898
R08	350480.832	5015030.264
R09	350554.166	5015064.842
R09	350554.287	5015064.337
R09	350554.523	5015063.738
R09	350555.254	5015062.649
R09	350556.224	5015061.515
R09	350557.044	5015060.784
R09	350558.118	5015060.038
R09	350559.207	5015059.427
R09	350560.416	5015059.024
R09	350561.654	5015058.755
R09	350563.026	5015058.696
R10	350546.105	5015063.079

R10	350546.335	5015062.506
R10	350546.603	5015061.591
R10	350547.217	5015059.642
R10	350547.911	5015058.2
R10	350549.006	5015056.411
R10	350549.887	5015055.744
R10	350551.249	5015055.423
R10	350552.21	5015055.236
R10	350553.332	5015055.236
R10	350554.88	5015055.583
R10	350557.71	5015056.545
R10	350562.542	5015058.138
R11	350469.966	5015022.816
R11	350470.98	5015022.548
R11	350472.53	5015022.127
R11	350474.271	5015021.783
R11	350476.108	5015021.611
R11	350477.428	5015021.611
R11	350479.877	5015021.706
R11	350481.561	5015022.127
R11	350483.895	5015022.835
R11	350555.002	5015046.903
R12	350580.725	5015055.859
R12	350590.263	5015058.963
R12	350597.824	5015061.567
R12	350604.259	5015063.82
R12	350608.665	5015064.772
R12	350615.625	5015065.698
R12	350624.162	5015067.038
R12	350624.697	5015067.197
R12	350624.956	5015067.28
R13	350625.32	5015067.393
R13	350632.374	5015069.879
R13	350676.513	5015084.801
R13	350679.868	5015086.278
R13	350681.645	5015087.404
R13	350682.772	5015088.706
R13	350683.039	5015089.612
R14	350622.327	5015075.302
R14	350624.56	5015075.925
R14	350663.011	5015088.574
R14	350665.007	5015089.863
R14	350665.839	5015090.612
R14	350666.838	5015091.901
R14	350667.669	5015093.607
R14	350668.145	5015096.072
R14	350668.08	5015097.033
R15	350577.563	5015063.065
R15	350590.626	5015067.52
R15	350599.234	5015070.356
R15	350607.031	5015072.685
R15	350610.17	5015073.427
R15	350612.837	5015073.765
R15	350615.841	5015073.9
R15	350619.254	5015074.552
R15	350620.653	5015074.915
R15	350621.372	5015075.034
R16	350539.049	5015231.852
R16	350539.771	5015232.489
R16	350540.889	5015232.738
R16	350543.169	5015233.714
R16	350544.733	5015234.103
R16	350546.989	5015234.398
R16	350548.748	5015234.367
R16	350550.35	5015234.118
R16	350552.109	5015233.714
R16	350553.54	5015233.06
R17	350536.588	5015238.596
R17	350538.914	5015240.49
R17	350540.842	5015242.251
R17	350541.872	5015242.683
R17	350542.902	5015242.417
R17	350546.942	5015238.226
R17	350550.271	5015235.089
R17	350552.81	5015233.93
R18	350563.457	5015239.733
R18	350563.658	5015239.303
R18	350563.687	5015238.712
R18	350563.622	5015237.466
R18	350563.728	5015236.48
R18	350564.144	5015235.386
R18	350564.584	5015234.464
R18	350580.55	5015217.877
R19	350564.327	5015223.043
R19	350574.148	5015213.085
R20	350581.252	5015217.153
R20	350603.279	5015190.77
R20	350631.75	5015156.598
R21	350575.236	5015212.077
R21	350626.187	5015151.499
R22	350632.945	5015155.287
R22	350659.643	5015122.789
R22	350681.572	5015097.8
R22	350683.041	5015095.598
R22	350683.571	5015094.29
R22	350683.886	5015092.462
R22	350683.59	5015091.668
R23	350627.032	5015150.333
R23	350627.124	5015149.595
R23	350657.703	5015112.666
R23	350666.588	5015102.09
R23	350667.318	5015100.661
R23	350667.749	5015099.363
R23	350668.015	5015098.408
R24	350246.353	5015313.522
R24	350244.438	5015314.175

R24	350242.77	5015315.18
R24	350241.572	5015316.431
R24	350240.684	5015317.619
R24	350239.796	5015319.329
R24	350239.196	5015322.327
R24	350237.752	5015334.1
R24	350237.261	5015337.806
R24	350236.553	5015341.24
R24	350235.272	5015344.702
R24	350233.473	5015348.381
R24	350231.04	5015352.347
R24	350227.625	5015358.005
R24	350225.333	5015360.737
R24	350221.333	5015365.273
R25	350310.846	5015349.204
R25	350311.582	5015348.674
R25	350311.726	5015348.113
R25	350363.47	5015288.645
R26	350313.076	5015357.438
R26	350314.179	5015356.786
R26	350316.085	5015355.402
R26	350317.793	5015353.68
R26	350320.857	5015350.221
R27	350369.563	5015292.635
R27	350370.119	5015291.906
R27	350370.948	5015291.97
R28	350364.194	5015287.898
R28	350419.262	5015224.247
R29	350425.308	5015227.908
R29	350425.981	5015227.068
R29	350427.04	5015227.118
R29	350461.462	5015187.723
R29	350463.653	5015185.518
R29	350464.834	5015184.778
R30	350420.449	5015223.287
R30	350420.994	5015222.64
R30	350421.062	5015221.856
R30	350463.357	5015173.105
R31	350464.377	5015172.202
R31	350465.253	5015171.426
R31	350465.23	5015170.583
R31	350509.996	5015119.189
R32	350467.005	5015183.407
R32	350467.75	5015183.338
R32	350468.98	5015183.979
R32	350470.192	5015184.065
R32	350471.509	5015184.412
R32	350472.946	5015185.035
R32	350474.297	5015185.867
R32	350532.246	5015235.864
R32	350533.582	5015236.911
R33	350511.659	5015118.372
R33	350512.347	5015117.626
R33	350511.864	5015116.953
R33	350530.125	5015096.133
R33	350532.979	5015092.677
R33	350535.1	5015089.744
R33	350536.724	5015087.047
R33	350538.688	5015083.512
R33	350545.787	5015063.889
R33	350545.953	5015063.499
R34	350517.052	5015122.474
R34	350517.499	5015121.996
R34	350517.859	5015121.964
R34	350538.513	5015098.111
R34	350541.199	5015094.873
R34	350542.58	5015092.613
R34	350544.89	5015088.321
R34	350546.622	5015084.43
R34	350553.561	5015066.376
R34	350553.987	5015065.349
IN09004-ICD	350241.872	5015289.056
IN09004-ICD	350241.094	5015289.354
IN09004-ICD	350238.462	5015292.562
IN09005-ICD	350301.363	5015217.207
IN09005-ICD	350301.413	5015217.758
IN09005-ICD	350291.485	5015228.24
IN09006-ICD	350303.415	5015221.919
IN09006-ICD	350295.551	5015231.269
IN09007-ICD	350357.307	5015161.501
IN09007-ICD	350356.552	5015161.675
IN09007-ICD	350355.012	5015163.4
IN09008-ICD	350352.003	5015157.431
IN09008-ICD	350351.955	5015157.804
IN09008-ICD	350349.676	5015160.321
IN09009-ICD	350400.3	5015102.355
IN09009-ICD	350407.391	5015093.864
IN09010-ICD	350404.554	5015107.262
IN09010-ICD	350403.535	5015104.811
IN09010-ICD	350410.028	5015097.226
IN09011-ICD	350467.421	5015024.755
IN09011-ICD	350466.698	5015025.785
IN09012-ICD	350469.993	5015030.36
IN09013-ICD	350555.895	5015048.88
IN09014-ICD	350623.616	5015073.245
IN09014-ICD	350625.864	5015073.945
IN09015-ICD	350625.715	5015068.474
IN09015-ICD	350628.238	5015069.448
IN09016-ICD	350668.74	5015100.546
IN09016-ICD	350631.121	5015146.614
IN09017-ICD	350630.266	5015152.878
IN09017-ICD	350631.848	5015150.966
IN09018-ICD	350631.741	5015154.008
IN09018-ICD	350633.472	5015151.909
IN09019-ICD	350576.961	5015214.57
IN09019-ICD	350578.054	5015214.472

```
IN09019-ICD      350581.937       5015209.411
IN09020-ICD      350580.829       5015215.599
IN09020-ICD      350583.98        5015211.309
IN09021-ICD      350555.952       5015249.96
IN09022-ICD      350308.98        5015355.044
IN09022-ICD      350304.544       5015355.254
IN09023-ICD      350307.457       5015352.682
IN09023-ICD      350306.14        5015352.883
IN09023-ICD      350302.969       5015353.233
IN09024-ICD      350365.306       5015289.191
IN09024-ICD      350365.141       5015290.114
IN09024-ICD      350349.087       5015309.499
IN09025-ICD      350369.407       5015292.134
IN09025-ICD      350368.693       5015292.209
IN09025-ICD      350351.126       5015312.921
IN09026-ICD      350420.469       5015226.207
IN09026-ICD      350407.489       5015241.576
IN09027-ICD      350423.725       5015228.795
IN09027-ICD      350410.488       5015244.156
IN09028-ICD      350466.009       5015181.057
IN09029-ICD      350464.611       5015174.332
IN09030-ICD      350513.132       5015119.276
IN09030-ICD      350513.163       5015120.106
IN09030-ICD      350504.186       5015130.559
IN09031-ICD      350516.152       5015121.64
IN09031-ICD      350515.304       5015121.64
IN09031-ICD      350506.582       5015132.521
IN09032-ICD      350547.678       5015065.692
IN09032-ICD      350540.488       5015086.32
IN09033-ICD      350553.082       5015064.322
IN09033-ICD      350552.129       5015065.225
IN09033-ICD      350543.826       5015087.347
IN09034-ICD      350534.287       5015236.056
IN09034-ICD      350504.005       5015210.844
IN09035-ICD      350535.193       5015231.94
IN09035-ICD      350506.168       5015208.022
IN103407-ICD     350220.497       5015352.317

[POLYGONS]
;;Subcatchment   X-Coord          Y-Coord
;;-------------- ---------------- ----------------
ES01_1           350246.596       5015314.238
ES01_1           350249.833       5015306.976
ES01_1           350239.121       5015295.194
ES01_1           350228.288       5015297.311
ES01_1           350228.295       5015297.313
ES01_1           350227.076       5015307.139
ES01_1           350223.845       5015334.24
ES01_1           350223.681       5015335.166
ES01_1           350223.487       5015336.086
ES01_1           350223.262       5015336.998
ES01_1           350223.007       5015337.903
ES01_1           350222.722       5015338.799
ES01_1           350222.407       5015339.685
ES01_1           350222.063       5015340.56
ES01_1           350221.69        5015341.423
ES01_1           350221.289       5015342.273
ES01_1           350220.86        5015343.109
ES01_1           350220.403       5015343.931
ES01_1           350219.92        5015344.737
ES01_1           350219.41        5015345.526
ES01_1           350218.873       5015346.298
ES01_1           350218.312       5015347.052
ES01_1           350217.726       5015347.787
ES01_1           350217.048       5015348.568
ES01_1           350201.662       5015365.502
ES01_1           350186.7         5015366.274
ES01_1           350181.891       5015366.534
ES01_1           350181.593       5015373.969
ES01_1           350169.716       5015388.007
ES01_1           350191.968       5015407.869
ES01_1           350206.557       5015391.73
ES01_1           350229.475       5015381.327
ES01_1           350237.544       5015349.952
ES01_1           350259.532       5015342.13
ES01_1           350261.014       5015340.444
ES01_1           350244.79        5015325.87
ES01_1           350246.596       5015314.238
ES02_1           350272.925       5015326.896
ES02_1           350288.081       5015309.656
ES02_1           350268.01        5015291.14
ES02_1           350249.661       5015293.941
ES02_1           350241.854       5015291.481
ES02_1           350239.121       5015295.194
ES02_1           350249.833       5015306.976
ES02_1           350272.925       5015326.896
ES02_2           350244.79        5015325.87
ES02_2           350261.014       5015340.444
ES02_2           350272.925       5015326.896
ES02_2           350249.833       5015306.976
ES02_2           350246.596       5015314.238
ES02_2           350244.79        5015325.87
ES03_1           350242.683       5015290.339
ES03_1           350302.554       5015219.116
ES03_1           350282.887       5015202.618
ES03_1           350275.492       5015211.374
ES03_1           350212.793       5015283.918
ES03_1           350228.295       5015297.313
ES03_1           350239.121       5015295.194
ES03_1           350241.854       5015291.481
ES03_1           350242.683       5015290.339
ES03_2           350302.554       5015219.116
ES03_2           350242.683       5015290.339
ES03_2           350241.854       5015291.481
ES03_2           350249.661       5015293.941
ES03_2           350268.01        5015291.14
```

ES03_2	350317.719	5015237.254
ES03_2	350320.254	5015234.481
ES03_2	350302.554	5015219.116
ES04_1	350354.62	5015159.699
ES04_1	350351.255	5015156.741
ES04_1	350334.405	5015141.95
ES04_1	350323.339	5015154.439
ES04_1	350282.887	5015202.618
ES04_1	350302.554	5015219.116
ES04_1	350354.62	5015159.699
ES04_2	350354.62	5015159.699
ES04_2	350302.554	5015219.116
ES04_2	350320.254	5015234.481
ES04_2	350374.817	5015175.359
ES04_2	350357.821	5015162.128
ES04_2	350354.62	5015159.699
ES05_1	350354.62	5015159.699
ES05_1	350401.995	5015104.511
ES05_1	350398.784	5015101.692
ES05_1	350382.489	5015087.882
ES05_1	350334.405	5015141.95
ES05_1	350351.255	5015156.741
ES05_1	350354.62	5015159.699
ES05_2	350401.995	5015104.511
ES05_2	350354.62	5015159.699
ES05_2	350357.821	5015162.128
ES05_2	350374.817	5015175.359
ES05_2	350421.526	5015120.994
ES05_2	350405.306	5015107.418
ES05_2	350401.995	5015104.511
ES06_1	350470.851	5015027.144
ES06_1	350471.247	5015027.047
ES06_1	350471.244	5015027.036
ES06_1	350469.967	5015022.477
ES06_1	350454.439	5015004.767
ES06_1	350442.724	5015018.336
ES06_1	350382.489	5015087.882
ES06_1	350398.784	5015101.692
ES06_1	350401.995	5015104.511
ES06_1	350465.666	5015031.175
ES06_1	350467.966	5015028.874
ES06_1	350469.214	5015027.951
ES06_1	350470.851	5015027.144
ES06_2	350465.666	5015031.175
ES06_2	350401.995	5015104.511
ES06_2	350405.306	5015107.418
ES06_2	350421.526	5015120.994
ES06_2	350480.519	5015050.249
ES06_2	350472.085	5015031.234
ES06_2	350471.247	5015027.047
ES06_2	350470.851	5015027.144
ES06_2	350469.214	5015027.951
ES06_2	350467.966	5015028.874
ES06_2	350465.666	5015031.175
ES07	350526.313	5015041.811
ES07	350554.367	5015051.146
ES07	350562.689	5015027.23
ES07	350502.967	5015008.267
ES07	350489.816	5015018.728
ES07	350474.118	5015013.397
ES07	350468.867	5014996.843
ES07	350454.439	5015004.767
ES07	350469.967	5015022.477
ES07	350471.244	5015027.036
ES07	350473.652	5015026.496
ES07	350476.019	5015025.965
ES07	350480.482	5015026.197
ES07	350484.328	5015027.496
ES07	350502.826	5015033.836
ES07	350526.313	5015041.811
ES08_1	350301.969	5015352.788
ES08_1	350272.93	5015326.89
ES08_1	350259.532	5015342.13
ES08_1	350294.076	5015372.967
ES08_1	350319.242	5015374.474
ES08_1	350313.122	5015357.333
ES08_1	350312.086	5015353.119
ES08_1	350310.036	5015354.088
ES08_1	350308.467	5015354.43
ES08_1	350305.714	5015354.485
ES08_1	350303.849	5015353.843
ES08_1	350301.969	5015352.788
ES08_2	350310.036	5015354.088
ES08_2	350312.086	5015353.119
ES08_2	350310.984	5015348.635
ES08_2	350306.052	5015326.234
ES08_2	350288.081	5015309.656
ES08_2	350272.93	5015326.89
ES08_2	350301.969	5015352.788
ES08_2	350303.849	5015353.843
ES08_2	350305.714	5015354.485
ES08_2	350308.467	5015354.43
ES08_2	350310.036	5015354.088
ES09_1	350315.954	5015349.036
ES09_1	350367.301	5015290.193
ES09_1	350363.859	5015287.57
ES09_1	350348.867	5015275.034
ES09_1	350306.052	5015326.234
ES09_1	350310.984	5015348.635
ES09_1	350312.085	5015353.114
ES09_1	350312.803	5015352.64
ES09_1	350313.879	5015351.529
ES09_1	350315.954	5015349.036
ES09_2	350312.803	5015352.64
ES09_2	350312.085	5015353.114
ES09_2	350313.122	5015357.333

ES09_2	350319.242	5015374.474
ES09_2	350383.043	5015303.573
ES09_2	350370.579	5015292.69
ES09_2	350367.301	5015290.193
ES09_2	350315.954	5015349.036
ES09_2	350313.879	5015351.529
ES09_2	350312.803	5015352.64
ES10_1	350367.301	5015290.193
ES10_1	350423.501	5015225.4
ES10_1	350420.139	5015222.589
ES10_1	350404.004	5015209.097
ES10_1	350401.433	5015212.171
ES10_1	350353.992	5015268.905
ES10_1	350348.867	5015275.034
ES10_1	350363.859	5015287.57
ES10_1	350367.301	5015290.193
ES10_2	350423.501	5015225.4
ES10_2	350367.301	5015290.193
ES10_2	350370.579	5015292.69
ES10_2	350383.043	5015303.573
ES10_2	350440.411	5015239.822
ES10_2	350426.223	5015227.675
ES10_2	350423.501	5015225.4
ES11_1	350423.501	5015225.4
ES11_1	350467.202	5015176.36
ES11_1	350466.293	5015170.651
ES11_1	350449.238	5015155.003
ES11_1	350404.004	5015209.097
ES11_1	350420.139	5015222.589
ES11_1	350423.501	5015225.4
ES11_2	350467.202	5015176.36
ES11_2	350423.501	5015225.4
ES11_2	350426.223	5015227.675
ES11_2	350440.411	5015239.822
ES11_2	350471.902	5015204.826
ES11_2	350467.202	5015176.36
ES12_1	350514.415	5015119.799
ES12_1	350511.529	5015117.439
ES12_1	350507.005	5015113.557
ES12_1	350494.422	5015100.968
ES12_1	350483.267	5015114.309
ES12_1	350449.238	5015155.003
ES12_1	350466.293	5015170.651
ES12_1	350467.202	5015176.36
ES12_1	350514.415	5015119.799
ES12_2	350514.415	5015119.799
ES12_2	350467.202	5015176.36
ES12_2	350500.572	5015174.972
ES12_2	350533.605	5015135.958
ES12_2	350517.576	5015122.386
ES12_2	350514.415	5015119.799
ES13_1	350541.96	5015086.344
ES13_1	350549.524	5015063.793

ES13_1	350546.071	5015062.538
ES13_1	350521.632	5015066.116
ES13_1	350511.126	5015082.018
ES13_1	350494.422	5015100.968
ES13_1	350507.005	5015113.557
ES13_1	350511.529	5015117.439
ES13_1	350514.415	5015119.799
ES13_1	350534.378	5015097.718
ES13_1	350538.765	5015092.194
ES13_1	350541.96	5015086.344
ES13_2	350534.378	5015097.718
ES13_2	350514.415	5015119.799
ES13_2	350517.576	5015122.386
ES13_2	350533.605	5015135.958
ES13_2	350560.92	5015103.697
ES13_2	350569.201	5015078.321
ES13_2	350554.648	5015064.422
ES13_2	350549.524	5015063.793
ES13_2	350541.96	5015086.344
ES13_2	350538.765	5015092.194
ES13_2	350534.378	5015097.718
ES14_1	350598.934	5015066.244
ES14_1	350554.334	5015051.239
ES14_1	350549.524	5015063.793
ES14_1	350554.648	5015064.422
ES14_1	350569.201	5015078.321
ES14_1	350601.222	5015088.612
ES14_1	350621.472	5015080.131
ES14_1	350624.263	5015071.886
ES14_1	350620.533	5015070.598
ES14_1	350617.033	5015069.915
ES14_1	350614.301	5015069.403
ES14_1	350610.203	5015068.805
ES14_1	350606.618	5015068.037
ES14_1	350602.691	5015067.354
ES14_1	350598.934	5015066.244
ES14_2	350620.533	5015070.598
ES14_2	350624.263	5015071.886
ES14_2	350631.522	5015050.441
ES14_2	350562.689	5015027.23
ES14_2	350554.367	5015051.146
ES14_2	350554.334	5015051.239
ES14_2	350598.934	5015066.244
ES14_2	350602.691	5015067.354
ES14_2	350606.618	5015068.037
ES14_2	350610.203	5015068.805
ES14_2	350614.301	5015069.403
ES14_2	350617.033	5015069.915
ES14_2	350620.533	5015070.598
ES15_1	350667.353	5015085.75
ES15_1	350624.262	5015071.891
ES15_1	350621.472	5015080.131
ES15_1	350636.525	5015096.98

ES15_1	350667.555	5015095.113
ES15_1	350675.352	5015092.73
ES15_1	350674.518	5015090.875
ES15_1	350673.691	5015089.497
ES15_1	350672.479	5015088.064
ES15_1	350667.353	5015085.75
ES15_2	350674.518	5015090.875
ES15_2	350675.352	5015092.73
ES15_2	350683.196	5015090.837
ES15_2	350684.893	5015089.977
ES15_2	350676.012	5015072.254
ES15_2	350677.665	5015066.586
ES15_2	350633.769	5015051.181
ES15_2	350631.522	5015050.441
ES15_2	350624.262	5015071.891
ES15_2	350667.353	5015085.75
ES15_2	350672.479	5015088.064
ES15_2	350673.691	5015089.497
ES15_2	350674.518	5015090.875
ES16_1	350467.202	5015176.36
ES16_1	350471.902	5015204.826
ES16_1	350490.656	5015208.217
ES16_1	350516.816	5015231.613
ES16_1	350520.547	5015239.947
ES16_1	350533.326	5015238.736
ES16_1	350534.416	5015237.367
ES16_1	350537.166	5015234.378
ES16_1	350467.202	5015176.36
ES16_2	350467.202	5015176.36
ES16_2	350537.166	5015234.378
ES16_2	350543.352	5015228.647
ES16_2	350544.914	5015210.616
ES16_2	350500.572	5015174.972
ES16_2	350467.202	5015176.36
ES17	350503.081	5015293.23
ES17	350523.624	5015268.442
ES17	350539.907	5015250.846
ES17	350548.888	5015242.22
ES17	350537.166	5015234.378
ES17	350534.416	5015237.367
ES17	350533.326	5015238.736
ES17	350520.547	5015239.947
ES17	350486.567	5015280.036
ES17	350503.081	5015293.23
ES18	350579.975	5015251.855
ES18	350559.918	5015236.037
ES18	350548.888	5015242.22
ES18	350539.907	5015250.846
ES18	350523.624	5015268.442
ES18	350503.081	5015293.23
ES18	350524.877	5015311.721
ES18	350579.975	5015251.855
ES19	350537.166	5015234.378
ES19	350548.888	5015242.22
ES19	350559.918	5015236.037
ES19	350578.255	5015215.022
ES19	350574.561	5015212.24
ES19	350571.935	5015206.644
ES19	350558.48	5015195.476
ES19	350544.914	5015210.616
ES19	350543.352	5015228.647
ES19	350537.166	5015234.378
ES20	350596.738	5015232.091
ES20	350586.069	5015221.104
ES20	350581.212	5015217.25
ES20	350578.255	5015215.022
ES20	350559.918	5015236.037
ES20	350579.975	5015251.855
ES20	350596.738	5015232.091
ES21_1	350629.767	5015153.191
ES21_1	350610.825	5015175.979
ES21_1	350630.223	5015192.681
ES21_1	350650.406	5015168.925
ES21_1	350638.08	5015158.476
ES21_1	350632.805	5015155.859
ES21_1	350629.767	5015153.191
ES21_3	350610.824	5015175.978
ES21_3	350578.255	5015215.022
ES21_3	350581.212	5015217.25
ES21_3	350586.069	5015221.104
ES21_3	350596.738	5015232.091
ES21_3	350630.223	5015192.681
ES21_3	350610.824	5015175.978
ES21_4	350578.255	5015215.022
ES21_4	350610.824	5015175.978
ES21_4	350588.892	5015157.094
ES21_4	350558.48	5015195.476
ES21_4	350571.935	5015206.644
ES21_4	350574.561	5015212.24
ES21_4	350578.255	5015215.022
ES21_5	350610.825	5015175.979
ES21_5	350629.767	5015153.191
ES21_5	350626.273	5015150.337
ES21_5	350622.373	5015146.391
ES21_5	350607.248	5015134.276
ES21_5	350588.892	5015157.094
ES21_5	350610.825	5015175.979
ES22_1	350675.443	5015093.308
ES22_1	350675.307	5015092.744
ES22_1	350667.555	5015095.113
ES22_1	350636.525	5015096.98
ES22_1	350607.248	5015134.276
ES22_1	350622.373	5015146.391
ES22_1	350626.273	5015150.337
ES22_1	350629.767	5015153.191
ES22_1	350669.773	5015104.421

ES22_1	350672.575	5015100.901
ES22_1	350674.465	5015097.447
ES22_1	350675.345	5015095.198
ES22_1	350675.443	5015093.308
ES22_2	350669.773	5015104.421
ES22_2	350629.767	5015153.191
ES22_2	350632.805	5015155.859
ES22_2	350638.08	5015158.476
ES22_2	350650.406	5015168.925
ES22_2	350701.817	5015108.415
ES22_2	350684.893	5015089.977
ES22_2	350683.196	5015090.837
ES22_2	350675.352	5015092.73
ES22_2	350675.307	5015092.744
ES22_2	350675.443	5015093.308
ES22_2	350675.345	5015095.198
ES22_2	350674.465	5015097.447
ES22_2	350672.575	5015100.901
ES22_2	350669.773	5015104.421
ES23	350275.492	5015211.374
ES23	350282.887	5015202.618
ES23	350289.035	5015195.296
ES23	350277.456	5015185.27
ES23	350212.457	5015261.227
ES23	350208.517	5015261.122
ES23	350198.768	5015271.796
ES23	350212.793	5015283.918
ES23	350275.492	5015211.374
ES24	350312.067	5015144.703
ES24	350277.456	5015185.27
ES24	350289.035	5015195.296
ES24	350323.339	5015154.439
ES24	350312.067	5015144.703
ES25	350334.405	5015141.95
ES25	350382.489	5015087.882
ES25	350401.067	5015066.555
ES25	350388.3	5015055.525
ES25	350312.067	5015144.703
ES25	350323.339	5015154.439
ES25	350334.405	5015141.95
ES26	350442.724	5015018.336
ES26	350429.701	5015007.093
ES26	350388.3	5015055.525
ES26	350401.067	5015066.555
ES26	350442.724	5015018.336
ES27	350353.992	5015268.905
ES27	350317.719	5015237.254
ES27	350268.01	5015291.14
ES27	350288.081	5015309.656
ES27	350306.052	5015326.234
ES27	350353.992	5015268.905
ES28	350401.433	5015212.171
ES28	350367.692	5015183.082
ES28	350320.254	5015234.481
ES28	350317.719	5015237.254
ES28	350353.992	5015268.905
ES28	350401.433	5015212.171
ES29	350401.433	5015212.171
ES29	350449.238	5015155.003
ES29	350416.484	5015126.862
ES29	350374.817	5015175.359
ES29	350367.692	5015183.082
ES29	350401.433	5015212.171
ES30	350449.238	5015155.003
ES30	350483.267	5015114.309
ES30	350450.609	5015086.116
ES30	350421.526	5015120.994
ES30	350416.484	5015126.862
ES30	350449.238	5015155.003
ES31	350494.422	5015100.968
ES31	350511.126	5015082.018
ES31	350481.422	5015052.285
ES31	350480.519	5015050.249
ES31	350450.609	5015086.116
ES31	350483.267	5015114.309
ES31	350494.422	5015100.968
ES32	350558.48	5015195.476
ES32	350607.248	5015134.276
ES32	350636.525	5015096.98
ES32	350621.472	5015080.131
ES32	350601.222	5015088.612
ES32	350569.201	5015078.321
ES32	350560.92	5015103.697
ES32	350500.572	5015174.972
ES32	350544.914	5015210.616
ES32	350558.48	5015195.476
ES33	350267.274	5015375.65
ES33	350280.493	5015360.842
ES33	350259.532	5015342.13
ES33	350237.544	5015349.952
ES33	350229.475	5015381.327
ES33	350246.554	5015396.89
ES33	350267.274	5015375.65
ES34	350341.416	5015396.087
ES34	350396.729	5015335.026
ES34	350384.909	5015319.835
ES34	350375.792	5015311.631
ES34	350319.242	5015374.474
ES34	350294.076	5015372.967
ES34	350280.493	5015360.842
ES34	350267.274	5015375.65
ES34	350289.432	5015395.43
ES34	350297.547	5015401.984
ES34	350341.416	5015396.087
ES35	350486.567	5015280.036
ES35	350520.547	5015239.947

ES35	350516.816	5015231.613
ES35	350490.656	5015208.217
ES35	350471.902	5015204.826
ES35	350440.411	5015239.822
ES35	350383.043	5015303.573
ES35	350375.792	5015311.631
ES35	350384.909	5015319.835
ES35	350396.729	5015335.026
ES35	350424.484	5015357.689
ES35	350486.567	5015280.036
ES36	350476.019	5015025.965
ES36	350471.244	5015027.036
ES36	350472.085	5015031.234
ES36	350481.422	5015052.285
ES36	350511.126	5015082.018
ES36	350521.632	5015066.116
ES36	350546.071	5015062.538
ES36	350549.524	5015063.793
ES36	350550.007	5015062.533
ES36	350554.367	5015051.146
ES36	350526.313	5015041.811
ES36	350502.826	5015033.836
ES36	350484.328	5015027.496
ES36	350480.482	5015026.197
ES36	350476.019	5015025.965
S01	350184.844	5015310.363
S01	350177.65	5015304.164
S01	350168.942	5015313.701
S01	350165.549	5015311.05
S01	350150.342	5015327.786
S01	350169.972	5015345.351
S01	350182.595	5015356.647
S01	350196.599	5015359.286
S01	350204.273	5015350.909
S01	350207.291	5015346.328
S01	350209.118	5015337.455
S01	350200.93	5015335.569
S01	350198.855	5015326.267
S01	350197.439	5015321.911
S01	350193.582	5015318.297
S01	350184.844	5015310.363
S02	350200.93	5015335.569
S02	350209.118	5015337.455
S02	350215.262	5015309.144
S02	350227.076	5015307.139
S02	350228.288	5015297.311
S02	350215.081	5015294.443
S02	350214.891	5015293.867
S02	350217.754	5015290.668
S02	350198.158	5015273.127
S02	350194.923	5015276.741
S02	350194.429	5015276.768
S02	350194.17	5015276.536
S02	350193.252	5015276.587
S02	350189.918	5015280.314
S02	350189.969	5015281.232
S02	350194.657	5015285.427
S02	350189.982	5015290.65
S02	350189.982	5015290.659
S02	350177.65	5015304.164
S02	350184.844	5015310.363
S02	350193.582	5015318.297
S02	350197.439	5015321.911
S02	350198.855	5015326.267
S02	350200.93	5015335.569
S03	350183.588	5015284.926
S03	350189.982	5015290.65
S03	350194.657	5015285.427
S03	350189.969	5015281.232
S03	350189.918	5015280.314
S03	350193.252	5015276.587
S03	350194.17	5015276.536
S03	350194.429	5015276.768
S03	350194.923	5015276.741
S03	350198.158	5015273.127
S03	350217.754	5015290.668
S03	350214.891	5015293.867
S03	350215.081	5015294.443
S03	350228.295	5015297.318
S03	350196.633	5015269.95
S03	350183.588	5015284.926
S04	350155.738	5015284.72
S04	350159.373	5015280.428
S04	350126.935	5015251.392
S04	350100.074	5015282.781
S04	350136.045	5015314.992
S04	350140.179	5015310.41
S04	350144.135	5015309.53
S04	350157.317	5015293.332
S04	350153.453	5015289.791
S04	350155.738	5015284.72
S05	350140.179	5015310.41
S05	350136.045	5015314.992
S05	350150.342	5015327.795
S05	350165.549	5015311.059
S05	350168.941	5015313.711
S05	350189.982	5015290.669
S05	350168.345	5015271.31
S05	350162.87	5015277.22
S05	350161.176	5015279.124
S05	350160.952	5015278.924
S05	350159.502	5015280.544
S05	350159.373	5015280.428
S05	350155.738	5015284.72
S05	350153.453	5015289.791
S05	350157.317	5015293.332

```
S05              350144.135       5015309.53      
S05              350140.179       5015310.41      
S06              350126.935       5015251.392     
S06              350159.502       5015280.544     
S06              350160.952       5015278.924     
S06              350161.176       5015279.124     
S06              350162.87        5015277.22      
S06              350168.345       5015271.301     
S06              350129.089       5015236.177     
S06              350126.935       5015251.392     
S07              350100.074       5015282.781     
S07              350126.935       5015251.392     
S07              350129.089       5015236.177     
S07              350093.341       5015276.753     
S07              350100.074       5015282.781     
S08_1            350145.703       5015323.624     
S08_1            350140.479       5015329.438     
S08_1            350179.362       5015364.268     
S08_1            350182.364       5015361.059     
S08_1            350182.743       5015356.675     
S08_1            350182.595       5015356.647     
S08_1            350148.071       5015325.743     
S08_1            350145.703       5015323.624     
S08_2            350140.479       5015329.438     
S08_2            350145.703       5015323.624     
S08_2            350093.341       5015276.753     
S08_2            350088.191       5015282.599     
S08_2            350140.479       5015329.438     
S09              350182.743       5015356.675     
S09              350182.364       5015361.059     
S09              350179.362       5015364.268     
S09              350181.891       5015366.534     
S09              350201.662       5015365.507     
S09              350217.048       5015348.568     
S09              350217.665       5015347.856     
S09              350218.257       5015347.124     
S09              350218.823       5015346.372     
S09              350219.362       5015345.6       
S09              350219.874       5015344.81      
S09              350220.359       5015344.003     
S09              350220.815       5015343.179     
S09              350221.242       5015342.34      
S09              350221.639       5015341.486     
S09              350222.007       5015340.619     
S09              350222.344       5015339.74      
S09              350222.65        5015338.85      
S09              350222.925       5015337.95      
S09              350223.169       5015337.04      
S09              350223.381       5015336.123     
S09              350223.56        5015335.199     
S09              350223.708       5015334.269     
S09              350227.076       5015307.139     
S09              350215.262       5015309.144     
```

```
S09              350207.291       5015346.328     
S09              350204.273       5015350.909     
S09              350196.599       5015359.286     
S09              350182.743       5015356.675     

[SYMBOLS]
;;Gage           X-Coord          Y-Coord         
;;-------------- ---------------- ----------------

[PROFILES]
;;Name           Links     
;;-------------- ----------
"Node MHST09016 to Node OF-CREEK (Denham Way)" STM07876 STM45150 STM45151 STM45152 STM45153
"Node MHST09016 to Node OF-CREEK (Denham Way)" STM45154 STM45155 STM45156 STM45159 STM45160
"Node MHST09016 to Node OF-CREEK (Denham Way)" STM07871
"Node MHST09001 to Node OF-CREEK (Victor St)" STM07874 STM45163 STM45164_1 STM45164_2 STM45165
"Node MHST09001 to Node OF-CREEK (Victor St)" STM07857 STM07875 STM45161 STM45162 STM07873
"Node MHST09001 to Node OF-CREEK (Victor St)" STM45159 STM45160 STM07871
"Node MHST09024 to Node OF-CREEK (Savage Dr)" STM07872 STM07870 STM04620 STM04621 STM07871
"Node CBE04 to Node CBE15 (Perforated Pipes Along Hazeldean)" C28 C29 C30 C31 C32
"Node CBE04 to Node CBE15 (Perforated Pipes Along Hazeldean)" C33 C34 C35 C36 C37
"Node CBE04 to Node CBE15 (Perforated Pipes Along Hazeldean)" C38
"Node CBE01 to Node CHAMBERS-2 (Rear Perf Pipes)" C17 C18 C19 C20 C14
"Node CB03 to Node 205  (Through West Chambers 1)" C08 C09 C24 215-ICD
"Node 207 to Node 200 (Onsite Storm)" C01 C02 C03 C04 C05
"Node 207 to Node 200 (Onsite Storm)" C06 C25 C07 C10
"Node CB06 to Node 216 (Through East Chambers 1)" C23 C11 C16 C15 212-ICD
"Node CB01 to Node 216 (Through East Chambers 2)" C12 C16 C15 212-ICD
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

Updated PCSWMM Model to Include offsite Storm Sewer Analysis
Full Dual Drainage Model
J Fitzpatrick

WARNING 03: negative offset ignored for Link C01
WARNING 03: negative offset ignored for Link C02
WARNING 03: negative offset ignored for Link C16
WARNING 03: negative offset ignored for Link C25
WARNING 03: negative offset ignored for Link R10
WARNING 03: negative offset ignored for Link R10
WARNING 03: negative offset ignored for Link R16
WARNING 03: negative offset ignored for Link R16
WARNING 03: negative offset ignored for Link R17
WARNING 03: negative offset ignored for Link R17
WARNING 03: negative offset ignored for Link R18
WARNING 03: negative offset ignored for Link R18
WARNING 03: negative offset ignored for Link R19
WARNING 03: negative offset ignored for Link R19
WARNING 03: negative offset ignored for Link R20
WARNING 03: negative offset ignored for Link R21
WARNING 03: negative offset ignored for Link IN09009-INC
WARNING 03: negative offset ignored for Link IN09010-ICD
WARNING 03: negative offset ignored for Link IN09015-INC
WARNING 02: maximum depth increased for Node IN09003-MAJ
WARNING 02: maximum depth increased for Node IN09004-MAJ
WARNING 02: maximum depth increased for Node IN09005-MAJ
WARNING 02: maximum depth increased for Node IN09006-MAJ
WARNING 02: maximum depth increased for Node IN09009-MAJ
WARNING 02: maximum depth increased for Node IN09010-MAJ
WARNING 02: maximum depth increased for Node IN09011-MAJ
WARNING 02: maximum depth increased for Node IN09012-MAJ
WARNING 02: maximum depth increased for Node IN09013-MAJ
WARNING 02: maximum depth increased for Node IN09014-MAJ
WARNING 02: maximum depth increased for Node IN09015-MAJ
WARNING 02: maximum depth increased for Node IN09017-MAJ
WARNING 02: maximum depth increased for Node IN09018-MAJ
WARNING 02: maximum depth increased for Node IN09019-MAJ
WARNING 02: maximum depth increased for Node IN09020-MAJ
WARNING 02: maximum depth increased for Node IN09021-MAJ
WARNING 02: maximum depth increased for Node IN09022-MAJ
WARNING 02: maximum depth increased for Node IN09023-MAJ
WARNING 02: maximum depth increased for Node IN09024-MAJ
WARNING 02: maximum depth increased for Node IN09025-MAJ
WARNING 02: maximum depth increased for Node IN09026-MAJ
WARNING 02: maximum depth increased for Node IN09027-MAJ
WARNING 02: maximum depth increased for Node IN09028-MAJ
WARNING 02: maximum depth increased for Node IN09029-MAJ
WARNING 02: maximum depth increased for Node IN09030-MAJ
WARNING 02: maximum depth increased for Node IN09031-MAJ
```

```
WARNING 02: maximum depth increased for Node IN09032-MAJ
WARNING 02: maximum depth increased for Node IN09033-MAJ
WARNING 02: maximum depth increased for Node IN09034-MAJ
WARNING 02: maximum depth increased for Node IN09035-MAJ
WARNING 02: maximum depth increased for Node J1
WARNING 02: maximum depth increased for Node J2

*************
Element Count
*************
Number of rain gages ...... 3
Number of subcatchments ... 64
Number of nodes ........... 143
Number of links ........... 177
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                    Data       Recording
Name                 Data Source                    Type       Interval
------------------------------------------------------------------------
Chicago_3h_100yr     Chicago_3h_100yr               INTENSITY   10 min.
Chicago_3h_2year     Chicago_3h_2yr                 INTENSITY   10 min.
Chicago_3h_5year     Chicago_3h_5year               INTENSITY   10 min.


********************
Subcatchment Summary
********************
Name                       Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------------------
ES01_1                     0.33     57.00     67.78    1.5000 Chicago_3h_100yr     IN103407
ES02_1                     0.09     48.80     31.29    1.0000 Chicago_3h_100yr     IN09004-MAJ
ES02_2                     0.05     36.70     44.98    1.0000 Chicago_3h_100yr     IN09003-MAJ
ES03_1                     0.28    132.10     55.55    1.0000 Chicago_3h_100yr     IN09005-MAJ
ES03_2                     0.19    114.50     50.13    1.0000 Chicago_3h_100yr     IN09006-MAJ
ES04_1                     0.21     98.10     59.96    0.5000 Chicago_3h_100yr     IN09008
ES04_2                     0.20     98.00     55.14    0.5000 Chicago_3h_100yr     IN09007
ES05_1                     0.19     91.60     52.18    0.5000 Chicago_3h_100yr     IN09009-MAJ
ES05_2                     0.18     89.90     54.38    0.5000 Chicago_3h_100yr     IN09010-MAJ
ES06_1                     0.28    134.90     59.04    0.5000 Chicago_3h_100yr     IN09011-MAJ
ES06_2                     0.24    123.40     55.20    0.5000 Chicago_3h_100yr     IN09012-MAJ
ES07                       0.21     96.70     55.58    0.5000 Chicago_3h_100yr     IN09013-MAJ
ES08_1                     0.12     85.10     44.67    0.5000 Chicago_3h_100yr     IN09022-MAJ
ES08_2                     0.09     47.20     29.63    0.5000 Chicago_3h_100yr     IN09023-MAJ
ES09_1                     0.17     96.60     53.85    0.5000 Chicago_3h_100yr     IN09024-MAJ
ES09_2                     0.18    125.60     40.27    0.5000 Chicago_3h_100yr     IN09025-MAJ
ES10_1                     0.21    108.10     50.25    0.5000 Chicago_3h_100yr     IN09026-MAJ
ES10_2                     0.18    110.00     48.55    0.5000 Chicago_3h_100yr     IN09027-MAJ
ES11_1                     0.18     88.30     55.00    0.5000 Chicago_3h_100yr     IN09029-MAJ
```

```
ES11_2                    0.13     71.20     44.55    0.5000 Chicago_3h_100yr     IN09028-MAJ
ES12_1                    0.19     92.70     56.58    0.5000 Chicago_3h_100yr     MHST09022
ES12_2                    0.16     77.30     55.36    0.5000 Chicago_3h_100yr     IN09031-MAJ
ES13_1                    0.16     69.90     56.35    0.5000 Chicago_3h_100yr     MHST09023
ES13_2                    0.17     85.30     53.56    0.5000 Chicago_3h_100yr     MHST09023
ES14_1                    0.13     97.60     42.85    0.5000 Chicago_3h_100yr     IN09014-MAJ
ES14_2                    0.18     88.70     60.09    0.5000 Chicago_3h_100yr     IN09015-MAJ
ES15_1                    0.07     75.60     37.06    0.5000 Chicago_3h_100yr     IN09016
ES15_2                    0.12     70.50     57.09    0.5000 Chicago_3h_100yr     MHST09012
ES16_1                    0.10    107.50     35.74    1.5000 Chicago_3h_100yr     IN09034-MAJ
ES16_2                    0.17    100.20     26.88    1.5000 Chicago_3h_100yr     IN09035-MAJ
ES17                      0.14     78.50     41.72    2.0000 Chicago_3h_100yr     IN09034-MAJ
ES18                      0.24     93.30     40.76    2.0000 Chicago_3h_100yr     IN09021-MAJ
ES19                      0.10     46.40     63.06    0.5000 Chicago_3h_100yr     IN09019-MAJ
ES20                      0.07     32.30     33.18    0.5000 Chicago_3h_100yr     IN09020-MAJ
ES21_1                    0.08     36.80     58.87    0.5000 Chicago_3h_100yr     IN09018-MAJ
ES21_3                    0.13     60.80     42.56    0.5000 Chicago_3h_100yr     IN09020-MAJ
ES21_4                    0.14     60.30     62.82    0.5000 Chicago_3h_100yr     IN09019-MAJ
ES21_5                    0.09     36.20     54.72    0.5000 Chicago_3h_100yr     IN09017-MAJ
ES22_1                    0.18     74.80     62.63    0.5000 Chicago_3h_100yr     IN09016
ES22_2                    0.22    100.50     55.46    0.5000 Chicago_3h_100yr     MHST09012
ES23                      0.18     22.50     32.55    1.0000 Chicago_3h_100yr     IN45587
ES24                      0.08     15.80     27.01    1.0000 Chicago_3h_100yr     IN45588
ES25                      0.19     16.60     27.25    1.0000 Chicago_3h_100yr     IN45589
ES26                      0.11     17.70     32.21    1.0000 Chicago_3h_100yr     IN45590
ES27                      0.37     52.40     13.47    1.0000 Chicago_3h_100yr     IN45575
ES28                      0.34     50.10     21.80    1.0000 Chicago_3h_100yr     IN45570
ES29                      0.33     46.00     26.73    1.0000 Chicago_3h_100yr     IN45569
ES30                      0.23     47.40     28.57    1.0000 Chicago_3h_100yr     IN45572
ES31                      0.19     48.30     24.97    1.0000 Chicago_3h_100yr     IN45577
ES32                      0.79     57.10     19.91    1.0000 Chicago_3h_100yr     IN07998
ES33                      0.16     51.30     31.77    1.0000 Chicago_3h_100yr     IN45573
ES34                      0.41     54.30     10.08    1.0000 Chicago_3h_100yr     IN45574
ES35                      0.97     66.50     14.69    1.0000 Chicago_3h_100yr     IN45566
ES36                      0.22    113.80     32.12    0.5000 Chicago_3h_100yr     IN09032-MAJ
S01                       0.18     58.00     80.67    1.0000 Chicago_3h_100yr     CB06
S02                       0.15     51.70     88.23    1.0000 Chicago_3h_100yr     CB01
S03                       0.02     80.90     14.52    1.0000 Chicago_3h_100yr     CB01
S04                       0.20     70.20     79.11    1.0000 Chicago_3h_100yr     CB03
S05                       0.13     53.10     73.96    1.0000 Chicago_3h_100yr     218
S06                       0.06     52.30     35.84    1.0000 Chicago_3h_100yr     CBT03
S07                       0.04     54.60     37.94    1.0000 Chicago_3h_100yr     CBE01
S08_1                     0.04     57.86     59.42    1.0000 Chicago_3h_100yr     CBT14
S08_2                     0.05     78.29     54.84    1.0000 Chicago_3h_100yr     CBE04
S09                       0.08     94.80     71.20    1.0000 Chicago_3h_100yr     IN103407


************
Node Summary
************
                                         Invert      Max.    Ponded    External
Name                 Type                 Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
```

```
200                  JUNCTION            111.14      2.76       0.0
201                  JUNCTION            111.34      2.54       0.0
202                  JUNCTION            111.46      2.44       0.0
203                  JUNCTION            111.61      2.54       0.0    Yes
204                  JUNCTION            111.70      2.35       0.0    Yes
205                  JUNCTION            111.88      2.25       0.0    Yes
206                  JUNCTION            112.42      2.30       0.0    Yes
207                  JUNCTION            113.28      1.97       0.0    Yes
208                  JUNCTION            112.57      1.94       0.0
210                  JUNCTION            112.16      2.12       0.0
211                  JUNCTION            111.81      2.24       0.0
212                  JUNCTION            111.42      2.70       0.0
213                  JUNCTION            112.82      1.50       0.0
215                  JUNCTION            112.24      2.26       0.0
216                  JUNCTION            111.32      2.51       0.0
217                  JUNCTION            113.46      1.50       0.0
218                  JUNCTION            112.74      1.26       0.0
219                  JUNCTION            111.30      2.47       0.0
CB03                 JUNCTION            113.10      1.15       0.0
CB05                 JUNCTION            114.00      1.06       0.0
CBE01                JUNCTION            114.25      1.06       0.0
CBE04                JUNCTION            113.90      1.00       0.0
CBT02                JUNCTION            114.11      1.06       0.0
CBT03                JUNCTION            113.78      1.06       0.0
CBT05                JUNCTION            113.79      1.02       0.0
CBT06                JUNCTION            113.68      1.04       0.0
CBT07                JUNCTION            113.61      1.05       0.0
CBT08                JUNCTION            113.52      1.16       0.0
CBT09                JUNCTION            113.39      1.08       0.0
CBT10                JUNCTION            113.28      1.07       0.0
CBT11                JUNCTION            112.86      1.44       0.0
CBT12                JUNCTION            112.89      1.39       0.0
CBT13                JUNCTION            112.92      1.14       0.0
CBT14                JUNCTION            112.94      1.08       0.0
IN07998              JUNCTION            110.43      1.40       0.0
IN09003-MAJ          JUNCTION            113.93      0.20       0.0
IN09004-MAJ          JUNCTION            113.83      0.20       0.0
IN09005-MAJ          JUNCTION            113.22      0.20       0.0
IN09006-MAJ          JUNCTION            113.22      0.20       0.0
IN09009-MAJ          JUNCTION            112.75      0.20       0.0
IN09010-MAJ          JUNCTION            112.75      0.20       0.0
IN09011-MAJ          JUNCTION            112.21      0.20       0.0
IN09012-MAJ          JUNCTION            112.21      0.20       0.0
IN09013-MAJ          JUNCTION            111.78      0.20       0.0
IN09014-MAJ          JUNCTION            111.41      0.20       0.0
IN09015-MAJ          JUNCTION            111.41      0.20       0.0
IN09017-MAJ          JUNCTION            111.56      0.20       0.0
IN09018-MAJ          JUNCTION            111.56      0.20       0.0
IN09019-MAJ          JUNCTION            111.33      0.20       0.0
IN09020-MAJ          JUNCTION            111.33      0.20       0.0
IN09021-MAJ          JUNCTION            111.00      0.20       0.0
IN09022-MAJ          JUNCTION            113.94      0.20       0.0
IN09023-MAJ          JUNCTION            113.75      0.20       0.0
```

```
IN09024-MAJ          JUNCTION            113.15      0.20       0.0
IN09025-MAJ          JUNCTION            113.13      0.20       0.0
IN09026-MAJ          JUNCTION            112.66      0.20       0.0
IN09027-MAJ          JUNCTION            112.68      0.20       0.0
IN09028-MAJ          JUNCTION            112.36      0.20       0.0
IN09029-MAJ          JUNCTION            112.37      0.20       0.0
IN09030-MAJ          JUNCTION            111.97      0.20       0.0
IN09031-MAJ          JUNCTION            111.97      0.20       0.0
IN09032-MAJ          JUNCTION            111.62      0.20       0.0
IN09033-MAJ          JUNCTION            111.62      0.20       0.0
IN09034-MAJ          JUNCTION            111.27      0.20       0.0
IN09035-MAJ          JUNCTION            111.27      0.20       0.0
IN45566              JUNCTION            109.82      1.39       0.0
IN45569              JUNCTION            111.61      1.40       0.0
IN45570              JUNCTION            111.70      1.40       0.0
IN45572              JUNCTION            111.51      1.40       0.0
IN45573              JUNCTION            112.76      1.40       0.0
IN45574              JUNCTION            111.30      0.30       0.0
IN45575              JUNCTION            112.17      1.40       0.0
IN45577              JUNCTION            111.28      1.40       0.0
IN45587              JUNCTION            112.44      1.41       0.0
IN45588              JUNCTION            112.52      1.40       0.0
IN45589              JUNCTION            111.85      1.40       0.0
IN45590              JUNCTION            111.58      1.40       0.0
J1                   JUNCTION            111.77      0.20       0.0
J2                   JUNCTION            111.20      0.20       0.0
MHST09001            JUNCTION            111.29      1.85       0.0
MHST09002            JUNCTION            111.25      1.97       0.0
MHST09003            JUNCTION            111.15      2.69       0.0
MHST09004            JUNCTION            111.02      3.01       0.0
MHST09005            JUNCTION            110.43      3.07       0.0
MHST09006            JUNCTION            110.07      2.86       0.0
MHST09007            JUNCTION            109.61      3.22       0.0
MHST09008            JUNCTION            109.27      3.15       0.0
MHST09009            JUNCTION            109.21      3.07       0.0
MHST09010            JUNCTION            108.65      3.32       0.0
MHST09011            JUNCTION            108.29      3.38       0.0
MHST09013            JUNCTION            108.16      3.43       0.0
MHST09014            JUNCTION            108.38      3.12       0.0
MHST09015            JUNCTION            108.53      3.27       0.0
MHST09016            JUNCTION            110.98      3.20       0.0
MHST09017            JUNCTION            110.75      3.35       0.0
MHST09018            JUNCTION            110.66      3.21       0.0
MHST09019            JUNCTION            110.38      2.90       0.0
MHST09020            JUNCTION            109.94      2.99       0.0
MHST09021            JUNCTION            109.05      3.48       0.0
MHST09022            JUNCTION            108.93      3.34       0.0
MHST09023            JUNCTION            108.79      3.01       0.0
MHST09024            JUNCTION            108.86      2.53       0.0
OF-CREEK             OUTFALL             107.50      0.90       0.0
OF-HAZELDEAN         OUTFALL             112.83      0.30       0.0
CB01                 STORAGE             112.40      1.40       0.0
CB06                 STORAGE             112.50      1.40       0.0
```

```
CHAMBERS-1           STORAGE             111.52      2.58       0.0
CHAMBERS-2           STORAGE             112.30      2.20       0.0
IN09003              STORAGE             112.53      1.40       0.0
IN09004              STORAGE             112.43      1.55       0.0
IN09005              STORAGE             111.82      1.40       0.0
IN09006              STORAGE             111.82      1.40       0.0
IN09007              STORAGE             111.58      1.55       0.0
IN09008              STORAGE             111.58      1.55       0.0
IN09009              STORAGE             111.35      1.40       0.0
IN09010              STORAGE             111.35      1.40       0.0
IN09011              STORAGE             110.81      1.40       0.0
IN09012              STORAGE             110.81      1.40       0.0
IN09013              STORAGE             110.38      1.40       0.0
IN09014              STORAGE             110.01      1.40       0.0
IN09015              STORAGE             110.01      1.40       0.0
IN09016              STORAGE             109.85      1.55       0.0
IN09017              STORAGE             110.16      1.40       0.0
IN09018              STORAGE             110.16      1.40       0.0
IN09019              STORAGE             109.93      1.40       0.0
IN09020              STORAGE             109.93      1.40       0.0
IN09021              STORAGE             109.60      1.40       0.0
IN09022              STORAGE             112.54      1.40       0.0
IN09023              STORAGE             112.35      1.40       0.0
IN09024              STORAGE             111.75      1.40       0.0
IN09025              STORAGE             111.73      1.40       0.0
IN09026              STORAGE             111.26      1.40       0.0
IN09027              STORAGE             111.28      1.40       0.0
IN09028              STORAGE             110.96      1.40       0.0
IN09029              STORAGE             110.97      1.40       0.0
IN09030              STORAGE             110.57      1.40       0.0
IN09031              STORAGE             110.57      1.40       0.0
IN09032              STORAGE             110.22      1.40       0.0
IN09033              STORAGE             110.22      1.40       0.0
IN09034              STORAGE             109.87      1.40       0.0
IN09035              STORAGE             109.87      1.40       0.0
IN103407             STORAGE             111.64      1.61       0.0
MHST09012            STORAGE             107.61      3.52       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
---------------------------------------------------------------------------------------------
C01              207              206              CONDUIT           15.8    5.1594    0.0130
C02              206              205              CONDUIT           46.8    0.8489    0.0130
C03              205              204              CONDUIT           44.5    0.3373    0.0130
C04              204              203              CONDUIT            8.5    0.3519    0.0130
C05              203              202              CONDUIT           35.1    0.3422    0.0130
C06              202              201              CONDUIT           11.5    0.3491    0.0130
C07              216              219              CONDUIT           10.3    0.2143    0.0130
C08              CB03             208              CONDUIT           15.0    3.5978    0.0100
C09              208              CHAMBERS-2       CONDUIT            1.5    1.0001    0.0130
```

```
C1               IN45587          MHST09004        CONDUIT        40.0     1.0001     0.0130
C10              219              200              CONDUIT        10.7     0.9507     0.0130
C11              210              211              CONDUIT        15.3     1.0429     0.0130
C12              CB01             211              CONDUIT        16.0     1.3093     0.0130
C13              IN07998          MHST09011        CONDUIT        10.0     1.0001     0.0130
C14              217              CHAMBERS-2       CONDUIT         7.6     7.2824     0.0130
C15              CHAMBERS-1       212              CONDUIT        23.7     0.1688     0.0130
C16              211              CHAMBERS-1       CONDUIT         2.5     1.6002     0.0130
C17              CBE01            CBT02            CONDUIT        22.2     0.6161     0.0130
C18              CBT02            CB05             CONDUIT        22.2     0.4902     0.0130
C19              CB05             CBT03            CONDUIT        35.1     0.6270     0.0130
C2               IN45588          MHST09005        CONDUIT       116.3     0.4298     0.0130
C20              CBT03            217              CONDUIT        22.9     1.1974     0.0130
C21              218              208              CONDUIT        15.2     0.9300     0.0130
C22              IN45573          MHST09016        CONDUIT        40.0     1.2501     0.0130
C23              CB06             210              CONDUIT        11.3     1.6836     0.0130
C24              CHAMBERS-2       215              CONDUIT         1.5     2.6676     0.0130
C25              201              216              CONDUIT         6.4     0.4972     0.0130
C26              IN45574          MHST09017        CONDUIT        40.0     0.7500     0.0130
C27              IN45566          MHST09024        CONDUIT        10.0     1.0001     0.0130
C28              CBE04            CBT05            CONDUIT        11.4     0.9996     0.0130
C29              CBT05            CBT06            CONDUIT        10.5     1.0060     0.0130
C3               IN45589          MHST09007        CONDUIT        40.0     1.0001     0.0130
C30              CBT06            CBT07            CONDUIT         6.7     1.0056     0.0130
C31              CBT07            CBT08            CONDUIT         9.8     1.0014     0.0130
C32              CBT08            CBT09            CONDUIT        12.7     1.0043     0.0130
C33              CBT09            CBT10            CONDUIT        11.2     1.0027     0.0130
C34              CBT10            213              CONDUIT         3.3     1.0016     0.0130
C35              CBT11            213              CONDUIT         3.3     0.3035     0.0130
C36              CBT12            CBT11            CONDUIT         9.5     0.3044     0.0130
C37              CBT13            CBT12            CONDUIT        12.7     0.3060     0.0130
C38              CBT14            CBT13            CONDUIT        12.7     0.2982     0.0130
C39              IN103407         OF-HAZELDEAN     CONDUIT        40.3     0.5205     0.0130
C4               IN45590          MHST09007        CONDUIT        40.0     1.2501     0.0130
C40              213              218              CONDUIT        29.3     0.3007     0.0130
C5               IN45575          MHST09019        CONDUIT        40.0     1.0001     0.0130
C6               IN45570          MHST09020        CONDUIT        40.0     1.0001     0.0130
C7               IN45569          MHST09021        CONDUIT        40.0     0.5000     0.0130
C8               IN45572          MHST09021        CONDUIT        40.0     1.0001     0.0130
C9               IN45577          MHST09022        CONDUIT        40.0     1.0001     0.0130
C98              CHAMBERS-1       212              CONDUIT        26.5     0.3621     0.0130
C99              CHAMBERS-2       215              CONDUIT        28.6     0.0908     0.0130
OF1              IN09016          MHST09012        CONDUIT        17.9     1.5198     0.0130
R01              IN09004-MAJ      IN09006-MAJ      CONDUIT        92.7     0.6582     0.0130
R02              IN09006-MAJ      IN09007          CONDUIT        79.6     0.1131     0.0130
R03              IN09005-MAJ      IN09008          CONDUIT        79.2     0.3030     0.0130
R04              IN09007          IN09010-MAJ      CONDUIT        71.6     0.5311     0.0130
R05              IN09008          IN09009-MAJ      CONDUIT        72.2     0.3185     0.0130
R06              IN09010-MAJ      IN09012-MAJ      CONDUIT       102.0     0.5295     0.0130
R07              IN09009-MAJ      IN09011-MAJ      CONDUIT       106.2     0.5083     0.0130
R08              IN09012-MAJ      J1               CONDUIT        98.2     0.4481     0.0130
R09              IN09033-MAJ      J1               CONDUIT        13.7    -1.0926     0.0130
R10              IN09032-MAJ      J1               CONDUIT        24.2    -0.6203     0.0130
```

```
R11              IN09011-MAJ      IN09013-MAJ      CONDUIT        92.0     0.4674     0.0130
R12              IN09013-MAJ      IN09015-MAJ      CONDUIT        71.8     0.5157     0.0130
R13              IN09015-MAJ      MHST09012        CONDUIT        64.1     0.4402     0.0130
R14              IN09014-MAJ      IN09016          CONDUIT        54.5     0.2937     0.0130
R15              J1               IN09014-MAJ      CONDUIT        59.6     0.6039     0.0130
R16              IN09035-MAJ      J2               CONDUIT        17.7     0.3945     0.0130
R17              IN09034-MAJ      J2               CONDUIT        26.1     0.2680     0.0130
R18              IN09021-MAJ      IN09020-MAJ      CONDUIT        30.5    -1.0809     0.0130
R19              J2               IN09019-MAJ      CONDUIT        27.5    -0.4731     0.0130
R20              IN09020-MAJ      IN09018-MAJ      CONDUIT        80.6    -0.2853     0.0130
R21              IN09019-MAJ      IN09017-MAJ      CONDUIT        81.1    -0.2837     0.0130
R22              IN09018-MAJ      MHST09012        CONDUIT        83.6     0.5168     0.0130
R23              IN09017-MAJ      IN09016          CONDUIT        67.8     0.4574     0.0130
R24              IN09003-MAJ      IN103407         CONDUIT        71.3     1.2492     0.0130
R25              IN09023-MAJ      IN09024-MAJ      CONDUIT        81.4     0.7369     0.0130
R26              IN09022-MAJ      IN09025-MAJ      CONDUIT        86.5     0.9367     0.0130
R27              IN09025-MAJ      IN09027-MAJ      CONDUIT        86.0     0.5232     0.0130
R28              IN09024-MAJ      IN09026-MAJ      CONDUIT        85.8     0.5711     0.0130
R29              IN09027-MAJ      IN09028-MAJ      CONDUIT        61.8     0.5175     0.0130
R30              IN09026-MAJ      IN09029-MAJ      CONDUIT        68.1     0.4259     0.0130
R31              IN09029-MAJ      IN09030-MAJ      CONDUIT        72.3     0.5536     0.0130
R32              IN09028-MAJ      IN09034-MAJ      CONDUIT        88.1     1.2372     0.0130
R33              IN09030-MAJ      IN09032-MAJ      CONDUIT        67.3     0.5202     0.0130
R34              IN09031-MAJ      IN09033-MAJ      CONDUIT        69.9     0.5008     0.0130
STM04620         MHST09014        MHST09013        CONDUIT        76.3     0.2096     0.0130
STM04621         MHST09013        MHST09012        CONDUIT        78.0     0.2051     0.0130
STM07857         MHST09005        MHST09006        CONDUIT        90.1     0.3995     0.0130
STM07870         MHST09015        MHST09014        CONDUIT        51.7     0.1547     0.0130
STM07871         MHST09012        OF-CREEK         CONDUIT        44.6     0.2467     0.0130
STM07872         MHST09024        MHST09015        CONDUIT        65.6     0.3813     0.0130
STM07873         MHST09009        MHST09010        CONDUIT        81.5     0.3434     0.0130
STM07874         MHST09001        MHST09002        CONDUIT        10.4     0.3837     0.0130
STM07875         MHST09006        MHST09007        CONDUIT        90.0     0.4001     0.0130
STM07876         MHST09016        MHST09017        CONDUIT        39.5     0.3802     0.0130
STM45150         MHST09017        MHST09018        CONDUIT        13.5     0.3709     0.0130
STM45151         MHST09018        MHST09019        CONDUIT        52.8     0.3976     0.0130
STM45152         MHST09019        MHST09020        CONDUIT        90.1     0.3996     0.0130
STM45153         MHST09020        MHST09021        CONDUIT        89.4     0.9061     0.0130
STM45154         MHST09021        MHST09022        CONDUIT        58.9     0.2036     0.0130
STM45155         MHST09022        MHST09023        CONDUIT        56.8     0.2465     0.0130
STM45156         MHST09023        MHST09010        CONDUIT        41.5     0.3132     0.0130
STM45159         MHST09010        MHST09011        CONDUIT        75.1     0.4795     0.0130
STM45160         MHST09011        MHST09012        CONDUIT        58.2     0.5157     0.0130
STM45161         MHST09007        MHST09008        CONDUIT        88.1     0.3518     0.0130
STM45162         MHST09008        MHST09009        CONDUIT        12.7     0.1577     0.0130
STM45163         MHST09002        MHST09003        CONDUIT        36.6     0.2736     0.0130
STM45164_1       MHST09003        200              CONDUIT         4.7     0.2980     0.0130
STM45164_2       200              MHST09004        CONDUIT        11.9     0.3024     0.0130
STM45165         MHST09004        MHST09005        CONDUIT        82.9     0.6151     0.0130
212-ICD          212              216              OUTLET
215-ICD          215              205              OUTLET
IN09003-ICD      IN09003          MHST09003        OUTLET
IN09003-INC      IN09003-MAJ      IN09003          OUTLET
```

```
IN09004-ICD      IN09004          MHST09004        OUTLET
IN09004-INC      IN09004-MAJ      IN09004          OUTLET
IN09005-ICD      IN09005          MHST09005        OUTLET
IN09005-INC      IN09005-MAJ      IN09005          OUTLET
IN09006-ICD      IN09006          MHST09005        OUTLET
IN09006-INC      IN09006-MAJ      IN09006          OUTLET
IN09007-ICD      IN09007          MHST09006        OUTLET
IN09008-ICD      IN09008          MHST09006        OUTLET
IN09009-ICD      IN09009          MHST09007        OUTLET
IN09009-INC      IN09009-MAJ      IN09009          OUTLET
IN09010-ICD      IN09010          MHST09007        OUTLET
IN09010-INC      IN09010-MAJ      IN09010          OUTLET
IN09011-ICD      IN09011          MHST09008        OUTLET
IN09011-INC      IN09011-MAJ      IN09011          OUTLET
IN09012-ICD      IN09012          MHST09008        OUTLET
IN09012-INC      IN09012-MAJ      IN09012          OUTLET
IN09013-ICD      IN09013          MHST09010        OUTLET
IN09013-INC      IN09013-MAJ      IN09013          OUTLET
IN09014-ICD      IN09014          MHST09011        OUTLET
IN09014-INC      IN09014-MAJ      IN09014          OUTLET
IN09015-ICD      IN09015          MHST09011        OUTLET
IN09015-INC      IN09015-MAJ      IN09015          OUTLET
IN09016-ICD      IN09016          MHST09013        OUTLET
IN09017-ICD      IN09017          MHST09013        OUTLET
IN09017-INC      IN09017-MAJ      IN09017          OUTLET
IN09018-ICD      IN09018          MHST09013        OUTLET
IN09018-INC      IN09018-MAJ      IN09018          OUTLET
IN09019-ICD      IN09019          MHST09014        OUTLET
IN09019-INC      IN09019-MAJ      IN09019          OUTLET
IN09020-ICD      IN09020          MHST09014        OUTLET
IN09020-INC      IN09020-MAJ      IN09020          OUTLET
IN09021-ICD      IN09021          MHST09015        OUTLET
IN09021-INC      IN09021-MAJ      IN09021          OUTLET
IN09022-ICD      IN09022          MHST09017        OUTLET
IN09022-INC      IN09022-MAJ      IN09022          OUTLET
IN09023-ICD      IN09023          MHST09017        OUTLET
IN09023-INC      IN09023-MAJ      IN09023          OUTLET
IN09024-ICD      IN09024          MHST09019        OUTLET
IN09024-INC      IN09024-MAJ      IN09024          OUTLET
IN09025-ICD      IN09025          MHST09019        OUTLET
IN09025-INC      IN09025-MAJ      IN09025          OUTLET
IN09026-ICD      IN09026          MHST09020        OUTLET
IN09026-INC      IN09026-MAJ      IN09026          OUTLET
IN09027-ICD      IN09027          MHST09020        OUTLET
IN09027-INC      IN09027-MAJ      IN09027          OUTLET
IN09028-ICD      IN09028          MHST09021        OUTLET
IN09028-INC      IN09028-MAJ      IN09028          OUTLET
IN09029-ICD      IN09029          MHST09021        OUTLET
IN09029-INC      IN09029-MAJ      IN09029          OUTLET
IN09030-ICD      IN09030          MHST09022        OUTLET
IN09030-INC      IN09030-MAJ      IN09030          OUTLET
IN09031-ICD      IN09031          MHST09022        OUTLET
IN09031-INC      IN09031-MAJ      IN09031          OUTLET
```

```
IN09032-ICD      IN09032          MHST09023        OUTLET
IN09032-INC      IN09032-MAJ      IN09032          OUTLET
IN09033-ICD      IN09033          MHST09023        OUTLET
IN09033-INC      IN09033-MAJ      IN09033          OUTLET
IN09034-ICD      IN09034          MHST09024        OUTLET
IN09034-INC      IN09034-MAJ      IN09034          OUTLET
IN09035-ICD      IN09035          MHST09024        OUTLET
IN09035-INC      IN09035-MAJ      IN09035          OUTLET
IN103407-ICD     IN103407         MHST09001        OUTLET


*********************
Cross Section Summary
*********************
                                      Full     Full     Hyd.     Max.   No. of     Full
Conduit          Shape               Depth     Area     Rad.    Width  Barrels     Flow
---------------------------------------------------------------------------------------
C01              CIRCULAR             0.25     0.05     0.06     0.25        1   135.08
C02              CIRCULAR             0.25     0.05     0.06     0.25        1    54.79
C03              CIRCULAR             0.38     0.11     0.09     0.38        1   101.83
C04              CIRCULAR             0.38     0.11     0.09     0.38        1   104.01
C05              CIRCULAR             0.38     0.11     0.09     0.38        1   102.57
C06              CIRCULAR             0.38     0.11     0.09     0.38        1   103.60
C07              CIRCULAR             0.38     0.11     0.09     0.38        1    81.18
C08              CIRCULAR             0.30     0.07     0.07     0.30        1   238.46
C09              CIRCULAR             0.60     0.28     0.15     0.60        1   614.06
C1               CIRCULAR             0.20     0.03     0.05     0.20        1    32.80
C10              CIRCULAR             0.38     0.11     0.09     0.38        1   170.97
C11              CIRCULAR             0.30     0.07     0.07     0.30        1    98.76
C12              CIRCULAR             0.30     0.07     0.07     0.30        1   110.65
C13              CIRCULAR             0.20     0.03     0.05     0.20        1    32.80
C14              CIRCULAR             0.30     0.07     0.07     0.30        1   260.97
C15              CIRCULAR             0.38     0.11     0.09     0.38        1    72.03
C16              CIRCULAR             0.60     0.28     0.15     0.60        1   776.77
C17              CIRCULAR             0.25     0.05     0.06     0.25        1    46.68
C18              CIRCULAR             0.25     0.05     0.06     0.25        1    41.64
C19              CIRCULAR             0.25     0.05     0.06     0.25        1    47.09
C2               CIRCULAR             0.20     0.03     0.05     0.20        1    21.50
C20              CIRCULAR             0.25     0.05     0.06     0.25        1    65.08
C21              CIRCULAR             0.30     0.07     0.07     0.30        1    93.26
C22              CIRCULAR             0.20     0.03     0.05     0.20        1    36.67
C23              CIRCULAR             0.30     0.07     0.07     0.30        1   125.48
C24              CIRCULAR             0.38     0.11     0.09     0.38        1   286.38
C25              CIRCULAR             0.38     0.11     0.09     0.38        1   123.64
C26              CIRCULAR             0.20     0.03     0.05     0.20        1    28.41
C27              CIRCULAR             0.20     0.03     0.05     0.20        1    32.80
C28              CIRCULAR             0.25     0.05     0.06     0.25        1    59.46
C29              CIRCULAR             0.25     0.05     0.06     0.25        1    59.65
C3               CIRCULAR             0.20     0.03     0.05     0.20        1    32.80
C30              CIRCULAR             0.25     0.05     0.06     0.25        1    59.64
C31              CIRCULAR             0.25     0.05     0.06     0.25        1    59.51
C32              CIRCULAR             0.25     0.05     0.06     0.25        1    59.60
C33              CIRCULAR             0.25     0.05     0.06     0.25        1    59.55
```

```
  C34              CIRCULAR             0.25      0.05      0.06      0.25        1    59.52
  C35              CIRCULAR             0.25      0.05      0.06      0.25        1    32.76
  C36              CIRCULAR             0.25      0.05      0.06      0.25        1    32.81
  C37              CIRCULAR             0.25      0.05      0.06      0.25        1    32.90
  C38              CIRCULAR             0.25      0.05      0.06      0.25        1    32.47
  C39              TRAPEZOIDAL          0.30      0.57      0.20      2.80        1  1070.08
  C4               CIRCULAR             0.20      0.03      0.05      0.20        1    36.67
  C40              CIRCULAR             0.30      0.07      0.07      0.30        1    53.03
  C5               CIRCULAR             0.20      0.03      0.05      0.20        1    32.80
  C6               CIRCULAR             0.20      0.03      0.05      0.20        1    32.80
  C7               CIRCULAR             0.20      0.03      0.05      0.20        1    23.19
  C8               CIRCULAR             0.20      0.03      0.05      0.20        1    32.80
  C9               CIRCULAR             0.20      0.03      0.05      0.20        1    32.80
  C98              CIRCULAR             0.10      0.01      0.03      0.10        1     3.11
  C99              CIRCULAR             0.10      0.01      0.03      0.10        1     1.56
  OF1              Half_Street_4.25m     0.20      0.82      0.09      8.42        1  1552.15
  R01              Half_Street_4.25m     0.20      0.82      0.09      8.42        1  1021.45
  R02              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   423.38
  R03              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   693.06
  R04              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   917.52
  R05              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   710.59
  R06              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   916.20
  R07              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   897.66
  R08              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   842.83
  R09              Half_Street_4.25m     0.20      0.82      0.09      8.42        1  1316.06
  R10              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   991.63
  R11              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   860.77
  R12              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   904.10
  R13              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   835.38
  R14              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   682.29
  R15              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   978.40
  R16              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   790.77
  R17              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   651.76
  R18              Half_Street_4.25m     0.20      0.82      0.09      8.42        1  1308.97
  R19              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   866.03
  R20              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   672.53
  R21              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   670.58
  R22              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   905.11
  R23              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   851.52
  R24              Half_Street_4.25m     0.20      0.82      0.09      8.42        1  1407.17
  R25              Half_Street_4.25m     0.20      0.82      0.09      8.42        1  1080.77
  R26              Half_Street_4.25m     0.20      0.82      0.09      8.42        1  1218.50
  R27              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   910.70
  R28              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   951.44
  R29              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   905.74
  R30              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   821.66
  R31              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   936.79
  R32              Half_Street_4.25m     0.20      0.82      0.09      8.42        1  1400.42
  R33              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   908.08
  R34              Half_Street_4.25m     0.20      0.82      0.09      8.42        1   890.97
  STM04620         CIRCULAR             0.53      0.22      0.13      0.53        1   196.89
  STM04621         CIRCULAR             0.60      0.28      0.15      0.60        1   278.12
  STM07857         CIRCULAR             0.53      0.22      0.13      0.53        1   271.84
```

```
  STM07870         CIRCULAR             0.45      0.16      0.11      0.45        1   112.14
  STM07871         CIRCULAR             0.90      0.64      0.23      0.90        1   899.20
  STM07872         CIRCULAR             0.38      0.11      0.09      0.38        1   108.27
  STM07873         CIRCULAR             0.60      0.28      0.15      0.60        1   359.85
  STM07874         CIRCULAR             0.38      0.11      0.09      0.38        1   108.61
  STM07875         CIRCULAR             0.53      0.22      0.13      0.53        1   272.03
  STM07876         CIRCULAR             0.30      0.07      0.07      0.30        1    59.63
  STM45150         CIRCULAR             0.38      0.11      0.09      0.38        1   106.78
  STM45151         CIRCULAR             0.38      0.11      0.09      0.38        1   110.57
  STM45152         CIRCULAR             0.45      0.16      0.11      0.45        1   180.23
  STM45153         CIRCULAR             0.53      0.22      0.13      0.53        1   409.40
  STM45154         CIRCULAR             0.60      0.28      0.15      0.60        1   277.09
  STM45155         CIRCULAR             0.60      0.28      0.15      0.60        1   304.85
  STM45156         CIRCULAR             0.60      0.28      0.15      0.60        1   343.62
  STM45159         CIRCULAR             0.75      0.44      0.19      0.75        1   770.94
  STM45160         CIRCULAR             0.75      0.44      0.19      0.75        1   799.49
  STM45161         CIRCULAR             0.60      0.28      0.15      0.60        1   364.22
  STM45162         CIRCULAR             0.60      0.28      0.15      0.60        1   243.84
  STM45163         CIRCULAR             0.38      0.11      0.09      0.38        1    91.71
  STM45164_1       CIRCULAR             0.38      0.11      0.09      0.38        1    95.72
  STM45164_2       CIRCULAR             0.38      0.11      0.09      0.38        1    96.42
  STM45165         CIRCULAR             0.45      0.16      0.11      0.45        1   223.62


  ****************
  Transect Summary
  ****************

  Transect Half_Street_4.25m
  Area:
            0.0003     0.0013     0.0029     0.0051     0.0079
            0.0114     0.0156     0.0203     0.0257     0.0317
            0.0384     0.0457     0.0536     0.0622     0.0714
            0.0813     0.0917     0.1028     0.1146     0.1270
            0.1403     0.1550     0.1710     0.1882     0.2068
            0.2267     0.2479     0.2705     0.2943     0.3194
            0.3459     0.3736     0.4026     0.4324     0.4628
            0.4939     0.5256     0.5581     0.5912     0.6250
            0.6594     0.6946     0.7304     0.7669     0.8041
            0.8419     0.8804     0.9196     0.9595     1.0000
  Hrad:
            0.0218     0.0436     0.0655     0.0873     0.1091
            0.1309     0.1528     0.1746     0.1964     0.2182
            0.2401     0.2619     0.2837     0.3055     0.3273
            0.3492     0.3710     0.3928     0.4146     0.4365
            0.4574     0.4757     0.4920     0.5069     0.5206
            0.5334     0.5457     0.5575     0.5690     0.5803
            0.5915     0.6026     0.6221     0.6495     0.6761
            0.7019     0.7270     0.7514     0.7751     0.7982
            0.8207     0.8426     0.8639     0.8848     0.9051
            0.9250     0.9444     0.9633     0.9819     1.0000
  Width:
```

```
            0.0155     0.0311     0.0466     0.0621     0.0777
            0.0932     0.1087     0.1242     0.1398     0.1553
            0.1708     0.1864     0.2019     0.2174     0.2330
            0.2485     0.2640     0.2796     0.2951     0.3106
            0.3427     0.3747     0.4067     0.4388     0.4708
            0.5029     0.5349     0.5669     0.5990     0.6310
            0.6630     0.6951     0.7194     0.7359     0.7524
            0.7689     0.7854     0.8019     0.8184     0.8349
            0.8514     0.8679     0.8844     0.9010     0.9175
            0.9340     0.9505     0.9670     0.9835     1.0000


  *********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  *********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... LPS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... YES
    Ponding Allowed ........ NO
    Water Quality .......... NO
  Infiltration Method ...... HORTON
  Flow Routing Method ...... DYNWAVE
  Starting Date ............ 09/26/2018 00:00:00
  Ending Date .............. 09/26/2018 06:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Wet Time Step ............ 00:01:00
  Dry Time Step ............ 00:01:00
  Routing Time Step ........ 5.00 sec
  Variable Time Step ....... YES
  Maximum Trials ........... 8
  Number of Threads ........ 2
  Head Tolerance ........... 0.001500 m


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         0.864        71.708
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.334        27.748
  Surface Runoff ...........         0.523        43.433
  Final Storage ............         0.007         0.582
```

```
  Continuity Error (%) .....        -0.077


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.523         5.234
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.011         0.110
  External Outflow .........         0.468         4.681
  Flooding Loss ............         0.062         0.623
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.005         0.055
  Continuity Error (%) .....        -0.278


  *************************
  Highest Continuity Errors
  *************************
  Node 208 (-3.09%)
  Node J2 (2.79%)
  Node CBT11 (-2.78%)
  Node IN09030-MAJ (-2.01%)
  Node IN09032-MAJ (1.67%)


  ***************************
  Time-Step Critical Elements
  ***************************
  Link C25 (36.39%)
  Link STM45164_1 (28.88%)
  Link C09 (15.69%)
  Link C24 (4.38%)
  Link C35 (4.06%)


  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link C24 (22)
  Link C09 (19)
  Link C08 (9)
  Link C14 (9)
  Link C21 (8)


  *************************
  Routing Time Step Summary
  *************************
```

```
Minimum Time Step           :     0.03 sec
Average Time Step           :     2.34 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.32
Percent Not Converging      :     2.88


***************************
Subcatchment Runoff Summary
***************************

------------------------------------------------------------------------------------------------------------
                            Total      Total      Total      Total      Total        Total     Peak  Runoff
                           Precip      Runon       Evap      Infil     Runoff       Runoff   Runoff   Coeff
Subcatchment                   mm         mm         mm         mm         mm     10^6 ltr      LPS
------------------------------------------------------------------------------------------------------------
ES01_1                      71.71       0.00       0.00      14.55      56.26         0.18   136.52   0.785
ES02_1                      71.71       0.00       0.00      30.80      40.53         0.04    31.03   0.565
ES02_2                      71.71       0.00       0.00      24.27      46.88         0.02    19.97   0.654
ES03_1                      71.71       0.00       0.00      19.75      51.25         0.14   117.33   0.715
ES03_2                      71.71       0.00       0.00      22.08      49.01         0.09    78.54   0.683
ES04_1                      71.71       0.00       0.00      17.93      53.00         0.11    86.70   0.739
ES04_2                      71.71       0.00       0.00      20.12      50.88         0.10    78.13   0.710
ES05_1                      71.71       0.00       0.00      21.53      49.51         0.09    73.74   0.690
ES05_2                      71.71       0.00       0.00      20.49      50.51         0.09    72.96   0.704
ES06_1                      71.71       0.00       0.00      18.33      52.61         0.15   114.46   0.734
ES06_2                      71.71       0.00       0.00      20.07      50.92         0.12    96.75   0.710
ES07                        71.71       0.00       0.00      20.00      50.99         0.11    84.84   0.711
ES08_1                      71.71       0.00       0.00      24.71      46.44         0.06    47.15   0.648
ES08_2                      71.71       0.00       0.00      32.04      39.30         0.03    26.74   0.548
ES09_1                      71.71       0.00       0.00      20.64      50.37         0.09    69.93   0.702
ES09_2                      71.71       0.00       0.00      26.74      44.47         0.08    66.90   0.620
ES10_1                      71.71       0.00       0.00      22.38      48.68         0.10    81.31   0.679
ES10_2                      71.71       0.00       0.00      23.04      48.05         0.09    71.49   0.670
ES11_1                      71.71       0.00       0.00      20.22      50.78         0.09    73.23   0.708
ES11_2                      71.71       0.00       0.00      24.95      46.19         0.06    46.69   0.644
ES12_1                      71.71       0.00       0.00      19.48      51.50         0.10    77.70   0.718
ES12_2                      71.71       0.00       0.00      20.02      50.97         0.08    62.22   0.711
ES13_1                      71.71       0.00       0.00      19.64      51.34         0.08    62.01   0.716
ES13_2                      71.71       0.00       0.00      20.84      50.18         0.08    66.18   0.700
ES14_1                      71.71       0.00       0.00      25.50      45.67         0.06    50.81   0.637
ES14_2                      71.71       0.00       0.00      17.84      53.09         0.10    75.32   0.740
ES15_1                      71.71       0.00       0.00      27.90      43.36         0.03    28.86   0.605
ES15_2                      71.71       0.00       0.00      19.13      51.85         0.06    50.90   0.723
ES16_1                      71.71       0.00       0.00      28.15      43.13         0.04    42.83   0.601
ES16_2                      71.71       0.00       0.00      32.57      38.81         0.07    62.46   0.541
ES17                        71.71       0.00       0.00      25.71      45.49         0.06    55.98   0.634
ES18                        71.71       0.00       0.00      26.42      44.79         0.11    91.20   0.625
ES19                        71.71       0.00       0.00      16.50      54.39         0.05    42.02   0.758
ES20                        71.71       0.00       0.00      30.58      40.71         0.03    21.40   0.568
ES21_1                      71.71       0.00       0.00      18.44      52.50         0.04    32.35   0.732
ES21_3                      71.71       0.00       0.00      26.08      45.08         0.06    44.95   0.629
```

```
ES21_4                      71.71       0.00       0.00      16.65      54.23         0.08    58.53   0.756
ES21_5                      71.71       0.00       0.00      20.46      50.54         0.04    33.50   0.705
ES22_1                      71.71       0.00       0.00      16.78      54.11         0.10    76.60   0.755
ES22_2                      71.71       0.00       0.00      20.03      50.96         0.11    86.38   0.711
ES23                        71.71       0.00       0.00      33.09      38.19         0.07    42.33   0.533
ES24                        71.71       0.00       0.00      34.70      36.67         0.03    19.06   0.511
ES25                        71.71       0.00       0.00      37.08      34.27         0.06    35.20   0.478
ES26                        71.71       0.00       0.00      32.49      38.80         0.04    26.83   0.541
ES27                        71.71       0.00       0.00      42.85      28.69         0.11    54.66   0.400
ES28                        71.71       0.00       0.00      38.27      33.16         0.11    65.07   0.462
ES29                        71.71       0.00       0.00      35.76      35.60         0.12    68.83   0.496
ES30                        71.71       0.00       0.00      33.77      37.58         0.09    56.80   0.524
ES31                        71.71       0.00       0.00      35.12      36.27         0.07    47.73   0.506
ES32                        71.71       0.00       0.00      42.10      29.34         0.23   112.45   0.409
ES33                        71.71       0.00       0.00      31.30      40.01         0.06    47.93   0.558
ES34                        71.71       0.00       0.00      44.97      26.62         0.11    52.02   0.371
ES35                        71.71       0.00       0.00      45.45      26.07         0.25   111.44   0.364
ES36                        71.71       0.00       0.00      30.90      40.41         0.09    68.09   0.564
S01                         71.71       0.00       0.00       8.49      62.27         0.11    82.83   0.868
S02                         71.71       0.00       0.00       5.13      65.54         0.10    72.09   0.914
S03                         71.71       0.00       0.00      37.08      34.57         0.01     7.78   0.482
S04                         71.71       0.00       0.00       9.18      61.61         0.12    94.15   0.859
S05                         71.71       0.00       0.00      11.46      59.40         0.08    58.55   0.828
S06                         71.71       0.00       0.00      28.34      42.99         0.03    24.79   0.599
S07                         71.71       0.00       0.00      27.17      44.14         0.02    17.94   0.616
S08_1                       71.71       0.00       0.00      17.66      53.49         0.02    18.82   0.746
S08_2                       71.71       0.00       0.00      19.67      51.45         0.03    25.18   0.717
S09                         71.71       0.00       0.00      12.52      58.41         0.05    38.28   0.815


******************
Node Depth Summary
******************

---------------------------------------------------------------------------------
                               Average  Maximum  Maximum  Time of Max    Reported
                                 Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type       Meters   Meters   Meters  days hr:min      Meters
---------------------------------------------------------------------------------
200                  JUNCTION     0.16     0.24   111.38     0  01:11        0.24
201                  JUNCTION     0.12     0.16   111.50     0  01:21        0.16
202                  JUNCTION     0.11     0.14   111.59     0  01:20        0.14
203                  JUNCTION     0.11     0.14   111.75     0  01:20        0.14
204                  JUNCTION     0.10     0.13   111.83     0  01:20        0.13
205                  JUNCTION     0.10     0.14   112.01     0  01:19        0.14
206                  JUNCTION     0.03     0.03   112.45     0  05:50        0.03
207                  JUNCTION     0.01     0.01   113.30     0  00:11        0.01
208                  JUNCTION     0.55     1.51   114.08     0  01:18        1.44
210                  JUNCTION     0.25     0.65   112.81     0  01:30        0.65
211                  JUNCTION     0.31     1.00   112.81     0  01:30        1.00
212                  JUNCTION     0.55     1.39   112.81     0  01:30        1.39
213                  JUNCTION     0.40     1.20   114.02     0  01:18        1.19
215                  JUNCTION     0.81     1.84   114.08     0  01:18        1.76
```

```
216                  JUNCTION     0.13     0.17   111.50     0  01:21        0.17
217                  JUNCTION     0.12     0.68   114.14     0  01:18        0.54
218                  JUNCTION     0.45     1.26   114.00     0  01:18        1.26
219                  JUNCTION     0.10     0.15   111.45     0  01:21        0.15
CB03                 JUNCTION     0.26     0.98   114.09     0  01:18        0.91
CB05                 JUNCTION     0.02     0.11   114.11     0  01:10        0.11
CBE01                JUNCTION     0.02     0.11   114.36     0  01:10        0.11
CBE04                JUNCTION     0.03     0.13   114.03     0  01:19        0.13
CBT02                JUNCTION     0.02     0.11   114.23     0  01:10        0.11
CBT03                JUNCTION     0.05     0.78   114.57     0  01:18        0.24
CBT05                JUNCTION     0.05     0.24   114.03     0  01:19        0.24
CBT06                JUNCTION     0.07     0.43   114.11     0  01:16        0.34
CBT07                JUNCTION     0.08     0.47   114.08     0  01:16        0.41
CBT08                JUNCTION     0.11     0.53   114.05     0  01:16        0.50
CBT09                JUNCTION     0.15     0.64   114.03     0  01:16        0.62
CBT10                JUNCTION     0.19     0.75   114.02     0  01:18        0.73
CBT11                JUNCTION     0.38     1.16   114.02     0  01:18        1.15
CBT12                JUNCTION     0.37     1.14   114.02     0  01:18        1.13
CBT13                JUNCTION     0.35     1.14   114.06     0  01:06        1.10
CBT14                JUNCTION     0.34     1.08   114.02     0  01:06        1.07
IN07998              JUNCTION     0.15     1.28   111.71     0  01:10        1.28
IN09003-MAJ          JUNCTION     0.01     0.03   113.96     0  01:10        0.03
IN09004-MAJ          JUNCTION     0.01     0.04   113.87     0  01:10        0.04
IN09005-MAJ          JUNCTION     0.02     0.09   113.31     0  01:10        0.09
IN09006-MAJ          JUNCTION     0.02     0.09   113.31     0  01:10        0.09
IN09009-MAJ          JUNCTION     0.02     0.10   112.85     0  01:10        0.10
IN09010-MAJ          JUNCTION     0.02     0.07   112.82     0  01:10        0.07
IN09011-MAJ          JUNCTION     0.03     0.11   112.32     0  01:10        0.11
IN09012-MAJ          JUNCTION     0.02     0.10   112.31     0  01:10        0.09
IN09013-MAJ          JUNCTION     0.03     0.11   111.89     0  01:10        0.11
IN09014-MAJ          JUNCTION     0.02     0.07   111.48     0  01:10        0.07
IN09015-MAJ          JUNCTION     0.03     0.11   111.52     0  01:11        0.11
IN09017-MAJ          JUNCTION     0.01     0.04   111.60     0  01:10        0.04
IN09018-MAJ          JUNCTION     0.01     0.04   111.60     0  01:10        0.04
IN09019-MAJ          JUNCTION     0.02     0.08   111.41     0  01:10        0.08
IN09020-MAJ          JUNCTION     0.02     0.06   111.39     0  01:10        0.06
IN09021-MAJ          JUNCTION     0.04     0.20   111.20     0  01:06        0.20
IN09022-MAJ          JUNCTION     0.01     0.05   113.99     0  01:10        0.05
IN09023-MAJ          JUNCTION     0.01     0.04   113.79     0  01:10        0.04
IN09024-MAJ          JUNCTION     0.02     0.07   113.22     0  01:10        0.07
IN09025-MAJ          JUNCTION     0.02     0.08   113.21     0  01:10        0.08
IN09026-MAJ          JUNCTION     0.02     0.09   112.75     0  01:10        0.09
IN09027-MAJ          JUNCTION     0.02     0.09   112.77     0  01:10        0.09
IN09028-MAJ          JUNCTION     0.02     0.07   112.43     0  01:10        0.07
IN09029-MAJ          JUNCTION     0.02     0.09   112.46     0  01:10        0.09
IN09030-MAJ          JUNCTION     0.02     0.07   112.04     0  01:11        0.07
IN09031-MAJ          JUNCTION     0.02     0.07   112.04     0  01:10        0.07
IN09032-MAJ          JUNCTION     0.04     0.20   111.82     0  01:11        0.20
IN09033-MAJ          JUNCTION     0.02     0.11   111.73     0  01:11        0.11
IN09034-MAJ          JUNCTION     0.03     0.14   111.41     0  01:08        0.14
IN09035-MAJ          JUNCTION     0.03     0.13   111.40     0  01:07        0.13
IN45566              JUNCTION     0.16     1.27   111.09     0  01:10        1.26
IN45569              JUNCTION     0.15     1.40   113.01     0  01:01        1.40
```

```
IN45570              JUNCTION     0.10     1.40   113.10     0  01:03        1.38
IN45572              JUNCTION     0.07     1.40   112.91     0  01:05        0.96
IN45573              JUNCTION     0.04     1.40   114.16     0  01:08        0.51
IN45574              JUNCTION     0.06     0.30   111.60     0  01:06        0.30
IN45575              JUNCTION     0.07     1.40   113.57     0  01:07        0.87
IN45577              JUNCTION     0.05     1.40   112.68     0  01:07        0.66
IN45587              JUNCTION     0.05     0.92   113.36     0  01:08        0.42
IN45588              JUNCTION     0.03     0.14   112.66     0  01:10        0.14
IN45589              JUNCTION     0.04     0.17   112.02     0  01:10        0.17
IN45590              JUNCTION     0.03     0.13   111.71     0  01:10        0.13
J1                   JUNCTION     0.01     0.05   111.82     0  01:10        0.05
J2                   JUNCTION     0.10     0.20   111.40     0  01:07        0.20
MHST09001            JUNCTION     0.06     0.14   111.43     0  01:11        0.14
MHST09002            JUNCTION     0.07     0.16   111.41     0  01:12        0.16
MHST09003            JUNCTION     0.14     0.23   111.38     0  01:11        0.23
MHST09004            JUNCTION     0.14     0.25   111.27     0  01:10        0.25
MHST09005            JUNCTION     0.16     0.33   110.76     0  01:10        0.33
MHST09006            JUNCTION     0.18     0.38   110.45     0  01:12        0.38
MHST09007            JUNCTION     0.19     0.50   110.11     0  01:12        0.50
MHST09008            JUNCTION     0.22     1.01   110.28     0  01:10        0.69
MHST09009            JUNCTION     0.21     1.01   110.22     0  01:10        0.72
MHST09010            JUNCTION     0.27     1.18   109.83     0  01:10        1.03
MHST09011            JUNCTION     0.26     0.87   109.16     0  01:11        0.87
MHST09013            JUNCTION     0.15     0.59   108.75     0  01:10        0.59
MHST09014            JUNCTION     0.15     0.71   109.09     0  01:10        0.57
MHST09015            JUNCTION     0.15     0.73   109.26     0  01:10        0.63
MHST09016            JUNCTION     0.05     0.37   111.35     0  01:12        0.37
MHST09017            JUNCTION     0.08     0.62   111.37     0  01:10        0.56
MHST09018            JUNCTION     0.09     0.65   111.31     0  01:10        0.62
MHST09019            JUNCTION     0.12     0.79   111.17     0  01:12        0.79
MHST09020            JUNCTION     0.13     0.94   110.88     0  01:12        0.94
MHST09021            JUNCTION     0.25     1.56   110.61     0  01:10        1.56
MHST09022            JUNCTION     0.25     1.49   110.42     0  01:10        1.49
MHST09023            JUNCTION     0.24     1.39   110.18     0  01:10        1.28
MHST09024            JUNCTION     0.14     0.82   109.68     0  01:10        0.80
OF-CREEK             OUTFALL      0.27     0.74   108.24     0  01:10        0.74
OF-HAZELDEAN         OUTFALL      0.01     0.11   112.94     0  01:10        0.11
CB01                 STORAGE      0.10     0.41   112.81     0  01:30        0.41
CB06                 STORAGE      0.08     0.32   112.82     0  01:30        0.32
CHAMBERS-1           STORAGE      0.52     1.30   112.81     0  01:30        1.30
CHAMBERS-2           STORAGE      0.77     1.78   114.08     0  01:18        1.71
IN09003              STORAGE      0.04     0.35   112.88     0  01:10        0.34
IN09004              STORAGE      0.09     0.54   112.97     0  01:11        0.54
IN09005              STORAGE      0.27     1.40   113.22     0  01:03        1.40
IN09006              STORAGE      0.26     1.40   113.22     0  01:05        1.40
IN09007              STORAGE      0.41     1.55   113.13     0  01:04        1.55
IN09008              STORAGE      0.44     1.51   113.09     0  01:10        1.51
IN09009              STORAGE      0.24     1.40   112.75     0  01:05        1.40
IN09010              STORAGE      0.03     0.04   111.39     0  02:30        0.04
IN09011              STORAGE      0.36     1.40   112.21     0  01:03        1.40
IN09012              STORAGE      0.29     1.40   112.21     0  01:03        1.40
IN09013              STORAGE      0.31     1.40   111.78     0  01:03        1.40
IN09014              STORAGE      0.17     1.40   111.41     0  01:08        1.40
```

```
  IN09015             STORAGE      0.31     1.40   111.41     0  01:03        1.40
  IN09016             STORAGE      0.53     1.55   111.40     0  01:05        1.55
  IN09017             STORAGE      0.07     0.50   110.66     0  01:11        0.50
  IN09018             STORAGE      0.07     0.49   110.65     0  01:11        0.49
  IN09019             STORAGE      0.28     1.40   111.33     0  01:04        1.40
  IN09020             STORAGE      0.13     0.90   110.83     0  01:10        0.90
  IN09021             STORAGE      0.31     1.40   111.00     0  01:01        1.40
  IN09022             STORAGE      0.10     0.61   113.15     0  01:10        0.61
  IN09023             STORAGE      0.06     0.48   112.83     0  01:11        0.48
  IN09024             STORAGE      0.17     1.40   113.15     0  01:09        1.40
  IN09025             STORAGE      0.18     1.40   113.13     0  01:07        1.40
  IN09026             STORAGE      0.26     1.40   112.66     0  01:04        1.40
  IN09027             STORAGE      0.24     1.40   112.68     0  01:05        1.40
  IN09028             STORAGE      0.18     1.40   112.36     0  01:08        1.40
  IN09029             STORAGE      0.28     1.40   112.37     0  01:03        1.40
  IN09030             STORAGE      0.15     1.40   111.97     0  01:08        1.40
  IN09031             STORAGE      0.15     1.21   111.78     0  01:10        1.18
  IN09032             STORAGE      0.33     1.40   111.62     0  01:03        1.40
  IN09033             STORAGE      0.22     1.40   111.62     0  01:05        1.40
  IN09034             STORAGE      0.28     1.40   111.27     0  01:03        1.40
  IN09035             STORAGE      0.27     1.40   111.27     0  01:03        1.40
  IN103407            STORAGE      0.46     1.51   113.15     0  01:10        1.51
  MHST09012           STORAGE      0.32     0.99   108.60     0  01:10        0.99


  *******************
  Node Inflow Summary
  *******************

  -------------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral       Total        Flow
                                Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type         LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  200                  JUNCTION    0.00    85.73     0  01:11           0       0.753       0.057
  201                  JUNCTION    0.00    29.12     0  01:21           0       0.391       0.033
  202                  JUNCTION    0.00    29.12     0  01:20           0       0.391       0.059
  203                  JUNCTION    1.91    29.13     0  01:20      0.0413       0.392       0.141
  204                  JUNCTION    0.85    27.22     0  01:19      0.0184       0.351       0.044
  205                  JUNCTION    0.85    26.85     0  01:18      0.0184       0.333       0.149
  206                  JUNCTION    0.85     1.49     0  05:14      0.0184      0.0322       0.535
  207                  JUNCTION    0.64     0.64     0  00:00      0.0138      0.0138       0.198
  208                  JUNCTION    0.00   186.81     0  01:10           0       0.239      -2.997
  210                  JUNCTION    0.00    84.12     0  01:09           0       0.109       0.200
  211                  JUNCTION    0.00   160.14     0  01:08           0       0.212      -0.868
  212                  JUNCTION    0.00    27.48     0  01:03           0       0.211      -0.161
  213                  JUNCTION    0.00    42.67     0  01:06           0      0.0519      -1.000
  215                  JUNCTION    0.00    93.81     0  01:02           0       0.282      -1.310
  216                  JUNCTION    0.00    50.40     0  01:30           0       0.602       0.033
  217                  JUNCTION    0.00    41.60     0  01:10           0      0.0448      -0.830
  218                  JUNCTION   58.55    93.40     0  01:09      0.0751        0.13       0.037
  219                  JUNCTION    0.00    50.41     0  01:33           0       0.601       0.017
```

```
  CB03                 JUNCTION   94.15    94.15     0  01:10       0.123       0.123      -0.141
  CB05                 JUNCTION    0.00    17.71     0  01:10           0      0.0184      -0.067
  CBE01                JUNCTION   17.94    17.94     0  01:10      0.0183      0.0183      -0.014
  CBE04                JUNCTION   25.18    25.18     0  01:10      0.0282      0.0282      -0.025
  CBT02                JUNCTION    0.00    17.84     0  01:10           0      0.0183      -0.001
  CBT03                JUNCTION   24.79    42.14     0  01:10      0.0265       0.045       0.684
  CBT05                JUNCTION    0.00    25.15     0  01:10           0      0.0282       0.001
  CBT06                JUNCTION    0.00    25.07     0  01:09           0      0.0282      -0.049
  CBT07                JUNCTION    0.00    25.05     0  01:09           0      0.0282      -0.180
  CBT08                JUNCTION    0.00    25.33     0  01:09           0      0.0283      -0.235
  CBT09                JUNCTION    0.00    24.58     0  01:08           0      0.0284      -0.315
  CBT10                JUNCTION    0.00    24.28     0  01:07           0      0.0284      -0.775
  CBT11                JUNCTION    0.00    20.48     0  01:06           0      0.0228      -2.706
  CBT12                JUNCTION    0.00    19.97     0  01:06           0      0.0224      -1.074
  CBT13                JUNCTION    0.00    20.61     0  01:06           0       0.022      -0.967
  CBT14                JUNCTION   18.82    18.82     0  01:10      0.0217      0.0217      -0.896
  IN07998              JUNCTION  112.45   112.45     0  01:10       0.231       0.231      -0.007
  IN09003-MAJ          JUNCTION   19.97    19.97     0  01:10      0.0224      0.0224      -0.357
  IN09004-MAJ          JUNCTION   31.03    31.03     0  01:10      0.0358      0.0359      -0.241
  IN09005-MAJ          JUNCTION  117.33   117.33     0  01:10       0.144       0.144       1.395
  IN09006-MAJ          JUNCTION   78.54    93.44     0  01:10      0.0921       0.104       0.146
  IN09009-MAJ          JUNCTION   73.74   187.18     0  01:10      0.0944       0.181       0.155
  IN09010-MAJ          JUNCTION   72.96    72.96     0  01:10      0.0931      0.0932      -0.077
  IN09011-MAJ          JUNCTION  114.46   225.08     0  01:10       0.146       0.249      -0.062
  IN09012-MAJ          JUNCTION   96.75   141.99     0  01:10       0.123       0.166      -0.090
  IN09013-MAJ          JUNCTION   84.84   226.01     0  01:10        0.11       0.252      -0.011
  IN09014-MAJ          JUNCTION   50.81    72.61     0  01:10      0.0602       0.088      -1.032
  IN09015-MAJ          JUNCTION   75.32   219.81     0  01:10      0.0961       0.246       0.054
  IN09017-MAJ          JUNCTION   33.50    33.50     0  01:10      0.0437      0.0437      -1.318
  IN09018-MAJ          JUNCTION   32.35    32.35     0  01:10      0.0415      0.0416       0.009
  IN09019-MAJ          JUNCTION  100.55   108.47     0  01:10        0.13       0.138      -0.485
  IN09020-MAJ          JUNCTION   66.35    73.76     0  01:10      0.0864      0.0938      -0.407
  IN09021-MAJ          JUNCTION   91.20   143.06     0  01:10       0.107       0.157       0.247
  IN09022-MAJ          JUNCTION   47.15    47.15     0  01:10      0.0565      0.0566      -0.211
  IN09023-MAJ          JUNCTION   26.74    26.74     0  01:10      0.0339      0.0339       0.119
  IN09024-MAJ          JUNCTION   69.93    81.77     0  01:10      0.0876      0.0987      -0.085
  IN09025-MAJ          JUNCTION   66.90    97.82     0  01:10      0.0799       0.105       0.141
  IN09026-MAJ          JUNCTION   81.31   131.93     0  01:10       0.103       0.151       0.074
  IN09027-MAJ          JUNCTION   71.49   130.26     0  01:10      0.0883       0.141      -0.034
  IN09028-MAJ          JUNCTION   46.69   121.78     0  01:10      0.0582       0.131      -0.504
  IN09029-MAJ          JUNCTION   73.23   148.81     0  01:10      0.0937        0.17      -0.204
  IN09030-MAJ          JUNCTION    0.00    90.68     0  01:10           0       0.089      -1.974
  IN09031-MAJ          JUNCTION   62.22    62.22     0  01:10      0.0792      0.0792      -0.833
  IN09032-MAJ          JUNCTION   68.09   143.50     0  01:10      0.0869       0.156       1.696
  IN09033-MAJ          JUNCTION    0.00    68.99     0  01:10           0      0.0722       1.014
  IN09034-MAJ          JUNCTION   98.80   183.88     0  01:10       0.105        0.19       0.386
  IN09035-MAJ          JUNCTION   62.46    71.30     0  01:05      0.0673       0.126      -0.015
  IN45566              JUNCTION  111.44   111.44     0  01:10       0.252       0.252      -0.007
  IN45569              JUNCTION   68.83    68.83     0  01:10       0.116       0.116      -0.005
  IN45570              JUNCTION   65.07    65.07     0  01:10       0.114       0.114       0.004
  IN45572              JUNCTION   56.80    56.80     0  01:10       0.086      0.0861       0.009
  IN45573              JUNCTION   47.93    47.93     0  01:10      0.0637      0.0637       0.010
  IN45574              JUNCTION   52.02    52.02     0  01:10       0.109       0.109      -0.001
```

```
  IN45575              JUNCTION     54.66    54.66     0  01:10       0.106       0.106      -0.007
  IN45577              JUNCTION     47.73    47.73     0  01:10      0.0697      0.0698       0.060
  IN45587              JUNCTION     42.33    42.33     0  01:10      0.0702      0.0702       0.018
  IN45588              JUNCTION     19.06    19.06     0  01:10      0.0296      0.0296       0.005
  IN45589              JUNCTION     35.20    35.20     0  01:10      0.0643      0.0643       0.002
  IN45590              JUNCTION     26.83    26.83     0  01:10      0.0421      0.0422       0.002
  J1                   JUNCTION      0.00    78.66     0  01:10           0       0.082      -0.092
  J2                   JUNCTION      0.00   251.73     0  01:09           0       0.123       2.872
  MHST09001            JUNCTION      0.00    31.48     0  01:10           0       0.138      -0.002
  MHST09002            JUNCTION      0.00    31.45     0  01:08           0       0.138      -0.047
  MHST09003            JUNCTION      0.00    41.63     0  01:10           0       0.152       0.220
  MHST09004            JUNCTION      0.00   137.96     0  01:10           0       0.847       0.122
  MHST09005            JUNCTION      0.00   194.93     0  01:10           0        1.01       0.072
  MHST09006            JUNCTION      0.00   238.66     0  01:10           0        1.18       0.205
  MHST09007            JUNCTION      0.00   310.49     0  01:10           0        1.37      -0.042
  MHST09008            JUNCTION      0.00   349.36     0  01:10           0        1.52       0.122
  MHST09009            JUNCTION      0.00   339.11     0  01:14           0        1.51       0.096
  MHST09010            JUNCTION      0.00   940.46     0  01:10           0         3.1      -0.006
  MHST09011            JUNCTION      0.00  1075.53     0  01:10           0        3.46       0.041
  MHST09013            JUNCTION      0.00   275.22     0  01:10           0       0.801      -0.110
  MHST09014            JUNCTION      0.00   232.02     0  01:10           0       0.641       0.091
  MHST09015            JUNCTION      0.00   193.96     0  01:10           0       0.528       0.090
  MHST09016            JUNCTION      0.00    47.91     0  01:10           0      0.0637       0.565
  MHST09017            JUNCTION      0.00   108.31     0  01:10           0       0.222      -0.204
  MHST09018            JUNCTION      0.00   105.71     0  01:09           0       0.222       0.211
  MHST09019            JUNCTION      0.00   196.90     0  01:09           0       0.428       0.186
  MHST09020            JUNCTION      0.00   280.41     0  01:08           0       0.664      -0.205
  MHST09021            JUNCTION      0.00   363.25     0  01:13           0        0.98       0.081
  MHST09022            JUNCTION     77.70   484.14     0  01:10      0.0994        1.23       0.004
  MHST09023            JUNCTION    128.19   618.74     0  01:10       0.164        1.52      -0.006
  MHST09024            JUNCTION      0.00   172.12     0  01:10           0       0.434       0.076
  OF-CREEK             OUTFALL       0.00  1577.82     0  01:10           0        4.58       0.000
  OF-HAZELDEAN         OUTFALL       0.00   148.26     0  01:10           0       0.101       0.000
  CB01                 STORAGE      79.88    79.88     0  01:10       0.103       0.103       0.341
  CB06                 STORAGE      82.83    82.83     0  01:10       0.109       0.109       0.201
  CHAMBERS-1           STORAGE       0.00   159.67     0  01:08           0       0.214       0.122
  CHAMBERS-2           STORAGE       0.00   227.73     0  01:10           0       0.293       0.444
  IN09003              STORAGE       0.00    10.92     0  01:10           0      0.0146       0.002
  IN09004              STORAGE       0.00    13.22     0  01:10           0      0.0237       0.099
  IN09005              STORAGE       0.00    49.44     0  01:10           0      0.0802      -0.021
  IN09006              STORAGE       0.00    50.88     0  01:10           0      0.0772      -0.021
  IN09007              STORAGE      78.13   106.09     0  01:10      0.0993       0.126      -0.011
  IN09008              STORAGE      86.70   151.31     0  01:10       0.111       0.173      -1.198
  IN09009              STORAGE       0.00    54.70     0  01:10           0      0.0785      -0.028
  IN09010              STORAGE       0.00    24.64     0  01:10           0      0.0498       0.005
  IN09011              STORAGE       0.00    55.00     0  01:07           0       0.106       0.024
  IN09012              STORAGE       0.00    54.05     0  01:10           0      0.0878      -0.023
  IN09013              STORAGE       0.00    55.00     0  01:08           0       0.103      -0.018
  IN09014              STORAGE       0.00    29.08     0  01:10           0      0.0488      -0.017
  IN09015              STORAGE       0.00    55.00     0  01:08           0       0.103      -0.024
  IN09016              STORAGE     105.46   154.75     0  01:10       0.132       0.182       0.771
  IN09017              STORAGE       0.00    12.84     0  01:10           0      0.0262       0.001
  IN09018              STORAGE       0.00    12.72     0  01:10           0      0.0248       0.000
```

```
  IN09019              STORAGE       0.00    40.81     0  01:10           0      0.0766      -0.013
  IN09020              STORAGE       0.00    18.91     0  01:10           0      0.0442       0.001
  IN09021              STORAGE       0.00    55.00     0  01:02           0        0.13      -0.020
  IN09022              STORAGE       0.00    14.32     0  01:10           0      0.0318       0.001
  IN09023              STORAGE       0.00    12.72     0  01:10           0      0.0228       0.000
  IN09024              STORAGE       0.00    26.78     0  01:10           0      0.0508      -0.000
  IN09025              STORAGE       0.00    32.56     0  01:10           0      0.0522      -0.009
  IN09026              STORAGE       0.00    49.26     0  01:10           0      0.0751      -0.020
  IN09027              STORAGE       0.00    48.30     0  01:10           0      0.0684      -0.023
  IN09028              STORAGE       0.00    30.80     0  01:10           0      0.0492      -0.010
  IN09029              STORAGE       0.00    52.03     0  01:10           0      0.0811      -0.024
  IN09030              STORAGE       0.00    30.79     0  01:11           0      0.0391      -0.011
  IN09031              STORAGE       0.00    21.63     0  01:10           0      0.0449       0.001
  IN09032              STORAGE       0.00    55.00     0  01:05           0       0.141      -0.016
  IN09033              STORAGE       0.00    55.00     0  01:09           0      0.0714      -0.029
  IN09034              STORAGE       0.00    55.00     0  01:04           0       0.131      -0.017
  IN09035              STORAGE       0.00    55.00     0  01:05           0       0.124      -0.019
  IN103407             STORAGE     174.80   183.35     0  01:10        0.23       0.238       0.040
  MHST09012            STORAGE     137.28  1575.67     0  01:10       0.175        4.58       0.029


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  ---------------------------------------------------------------------
                                               Max. Height   Min. Depth
                                   Hours       Above Crown    Below Rim
  Node                 Type      Surcharged        Meters       Meters
  ---------------------------------------------------------------------
  208                  JUNCTION        2.39         0.913        0.422
  210                  JUNCTION        0.96         0.205        1.465
  211                  JUNCTION        1.24         0.323        1.237
  212                  JUNCTION        2.24         0.755        1.310
  213                  JUNCTION        1.74         0.527        0.300
  215                  JUNCTION        3.20         1.265        0.420
  217                  JUNCTION        1.06         0.379        0.819
  218                  JUNCTION        2.67         0.964        0.000
  CB03                 JUNCTION        1.93         0.681        0.165
  CBT03                JUNCTION        0.01         0.534        0.272
  CBT06                JUNCTION        0.56         0.178        0.611
  CBT07                JUNCTION        0.79         0.220        0.576
  CBT08                JUNCTION        1.09         0.282        0.632
  CBT09                JUNCTION        1.40         0.391        0.441
  CBT10                JUNCTION        1.66         0.496        0.328
  CBT11                JUNCTION        2.49         0.897        0.279
  CBT12                JUNCTION        2.44         0.882        0.255
  CBT13                JUNCTION        2.38         0.885        0.000
  CBT14                JUNCTION        2.32         0.815        0.000
  IN07998              JUNCTION        0.59         1.085        0.117
  IN09021-MAJ          JUNCTION        0.18         0.000        0.000
  IN09032-MAJ          JUNCTION        0.09         0.000        0.000
```

```
  IN45566              JUNCTION        0.71         1.065        0.130
  IN45569              JUNCTION        0.41         1.197        0.000
  IN45570              JUNCTION        0.29         1.204        0.000
  IN45572              JUNCTION        0.12         1.202        0.000
  IN45573              JUNCTION        0.04         1.196        0.000
  IN45574              JUNCTION        0.31         0.100        0.000
  IN45575              JUNCTION        0.23         1.202        0.000
  IN45577              JUNCTION        0.06         1.202        0.000
  IN45587              JUNCTION        0.05         0.716        0.489
  J2                   JUNCTION        0.17         0.000        0.000
  MHST09008            JUNCTION        0.09         0.379        2.146
  MHST09009            JUNCTION        0.10         0.368        2.061
  MHST09010            JUNCTION        0.20         0.300        2.144
  MHST09014            JUNCTION        0.02         0.189        2.402
  MHST09015            JUNCTION        0.12         0.275        2.538
  MHST09017            JUNCTION        0.09         0.167        2.731
  MHST09018            JUNCTION        0.14         0.236        2.560
  MHST09023            JUNCTION        0.38         0.787        1.627


  *********************
  Node Flooding Summary
  *********************

  Flooding refers to all water that overflows a node, whether it ponds or not.
  --------------------------------------------------------------------------
                                                           Total   Maximum
                                 Maximum   Time of Max     Flood    Ponded
                         Hours      Rate    Occurrence    Volume     Depth
  Node                 Flooded       LPS   days hr:min  10^6 ltr    Meters
  --------------------------------------------------------------------------
  218                     0.25     49.99      0  01:19     0.014     0.000
  CBT13                   0.01     15.28      0  01:06     0.000     0.000
  CBT14                   0.01      8.00      0  01:06     0.000     0.000
  IN09021-MAJ             0.17     87.93      0  01:10     0.026     0.000
  IN09032-MAJ             0.09     65.01      0  01:11     0.008     0.000
  IN45569                 0.04      9.28      0  01:01     0.000     0.000
  IN45570                 0.01      3.03      0  01:03     0.000     0.000
  IN45572                 0.01      2.14      0  01:05     0.000     0.000
  IN45573                 0.01      3.13      0  01:08     0.000     0.000
  IN45574                 0.23     17.18      0  01:10     0.006     0.000
  IN45575                 0.01      2.75      0  01:07     0.000     0.000
  IN45577                 0.01      2.62      0  01:07     0.000     0.000
  J2                      0.16    251.66      0  01:09     0.057     0.000
  IN09005                 0.17     28.04      0  01:10     0.011     0.000
  IN09006                 0.24     29.48      0  01:10     0.013     0.000
  IN09007                 0.34     83.49      0  01:10     0.041     0.000
  IN09009                 0.27     33.30      0  01:10     0.019     0.000
  IN09011                 0.35     34.08      0  01:09     0.029     0.000
  IN09012                 0.23     32.65      0  01:10     0.017     0.000
  IN09013                 0.34     33.60      0  01:10     0.028     0.000
  IN09014                 0.07      7.68      0  01:10     0.001     0.000
  IN09015                 0.35     33.60      0  01:10     0.029     0.000
```

```
  IN09016                 0.39    132.12      0  01:10     0.070     0.000
  IN09019                 0.28     19.41      0  01:10     0.008     0.000
  IN09021                 0.41     24.63      0  01:06     0.036     0.000
  IN09024                 0.04      5.39      0  01:10     0.001     0.000
  IN09025                 0.08     11.16      0  01:10     0.002     0.000
  IN09026                 0.19     27.86      0  01:10     0.011     0.000
  IN09027                 0.17     26.90      0  01:10     0.009     0.000
  IN09028                 0.09      9.40      0  01:10     0.002     0.000
  IN09029                 0.23     30.63      0  01:10     0.015     0.000
  IN09030                 0.10      9.39      0  01:11     0.002     0.000
  IN09032                 0.56     33.60      0  01:10     0.065     0.000
  IN09033                 0.31     33.60      0  01:10     0.026     0.000
  IN09034                 0.44     24.63      0  01:06     0.037     0.000
  IN09035                 0.44     24.63      0  01:06     0.036     0.000


  **********************
  Storage Volume Summary
  **********************

  --------------------------------------------------------------------------------------------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt     Occurrence    Outflow
  Storage Unit            1000 m3   Full  Loss  Loss       1000 m3    Full    days hr:min        LPS
  --------------------------------------------------------------------------------------------------
  CB01                      0.000      1     0     0         0.000       9       0  01:30      80.43
  CB06                      0.000      1     0     0         0.000       5       0  01:30      84.12
  CHAMBERS-1                0.047     31     0     0         0.118      77       0  01:30      27.48
  CHAMBERS-2                0.072     46     0     0         0.155     100       0  01:18      93.81
  IN09003                   0.000      3     0     0         0.000      25       0  01:10      10.52
  IN09004                   0.000      0     0     0         0.000       5       0  01:11      12.96
  IN09005                   0.000     20     0     0         0.001     100       0  01:03      21.40
  IN09006                   0.000     18     0     0         0.001     100       0  01:05      21.40
  IN09007                   0.002     17     0     0         0.009     100       0  01:04      22.51
  IN09008                   0.001     11     0     0         0.009     100       0  01:07     138.69
  IN09009                   0.000     17     0     0         0.001     100       0  01:05      21.40
  IN09010                   0.026      2     0     0         0.040       3       0  02:30       1.60
  IN09011                   0.000     26     0     0         0.001     100       0  01:03      20.92
  IN09012                   0.000     20     0     0         0.001     100       0  01:03      21.40
  IN09013                   0.000     22     0     0         0.001     100       0  01:03      21.40
  IN09014                   0.000     12     0     0         0.001     100       0  01:08      21.40
  IN09015                   0.000     22     0     0         0.001     100       0  01:03      21.40
  IN09016                   0.000     30     0     0         0.000     100       0  01:05      22.51
  IN09017                   0.000      5     0     0         0.000      36       0  01:11      12.70
  IN09018                   0.000      5     0     0         0.000      35       0  01:11      12.58
  IN09019                   0.000     20     0     0         0.001     100       0  01:04      21.40
  IN09020                   0.000      9     0     0         0.000      64       0  01:10      17.14
  IN09021                   0.000     22     0     0         0.001     100       0  01:01      30.37
  IN09022                   0.000      7     0     0         0.000      43       0  01:10      14.10
  IN09023                   0.000      4     0     0         0.000      34       0  01:11      12.46
  IN09024                   0.000     12     0     0         0.001     100       0  01:09      21.40
  IN09025                   0.000     13     0     0         0.001     100       0  01:07      21.40
  IN09026                   0.000     18     0     0         0.001     100       0  01:04      21.40
```

```
IN09027                  0.000      17     0     0         0.001     100       0  01:05      21.40
IN09028                  0.000      13     0     0         0.001     100       0  01:08      21.40
IN09029                  0.000      20     0     0         0.001     100       0  01:03      21.40
IN09030                  0.000      11     0     0         0.001     100       0  01:08      21.40
IN09031                  0.000      11     0     0         0.000      86       0  01:10      19.88
IN09032                  0.000      24     0     0         0.001     100       0  01:03      21.40
IN09033                  0.000      15     0     0         0.001     100       0  01:05      21.40
IN09034                  0.000      20     0     0         0.001     100       0  01:03      30.37
IN09035                  0.000      20     0     0         0.001     100       0  01:03      30.37
IN103407                 0.001      15     0     0         0.010     100       0  01:03     179.74
MHST09012                0.000       9     0     0         0.001      28       0  01:10    1577.82


***********************
Outfall Loading Summary
***********************

-----------------------------------------------------------
                       Flow       Avg       Max       Total
                       Freq      Flow      Flow      Volume
Outfall Node           Pcnt       LPS       LPS    10^6 ltr
-----------------------------------------------------------
OF-CREEK              99.49    347.82   1577.82       4.581
OF-HAZELDEAN          25.30     48.89    148.26       0.101
-----------------------------------------------------------
System                62.40    396.71   1722.24       4.681


********************
Link Flow Summary
********************

-----------------------------------------------------------------------------
                               Maximum  Time of Max   Maximum    Max/    Max/
                                |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type          LPS  days hr:min     m/sec    Flow   Depth
-----------------------------------------------------------------------------
C01                  CONDUIT      0.64     0  05:14      0.70    0.00    0.05
C02                  CONDUIT      1.49     0  04:57      0.48    0.03    0.11
C03                  CONDUIT     26.37     0  01:19      0.83    0.26    0.33
C04                  CONDUIT     27.22     0  01:20      0.88    0.26    0.32
C05                  CONDUIT     29.12     0  01:20      0.86    0.28    0.35
C06                  CONDUIT     29.12     0  01:21      0.89    0.28    0.34
C07                  CONDUIT     50.41     0  01:33      1.16    0.62    0.43
C08                  CONDUIT     94.08     0  01:09      2.04    0.39    1.00
C09                  CONDUIT    189.80     0  01:10      1.65    0.31    1.00
C1                   CONDUIT     42.31     0  01:10      1.39    1.29    0.93
C10                  CONDUIT     50.52     0  01:33      1.34    0.30    0.43
C11                  CONDUIT     81.48     0  01:08      1.56    0.83    1.00
C12                  CONDUIT     80.43     0  01:09      1.70    0.73    1.00
C13                  CONDUIT    112.40     0  01:10      3.58    3.43    1.00
C14                  CONDUIT     41.08     0  01:09      2.31    0.16    1.00
C15                  CONDUIT     26.74     0  01:03      0.59    0.37    1.00
```

```
C16                  CONDUIT    159.67     0  01:08      2.05    0.21    1.00
C17                  CONDUIT     17.84     0  01:10      0.85    0.38    0.44
C18                  CONDUIT     17.71     0  01:10      0.86    0.43    0.44
C19                  CONDUIT     17.54     0  01:10      0.74    0.37    0.62
C2                   CONDUIT     16.36     0  01:10      0.80    0.76    0.62
C20                  CONDUIT     41.60     0  01:10      1.41    0.64    1.00
C21                  CONDUIT     93.44     0  01:09      1.34    1.00    1.00
C22                  CONDUIT     47.91     0  01:10      1.55    1.31    0.95
C23                  CONDUIT     84.12     0  01:09      1.88    0.67    1.00
C24                  CONDUIT     93.81     0  01:02      1.24    0.33    1.00
C25                  CONDUIT     29.12     0  01:21      0.69    0.24    0.43
C26                  CONDUIT     35.68     0  01:10      1.17    1.26    1.00
C27                  CONDUIT    111.38     0  01:10      3.55    3.40    1.00
C28                  CONDUIT     25.15     0  01:10      1.16    0.42    0.74
C29                  CONDUIT     25.07     0  01:09      1.15    0.42    0.99
C3                   CONDUIT     34.05     0  01:10      1.23    1.04    0.83
C30                  CONDUIT     25.05     0  01:09      1.16    0.42    1.00
C31                  CONDUIT     25.33     0  01:09      1.16    0.43    1.00
C32                  CONDUIT     24.58     0  01:08      1.15    0.41    1.00
C33                  CONDUIT     24.28     0  01:07      1.12    0.41    1.00
C34                  CONDUIT     22.01     0  01:06      1.12    0.37    1.00
C35                  CONDUIT     21.31     0  01:06      0.72    0.65    1.00
C36                  CONDUIT     20.48     0  01:06      0.62    0.62    1.00
C37                  CONDUIT     19.97     0  01:06      0.61    0.61    1.00
C38                  CONDUIT     19.53     0  01:06      0.63    0.60    1.00
C39                  CONDUIT    148.26     0  01:10      1.06    0.14    0.35
C4                   CONDUIT     26.25     0  01:10      1.27    0.72    0.63
C40                  CONDUIT     37.09     0  01:06      0.59    0.70    1.00
C5                   CONDUIT     54.64     0  01:10      1.76    1.67    0.97
C6                   CONDUIT     65.07     0  01:10      2.07    1.98    1.00
C7                   CONDUIT     61.30     0  01:09      1.95    2.64    1.00
C8                   CONDUIT     56.78     0  01:10      1.82    1.73    0.97
C9                   CONDUIT     47.72     0  01:10      1.55    1.45    0.95
C98                  CONDUIT      4.62     0  00:57      0.59    1.49    1.00
C99                  CONDUIT      4.04     0  00:53      0.54    2.60    1.00
OF1                  CHANNEL      0.00     0  00:00      0.00    0.00    0.00
R01                  CHANNEL     15.17     0  01:10      0.21    0.01    0.33
R02                  CHANNEL     28.70     0  01:10      0.32    0.07    0.37
R03                  CHANNEL     64.78     0  01:10      0.48    0.09    0.49
R04                  CHANNEL      0.00     0  00:00      0.00    0.00    0.17
R05                  CHANNEL    116.49     0  01:10      0.62    0.16    0.52
R06                  CHANNEL     45.38     0  01:10      0.41    0.05    0.41
R07                  CHANNEL    115.27     0  01:10      0.62    0.13    0.52
R08                  CHANNEL     78.66     0  01:10      0.89    0.09    0.37
R09                  CHANNEL     30.55     0  01:10      0.38    0.02    0.40
R10                  CHANNEL     23.02     0  01:10      0.17    0.02    0.63
R11                  CHANNEL    147.91     0  01:10      0.70    0.17    0.55
R12                  CHANNEL    153.55     0  01:10      0.73    0.17    0.55
R13                  CHANNEL    142.47     0  01:11      0.68    0.17    0.55
R14                  CHANNEL     39.55     0  01:10      0.24    0.06    0.56
R15                  CHANNEL     22.71     0  01:10      0.40    0.02    0.31
R16                  CHANNEL     38.02     0  01:26      0.18    0.05    0.83
R17                  CHANNEL    171.10     0  01:09      0.30    0.26    0.85
```

```
R18                  CHANNEL     52.12     0  01:10      0.24    0.04    0.66
R19                  CHANNEL     65.77     0  01:10      0.21    0.08    0.70
R20                  CHANNEL      7.47     0  01:10      0.17    0.01    0.26
R21                  CHANNEL      8.00     0  01:10      0.13    0.01    0.30
R22                  CHANNEL      9.73     0  01:10      0.40    0.01    0.19
R23                  CHANNEL     10.16     0  01:10      0.23    0.01    0.48
R24                  CHANNEL      8.57     0  01:10      0.28    0.01    0.34
R25                  CHANNEL     12.06     0  01:10      0.24    0.01    0.28
R26                  CHANNEL     31.07     0  01:10      0.45    0.03    0.33
R27                  CHANNEL     59.35     0  01:10      0.55    0.07    0.41
R28                  CHANNEL     50.90     0  01:10      0.50    0.05    0.40
R29                  CHANNEL     76.14     0  01:10      0.72    0.08    0.40
R30                  CHANNEL     76.18     0  01:10      0.57    0.09    0.45
R31                  CHANNEL     90.68     0  01:10      0.82    0.10    0.42
R32                  CHANNEL     86.08     0  01:10      0.48    0.06    0.53
R33                  CHANNEL     55.79     0  01:11      0.29    0.06    0.69
R34                  CHANNEL     39.46     0  01:10      0.57    0.04    0.42
STM04620             CONDUIT    227.48     0  01:10      1.17    1.16    1.00
STM04621             CONDUIT    276.26     0  01:11      1.27    0.99    0.99
STM07857             CONDUIT    193.96     0  01:10      1.26    0.71    0.67
STM07870             CONDUIT    193.95     0  01:10      1.23    1.73    1.00
STM07871             CONDUIT   1577.82     0  01:10      2.60    1.75    0.91
STM07872             CONDUIT    163.59     0  01:10      1.48    1.51    1.00
STM07873             CONDUIT    339.46     0  01:14      1.53    0.94    1.00
STM07874             CONDUIT     31.45     0  01:08      0.79    0.29    0.40
STM07875             CONDUIT    237.07     0  01:11      1.51    0.87    0.74
STM07876             CONDUIT     47.23     0  01:10      0.94    0.79    1.00
STM45150             CONDUIT    105.71     0  01:09      1.30    0.99    1.00
STM45151             CONDUIT    102.12     0  01:09      1.13    0.92    1.00
STM45152             CONDUIT    178.64     0  01:08      1.36    0.99    1.00
STM45153             CONDUIT    254.87     0  01:23      1.29    0.62    1.00
STM45154             CONDUIT    370.37     0  01:14      1.31    1.34    1.00
STM45155             CONDUIT    479.38     0  01:11      1.70    1.57    1.00
STM45156             CONDUIT    618.76     0  01:10      2.19    1.80    1.00
STM45159             CONDUIT    943.85     0  01:10      2.14    1.22    1.00
STM45160             CONDUIT   1060.10     0  01:11      2.49    1.33    0.92
STM45161             CONDUIT    307.04     0  01:10      1.41    0.84    0.92
STM45162             CONDUIT    339.11     0  01:14      1.58    1.39    1.00
STM45163             CONDUIT     31.43     0  01:08      0.70    0.34    0.51
STM45164_1           CONDUIT     41.17     0  01:10      0.67    0.43    0.62
STM45164_2           CONDUIT     85.74     0  01:11      1.23    0.89    0.60
STM45165             CONDUIT    135.79     0  01:10      1.47    0.61    0.56
212-ICD              DUMMY       21.32     0  01:30
215-ICD              DUMMY       24.51     0  01:18
IN09003-ICD          DUMMY       10.52     0  01:10
IN09003-INC          DUMMY       10.92     0  01:10
IN09004-ICD          DUMMY       12.96     0  01:11
IN09004-INC          DUMMY       13.22     0  01:10
IN09005-ICD          DUMMY       21.40     0  01:03
IN09005-INC          DUMMY       49.44     0  01:10
IN09006-ICD          DUMMY       21.40     0  01:05
IN09006-INC          DUMMY       50.88     0  01:10
IN09007-ICD          DUMMY       22.51     0  01:04
```

```
IN09008-ICD          DUMMY       22.21     0  01:10
IN09009-ICD          DUMMY       21.40     0  01:05
IN09009-INC          DUMMY       54.70     0  01:10
IN09010-ICD          DUMMY        1.60     0  02:30
IN09010-INC          DUMMY       24.64     0  01:10
IN09011-ICD          DUMMY       20.92     0  01:03
IN09011-INC          DUMMY       55.00     0  01:07
IN09012-ICD          DUMMY       21.40     0  01:03
IN09012-INC          DUMMY       54.05     0  01:10
IN09013-ICD          DUMMY       21.40     0  01:03
IN09013-INC          DUMMY       55.00     0  01:08
IN09014-ICD          DUMMY       21.40     0  01:08
IN09014-INC          DUMMY       29.08     0  01:10
IN09015-ICD          DUMMY       21.40     0  01:03
IN09015-INC          DUMMY       55.00     0  01:08
IN09016-ICD          DUMMY       22.51     0  01:05
IN09017-ICD          DUMMY       12.70     0  01:11
IN09017-INC          DUMMY       12.84     0  01:10
IN09018-ICD          DUMMY       12.58     0  01:11
IN09018-INC          DUMMY       12.72     0  01:10
IN09019-ICD          DUMMY       21.40     0  01:04
IN09019-INC          DUMMY       40.81     0  01:10
IN09020-ICD          DUMMY       17.14     0  01:10
IN09020-INC          DUMMY       18.91     0  01:10
IN09021-ICD          DUMMY       30.37     0  01:01
IN09021-INC          DUMMY       55.00     0  01:02
IN09022-ICD          DUMMY       14.10     0  01:10
IN09022-INC          DUMMY       14.32     0  01:10
IN09023-ICD          DUMMY       12.46     0  01:11
IN09023-INC          DUMMY       12.72     0  01:10
IN09024-ICD          DUMMY       21.40     0  01:09
IN09024-INC          DUMMY       26.78     0  01:10
IN09025-ICD          DUMMY       21.40     0  01:07
IN09025-INC          DUMMY       32.56     0  01:10
IN09026-ICD          DUMMY       21.40     0  01:04
IN09026-INC          DUMMY       49.26     0  01:10
IN09027-ICD          DUMMY       21.40     0  01:05
IN09027-INC          DUMMY       48.30     0  01:10
IN09028-ICD          DUMMY       21.40     0  01:08
IN09028-INC          DUMMY       30.80     0  01:10
IN09029-ICD          DUMMY       21.40     0  01:04
IN09029-INC          DUMMY       52.03     0  01:10
IN09030-ICD          DUMMY       21.40     0  01:08
IN09030-INC          DUMMY       30.79     0  01:11
IN09031-ICD          DUMMY       19.88     0  01:10
IN09031-INC          DUMMY       21.63     0  01:10
IN09032-ICD          DUMMY       21.40     0  01:03
IN09032-INC          DUMMY       55.00     0  01:05
IN09033-ICD          DUMMY       21.40     0  01:05
IN09033-INC          DUMMY       55.00     0  01:09
IN09034-ICD          DUMMY       30.37     0  01:03
IN09034-INC          DUMMY       55.00     0  01:04
IN09035-ICD          DUMMY       30.37     0  01:03
```

```
IN09035-INC          DUMMY       55.00     0  01:05
IN103407-ICD         DUMMY       31.48     0  01:10


***************************
Flow Classification Summary
***************************

-------------------------------------------------------------------------------------
                    Adjusted    ---------- Fraction of Time in Flow Class ----------
                     /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------
C01                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C02                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C03                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C04                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C05                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C06                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C07                     1.00   0.00  0.00  0.00  0.14  0.86  0.00  0.00  0.00  0.00
C08                     1.00   0.00  0.00  0.00  0.75  0.25  0.00  0.00  0.57  0.00
C09                     1.00   0.00  0.00  0.00  0.67  0.01  0.00  0.31  0.01  0.00
C1                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C10                     1.00   0.00  0.00  0.00  0.21  0.12  0.00  0.66  0.01  0.00
C11                     1.00   0.02  0.00  0.00  0.34  0.00  0.00  0.64  0.06  0.00
C12                     1.00   0.00  0.00  0.00  0.31  0.01  0.00  0.68  0.08  0.00
C13                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C14                     1.00   0.00  0.00  0.00  0.50  0.02  0.00  0.48  0.20  0.00
C15                     1.00   0.34  0.00  0.00  0.54  0.00  0.00  0.11  0.00  0.00
C16                     1.00   0.00  0.00  0.00  0.51  0.02  0.00  0.47  0.02  0.00
C17                     1.00   0.00  0.00  0.00  0.97  0.03  0.00  0.00  0.91  0.00
C18                     1.00   0.00  0.00  0.00  0.96  0.04  0.00  0.00  0.51  0.00
C19                     1.00   0.00  0.01  0.00  0.99  0.00  0.00  0.00  0.98  0.00
C2                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C20                     1.00   0.00  0.00  0.00  0.27  0.00  0.00  0.72  0.12  0.00
C21                     1.00   0.00  0.00  0.00  0.64  0.01  0.00  0.35  0.06  0.00
C22                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C23                     1.00   0.00  0.00  0.00  0.27  0.03  0.00  0.70  0.08  0.00
C24                     1.00   0.17  0.00  0.00  0.77  0.01  0.00  0.04  0.00  0.00
C25                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.01  0.00
C26                     1.00   0.00  0.00  0.00  0.03  0.00  0.00  0.97  0.00  0.00
C27                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C28                     1.00   0.00  0.00  0.00  0.58  0.42  0.00  0.00  0.51  0.00
C29                     1.00   0.00  0.14  0.00  0.49  0.36  0.00  0.00  0.77  0.00
C3                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C30                     1.00   0.01  0.00  0.00  0.65  0.34  0.00  0.00  0.65  0.00
C31                     1.00   0.01  0.00  0.00  0.68  0.31  0.00  0.00  0.58  0.00
C32                     1.00   0.01  0.00  0.00  0.72  0.27  0.00  0.00  0.57  0.00
C33                     1.00   0.01  0.00  0.00  0.74  0.25  0.00  0.00  0.50  0.00
C34                     1.00   0.02  0.00  0.00  0.38  0.00  0.00  0.60  0.01  0.00
C35                     1.00   0.03  0.00  0.00  0.56  0.00  0.00  0.41  0.00  0.00
C36                     1.00   0.02  0.00  0.00  0.98  0.00  0.00  0.00  0.43  0.00
C37                     1.00   0.01  0.00  0.00  0.98  0.00  0.00  0.00  0.45  0.00
```

```
C38                     1.00   0.01  0.00  0.00  0.99  0.00  0.00  0.00  0.48  0.00
C39                     1.00   0.75  0.00  0.00  0.11  0.14  0.00  0.00  0.04  0.00
C4                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C40                     1.00   0.00  0.02  0.00  0.98  0.00  0.00  0.00  0.42  0.00
C5                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C6                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C7                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C8                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C9                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C98                     1.00   0.01  0.00  0.00  0.96  0.04  0.00  0.00  0.00  0.00
C99                     1.00   0.01  0.00  0.00  0.82  0.00  0.00  0.17  0.00  0.00
OF1                     1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
R01                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R02                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
R03                     1.00   0.00  0.00  0.00  0.17  0.00  0.00  0.83  0.07  0.00
R04                     1.00   0.00  1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
R05                     1.00   0.00  0.79  0.00  0.20  0.00  0.00  0.00  0.77  0.00
R06                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R07                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R08                     1.00   0.00  0.00  0.00  0.50  0.50  0.00  0.00  0.00  0.00
R09                     1.00   0.01  0.00  0.00  0.69  0.30  0.00  0.00  0.73  0.00
R10                     1.00   0.00  0.01  0.00  0.99  0.00  0.00  0.00  0.94  0.00
R11                     1.00   0.00  0.00  0.00  0.93  0.07  0.00  0.00  0.48  0.00
R12                     1.00   0.00  0.00  0.00  0.91  0.09  0.00  0.00  0.58  0.00
R13                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
R14                     1.00   0.00  0.00  0.00  0.27  0.00  0.00  0.73  0.16  0.00
R15                     1.00   0.00  0.01  0.00  0.99  0.00  0.00  0.00  0.98  0.00
R16                     1.00   0.00  0.00  0.00  0.99  0.01  0.00  0.00  0.11  0.00
R17                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.16  0.00
R18                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R19                     1.00   0.00  0.00  0.00  0.99  0.00  0.00  0.00  0.93  0.00
R20                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R21                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R22                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
R23                     1.00   0.00  0.00  0.00  0.27  0.00  0.00  0.73  0.16  0.00
R24                     1.00   0.00  0.00  0.00  0.18  0.01  0.00  0.80  0.08  0.00
R25                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R26                     1.00   0.00  0.00  0.00  0.99  0.00  0.00  0.00  0.97  0.00
R27                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R28                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R29                     1.00   0.00  0.00  0.00  0.80  0.20  0.00  0.00  0.00  0.00
R30                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.75  0.00
R31                     1.00   0.00  0.00  0.00  0.41  0.59  0.00  0.00  0.39  0.00
R32                     1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.99  0.00
R33                     1.00   0.00  0.01  0.00  0.99  0.00  0.00  0.00  0.98  0.00
R34                     1.00   0.00  0.00  0.00  0.85  0.15  0.00  0.00  0.56  0.00
STM04620                1.00   0.01  0.00  0.00  0.32  0.00  0.00  0.67  0.00  0.00
STM04621                1.00   0.00  0.00  0.00  0.15  0.00  0.00  0.85  0.00  0.00
STM07857                1.00   0.00  0.01  0.00  0.99  0.01  0.00  0.00  0.93  0.00
STM07870                1.00   0.01  0.00  0.00  0.18  0.00  0.00  0.81  0.00  0.00
STM07871                1.00   0.00  0.00  0.00  0.99  0.01  0.00  0.00  0.00  0.00
STM07872                1.00   0.00  0.00  0.00  0.20  0.00  0.00  0.79  0.00  0.00
STM07873                1.00   0.01  0.00  0.00  0.10  0.00  0.00  0.89  0.00  0.00
```

```
  STM07874               1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.70  0.00
  STM07875               1.00   0.00  0.00  0.00  0.03  0.00  0.00  0.97  0.01  0.00
  STM07876               1.00   0.00  0.00  0.00  0.18  0.00  0.00  0.81  0.04  0.00
  STM45150               1.00   0.00  0.00  0.00  0.07  0.00  0.00  0.93  0.00  0.00
  STM45151               1.00   0.01  0.00  0.00  0.15  0.00  0.00  0.85  0.02  0.00
  STM45152               1.00   0.00  0.00  0.00  0.08  0.00  0.00  0.92  0.01  0.00
  STM45153               1.00   0.00  0.00  0.00  0.19  0.18  0.00  0.63  0.13  0.00
  STM45154               1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.81  0.00
  STM45155               1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.85  0.00
  STM45156               1.00   0.00  0.00  0.00  0.98  0.00  0.00  0.02  0.74  0.00
  STM45159               1.00   0.00  0.00  0.00  0.36  0.64  0.00  0.00  0.41  0.00
  STM45160               1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
  STM45161               1.00   0.00  0.00  0.00  0.50  0.00  0.00  0.50  0.03  0.00
  STM45162               1.00   0.01  0.00  0.00  0.12  0.00  0.00  0.87  0.00  0.00
  STM45163               1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.46  0.00
  STM45164_1             1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.00  0.00
  STM45164_2             1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
  STM45165               1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00


  *************************
  Conduit Surcharge Summary
  *************************

  ----------------------------------------------------------------------------
                                                             Hours        Hours 
                             --------- Hours Full --------   Above Full   Capacity
  Conduit                    Both Ends  Upstream  Dnstream   Normal Flow  Limited 
  ----------------------------------------------------------------------------
  C08                             1.93      1.93      3.08       0.01         0.01
  C09                             2.39      2.39      2.42       0.01         0.01
  C1                              0.01      0.05      0.01       0.10         0.01
  C11                             1.03      1.03      1.41       0.01         0.01
  C12                             0.66      0.66      1.24       0.01         0.01
  C13                             0.25      0.59      0.25       0.69         0.25
  C14                             1.06      1.06      2.30       0.01         0.01
  C15                             2.16      2.16      2.24       0.01         0.01
  C16                             1.43      1.43      1.53       0.01         0.01
  C19                             0.01      0.01      0.01       0.01         0.01
  C20                             0.01      0.01      1.07       0.01         0.01
  C21                             2.67      2.67      3.00       0.01         0.01
  C22                             0.01      0.04      0.01       0.07         0.01
  C23                             0.24      0.24      0.96       0.01         0.01
  C24                             3.10      3.10      3.20       0.01         0.01
  C26                             0.09      0.31      0.09       0.37         0.06
  C27                             0.33      0.71      0.33       0.82         0.33
  C29                             0.01      0.01      0.56       0.01         0.01
  C3                              0.01      0.01      0.01       0.02         0.01
  C30                             0.56      0.56      0.79       0.01         0.01
  C31                             0.79      0.79      1.09       0.01         0.01
  C32                             1.09      1.09      1.40       0.01         0.01
  C33                             1.40      1.40      1.66       0.01         0.01
  C34                             1.66      1.66      1.74       0.01         0.01
```

```
  C35                             2.49      2.49      2.50       0.01         0.01
  C36                             2.44      2.44      2.50       0.01         0.01
  C37                             2.38      2.38      2.45       0.01         0.01
  C38                             2.32      2.32      2.39       0.01         0.01
  C40                             2.49      2.49      2.67       0.01         0.01
  C5                              0.01      0.23      0.01       0.28         0.01
  C6                              0.02      0.29      0.02       0.33         0.02
  C7                              0.04      0.41      0.04       0.49         0.04
  C8                              0.01      0.12      0.01       0.18         0.01
  C9                              0.01      0.06      0.01       0.10         0.01
  C98                             3.62      4.18      3.62       1.44         0.69
  C99                             4.16      5.25      4.16       1.32         0.15
  R10                             0.01      0.01      0.09       0.01         0.01
  R16                             0.01      0.01      0.16       0.01         0.01
  R17                             0.01      0.01      0.16       0.01         0.01
  R18                             0.01      0.01      0.17       0.01         0.01
  R19                             0.01      0.01      0.16       0.01         0.01
  R33                             0.01      0.01      0.09       0.01         0.01
  STM04620                        0.01      0.02      0.01       0.17         0.01
  STM04621                        0.01      0.01      0.01       0.01         0.01
  STM07870                        0.03      0.14      0.03       0.52         0.03
  STM07871                        0.01      0.14      0.01       0.47         0.01
  STM07872                        0.12      0.30      0.12       0.48         0.12
  STM07873                        0.13      0.13      0.20       0.01         0.01
  STM07876                        0.06      0.06      0.13       0.01         0.01
  STM45150                        0.13      0.13      0.14       0.01         0.01
  STM45151                        0.16      0.16      0.21       0.01         0.01
  STM45152                        0.20      0.20      0.24       0.01         0.01
  STM45153                        0.24      0.24      0.38       0.01         0.01
  STM45154                        0.38      0.38      0.39       0.35         0.36
  STM45155                        0.38      0.39      0.38       0.42         0.38
  STM45156                        0.35      0.38      0.35       0.46         0.35
  STM45159                        0.23      0.27      0.23       0.34         0.23
  STM45160                        0.01      0.23      0.01       0.38         0.01
  STM45161                        0.01      0.01      0.09       0.01         0.01
  STM45162                        0.10      0.11      0.10       0.44         0.10


  Analysis begun on:  Fri Nov 01 14:46:54 2019
  Analysis ended on:  Fri Nov 01 14:46:56 2019
  Total elapsed time: 00:00:02
```

PCSWMM Report

PCSWMM REPORT

Model 250806_Post_Dev_Rev3.inp

exp Services Inc.
November 1, 2019

Table of Contents

Summaries

Maps

Graphs

Profiles

Table of Contents

Summary 1: Subcatchment attributes

Name	Chicago_3h_100yr	Chicago_3h_100yr + 20%	Chicago_3h_2yr	Chicago_3h_5yr	Historic_Aug4-88	Historic_Jul1-79
S01 - Peak Runoff (L/s)	82.67	100.76	30.40	44.35	72.47	50.26
S02 - Peak Runoff (L/s)	71.96	86.87	28.12	40.27	62.84	43.21
S03 - Peak Runoff (L/s)	7.77	9.62	0.89	3.36	6.99	4.66
S04 - Peak Runoff (L/s)	93.97	114.71	34.08	50.02	82.51	57.24
S05 - Peak Runoff (L/s)	58.44	71.70	20.19	30.29	51.52	35.81
S06 - Peak Runoff (L/s)	24.73	31.82	4.96	9.80	22.35	16.10
S07 - Peak Runoff (L/s)	17.89	22.48	3.61	7.55	15.86	11.13
S08_1 - Peak Runoff (L/s)	18.78	22.96	5.39	9.42	16.58	11.32
S08_2 - Peak Runoff (L/s)	25.13	30.84	6.76	12.23	22.18	15.20
S09 - Peak Runoff (L/s)	38.21	46.38	12.65	20.28	33.69	22.94
ES33 - Peak Runoff (L/s)	47.79	64.41	11.03	18.72	48.02	35.28
ES34 - Peak Runoff (L/s)	51.83	75.89	9.08	16.69	66.39	52.31
ES35 - Peak Runoff (L/s)	111.11	152.57	30.60	46.99	131.48	97.37
ES31 - Peak Runoff (L/s)	47.58	65.58	10.47	17.88	50.84	37.31
ES30 - Peak Runoff (L/s)	56.63	77.01	14.18	22.90	60.14	43.64
ES29 - Peak Runoff (L/s)	68.63	92.94	18.78	29.14	74.82	53.41
ES28 - Peak Runoff (L/s)	64.88	89.51	16.15	25.90	73.26	52.48
ES27 - Peak Runoff (L/s)	54.47	78.14	10.87	18.94	66.64	50.12
ES02_1 - Peak Runoff (L/s)	30.94	41.11	6.13	11.59	29.35	21.62
ES32 - Peak Runoff (L/s)	112.14	150.74	33.60	50.29	125.93	88.06
ES19 - Peak Runoff (L/s)	41.93	52.66	13.50	20.46	37.86	26.84
ES17 - Peak Runoff (L/s)	55.84	71.13	12.53	23.37	50.13	35.81
ES18 - Peak Runoff (L/s)	90.96	118.04	21.29	37.43	83.97	60.91
ES20 - Peak Runoff (L/s)	21.34	28.64	5.01	8.46	21.26	15.60
ES23 - Peak Runoff (L/s)	42.22	55.96	12.85	19.24	44.38	31.50
ES24 - Peak Runoff (L/s)	19.00	25.95	4.72	7.63	20.44	14.81
ES25 - Peak Runoff (L/s)	35.11	46.54	10.96	16.23	37.69	26.49

Summary 1: Subcatchment attributes (continued...)

Name	Chicago_3h_100yr	Chicago_3h_100yr + 20%	Chicago_3h_2yr	Chicago_3h_5yr	Historic_Aug4-88	Historic_Jul1-79
ES26 - Peak Runoff (L/s)	26.76	35.82	7.55	11.63	28.13	20.17
ES07 - Peak Runoff (L/s)	84.64	107.91	25.77	39.66	78.05	55.85
ES36 - Peak Runoff (L/s)	67.90	91.18	15.11	26.28	67.04	49.38
ES03_1 - Peak Runoff (L/s)	117.06	147.99	33.81	54.15	105.69	75.21
ES03_2 - Peak Runoff (L/s)	78.36	99.34	20.61	34.85	70.52	50.26
ES04_1 - Peak Runoff (L/s)	86.50	109.27	27.17	41.49	78.68	56.00
ES04_2 - Peak Runoff (L/s)	77.94	99.28	23.27	36.23	71.52	51.16
ES05_1 - Peak Runoff (L/s)	73.56	94.34	21.52	33.65	68.24	49.01
ES05_2 - Peak Runoff (L/s)	72.79	92.90	21.68	33.72	67.04	48.01
ES06_1 - Peak Runoff (L/s)	114.20	144.42	35.44	54.41	103.93	74.01
ES06_2 - Peak Runoff (L/s)	96.52	122.87	28.75	44.85	88.45	63.26
ES14_1 - Peak Runoff (L/s)	50.68	65.60	12.36	21.26	46.76	33.85
ES14_2 - Peak Runoff (L/s)	75.15	94.83	23.50	36.01	68.19	48.49
ES15_1 - Peak Runoff (L/s)	28.79	37.23	6.04	11.47	26.23	18.98
ES15_2 - Peak Runoff (L/s)	50.78	64.25	15.16	23.79	46.04	32.79
ES01_1 - Peak Runoff (L/s)	136.23	170.49	47.31	69.10	123.06	87.44
ES02_2 - Peak Runoff (L/s)	19.92	25.29	4.75	8.55	17.86	12.73
ES08_1 - Peak Runoff (L/s)	47.03	60.74	11.88	20.06	43.38	31.35
ES08_2 - Peak Runoff (L/s)	26.66	36.02	5.61	10.01	26.51	19.59
ES09_1 - Peak Runoff (L/s)	69.77	88.91	20.29	32.04	63.86	45.71
ES09_2 - Peak Runoff (L/s)	66.73	87.05	15.85	27.41	62.28	45.31
ES13_1 - Peak Runoff (L/s)	61.86	78.75	18.97	29.12	56.93	40.70
ES13_2 - Peak Runoff (L/s)	66.03	84.34	19.39	30.37	60.79	43.56
ES12_1 - Peak Runoff (L/s)	77.52	98.53	23.59	36.42	71.04	50.74
ES12_2 - Peak Runoff (L/s)	62.08	79.05	18.60	28.91	56.96	40.74
ES11_1 - Peak Runoff (L/s)	73.06	93.16	21.94	34.01	67.25	48.13
ES11_2 - Peak Runoff (L/s)	46.57	60.53	12.21	20.02	43.69	31.66

Summary 1: Subcatchment attributes (continued...)

Name	Chicago_3h_100yr	Chicago_3h_100yr + 20%	Chicago_3h_2yr	Chicago_3h_5yr	Historic_Aug4-88	Historic_Jul1-79
ES10_1 - Peak Runoff (L/s)	81.11	104.33	23.06	36.52	75.37	54.24
ES10_2 - Peak Runoff (L/s)	71.32	91.74	19.39	31.49	65.86	47.44
ES16_1 - Peak Runoff (L/s)	42.73	53.85	8.22	17.66	37.92	26.68
ES16_2 - Peak Runoff (L/s)	62.28	82.65	10.51	22.13	58.23	42.94
ES22_1 - Peak Runoff (L/s)	76.42	96.26	24.92	37.39	69.46	49.37
ES22_2 - Peak Runoff (L/s)	86.17	109.85	26.13	40.30	79.38	56.80
ES21_3 - Peak Runoff (L/s)	44.83	58.74	11.92	19.23	42.97	31.21
ES21_4 - Peak Runoff (L/s)	58.40	73.46	18.93	28.53	52.92	37.57
ES21_1 - Peak Runoff (L/s)	32.28	40.86	10.05	15.39	29.45	20.98
ES21_5 - Peak Runoff (L/s)	33.42	42.72	10.22	15.65	31.02	22.22

Summary 2: Storage attributes

Name	Chicago_3h_100yr	Chicago_3h_100yr + 20%	Chicago_3h_2yr	Chicago_3h_5yr	Historic_Aug4-88	Historic_Jul1-79
CHAMBERS-1 - Max. HGL (m)	112.81	113.14	111.96	112.18	112.89	113.08
CHAMBERS-1 - Max. Outflow (L/s)	27.30	24.61	19.80	23.09	21.95	23.24
CHAMBERS-1 - Max. Volume (1000 m^3)	0.118	0.148	0.041	0.060	0.125	0.142
CHAMBERS-2 - Max. HGL (m)	114.08	114.36	112.88	113.16	114.28	114.17
CHAMBERS-2 - Max. Outflow (L/s)	94.63	90.70	94.40	94.07	60.53	139.72
CHAMBERS-2 - Max. Volume (1000 m^3)	0.155	0.155	0.054	0.080	0.155	0.155

Summary 3: Conduit attributes

Name	Chicago_3h_100yr	Chicago_3h_100yr + 20%	Chicago_3h_2yr	Chicago_3h_5yr	Historic_Aug4-88	Historic_Jul1-79

Summary 3: Conduit attributes (continued...)

Name	Chicago_3h_100yr	Chicago_3h_100yr + 20%	Chicago_3h_2yr	Chicago_3h_5yr	Historic_Aug4-88	Historic_Jul1-79
C10 - Max. |Flow| (L/s)	50.50	52.84	32.76	38.13	51.45	52.53

Figure 1: SUBCATCHMENTS

Figure 2: CONDUITS

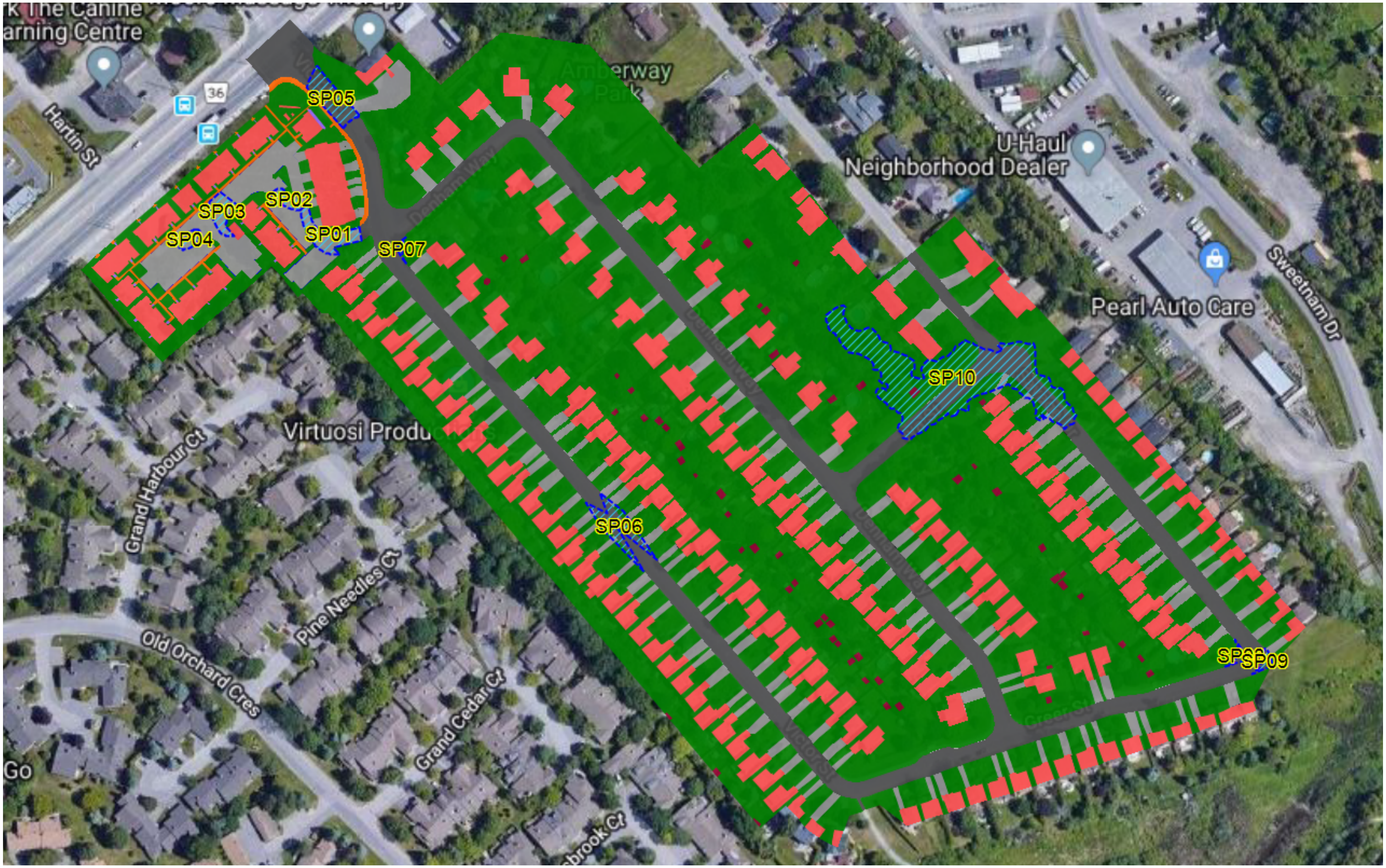
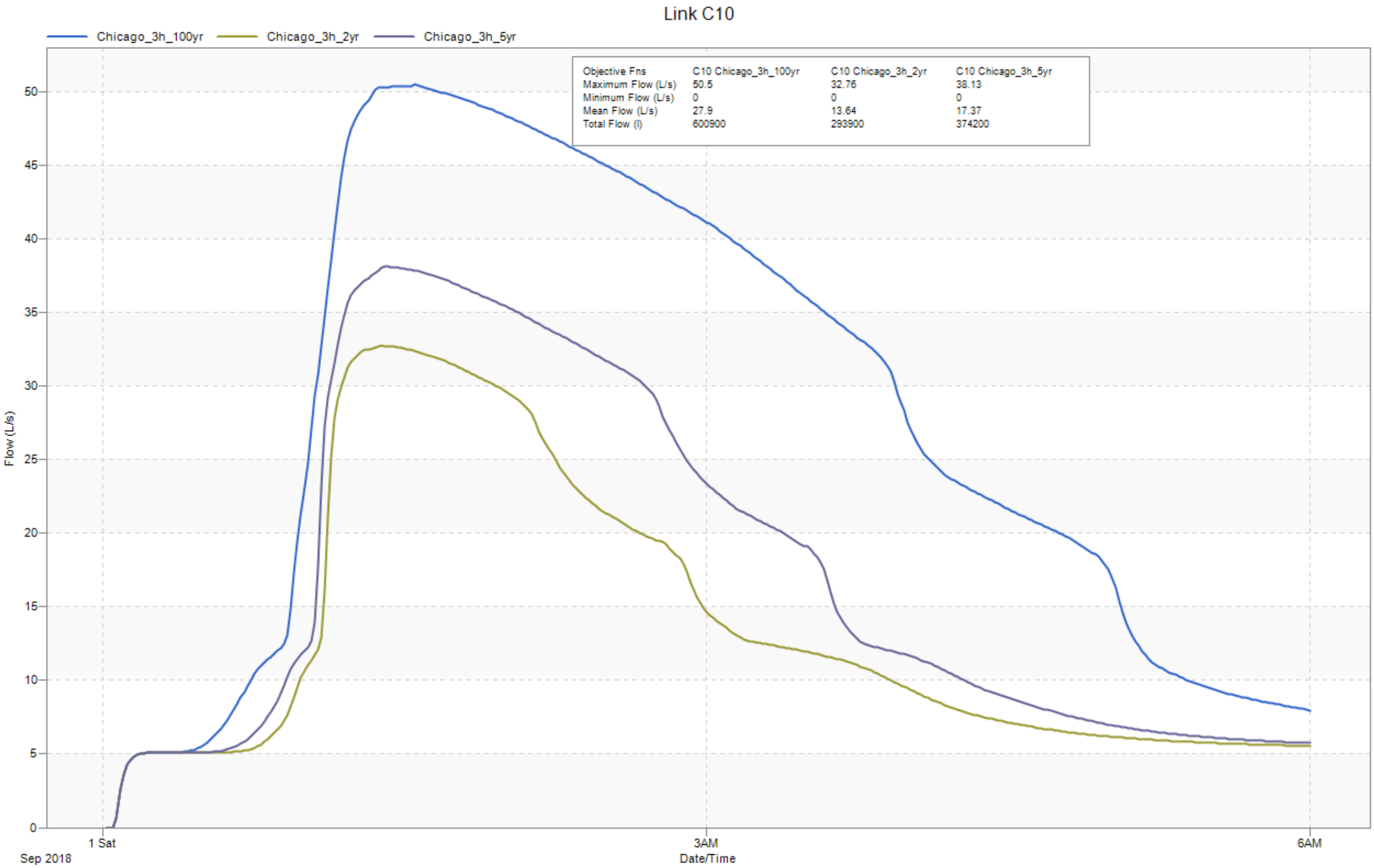


Figure 3: PONDING AREAS

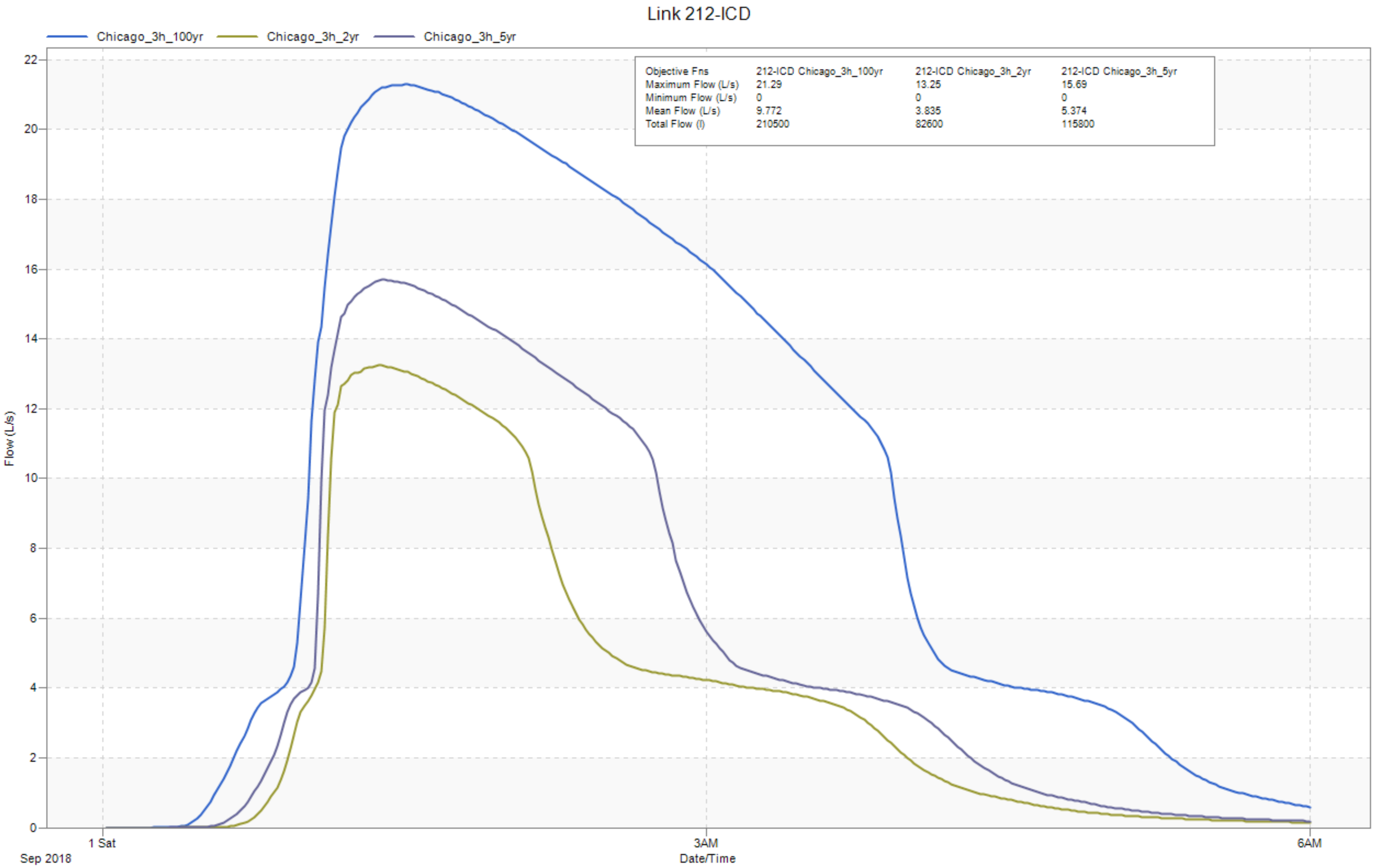
Figure 4: OFFSITE STRUCTURES

Figure 5: ONSITE SYSTEM



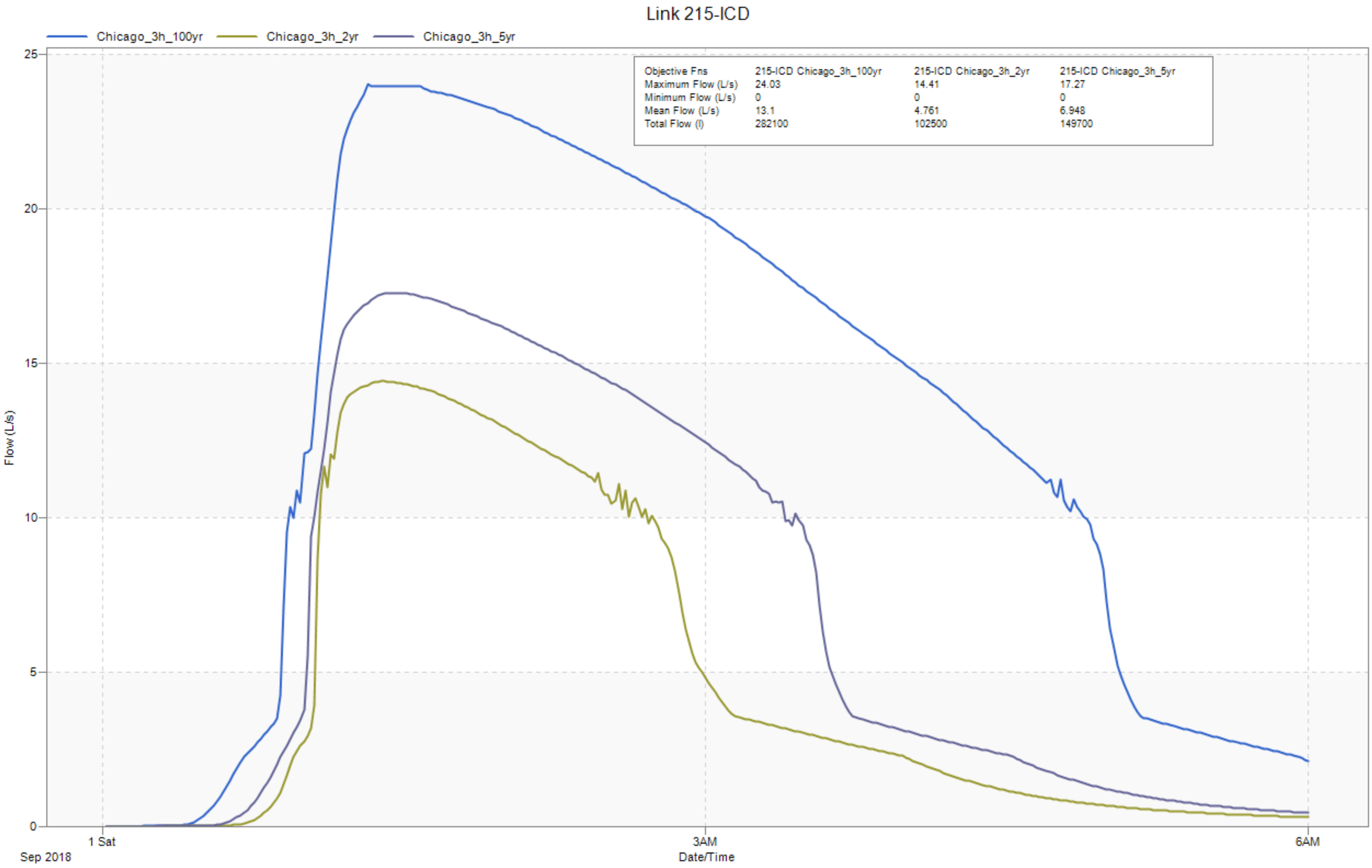
Objective Fns	C10 Chicago_3h_100yr	C10 Chicago_3h_2yr	C10 Chicago_3h_5yr
Maximum Flow (L/s)	50.5	32.76	38.13
Minimum Flow (L/s)	0	0	0
Mean Flow (L/s)	27.9	13.64	17.37
Total Flow (l)	600900	293900	374200

Figure 6: CONDUIT 10



Objective Fns	212-ICD Chicago_3h_100yr	212-ICD Chicago_3h_2yr	212-ICD Chicago_3h_5yr
Maximum Flow (L/s)	21.29	13.25	15.69
Minimum Flow (L/s)	0	0	0
Mean Flow (L/s)	9.772	3.835	5.374
Total Flow (l)	210500	82600	115800

Figure 7: LINK 212-ICD



Objective Fns	215-ICD Chicago_3h_100yr	215-ICD Chicago_3h_2yr	215-ICD Chicago_3h_5yr
Maximum Flow (L/s)	24.03	14.41	17.27
Minimum Flow (L/s)	0	0	0
Mean Flow (L/s)	13.1	4.761	6.948
Total Flow (l)	282100	102500	149700

Figure 8: LINK 215-ICD

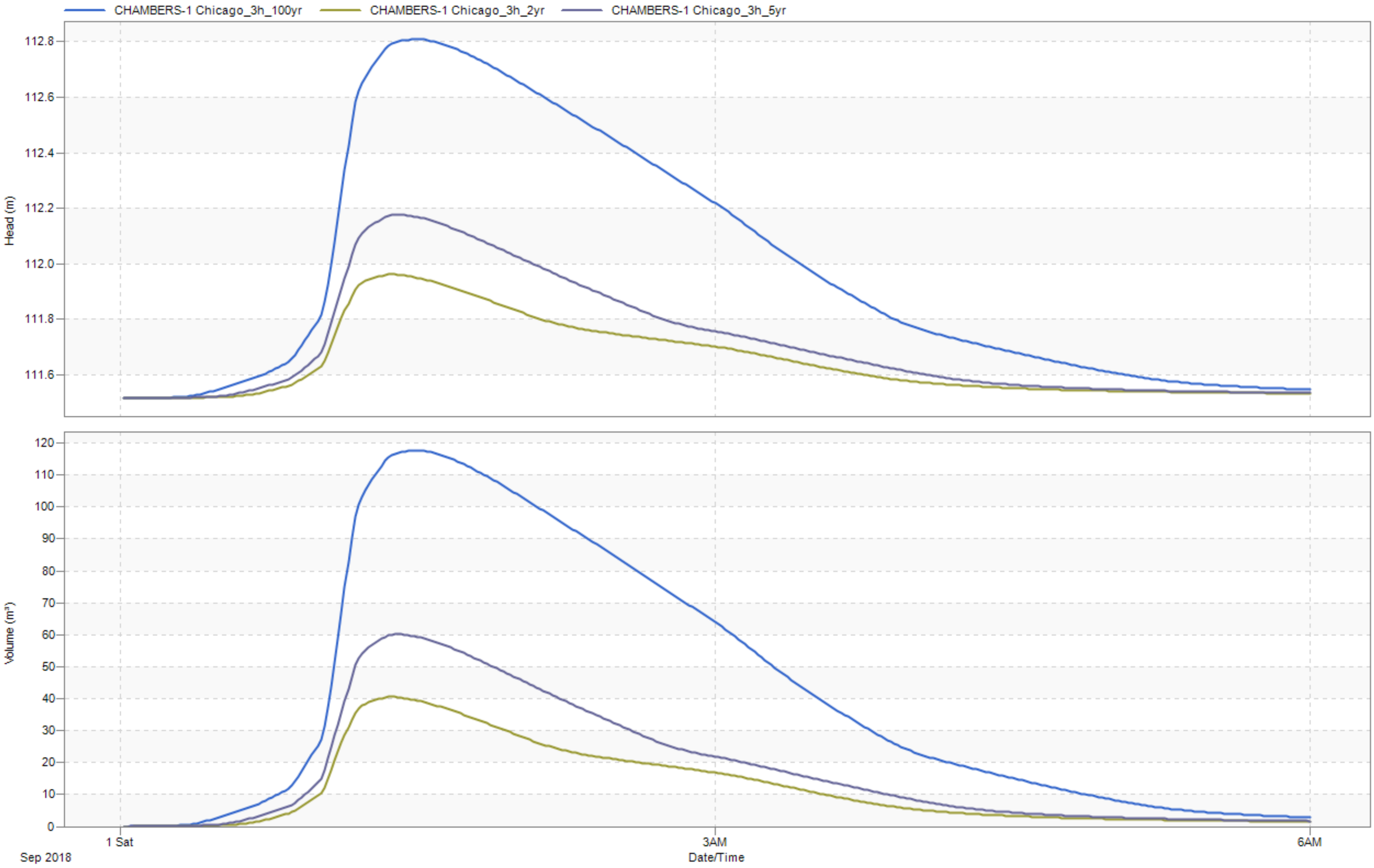


Figure 9: CHAMBERS 1

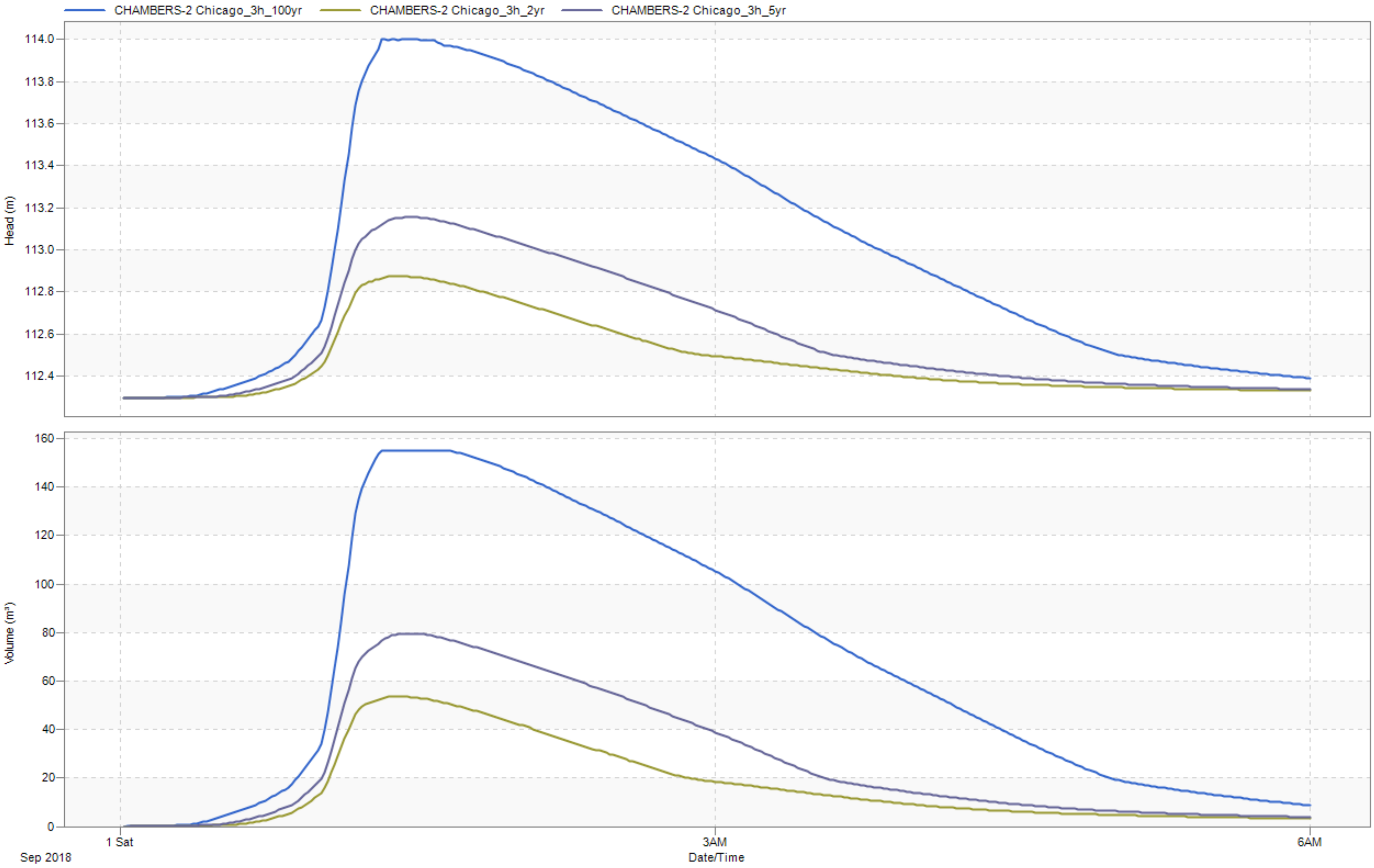
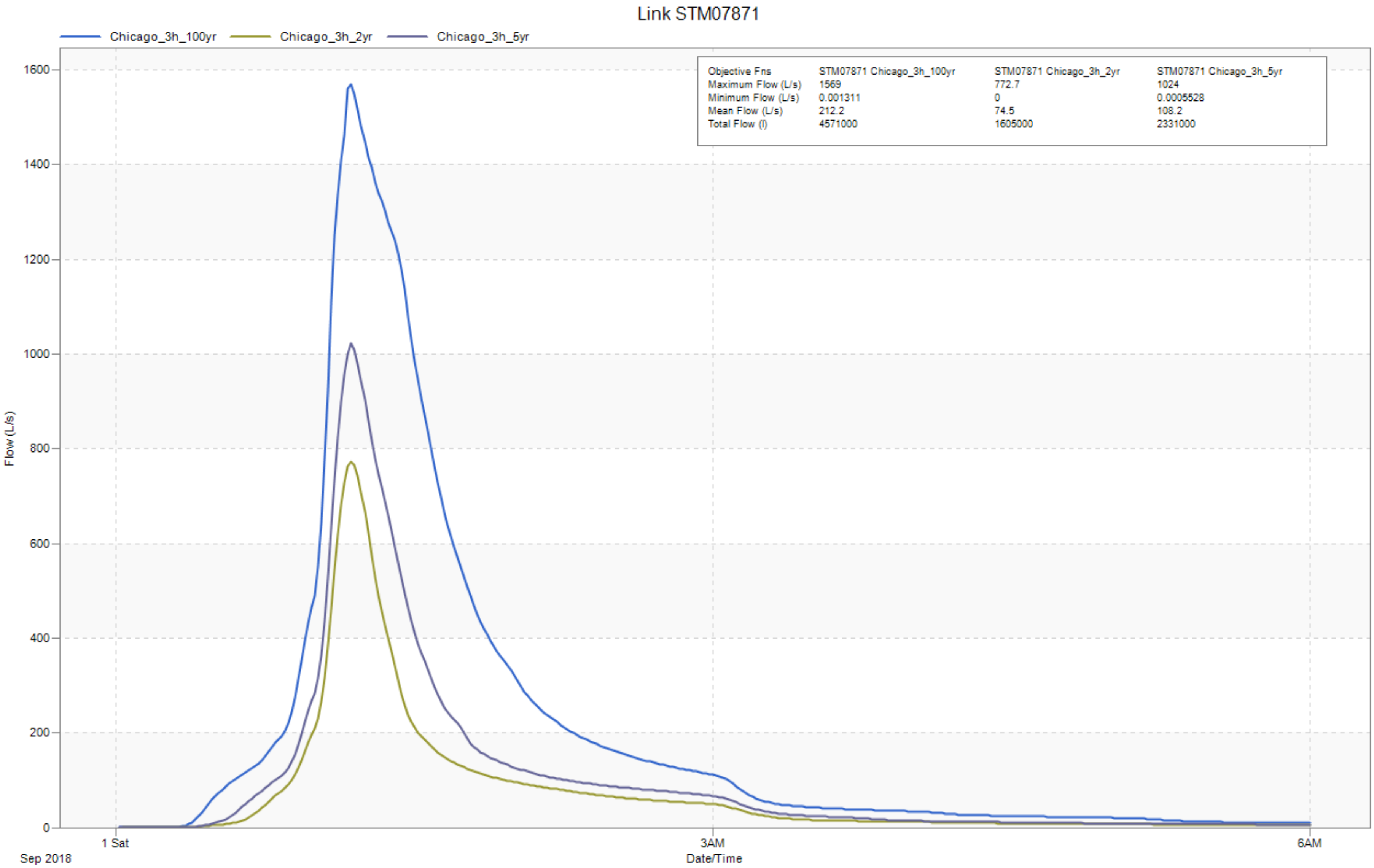


Figure 10: CHAMBERS 2



Objective Fns	STM07871 Chicago_3h_100yr	STM07871 Chicago_3h_2yr	STM07871 Chicago_3h_5yr
Maximum Flow (L/s)	1569	772.7	1024
Minimum Flow (L/s)	0.001311	0	0.0005528
Mean Flow (L/s)	212.2	74.5	108.2
Total Flow (l)	4571000	1605000	2331000

Figure 11: STM07871 - MAIN OUTLET

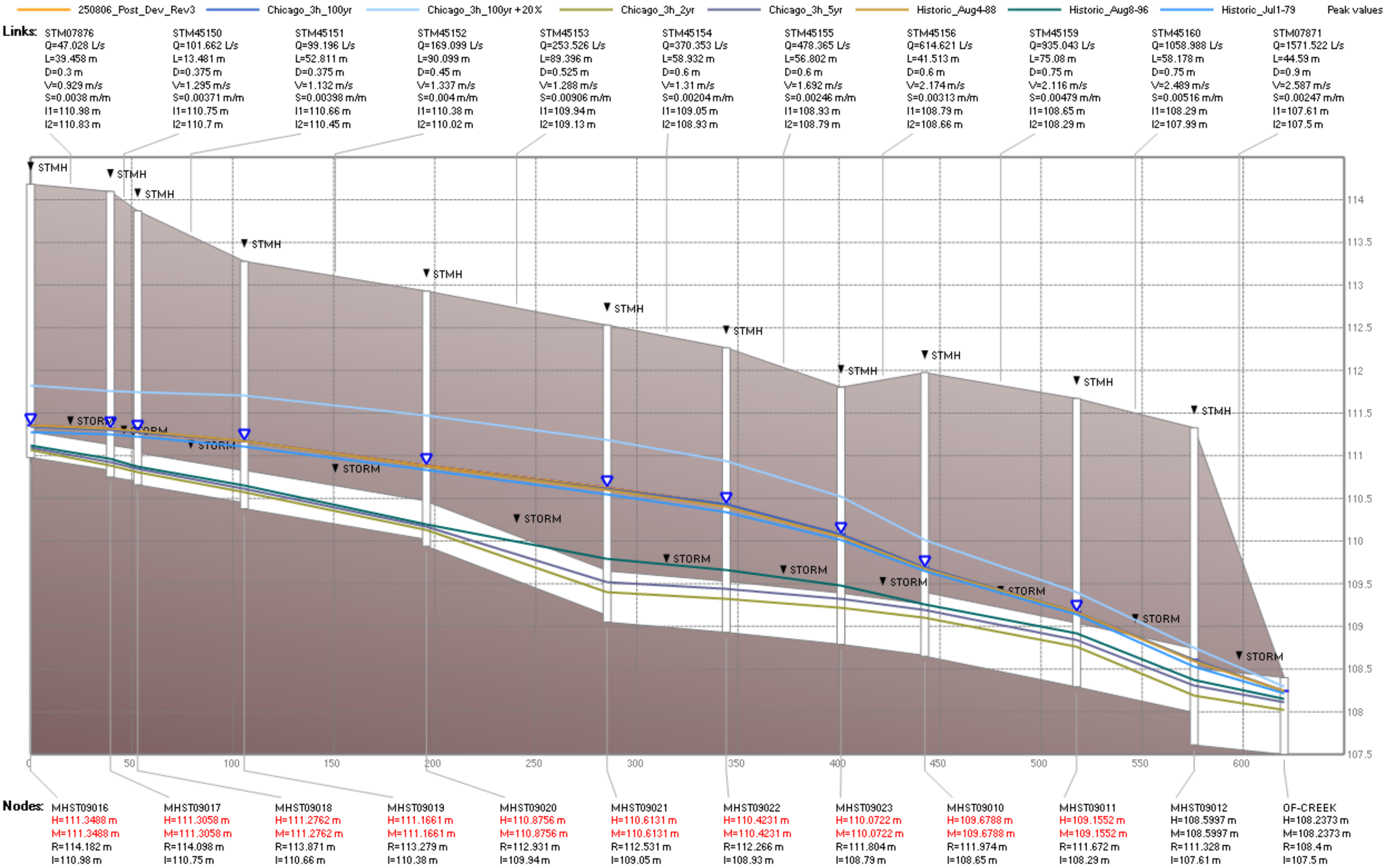


Figure 12: Node MHST09016 to Node OF-CREEK (Denham Way)

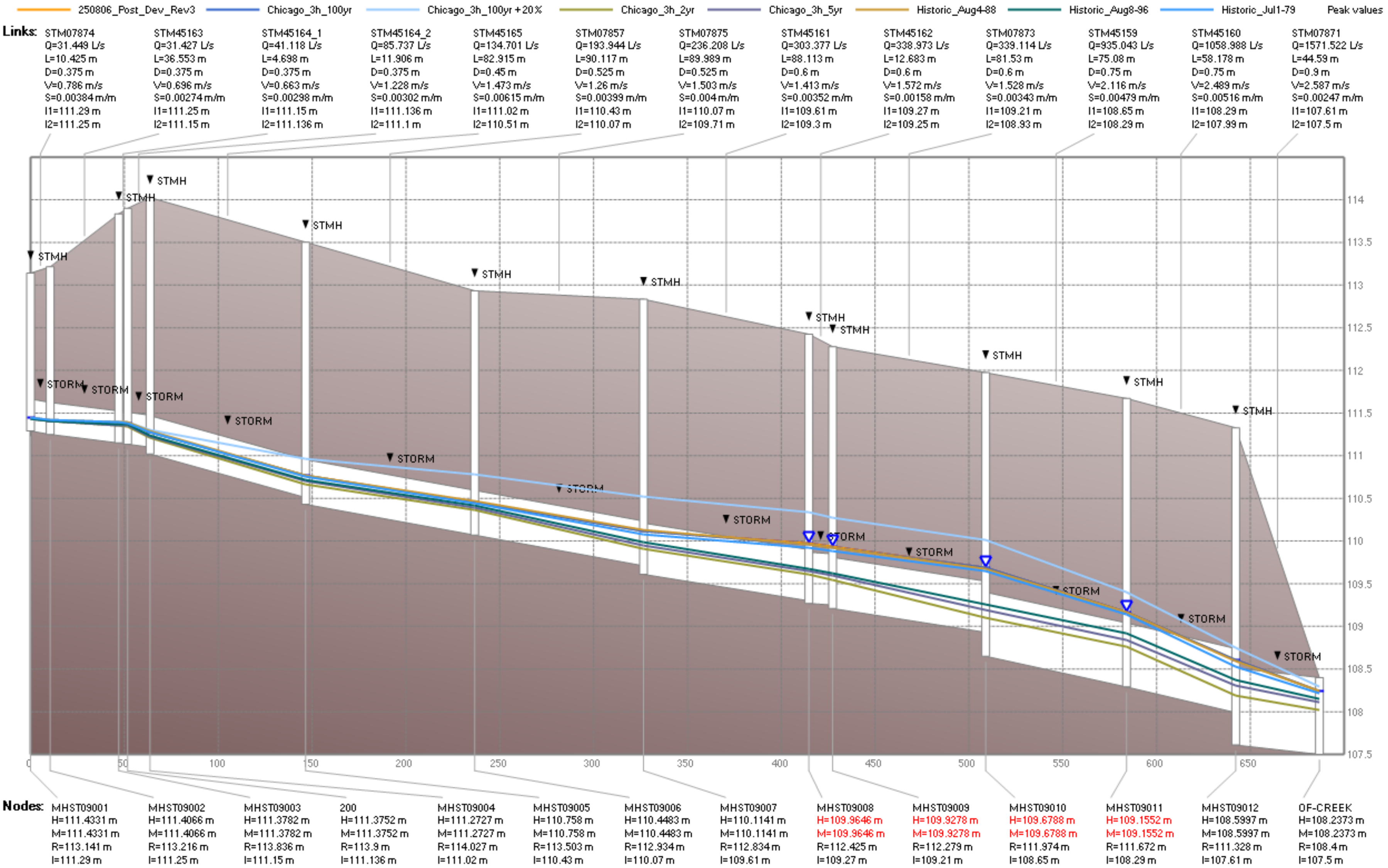


Figure 13: Node MHST09001 to Node OF-CREEK (Victor St)

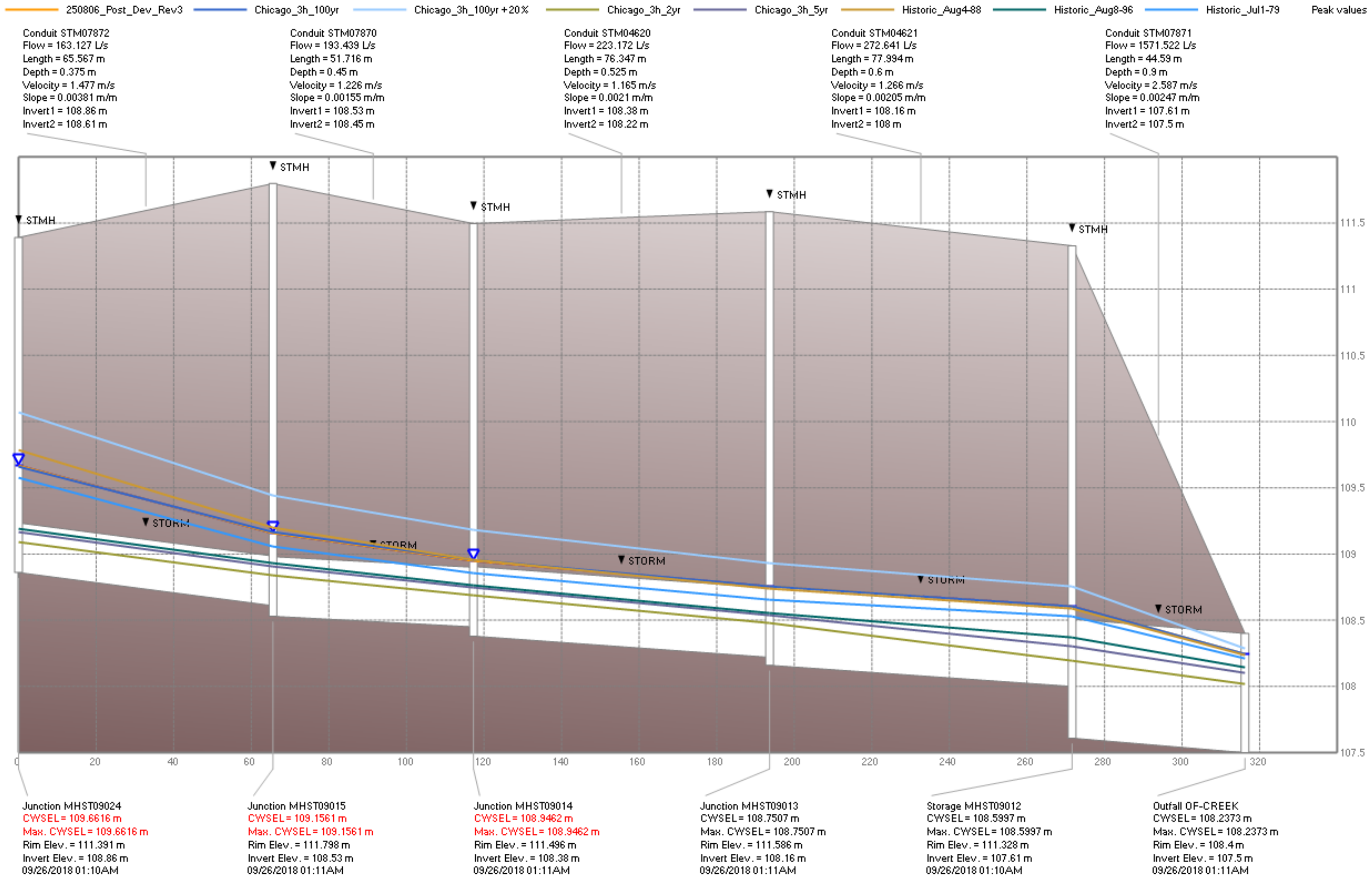


Figure 14: Node MHST09024 to Node OF-CREEK (Savage Dr)

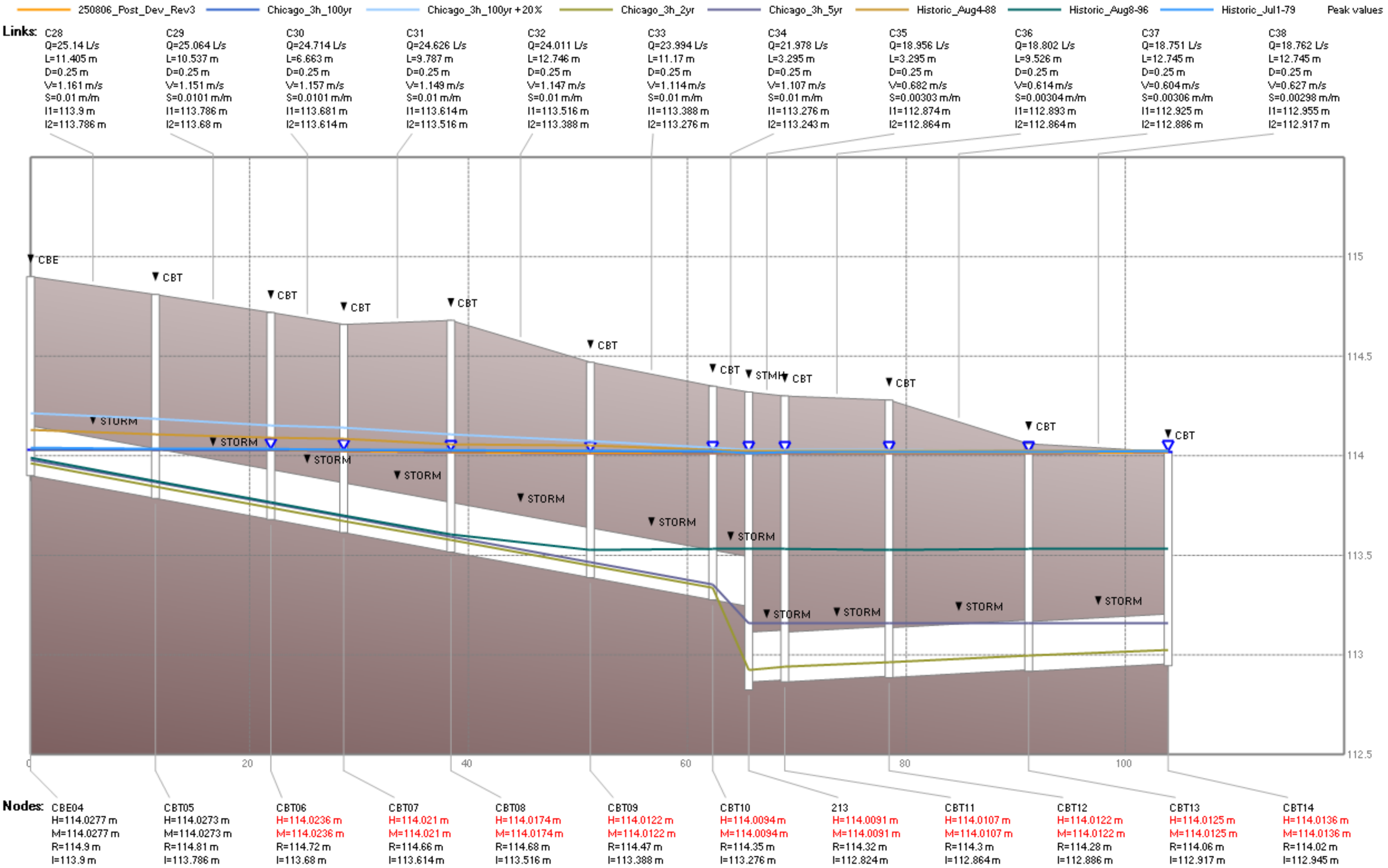


Figure 15: Node CBE04 to Node CBE15 (Perforated Pipes Along Hazeldean)

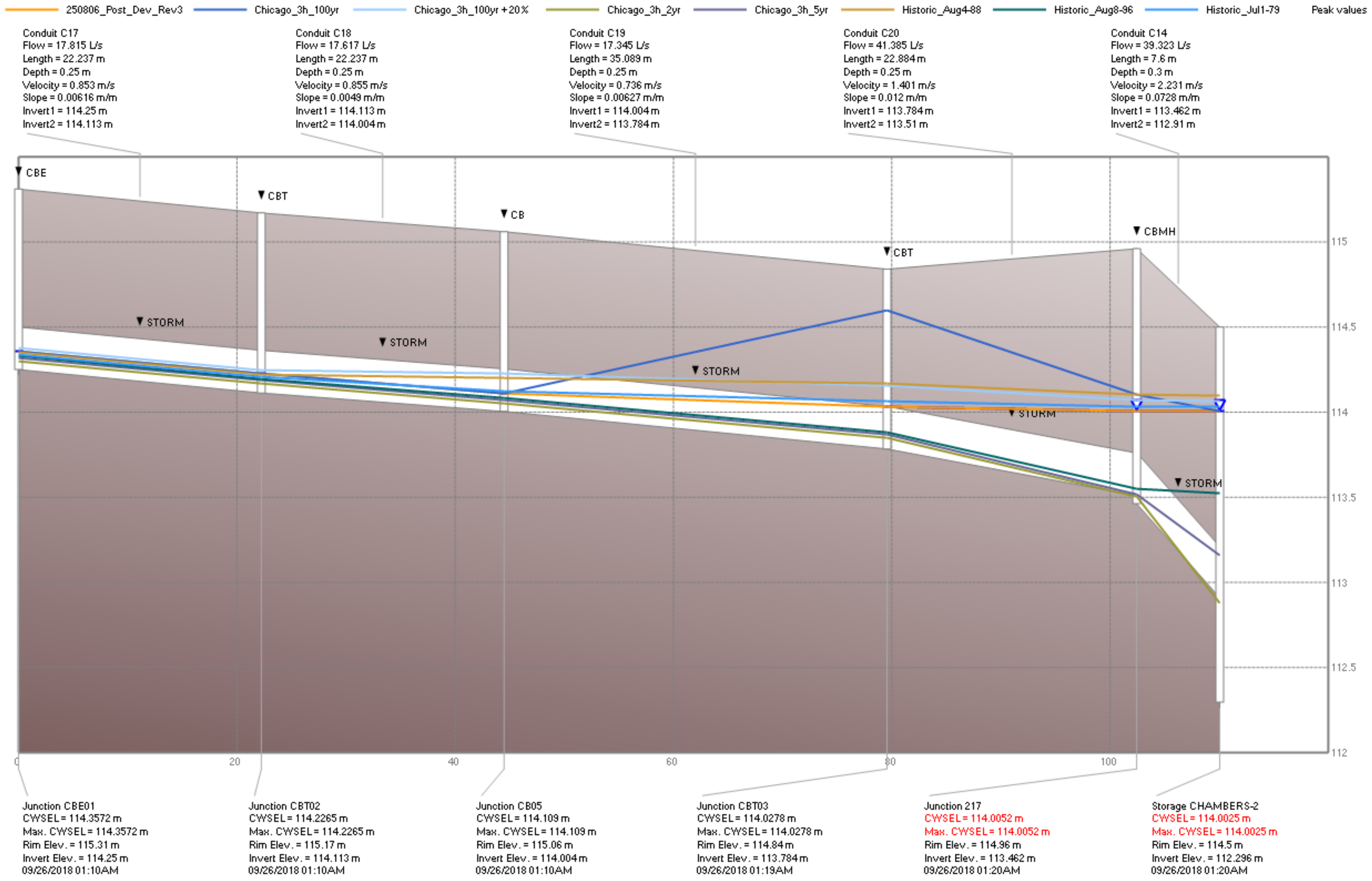
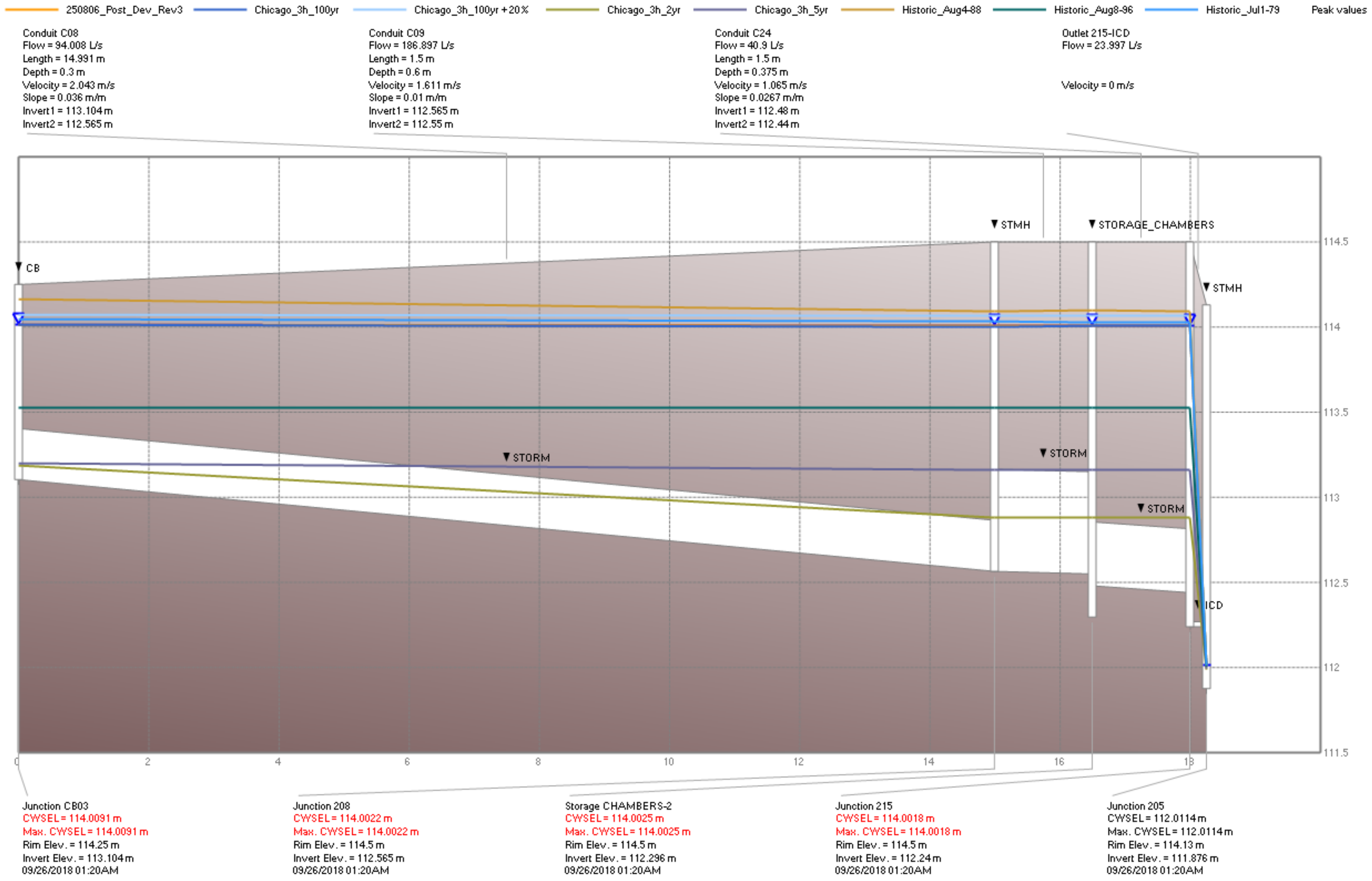


Figure 16: Node CBE01 to Node CHAMBERS-2 (Rear Perf Pipes)



Conduit C08
Flow = 94.008 L/s
Length = 14.991 m
Depth = 0.3 m
Velocity = 2.043 m/s
Slope = 0.036 m/m
Invert1 = 113.104 m
Invert2 = 112.565 m

Conduit C09
Flow = 186.897 L/s
Length = 1.5 m
Depth = 0.6 m
Velocity = 1.611 m/s
Slope = 0.01 m/m
Invert1 = 112.565 m
Invert2 = 112.55 m

Conduit C24
Flow = 40.9 L/s
Length = 1.5 m
Depth = 0.375 m
Velocity = 1.065 m/s
Slope = 0.0267 m/m
Invert1 = 112.48 m
Invert2 = 112.44 m

Outlet 215-ICD
Flow = 23.997 L/s

Velocity = 0 m/s

Junction CB03
CWSEL = 114.0091 m
Max. CWSEL = 114.0091 m
Rim Elev. = 114.25 m
Invert Elev. = 113.104 m
09/26/2018 01:20AM

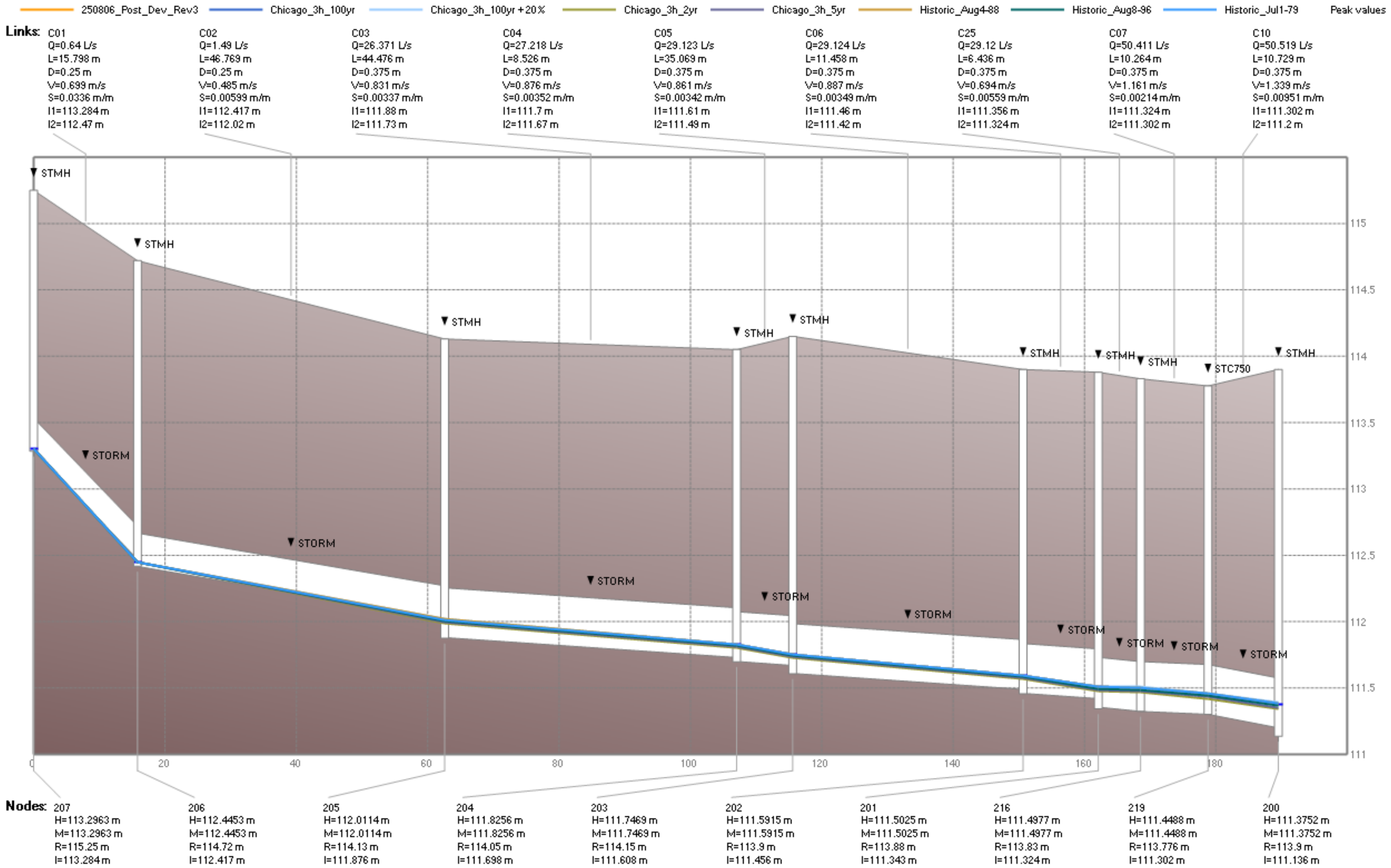
Junction 208
CWSEL = 114.0022 m
Max. CWSEL = 114.0022 m
Rim Elev. = 114.5 m
Invert Elev. = 112.565 m
09/26/2018 01:20AM

Storage CHAMBERS-2
CWSEL = 114.0025 m
Max. CWSEL = 114.0025 m
Rim Elev. = 114.5 m
Invert Elev. = 112.296 m
09/26/2018 01:20AM

Junction 215
CWSEL = 114.0018 m
Max. CWSEL = 114.0018 m
Rim Elev. = 114.5 m
Invert Elev. = 112.24 m
09/26/2018 01:20AM

Junction 205
CWSEL = 112.0114 m
Max. CWSEL = 112.0114 m
Rim Elev. = 114.13 m
Invert Elev. = 111.876 m
09/26/2018 01:20AM

Figure 17: Node CB03 to Node 205 (Through West Chambers 1)



Links:	C01	C02	C03	C04	C05	C06	C25	C07	C10
	Q=0.64 L/s	Q=1.49 L/s	Q=26.371 L/s	Q=27.218 L/s	Q=29.123 L/s	Q=29.124 L/s	Q=29.12 L/s	Q=50.411 L/s	Q=50.519 L/s
	L=15.798 m	L=46.769 m	L=44.476 m	L=8.526 m	L=35.069 m	L=11.458 m	L=6.436 m	L=10.264 m	L=10.729 m
	D=0.25 m	D=0.25 m	D=0.375 m	D=0.375 m	D=0.375 m	D=0.375 m	D=0.375 m	D=0.375 m	D=0.375 m
	V=0.699 m/s	V=0.485 m/s	V=0.831 m/s	V=0.876 m/s	V=0.861 m/s	V=0.887 m/s	V=0.694 m/s	V=1.161 m/s	V=1.339 m/s
	S=0.0336 m/m	S=0.00599 m/m	S=0.00337 m/m	S=0.00352 m/m	S=0.00342 m/m	S=0.00349 m/m	S=0.00559 m/m	S=0.00214 m/m	S=0.00951 m/m
	I1=113.284 m	I1=112.417 m	I1=111.88 m	I1=111.7 m	I1=111.61 m	I1=111.46 m	I1=111.356 m	I1=111.324 m	I1=111.302 m
	I2=112.47 m	I2=112.02 m	I2=111.73 m	I2=111.67 m	I2=111.49 m	I2=111.42 m	I2=111.324 m	I2=111.302 m	I2=111.2 m

Nodes:	207	206	205	204	203	202	201	216	219	200
	H=113.2963 m	H=112.4453 m	H=112.0114 m	H=111.8256 m	H=111.7469 m	H=111.5915 m	H=111.5025 m	H=111.4977 m	H=111.4488 m	H=111.3752 m
	M=113.2963 m	M=112.4453 m	M=112.0114 m	M=111.8256 m	M=111.7469 m	M=111.5915 m	M=111.5025 m	M=111.4977 m	M=111.4488 m	M=111.3752 m
	R=115.25 m	R=114.72 m	R=114.13 m	R=114.05 m	R=114.15 m	R=113.9 m	R=113.88 m	R=113.83 m	R=113.776 m	R=113.9 m
	I=113.284 m	I=112.417 m	I=111.876 m	I=111.698 m	I=111.608 m	I=111.456 m	I=111.343 m	I=111.324 m	I=111.302 m	I=111.136 m

Figure 18: Node 207 to Node 200 (Onsite Storm)

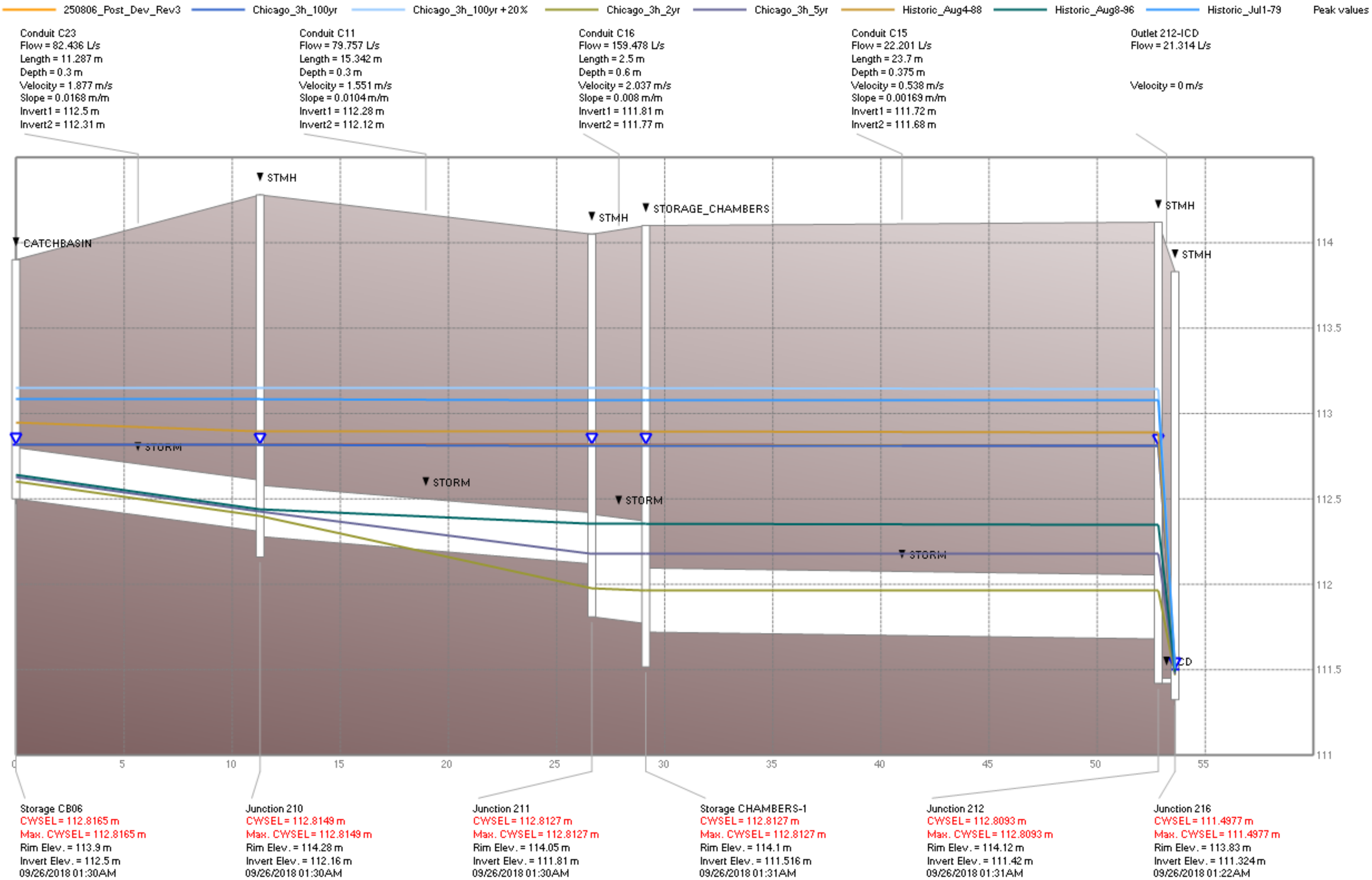


Figure 19: Node CB06 to Node 216 (Through East Chambers 1)

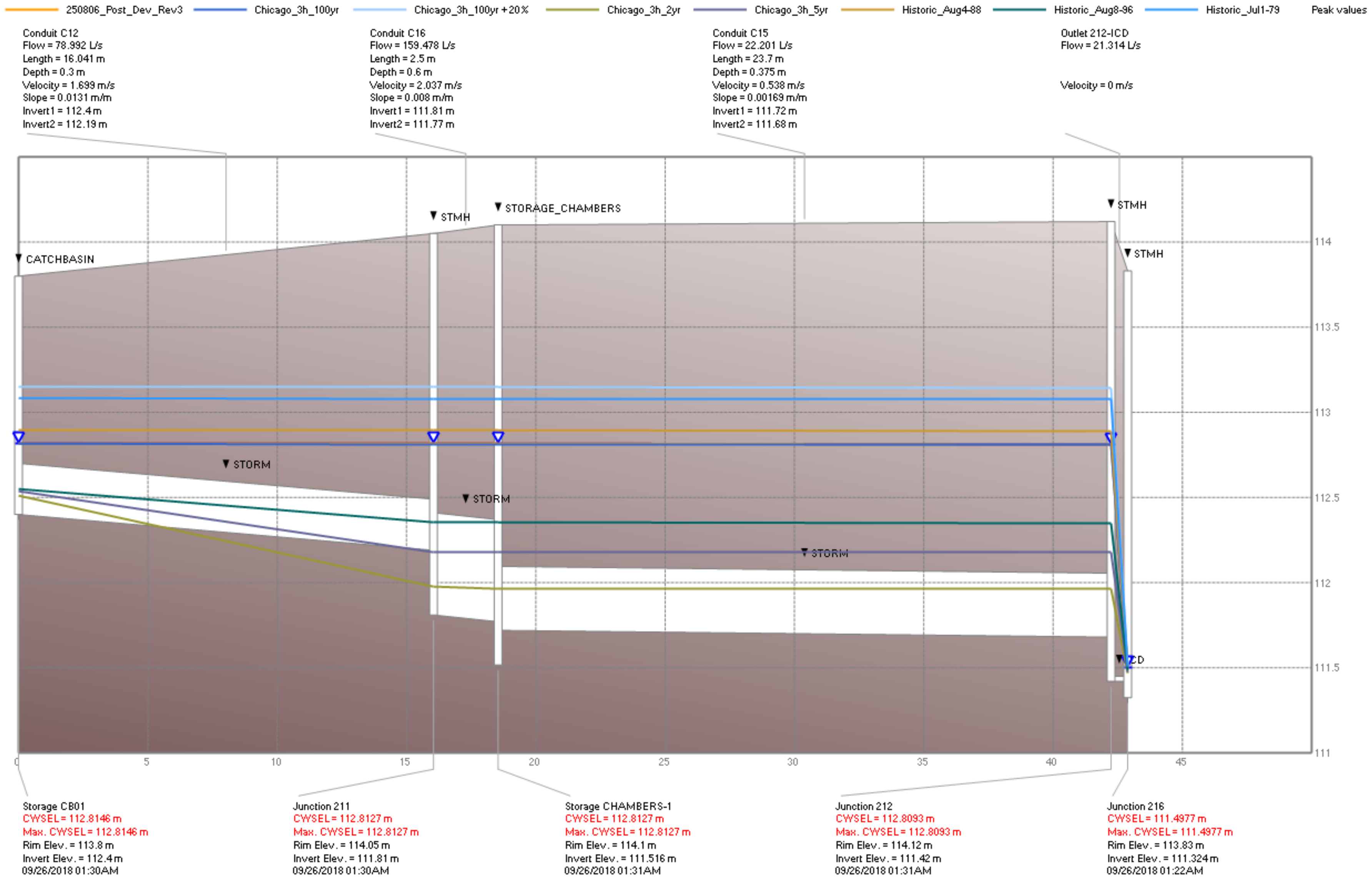


Figure 20: Node CB01 to Node 216 (Through East Chambers 2)

Table 1: OUTFALL - SUMMARY

Name	Inflows	Invert Elev. (m)	Rim Elev. (m)	Type	Max. Total Inflow (L/s)	Total inflow (ML)	Contributing Area (ha)	Contributing Imp. Area (ha)	Max. Unit Flow (L/s/ha)
OF-CREEK	NO	107.5	107.5	FREE	1577.82	4.58	12.044	5.025	131.008
OF-HAZELDEAN	NO	112.83	113.13	FREE	148.26	0.101	0.454	0.299	326.708

Table 2: JUNCTIONS - SUMMARY

Name	Tag	Invert Elev. (m)	Rim Elev. (m)	Max. HGL (m)
200	STMH	111.136	113.9	111.38
201	STMH	111.343	113.88	111.5
202	STMH	111.456	113.9	111.59
203	STMH	111.608	114.15	111.75
204	STMH	111.698	114.05	111.83
205	STMH	111.876	114.13	112.01
206	STMH	112.417	114.72	112.45
207	STMH	113.284	115.25	113.3
208	STMH	112.565	114.5	114.08
210	STMH	112.16	114.28	112.81
211	STMH	111.81	114.05	112.81
212	STMH	111.42	114.12	112.81
213	STMH	112.824	114.32	114.02
215	STMH	112.24	114.5	114.08
216	STMH	111.324	113.83	111.5
217	CBMH	113.462	114.96	114.14
218	CBMH	112.736	114	114
219	STC750	111.302	113.776	111.45
CB03	CB	113.104	114.25	114.09
CB05	CB	114.004	115.06	114.11
CBE01	CBE	114.25	115.31	114.36
CBE04	CBE	113.9	114.9	114.03
CBT02	CBT	114.113	115.17	114.23
CBT03	CBT	113.784	114.84	114.57
CBT05	CBT	113.786	114.81	114.03
CBT06	CBT	113.68	114.72	114.11
CBT07	CBT	113.614	114.66	114.08
CBT08	CBT	113.516	114.68	114.05
CBT09	CBT	113.388	114.47	114.03

Table 2: JUNCTIONS - SUMMARY (continued...)

Name	Tag	Invert Elev. (m)	Rim Elev. (m)	Max. HGL (m)
CBT10	CBT	113.276	114.35	114.02
CBT11	CBT	112.864	114.3	114.02
CBT12	CBT	112.886	114.28	114.02
CBT13	CBT	112.917	114.06	114.06
CBT14	CBT	112.945	114.02	114.02
IN07998	RYCB	110.43	111.832	111.71
IN09003-MAJ	MAJOR	113.93	114.08	113.96
IN09004-MAJ	MAJOR	113.83	113.98	113.87
IN09005-MAJ	MAJOR	113.22	113.37	113.31
IN09006-MAJ	MAJOR	113.22	113.37	113.31
IN09009-MAJ	MAJOR	112.75	112.9	112.85
IN09010-MAJ	MAJOR	112.75	112.9	112.82
IN09011-MAJ	MAJOR	112.21	112.36	112.32
IN09012-MAJ	MAJOR	112.21	112.36	112.31
IN09013-MAJ	MAJOR	111.78	111.93	111.89
IN09014-MAJ	MAJOR	111.41	111.56	111.48
IN09015-MAJ	MAJOR	111.41	111.56	111.52
IN09017-MAJ	MAJOR	111.56	111.71	111.6
IN09018-MAJ	MAJOR	111.56	111.71	111.6
IN09019-MAJ	MAJOR	111.33	111.48	111.41
IN09020-MAJ	MAJOR	111.33	111.48	111.39
IN09021-MAJ	MAJOR	111	111.15	111.2
IN09022-MAJ	MAJOR	113.94	114.09	113.99
IN09023-MAJ	MAJOR	113.75	113.9	113.79
IN09024-MAJ	MAJOR	113.15	113.3	113.22
IN09025-MAJ	MAJOR	113.13	113.28	113.21
IN09026-MAJ	MAJOR	112.66	112.81	112.75
IN09027-MAJ	MAJOR	112.68	112.83	112.77
IN09028-MAJ	MAJOR	112.36	112.51	112.43
IN09029-MAJ	MAJOR	112.37	112.52	112.46
IN09030-MAJ	MAJOR	111.97	112.12	112.04
IN09031-MAJ	MAJOR	111.97	112.12	112.04
IN09032-MAJ	MAJOR	111.62	111.77	111.82
IN09033-MAJ	MAJOR	111.62	111.77	111.73
IN09034-MAJ	MAJOR	111.27	111.42	111.41
IN09035-MAJ	MAJOR	111.27	111.42	111.4
IN45566	RYCB	109.82	111.215	111.09

Table 2: JUNCTIONS - SUMMARY (continued...)

Name	Tag	Invert Elev. (m)	Rim Elev. (m)	Max. HGL (m)
IN45569	RYCB	111.61	113.007	113.01
IN45570	RYCB	111.7	113.104	113.1
IN45572	RYCB	111.51	112.912	112.91
IN45573	RYCB	112.76	114.156	114.16
IN45574	RYCB	111.3	111.6	111.6
IN45575	RYCB	112.17	113.572	113.57
IN45577	RYCB	111.28	112.682	112.68
IN45587	RYCB	112.44	113.845	113.36
IN45588	RYCB	112.52	113.922	112.66
IN45589	RYCB	111.85	113.246	112.02
IN45590	RYCB	111.58	112.982	111.71
J1	MAJOR	111.77	111.92	111.82
J2	MAJOR	111.2	111.35	111.4
MHST09001	STMH	111.29	113.141	111.43
MHST09002	STMH	111.25	113.216	111.41
MHST09003	STMH	111.15	113.836	111.38
MHST09004	STMH	111.02	114.027	111.27
MHST09005	STMH	110.43	113.503	110.76
MHST09006	STMH	110.07	112.934	110.45
MHST09007	STMH	109.61	112.834	110.11
MHST09008	STMH	109.27	112.425	110.28
MHST09009	STMH	109.21	112.279	110.22
MHST09010	STMH	108.65	111.974	109.83
MHST09011	STMH	108.29	111.672	109.16
MHST09013	STMH	108.16	111.586	108.75
MHST09014	STMH	108.38	111.496	109.09
MHST09015	STMH	108.53	111.798	109.26
MHST09016	STMH	110.98	114.182	111.35
MHST09017	STMH	110.75	114.098	111.37
MHST09018	STMH	110.66	113.871	111.31
MHST09019	STMH	110.38	113.279	111.17
MHST09020	STMH	109.94	112.931	110.88
MHST09021	STMH	109.05	112.531	110.61
MHST09022	STMH	108.93	112.266	110.42
MHST09023	STMH	108.79	111.804	110.18
MHST09024	STMH	108.86	111.391	109.68

Table 3: STORAGES - SUMMARY

Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Storage Curve	Curve Name	Max. Depth (m)	Max. HGL (m)	Max. Total Inflow (L/s)	Max. Outflow (L/s)	CONDITON
CB01	112.4	113.8	1.4	TABULAR	CB01-STOR	0.41	112.81	79.88	80.43	PONDING
CB06	112.5	113.9	1.4	TABULAR	CB06-STOR	0.32	112.82	82.83	84.12	PONDING
CHAMBERS-1	111.516	114.1	2.584	TABULAR	STORAGE-1	1.3	112.81	159.67	27.48	UG STORAGE
CHAMBERS-2	112.296	114.5	2.204	TABULAR	STORAGE-2	1.78	114.08	227.73	93.81	UG STORAGE
IN09003	112.53	113.93	1.4	FUNCTIONAL	*	0.35	112.88	10.92	10.52	FLOW-BY
IN09004	112.43	113.98	1.55	TABULAR	IN09004-STOR	0.54	112.97	13.22	12.96	PONDING
IN09005	111.82	113.22	1.4	FUNCTIONAL	*	1.4	113.22	49.44	21.4	FLOW-BY
IN09006	111.82	113.22	1.4	FUNCTIONAL	*	1.4	113.22	50.88	21.4	FLOW-BY
IN09007	111.58	113.13	1.55	TABULAR	IN09007-STOR	1.55	113.13	106.09	22.51	PONDING
IN09008	111.58	113.13	1.55	TABULAR	IN09008-STOR	1.51	113.09	151.31	138.69	PONDING
IN09009	111.35	112.75	1.4	FUNCTIONAL	*	1.4	112.75	54.7	21.4	FLOW-BY
IN09010	111.35	112.75	1.4	FUNCTIONAL	IN09007-STOR	0.04	111.39	24.64	1.6	FLOW-BY
IN09011	110.81	112.21	1.4	FUNCTIONAL	*	1.4	112.21	55	20.92	FLOW-BY
IN09012	110.81	112.21	1.4	FUNCTIONAL	*	1.4	112.21	54.05	21.4	FLOW-BY
IN09013	110.38	111.78	1.4	FUNCTIONAL	*	1.4	111.78	55	21.4	FLOW-BY
IN09014	110.01	111.41	1.4	FUNCTIONAL	*	1.4	111.41	29.08	21.4	FLOW-BY
IN09015	110.01	111.41	1.4	FUNCTIONAL	*	1.4	111.41	55	21.4	FLOW-BY
IN09016	109.85	111.4	1.55	TABULAR	IN09016-STOR	1.55	111.4	154.75	22.51	PONDING
IN09017	110.16	111.56	1.4	FUNCTIONAL	*	0.5	110.66	12.84	12.7	FLOW-BY
IN09018	110.16	111.56	1.4	FUNCTIONAL	*	0.49	110.65	12.72	12.58	FLOW-BY
IN09019	109.93	111.33	1.4	FUNCTIONAL		1.4	111.33	40.81	21.4	FLOW-BY
IN09020	109.93	111.33	1.4	FUNCTIONAL		0.9	110.83	18.91	17.14	FLOW-BY
IN09021	109.6	111	1.4	FUNCTIONAL		1.4	111	55	30.37	FLOW-BY
IN09022	112.54	113.94	1.4	FUNCTIONAL	*	0.61	113.15	14.32	14.1	FLOW-BY
IN09023	112.35	113.75	1.4	FUNCTIONAL	*	0.48	112.83	12.72	12.46	FLOW-BY
IN09024	111.75	113.15	1.4	FUNCTIONAL	*	1.4	113.15	26.78	21.4	FLOW-BY
IN09025	111.73	113.13	1.4	FUNCTIONAL	*	1.4	113.13	32.56	21.4	FLOW-BY
IN09026	111.26	112.66	1.4	FUNCTIONAL	*	1.4	112.66	49.26	21.4	FLOW-BY
IN09027	111.28	112.68	1.4	FUNCTIONAL	*	1.4	112.68	48.3	21.4	FLOW-BY
IN09028	110.96	112.36	1.4	FUNCTIONAL	*	1.4	112.36	30.8	21.4	FLOW-BY
IN09029	110.97	112.37	1.4	FUNCTIONAL	*	1.4	112.37	52.03	21.4	FLOW-BY
IN09030	110.57	111.97	1.4	FUNCTIONAL	*	1.4	111.97	30.79	21.4	FLOW-BY
IN09031	110.57	111.97	1.4	FUNCTIONAL	*	1.21	111.78	21.63	19.88	FLOW-BY
IN09032	110.22	111.62	1.4	FUNCTIONAL	*	1.4	111.62	55	21.4	FLOW-BY
IN09033	110.22	111.62	1.4	FUNCTIONAL	*	1.4	111.62	55	21.4	FLOW-BY
IN09034	109.87	111.27	1.4	FUNCTIONAL		1.4	111.27	55	30.37	FLOW-BY
IN09035	109.87	111.27	1.4	FUNCTIONAL		1.4	111.27	55	30.37	FLOW-BY

Table 3: STORAGES - SUMMARY (continued...)

Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Storage Curve	Curve Name	Max. Depth (m)	Max. HGL (m)	Max. Total Inflow (L/s)	Max. Outflow (L/s)	CONDITON
IN103407	111.64	113.25	1.61	TABULAR	IN103407-STOR	1.51	113.15	183.35	179.74	PONDING
MHST09012	107.61	111.128	3.518	FUNCTIONAL	*	0.99	108.6	1575.67	1577.82	PONDING

Table 4A: CONDUITS - SUMMARY

Name	Inlet Node	Outlet Node	Tag	Length (m)	Roughness	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section
C01	207	206	STORM	15.798	0.013	113	112.47	CIRCULAR
C02	206	205	STORM	46.769	0.013	112.3	112.02	CIRCULAR
C03	205	204	STORM	44.476	0.013	111.88	111.73	CIRCULAR
C04	204	203	STORM	8.526	0.013	111.7	111.67	CIRCULAR
C05	203	202	STORM	35.069	0.013	111.61	111.49	CIRCULAR
C06	202	201	STORM	11.458	0.013	111.46	111.42	CIRCULAR
C07	216	219	STORM	10.264	0.013	111.324	111.302	CIRCULAR
C08	CB03	208	STORM	14.991	0.01	113.104	112.565	CIRCULAR
C09	208	CHAMBERS-2	STORM	1.5	0.013	112.565	112.55	CIRCULAR
C1	IN45587	MHST09004	RYCB_LEAD	40	0.013	112.44	112.04	CIRCULAR
C10	219	200	STORM	10.729	0.013	111.302	111.2	CIRCULAR
C11	210	211	STORM	15.342	0.013	112.28	112.12	CIRCULAR
C12	CB01	211	STORM	16.041	0.013	112.4	112.19	CIRCULAR
C13	IN07998	MHST09011	RYCB_LEAD	10	0.013	110.43	110.33	CIRCULAR
C14	217	CHAMBERS-2	STORM	7.6	0.013	113.462	112.91	CIRCULAR
C15	CHAMBERS-1	212	STORM	23.7	0.013	111.72	111.68	CIRCULAR
C16	211	CHAMBERS-1	STORM	2.5	0.013	111.79	111.77	CIRCULAR
C17	CBE01	CBT02	STORM	22.237	0.013	114.25	114.113	CIRCULAR
C18	CBT02	CB05	STORM	22.237	0.013	114.113	114.004	CIRCULAR
C19	CB05	CBT03	STORM	35.089	0.013	114.004	113.784	CIRCULAR
C2	IN45588	MHST09005	RYCB_LEAD	116.338	0.013	112.52	112.02	CIRCULAR
C20	CBT03	217	STORM	22.884	0.013	113.784	113.51	CIRCULAR
C21	218	208	STORM	15.162	0.013	112.736	112.595	CIRCULAR
C22	IN45573	MHST09016	RYCB_LEAD	40	0.013	112.76	112.26	CIRCULAR
C23	CB06	210	STORM	11.287	0.013	112.5	112.31	CIRCULAR
C24	CHAMBERS-2	215	STORM	1.5	0.013	112.48	112.44	CIRCULAR
C25	201	216	STORM	6.436	0.013	111.356	111.32	CIRCULAR
C26	IN45574	MHST09017	RYCB_LEAD	40	0.013	111.3	111	CIRCULAR
C27	IN45566	MHST09024	RYCB_LEAD	10	0.013	109.82	109.72	CIRCULAR

Table 4A: CONDUITS - SUMMARY (continued...)

Name	Inlet Node	Outlet Node	Tag	Length (m)	Roughness	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section
C28	CBE04	CBT05	STORM	11.405	0.013	113.9	113.786	CIRCULAR
C29	CBT05	CBT06	STORM	10.537	0.013	113.786	113.68	CIRCULAR
C3	IN45589	MHST09007	RYCB_LEAD	40	0.013	111.85	111.45	CIRCULAR
C30	CBT06	CBT07	STORM	6.663	0.013	113.681	113.614	CIRCULAR
C31	CBT07	CBT08	STORM	9.787	0.013	113.614	113.516	CIRCULAR
C32	CBT08	CBT09	STORM	12.746	0.013	113.516	113.388	CIRCULAR
C33	CBT09	CBT10	STORM	11.17	0.013	113.388	113.276	CIRCULAR
C34	CBT10	213	STORM	3.295	0.013	113.276	113.243	CIRCULAR
C35	CBT11	213	STORM	3.295	0.013	112.874	112.864	CIRCULAR
C36	CBT12	CBT11	STORM	9.526	0.013	112.893	112.864	CIRCULAR
C37	CBT13	CBT12	STORM	12.745	0.013	112.925	112.886	CIRCULAR
C38	CBT14	CBT13	STORM	12.745	0.013	112.955	112.917	CIRCULAR
C39	IN103407	OF-HAZELDEAN	MAJOR	40.346	0.013	113.04	112.83	TRAPEZOIDAL
C4	IN45590	MHST09007	RYCB_LEAD	40	0.013	111.58	111.08	CIRCULAR
C40	213	218	STORM	29.265	0.013	112.824	112.736	CIRCULAR
C5	IN45575	MHST09019	RYCB_LEAD	40	0.013	112.17	111.77	CIRCULAR
C6	IN45570	MHST09020	RYCB_LEAD	40	0.013	111.7	111.3	CIRCULAR
C7	IN45569	MHST09021	RYCB_LEAD	40	0.013	111.61	111.41	CIRCULAR
C8	IN45572	MHST09021	RYCB_LEAD	40	0.013	111.51	111.11	CIRCULAR
C9	IN45577	MHST09022	RYCB_LEAD	40	0.013	111.28	110.88	CIRCULAR
C98	CHAMBERS-1	212	SUBDRAIN	26.513	0.013	111.516	111.42	CIRCULAR
C99	CHAMBERS-2	215	SUBDRAIN	28.637	0.013	112.296	112.27	CIRCULAR
OF1	IN09016	MHST09012	OVERFLOW-ROAD	17.899	0.013	111.4	111.128	IRREGULAR
R01	IN09004-MAJ	IN09006-MAJ	MAJOR	92.678	0.013	113.83	113.22	IRREGULAR
R02	IN09006-MAJ	IN09007	MAJOR	79.588	0.013	113.22	113.13	IRREGULAR
R03	IN09005-MAJ	IN09008	MAJOR	79.205	0.013	113.22	112.98	IRREGULAR
R04	IN09007	IN09010-MAJ	MAJOR	71.554	0.013	113.13	112.75	IRREGULAR
R05	IN09008	IN09009-MAJ	MAJOR	72.205	0.013	112.98	112.75	IRREGULAR
R06	IN09010-MAJ	IN09012-MAJ	MAJOR	101.975	0.013	112.75	112.21	IRREGULAR
R07	IN09009-MAJ	IN09011-MAJ	MAJOR	106.231	0.013	112.75	112.21	IRREGULAR
R08	IN09012-MAJ	J1	MAJOR	98.186	0.013	112.21	111.77	IRREGULAR
R09	IN09033-MAJ	J1	MAJOR	13.729	0.013	111.62	111.77	IRREGULAR
R10	IN09032-MAJ	J1	MAJOR	24.181	0.013	0	111.62	IRREGULAR
R11	IN09011-MAJ	IN09013-MAJ	MAJOR	91.997	0.013	112.21	111.78	IRREGULAR
R12	IN09013-MAJ	IN09015-MAJ	MAJOR	71.755	0.013	111.78	111.41	IRREGULAR
R13	IN09015-MAJ	MHST09012	MAJOR	64.056	0.013	111.41	111.128	IRREGULAR
R14	IN09014-MAJ	IN09016	MAJOR	54.483	0.013	111.41	111.25	IRREGULAR

Table 4A: CONDUITS - SUMMARY (continued...)

Name	Inlet Node	Outlet Node	Tag	Length (m)	Roughness	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section
R15	J1	IN09014-MAJ	MAJOR	59.615	0.013	111.77	111.41	IRREGULAR
R16	IN09035-MAJ	J2	MAJOR	17.745	0.013	0	0	IRREGULAR
R17	IN09034-MAJ	J2	MAJOR	26.122	0.013	0	0	IRREGULAR
R18	IN09021-MAJ	IN09020-MAJ	MAJOR	30.532	0.013	0	0	IRREGULAR
R19	J2	IN09019-MAJ	MAJOR	27.476	0.013	0	0	IRREGULAR
R20	IN09020-MAJ	IN09018-MAJ	MAJOR	80.609	0.013	0	111.56	IRREGULAR
R21	IN09019-MAJ	IN09017-MAJ	MAJOR	81.078	0.013	0	111.56	IRREGULAR
R22	IN09018-MAJ	MHST09012	MAJOR	83.592	0.013	111.56	111.128	IRREGULAR
R23	IN09017-MAJ	IN09016	MAJOR	67.772	0.013	111.56	111.25	IRREGULAR
R24	IN09003-MAJ	IN103407	MAJOR	71.254	0.013	113.93	113.04	IRREGULAR
R25	IN09023-MAJ	IN09024-MAJ	MAJOR	81.428	0.013	113.75	113.15	IRREGULAR
R26	IN09022-MAJ	IN09025-MAJ	MAJOR	86.482	0.013	113.94	113.13	IRREGULAR
R27	IN09025-MAJ	IN09027-MAJ	MAJOR	86.008	0.013	113.13	112.68	IRREGULAR
R28	IN09024-MAJ	IN09026-MAJ	MAJOR	85.805	0.013	113.15	112.66	IRREGULAR
R29	IN09027-MAJ	IN09028-MAJ	MAJOR	61.833	0.013	112.68	112.36	IRREGULAR
R30	IN09026-MAJ	IN09029-MAJ	MAJOR	68.091	0.013	112.66	112.37	IRREGULAR
R31	IN09029-MAJ	IN09030-MAJ	MAJOR	72.254	0.013	112.37	111.97	IRREGULAR
R32	IN09028-MAJ	IN09034-MAJ	MAJOR	88.109	0.013	112.36	111.27	IRREGULAR
R33	IN09030-MAJ	IN09032-MAJ	MAJOR	67.283	0.013	111.97	111.62	IRREGULAR
R34	IN09031-MAJ	IN09033-MAJ	MAJOR	69.891	0.013	111.97	111.62	IRREGULAR
STM04620	MHST09014	MHST09013	STORM	76.347	0.013	108.38	108.22	CIRCULAR
STM04621	MHST09013	MHST09012	STORM	77.994	0.013	108.16	108	CIRCULAR
STM07857	MHST09005	MHST09006	STORM	90.117	0.013	110.43	110.07	CIRCULAR
STM07870	MHST09015	MHST09014	STORM	51.716	0.013	108.53	108.45	CIRCULAR
STM07871	MHST09012	OF-CREEK	STORM	44.59	0.013	107.61	107.5	CIRCULAR
STM07872	MHST09024	MHST09015	STORM	65.567	0.013	108.86	108.61	CIRCULAR
STM07873	MHST09009	MHST09010	STORM	81.53	0.013	109.21	108.93	CIRCULAR
STM07874	MHST09001	MHST09002	STORM	10.425	0.013	111.29	111.25	CIRCULAR
STM07875	MHST09006	MHST09007	STORM	89.989	0.013	110.07	109.71	CIRCULAR
STM07876	MHST09016	MHST09017	STORM	39.458	0.013	110.98	110.83	CIRCULAR
STM45150	MHST09017	MHST09018	STORM	13.481	0.013	110.75	110.7	CIRCULAR
STM45151	MHST09018	MHST09019	STORM	52.811	0.013	110.66	110.45	CIRCULAR
STM45152	MHST09019	MHST09020	STORM	90.099	0.013	110.38	110.02	CIRCULAR
STM45153	MHST09020	MHST09021	STORM	89.396	0.013	109.94	109.13	CIRCULAR
STM45154	MHST09021	MHST09022	STORM	58.932	0.013	109.05	108.93	CIRCULAR
STM45155	MHST09022	MHST09023	STORM	56.802	0.013	108.93	108.79	CIRCULAR
STM45156	MHST09023	MHST09010	STORM	41.513	0.013	108.79	108.66	CIRCULAR

Table 4A: CONDUITS - SUMMARY (continued...)

Name	Inlet Node	Outlet Node	Tag	Length (m)	Roughness	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section
STM45159	MHST09010	MHST09011	STORM	75.08	0.013	108.65	108.29	CIRCULAR
STM45160	MHST09011	MHST09012	STORM	58.178	0.013	108.29	107.99	CIRCULAR
STM45161	MHST09007	MHST09008	STORM	88.113	0.013	109.61	109.3	CIRCULAR
STM45162	MHST09008	MHST09009	STORM	12.683	0.013	109.27	109.25	CIRCULAR
STM45163	MHST09002	MHST09003	STORM	36.553	0.013	111.25	111.15	CIRCULAR
STM45164_1	MHST09003	200	STORM	4.698	0.013	111.15	111.136	CIRCULAR
STM45164_2	200	MHST09004	STORM	11.906	0.013	111.136	111.1	CIRCULAR
STM45165	MHST09004	MHST09005	STORM	82.915	0.013	111.02	110.51	CIRCULAR

Table 4B: CONDUITS - SUMMARY

Name	Geom1 (m)	Transect	Slope (m/m)	Max. |Flow| (L/s)	Max. |Velocity| (m/s)	Max/Full Flow	Max. Spread (m)
C01	0.25		0.03357	0.64	0.7	0	0
C02	0.25		0.00599	1.49	0.48	0.03	0
C03	0.375		0.00337	26.37	0.83	0.26	0
C04	0.375		0.00352	27.22	0.88	0.26	0
C05	0.375		0.00342	29.12	0.86	0.28	0
C06	0.375		0.00349	29.12	0.89	0.28	0
C07	0.375		0.00214	50.41	1.16	0.62	0
C08	0.3		0.03598	94.08	2.04	0.39	0
C09	0.6		0.01	189.8	1.65	0.31	0
C1	0.2		0.01	42.31	1.39	1.29	0
C10	0.375		0.00951	50.52	1.34	0.3	0
C11	0.3		0.01043	81.48	1.56	0.83	0
C12	0.3		0.01309	80.43	1.7	0.73	0
C13	0.2		0.01	112.4	3.58	3.43	0
C14	0.3		0.07282	41.08	2.31	0.16	0
C15	0.375		0.00169	26.74	0.59	0.37	0
C16	0.6		0.008	159.67	2.05	0.21	0
C17	0.25		0.00616	17.84	0.85	0.38	0
C18	0.25		0.0049	17.71	0.86	0.43	0
C19	0.25		0.00627	17.54	0.74	0.37	0
C2	0.2		0.0043	16.36	0.8	0.76	0
C20	0.25		0.01197	41.6	1.41	0.64	0
C21	0.3		0.0093	93.44	1.34	1	0
C22	0.2		0.0125	47.91	1.55	1.31	0

Table 4B: CONDUITS - SUMMARY (continued...)

Name	Geom1 (m)	Transect	Slope (m/m)	Max. |Flow| (L/s)	Max. |Velocity| (m/s)	Max/Full Flow	Max. Spread (m)
C23	0.3		0.01684	84.12	1.88	0.67	0
C24	0.375		0.02668	93.81	1.24	0.33	0
C25	0.375		0.00559	29.12	0.69	0.24	0
C26	0.2		0.0075	35.68	1.17	1.26	0
C27	0.2		0.01	111.38	3.55	3.4	0
C28	0.25		0.01	25.15	1.16	0.42	0
C29	0.25		0.01006	25.07	1.15	0.42	0
C3	0.2		0.01	34.05	1.23	1.04	0
C30	0.25		0.01006	25.05	1.16	0.42	0
C31	0.25		0.01001	25.33	1.16	0.43	0
C32	0.25		0.01004	24.58	1.15	0.41	0
C33	0.25		0.01003	24.28	1.12	0.41	0
C34	0.25		0.01002	22.01	1.12	0.37	0
C35	0.25		0.00303	21.31	0.72	0.65	0
C36	0.25		0.00304	20.48	0.62	0.62	0
C37	0.25		0.00306	19.97	0.61	0.61	0
C38	0.25		0.00298	19.53	0.63	0.6	0
C39	0.3		0.00521	148.26	1.06	0.14	0
C4	0.2		0.0125	26.25	1.27	0.72	0
C40	0.3		0.00301	37.09	0.59	0.7	0
C5	0.2		0.01	54.64	1.76	1.67	0
C6	0.2		0.01	65.07	2.07	1.98	0
C7	0.2		0.005	61.3	1.95	2.64	0
C8	0.2		0.01	56.78	1.82	1.73	0
C9	0.2		0.01	47.72	1.55	1.45	0
C98	0.1		0.00362	4.62	0.59	1.49	0
C99	0.1		0.00091	4.04	0.54	2.6	0
OF1	0	Half_Street_4.25m	0.0152	0	0	0	0
R01	0	Half_Street_4.25m	0.00658	15.17	0.21	0.01	2.158
R02	0	Half_Street_4.25m	0.00113	28.7	0.32	0.07	2.419
R03	0	Half_Street_4.25m	0.00303	64.78	0.48	0.09	3.829
R04	0	Half_Street_4.25m	0.00531	0	0	0	1.112
R05	0	Half_Street_4.25m	0.00319	116.49	0.62	0.16	4.234
R06	0	Half_Street_4.25m	0.0053	45.38	0.41	0.05	2.75
R07	0	Half_Street_4.25m	0.00508	115.27	0.62	0.13	4.234
R08	1	Half_Street_4.25m	0.00448	78.66	0.89	0.09	2.419
R09	1	Half_Street_4.25m	-0.01093	30.55	0.38	0.02	2.615

Table 4B: CONDUITS - SUMMARY (continued...)

Name	Geom1 (m)	Transect	Slope (m/m)	Max. |Flow| (L/s)	Max. |Velocity| (m/s)	Max/Full Flow	Max. Spread (m)
R10	1	Half_Street_4.25m	-999	23.02	0.17	0.02	5.718
R11	1	Half_Street_4.25m	0.00467	147.91	0.7	0.17	4.639
R12	1	Half_Street_4.25m	0.00516	153.55	0.73	0.17	4.639
R13	1	Half_Street_4.25m	0.0044	142.47	0.68	0.17	4.639
R14	1	Half_Street_4.25m	0.00294	39.55	0.24	0.06	4.774
R15	1	Half_Street_4.25m	0.00604	22.71	0.4	0.02	2.027
R16	1	Half_Street_4.25m	0	38.02	0.18	0.05	7.238
R17	1	Half_Street_4.25m	0	171.1	0.3	0.26	7.378
R18	1	Half_Street_4.25m	0	52.12	0.24	0.04	6.057
R19	1	Half_Street_4.25m	0	65.77	0.21	0.08	6.335
R20	1	Half_Street_4.25m	-999	7.47	0.17	0.01	1.7
R21	1	Half_Street_4.25m	-999	8	0.13	0.01	1.962
R22	1	Half_Street_4.25m	0.00517	9.73	0.4	0.01	1.242
R23	1	Half_Street_4.25m	0.00457	10.16	0.23	0.01	3.694
R24	1	Half_Street_4.25m	0.01249	8.57	0.28	0.01	2.223
R25	1	Half_Street_4.25m	0.00737	12.06	0.24	0.01	1.831
R26	1	Half_Street_4.25m	0.00937	31.07	0.45	0.03	2.158
R27	1	Half_Street_4.25m	0.00523	59.35	0.55	0.07	2.75
R28	1	Half_Street_4.25m	0.00571	50.9	0.5	0.05	2.615
R29	1	Half_Street_4.25m	0.00518	76.14	0.72	0.08	2.615
R30	1	Half_Street_4.25m	0.00426	76.18	0.57	0.09	3.29
R31	1	Half_Street_4.25m	0.00554	90.68	0.82	0.1	2.885
R32	1	Half_Street_4.25m	0.01237	86.08	0.48	0.06	4.369
R33	1	Half_Street_4.25m	0.0052	55.79	0.29	0.06	6.265
R34	1	Half_Street_4.25m	0.00501	39.46	0.57	0.04	2.885
STM04620	0.525		0.0021	227.48	1.17	1.16	0
STM04621	0.6		0.00205	276.26	1.27	0.99	0
STM07857	0.525		0.00399	193.96	1.26	0.71	0
STM07870	0.45		0.00155	193.95	1.23	1.73	0
STM07871	0.9		0.00247	1577.82	2.6	1.75	0
STM07872	0.375		0.00381	163.59	1.48	1.51	0
STM07873	0.6		0.00343	339.46	1.53	0.94	0
STM07874	0.375		0.00384	31.45	0.79	0.29	0
STM07875	0.525		0.004	237.07	1.51	0.87	0
STM07876	0.3		0.0038	47.23	0.94	0.79	0
STM45150	0.375		0.00371	105.71	1.3	0.99	0
STM45151	0.375		0.00398	102.12	1.13	0.92	0

Table 4B: CONDUITS - SUMMARY (continued...)

Name	Geom1 (m)	Transect	Slope (m/m)	Max. |Flow| (L/s)	Max. |Velocity| (m/s)	Max/Full Flow	Max. Spread (m)
STM45152	0.45		0.004	178.64	1.36	0.99	0
STM45153	0.525		0.00906	254.87	1.29	0.62	0
STM45154	0.6		0.00204	370.37	1.31	1.34	0
STM45155	0.6		0.00246	479.38	1.7	1.57	0
STM45156	0.6		0.00313	618.76	2.19	1.8	0
STM45159	0.75		0.00479	943.85	2.14	1.22	0
STM45160	0.75		0.00516	1060.1	2.49	1.33	0
STM45161	0.6		0.00352	307.04	1.41	0.84	0
STM45162	0.6		0.00158	339.11	1.58	1.39	0
STM45163	0.375		0.00274	31.43	0.7	0.34	0
STM45164_1	0.375		0.00298	41.17	0.67	0.43	0
STM45164_2	0.375		0.00302	85.74	1.23	0.89	0
STM45165	0.45		0.00615	135.79	1.47	0.61	0

Table 5: OUTLETS - SUMMARY

Name	Inlet Node	Outlet Node	Tag	Inlet Elev. (m)	Flap Gate	Rating Curve	Coefficient (m)	Exponent (m)	Curve Name	Max. |Flow| (L/s)
212-ICD	212	216	ICD	111.42	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.32
215-ICD	215	205	ICD	112.24	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	24.51
IN09003-ICD	IN09003	MHST09003	ICD	112.53	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	10.52
IN09003-INC	IN09003-MAJ	IN09003	INC	113.93	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	10.92
IN09004-ICD	IN09004	MHST09004	ICD	112.45	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	12.96
IN09004-INC	IN09004-MAJ	IN09004	INC	113.83	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	13.22
IN09005-ICD	IN09005	MHST09005	ICD	111.82	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09005-INC	IN09005-MAJ	IN09005	INC	113.22	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	49.44
IN09006-ICD	IN09006	MHST09005	ICD	111.82	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09006-INC	IN09006-MAJ	IN09006	INC	113.22	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	50.88
IN09007-ICD	IN09007	MHST09006	ICD	111.58	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	22.51
IN09008-ICD	IN09008	MHST09006	ICD	111.58	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	22.21
IN09009-ICD	IN09009	MHST09007	ICD	111.35	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09009-INC	IN09009-MAJ	IN09009	INC	112.72	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	54.7
IN09010-ICD	IN09010	MHST09007	ICD	111.32	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	1.6
IN09010-INC	IN09010-MAJ	IN09010	INC	112.75	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	24.64
IN09011-ICD	IN09011	MHST09008	ICD	110.87	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	20.92
IN09011-INC	IN09011-MAJ	IN09011	INC	112.21	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	55
IN09012-ICD	IN09012	MHST09008	ICD	110.81	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09012-INC	IN09012-MAJ	IN09012	INC	112.21	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	54.05
IN09013-ICD	IN09013	MHST09010	ICD	110.38	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09013-INC	IN09013-MAJ	IN09013	INC	111.78	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	55
IN09014-ICD	IN09014	MHST09011	ICD	110.01	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09014-INC	IN09014-MAJ	IN09014	INC	111.41	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	29.08
IN09015-ICD	IN09015	MHST09011	ICD	110.01	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09015-INC	IN09015-MAJ	IN09015	INC	56.848	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	55
IN09016-ICD	IN09016	MHST09013	ICD	109.85	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	22.51

Table 5: OUTLETS - SUMMARY (continued...)

Name	Inlet Node	Outlet Node	Tag	Inlet Elev. (m)	Flap Gate	Rating Curve	Coefficient (m)	Exponent (m)	Curve Name	Max. |Flow| (L/s)
IN09017-ICD	IN09017	MHST09013	ICD	110.16	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	12.7
IN09017-INC	IN09017-MAJ	IN09017	INC	111.56	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	12.84
IN09018-ICD	IN09018	MHST09013	ICD	110.16	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	12.58
IN09018-INC	IN09018-MAJ	IN09018	INC	111.56	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	12.72
IN09019-ICD	IN09019	MHST09014	ICD	109.93	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09019-INC	IN09019-MAJ	IN09019	INC	111.33	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	40.81
IN09020-ICD	IN09020	MHST09014	ICD	109.93	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	17.14
IN09020-INC	IN09020-MAJ	IN09020	INC	111.33	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	18.91
IN09021-ICD	IN09021	MHST09015	ICD	109.6	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEB	30.37
IN09021-INC	IN09021-MAJ	IN09021	INC	111	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	55
IN09022-ICD	IN09022	MHST09017	ICD	112.54	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	14.1
IN09022-INC	IN09022-MAJ	IN09022	INC	113.94	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	14.32
IN09023-ICD	IN09023	MHST09017	ICD	112.35	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	12.46
IN09023-INC	IN09023-MAJ	IN09023	INC	113.75	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	12.72
IN09024-ICD	IN09024	MHST09019	ICD	111.75	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09024-INC	IN09024-MAJ	IN09024	INC	113.15	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	26.78
IN09025-ICD	IN09025	MHST09019	ICD	111.73	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09025-INC	IN09025-MAJ	IN09025	INC	113.13	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	32.56
IN09026-ICD	IN09026	MHST09020	ICD	111.26	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09026-INC	IN09026-MAJ	IN09026	INC	112.66	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	49.26
IN09027-ICD	IN09027	MHST09020	ICD	111.28	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09027-INC	IN09027-MAJ	IN09027	INC	112.68	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	48.3
IN09028-ICD	IN09028	MHST09021	ICD	110.96	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09028-INC	IN09028-MAJ	IN09028	INC	112.36	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	30.8
IN09029-ICD	IN09029	MHST09021	ICD	110.97	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09029-INC	IN09029-MAJ	IN09029	INC	112.37	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	52.03
IN09030-ICD	IN09030	MHST09022	ICD	110.57	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4

Table 5: OUTLETS - SUMMARY (continued...)

Name	Inlet Node	Outlet Node	Tag	Inlet Elev. (m)	Flap Gate	Rating Curve	Coefficient (m)	Exponent (m)	Curve Name	Max. |Flow| (L/s)
IN09030-INC	IN09030-MAJ	IN09030	INC	111.97	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	30.79
IN09031-ICD	IN09031	MHST09022	ICD	110.57	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	19.88
IN09031-INC	IN09031-MAJ	IN09031	INC	111.97	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	21.63
IN09032-ICD	IN09032	MHST09023	ICD	110.22	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09032-INC	IN09032-MAJ	IN09032	INC	111.62	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	55
IN09033-ICD	IN09033	MHST09023	ICD	110.22	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEA	21.4
IN09033-INC	IN09033-MAJ	IN09033	INC	111.62	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	55
IN09034-ICD	IN09034	MHST09024	ICD	109.87	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEB	30.37
IN09034-INC	IN09034-MAJ	IN09034	INC	111.27	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	55
IN09035-ICD	IN09035	MHST09024	ICD	109.87	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEB	30.37
IN09035-INC	IN09035-MAJ	IN09035	INC	111.27	NO	TABULAR/DEPTH	10	0.5	CB-INC-1%	55
IN103407-ICD	IN103407	MHST09001	ICD	111.64	NO	TABULAR/DEPTH	10	0.5	IPEX-MHF-TYPEB	31.48

Table 6: SUBCATCHMENTS - SUMMARY

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	Peak Runoff (L/s)	CAVG
S03	CB01	0.0178	80.9	2.2	1	14.522	7.78	0.3
S06	CBT03	0.0617	52.3	11.8	1	35.843	24.79	0.45
S07	CBE01	0.0415	54.6	7.6	1	37.942	17.94	0.47
S02	CB01	0.1483	51.7	28.7	1	88.226	72.09	0.82
S04	CB03	0.2001	70.2	28.5	1	79.11	94.15	0.75
S05	218	0.1264	53.1	23.8	1	73.958	58.55	0.72
S01	CB06	0.1752	58	30.2	1	80.668	82.83	0.76
S09	IN103407	0.0806	94.8	8.5	1	71.197	38.28	0.7
ES33	IN45573	0.1591	51.3	31	1	31.774	47.93	0.42
ES34	IN45574	0.4099	54.3	75.5	1	10.084	52.02	0.27
ES35	IN45566	0.967	66.5	145.5	1	14.685	111.44	0.3
ES31	IN45577	0.1922	48.3	39.8	1	24.966	47.73	0.37
ES30	IN45572	0.2289	47.4	48.3	1	28.571	56.8	0.4
ES29	IN45569	0.3256	46	70.8	1	26.731	68.83	0.39
ES28	IN45570	0.3422	50.1	68.3	1	21.796	65.07	0.35
ES27	IN45575	0.3696	52.4	70.5	1	13.466	54.66	0.29
ES02_1	IN09004-MAJ	0.0884	48.8	18.1	1	31.285	31.03	0.42
ES32	IN07998	0.7854	57.1	137.6	1	19.912	112.45	0.34
ES19	IN09019-MAJ	0.0992	46.4	21.4	0.5	63.062	42.02	0.64
ES17	IN09034-MAJ	0.135	78.5	17.2	2	41.718	55.98	0.49
ES18	IN09021-MAJ	0.2378	93.3	25.5	2	40.757	91.2	0.49
ES20	IN09020-MAJ	0.0692	32.3	21.4	0.5	33.177	21.4	0.43
ES23	IN45587	0.1837	22.5	81.5	1	32.553	42.33	0.43
ES24	IN45588	0.0806	15.8	51.1	1	27.007	19.06	0.39
ES25	IN45589	0.1875	16.6	112.9	1	27.249	35.2	0.39
ES26	IN45590	0.1086	17.7	61.3	1	32.212	26.83	0.43
ES07	IN09013-MAJ	0.2147	96.7	22.2	0.5	55.576	84.84	0.59
ES36	IN09032-MAJ	0.215	113.8	18.9	0.5	32.12	68.09	0.42
ES03_1	IN09005-MAJ	0.2801	132.1	21.2	1	55.552	117.33	0.59
ES03_2	IN09006-MAJ	0.1878	114.5	16.4	1	50.126	78.54	0.55
ES04_1	IN09008	0.2099	98.1	21.4	0.5	59.961	86.7	0.62
ES04_2	IN09007	0.1951	98	19.9	0.5	55.139	78.13	0.59
ES05_1	IN09009-MAJ	0.1906	91.6	20.8	0.5	52.183	73.74	0.57
ES05_2	IN09010-MAJ	0.1843	89.9	20.5	0.5	54.377	72.96	0.58
ES06_1	IN09011-MAJ	0.2778	134.9	20.6	0.5	59.044	114.46	0.61
ES06_2	IN09012-MAJ	0.2407	123.4	19.5	0.5	55.203	96.75	0.59
ES14_1	IN09014-MAJ	0.1317	97.6	13.5	0.5	42.85	50.81	0.5

Table 6: SUBCATCHMENTS - SUMMARY (continued...)

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	Peak Runoff (L/s)	CAVG
ES14_2	IN09015-MAJ	0.181	88.7	20.4	0.5	60.093	75.32	0.62
ES15_1	IN09016	0.0733	75.6	9.7	0.5	37.055	28.86	0.46
ES15_2	MHST09012	0.1226	70.5	17.4	0.5	57.086	50.9	0.6
ES01_1	IN103407	0.3255	57	57.1	1.5	67.777	136.52	0.67
ES02_2	IN09003-MAJ	0.0477	36.7	13	1	44.983	19.97	0.51
ES08_1	IN09022-MAJ	0.1217	85.1	14.3	0.5	44.675	47.15	0.51
ES08_2	IN09023-MAJ	0.0863	47.2	18.3	0.5	29.627	26.74	0.41
ES09_1	IN09024-MAJ	0.1738	96.6	18	0.5	53.85	69.93	0.58
ES09_2	IN09025-MAJ	0.1796	125.6	14.3	0.5	40.275	66.9	0.48
ES13_1	MHST09023	0.1559	69.9	22.3	0.5	56.354	62.01	0.59
ES13_2	MHST09023	0.1672	85.3	19.6	0.5	53.557	66.18	0.57
ES12_1	MHST09022	0.1929	92.7	20.8	0.5	56.58	77.7	0.6
ES12_2	IN09031-MAJ	0.1553	77.3	20.1	0.5	55.364	62.22	0.59
ES11_1	IN09029-MAJ	0.1845	88.3	20.9	0.5	55.004	73.23	0.59
ES11_2	IN09028-MAJ	0.126	71.2	17.7	0.5	44.553	46.69	0.51
ES10_1	IN09026-MAJ	0.2118	108.1	19.6	0.5	50.248	81.31	0.55
ES10_2	IN09027-MAJ	0.1837	110	16.7	0.5	48.55	71.49	0.54
ES16_1	IN09034-MAJ	0.1	107.5	9.3	1.5	35.738	42.83	0.45
ES16_2	IN09035-MAJ	0.1733	100.2	17.3	1.5	26.876	62.46	0.39
ES22_1	IN09016	0.1847	74.8	24.7	0.5	62.634	76.6	0.64
ES22_2	MHST09012	0.218	100.5	21.7	0.5	55.462	86.38	0.59
ES21_3	IN09020-MAJ	0.129	60.8	21.2	0.5	42.562	44.95	0.5
ES21_4	IN09019-MAJ	0.1398	60.3	23.2	0.5	62.819	58.53	0.64
ES21_1	IN09018-MAJ	0.0791	36.8	21.5	0.5	58.867	32.35	0.61
ES21_5	IN09017-MAJ	0.0865	36.2	23.9	0.5	54.717	33.5	0.58
S08_1	CBT14	0.0405	57.857	7	1	59.421	18.82	0.62
S08_2	CBE04	0.0548	78.286	7	1	54.842	25.18	0.58

Table 7: Existing_Structures

NAME	TYPE	LID_ELEV	LID_SOURCE	RYCB_INV	GIS_LENGTH	GIS_AREA
IN07998	RYCB	111.832	CITY GIS	110.43	0	0
IN09001	Catch Basin	113.02	FMW Survey	111.62	0	0
IN09002	Catch Basin	113.02	FMW Survey	111.62	0	0
IN09003	Catch Basin	113.93	OMM grading plan	112.53	0	0
IN09004	Catch Basin	113.83	OMM grading plan	112.43	0	0
IN09005	Catch Basin	113.22	OMM grading plan	111.82	0	0
IN09006	Catch Basin	113.22	OMM grading plan	111.82	0	0
IN09007	Catch Basin	112.98	OMM grading plan	111.58	0	0
IN09008	Catch Basin	112.98	OMM grading plan	111.58	0	0
IN09009	Catch Basin	112.75	OMM Plan & Profile	111.35	0	0
IN09010	Catch Basin	112.75	OMM Plan & Profile	111.35	0	0
IN09011	Catch Basin	112.21	OMM Plan & Profile	110.81	0	0
IN09012	Catch Basin	112.21	OMM Plan & Profile	110.81	0	0
IN09013	Catch Basin	111.78	OMM Plan & Profile	110.38	0	0
IN09014	Catch Basin	111.41	OMM Plan & Profile	110.01	0	0
IN09015	Catch Basin	111.41	OMM Plan & Profile	110.01	0	0
IN09016	Catch Basin	111.25	OMM Plan & Profile	109.85	0	0
IN09017	Catch Basin	111.56	OMM Plan & Profile	110.16	0	0
IN09018	Catch Basin	111.56	OMM Plan & Profile	110.16	0	0
IN09019	Catch Basin	111.33	OMM Plan & Profile	109.93	0	0
IN09020	Catch Basin	111.33	OMM Plan & Profile	109.93	0	0
IN09021	Catch Basin	111	OMM Plan & Profile	109.6	0	0
IN09022	Catch Basin	113.94	OMM Plan & Profile	112.54	0	0
IN09023	Catch Basin	113.75	OMM Plan & Profile	112.35	0	0
IN09024	Catch Basin	113.15	OMM Plan & Profile	111.75	0	0
IN09025	Catch Basin	113.13	OMM Plan & Profile	111.73	0	0
IN09026	Catch Basin	112.66	OMM Plan & Profile	111.26	0	0
IN09027	Catch Basin	112.68	OMM Plan & Profile	111.28	0	0
IN09028	Catch Basin	112.36	OMM Plan & Profile	110.96	0	0
IN09029	Catch Basin	112.37	OMM Plan & Profile	110.97	0	0
IN09030	Catch Basin	111.97	OMM Plan & Profile	110.57	0	0
IN09031	Catch Basin	111.97	OMM Plan & Profile	110.57	0	0
IN09032	Catch Basin	111.62	OMM Plan & Profile	110.22	0	0
IN09033	Catch Basin	111.62	OMM Plan & Profile	110.22	0	0
IN09034	Catch Basin	111.27	OMM Plan & Profile	109.87	0	0
IN09035	Catch Basin	111.27	OMM Plan & Profile	109.87	0	0
IN103406	Double Catch Basin	112.95	FMW Survey	111.55	0	0
IN103407	Double Catch Basin	112.97	FMW Survey	111.57	0	0
IN45566	RYCB	111.215	CITY GIS	109.82	0	0

Table 7: Existing_Structures (continued...)

NAME	TYPE	LID_ELEV	LID_SOURCE	RYCB_INV	GIS_LENGTH	GIS_AREA
IN45569	RYCB	113.007	CITY GIS	111.61	0	0
IN45570	RYCB	113.104	CITY GIS	111.7	0	0
IN45572	RYCB	112.912	CITY GIS	111.51	0	0
IN45573	RYCB	114.156	CITY GIS	112.76	0	0
IN45574	RYCB	111.346	CITY GIS	109.95	0	0
IN45575	RYCB	113.572	CITY GIS	112.17	0	0
IN45577	RYCB	112.682	CITY GIS	111.28	0	0
IN45587	RYCB	113.845	CITY GIS	112.44	0	0
IN45588	RYCB	113.922	CITY GIS	112.52	0	0
IN45589	RYCB	113.246	CITY GIS	111.85	0	0
IN45590	RYCB	112.982	CITY GIS	111.58	0	0
MHST09001	Storm Manhole	113.141	DTM	111.74	0	0
MHST09002	Storm Manhole	113.216	DTM	111.82	0	0
MHST09003	Storm Manhole	113.836	DTM	112.44	0	0
MHST09004	Storm Manhole	114.027	DTM	112.63	0	0
MHST09005	Storm Manhole	113.503	DTM	112.1	0	0
MHST09006	Storm Manhole	112.934	DTM	111.53	0	0
MHST09007	Storm Manhole	112.834	DTM	111.43	0	0
MHST09008	Storm Manhole	112.425	DTM	111.02	0	0
MHST09009	Storm Manhole	112.279	DTM	110.88	0	0
MHST09010	Storm Manhole	111.974	DTM	110.57	0	0
MHST09011	Storm Manhole	111.672	DTM	110.27	0	0
MHST09012	Catch Basin Manhole	111.128	DTM	109.73	0	0
MHST09013	Storm Manhole	111.586	DTM	110.19	0	0
MHST09014	Storm Manhole	111.496	DTM	110.1	0	0
MHST09015	Storm Manhole	111.798	DTM	110.4	0	0
MHST09016	Storm Manhole	114.182	DTM	112.78	0	0
MHST09017	Storm Manhole	114.098	DTM	112.7	0	0
MHST09018	Storm Manhole	113.871	DTM	112.47	0	0
MHST09019	Storm Manhole	113.279	DTM	111.88	0	0
MHST09020	Storm Manhole	112.931	DTM	111.53	0	0
MHST09021	Storm Manhole	112.531	DTM	111.13	0	0
MHST09022	Storm Manhole	112.266	DTM	110.87	0	0
MHST09023	Storm Manhole	111.804	DTM	110.4	0	0
MHST09024	Storm Manhole	111.391	DTM	109.99	0	0

Appendix H – Correspondence

Correspondence from City of Ottawa

Jason Fitzpatrick

From:	Kuruvilla, Santhosh <Santhosh.Kuruvilla@ottawa.ca>
Sent:	Wednesday, October 9, 2019 7:40 AM
To:	Jason Fitzpatrick
Cc:	Bruce Thomas
Subject:	RE: Hazeldean Crossing - 5924, 5938 Hazeldean Road
Attachments:	5924 Hazeldean Road _Boundary Conditions_8Oct2019.docx
Categories:	RECEIVED - ACTION REQUIRED

Hi Jason,

Please find attached the boundary conditions for the subject application.

Thanks,

Santhosh

From: Jason Fitzpatrick <jason.fitzpatrick@exp.com>
Sent: October 03, 2019 9:28 AM
To: Kuruvilla, Santhosh <Santhosh.Kuruvilla@ottawa.ca>
Cc: Bruce Thomas <bruce.thomas@exp.com>
Subject: Hazeldean Crossing - 5924, 5938 Hazeldean Road

Hi Santosh,

We would appreciate if you could arrange for updated boundary conditions that we can use to revise our water model for the above noted project.

On our previous submission the boundary condition was based on a lower RFF of 10,000 L/min, whereas it should be based on a higher RFF of 250 L/sec (most critical block)

For reference , I've attached the previous boundary conditions that we received from Eric.

We would appreciate if Water Resources could provide Boundary Conditions at the same three locations, based on the higher RFF of 250 L/sec

The HGL boundary conditions based on the following information at your earliest convenience:

- Max Day Plus Fire flow : ~~167~~ **250** L/sec (most critical) + 3.5 L/sec = ~~170.5~~ **253.5** L/sec
- Peak Hour: 5.2 L/sec

Regards.

Jason Fitzpatrick, P.Eng.
EXP | Project Engineer
t : +1.613.688.1899 | m : +1.613.302.7441 | e : jason.fitzpatrick@exp.com
2650 Queensview Drive
Suite 100
Ottawa, ON K2B 8H6
CANADA

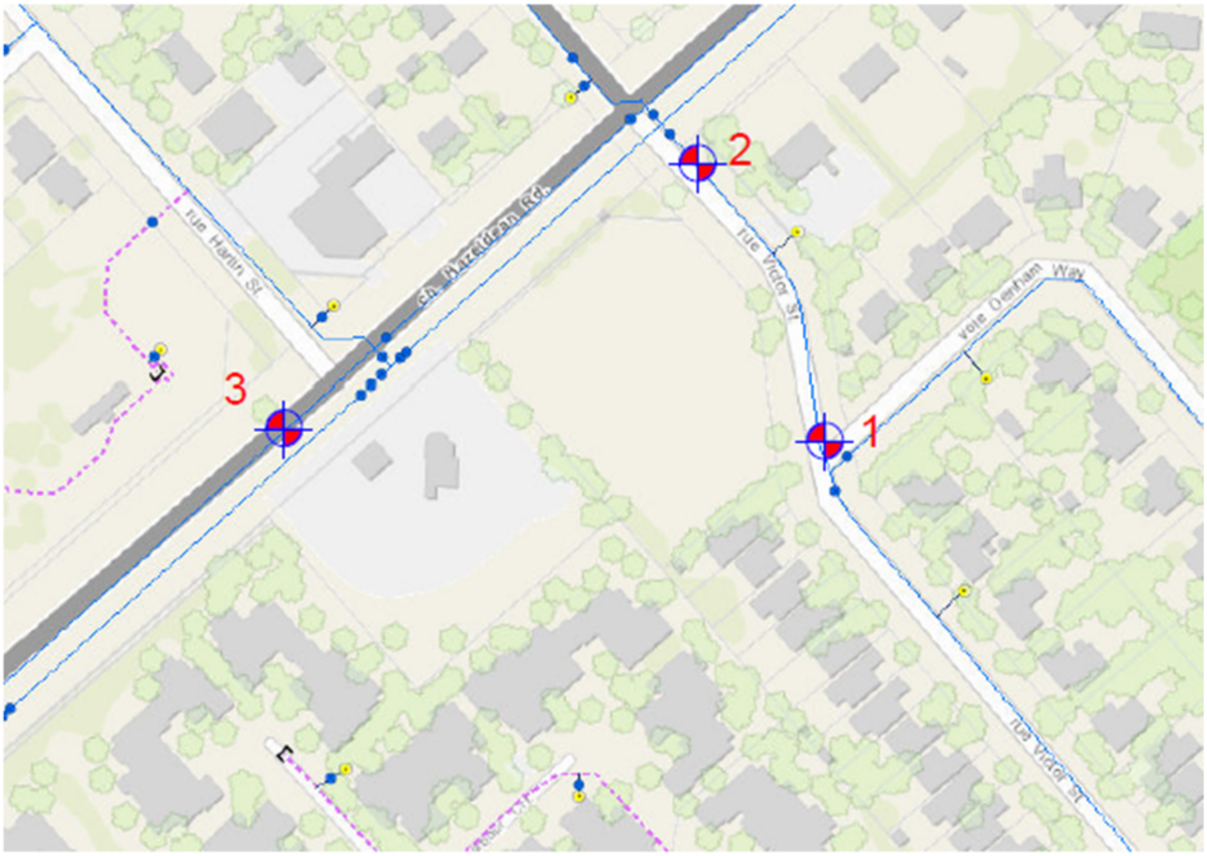
Boundary Conditions for 5924 Hazeldean Road

Date Provided October-19

Scenario	Demand	
	L/min	L/s
Average Daily Demand	46	0.76
Maximum Daily Demand	210	3.5
Peak Hour	312	5.2
Fire Flow Demand #1	15000	250

# of connections 3

Location:



Results:

Connection 1 - Victor Street and Denham Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.9	66.6
Peak Hour	157.2	61.4
Max Day plus Fire 1	135.4	30.4

[1] Ground Elevation = 114.0 m

Connection 2 - Victor Street

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.9	68.0
Peak Hour	157.3	62.9
Max Day plus Fire 1	154.1	58.4

[1] Ground Elevation = 113.0 m

Connection 3 - Hazeldean Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.8	66.2
Peak Hour	157.3	61.2
Max Day plus Fire 1	158.3	62.6

[1] Ground Elevation = 114.3 m

Notes:

1. Connection 3 to 762mm watermain on Hazeldean Road is not permitted.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Appendix I – Manufacturer Information

IPEX Tempest Inlet Control Devices – Technical Manual

Stormtech MC-3500 Design Manual (Pages B16, B17)

Stormtech MC-3500 Cut Sheet

Volume III: TEMPEST™ INLET CONTROL DEVICES

Municipal Technical Manual Series

SECOND EDITION

LMF (Low to Medium Flow) ICD

HF (High Flow) ICD

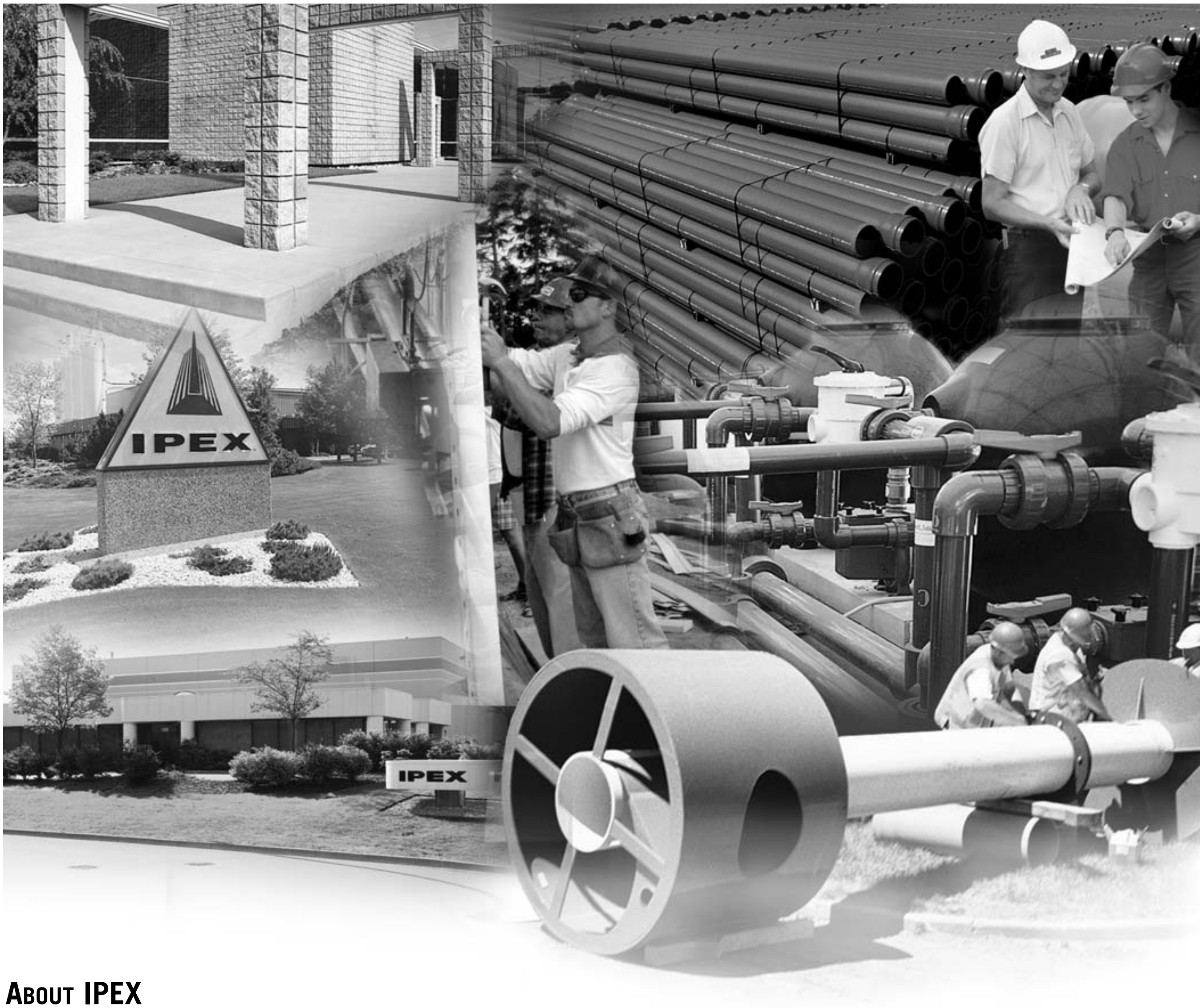
MHF (Medium to High Flow) ICD

IPEX

IPEX Tempest™
Inlet Control Devices

Municipal Technical Manual Series

Vol. I, 2nd Edition



About IPEX

At IPEX, we have been manufacturing non-metallic pipe and fittings since 1951. We formulate our own compounds and maintain strict quality control during production. Our products are made available for customers thanks to a network of regional stocking locations throughout North America. We offer a wide variety of systems including complete lines of piping, fittings, valves and custom-fabricated items.

More importantly, we are committed to meeting our customers' needs. As a leader in the plastic piping industry, IPEX continually develops new products, modernizes manufacturing facilities and acquires innovative process technology. In addition, our staff take pride in their work, making available to customers their extensive thermoplastic knowledge and field experience. IPEX personnel are committed to improving the safety, reliability and performance of thermoplastic materials. We are involved in several standards committees and are members of and/or comply with the organizations listed on this page.

For specific details about any IPEX product, contact our customer service department.

CONTENTS

PRODUCT INFORMATION: TEMPEST LOW, MEDIUM FLOW (LMF) ICD

Purpose

To control the amount of storm water runoff entering a sewer system by allowing a specified flow volume out of a catch basin or manhole at a specified head. This approach conserves pipe capacity so that catch basins downstream do not become uncontrollably surcharged, which can lead to basement floods, flash floods and combined sewer overflows.

Product Description

Our LMF ICD is designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter and larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 14 preset flow curves, the LMF ICD has the ability to provide flow rates: 2lps – 17lps (31gpm – 270gpm)

Product Function

The LMF ICD vortex flow action allows the LMF ICD to provide a narrower flow curve using a larger orifice than a conventional orifice plate ICD, making it less likely to clog. When comparing flows at the same head level, the LMF ICD has the ability to restrict more flow than a conventional ICD during a rain event, preserving greater sewer capacity.

Product Construction

Constructed from durable PVC, the LMF ICD is light weight 8.9 Kg (19.7 lbs).

Product Applications

Will accommodate both square and round applications:

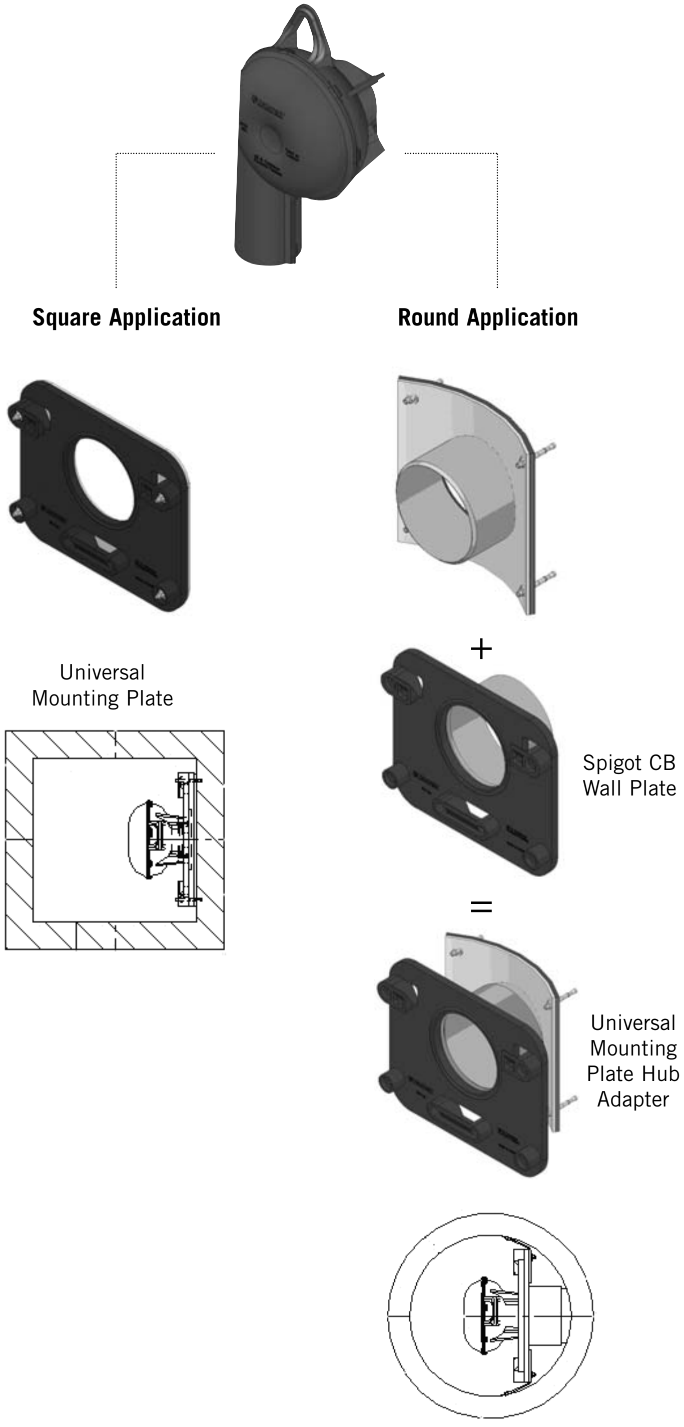


Chart 1: LMF 14 Preset Flow Curves

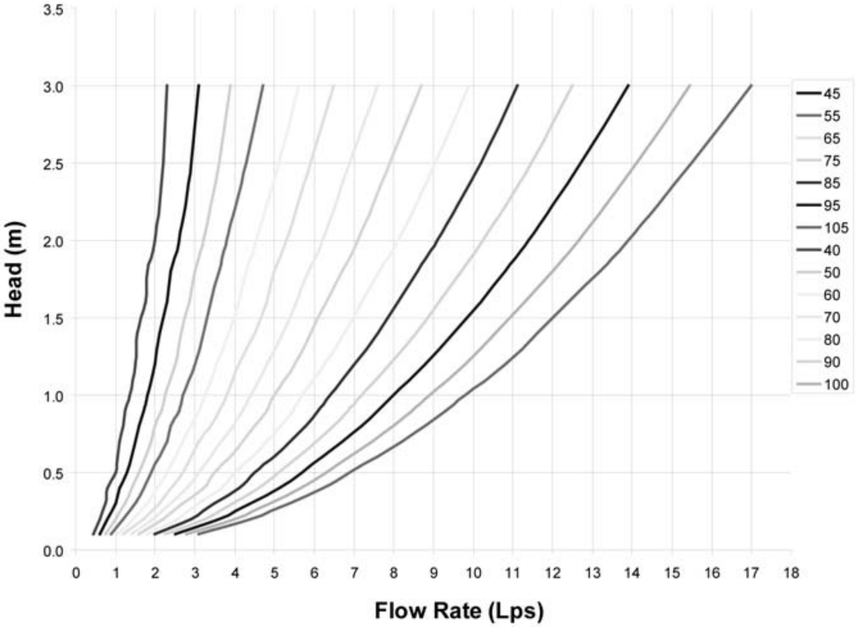
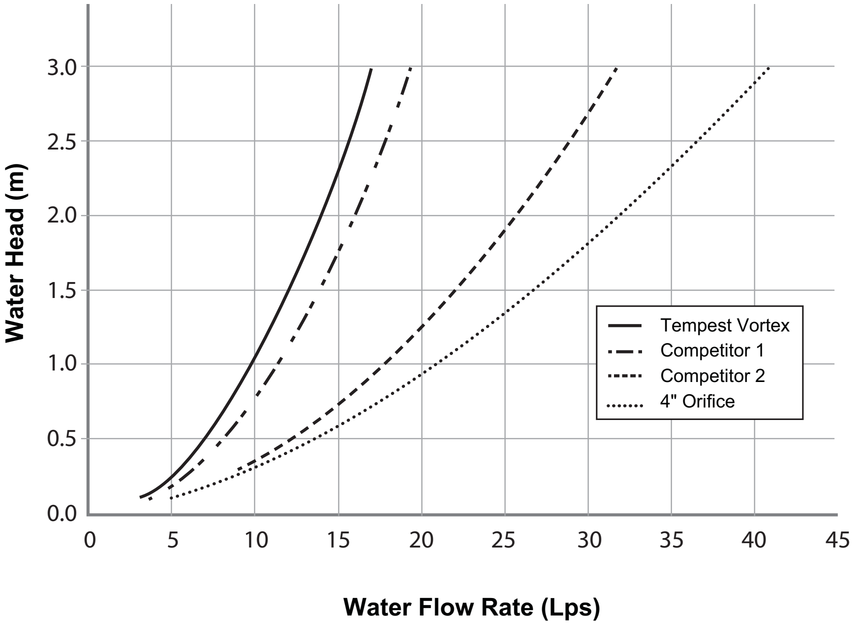


Chart 2: LMF Flow vs. ICD Alternatives



PRODUCT INSTALLATION

Instructions to assemble a TEMPEST LMF ICD into a Square Catch Basin:

STEPS:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device.
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal mounting plate and has created a seal.

⚠ WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST LMF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the spigot catch basin wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the CB spigot wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot wall plate and the catch basin wall.
6. Apply solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the universal mounting plate hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the mounting plate and has created a seal.

⚠ WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut back the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

PRODUCT TECHNICAL SPECIFICATION

General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook will be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above must not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices will consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's shall have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

PRODUCT INFORMATION: TEMPEST HF & MHF ICD

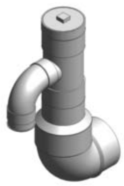
Product Description

Our HF, HF Sump and MHF ICD's are designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter or larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 5 preset flow curves, these ICDs have the ability to provide constant flow rates: 9lps (143 gpm) and greater

Product Function

TEMPEST HF (High Flow): designed to manage moderate to higher flows 15 L/s (240 gpm) or greater and prevent the propagation of odour and floatables. With this device, the cross-sectional area of the device is larger than the orifice diameter and has been designed to limit head losses. The HF ICD can also be ordered without flow control when only odour and floatable control is required.



TEMPEST HF (High Flow) Sump: The height of a sewer outlet pipe in a catch basin is not always conveniently located. At times it may be located very close to the catch basin floor, not providing enough sump for one of the other TEMPEST ICDs with universal back plate to be installed. In these applications, the HF Sump is offered. The HF Sump offers the same features and benefits as the HF ICD; however, is designed to raise the outlet in a square or round catch basin structure. When installed, the HF sump is fixed in place and not easily removed. Any required service to the device is performed through a clean-out located in the top of the device which can be often accessed from ground level.

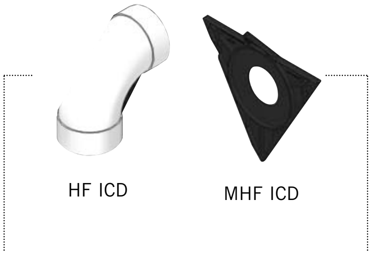
TEMPEST MHF (Medium to High Flow):
The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

Product Construction

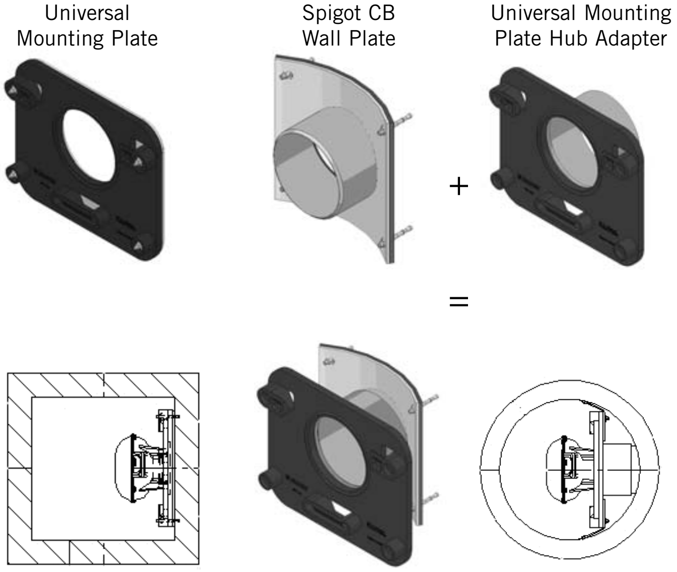
The HF, HF Sump and MHF ICDs are built to be light weight at a maximum weight of 6.8 Kg (14.6 lbs).

Product Applications

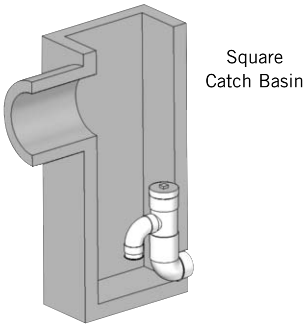
The HF and MHF ICD's are available to accommodate both square and round applications:



Square Application **Round Application**



The HF Sump is available to accommodate low to no sump applications in both square and round catch basins:



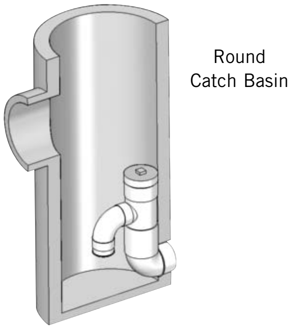
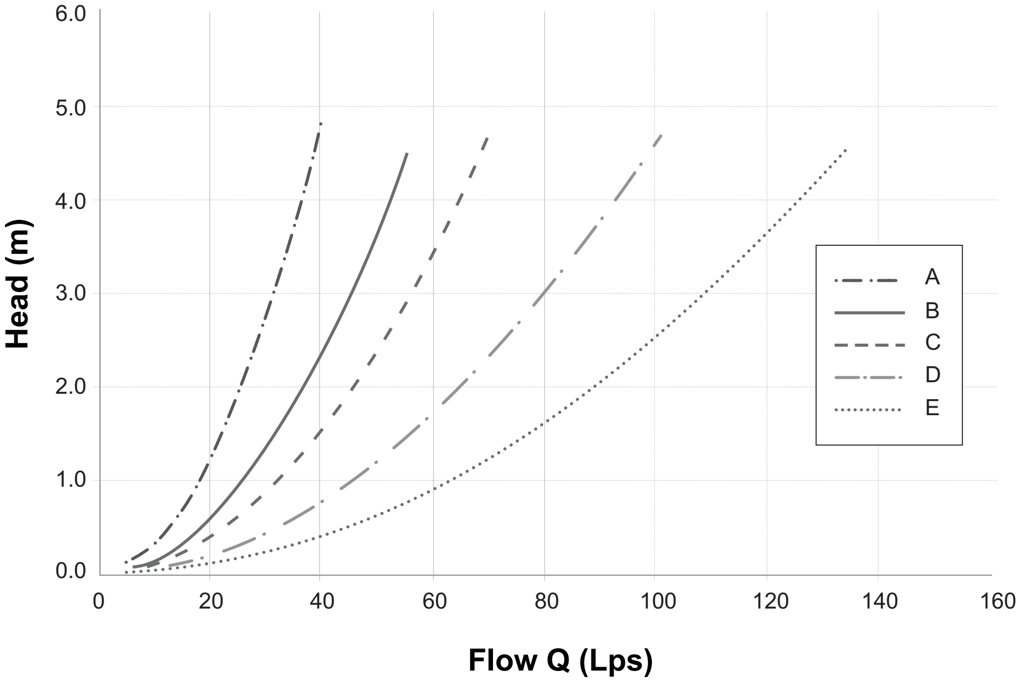


Chart 3: HF & MHF Preset Flow Curves



PRODUCT INSTALLATION

Instructions to assemble a TEMPEST HF or MHF ICD into a Square Catch Basin:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal wall mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal wall mounting plate and has created a seal.

⚠ WARNING

- Verify that the outlet pipe doesn’t protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST HF or MHF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the round catch basin spigot adaptor to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the spigot CB wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot CB wall plate and the catch basin wall.
6. Put solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the wall mounting plate and has created a seal.

⚠ WARNING

- Verify that the outlet pipe doesn’t protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST HF Sump into a Square or Round Catch Basin:

STEPS:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, mastic tape and metal strapping
   - Material: (2) concrete anchor 3/8 x 3-1/2, (2) washers, (2) nuts, HF Sump pieces (2).
2. Apply solvent cement to the spigot end of the top half of the sump. Apply solvent cement to the hub of the bottom half of the sump. Insert the spigot of the top half of the sump into the hub of the bottom half of the sump.
3. Install the 8" spigot of the device into the outlet pipe. Use the mastic tape to seal the device spigot into the outlet pipe. You should use a level to be sure that the fitting is standing at the vertical.
4. Use an impact drill with a 3/8" concrete bit to make a series of 2 holes along each side of the body throat. The depth of the hole should be between 1-1/2" to 2-1/2". Clean the concrete dust from the 2 holes.
5. Install the anchors (2) in the holes by using a hammer. Put the nuts on the top of the anchors to protect the threads when you hit the anchors. Remove the nuts from the ends of the anchors.
6. Cut the metal strapping to length and connect each end of the strapping to the anchors. Screw the nuts in place with a maximum torque of 40 N.m (30 lbf-ft). The device should be completely flush with the catch basin wall.

⚠ WARNING

- Verify that the outlet pipe doesn’t protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

PRODUCT TECHNICAL SPECIFICATION

General

Inlet control devices (ICD’s) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control where specified. All ICD’s will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook shall be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above shall not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices shall consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator’s hand.

ICD’s shall have no moving parts.

Materials

ICD’s are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8” thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD’s to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

SALES AND CUSTOMER SERVICE

Canadian Customers call IPEX Inc.

Toll free: (866) 473-9462

www.ipexinc.com

U.S. Customers call IPEX USA LLC

Toll free: (800) 463-9572

www.ipexamerica.com

About the IPEX Group of Companies

As leading suppliers of thermoplastic piping systems, the IPEX Group of Companies provides our customers with some of the largest and most comprehensive product lines. All IPEX products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have established a reputation for product innovation, quality, end-user focus and performance.

Markets served by IPEX group products are:

- Electrical systems
- Telecommunications and utility piping systems
- PVC, CPVC, PP, ABS, PEX, FR-PVDF and PE pipe and fittings (1/4" to 48")
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems

Products manufactured by IPEX Inc. and distributed in the United States by IPEX USA LLC.

Tempest™ is a trademark of IPEX Branding Inc.

MNMNTPIP110817

5.0 Cumulative Storage Volumes

Tables 7 and **8** provide cumulative storage volumes for the MC-3500 chamber and end cap. These tables can be used to calculate the stage-storage relationship for the retention or detention system. Digital spreadsheets in which the number of chambers and end caps can be input for quick cumulative storage calculations are available at www.stormtech.com. For assistance with site-specific calculations or input into routing software, contact the StormTech Technical Services Department.

TABLE 7 – MC-3500 Incremental Storage Volume Per Chamber

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above chambers, and 9" (230 mm) of spacing between chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
66 (1676)	↑ 0.00	178.96 (5.068)
65 (1651)	0.00	177.25 (5.019)
64 (1626)	0.00	175.54 (4.971)
63 (1600)	Stone 0.00	173.83 (4.922)
62 (1575)	Cover 0.00	172.11 (4.874)
61 (1549)	0.00	170.40 (4.825)
60 (1524)	0.00	168.69 (4.777)
59 (1499)	0.00	166.98 (4.728)
58 (1473)	0.00	165.27 (4.680)
57 (1448)	0.00	163.55 (4.631)
56 (1422)	0.00	161.84 (4.583)
55 (1397)	↓ 0.00	160.13 (4.534)
54 (1372)	109.95 (3.113)	158.42 (4.486)
53 (1346)	109.89 (3.112)	156.67 (4.436)
52 (1321)	109.69 (3.106)	154.84 (4.385)
51 (1295)	109.40 (3.098)	152.95 (4.331)
50 (1270)	109.00 (3.086)	151.00 (4.276)
49 (1245)	108.31 (3.067)	148.88 (4.216)
48 (1219)	107.28 (3.038)	146.55 (4.150)
47 (1194)	106.03 (3.003)	144.09 (4.080)
46 (1168)	104.61 (2.962)	141.52 (4.007)
45 (1143)	103.04 (2.918)	138.86 (3.932)
44 (1118)	101.33 (2.869)	136.13 (3.855)
43 (1092)	99.50 (2.818)	133.32 (3.775)
42 (1067)	97.56 (2.763)	130.44 (3.694)
41 (1041)	95.52 (2.705)	127.51 (3.611)
40 (1016)	93.39 (2.644)	124.51 (3.526)
39 (991)	91.16 (2.581)	121.47 (3.440)
38 (965)	88.86 (2.516)	118.37 (3.352)
37 (948)	86.47 (2.449)	115.23 (3.263)
36 (914)	84.01 (2.379)	112.04 (3.173)
35 (889)	81.49 (2.307)	108.81 (3.081)
34 (864)	78.89 (2.234)	105.54 (2.989)
33 (838)	76.24 (2.159)	102.24 (2.895)
32 (813)	73.52 (2.082)	98.90 (2.800)
31 (787)	70.75 (2.003)	95.52 (2.705)
30 (762)	67.92 (1.923)	92.12 (2.608)
29 (737)	65.05 (1.842)	88.68 (2.511)
28 (711)	62.12 (1.759)	85.21 (2.413)
27 (686)	59.15 (1.675)	81.72 (2.314)
26 (680)	56.14 (1.590)	78.20 (2.214)
25 (635)	53.09 (1.503)	74.65 (2.114)
24 (610)	49.99 (1.416)	71.09 (2.013)
23 (584)	46.86 (1.327)	67.50 (1.911)
22 (559)	43.70 (1.237)	63.88 (1.809)
21 (533)	40.50 (1.147)	60.25 (1.706)
20 (508)	37.27 (1.055)	56.60 (1.603)
19 (483)	34.01 (0.963)	52.93 (1.499)
18 (457)	30.72 (0.870)	49.25 (1.395)
17 (432)	27.40 (0.776)	45.54 (1.290)
16 (406)	24.05 (0.681)	41.83 (1.184)
15 (381)	20.69 (0.586)	38.09 (1.079)
14 (356)	17.29 (0.490)	34.34 (0.973)
13 (330)	13.88 (0.393)	30.58 (0.866)
12 (305)	10.44 (0.296)	26.81 (0.759)
11 (279)	6.98 (0.198)	23.02 (0.652)
10 (254)	3.51 (0.099)	19.22 (0.544)
9 (229)	↑ 0.00	15.41 (0.436)
8 (203)	0.00	13.70 (0.388)
7 (178)	0.00	11.98 (0.339)
6 (152)	Stone 0.00	10.27 (0.291)
5 (127)	Foundation 0.00	8.56 (0.242)
4 (102)	0.00	6.85 (0.194)
3 (76)	0.00	5.14 (0.145)
2 (51)	0.00	3.42 (0.097)
1 (25)	↓ 0.00	1.71 (0.048)

NOTE: Add 1.71 ft^3 (0.030 m^3) of storage for each additional inch (25 mm) of stone foundation.
Contact StormTech for cumulative volume spreadsheets in digital format.

5.0 Cumulative Storage Volume

TABLE 8 – MC-3500 Incremental Storage Volume Per End Cap

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above end caps, and 9" (230 mm) of spacing between end caps and 6" (150 mm) of stone perimeter.

Depth of Water in System Inches (mm)	Cumulative End Cap Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
66 (1676)	↑ 0.00	46.96 (1.330)
65 (1651)	0.00	46.39 (1.314)
64 (1626)	0.00	45.82 (1.298)
63 (1600)	Stone 0.00	45.25 (1.281)
62 (1575)	Cover 0.00	44.68 (1.265)
61 (1549)	0.00	44.11 (1.249)
60 (1524)	0.00	43.54 (1.233)
59 (1499)	0.00	42.98 (1.217)
58 (1473)	0.00	42.41 (1.201)
57 (1448)	0.00	41.84 (1.185)
56 (1422)	0.00	41.27 (1.169)
55 (1397)	↓ 0.00	40.70 (1.152)
54 (1372)	15.64 (0.443)	40.13 (1.136)
53 (1346)	15.64 (0.443)	39.56 (1.120)
52 (1321)	15.63 (0.443)	38.99 (1.104)
51 (1295)	15.62 (0.442)	38.41 (1.088)
50 (1270)	15.60 (0.442)	37.83 (1.071)
49 (1245)	15.56 (0.441)	37.24 (1.054)
48 (1219)	15.51 (0.439)	36.64 (1.037)
47 (1194)	15.44 (0.437)	36.02 (1.020)
46 (1168)	15.35 (0.435)	35.40 (1.003)
45 (1143)	15.25 (0.432)	34.77 (0.985)
44 (1118)	15.13 (0.428)	34.13 (0.966)
43 (1092)	14.99 (0.424)	33.48 (0.948)
42 (1067)	14.83 (0.420)	32.81 (0.929)
41 (1041)	14.65 (0.415)	32.13 (0.910)
40 (1016)	14.45 (0.409)	31.45 (0.890)
39 (991)	14.24 (0.403)	30.75 (0.871)
38 (965)	14.00 (0.396)	30.03 (0.850)
37 (948)	13.74 (0.389)	29.31 (0.830)
36 (914)	13.47 (0.381)	28.58 (0.809)
35 (889)	13.18 (0.373)	27.84 (0.788)
34 (864)	12.86 (0.364)	27.08 (0.767)

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
33 (838)	12.53 (0.355)	26.30 (0.745)
32 (813)	12.18 (0.345)	25.53 (0.723)
31 (787)	11.81 (0.335)	24.74 (0.701)
30 (762)	11.42 (0.323)	23.93 (0.678)
29 (737)	11.01 (0.312)	23.12 (0.655)
28 (711)	10.58 (0.300)	22.29 (0.631)
27 (686)	10.13 (0.287)	21.45 (0.607)
26 (680)	9.67 (0.274)	20.61 (0.583)
25 (635)	9.19 (0.260)	19.75 (0.559)
24 (610)	8.70 (0.246)	18.88 (0.559)
23 (584)	8.19 (0.232)	18.01 (0.510)
22 (559)	7.67 (0.217)	17.13 (0.485)
21 (533)	7.13 (0.202)	16.24 (0.460)
20 (508)	6.59 (0.187)	15.34 (0.434)
19 (483)	6.03 (0.171)	14.43 (0.409)
18 (457)	5.46 (0.155)	13.52 (0.383)
17 (432)	4.88 (0.138)	12.61 (0.357)
16 (406)	4.30 (0.122)	11.69 (0.331)
15 (381)	3.70 (0.105)	10.76 (0.305)
14 (356)	3.10 (0.088)	9.83 (0.278)
13 (330)	2.49 (0.071)	8.90 (0.252)
12 (305)	1.88 (0.053)	7.96 (0.225)
11 (279)	1.26 (0.036)	7.02 (0.199)
10 (254)	0.63 (0.018)	6.07 (0.172)
9 (229)	↑ 0.00	5.12 (0.145)
8 (203)	0.00	4.55 (0.129)
7 (178)	0.00	3.99 (0.113)
6 (152)	Stone 0.00	3.42 (0.097)
5 (127)	Foundation 0.00	2.85 (0.081)
4 (102)	0.00	2.28 (0.064)
3 (76)	0.00	1.71 (0.048)
2 (51)	0.00	1.14 (0.032)
1 (25)	↓ 0.00	0.56 (0.016)

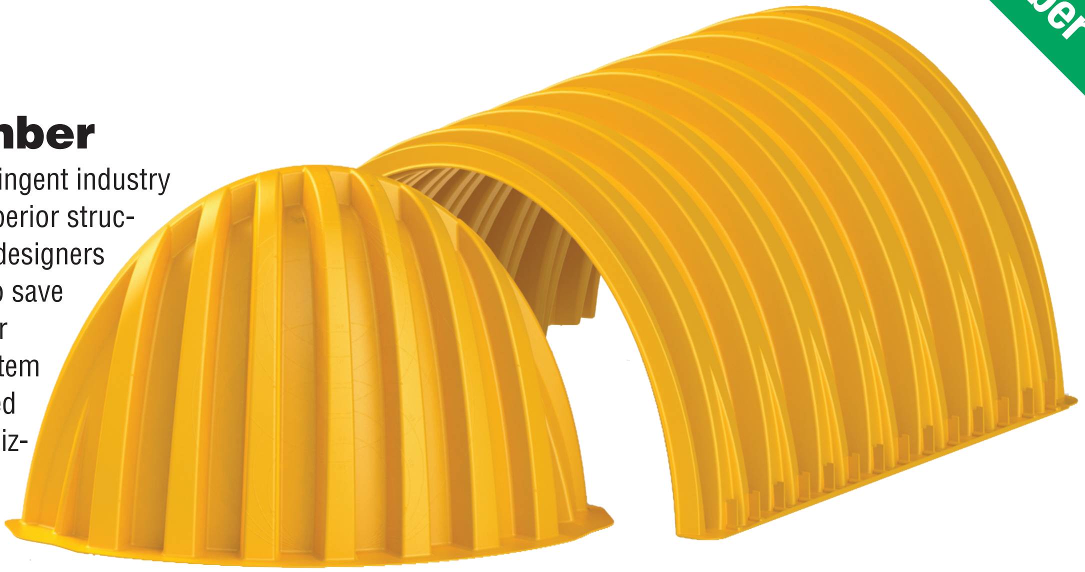
NOTE: Add 0.56 ft³ (0.016 m³) of storage for each additional inch (25 mm) of stone foundation.
Contact StormTech for cumulative volume spreadsheets in digital format.

StormTech®
Detention • Retention • Water Quality

MC-3500 Chamber

StormTech MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots thus maximizing land usage for commercial and municipal applications.



StormTech MC-3500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	90" (2286 mm) x 77" (1956 mm) x 45" (1143 mm)
Chamber Storage	109.9 ft³ (3.11 m³)
Min. Installed Storage*	178.9 ft³ (5.06 m³)
Weight	134 lbs (60.8 kg)

* This assumes a minimum of 12" (305 mm) of stone above, 9" (229 mm) of stone below chambers, 9" (229 mm) of row spacing, and 40% stone porosity.

StormTech MC-3500 End Cap (not to scale)

Nominal End Cap Specifications

Size (L x W x H)	25.7" (653 mm) x 75" (1905 mm) x 45" (1143 mm)
End Cap Storage	14.9 ft³ (0.42 m³)
Min. Installed Storage*	46.0 ft³ (1.30 m³)
Weight	49 lbs (22.2 kg)

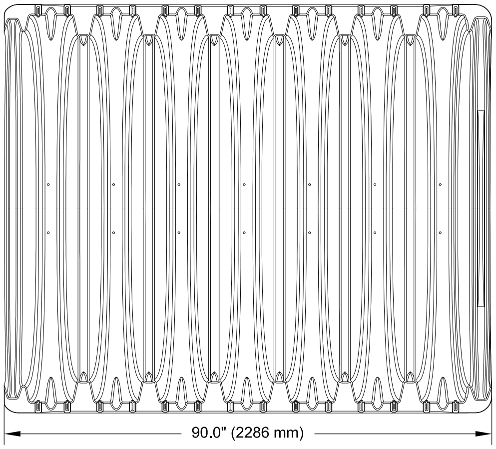
* This assumes a minimum of 12" (305mm) of stone above, 9" (229 mm) of stone below, 9" (229 mm) row spacing, 6" (152 mm) of stone perimeter, and 40% stone porosity.

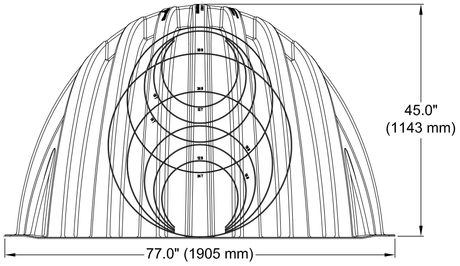
Shipping

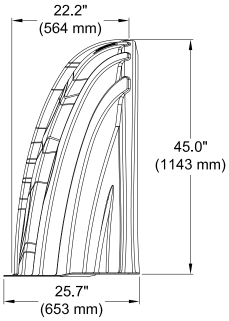
15 chambers/pallet

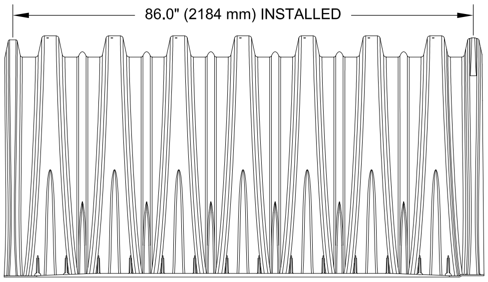
7 end caps/pallet

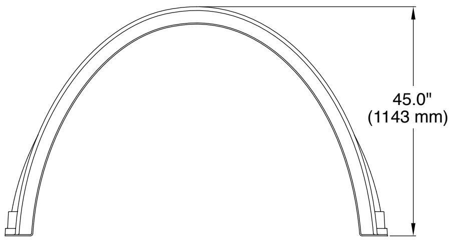
7 pallets/truck











Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
	ft³ (m³)	9 (229)	12 (305)	15 (381)	18 (457)
MC-3500 Chamber	109.9 (3.11)	178.9 (5.06)	184.0 (5.21)	189.2 (5.36)	194.3 (5.5)
MC-3500 End Cap	14.9 (0.42)	46.0 (1.33)	47.7 (1.35)	49.4 (1.40)	51.1 (1.45)

NOTE: Assumes 40% porosity for the stone plus the chamber/end cap volume. End Cap volume assumes 6" (152mm) stone perimeter.

Volume of Excavation Per Chamber/End Cap in yd³ (m³)

	Stone Foundation Depth in. (mm)			
	9 (229)	12 (305)	15 (381)	18 (457)
MC-3500	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)	13.8 (10.5)
End Cap	4.1 (3.1)	4.2 (3.2)	4.4 (3.3)	4.5 (3.5)

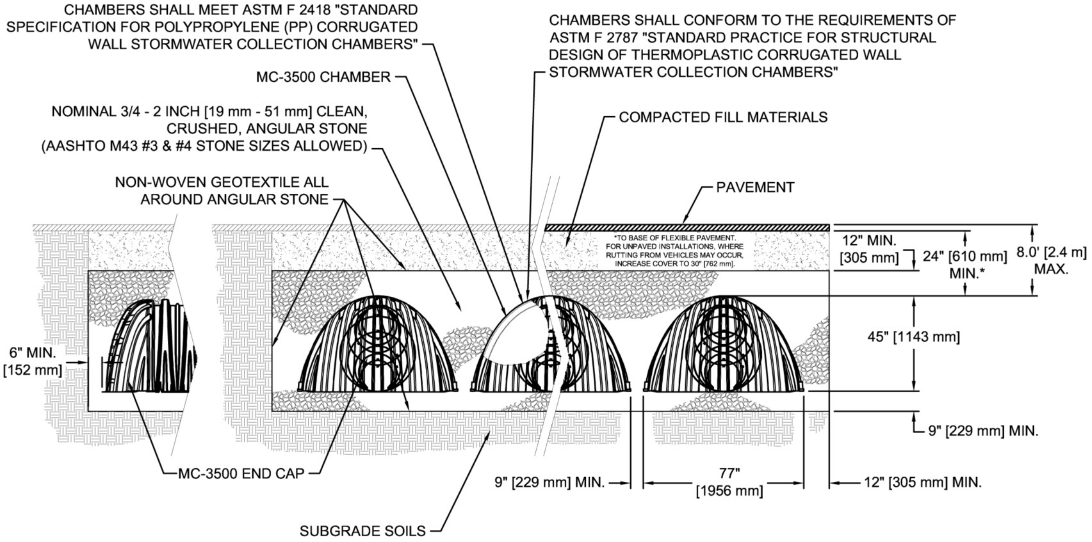
NOTE: Assumes 9" (229 mm) of separation between chamber rows, 6" (152 mm) of perimeter in front of end caps, and 24" (610 mm) of cover. The volume of excavation will vary as depth of cover increases.

Amount of Stone Per Chamber

ENGLISH tons (yd³)	Stone Foundation Depth			
	9 in.	**12 in.**	**15 in.**	**18 in.**
MC-3500	9.1 (6.4)	9.7 (6.9)	10.4 (7.3)	11.1 (7.8)
End Cap	4.1 (2.9)	4.3 (3.0)	4.5 (3.2)	4.7 (3.3)
METRIC kg (m³)	**229 mm**	**305 mm**	**381 mm**	**457 mm**
MC-3500	8220 (4.9)	8831 (5.3)	9443 (5.6)	10054 (6.0)
End Cap	3699 (2.2)	3900 (2.3)	4100 (2.4)	4301 (2.6)

NOTE: Assumes 12" (305 mm) of stone above, and 9" (229 mm) row spacing, and 6" (152mm) of perimeter stone in front of end caps.

General Cross Section



NOTES:

1. THIS CROSS SECTION PROVIDES GENERAL INFORMATION FOR THE MC-3500 CHAMBER. STORMTECH MC-3500 CHAMBERS MUST BE DESIGNED AND INSTALLED IN ACCORDANCE WITH THE MC-3500 DESIGN MANUAL AND MC-3500 CONSTRUCTION GUIDE.
2. PROPERLY INSTALLED MC-3500 CHAMBERS PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR EARTH AND LIVE LOADS WITH CONSIDERATION FOR IMPACT AND MULTIPLE PRESENCES.
3. PERIMETER STONE MUST ALWAYS BE BROUGHT UP EVENLY WITH BACKFILL OF BED. PERIMETER STONE MUST EXTEND HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH STRAIGHT OR SLOPED SIDEWALLS.

StormTech®
Detention • Retention • Water Quality
A division of ADS

70 Inwood Road, Suite 3 | Rocky Hill | Connecticut | 06067
860.529.8188 | 888.892.2694 | fax 866.328.8401 | fax 860-529-8040 | www.stormtech.com

S150909 03/2014

Printed on recycled paper ♻

Appendix J – Background Information

Plan & Profile – Victor Street, Oliver Mangione McCalla, Dwg 83-3638-1 to 6. (8.5x11 Reduction)

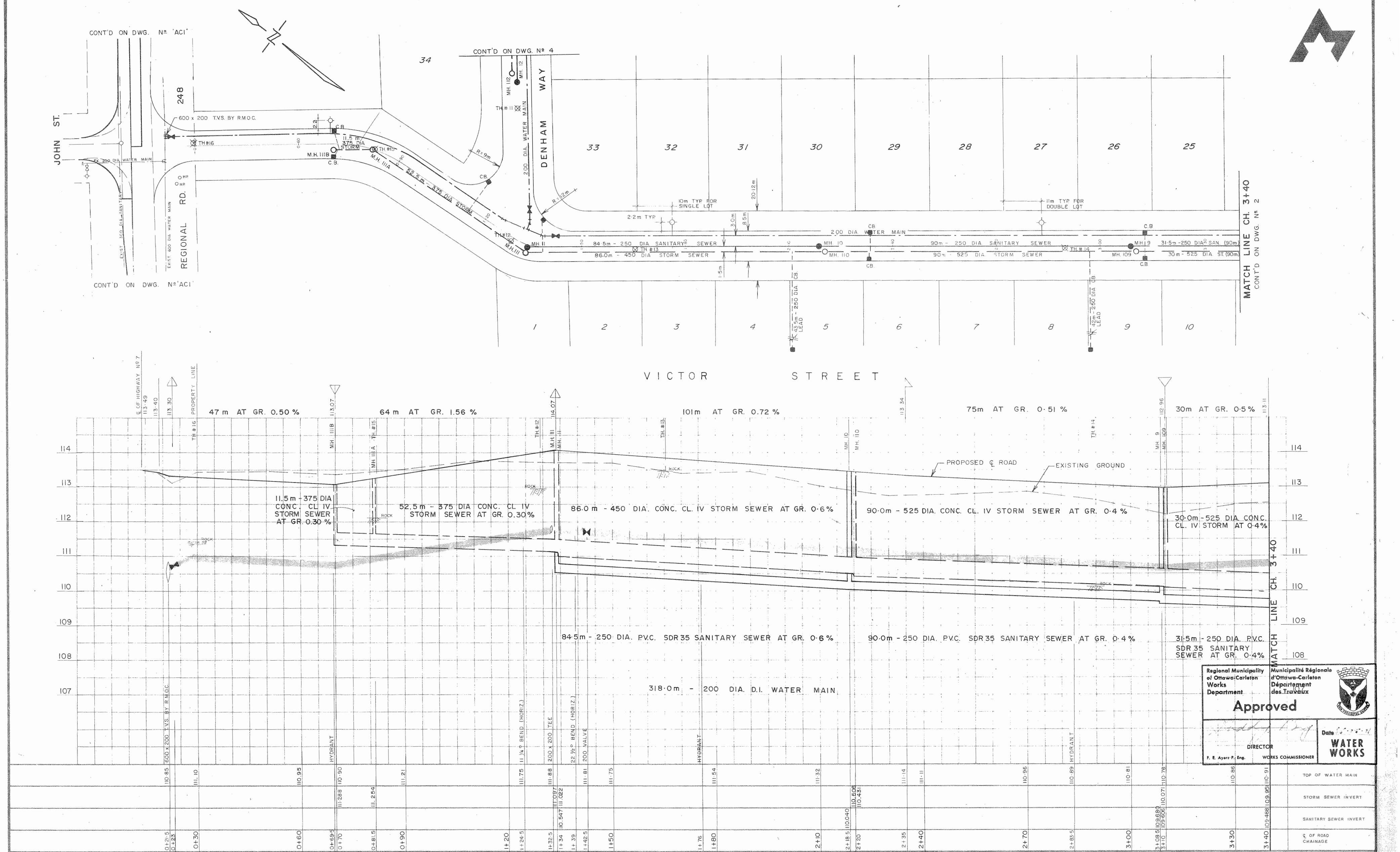
Grading Plan, Oliver Mangione McCalla, Dwg 83-3638-GR1. (8.5x11 Reduction)

Grade Control Plan, UMA, Dwg G1 (8.5x11 Reduction)

Savage Drive, Kostuch Eng. Dwg 5, 6, 8 (8.5x11 Reductions)

Site Services Plan – Amber Terrace, McIntosh Perry, Dwg C1.2. (8.5x11 Reduction)

Plan & Profile – Hazeldean Road Widening, McCormick Rankin. Dwg 022. (8.5x11 Reduction)



Regional Municipality of Ottawa-Carleton Works Department

Municipalité Régionale d'Ottawa-Carleton Département des Travaux

Approved

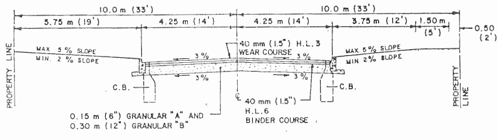
DIRECTOR

F. E. Ayers P. Eng.

WORKS COMMISSIONER

Date

WATER WORKS



TYPICAL ROAD CROSS - SECTION

N. T. S.

"WATERMAINS AND SERVICE CONNECTIONS TO RECEIVE FROST PROTECTION AS REQUIRED, PER R.M.O.C. STANDARDS AND SPECIFICATIONS"

No.	REVISIONS	DATE	BY
3.	REV. STREET NAMES PER R.M.O.C.	MAY. 88	R.B.
2.	GENERAL REVISIONS	MAR. 85	JM
1.	REVISED ~~AS~~ PER TOWNSHIP ENGINEERS	31/1/85	W.D.D.

APP'D

DESIGN S. J. P.
DRAWN W. D. D.
CHECKED J. N. S.

CLIENT HARVEY GREER

PROJECT AMBERWAY SUBDIVISION **3230-1**

TITLE
PLAN & PROFILE
VICTOR STREET - HWY. No. 7 to CH. 3+40

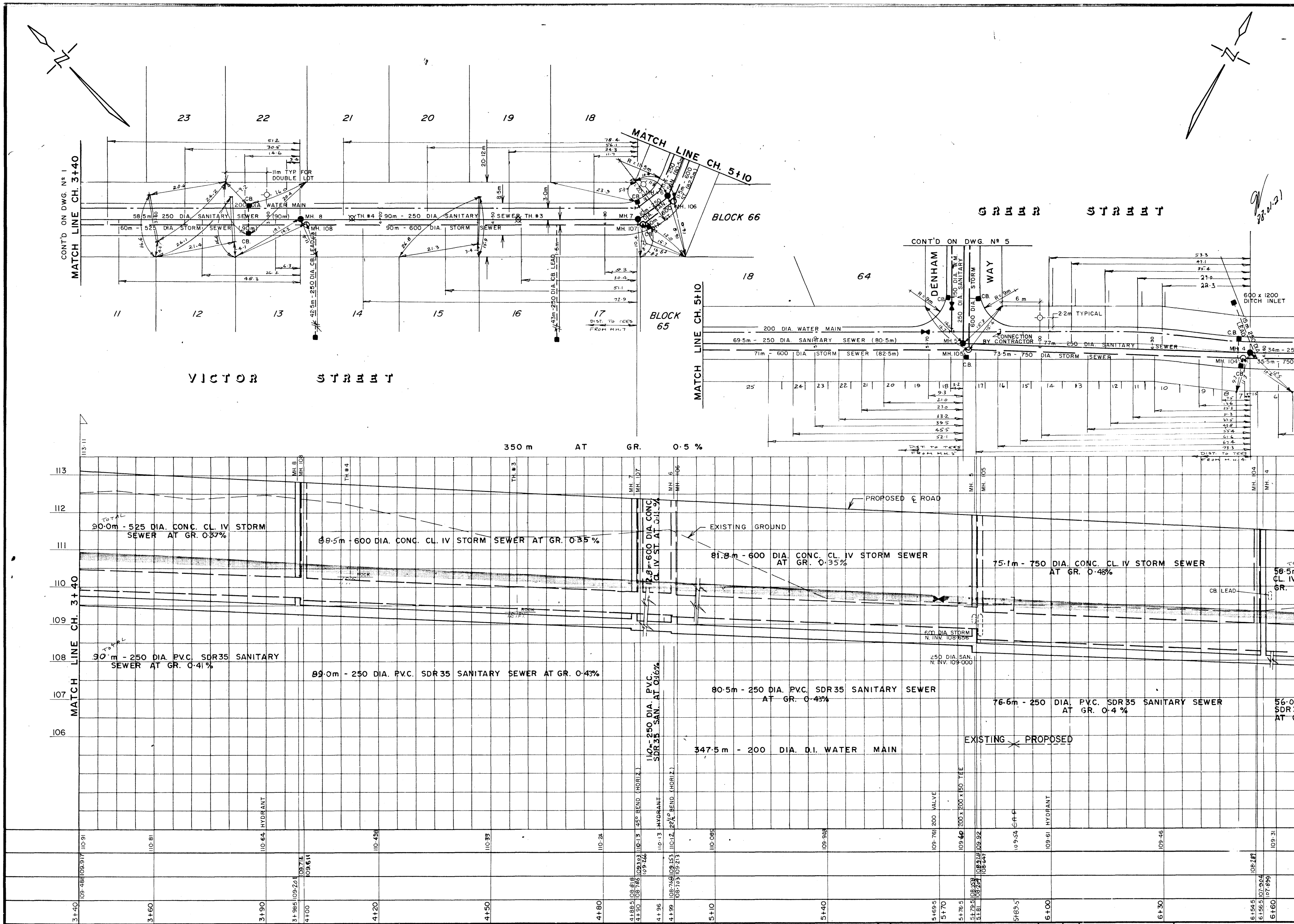
OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Ottawa

DATE AUGUST, 1984

SCALE HORIZ. - 1:500 VERT. - 1:50

DRAWING No. 83-3638-1

REV 2



REG. MUN. OF OTTAWA-CARLETON

ENGINEERING DIVISION **REVISED**

Regional Municipality of Ottawa-Carleton Works Department
Municipalité Régionale d'Ottawa-Carleton Département des Travaux

Approved

M. J. Willmott
For DIRECTOR
R.O. Pickard WORKS COMMISSIONER

Date 15 JAN 88

WATER WORKS

No.		DATE	BY
8.	REV. PER R.M.O.C.	14/01/88	M.W.
7	STREET NAME CHANGE AS PER T.W.P.	30/10/87	G.U.
6.	AS BUILTS	11/2/87	J.B.
5	LOT NUMBERS REV. AS PER DRAFT M-PLAN	3/9/85	M.J.M.
4.	REV. BLOCKLAND NUMBERS & DITCH INLET	14/6/85	W.D.D.
3.	ADDED LOTS & CB's TO BLOCKS 65 & 68	23/5/85	W.D.D.
2	GENERAL REVISIONS	MAR. 85	JM
1.	REV. AS PER TOWNSHIP ENGINEERS	31/1/85	W.D.D.

R E V I S I O N S

J. N. Sawarna
APP'D 22 Dec 87

DESIGN S. J. P.
DRAWN W. D. D.
CHECKED J. N. S.

CLIENT
HARVEY GREER 3230-2

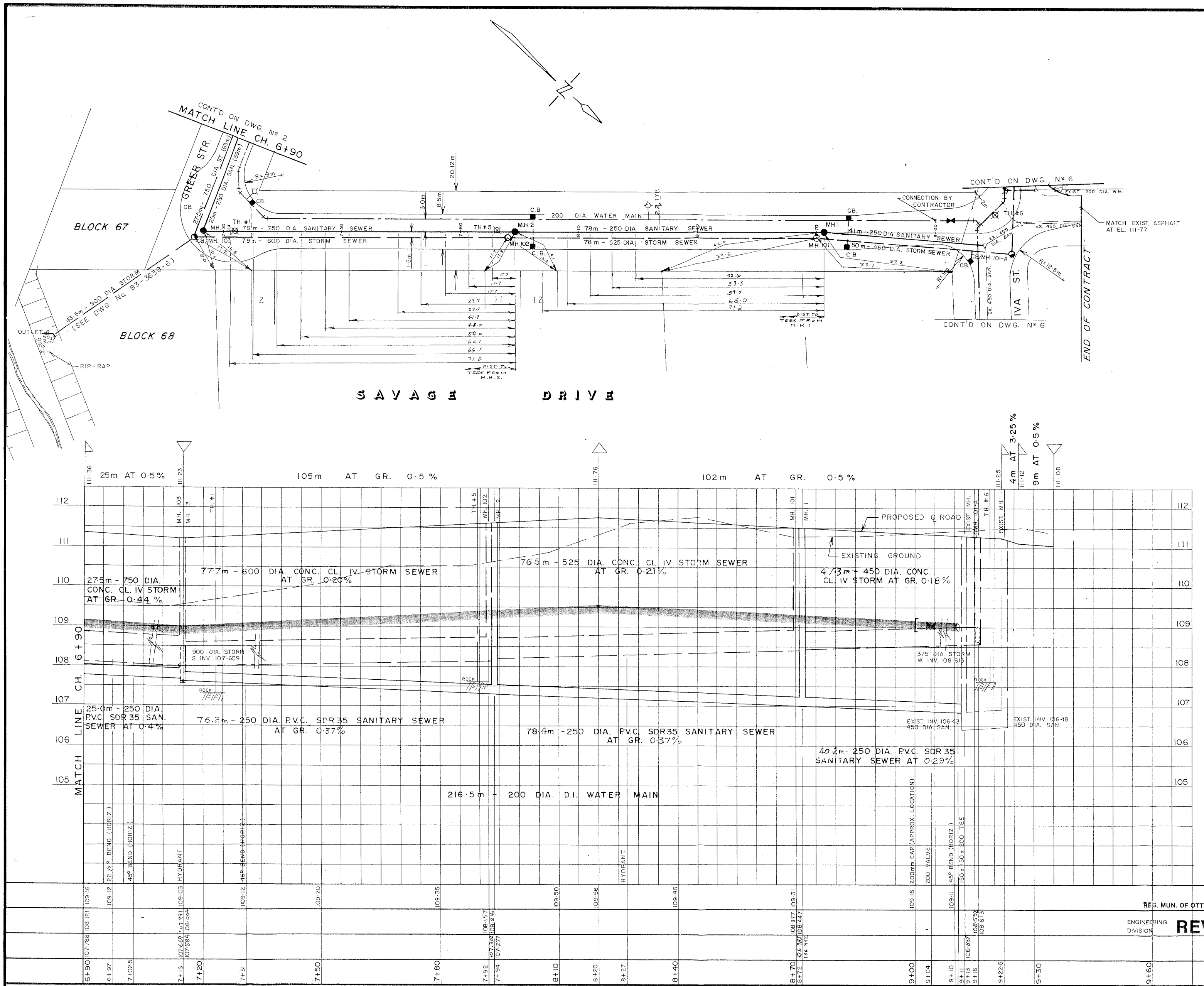
PROJECT
AMBERWAY SUBDIVISION

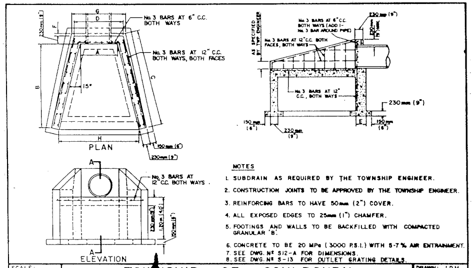
TITLE
PLAN & PROFILE
VICTOR & GREER STR. - CH. 3+40 to CH. 6+90

OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Ottawa

DATE AUGUST, 1984
SCALE HORIZ. - 1:500 VERT. - 1:50
DRAWING No 83-3638-2
REV 7.

K+E





NOTES

1. SUBDRAIN AS REQUIRED BY THE TOWNSHIP ENGINEER.
2. CONSTRUCTION JOINTS TO BE APPROVED BY THE TOWNSHIP ENGINEER.
3. REINFORCING BARS TO HAVE 50mm (2") COVER.
4. ALL EXPOSED EDGES TO 25mm (1") CHAMFER.
5. FOOTINGS AND WALLS TO BE BACKFILLED WITH COMPACTED GRANULAR 'B'.
6. CONCRETE TO BE 20 MPa (3000 P.S.I.) WITH 5-7% AIR ENTRAINMENT.
7. SEE DWG. Nº S12-A FOR DIMENSIONS.
8. SEE DWG. Nº S-13 FOR OUTLET GRATING DETAILS.

SCALE: N.T.S.
REVISION DATE

TOWNSHIP OF GOULBOURN

CONCRETE ENDWALL WITH APRON FOR STORM SEWER OUTLET

DRAWN: L.D.M.
CHECKED:
DWG. Nº: S-12

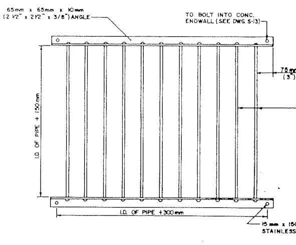
ENDWALL DIMENSIONS										ENDWALL DIMENSIONS									
PIPE DIAMETER IN INCHES										PIPE DIAMETER IN mm.									
	24"	27"	30"	36"	42"	48"	54"	60"	72"		600	675	750	900	1050	1200	1350	1500	1800
A	3'-6"	3'-9"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"	7'-6"	A	1100	1150	1250	1400	1550	1700	1850	2000	2300
B	8'-0"	8'-0"	8'-0"	8'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'0"	B	2450	2450	2450	2450	3050	3050	3050	3050	3050
C	9'-1"	9'-1"	9'-1"	9'-1"	11' 4"	11' 4"	11' 4"	11' 4"	11'4"	C	2800	2800	2800	2800	3450	3450	3450	3450	3450
D	4'-8"	4'11"	5'-2"	5'-8"	6'-2"	6'-8"	7' 2"	7' 8"	8'8"	D	1450	1500	1600	1750	1900	2050	2200	2350	2650
E	1'-0"	1'-0"	1'-0"	1'-0"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	E	350	350	350	350	400	400	400	400	400
F	3"	3"	3"	3"	6"	6"	6"	6"	6"	F	75	75	75	75	150	150	150	150	150
G	5'-1"	5'-4"	5'-7"	6'-1"	6'10"	7'-4"	7'10"	8'-4"	9'4"	G	1550	1650	1700	1850	2100	2250	2400	2550	2850
H	7'10"	8'-1"	8'-4"	8'-10"	10'4"	10'10"	11'4"	11'10"	12'10"	H	2400	2500	2550	2700	3150	3300	3450	3600	3900

SCALE N/A
REVISION DATE

TOWNSHIP OF GOULBOURN

ENDWALL DIMENSIONS FOR S-12

DRAWN: M.M.G.
CHECKED:
DWG. NO: S-12A



NOTES

1. SCREENS TO BE INSTALLED ON ALL SEWERS 450mm ø - 1350mm ø (18"-54") PIPES LARGER THAN 1350mm ø (54") REQUIRE SPECIAL DESIGN.
2. ALL PARTS OF SCREEN TO BE HOT DIP GALVANIZED AFTER ASSEMBLY.
3. VERTICAL BARS FOR INLET, HORIZONTAL BARS FOR OUTLET.

SCALE: N.T.S.
REVISION DATE: JULY 14, 1980

TOWNSHIP OF GOULBOURN

STORM SEWER OUTLET GRATING DETAIL

DRAWN: L.D.M.
CHECKED:
DWG. Nº: S-13

Regional Municipality of Ottawa-Carleton Works Department
Municipalité Régionale d'Ottawa-Carleton Département des Travaux

Approved

M. Gillmett
[illegible]
For DIRECTOR
R.O. Pickard WORKS COMMISSIONER

Date 15 JAN 88

WATER WORKS

REG. MUN. OF OTTAWA-CARLETON
ENGINEERING DIVISION **REVISED**
88.01.21

TOP OF WATER MAIN
STORM SEWER INVERT
SANITARY SEWER INVERT
℄ OF ROAD or SANITARY SEWER CHAINAGE

No.		DATE	BY
8.	REV. PER R.M.O.C.	14/01/88	M.W.
7.	STREET NAME CHANGE AS PER TWP.	30/10/87	G.U.
6.	AS BUILTS	11/2/87	J.B.
5	LOT NUMBERS REV. AS PER DRAFT M-PLAN	3/9/85	M.J.M.
4.	ADDED LOT NUMBERS TO BLOCKS	18/6/85	W.D.D.
3.	ADDED LOTS & CB's TO BLOCKS 65 & 66	23/5/85	W.D.D.
2.	REV. AS PER TOWNSHIP ENGINEERS	28/3/85	W.D.D.
1.	REV. AS PER TOWNSHIP ENGINEERS	31/1/85	J.M.

REVISIONS

APP'D Stevana 22 Dec 87

DESIGN S. J. P.
DRAWN W. D. D.
CHECKED J. N. S.

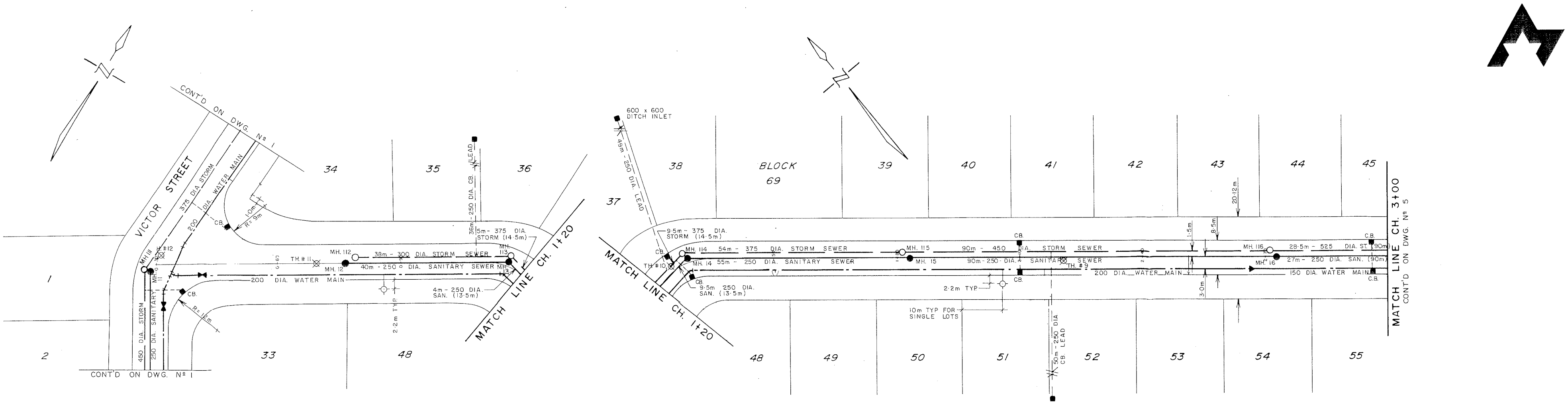
CLIENT
HARVEY GREER 3230-3

PROJECT
AMBERWAY SUBDIVISION

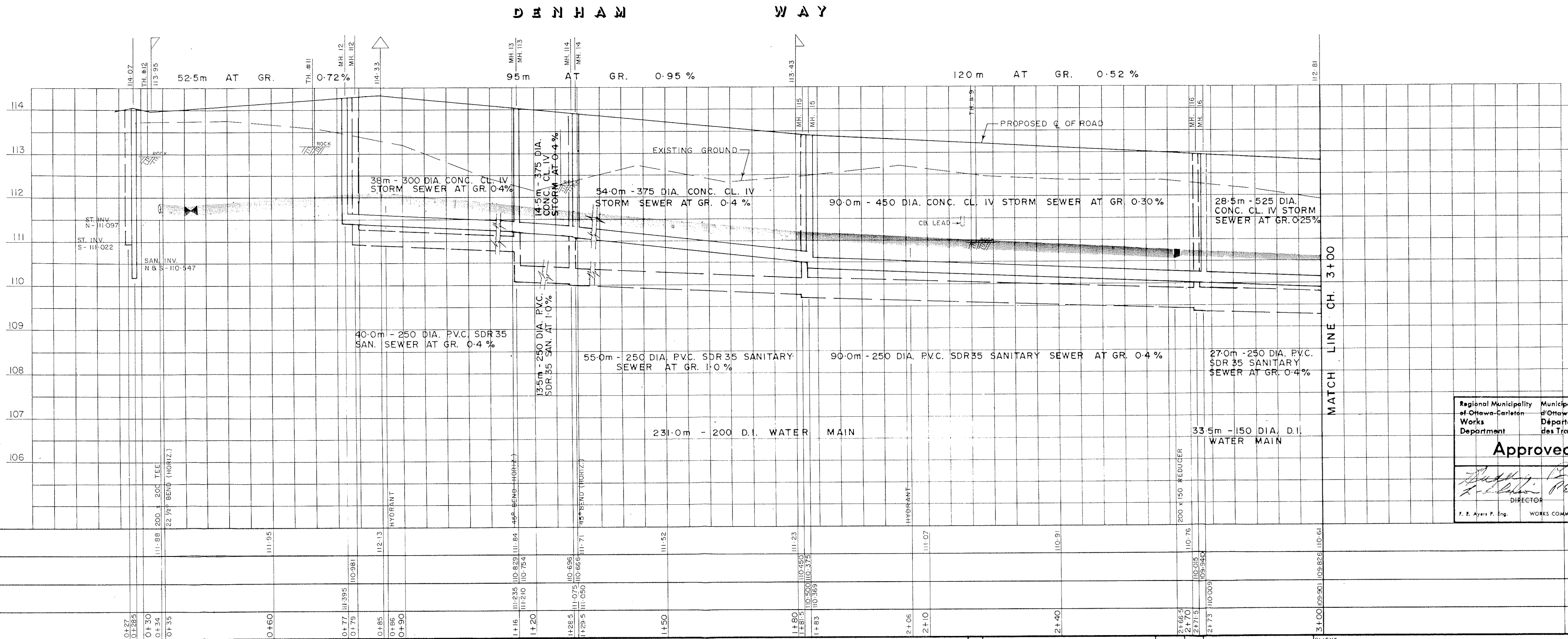
TITLE
PLAN & PROFILE
GREER ST. - CH. 6+90 to CH. 7+15
SAVAGE DR. - CH. 7+15 to IVA ST.

OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Ottawa

DATE	SCALE	DRAWING No	REV
AUGUST, 1984	HORIZ. - 1:500 VERT. - 1:50	83-3638 - 3	7.



DENHAM WAY



Regional Municipality of Ottawa-Carleton
Works Department
Municipalité Régionale d'Ottawa-Carleton
Département des Travaux

Approved

DIRECTOR
F. E. Ayers P. Eng.
WORKS COMMISSIONER

Date 85-05-3

WATER WORKS

"WATERMAINS AND SERVICE CONNECTIONS TO RECEIVE FROST PROTECTION AS REQUIRED, PER R.M.O.C. STANDARDS AND SPECIFICATIONS"

No.	REVISIONS	DATE	BY
3.	REV. STREET NAMES PER R.M.O.C.	MAY 88	R.B.
2.	GENERAL REVISIONS	MAR 85	JM
1.	REV. PER TOWNSHIP ENGINEERS	1/2/85	W.D.D.

APP'D

DESIGN S. J. P.
DRAWN W. D. D.
CHECKED J. N. S.

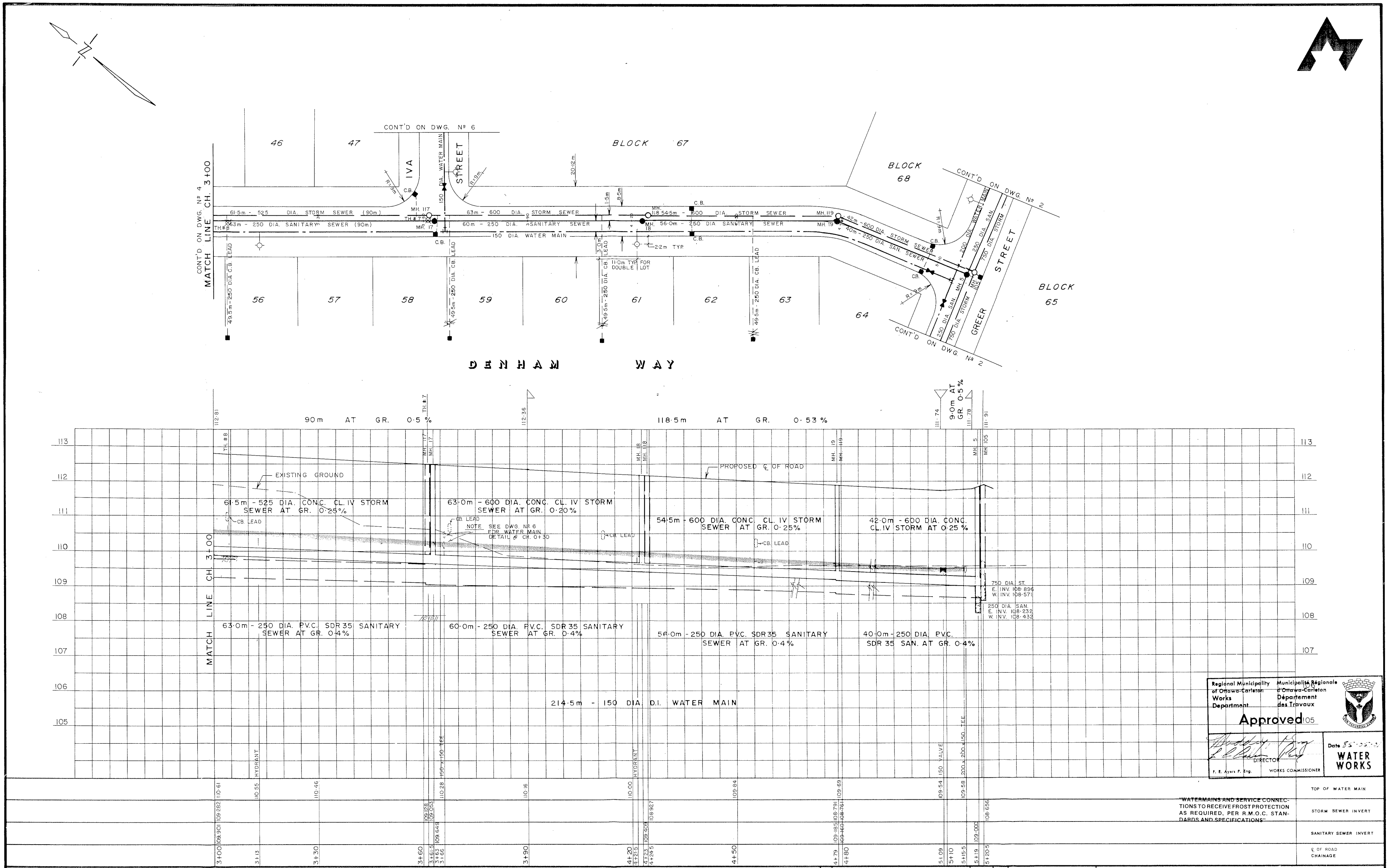
CLIENT
HARVEY GREER

PROJECT
AMBERWAY SUBDIVISION 3230-4

TITLE
PLAN & PROFILE
DENHAM WAY - VICTOR ST. to CH. 3+00

OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Ottawa

DATE AUGUST, 1984
SCALE HORIZ. - 1:500 VERT. - 1:50
DRAWING No 83 - 3638 - 4
REV 2



Regional Municipality of Ottawa-Carleton Works Department
Municipalité Régionale d'Ottawa-Carleton Département des Travaux

Approved

DIRECTOR

F. E. Ayers P. Eng. WORKS COMMISSIONER

Date 85-05-21

WATER WORKS

"WATERMAINS AND SERVICE CONNECTIONS TO RECEIVE FROST PROTECTION AS REQUIRED, PER R.M.O.C. STANDARDS AND SPECIFICATIONS"

No.		DATE	BY
3	REV. STREET NAMES PER R.M.O.C.	MAY 88	R.B.
2	GENERAL REVISIONS	MAR 85	JM
1	REVISED PER TWP. ENGINEERS	1·31·85	JM

REVISIONS

APP'D

DESIGN S. J. P.
DRAWN W. D. D.
CHECKED J. N. S.

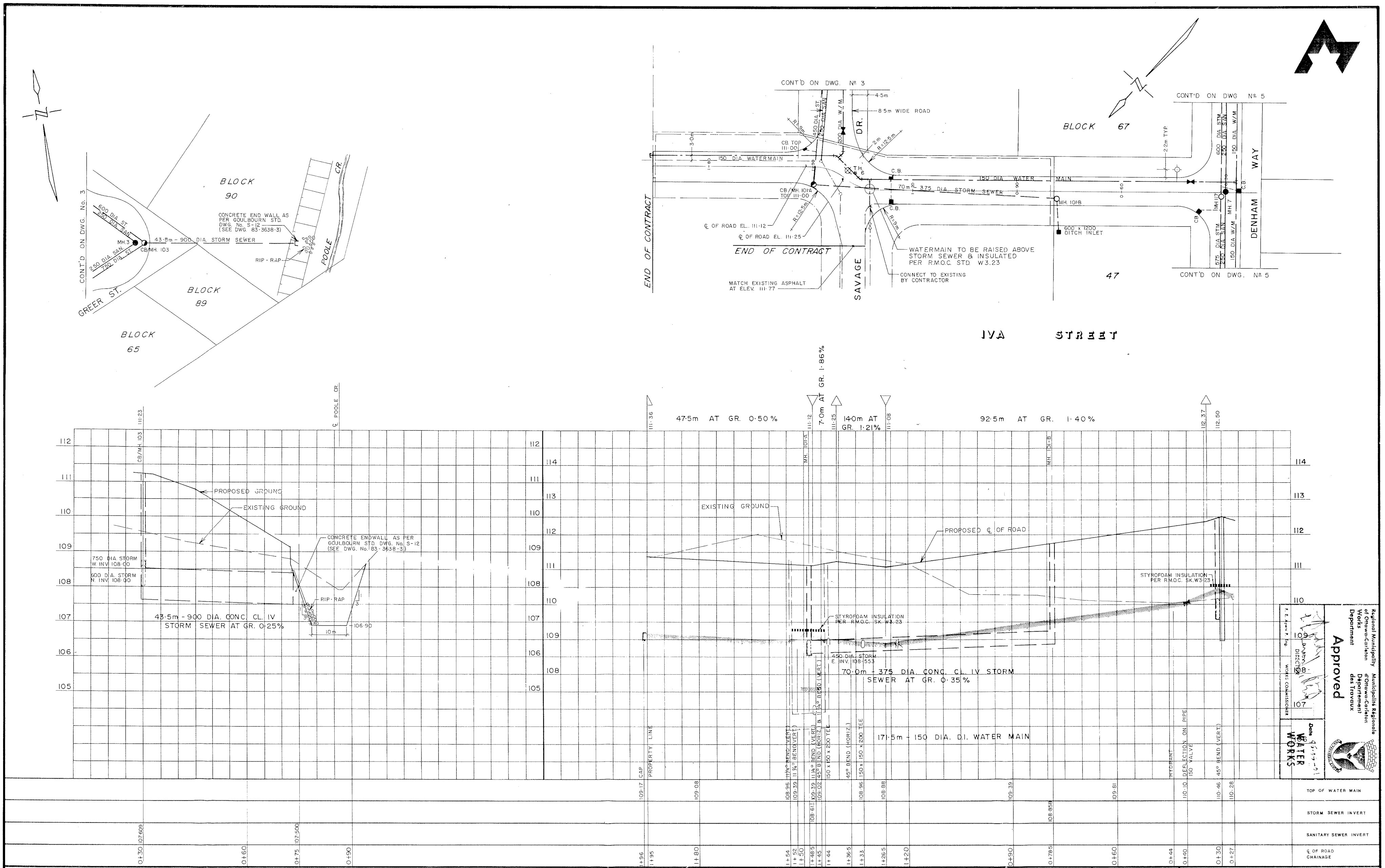
CLIENT
HARVEY GREER

PROJECT
AMBERWAY SUBDIVISION 3230-5

TITLE
PLAN & PROFILE
DENHAM WAY - CH. 3+00 to GREER ST.

OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting · Engineers
Ottawa

DATE AUGUST, 1984
SCALE HORIZ. - 1:500 VERT. - 1:50
DRAWING No 83-3638-5
REV 2



Regional Municipality of Ottawa-Carleton Works Department
Municipalité Régionale d'Ottawa-Carleton Département des Travaux

Approved

DIRECTOR

WORKS COMMISSIONER

Date 95-07-01

WATER WORKS

No.		DATE	BY
1	REV. STREET NAMES PER R.M.O.C.	MAY 88	R.B.

R E V I S I O N S

APP'D

DESIGN S. J. P.
DRAWN W. D. D.
CHECKED J. N. S.

CLIENT
HARVEY GREER

PROJECT
AMBERWAY SUBDIVISION 3230-6

TITLE
PLAN & PROFILE
IVA STREET - DENHAM WAY to CH. 1+96
STORM OUTLET - GREER ST. to POOLE CREEK

OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Ottawa

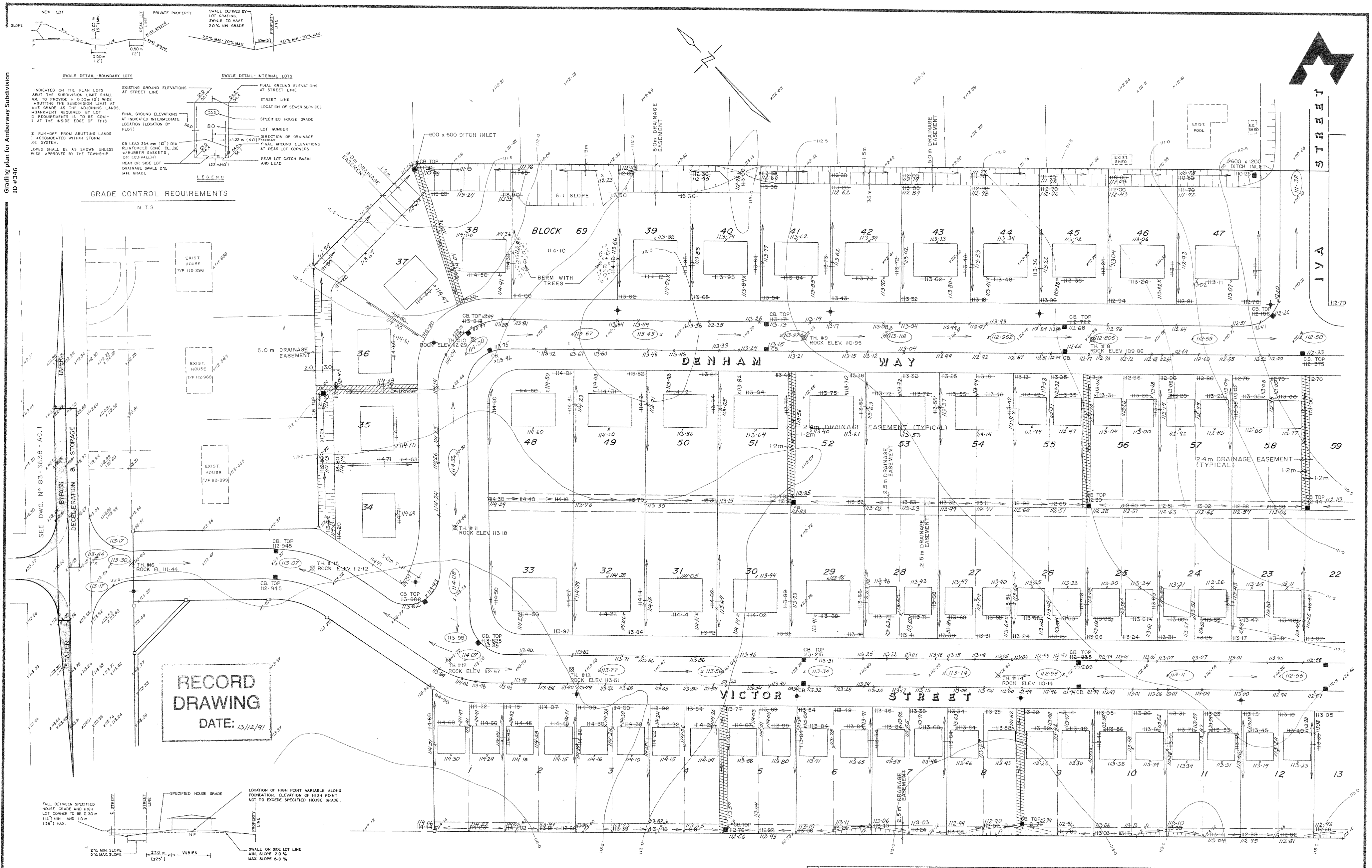
DATE MARCH, 1985
SCALE HORIZ. - 1:500 VERT. - 1:50
DRAWING No 84-3638-6
REV

NCC #350-015   File #1

VICTOR STREET

Grading plan for Amberway Subdivision

ID #346



NOTES:

1. IF ATTACHED GARAGE CONSTRUCTED THEN REAR YARD SLOPE MAY COMMENCE AT REAR GARAGE WALL.
2. ALL FOUR CORNERS SHALL BE LABELLED WITH EXISTING AND PROPOSED ELEVATIONS.
3. SLOPE FROM SPECIFIED HOUSE GRADE TO REAR LOT SWALE TO BE 2.0% MIN. AND 7.0% MAX. GRADING OVER 7.0% SHALL BE TERRACED.
4. IF A PROTECTIVE APRON IS REQUIRED AROUND THE FOUNDATION, GRADING SHOULD BE KEPT 0.15 m (6") BELOW SPECIFIED HOUSE GRADE. ALL GRADING TO REMAIN 2.0% MIN.
5. ALL SLOPES SHALL BE AS SHOWN UNLESS OTHERWISE APPROVED BY TOWNSHIP.
6. SEE M-2 FOR DETAILED LOT DIMENSIONS.

GRADE CONTROL-TYPICAL FRONT AND REAR LOT DRAINAGE

N. T. S.

NOTE

1. U.S.F. = FINISHED FIRST FL. – 2·84
2. SEE SUBDIVISION AGREEMENT FOR PARK DEVELOPMENT.

LEGEND

x113·05	EXISTING ELEVATION
114·15	*AS BUILT ELEVATION*
~~114·03~~	PROPOSED ELEVATION
114·53	PROPOSED FINISHED FIRST FLOOR ELEVATION
x(113·57)	PROPOSED ROAD ELEVATION
■	PROPOSED CATCH BASIN
⊠	TEST HOLE
●	PROPOSED STREET LIGHT
x114·32	*AS BUILT GARAGE FLOOR ELEVATION*

No.	REVISIONS	DATE	BY
6	*RECORD DRAWING*	13/12/91	G.U.
5.	STREET NAME CHANGE AS PER TWP.	30/10/87	G.U.
4	LOT NUMBERS REV. AS PER DRAFT M-PLAN	3/9/85	M.J.M.
3	REV. BLOCK NUMBER & ADDED ST. LIGHTS	17/6/85	W.D.D.
2	ADDED BYPASS & ACCESS LANE HWY. 7	MAR25·85	JM
1.	REV. AS PER TOWNSHIP ENGINEERS	4/2/85	W.D.D.

APP'D

DESIGN S.J.P.
DRAWN J.T.
CHECKED J.N.S.

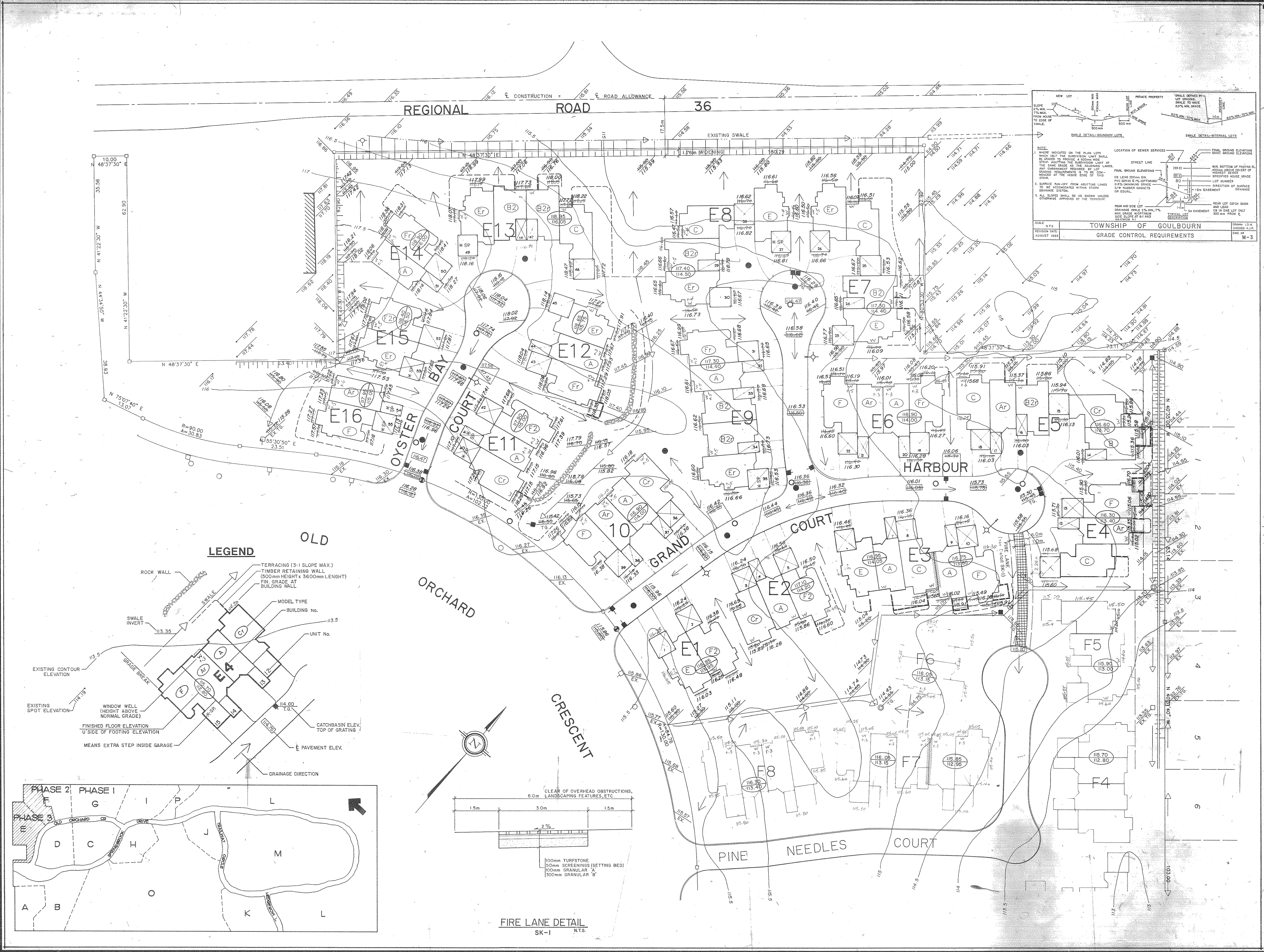
CLIENT
HARVEY GREER

PROJECT
AMBERWAY SUBDIVISION

TITLE
GRADING PLAN

OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Ottawa, Ontario

DATE	SCALE	DRAWING Nº	REV.
SEPTEMBER 1984	1 : 500	83 - 3638 - GR.1	6



NOTE:

1. WHERE INDICATED ON THE PLAN LOTS WHICH ABUT THE SUBDIVISION LIMIT SHALL BE GRADED TO PROVIDE A 500mm WIDE STRIP, ABUTTING THE SUBDIVISION LIMIT AT THE SAME GRADE AS THE ADJOINING LANDS. ANY EMBANKMENT REQUIRED BY LOT GRADING REQUIREMENTS IS TO BE COMMENCED AT THE INSIDE EDGE OF THIS STRIP.
2. SURFACE RUN-OFF FROM ABUTTING LANDS TO BE ACCOMODATED WITHIN STORM DRAINAGE SYSTEM.
3. ALL SLOPES SHALL BE AS SHOWN UNLESS OTHERWISE APPROVED BY THE TOWNSHIP.

SCALE: N.T.S.	TOWNSHIP OF GOULBOURN	DRAWN: L.D.M. CHECKED: A.J.R.
REVISION DATE: AUGUST 1985	GRADE CONTROL REQUIREMENTS	DWG. Nº M-3.

K+E

notes:

L. M. ERION

RECORD DRAWING
GRADING ELEVATIONS

no.	revision	date	by
3	AS BUILT ELEVATIONS TAKEN ON NOV, 29/90	7/02/91	R.B
2	REVISED T.H. BLOCKS E3 & E13 AND CURB RADIUS AT T.H. BLOCK E6	28/04/89	R.G.V.
1	ADDED FIRE LANE & DETAIL SK-1	15/03/89	R.G.V.
0	ISSUED FOR APPROVAL	28/02/89	R.G.V.

TAMARACK
DEVELOPMENTS CORPORATION

UMA Engineering Ltd.
Engineers & Planners
Ottawa, Ontario

AMBERWOOD VILLAGE
PHASE I

[redacted]

GRADE CON
PLAN

Grading Plan

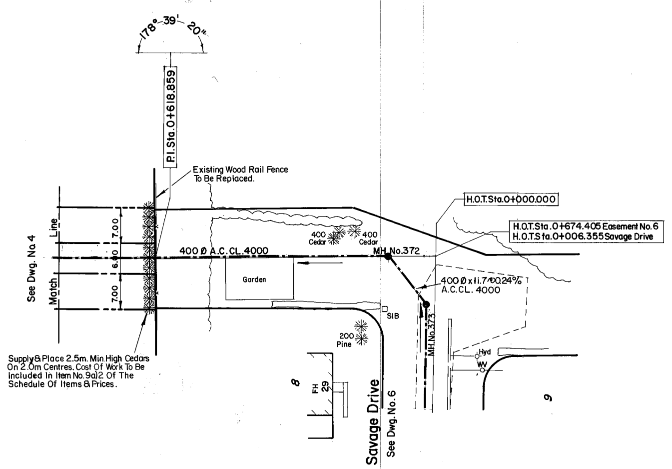
NCC #350-014 File #62
GRAND HARBOUR COURT
Grading plan for Amberwood Village Phase 3
ID #939

date: JANUARY 1989	scale:
drawn: R.G.V.	job no. 5772 - 003
checked:	drwg. no. G1
rev. no.: ZERO	

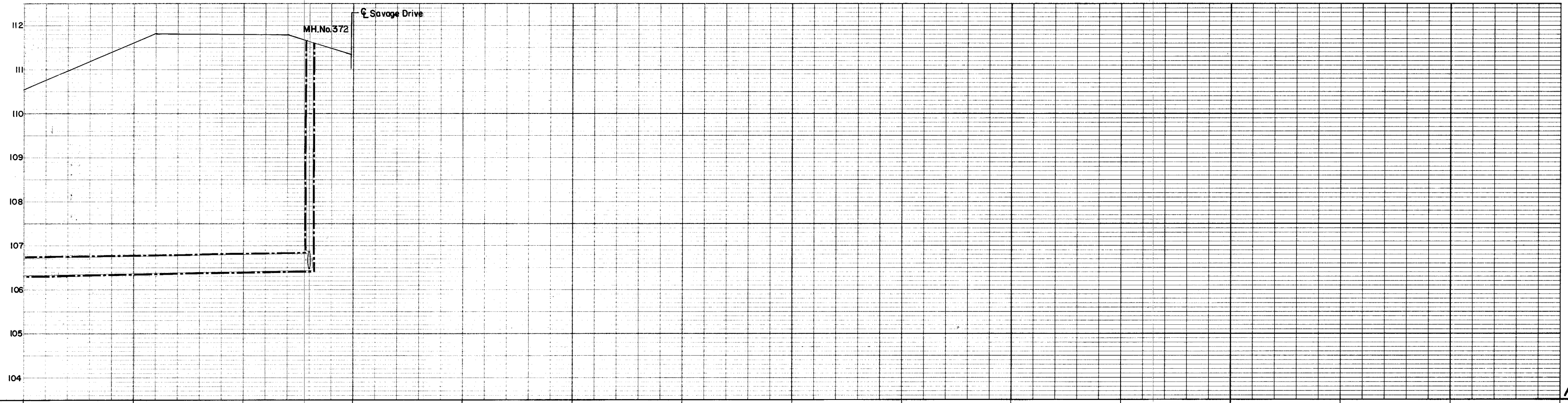
METRIC G0-245

All Dimensions Are In Millimetres And/Or Metres Unless Shown Otherwise.

All Underground Utilities Are Approximate. Contractor Is Required To Notify The Utility Before Excavating



Supply & Place 2.5m. Min.High Cedars On 2.0m Centres. Cost Of Work To Be Included In Item No.9a)2 Of The Schedule Of Items & Prices.



AS BUILT

EXISTING GRADE	110.550	111.810	111.800		111.350
WATER MAIN TOP OF PIPE ELEVATION					
SANITARY SEWER INVERT ELEVATION	400 ø X 119.8 @ 0.20%			106.441 E 106.476 N	
STORM SEWER INVERT ELEVATION					
CHAINAGE	0+600	0+625	0+650	+665.027	+674.405 0+675

D. McMANUS

No.	BY	DATE	REVISION
	T.Mc.	Feb.17/82	AS BUILT

SCALE (METRIC)
0 5 10 20m HORIZONTAL
0 0.5 1 2m VERTICAL

DESIGN D.M.	CHKD M.J.H.
DRAWN E.C.	CHKD D.M.
APPROVED	
W.P. No. 949	

KOSTUCH ENGINEERING LIMITED
CONSULTING ENGINEERS
BROCKVILLE · OTTAWA · BELLEVILLE · CORNWALL

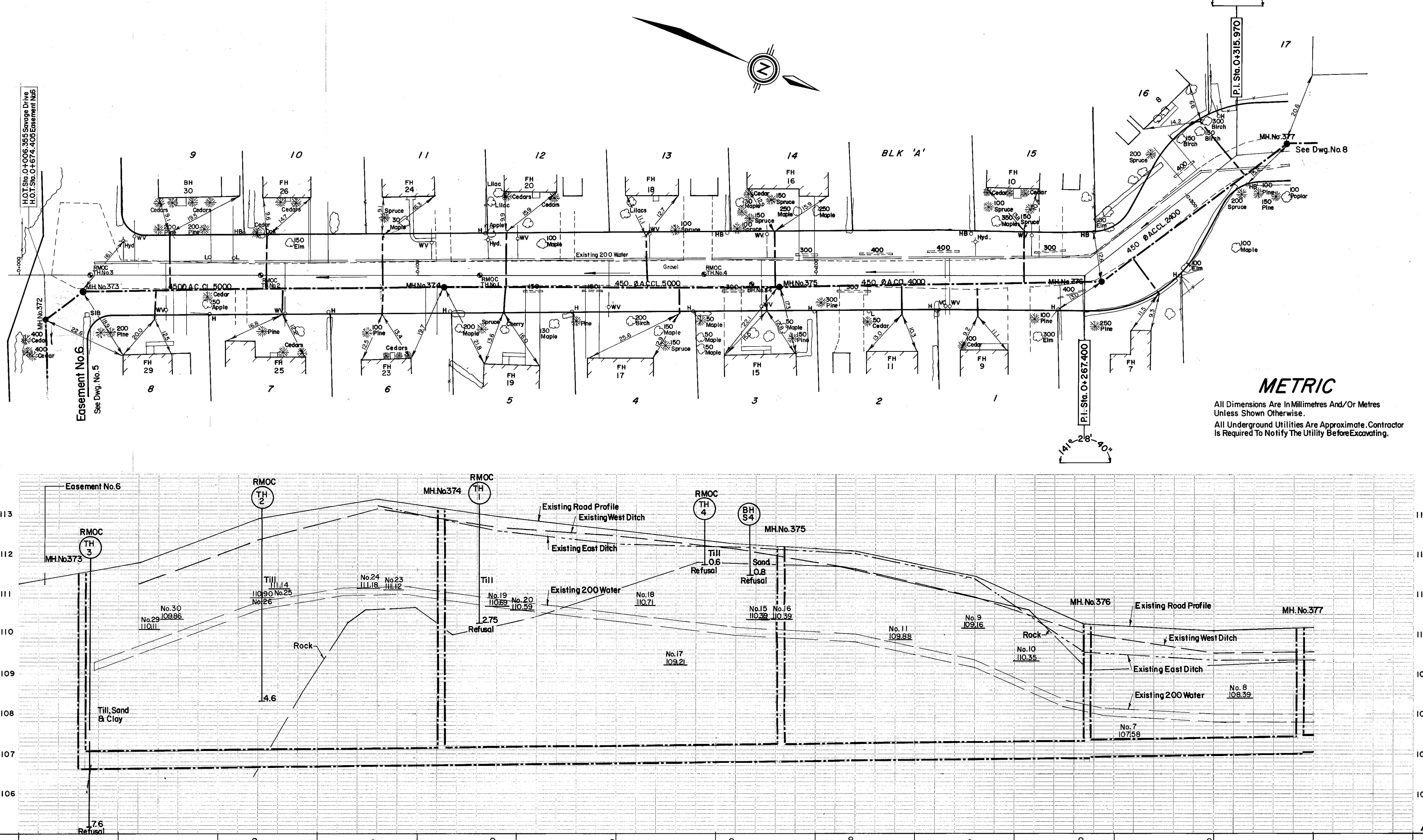
Ontario

Ministry Of The Environment
Sewage Works Project No. 1-0127
Township Of Goulbourn
Stittsville Sanitary Sewers

EASEMENT No.6
STA.0+600 to STA. 0+675

DATE DRAWN MAY 1, 1978
CONT. No. 6
DRAWING No. 5
REV. No. -

G0-245



METRIC

All Dimensions Are In Millimetres And/Or Metres Unless Shown Otherwise.

All Underground Utilities Are Approximate. Contractor Is Required To Notify The Utility Before Excavating.

AS BUILT

EXISTING GRADE	111.250		111.790	112.890		113.390		112.930	112.600	112.260		112.080		111.420	110.240		110.080			EXISTING GRADE
WATER MAIN TOP OF PIPE ELEVATION																				WATER MAIN TOP OF PIPE ELEVATION
SANITARY SEWER INVERT ELEVATION		106.502S 106.534N	450 ø X 90.40 @ 0.15%				106.672 S 106.665 N	450 ø X 85.10 @ 0.15%			106.795 S 106.803 N	450 ø X 80.80 @ 0.15%			106.917 S 106.940 N	450 ø X 57.80 @ 0.15%		107.030 S 107.054 N		SANITARY SEWER INVERT ELEVATION
STORM SEWER INVERT ELEVATION																				STORM SEWER INVERT ELEVATION
CHAINAGE	0+000	+015.855	0+025	0+050	0+075	0+100	+106.100	0+125	0+150	0+175	+191.250	0+200	0+225	0+250	+268.300	0+275	0+300	+321.650	0+325	CHAINAGE

No.	BY	DATE	REVISION
	T.Mc.	Feb.17/82	AS BUILT

SCALE (METRIC)
0 5 10 20m HORIZONTAL
0 0.5 1 2m VERTICAL

DESIGN	CHKD
D.M.	M.J.H.
DRAWN	CHKD
H.I.	E.C.
APPROVED	
W.P. No. 949	

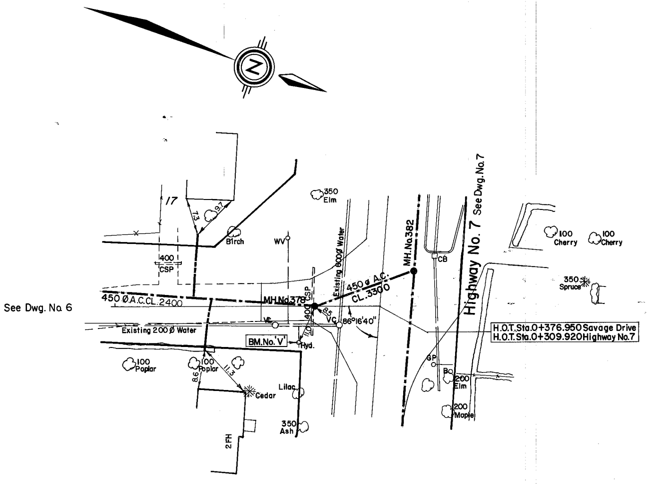
KOSTUCH ENGINEERING LIMITED
CONSULTING ENGINEERS
BROCKVILLE - OTTAWA - BELLEVILLE - CORNWALL

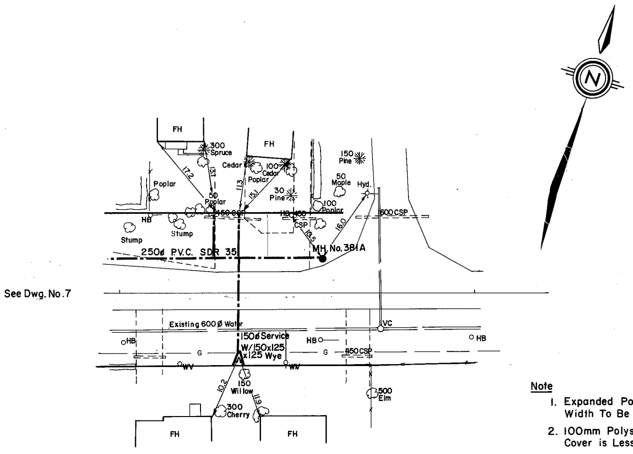
Ontario
Ministry Of The Environment
Sewage Works Project No. 1-0127
Township Of Goulbourn
Stittsville Sanitary Sewers

SAVAGE DRIVE
STA.0+000 to STA. 0+325

DATE DRAWN MAY 1, 1980
CONT. No. 6
DRAWING No. 6
REV. No.

G0-245

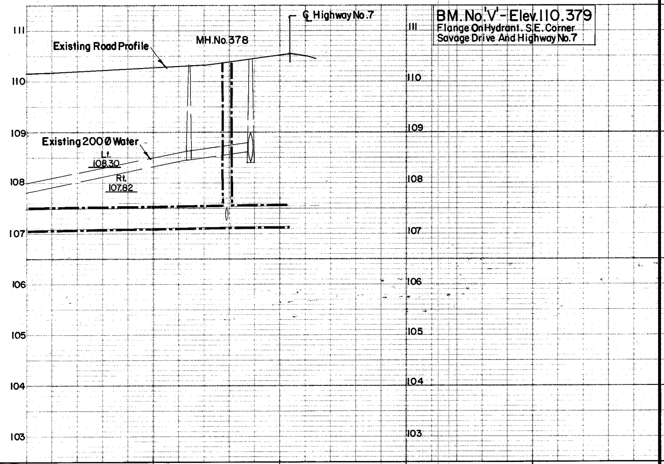




Note

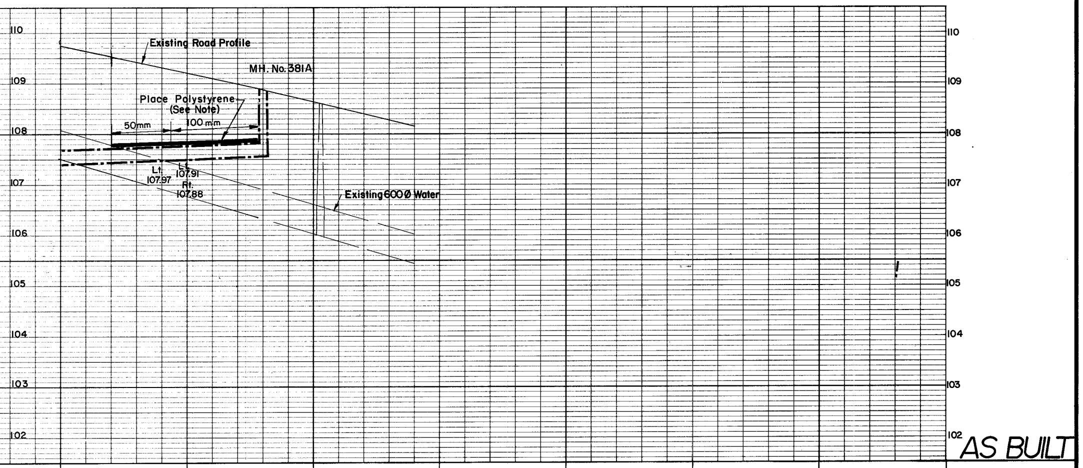
1. Expanded Polystyrene Insulation CBSB, Type 4 Over Pipe. Width To Be Min. 1.2m, Thickness As Shown.
2. 100mm Polystyrene To Be Placed Over Service Where Cover is Less Than 2.0 Meters.

SAVAGE DRIVE



BM.No.'V'-Elev.110.379
Flange On Hydrant. S.E. Corner
Savage Drive And Highway No.7

HIGHWAY No.7



AS BUILT

EXISTING GRADE	110.180	110.310		110.540
WATER MAIN TOP OF PIPE ELEVATION				
SANITARY SEWER INVERT ELEVATION	450 ø x 36.3 @ 0.18%		107.18 S 107.23 N	450 ø x 21.6 @ 0.13%
STORM SEWER INVERT ELEVATION				
CHAINAGE	0+325	0+350	+364.500	0+375 +376.950

EXISTING GRADE		109.530		108.890		108.170	
WATER MAIN TOP OF PIPE ELEVATION							
SANITARY SEWER INVERT ELEVATION			250ø x 55.0 @ 0.29%	107.558			
STORM SEWER INVERT ELEVATION							
CHAINAGE	0+350	+359.000	0+375		0+400		0+425

REGISTERED PROFESSIONAL ENGINEER
J.D. McMANUS
PROVINCE OF ONTARIO

No.	BY	DATE	REVISION
	T.Mc.	Feb.18/82	AS BUILT
1	EC	22/6/81	MH 381A ADDED

SCALE (METRIC)
0 5 10 20m HORIZONTAL
0 0.5 1 2m VERTICAL

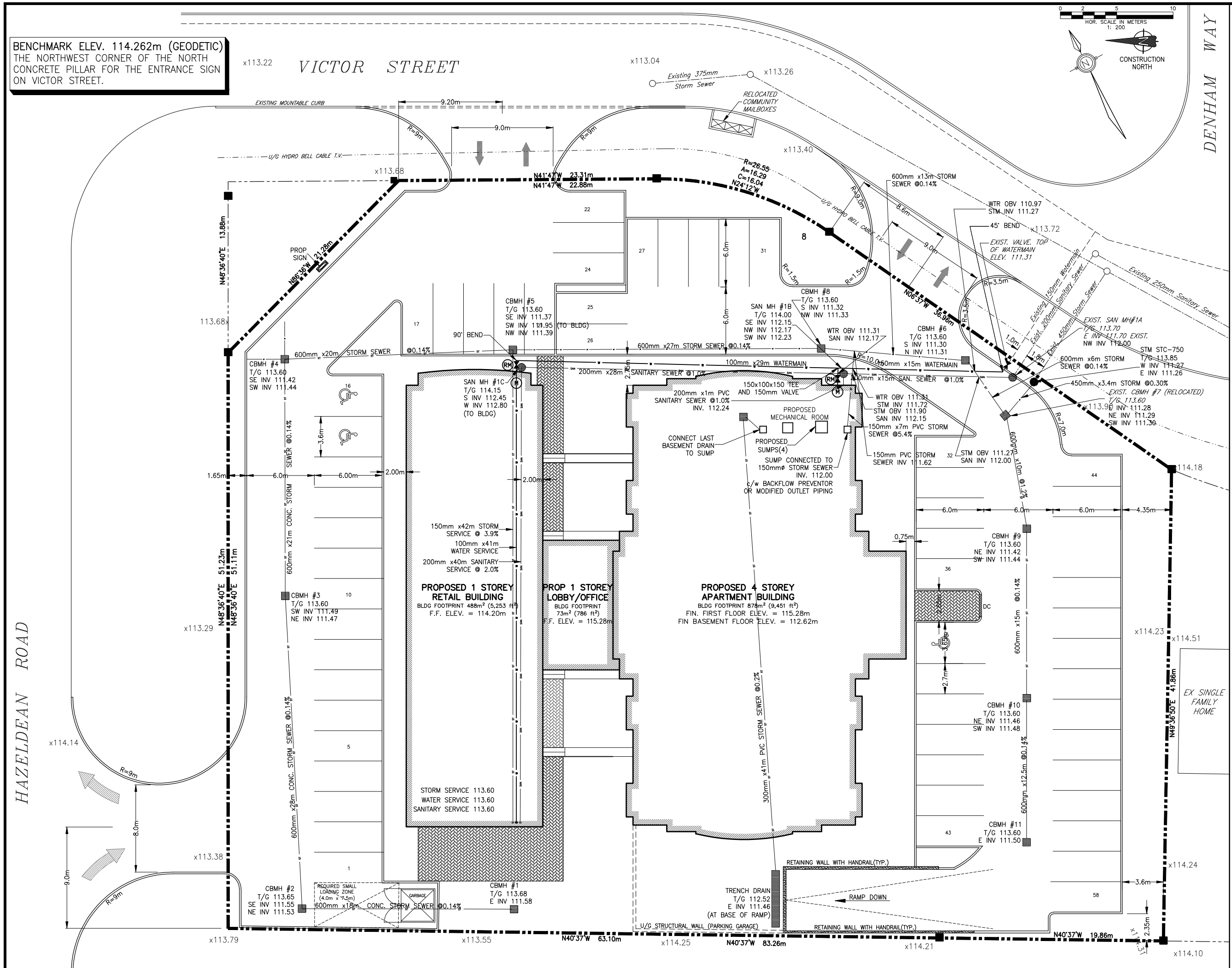
DESIGN D.M.	CHKD M.J
DRAWN E.C.	CHKD D.M.
APPROVED	
W.P. No. 949	

KOSTUCH ENGINEERING LIMITED
CONSULTING ENGINEERS
BROCKVILLE - OTTAWA - BELLEVILLE - CORNWALL

Ontario
Ministry Of The Environment
Sewage Works Project No. 1-0127
Township Of Goulbourn
Stittsville Sanitary Sewers

SAVAGE DRIVE
STA. 0+325 to STA. 0+377
HIGHWAY No. 7
STA. 0+350 to STA. 0+425

DATE DRAWN MAY 1, 1980
CONT. No. 6
DRAWING No. 8
REV. No.



BENCHMARK ELEV. 114.262m (GEODETIC)
THE NORTHWEST CORNER OF THE NORTH CONCRETE PILLAR FOR THE ENTRANCE SIGN ON VICTOR STREET.

GENERAL NOTES:

1. THE ORIGINAL TOPOGRAPHY, GROUND ELEVATION AND SURVEY DATA SHOWN ARE SUPPLIED FOR INFORMATION PURPOSES ONLY, AND IMPLY NO GUARANTEE OF ACCURACY. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION OBTAINED FROM THEM.
2. THE CONTRACTOR IS TO OBTAIN AND PAY FOR ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA BEFORE COMMENCING CONSTRUCTION.
3. THE CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT.
4. THE CONTRACTOR IS TO DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME ALL RESPONSIBILITY FOR EXISTING UTILITIES WHETHER OR NOT SHOWN ON THESE DRAWINGS. IF THERE IS ANY DISCREPANCY THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.
5. ALL 'GREEN AREAS' TO BE TREATED WITH 75mm TOPSOIL, SEED & MULCH AS SOON AS FEASIBLE.
6. RESTORE ALL TRENCHES AND SURFACES OF PUBLIC ROAD ALLOWANCES TO CONDITION EQUAL OR BETTER THAN ORIGINAL CONDITION AND TO THE SATISFACTION OF CITY OF OTTAWA AUTHORITIES.
7. EXCAVATE AND DISPOSE OF ALL EXCESS EXCAVATED MATERIAL, SUCH AS ASPHALT, CURBING AND DEBRIS, OFF SITE AS DIRECTED BY THE ENGINEER, OR THE CITY.
8. TOPSOIL TO BE STRIPPED AND STOCKPILED FOR REHABILITATION. CLEAN FILL TO BE PLACED IN FILL AREAS AND COMPACTED TO 95% STANDARD PROCTOR DENSITY.
9. ALL DISTURBED AREAS TO BE RESTORED TO ORIGINAL CONDITION OR BETTER UNLESS OTHERWISE SPECIFIED.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TRAFFIC CONTROL AND SAFETY MEASURES DURING THE CONSTRUCTION PERIOD, INCLUDING THE SUPPLY, INSTALLATION, AND REMOVAL OF ALL NECESSARY SIGNAGE, DELINEATORS, MARKERS AND BARRIERS.
11. DO NOT ALTER GRADING OF THE SITE WITHOUT PRIOR APPROVAL OF THE CITY.
12. ALL ROADWAY, PARKING LOT, AND GRADING WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS.
13. PROVIDE POSITIVE DRAINAGE AWAY FROM THE BUILDING, PER SITE GRADING & DRAINAGE PLAN DRAWING C1.1.
14. CONTACT THE CITY FOR INSPECTION OF ROUGH GRADING OF PARKING LOTS, ROADWAYS AND LANDSCAPED AREAS PRIOR TO PLACEMENT OF ASPHALT AND TOPSOIL. ALL DEFICIENCIES NOTED SHALL BE RECTIFIED TO THE CITY'S SATISFACTION PRIOR TO PLACEMENT OF ANY ASPHALT, TOPSOIL, SEED & MULCH AND/OR SOD.
15. ALL DIMENSIONS AND INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION, IF THERE IS ANY DISCREPANCY THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.
16. HYDRO, GAS AND BELL SERVICE LOCATIONS SUBJECT TO THE APPROVAL AGENCY:
    TELEPHONE SERVICE – BELL CANADA
    ELECTRICAL SERVICE – OTTAWA HYDRO
    GAS SERVICE – ENBRIDGE
    CABLE – ROGERS

    INSTALLATION TO BE IN ACCORDANCE WITH CURRENT CODES AND STANDARDS OF APPROVAL AGENCIES (BELL, HYDRO) AND THE CITY OF OTTAWA.
17. PROPOSED SIDEWALK CONSTRUCTION AS PER CITY OF OTTAWA STANDARDS SC4 AND SC5.

EROSION AND SEDIMENT CONTROL NOTES

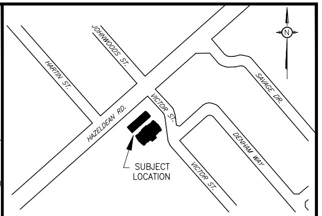
1. THE SITE GRADING CONTRACTOR IS RESPONSIBLE FOR ENSURING SEDIMENT AND EROSION CONTROL STRUCTURES ARE INSTALLED AS SHOWN. CARE SHALL BE TAKEN AT THE REMOVAL STAGE TO ENSURE THAT ANY SILT THAT HAS ACCUMULATED IS PROPERLY HANDLED AND DISPOSED OF.
2. AT THE DISCRETION OF THE PROJECT MANAGER OR MUNICIPAL STAFF, ADDITIONAL SILT CONTROL DEVICES SHALL BE INSTALLED AT DESIGNATED LOCATIONS.
3. FOR STRAW BALE FLOW CHECK USE OPSD 219–180. FOR SILT FENCE BARRIER, USE OPSD 219.110.

SEWER NOTES

1. CONSTRUCT ALL SEWER AND APPURTENANCES TO ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS, AS WELL AS THE CITY OF OTTAWA STANDARDS AS INDICATED.
2. SEWER TRENCHING AND BEDDING SHALL CONFORM TO OPSD 802.010 AND 802.013 UNLESS NOTED OTHERWISE.
    - .1 BEDDING SHALL BE A MINIMUM 150mm OF GRANULAR "A", COMPACTED TO MINIMUM 95% STANDARD PROCTOR DRY DENSITY. CLEAR STONE BEDDING SHALL NOT BE PERMITTED.
    - .2 SUB–BEDDING, IF REQUIRED SHALL BE AS PER THE DIRECTION GEOTECHNICAL ENGINEER
    - .3 BACKFILL TO AT LEAST 300mm ABOVE TOP OF PIPE WITH GRANULAR "A" OR SAND.
    - .4 TO MINIMIZE DIFFERENTIAL FROST HEAVING, TRENCH BACKFILL (FROM PAVEMENT SUBGRADE TO 2 METRES BELOW FINISHED GRADE) SHALL MATCH EXISTING SOIL CONDITIONS.
3. SEWERS AND CONNECTIONS 150mm DIAMETER AND SMALLER TO BE PVC SDR 28 OR APPROVED EQUIVALENT.
4. SEWERS AND CONNECTIONS 200mm DIAMETER AND LARGER TO BE PVC SDR 35 OR APPROVED EQUIVALENT.
5. INSULATE ALL SANITARY SEWERS/SERVICES THAT HAVE LESS THAN 1.5m OF COVER WITH THERMAL INSULATION SIMILAR TO CITY OF OTTAWA STANDARD DETAIL W22 & W23.
6. SUPPLY AND INSTALL ALL PIPING AND APPURTENANCES AS SHOWN AND DETAILED TO WITHIN 1m OF BUILDING. ALL ENDS OF SERVICES TO BE PROPERLY CAPPED AND LOCATED WITH 2"x4"x8' LONG MARKER.

WATERMAIN NOTES

1. CONSTRUCT ALL WATERMAINS AND APPURTENANCES IN ACCORDANCE WITH OPSD STANDARDS AND SPECIFICATIONS AS WELL AS CITY STANDARDS AS INDICATED.
2. WATERMAINS AND/OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 2.4m. OTHERWISE THERMAL INSULATION IS REQUIRED AS PER CITY DWG. No. W22.
3. IF THE WATERMAIN MUST BE DEFLECTED TO MEET ALIGNMENT, ENSURE THAT THE AMOUNT OF DEFLECTION USED IS EQUAL TO OR LESS THAN THAT WHICH IS RECOMMENDED BY THE MANUFACTURER.
4. WATERMAINS TO BE C900 CLASS 150 DR–18 OR APPROVED EQUIVALENT.
5. CONNECTION TO EXISTING BY CITY, EXCAVATION, BACKFILLING AND REINSTATEMENT BY CONTRACTOR



KEY PLAN

LEGEND

PROPOSED GRADE / EXISTING GRADE	CORNER LOT GRADES
━ ▪ ▪ ━ ▪ ▪ ━	LEGAL BOUNDARY
← 2.0%	DIRECTION OF SURFACE WATER DRAINAGE
⁓→	DIRECTION OF SURFACE WATER DRAINAGE
(88.03)	PROPOSED GRADES
═	PROPOSED BARRIER CURB
DC	PROPOSED DEPRESSED CURB
x85.53	EXISTING GRADES
▲	PROPOSED BUILDING ENTRANCE(S)
● MH	PROPOSED MANHOLE
■ CB	PROPOSED CATCHBASIN
⊗ CS	PROPOSED CURB STOP
Ⓜ	PROPOSED WATER METER
(RM)	PROPOSED REMOTE WATER METER
○	EXISTING MANHOLE
– – – –	EXISTING WATERMAIN
◁- · - · ◁	EXISTING SANITARY SEWER
– · – · –	EXISTING STORM SEWER
—— W ——	PROPOSED WATERMAIN
—— SAN ——	PROPOSED SANITARY SEWER
—— ST ——	PROPOSED STORM SEWER
— GAS — GAS — GAS —	PROPOSED GAS
—— HCU ——	PROPOSED HYDRO, BELL, CABLE
-□-□-□-□-	PROPOSED FENCE
▨	PROPOSED HEAVY DUTY PAVEMENT
▩	PAVERS
FIRE ROUTE	PROPOSED FIRE ROUTE
⌇⌇⌇	PROPOSED SILT FENCE
100–yr ponding 113.75	100 YR PONDING

SCHEDULE OF ONTARIO PROVINCIAL STANDARD DRAWINGS

No.	TITLE	DATE	REVISION
219.110	LIGHT DUTY SILT FENCE BARRIER	1996 02 01	0
310.030	CONCRETE SIDEWALK RAMPS AT INTERSECTIONS	93 10 01	0
400.020	CAST IRON, SQUARE FRAME WITH SQUARE FLAT GRATE FOR CATCH BASINS, HERRING BONE OPENINGS	NOV 2001	0
401.010	CAST IRON, SQUARE FRAME WITH CIRCULAR CLOSED OR OPEN COVER FOR MAINTENANCE HOLES	NOV 2002	1
405.010	MAINTENANCE HOLE STEPS, HOLLOW	1996 09 15	0
509.010	PAVEMENT REINSTATEMENT FOR UTILITY CUTS	1994 08 15	0
701.010	PRECAST CONCRETE MAINTENANCE HOLE, 1200mm DIAMETER	NOV 2004	3
701.021	MAINTENANCE HOLE BENCHING AND PIPE OPENING DETAILS	NOV 2004	2
701.030	PRECAST CONCRETE MAINTENANCE HOLE COMPONENTS, 1200mm DIAMETER TAPERED TOP AND FLAT CAP	NOV 2004	2
701.031	PRECAST CONCRETE MAINTENANCE HOLE COMPONENTS, 1200mm DIAMETER RISER AND MONOLITHIC BASE	NOV 2004	0
704.010	PRECAST CONCRETE ADJUSTMENT UNITS FOR MAINTENANCE HOLES, CATCH BASINS, AND VALVE CHAMBERS	NOV 2004	1
705.010	PRECAST CONCRETE CATCH BASIN, 600x600mm	NOV 2004	1
708.030	CATCH BASIN CONNECTION, FLEXIBLE PIPE SEWER	1991 06 15	0
1006.020	SEWER SERVICE CONNECTIONS, FOR FLEXIBLE MAIN PIPE SEWER	NOV 1999	0

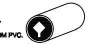
SCHEDULE OF CITY OF OTTAWA STANDARD DRAWINGS

No.	No.	No.	No.	No.
S1	W17	W25.2	W32	SC4
S6	W18	W25.3	W33	SC5
S7	W19	W25.4	W38	
S10	W22	W25.5	W40	
S11	W24	W25.6	W42	
S24	W25	W27	R10	
S25	W25.1	W28	SC1.1	

WATER SERVICE COVER TABLE

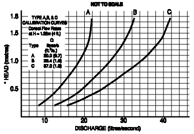
LOCATION	STATION	FINISHED GRADE	TOP OF SERVICE	DEPTH
CONNECTION	1+000	113.85	111.31	2.54
@45° BEND	1+000.5	113.70	111.30	2.40
TEE @ APT BLDG	1+015.1	114.05	111.65	2.40
@ APT. BLDG		114.10	111.70	2.40
90° BEND	1+043.6	114.15	111.75	2.40
@ RETAIL BLDG		114.15	111.75	2.40
@ TERMINATION (UNDER BLDG SLAB)	1+083.6	114.20	113.60	0.60

1. I.C.D. PLUG TYPE ORIFICE. REMOVEABLE FOR CLEANING PURPOSES.
2. I.C.D. MANUFACTURED FROM PVC.
3. I.C.D. MACHINED TO PROVIDE FRICTION FIT INTO THE OUTLET PIPE.



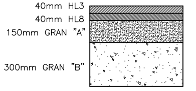
IPEX PLUG TYPE ORIFICE

NOT TO SCALE



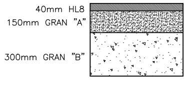
* Head is measured from the centre line of the diamond to the water elevation or flood level.

Calibration Curves for Standard ICDs



HEAVY DUTY PAVEMENT CROSS–SECTION

NOT TO SCALE



ASPHALT PARKING CROSS–SECTION

NOT TO SCALE

ALL ELEVATIONS ON THIS PLAN ARE GEODETIC

REVISIONS

No.	DESCRIPTION	DATE	BY
01	ISSUED FOR		

CLIENT
ROSELAND DEVELOPMENTS
157 Walgreen Road, Carp, ON

DESIGNED AQ
DRAWN dmw
CHECKED TP

PROJECT
AMBER TERRACE
Hazeldean Rd., Stittsville, ON

TITLE
SITE SERVICES PLAN

Consulting Engineers of Ontario

McINTOSH PERRY Consulting Engineers Ltd.
115 Walgreen Rd., R.R. #3, Carp ON. K0A 1L0
Tel.: (613) 836-2184 Fax: (613) 836-3742

DATE	SCALE	PROJECT No.	DWG. No.
FEB 16, 2007	1:200 metric	P06-257	C1.2 of 4

d.whynot G:\P06-257 – Latimer (Amber Terrace)\dwg\P06-257_rev01 NEW LINK VERSION (15may07).dwg MAY 15, 2007 01:57 pm
Xrefs: [none]
Images: [C:\ACAD Utilities\Blocks\hYDROVEX\, VHV.tif]

HAZELDEAN ROAD WIDENING

100m EAST OF CARP ROAD TO
100m WEST OF IBER ROAD

762mm WATERMAIN
STA. 101+400 TO STA. 101+700

Ottawa

Contract No. ISB09-5044
Dwg. No. 022
Sheet 22 of 148
Asset No.
Asset Group: ISB
Des: JZ/DP Chk'd: PH/MB
Dwn: MS Chk'd: PH
Utility Circ. No.:
Const. Inspector:
Scale: HORIZONTAL 0m 10 20

B. MASON, P.Eng.
Manager - Design and Construction West

S. HARISH, P.Eng.
Project Manager, Infrastructure Services

NOTE:
The location of utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

McCORMICK RANKIN CORPORATION
A member of MMM GROUP

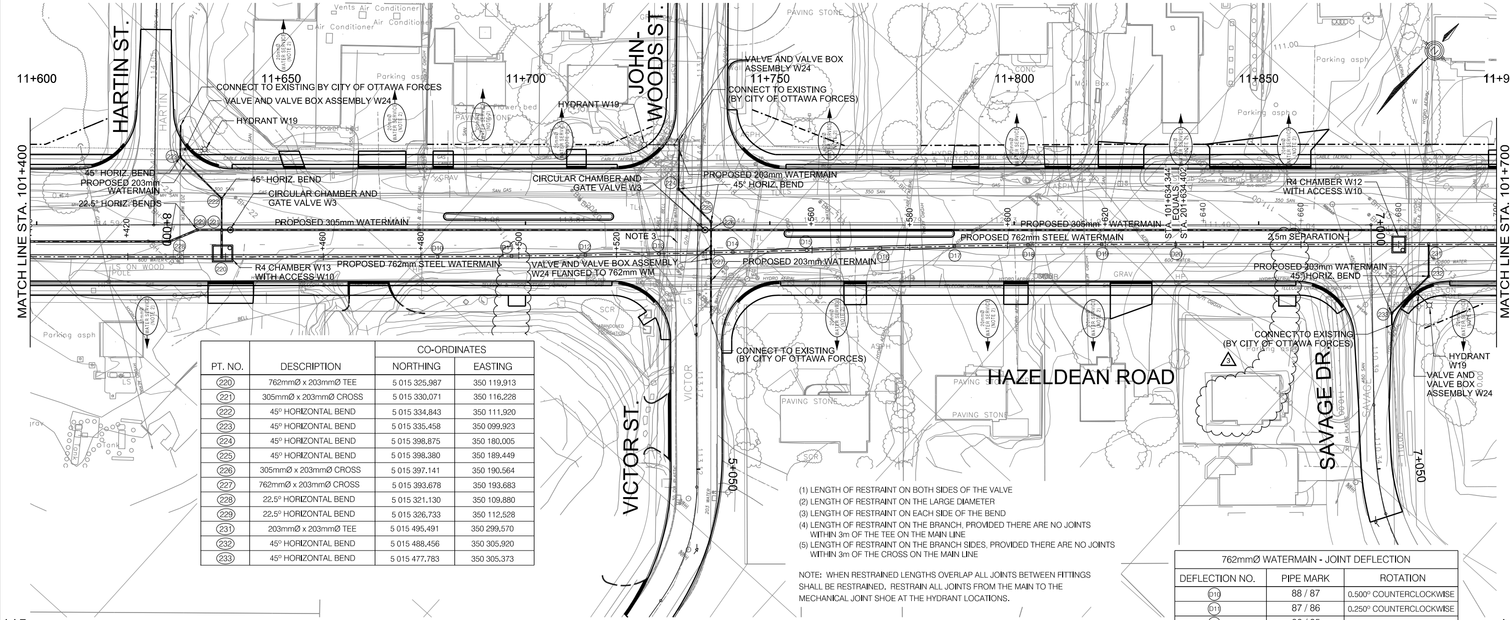
REVISIONS

No.	Description	By	Date
	ISSUED FOR REVIEW	P.H.	24/07/2009
	ISSUED FOR TENDER	P.H.	11/08/2009
	ISSUED FOR CONSTRUCTION	P.H.	26/11/2009
1	REVISIONS PER CITY COMMENTS	P.H.	13/01/2010
2	REVISIONS PER CITY COMMENTS AND REALIGNMENT	M.B.	[illegible]

AS-BUILT

REVISIONS

No.	Description	By	Date
	REISSUED FOR CONSTRUCTION	M.B.	07/05/2010
	762mm/305mm/203mm WATERMAIN DESIGN CHANGE	M.B.	08/09/2010
	AS-BUILT	B.M.	SEPT 2012

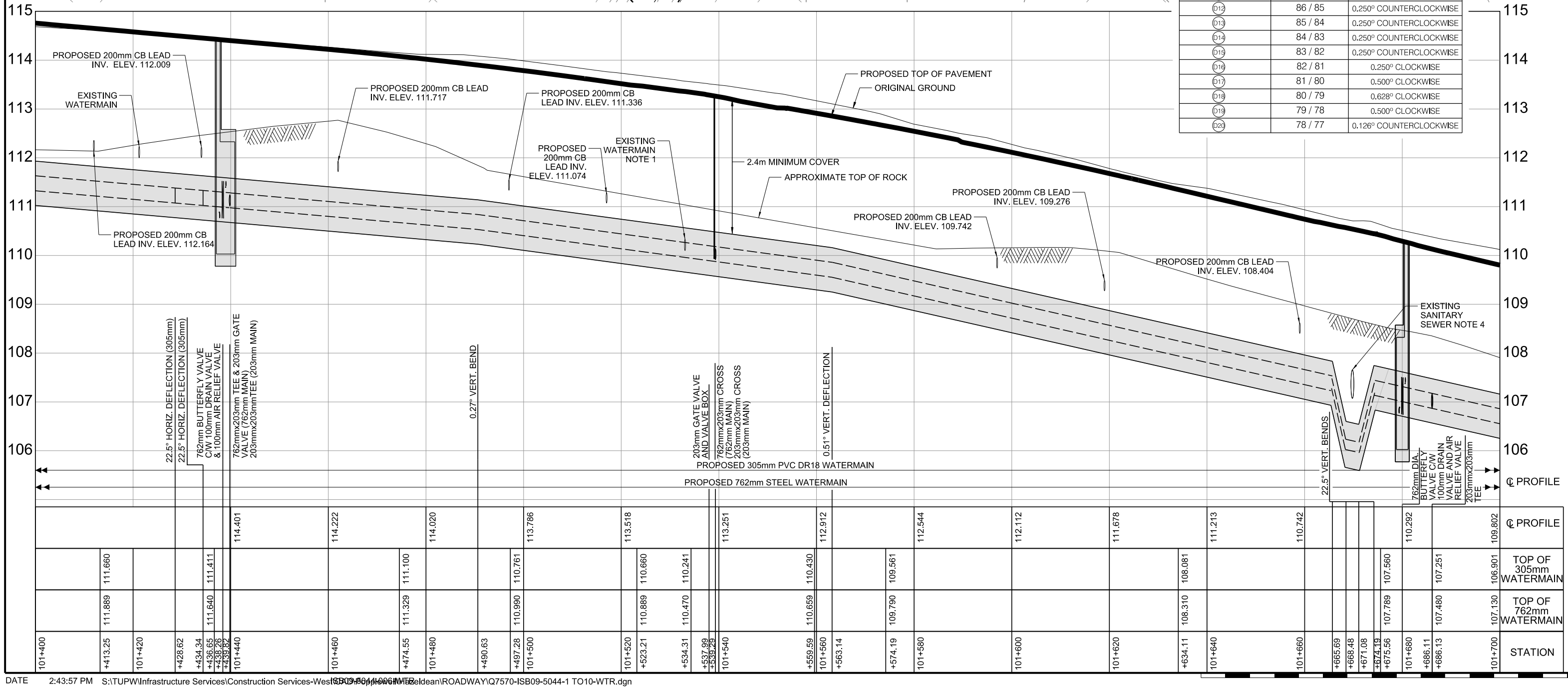


PT. NO.	DESCRIPTION	CO-ORDINATES	
		NORTHING	EASTING
(220)	762mmØ x 203mmØ TEE	5 015 325.987	350 119.913
(221)	305mmØ x 203mmØ CROSS	5 015 330.071	350 116.228
(222)	45° HORIZONTAL BEND	5 015 334.843	350 111.920
(223)	45° HORIZONTAL BEND	5 015 335.458	350 099.923
(224)	45° HORIZONTAL BEND	5 015 398.875	350 180.005
(225)	45° HORIZONTAL BEND	5 015 398.380	350 189.449
(226)	305mmØ x 203mmØ CROSS	5 015 397.141	350 190.564
(227)	762mmØ x 203mmØ CROSS	5 015 393.678	350 193.683
(228)	22.5° HORIZONTAL BEND	5 015 321.130	350 109.880
(229)	22.5° HORIZONTAL BEND	5 015 326.733	350 112.528
(231)	203mmØ x 203mmØ TEE	5 015 495.491	350 299.570
(232)	45° HORIZONTAL BEND	5 015 488.456	350 305.920
(233)	45° HORIZONTAL BEND	5 015 477.783	350 305.373

(1) LENGTH OF RESTRAINT ON BOTH SIDES OF THE VALVE
(2) LENGTH OF RESTRAINT ON THE LARGE DIAMETER
(3) LENGTH OF RESTRAINT ON EACH SIDE OF THE BEND
(4) LENGTH OF RESTRAINT ON THE BRANCH, PROVIDED THERE ARE NO JOINTS WITHIN 3m OF THE TEE ON THE MAIN LINE
(5) LENGTH OF RESTRAINT ON THE BRANCH SIDES, PROVIDED THERE ARE NO JOINTS WITHIN 3m OF THE CROSS ON THE MAIN LINE

NOTE: WHEN RESTRAINED LENGTHS OVERLAP ALL JOINTS BETWEEN FITTINGS SHALL BE RESTRAINED. RESTRAIN ALL JOINTS FROM THE MAIN TO THE MECHANICAL JOINT SHOE AT THE HYDRANT LOCATIONS.

762mmØ WATERMAIN - JOINT DEFLECTION		
DEFLECTION NO.	PIPE MARK	ROTATION
(D10)	88 / 87	0.500° COUNTERCLOCKWISE
(D11)	87 / 86	0.250° COUNTERCLOCKWISE
(D12)	86 / 85	0.250° COUNTERCLOCKWISE
(D13)	85 / 84	0.250° COUNTERCLOCKWISE
(D14)	84 / 83	0.250° COUNTERCLOCKWISE
(D15)	83 / 82	0.250° COUNTERCLOCKWISE
(D16)	82 / 81	0.250° CLOCKWISE
(D17)	81 / 80	0.500° CLOCKWISE
(D18)	80 / 79	0.628° CLOCKWISE
(D19)	79 / 78	0.500° CLOCKWISE
(D20)	78 / 77	0.126° COUNTERCLOCKWISE



NOTE:

1. FOR GENERAL NOTES, SEE DWG. NO. ISB09-5044-017
2. WATER SERVICE TO COME FROM 305mmØ DISTRIBUTION MAIN.
3. A PORTION OF THE EXISTING JOHNWOODS STREET 203mmØ BRANCH WATERMAIN MUST BE REMOVED PRIOR TO CONSTRUCTION OF THE 762mmØ MAIN. THIS WORK MUST BE STAGED SUCH THAT THE HARTIN STREET CONNECTION REMAINS OPERATIONAL WHILE THE EXISTING JOHNWOODS STREET BRANCH IS DISCONNECTED.
4. POSSIBLE ASBESTOS PIPE USED FOR EXISTING SANITARY SEWER.
5. FOR THE PURPOSES OF CLARITY THE DRAWING REVISIONS ASSOCIATED WITH △1 AND △2 HAVE BEEN REMOVED FROM THIS DRAWING.

RESTRAINT TABLE

203mmØ WATERMAIN - SAVAGE DRIVE

STATION	FITTING TYPE	RESTRAINT LENGTH		
		UPPER BEND	LOWER BEND	
+000.00	762mmØ x 203mmØ TEE			3 (4)
+006.52	203mmØ x 45° HB			3 (3)
+010.60	203mmØ x 152mmØ TEE			(4)
+012.74	203mmØ x 22.5° VB		6 (3)	
+016.40	203mmØ x 22.5° VB	6 (3)		
+017.20	203mmØ x 45° HB			3 (3)

RESTRAINT TABLE

203mmØ WATERMAIN - HARTIN STREET

STATION	FITTING TYPE	RESTRAINT LENGTH		
		UPPER BEND	LOWER BEND	
+000.00	762mmØ x 203mmØ TEE			3 (4)
+998.97	203mmØ VALVE			9 (1)
+994.58	203mmØ x 305mmØ CROSS			3 (5)
+988.15	203mmØ x 45° HB			3 (3)
+976.14	203mmØ x 45° HB			3 (3)
+974.53	203mmØ x 152mmØ TEE			(4)

RESTRAINT TABLE

203mmØ WATERMAIN - JOHNWOODS & VICTOR STREET

STATION	FITTING TYPE	RESTRAINT LENGTH		
		UPPER BEND	LOWER BEND	
+976.90	203mmØ x 152mmØ TEE			(4)
+985.89	203mmØ x 45° HB			3 (3)
+995.35	203mmØ x 45° HB			3 (3)
+997.00	203mmØ x 305mmØ CROSS			3 (5)
+998.50	203mmØ VALVE			9 (1)
+000.00	762mmØ x 203mmØ CROSS			3 (5)
+001.50	203mmØ VALVE			9 (1)
+002.70	203mmØ x 22.5° VB	6 (3)		
+003.98	203mmØ x 22.5° VB		6 (3)	
+008.61	203mmØ x 22.5° VB		6 (3)	
+012.12	203mmØ x 22.5° VB	6 (3)		

TITLE FRAME: 709mm x 534mm City of Ottawa 2008

Consultant Drawing Number

DATE 2:43:57 PM S:\TUPW\Infrastructure Services\Construction Services-West\ISB09-5044\Hazeldean\ROADWAY\Q7570-ISB09-5044-1 TO10-WTR.dgn

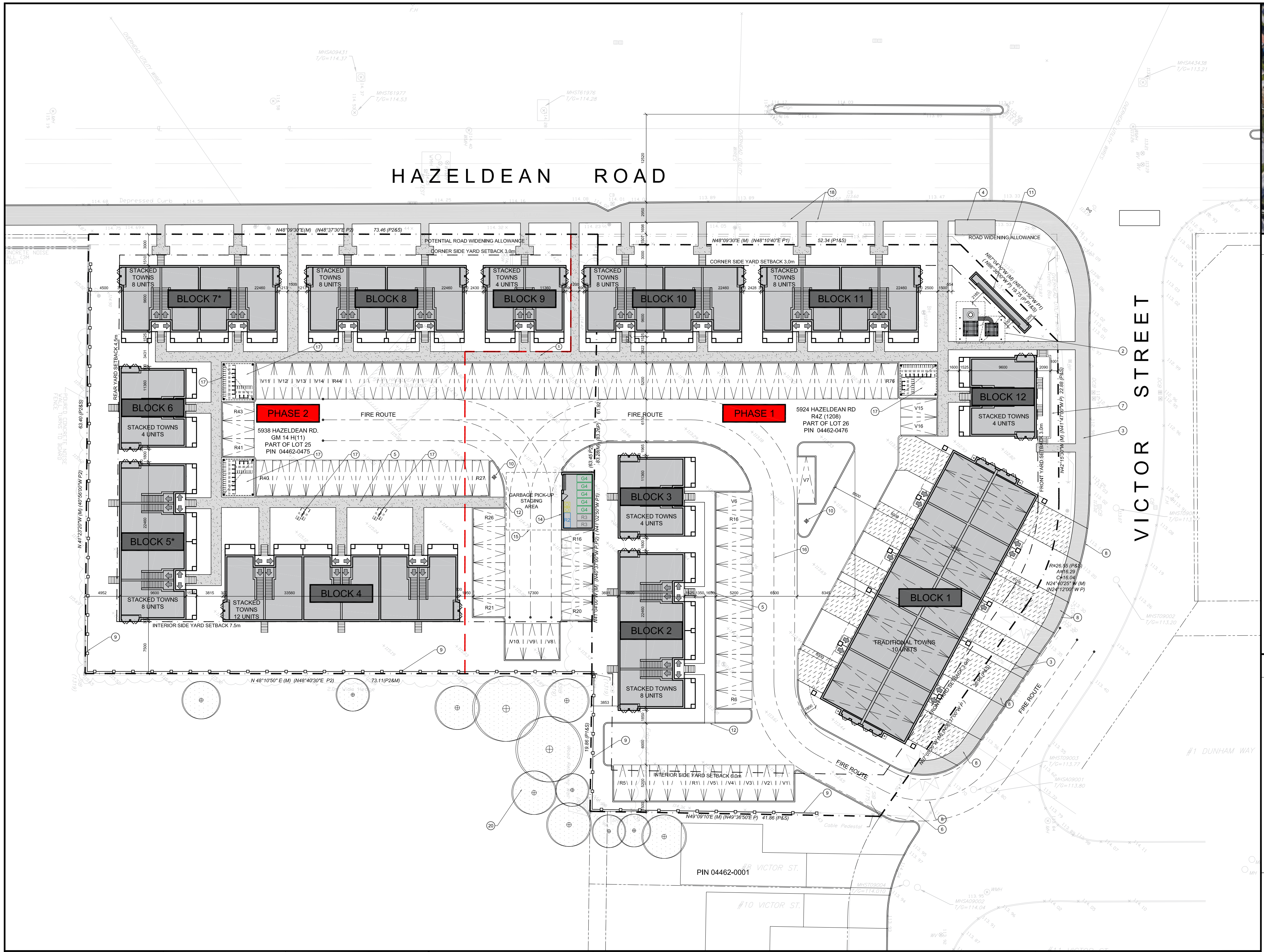
Appendix K – Drawings

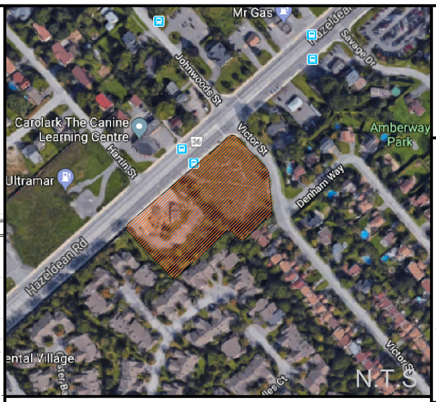
Other Drawings (All 11x17 Reduction, Scale: NTS)

- **Site Plan, Roderick Lahey Architect Inc. Dwg SP-0 (11x17 Reduction)**
- **Topographic Survey, Fairhall Moffatt Woodland, April 09, 2019 (11x17 Reduction)**

Engineering Drawings (Included Separately)

- **Existing Conditions and Removals Plan, Drawing C000, Rev4**
- **Legends and Notes, Drawing C001, Rev4**
- **Site Servicing Plan, Drawing C100, Rev4**
- **Site Servicing Tables, Drawing C100, Rev4**
- **Site Grading Plan, Drawing C200, Rev4**
- **Erosion & Sediment Control Plan, Drawing C300, Rev4**
- **Post-Development Storm Drainage Plan, Drawing C400, Rev4**
- **Detail Sheet, Drawing C700, Rev4**





IT IS THE RESPONSIBILITY OF THE APPROPRIATE CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE AND TO REPORT ALL ERRORS AND/OR OMISSIONS TO THE ARCHITECT.

ALL CONTRACTORS MUST COMPLY WITH ALL PERTINENT CODES AND BY-LAWS.

THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION UNTIL SIGNED BY THE ARCHITECT.

DO NOT SCALE DRAWINGS.

NOTATION SYMBOLS:

(00)	INDICATES DRAWING NOTES, LISTED ON EACH SHEET.
◇00	INDICATES ASSEMBLIE TYPE; REFER TO TYPICAL ASSEMBLIES SCHEDUAL.
⬡00	INDICATES WINDOW TYPE; REFER TO WINDOW ELEVATIONS AND DETAILS ON A900 SERIES.
(000)	INDICATES DOOR TYPE; REFER TO DOOR SCHEDULE AND DETAILS ON A900 SERIES.

00 A000 A000 TITLE SCALE
- DETAIL NUMBER
- DETAIL REFERENCE PAGE
- DETAIL CROSS REFERENCE PAGE

PROJECT NOTES

1. --
2. SITE TRANSFORMER
3. NEW CONCRETE SIDEWALK BUILT TO CITY OF OTTAWA STANDARDS
4. BUS SHELTER RELOCATED 2200mm NE
5. NEW PRIVATELY OWNED SIDEWALK
6. SITE APPROACH (SUBJECT TO APPROVAL OF MINOR VARIANCE)
7. LANDSCAPE TERRACE
8. 150mm WIDE MOUNTABLE CURB
9. 2.5m. HIGH PRIVACY FENCE
10. NEW FIRE HYDRANT (EXACT LOCATION TO BE CONFIRMED BY CIVIL ENGINEER)
11. ELECTRICAL DISTRIBUTION EQUIPMENT AND DEVELOPMENT SIGN
12. PROVIDE DEPRESSED SIDEWALK
13. STORAGE ROOM CONNECTED TO GARBAGE SHED
14. GARBAGE STORAGE SHED (TO SERVICE 86 UNITS) C/W ROLLING STEEL DOOR, PROVIDE BINS ON CASTERS, MATCH TYPICAL FINISH MATERIALS, PROVIDE ELECTRICAL CONNECTION FOR LIGHTING
15. PROVIDE CONCRETE PAD FOR GARBAGE PICK-UP STAGING AREA
16. PROVIDE PAVED PATHWAY DESIGNED TO SUPPORT FULLY LOADED GARBAGE TRUCK OR FIRE TRUCK (35,000 lbs.)
17. NEW "BICYCLE RACK" AND OR "BICYCLE PARKING"
18. EXISTING BIKE RACK, RELOCATE IF NECESSARY
19. EXISTING LIGHT STANDARD TO BE RELOCATED IF NECESSARY (RELOCATED BY ELECTRICAL ENGINEER)
20. GROUP OF EXISTING TREES (EXTERIOR TO SITE) TO BE PROTECTED DURING CONSTRUCTION (EXACT LOCATION, SIZE AND NUMBER TO BE DETERMINED BY SURVEYOR)

GENERAL NOTES:

- (A) REFER TO TYPICAL ASSEMBLIES SHEET FOR WALL, PARTITION, ROOF CEILING & FLOOR TYPES.
- (B) FOR DOOR TYPES AND HARDWARE REQUIREMENTS REFER TO DOOR SCHEDULE ON A900 SERIES.
- (C) ALL INTERIOR DIMENSIONS ARE TAKEN FROM THE FACE OF STUD
- (D) ALL EXTERIOR DIMENSIONS ARE TAKEN FROM THE FACE OF STUD
- (E) ALL EXTERIOR WALLS ARE TO BE TYPE 'W1' UNLESS NOTED OTHER WISE.
- (F) ALL INTERIOR PARTITIONS ARE TO BE TYPE 'P1' UNLESS NOTED OTHER WISE.
- (G) ALL REINFORCED CONCRETE SUSPENDED SLABS, COLUMNS & BEAMS HAVE A MIN. FRR OF 1.5 HRS (AS DETERMINED BY OBC SB-2) UNLESS OTHERWISE STATED.

LEGEND

ORGANICS BIN	O
3 YRD. GARBAGE BIN	G3
4 YRD. GARBAGE BIN	G4
3 YRD. FIBROUS RECYCLING BIN	R3
2 YRD. GLASS AND PLASTIC RECYCLING BIN	R2
TYPICAL PARKING SPACE	5200 × 2600
SMALL PARKING SPACE	5200 × 2400
SMALL PARKING SPACE	4600 × 2600
UNIT ENTRY POINT	➡
TRAFFIC FLOW	⇨
EXISTING TREES	⊙
FIRE HYDRANT	⊕
NEW LIGHT STANDARD	⊕
EXISTING LIGHT STANDARD	
VISITOR PARKING	V#
RESIDENT PARKING	R#
GEODETIC ELEVATION MARKER	
BICYCLE PARKING	1800 × 600
PROPERTY LINE	▬ ▬
SETBACK LINE	— —
PHASING LINE	🟥 🟥
FIRE TRUCK AND GARBAGE PICK UP ROUTE	FIRE ROUTE
PROPOSED BUILDING OUTLINE	▭
NEW PRIVACY FENCE	—□—□—
EXISTING BOARD FENCE	
NEW PRIVATE DRIVEWAY	▨
NEW PRIVATE SIDEWALKS	▒
NEW PUBLIC SIDEWALKS	░

ADDITIONAL NOTES

** 6000mm DRIVE AISLES WILL BE SUBJECT TO APPROVAL OF A MINOR VARIANCE ALLOWING DRIVE AISLES NARROWER THAN 6700mm

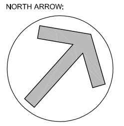
*** WINTER SNOW STORAGE WILL NOT BE PROVIDED. SNOW WILL BE TRUCKED OFF OFF SITE AS REQUIRED.

No.	DESCRIPTION	DATE
2	ISSUED FOR COORDINATION	29-10-2019
1	ISSUED FOR SITE PLAN APPROVAL	23-05-2019

REVISIONS:

ARCHITECT SEAL:
ONTARIO ASSOCIATION OF ARCHITECTS
RODERICK I. LAHEY
LICENCE 4375
SEAL DATE: STAMP DATE

NORTH ARROW:



CLIENT:
gncr DEVELOPMENTS

ARCHITECT:
rla/architecture
roderick lahey architect inc.
56 beech street, ottawa, ontario K1S 3J6
t. 613.724.9932 f. 613.724.1209 rlaarchitecture.ca

PROJECT TITLE:
HCTOWNS
HAZELDEAN CROSSING TOWNS
OTTAWA ONTARIO

SHEET TITLE:
SITE PLAN

DRAWN: L.M.
CHECKED: R.V.
SCALE: 1:150
SHEET No. SP-00
PROJECT No. 1831

D07-12-19-0089

PROJECT DEVELOPER
GNCR DEVELOPMENTS

Konaklar Mh. Akasyalı Sk.
No:26 34330
Beşiktaş İstanbul Turkey

PHONE: +90 212 212 60 60
FAX: +90 212 284 82 77

CIVIL ENGINEER
EXP SERVICES INC.

2650 QUEENSVIEW DRIVE
SUITE 100
OTTAWA, ONTARIO
K2B 8H6

PHONE: 613 688 1899

TRAFFIC ENGINEER
EXP SERVICES INC.

2650 QUEENSVIEW DRIVE
SUITE 100
OTTAWA, ONTARIO
K2B 8H6

PHONE: 613 688 1899

LANDSCAPE ARCHITECT
JAMES B. LENNOX AND ASSOCIATES INC

3332 CARLING AVE.
OTTAWA, ONTARIO, CANADA
K2H 5A8

PHONE: 613 722 5168
FAX: 1 866 343 3942

SURVEYOR
FAIRHALL MOFFATT & WOODLAND LTD.

3332 CARLING AVE.
OTTAWA, ONTARIO, CANADA
K2H 5A8

PHONE: 613 722 5168
FAX: 1 866 343 3942

SITE INFORMATION

ZONING (5924)	R4Z [1208]
MAX BUILDING HEIGHT	14.5 M.
LOT AREA	4,930.9 SQ. M.

5924 HAZELDEAN RD
STITTSVILLE, ONTARIO,
CANADA
K2S1B9

ZONING (5938)	GM14 H[11]
MAX BUILDING HEIGHT	11.0 M.
LOT AREA	4,645.6 SQ. M.

5938 HAZELDEAN RD
STITTSVILLE, ONTARIO,
CANADA
K2S1B9

SITE AREA	
TOTAL SITE AREA	9,576.5 SQ. M.

RESIDENTIAL UNITS	
STACKED TOWNHOUSES:	76
TRADITIONAL TOWNHOUSES:	10
TOTAL UNITS:	86

DEVELOPMENT STATISTICS

SITE SETBACKS (5924)	REQUIRED	PROVIDED
FRONT YARD (HAZELDEAN)	3.0m	3.0m
CORNER SIDE YARD *(VICTOR)*	3.0m	3.0m
REAR YARD	6.0m	14.85m*

SITE SETBACKS (5938)	REQUIRED	PROVIDED
FRONT YARD (HAZELDEAN)	3.0m	3.0m
REAR YARD	7.5m	7.5m
INTERIOR SIDE YARD *(SW ONLY)*	3.0m	3.0m

BUILDING STATISTICS	AREA	# OF UNITS	TOTAL UNIT AREA
STACKED TOWN TYPE A (1A) -	1,038 SQFT	22	22,836 SQFT
STACKED TOWN TYPE B (2A) -	1,053 SQFT	16	16,848 SQFT
STACKED TOWN TYPE C (1B) -	1,311 SQFT	22	28,842 SQFT
STACKED TOWN TYPE D (2B) -	1,171 SQFT	16	18,736 SQFT
TRADITIONAL TOWN TYPE A -	1,536 SQFT	4	6,144 SQFT
TRADITIONAL TOWN TYPE B -	1,528 SQFT	4	6,112 SQFT
TRADITIONAL TOWN TYPE C -	1,178 SQFT	2	2,356 SQFT
TOTAL -		86	101,874 SQFT (9,205.2 SQM)

PARKING	REQUIRED
STACKED TOWNS	
RESIDENTIAL:	1.2 PER DWELLING
VISITOR:	0.2 PER DWELLING
TRADITIONAL TOWNS	
RESIDENTIAL:	1.0 PER DWELLING
VISITOR:	0.2 PER DWELLING

PARKING	REQUIRED	PROVIDED
STACKED TOWNS		
RESIDENTIAL:	91	76
VISITOR:	15	16
BICYCLE:	38	44
TRADITIONAL TOWNS		
RESIDENTIAL:	10	18
VISITOR:	2	17

PHASING	UNITS
PHASE 1	
STACKED:	32
TRADITIONAL TOWN:	10
PHASE 2	
STACKED:	44
TRADITIONAL TOWN:	0
TOTAL:	86

SITE COVERAGE

SPACE		AREA (sq.m.)
BUILDING FOOTPRINT	-	2,746.6
PARKING LOT	-	2,889.0
SIDEWALKS	-	636.8
DRIVEWAYS	-	240.2
LOT AREA		
5924 HAZELDEAN RD.	-	4,930.9
5938 HAZELDEAN RD.	-	4,645.6
TOTAL	-	9,576.5
LANDSCAPE SPACE	-	3,700.7
TOTAL LANDSCAPE SPACE (%)	-	45.3

*SNOW STORAGE WILL NOT BE PROVIDED ON SITE. SNOW WILL BE REQUIRED TO BE TRUCKED OFF SITE.

PLOT DATE: Tuesday, October 29, 2019

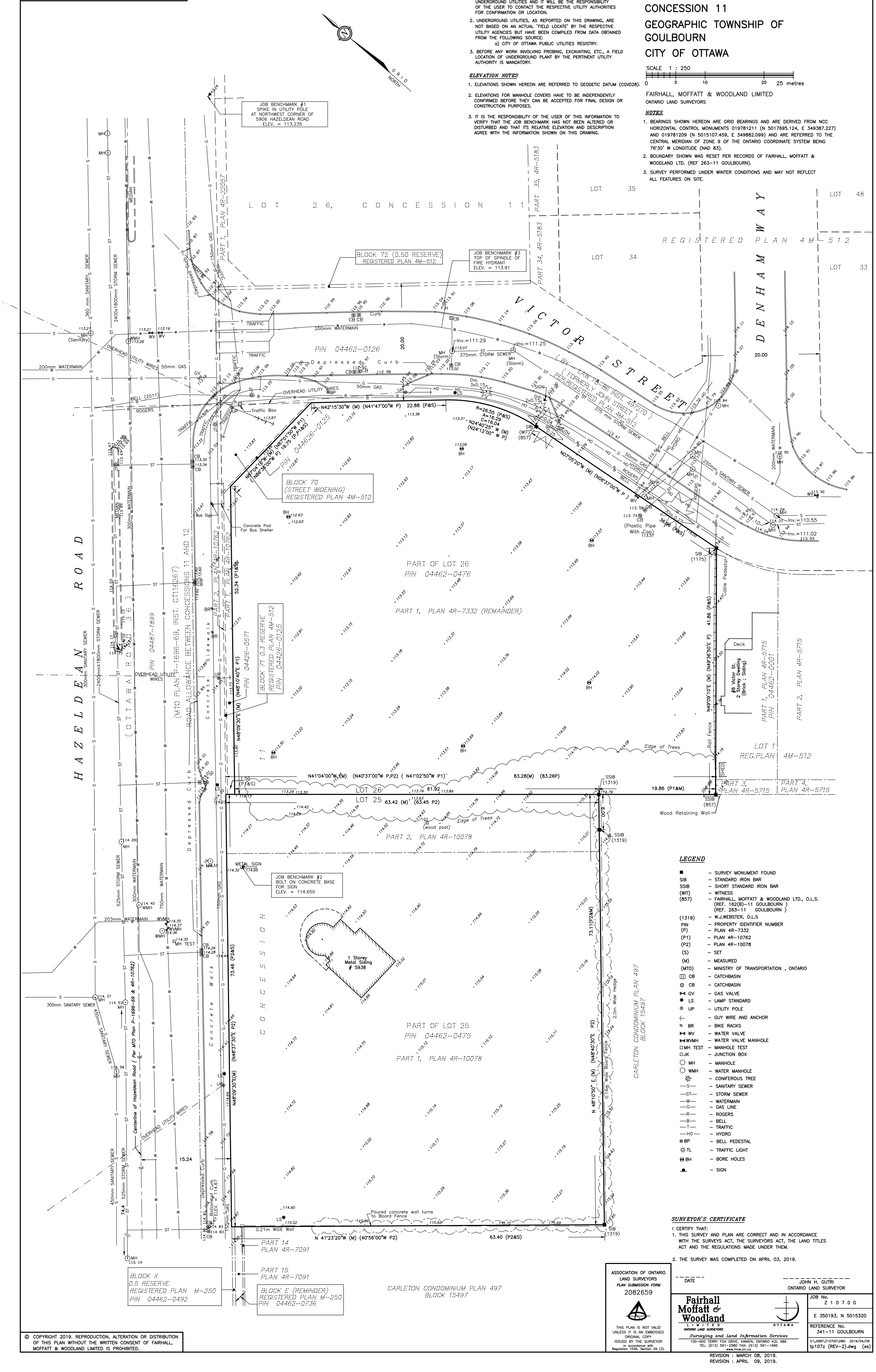
Plan No.: #18003

METRIC
DISTANCES AND ELEVATIONS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

TOPOGRAPHIC SURVEY OF
PART OF LOTS 25 & 26
CONCESSION 11
GEOGRAPHIC TOWNSHIP OF GOULBOURN
CITY OF OTTAWA

SCALE 1 : 250
0 5 10 20 25 metres

FAIRHALL, MOFFATT & WOODLAND LIMITED
ONTARIO LAND SURVEYORS



UTILITY NOTES

1. THIS DRAWING CANNOT BE ACCEPTED AS ACKNOWLEDGING ALL OF THE UNDERGROUND UTILITIES AND IT WILL BE THE RESPONSIBILITY OF THE USER TO CONTACT THE RESPECTIVE UTILITY AUTHORITIES FOR CONFIRMATION OR LOCATION.
2. UNDERGROUND UTILITIES, AS REPORTED ON THIS DRAWING, ARE NOT BASED ON AN ACTUAL 'FIELD LOCATE' BY THE RESPECTIVE UTILITY AGENCIES BUT HAVE BEEN COMPILED FROM DATA OBTAINED FROM THE FOLLOWING SOURCE:
   a) CITY OF OTTAWA PUBLIC UTILITIES REGISTRY.
3. BEFORE ANY WORK INVOLVING PROBING, EXCAVATING, ETC., A FIELD LOCATION OF UNDERGROUND PLANT BY THE PERTINENT UTILITY AUTHORITY IS MANDATORY.

ELEVATION NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERRED TO GEODETIC DATUM (CGVD28).
2. ELEVATIONS FOR MANHOLE COVERS HAVE TO BE INDEPENDENTLY CONFIRMED BEFORE THEY CAN BE ACCEPTED FOR FINAL DESIGN OR CONSTRUCTION PURPOSES.
3. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARK HAS NOT BEEN ALTERED OR DISTURBED AND THAT ITS RELATIVE ELEVATION AND DESCRIPTION AGREE WITH THE INFORMATION SHOWN ON THIS DRAWING.

NOTES

1. BEARINGS SHOWN HEREON ARE GRID BEARINGS AND ARE DERIVED FROM NCC HORIZONTAL CONTROL MONUMENTS 019781211 (N 5017695.124, E 349387.227) AND 019781209 (N 5015107.459, E 349882.099) AND ARE REFERRED TO THE CENTRAL MERIDIAN OF ZONE 9 OF THE ONTARIO COORDINATE SYSTEM BEING 76°30' W LONGITUDE (NAD 83).
2. BOUNDARY SHOWN WAS RESET PER RECORDS OF FAIRHALL, MOFFATT & WOODLAND LTD. (REF 263-11 GOULBOURN).
3. SURVEY PERFORMED UNDER WINTER CONDITIONS AND MAY NOT REFLECT ALL FEATURES ON SITE.

LEGEND

■	- SURVEY MONUMENT FOUND
SIB	- STANDARD IRON BAR
SSIB	- SHORT STANDARD IRON BAR
(WIT)	- WITNESS
(857)	- FAIRHALL, MOFFATT & WOODLAND LTD., O.L.S. (REF. 162(B)-11 GOULBOURN) (REF. 263-11 GOULBOURN)
(1319)	- W.J.WEBSTER, O.L.S
PIN	- PROPERTY IDENTIFIER NUMBER
(P)	- PLAN 4R-7332
(P1)	- PLAN 4R-10762
(P2)	- PLAN 4R-10078
(S)	- SET
(M)	- MEASURED
(MTO)	- MINISTRY OF TRANSPORTATION , ONTARIO
▥ CB	- CATCHBASIN
⊖ CB	- CATCHBASIN
⋈ GV	- GAS VALVE
● LS	- LAMP STANDARD
⊗ UP	- UTILITY POLE
⟵	- GUY WIRE AND ANCHOR
⊘ BR	- BIKE RACKS
⋈ WV	- WATER VALVE
⋈ WVMH	- WATER VALVE MANHOLE
□ MH TEST	- MANHOLE TEST
□ JK	- JUNCTION BOX
○ MH	- MANHOLE
○ WMH	- WATER MANHOLE
✲	- CONIFEROUS TREE
—S—	- SANITARY SEWER
—ST—	- STORM SEWER
—W—	- WATERMAIN
—G—	- GAS LINE
—R—	- ROGERS
—B—	- BELL
—T—	- TRAFFIC
—HO—	- HYDRO
⊠ BP	- BELL PEDESTAL
☼ TL	- TRAFFIC LIGHT
⊕ BH	- BORE HOLES
●	- SIGN

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT, THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON APRIL 03, 2019.

DATE

JOHN H. GUTRI
ONTARIO LAND SURVEYOR

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2082659

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR
In accordance with Regulation 1026. Section 29 (3).

Fairhall Moffatt & Woodland
L I M I T E D
ONTARIO LAND SURVEYORS
O T T A W A
Surveying and Land Information Services
100-600 TERRY FOX DRIVE, KANATA, ONTARIO K2L 4B6
TEL: (613) 591-2580 FAX: (613) 591-1495
www.fmw.on.ca

JOB No.
Z 1 0 7 0 0

E 350193, N 5015320

REFERENCE No.
341-11 GOULBOURN

S:\JOBS\Z10700\DWG 2019/04/09
tp107z (REV-2).dwg (ss)

REVISION : MARCH 08, 2019.
REVISION : APRIL 09, 2019.

Appendix L – Checklist

4.1 General Content

☒ Executive Summary (for larger reports only).

Comments: N/A

☒ Date and revision number of the report.

Comments: Dated November 2019. Site Plan Submission.

☒ Location map and plan showing municipal address, boundary, and layout of proposed development.

Comments: A Site location Plan is included as Figure A1 in Appendix A.

☒ Plan showing the site and location of all existing services.

Comments: Refer to the Site Servicing Plans for service locations.

☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.

Comments: Refer to site plan prepared by RLA Architecture.

☒ Summary of Pre-consultation Meetings with City and other approval agencies.

Comments: A pre-consultation meeting was held with City and others on team.

☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.

Comments: No higher level studies available.

☒ Statement of objectives and servicing criteria.

Comments: Stated throughout the Servicing & SWM Report.

☒ Identification of existing and proposed infrastructure available in the immediate area.

Comments: Refer to the Site Servicing Plans for service locations.

☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).

Comments: *Refer to reports prepared by others.*

☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

Comments: *Refer to Grading Plan*

☒ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.

Comments: *N/A*

☒ Proposed phasing of the development, if applicable.

Comments: *All existing and proposed phasing shown on the Site Servicing Plan.*

☒ Reference to geotechnical studies and recommendations concerning servicing.

Comments: *Geo-technical Investigation (EXP, dated May 14, 2019) is referenced in the report and drawings.*

☒ All preliminary and formal site plan submissions should have the following information:

☒ Metric scale
☒ North arrow (including construction North)
☒ Key plan
☒ Name and contact information of applicant and property owner
☐ Property limits including bearings and dimensions
☒ Existing and proposed structures and parking areas
☒ Easements, road widening and rights-of-way
☒ Adjacent street names

Comments: Refer to legal plans for property information.

4.2 Development Servicing Report: Water

☒ Confirm consistency with Master Servicing Study, if available

Comments: *Water as per City Guidelines. No Master Servicing Studies.*

☒ Availability of public infrastructure to service proposed development

Comments: *Refer to the Servicing & SWM Report.*

☒ Identification of system constraints

Comments: *Refer to the Servicing & SWM Report.*

☒ Identify boundary conditions

Comments: *Refer to the Servicing & SWM Report, Section 4.4 for the water system boundary conditions.*

☒ Confirmation of adequate domestic supply and pressure

Comments: *Refer to the Servicing & SWM Report, Section 4.*

☒ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.

Comments: *Refer to the Servicing & SWM Report, Sections 4.3*

☒ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

Comments: *Refer to the Servicing & SWM Report, Section 4.*

☒ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

Comments: *No Phasing constraints.*

☒ Address reliability requirements such as appropriate location of shut-off valves

Comments: *Two shut off valves placed at the property lines*

☒ Check on the necessity of a pressure zone boundary modification.

Comments: *N/A*

☒ Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range

Comments: *Refer to the Servicing & SWM Report, Section 4.5.*

☒ Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.

Comments: *Refer to the Servicing & SWM Report, Section 4.*

☒ Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.

Comments: *N/A*

☒ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.

Comments: *Water Demands as per City Guidelines. Refer to the Servicing & SWM Report and Appendices for the demand calculations.*

☒ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

Comments: *N/A*

4.3 Development Servicing Report: Wastewater

☒ Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).

Comments: *N/A*

☒ Confirm consistency with Master Servicing Study and/or justifications for deviations.

Comments: *N/A*

☒ Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.

Comments: *N/A*

☒ Description of existing sanitary sewer available for discharge of wastewater from proposed development.

Comments: *Refer to the Servicing & SWM Report, Section 5.*

☒ Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)

Comments: *No upgrades are recommended to the downstream sewer. Refer to the Servicing & SWM Report, Section 5.*

☒ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

Comments: *N/A*

☒ Special considerations such as contamination, corrosive environment etc.

Comments: *N/A*

4.4 Development Servicing Report: Stormwater

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

Comments: *Majority of Storm runoff discharges to underground storage chambers prior to outletting to the Storm sewer on Victor Street.*

☒ Analysis of available capacity in existing public infrastructure.

Comments: *Flows controlled to allowable rate based on agreed flow of 50L/sec into Victor Street Storm Sewer. Refer to Site Servicing and SWM Rreport.*

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

Comments: *Refer to the Grading Plan and the Storm Drainage Area Plan included in the report*

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

Comments: *Refer to the Servicing and SWM Report for the quantity control objectives.*

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

Comments: *Oil and Grit separator to be installed downstream of the site to remove a minimum 80% TSS, as per city comments. Refer to the Servicing and SWM Report , Section 6.11*

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

Comments: *Refer to Servicing & SWM Report.*

☒ Set-back from private sewage disposal systems.

Comments: *N/A*

☒ Watercourse and hazard lands setbacks.

Comments: *N/A*

☒ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

Comments: *Discussion held with MVCA.*

☒ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

Comments: *N/A*

☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).

Comments: *Refer to calculations provided in the Servicing & SWM Report, Section 6 and within Appendix E.*

☒ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.

Comments: *N/A*

☒ Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.

Comments: *Included in the Servicing & SWM Report.*

☒ Any proposed diversion of drainage catchment areas from one outlet to another.

Comments: *N/A*

☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.

Comments: *N/A*

☒ If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.

Comments: *Quantity control is proposed. Refer to the Servicing & SWM Report.*

☒ Identification of potential impacts to receiving watercourses

Comments: *N/A*

☒ Identification of municipal drains and related approval requirements.

Comments: *N/A*

☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.

Comments: Refer to the Servicing & SWM Report.

☒ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

Comments: No surface ponding proposed in all rainfall events. Major flow routing to the existing roadway or watercourse.

☒ Inclusion of hydraulic analysis including hydraulic grade line elevations.

Comments: Dynamic PCSWMM model included for City review.

☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.

Comments: Refer to the Servicing & SWM Report, Section 7 and Erosion & Sediment Control Plan.

☒ Identification of floodplains - proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.

Comments: N/A

☒ Identification of fill constraints related to floodplain and geotechnical investigation.

Comments: N/A

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

☒ Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.

Comments: *N/A*

☒ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.

Comments: *A new sanitary sewer is proposed further north along Victor Street in order to service the town homes facing Victor Street beginning at SANMH 100. (ECA application*

☒ Changes to Municipal Drains.

Comments: *N/A*

☒ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

Comments: *N/A*

4.6 Conclusion Checklist

☒ Clearly stated conclusions and recommendations

Comments: *Refer to the Servicing & SWM Report, Section 8.*

☒ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

Comments: *N/A*

☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

Comments: *All reports are signed and stamped by a professional Engineer registered in Ontario.*