Site Servicing and Stormwater Management Report Hazeldean Crossing

Type of Document
Site Plan Submission

Project Name
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Date Submitted
May 2019

Hazeldean Crossing Inc.

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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 sanitary and storm sewers an Environmental Compliance Approval (ECA) will be required from the Ministry of Environment, Conservation and Parks (MECP), formerly the Ministry of the Environment and Climate Change (MOECC), for the private sewage works. The ECA application will be filled as a direct submission with the MECP, after municipal signoff of the application.

Regarding the onsite stormwater system, generally the ECA would include 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 merge 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 a separate 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 will be contacted to confirm 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 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 450mm 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, F (L/min)**	**[2]Type of Constr. Coeff, C**	**[3]Reduction Due to Occupancy (%)**	**[4]Total Increase due to Exposures (%)**	**[5,6]Required Fire Flow in**	
							(L/min)	**(L/sec)**
1	Townhomes (back-to-back)	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

Notes:

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.
6 - A 50% reduction was used for fully supervised sprinkler systems (all towers)

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. Connection # 3 was used for modelling as it represents the closest junction to the boundary condition. The following hydraulic grade line (HGL) boundary condition was provided:

- Maximum HGL = 160.9m
- Max Day + Fire Flow HGL = 147.5 m
- Peak Hour HGL = 157.30 m

The above noted HGL is based on a ground elevation of approximately 113.94 m at the boundary condition location. This results in a system water pressure of 43.36 m or 61.7 psi 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 (5) 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.

- Scenario 1 Peak Hour
- Scenario 2 Max Day Plus Fire Flow

Please refer to Figure A2 in Appendix A which illustrates the water distribution layout.

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 1 for Peak Hour

Junction	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-1	113.94	0.38	157.30	61.5
J-2	114.00	0.00	157.30	61.5
J-3	114.00	0.62	157.30	61.5
J-4	113.95	1.17	157.29	61.5
J-5	114.36	0.00	157.29	60.9
J-6	114.50	1.76	157.29	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	156.94	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 are 72 psi and 76 psi under peak hour conditions for all junctions. This meet the minimum 40 psi as per City of Ottawa Guidelines. Table 4-3 below provides the results of scenarios 2 under maximum day plus fire flow conditions.

Table 4-3: Summary Results of Scenario 2 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

Residential Sewage Flow

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

Extraneous Flows

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

Total Sewage Flow

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 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.

6.1.1 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.

6.1.2 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.

6.2 Runoff Coefficients

Runoff coefficients used for post-development conditions were based on actual areas taken from CAD. 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 were calculated for each inlet drainage area using a runoff coefficient of 0.20 for pervious surfaces and 0.90 for impervious surfaces. PCSWMM modelling software was used for area weighting of catchments.

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

Table 6-1: Summary of Post Development Average Runoff Coefficients

Location	Area (hectares)	Average Runoff Coefficient (C_{AVG})	
		Pre-Development	Post-Development
Site 1	0.4995	0.20	0.70
Site 2	0.4645	0.54	0.67
Totals	0.9640	0.36	0.69

6.3 Time of Concentration

The time of concentration for the pre-development catchments 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.

6.4 Pre-Development Conditions

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-1 and PRE-2 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 be 7.39 minutes and 1.93 minutes respectively. 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 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	55.2	45.8	101.0
5-year	75.0	62.8	137.8
100-year	160.9	135.4	296.3

6.5 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 pre-consultation with the City of Ottawa, the post-development flows are to be controlled to the pre-development rates for all storms up to the 100-year event. Using a time of concentration (T_C) of 10 minutes and an average pre-development runoff coefficient of 0.36, the allowable release rates from the site were determined for the 2-year, 5-year, and 100-year storms as follows:

Q_{2ALL} = $2.78\ (0.36)\ (I_{2\text{-year}})\ (0.9642\ \text{ha})$
= $2.78\ (0.36)\ (732.951/(10+6.199)\text{^}0.810)\ (0.9642\ \text{ha})$ = 74.1 L/sec

Q_{5ALL} = $2.78\ (0.36)\ (I_{5\text{-year}})\ (0.9642\ \text{ha})$
= $2.78\ (0.36)\ (998.071/(10+6.035)\text{^}0.814)\ (0.9642\ \text{ha})$ = 100.6 L/sec

Q_{100ALL} = $2.78\ (0.36)\ (I_{100\text{-year}})\ (0.9642\ \text{ha})$
= $2.78\ (0.36*1.25)\ (1735.688/(10+6.014)\text{^}0.820)\ (0.9642\ \text{ha})$ = 215.3 L/sec

Therefore, the allowable release rate from the proposed site is 74.1 L/sec, 100.6 L/sec, and 215.3 L/sec based on a 2-year, 5-year, and 100-year storm event respectively. This will include both directly connected and uncontrolled overland flows.

6.6 Offsite Overland Flow Areas

As small amount of onsite drainage fronting both Hazeldean and Victor discharges overland directly to the right-of-way it was necessary to subtract the peak flows from these areas to ensure that no increase in runoff occurs under post-development conditions.

As illustrated in drawing C400 the 100-year peak flows from subcatchment areas S08 and S09 were calculated to account for overland flow that will discharge offsite without being captured in the onsite minor system.

Using a post-development time of concentration (T_C) of 10 minutes and a runoff coefficient of 0.54 and 0.60 respectively, the 100-year uncontrolled flow rate, Q_{100UNC}, was determined using the Rational Method as follows:

Q_{100UNC} = 2.78 x 0.55 x 125% x 178.56 x (0.1123) = 42.5 L/sec (Area S08)

Q_{100UNC} = 2.78 x 0.62 x 125% x 178.56 x (0.0869) = 40.3 L/sec (Area S09)

As the entire development will be serviced with one storm sewer outfall, the allowable release rate to the storm sewers (minor system) on Victor Street was determined by subtracting the uncontrolled 100-year runoff from the allowable release rate as follows:

$$
\begin{aligned}
Q_{REL} &= Q_{ALLOW} - Q_{100UNC} \\
&= Q_{ALLOW} - Q_{100UNC\text{-}S08} - Q_{100UNC\text{-}S09} \\
&= 215.4 - 42.5 - 40.3 \\
&= 132.6 \text{ L/sec}
\end{aligned}
$$

Therefore, the allowable discharge into the existing storm sewer (directly connected) from the site is 132.6 L/sec in the 100-year event.

6.7 Calculation of Post-Development Runoff

Stormwater runoff from the proposed site will drain from a combination of controlled and uncontrolled areas. As a result of the changes onsite the overall post development runoff coefficient will increase over pre-development conditions. This increase in runoff is the result of changes due to site development (i.e. additional hard surfaces, roof areas and hard landscaping).

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 PCSWM 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.

6.8 Minor System (Storm Sewer) Design

A storm drainage plan is illustrated on drawing C400 located in Appendix A. A total nine (9) subcatchments (or drainage areas) within the development site are shown on this drawing with average runoff coefficients calculated for each drainage area. Three additional offsite drainage areas were determined to estimate peak flows and determine available capacity within the downstream storm sewer run on Victor Street.

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.

6.9 Stormwater Management Modelling

The site is designed using a dynamic stormwater model. For this analysis all minor and major system components were 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.

6.9.1 Hydrologic/Hydraulic Analysis

PCSWMM was used to create a complete hydrologic/hydraulic model of the storm sewer system. 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.

6.9.2 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 6-3: 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	25%
Subcatchment Slopes	Slope	1%

The table below presents the individual subcatchment parameters that were developed and used in the PCSWMM model.

Table 6-4: Post-Development Subcatchment Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Path Length (m)	Slope (%)	IMP (%)	Cavg
S01	CB6	0.1752	67.9	25.8	1	74.9	0.72
S02	CB1	0.1422	47.2	30.1	1	90.3	0.83
S03	CB1	0.0178	79.8	2.2	1	14.9	0.30
S04	cb3	0.2001	70.3	28.5	1	78.8	0.75
S05	CB4	0.1264	53.2	23.8	1	75.1	0.73
S06	CBT1	0.0617	52.4	11.8	1	35.1	0.45
S07	CBE1	0.0415	54.6	7.6	1	52.3	0.57
S08	OF-HAZELDEAN	0.1123	140.4	8.0	1	50.7	0.55
S09	OF-VICTOR	0.0869	96.6	9.0	1	60.1	0.62

6.9.3 Storage Node Parameters

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 6-5: Storage Node Parameters

Name	Number of Chambers	Number of Endcaps	Total Volume (m^3)
CHAMBERS-1 (east)	22	8	120
CHAMBERS-2 (west)	22	10	122

Table 6-6 below summarizes all 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 6-6: Storage Node Parameters

Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Storage Curve	Curve Name	TYPE
CHAMBERS-1	111.49	114.1	2.61	TABULAR	STORAGE-1	Underground Chambers
CHAMBERS-2	112.27	114.5	2.23	TABULAR	STORAGE-2	Underground Chambers

6.9.4 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 6-7: Outlet (ICD) Node Parameters

Name	Outlet Node	Type	Inlet Elev. (m)	Rating Curve	Curve Name	100-yr Flow (L/s)
C14	205	ICD	112.13	TABULAR/DEPTH	LMF-Type B	43.5
C7	216	ICD	111.42	TABULAR/DEPTH	LMF-Type B	31.4

6.10 Dual Drainage Modelling

The subcatchment (or storm drainage areas) were developed in Autodesk CIVIL 3D and imported into PCSWMM. PCSWMM was then used to generate impervious levels for each subcatchment with the area-weighting command. Storm sewers and manholes were imported from CIVIL 3D as GIS shape files and the node and conduit elevations and sizes were inputted based on the preliminary sizing completed with the Rational Method analysis.

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 are shown as green squares.

Figure 1 - Model Schematic Illustrating Subcatchments, Links, Nodes, Outlets (ICDs)

6.11 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

6.11.1 Modelling Results

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

- Peak flows to the storm sewer on Victor Street meet the allowable rate of 143.2 L/sec based on pre-development peak flows. This includes the small allowance of constant inflow for foundation drainage.
- The combined peak flows of all minor system captured flow and uncontrolled overland flows to meet pre-development rates for all rainfall events up to the 100-year storm.

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

Table 6-8: Peak Flows at Outfalls

Storm Event	Max. Flow (L/sec) to Hazeldean Road as Uncontrolled Overland Flow	Max. Flow (L/sec) to Victor Street			Total Max. Flow (L/sec) Both Outfalls
		Uncontrolled Overland Flow	Minor System Controlled Flows	Total	
Chicago_3h_2yr	12.7	11.7	45.0	56.7	69.4
Chicago_3h_5yr	24.1	20.2	52.2	72.4	96.5
Chicago_3h_100yr	50.9	40.3	70.8	111.1	162
Historic_Jul1-79	62.7	49.3	79.7	129	191.7
Chicago_3h_100yr + 20%	30.9	24.3	71.5	95.8	126.7
Historic_Aug4-88	45.1	35.6	70.9	106.5	151.6
Historic_Aug8-96	30.2	24.9	58.1	83	113.2

Table 6-9: Comparison of Pre-Development and Post-Development Peak Flows

Return Period Storm	Total Peak Flow (L/sec)		% Reduction
	Pre-Dev	Post-Dev	
2-year	74.1	69.4	-6%
5-year	100.6	96.5	-4%
100-year	215.4	162.0	-25%

6.11.2 Underground Storage

The total storage occurring during all storm events is presented in the Table 6-9 below. These results as based on the maximum volumes occurring in each PCSWMM STORAGE node.

Table 6-10: 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	36	0.48	38	0.51	74
Chicago_3h_5yr	52	0.70	58	0.77	110
Chicago_3h_100yr	104	1.40	124	1.67	228
Chicago_3h_100yr + 20%	125	2.34	125	2.23	250
Historic_Jul1-79	113	1.52	125	2.23	238
Historic_Aug4-88	106	1.42	125	1.68	231
Historic_Aug8-96	68	0.91	76	1.01	144

6.12 Hydraulics

6.12.1 Hydraulic Grade Line Analysis

The HGL was plotted from PCSWMM for the 2-year, 5-year and 100-year event. A profile through the complete storm sewer systems is shown below in Figure 2 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.

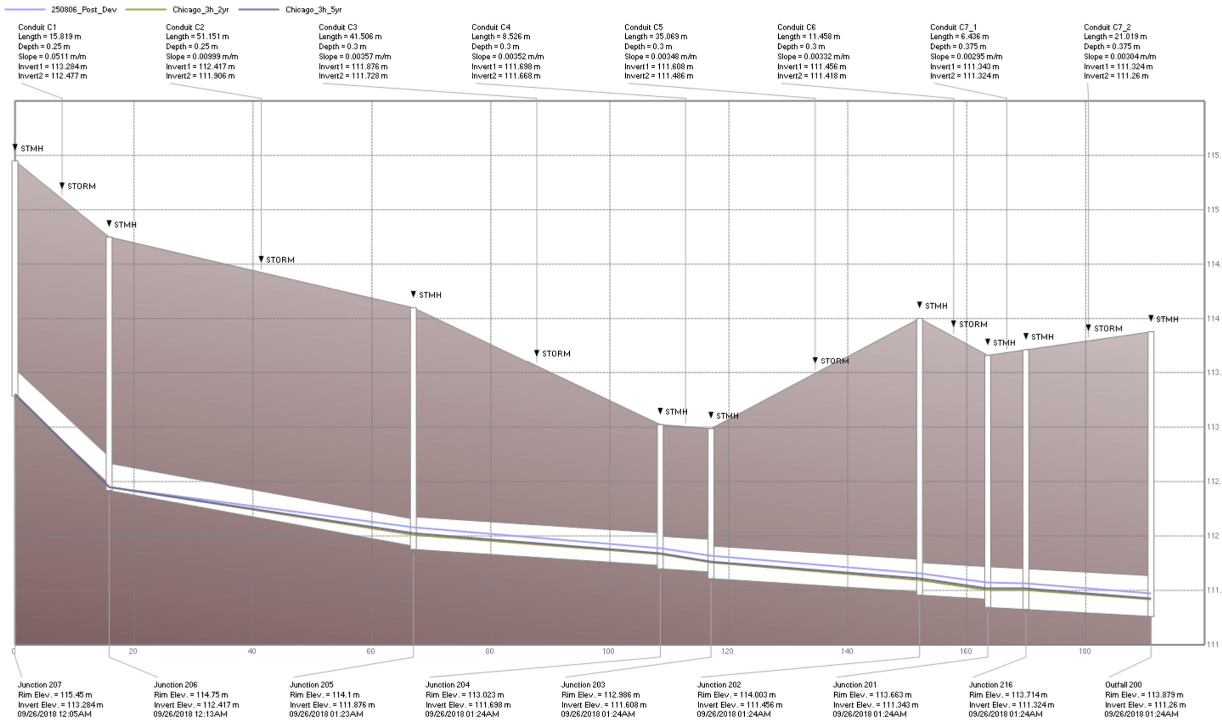


Figure 2 – 100-year HGL (Main Storm Sewer)

6.13 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. A Stormceptor STC300i will we necessary to provide the minimum 80% TSS and 85% volume reduction. The following summarizes the design parameters used in the sizing of the Stormceptor manhole:

Table 6-11: Design Parameters Used for Oil Grit Separator Sizing

Parameter	Value Used
Drainage Area	0.765 hectares
Imperviousness	63.7 %
TSS Removal Requirements	80 %
Runoff Volume Capture	85%
Flow attenuation upstream of OG separator	0.085 m^3/s at 0.012 ha.m
Particle distribution	fine

Output from the PCSWMM for Stormceptor program is provided in Appendix G for reference. A Stormceptor model STC750 is necessary to meet the required TSS removal of 80%. The STC750 will provide an approximate TSS removal of 80%.

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.
- 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 58.9 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 lateral 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 release rate for the site is limited to the pre-development flows of 74.1 L/sec, 100.6 L/sec, and 215.3 L/sec for the 2-year, 5-year, and 100-year storms respectively. Peak flows will be detained onsite for up to the 100-year storm event.
- To meet the stormwater requirements, underground chambers will be used which will have a single outlet manhole and flow control devices (ICDs). IPEX Type B ICDs will be used to control outflows from CHAMBERS-1 (within MH215) to 34.5 L/sec at 1.81m head, and to 31.1 L/sec at 2.23m head from CHAMBERS-2 (within MH212). The total 100-year storage volume for the site was estimated at 195.5 m^3 using the Modified Rational Method. The actual combined volume occurring within the underground chambers during the 100-year event is 228 m^3. Based on Manufactures' specifications, and the number of chambers selected the total combined volume available in the chambers would be 242 m^3.
- The total combined 2-year, 5-year and 100-year peak flows from the site (including uncontrolled overland flow) was estimated at 71.7 L/sec, 99.3 L/sec, and 162.2 L/sec respectively.

Appendix A – Figures

Figure A1: Site Location Plan

Figure A2: Water Distribution Plan

Figure A3: Water Demand Allocation Plan

Figure A4: Fire Hydrant Location Plan

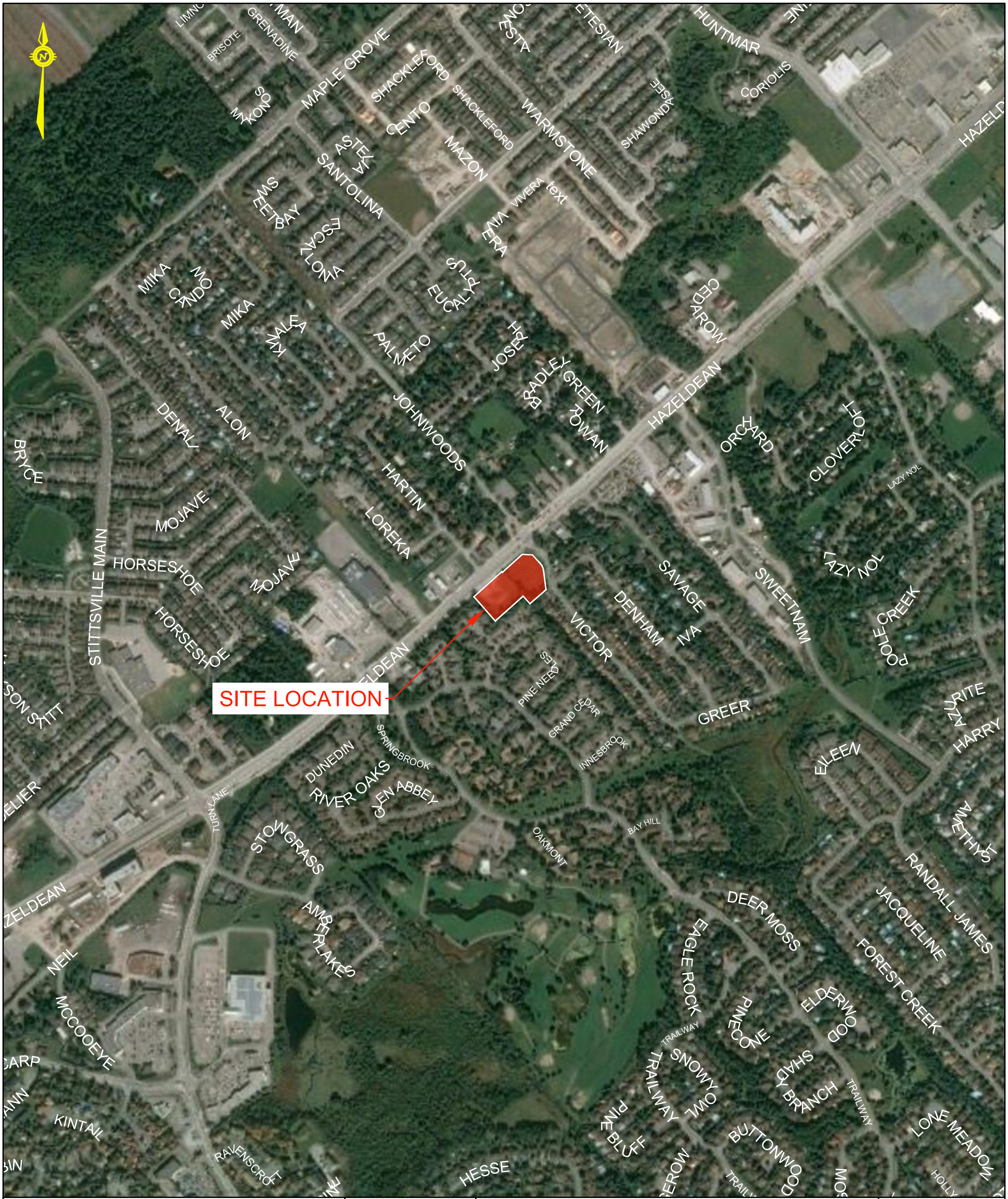
Figure A5: Exposure Distances (FUS)

Figure A6: Sanitary Drainage Area Plan – Onsite Sewers

Figure A4: Sanitary Drainage Area Plan - Offsite Sewers

Figure A8: Pre-Development Drainage Area Plan

Drawing C400: Post-Development Drainage Area Plan (Reduced to 11x17)



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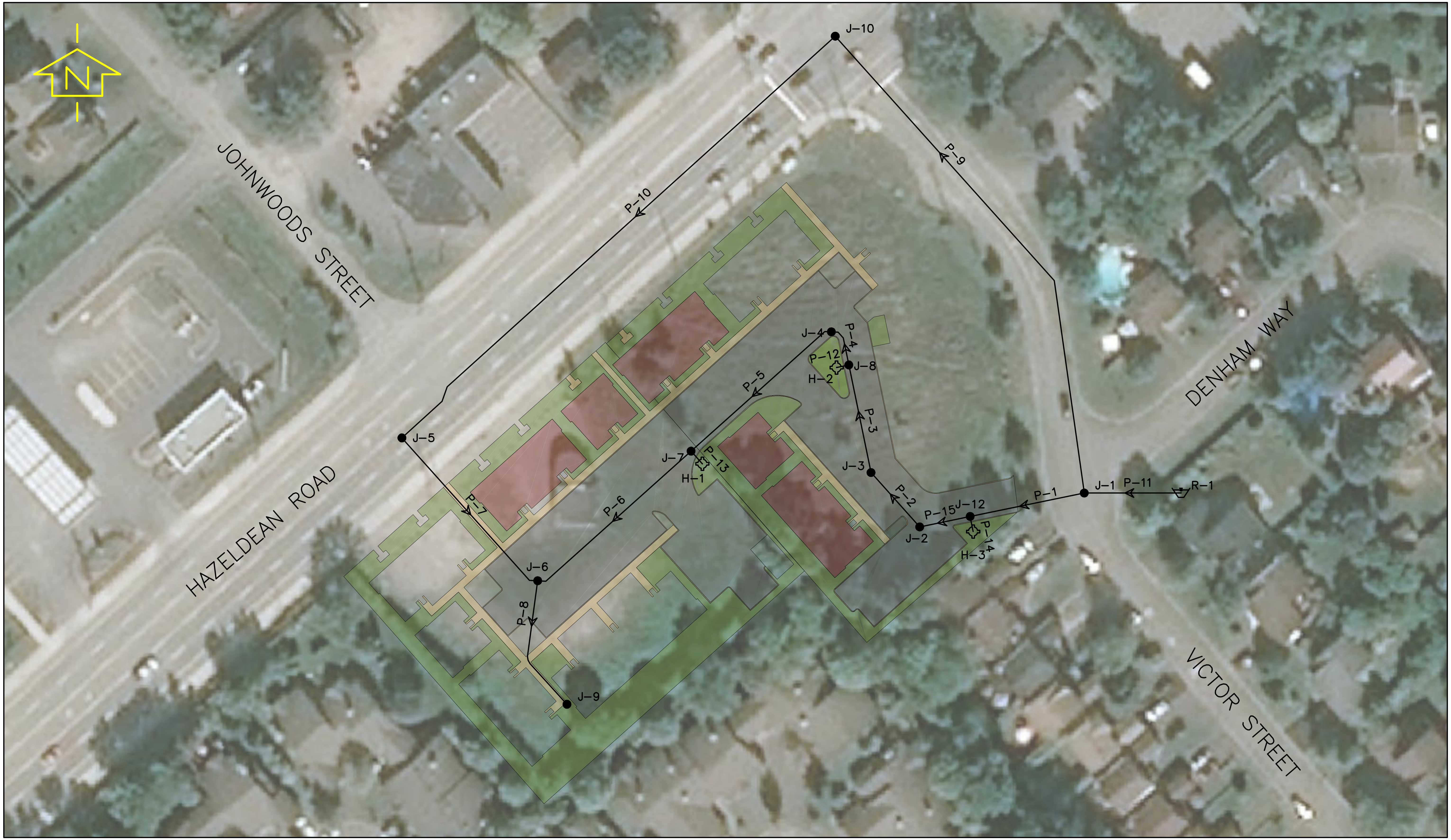
DESIGN	MZG
DRAWN	MZG
DATE	MAY 2019
FILE NO	250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

SITE LOCATION
PLAN

SCALE
1:10000

SKETCH NO
FIG A1



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DESIGN	JLF
DRAWN	SAB
DATE	MAY 2019
FILE NO	250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

WATER DISTRIBUTION PLAN

SCALE 1:750

FIGURE NO
FIG A2

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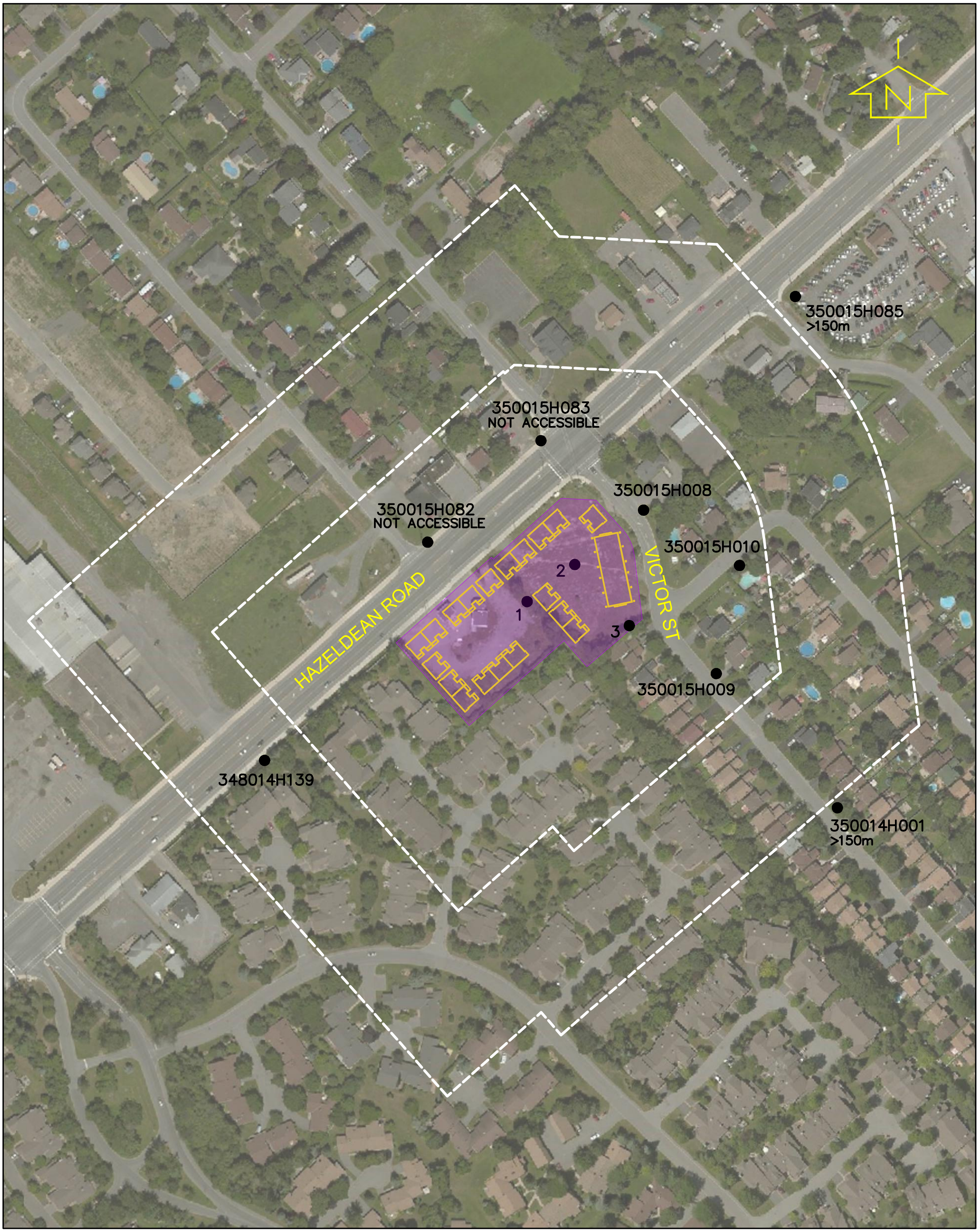
DRAWN SAB
DATE MAY 2019
FILE NO 250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

WATER DISTRIBUTION
DEMAND ALLOCATION

SCALE 1:750
FIGURE NO
FIG A3



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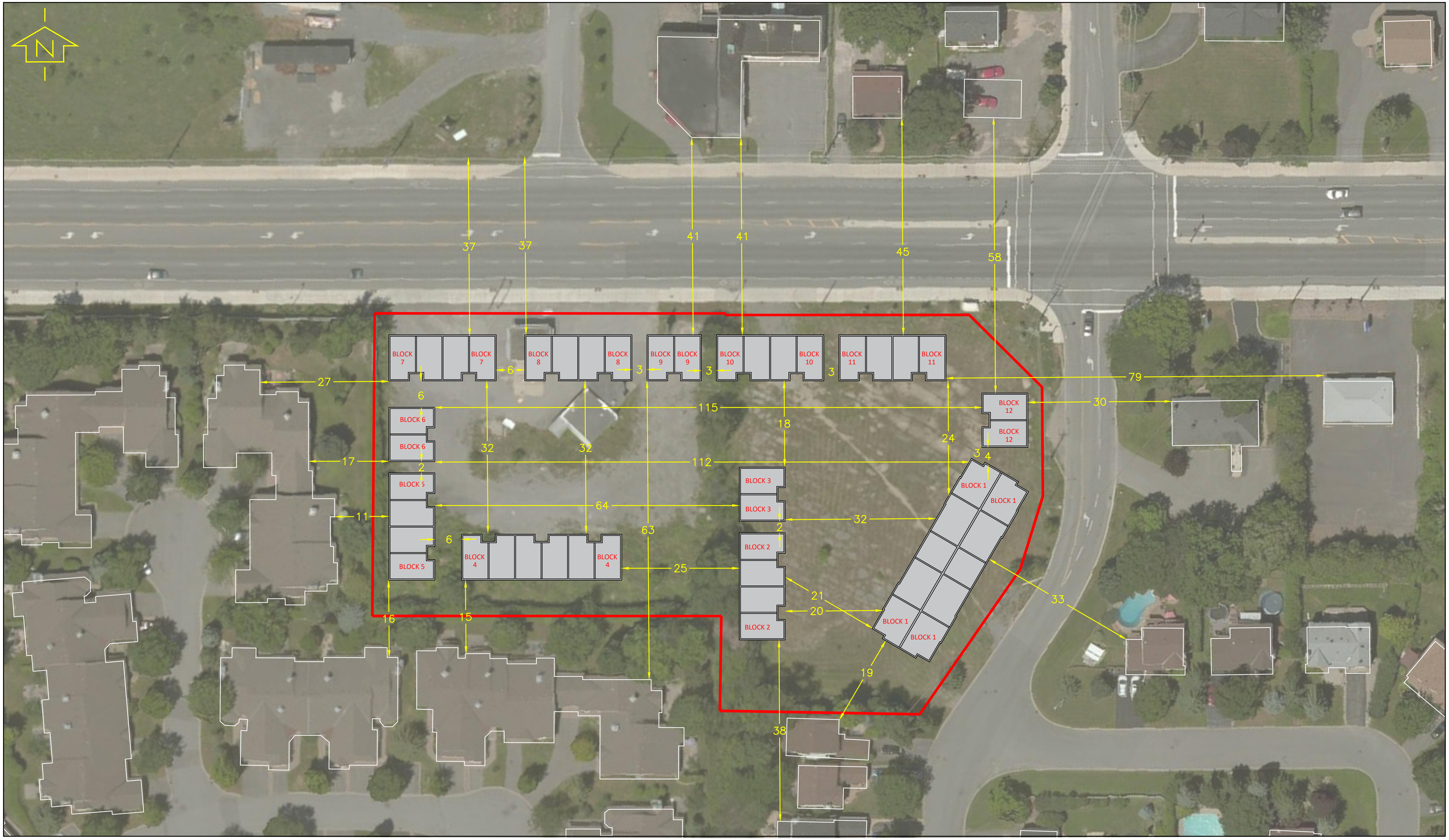
FILE NO 250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

HYDRANT LOCATION
PLAN

SCALE 1:3000
SKETCH NO
FIG A4



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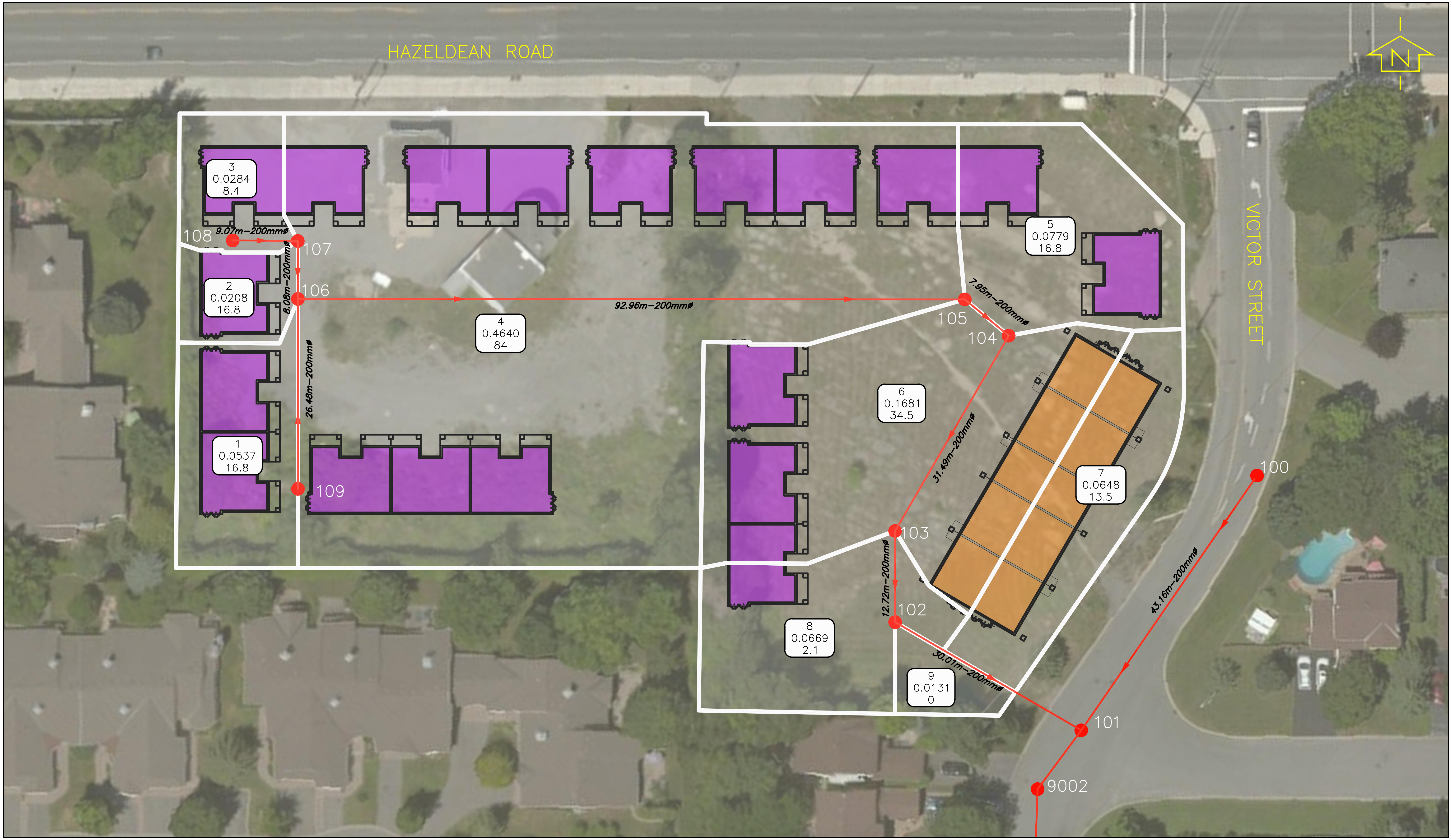
DESIGN MZG
DRAWN MZG
DATE MAY 2019
FILE NO 250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

FUS EXPOSURE
DISTANCES

SCALE 1:750
FIGURE NO FIG A5



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🟪	TOWN HOMES
🟧	BACK TO BACK TOWN HOMES

1 0.0537 16.8	AREA NUMBER AREA (HECTARES) POPULATION
→	FLOW DIRECTION

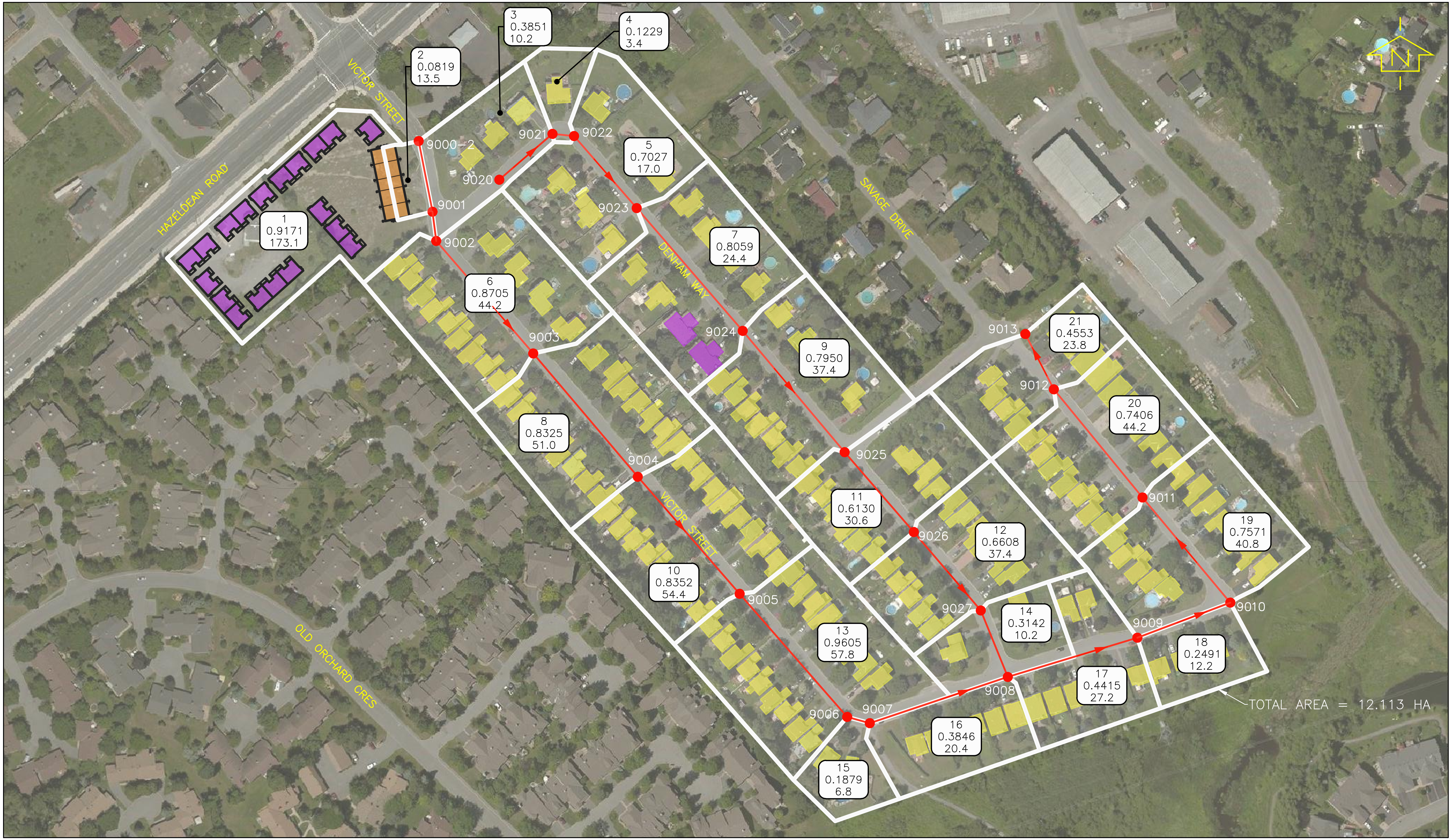
DESIGN	MZG
DRAWN	MZG
DATE	MAY 2019
FILE NO	250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

SANITARY
SEWERS

SCALE
1:500

FIGURE NO
FIG A6



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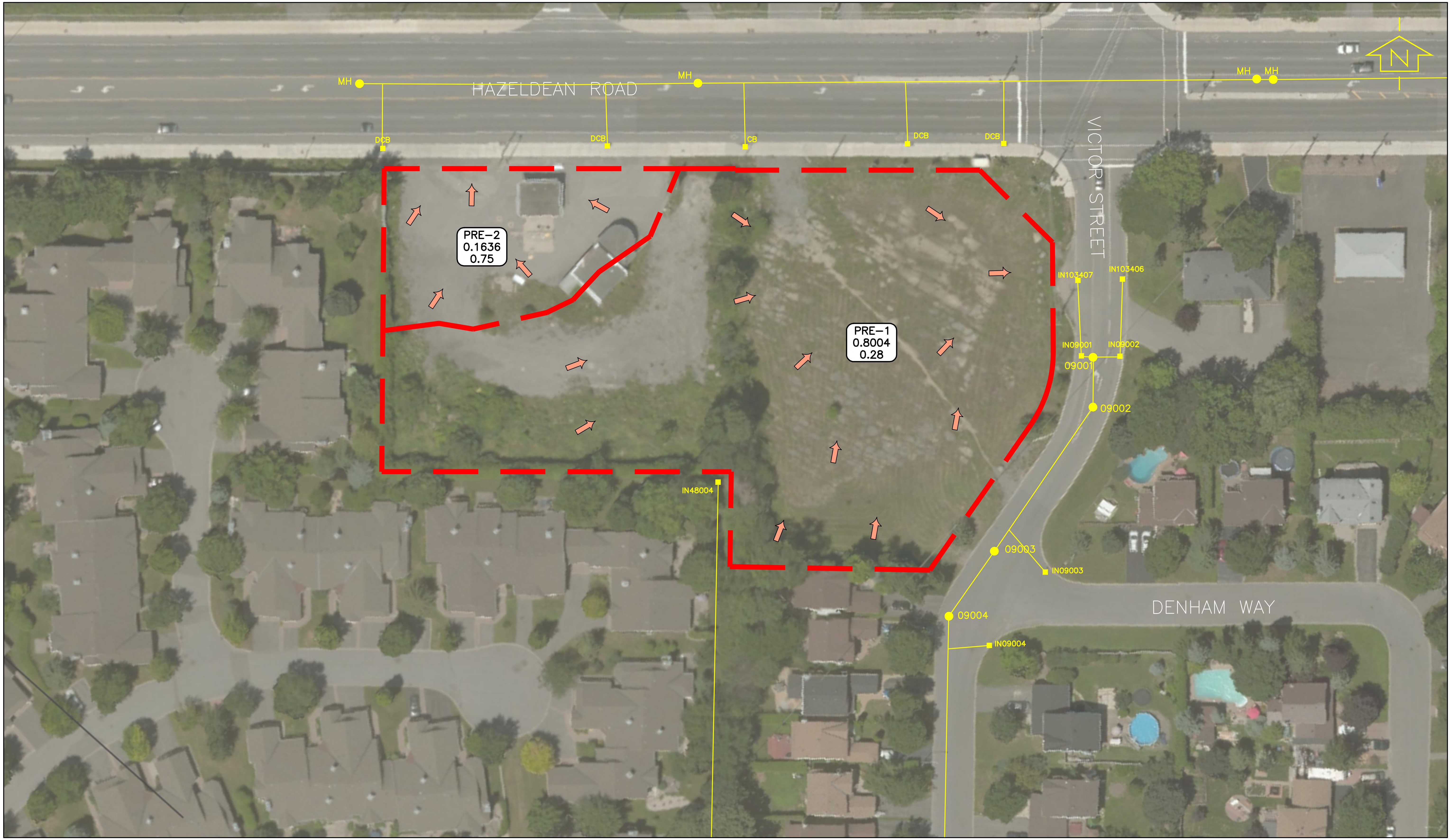
🟨	SINGLES
🟪	TOWN HOMES
🟧	BACK TO BACK TOWN HOMES

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

DESIGN	MZG	HAZELDEAN CROSSING 5924 HAZELDEAN ROAD	SCALE 1: 2000
DRAWN	MZG		FIGURE NO
DATE	MAY 2019	OFFSITE SANITARY SEWERS	FIG A7
FILE NO	250806		



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↑ OVERLAND FLOW DIRECTION

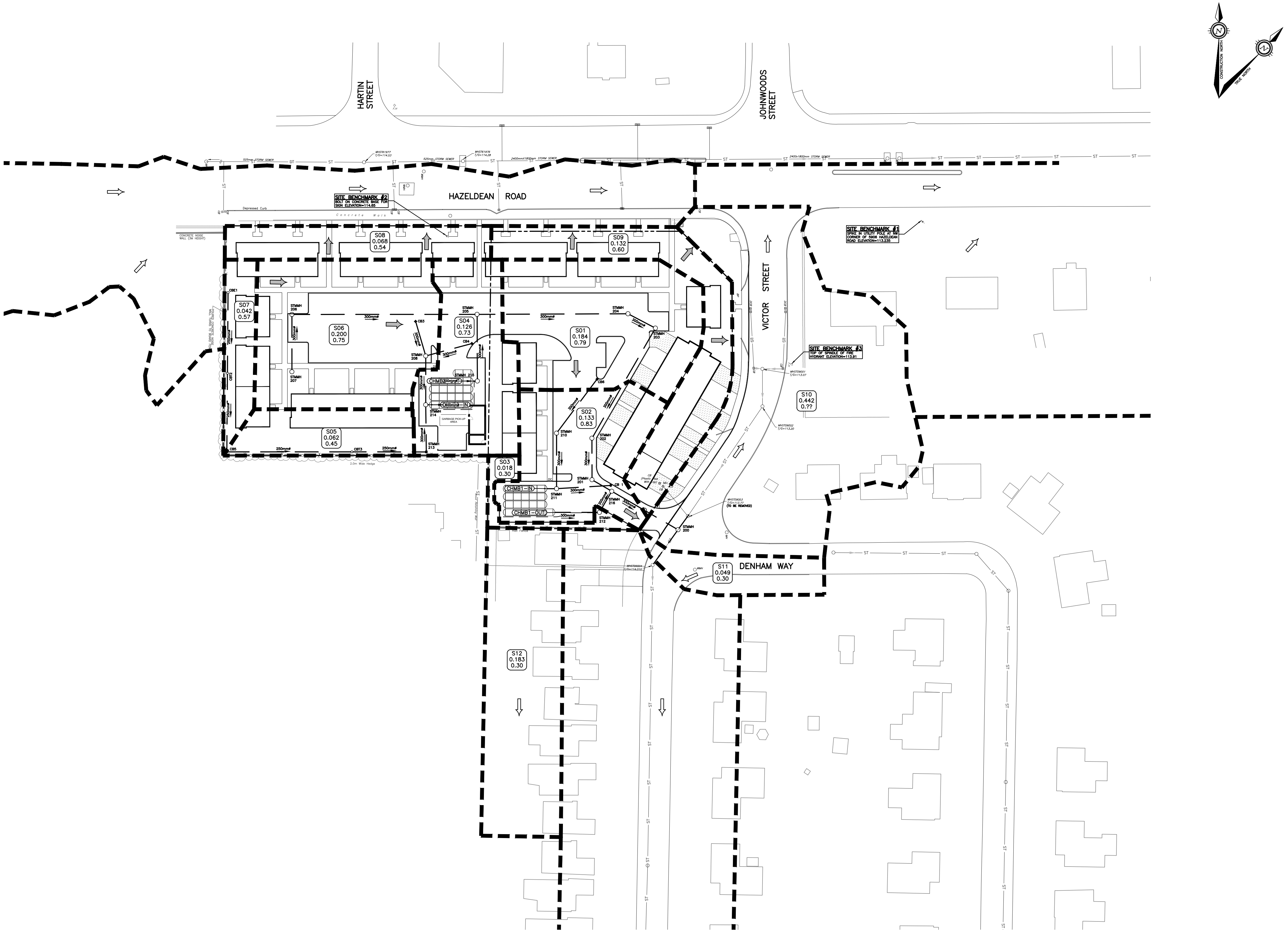
PRE–2	AREA NUMBER
0.1636	AREA (HECTARES)
0.75	POPULATION

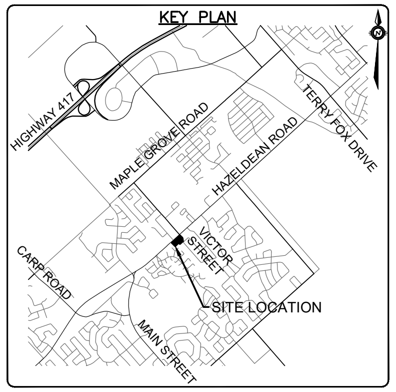
DESIGN MZG
DRAWN MZG
DATE MAY 2019
FILE NO 250806

HAZELDEAN CROSSING
5924 HAZELDEAN ROAD

PRE–DEVELOPMENT
CATCHMENTS

SCALE 1:750
FIGURE NO
FIG A8





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: 5/18/2019 5:53:47 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.

					2	ISSUED FOR SITE PLAN APPROVAL	21/05/19	SAB	BMT
					1	ISSUED FOR REVIEW	18/04/19	AO	BMT
REV	REVISION DESCRIPTION	DATE	BY	APPD	REV	REVISION DESCRIPTION	DATE	BY	APPD

SCALE
0 5m 10m 20m
HORIZONTAL 1:500

DESIGNED BY

REVIEWED BY

CLIENT
HAZELDEAN CROSSING INC.
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OTTAWA, ON.

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• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

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

PROJECT
HAZELDEAN CROSSING TOWNS
5924 HAZELDEAN ROAD
OTTAWA, ONTARIO.

TITLE
POST-DEVELOPMENT
CATCHMENTS

PROJECT No. OTT-00250806-A0
SURVEY FSD
DATE APRIL 2019
DRAWING No. C400

Appendix B – Water Servicing Design Tables

Table B1: Water Demand Chart

Table B2: Fire Flow Contribution Based on Hydrant Spacing

Table B3: Fire Flow Requirements based on FUS, 1999 – Block 1

Table B4: Fire Flow Requirements based on FUS, 1999 – Block 2

Table B5: Fire Flow Requirements based on FUS, 1999 – Block 3

Table B6: Fire Flow Requirements based on FUS, 1999 – Block 4

Table B7: Fire Flow Requirements based on FUS, 1999 – Block 5

Table B8: Fire Flow Requirements based on FUS, 1999 – Block 6

Table B9: Fire Flow Requirements based on FUS, 1999 – Block 7

Table B10: Fire Flow Requirements based on FUS, 1999 – Block 8

Table B11: Fire Flow Requirements based on FUS, 1999 – Block 9

Table B12: Fire Flow Requirements based on FUS, 1999 – Block 10

Table B13: Fire Flow Requirements based on FUS, 1999 – Block 11

Table B14: Fire Flow Requirements based on FUS, 1999 – Block 12

TABLE B1: Water Demand Chart

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

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)	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					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)	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%			

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**

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 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%				

	Exposures	Separation 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	Separation 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)	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%			

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							
						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)	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	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%	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%			

Task		
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%											
Choose Structure Exposure Distance						Exposed Wall Length							
	Exposures	Separation 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)	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	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%	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

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

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 - CONNECTION TO VICTOR ST & HAZELEAN RD

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-1	113.94	0.38	157.30	61.5
J-2	114.00	0.00	157.30	61.5
J-3	114.00	0.62	157.30	61.5
J-4	113.95	1.17	157.29	61.5
J-5	114.36	0.00	157.29	60.9
J-6	114.50	1.76	157.29	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	156.94	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	2.94	157.30	157.30	0.09	0.000
P-3	J-3	J-8	23	204.0	110.0	2.32	157.29	157.30	0.07	0.000
P-4	J-8	J-4	9	204.0	110.0	2.32	157.29	157.29	0.07	0.000
P-5	J-4	J-7	39	204.0	110.0	1.15	157.29	157.29	0.04	0.000
P-6	J-7	J-6	43	204.0	110.0	0.33	157.29	157.29	0.01	0.000
P-7	J-6	J-5	42	204.0	110.0	-1.90	157.29	157.29	0.06	0.000
P-8	J-9	J-6	29	38.0	100.0	-0.47	157.29	156.94	0.41	0.012
P-9	J-1	J-10	114	204.0	110.0	1.90	157.30	157.30	0.06	0.000
P-10	J-10	J-5	124	297.0	110.0	1.90	157.29	157.30	0.03	0.000
P-11	R-1	J-1	20	600.0	130.0	5.22	157.30	157.30	0.02	0.000
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>	5.22	157.30

5924 & 5938 Hazeldean Road

MAX DAY PLUYS FIREFLOW - CONNECTION TO VICTOR ST & HAZELEAN RD

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-1	113.94	0.25	147.50	47.6
J-2	114.00	0.00	147.50	47.6
J-3	114.00	0.41	147.50	47.5
J-4	113.95	0.77	147.50	47.6
J-5	114.36	0.00	147.50	47.0
J-6	114.50	1.17	147.50	46.8
J-7	114.32	0.55	147.50	47.1
J-8	113.90	0.00	147.50	47.7
J-9	115.45	0.31	147.34	45.3
J-10	113.20	0.00	147.50	48.7

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	147.50	147.50	0.06	0.000
P-3	J-3	J-8	23	204.0	110.0	1.54	147.50	147.50	0.05	0.000
P-4	J-8	J-4	9	204.0	110.0	1.54	147.50	147.50	0.05	0.000
P-5	J-4	J-7	39	204.0	110.0	0.77	147.50	147.50	0.02	0.000
P-6	J-7	J-6	43	204.0	110.0	0.22	147.50	147.50	0.01	0.000
P-7	J-6	J-5	42	204.0	110.0	-1.26	147.50	147.50	0.04	0.000
P-8	J-9	J-6	29	38.0	100.0	-0.31	147.50	147.34	0.27	0.006
P-9	J-1	J-10	114	204.0	110.0	1.26	147.50	147.50	0.04	0.000
P-10	J-10	J-5	124	297.0	110.0	1.26	147.50	147.50	0.02	0.000
P-11	R-1	J-1	20	600.0	130.0	3.46	147.50	147.50	0.01	0.000
P-12	J-8	H-2	3	155.0	100.0	0.00	147.50	147.50	0.00	0.000
P-13	H-1	J-7	4	155.0	100.0	0.00	147.50	147.50	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	147.50

5924 & 5938 Hazeldean Road

MAX DAY PLUYS FIREFLOW - CONNECTION TO VICTOR ST & HAZELEAN RD

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 (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Satisfies Fire Flow Constraints?
H-1	0.00	250.00	295.75	295.75	0.0	172.5	True
H-2	0.00	250.00	300.00	300.00	0.0	180.0	True
J-1	0.00	250.25	300.00	300.25	0.0	47.6	True
J-2	0.00	250.00	300.00	300.00	0.0	34.1	True
J-3	0.00	250.41	300.00	300.41	0.0	30.2	True
J-4	0.00	250.77	300.00	300.77	0.0	24.2	True
J-5	0.00	250.00	291.17	291.17	0.0	20.0	True
J-6	0.00	251.17	274.90	276.07	0.0	21.6	True
J-7	0.00	250.55	295.75	296.30	0.0	20.0	True
J-8	0.00	250.00	300.00	300.00	0.0	25.7	True
J-9	0.00	(N/A)	(N/A)	(N/A)	0.0	(N/A)	(N/A)
J-10	0.00	250.00	300.00	300.00	0.0	21.6	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						
				Area (ha)		NUMBER OF UNITS							POPULATION				AREA (ha)			AREA (ha)					AREA (ha)										
Street	U/S MH	D/S MH	Area #	INDIV	ACCUM	Singles	Semis	Towns	1-Bed Apt.	2-Bed Apt.	3-Bed Apt.	4-Bed Apt.	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	Peak Flow (L/sec)	INDIV	ACCU	Peak Factor (per MOE)	AREA (Ha)	ACCU AREA (Ha)	INDIV	ACCUM	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q_{CAP} (%)	Velocity (m/s) Min 0.6 Max 3.0
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	250	251.46	0.65	41.50	48.7	0%	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	4.12	26.48	67.6	0%	2.46
	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	1.98	9.07	46.9	0%	1.71
	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	0.59	92.96	25.6	6%	0.93
	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 Peak Factor =	1.5	(when area >20%)	Peak Population Flow, (L/sec) =	P*q*M/86.4	Unti Type	Persons/Unit
Commercial Avg. Daily Flow (L/gross ha/day) =	28,000		1.0	(when area <20%)	Peak Extraneous Flow, (L/sec) =	I*Ac	Singles	3.4
or L/gross ha/sec =	0.324				Residential Peaking Factor, M =	1 + (14/(4+P^0.5)) * K	Semi-Detached	2.7
Institutianal Avg. Daily Flow (L/s/ha) =	28,000	Institutional Peak Factor =	1.5	(when area >20%)	A_c = Cumulative Area (hectares)		Townhomes	2.7
or L/gross ha/sec =	0.324		1.0	(when area <20%)	P = Population (thousands)		Single Apt. Unit	1.4
Light Industrial Flow (L/gross ha/day) =	35,000						2-bed Apt. Unit	2.1
or L/gross ha/sec =	0.40509	Residential Correction Factor, K =	0.80		Sewer Capacity, Qcap (L/sec) =	$1/N\ S^{1/2} R^{2/3} A_c$	3-bed Apt. Unit	3.1
Light Industrial Flow (L/gross ha/day) =	55,000	Manning N =	0.013		(Manning's Equation)		4-bed Apt. Unit	4.1
or L/gross ha/sec =	0.637	Peak extraneous flow, I (L/s/ha) =	0.33	(Total I/I)				

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, May 2019.xlsx	1 of 1

Appendix E – Stormwater Design Tables

Table E1: Estimation of Catchment Time of Concentration (Pre-Development)

Table E2: Estimation of Peak Flows (Pre-Development)

Table E3: Estimation of Allowable Peak Flows (Based on Pre-Development C=0.36 with Tc=10mins)

Table E4: Average Runoff Coefficient (Post-Development)

Table E5: Summary of Post Development Peak Flows (Uncontrolled and Controlled)

Table E6: Summary of Post Development Storage

Table E7: Storage Volumes for 2-yr, 5-yr, 100-yr Storms Based on Modified Rational Method (Site 1)

Table E8: Storage Volumes for 2-yr, 5-yr, 100-yr Storms Based on Modified Rational Method (Site 2)

Table E9: MC-3500 Site Calculator for Chambers 1 (Site 1)

Table E10: MC-3500 Site Calculator for Chambers 2 (Site 2)

Table E11: MC-3500 Cumulative Storage Vs Depth Table (Site 1)

Table E12: MC-3500 Cumulative Storage Vs Depth Table (Site 2)

Table E13: 2-year Storm Sewer Calculation Sheet

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-1	0.8005	Victor	115.11	112.88	182.3	1.22	0.28	7.39	See Note 1
PRE-2	0.1637	Hazeldean	115.20	114.70	31.1	1.61	0.75	1.93	See Note 2
Totals	0.9642						Avg=0.36		

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: $T_C = 3.26* (1.1-C)* L^{0.5}/ S_W^{0.33}$

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)

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-1	0.8005	Victor	7.39	88.55	0.28	55.2	120.39	0.28	75.0	206.61	0.35	160.9
PRE-2	0.1637	Hazeldean	1.93	134.27	0.75	45.8	184.01	0.75	62.8	317.31	0.94	135.4
Totals	0.9642					101.0			137.8			296.3

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 Pre-Development C=0.36 with Tc=10mins)

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_{ALLOW} (L/sec)	I_5 (mm/hr)	Cavg	Q_{ALLOW} (L/sec)	I_{100} (mm/hr)	Cavg	Q_{ALLOW} (L/sec)
PRE-1	0.8005	Victor	10	76.81	0.36	61.5	104.29	0.36	83.5	178.56	0.45	178.8
PRE-2	0.1637	Hazeldean	10	76.81	0.36	12.6	104.29	0.36	17.1	178.56	0.45	36.6
Both Sites	0.9642					74.1			100.6			215.4

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.

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

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							1258.1	1752	0.72	Surface Areas
S02							1184.8	1422	0.83	Surface Areas
S03							54.2	178	0.30	Surface Areas
S04							1504.1	2001	0.75	Surface Areas
S05							917.1	1264	0.73	Surface Areas
S06							275.1	617	0.45	Surface Areas
S07							235.0	415	0.57	Surface Areas
S08							617.7	1123	0.55	Surface Areas
S09							538.8	869	0.62	Surface Areas
Totals							6584.8	9,641	0.68	

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	0.72	76.81	26.9	(19.6)	0.72	104.19	36.4	(25.1)	0.90	178.56	78.1	(31.1)	Controlled at MH215 (CHAMBERS 1 - EAST)
S02	0.1422	10	0.83	76.81	25.3		0.83	104.19	34.3		1.00	178.56	70.6		
S03	0.0178	10	0.30	76.81	1.2		0.30	104.19	1.6		0.38	178.56	3.4		
S04	0.2001	10	0.75	76.81	32.1	(22.2)	0.75	104.19	43.6	(24.5)	0.94	178.56	93.3	(34.5)	Controlled at MH212 (CHAMBERS 2 - WEST)
S05	0.1264	10	0.73	76.81	19.6		0.73	104.19	26.6		0.91	178.56	56.9		
S06	0.0617	10	0.45	76.81	5.9		0.45	104.19	8.0		0.56	178.56	17.1		
S07	0.0415	10	0.57	76.81	5.0		0.57	104.19	6.8		0.71	178.56	14.6		
S08	0.1123	10	0.55	76.81	13.2	12.8	0.55	104.19	17.9	24.1	0.69	178.56	38.3	50.9	Uncontrolled - Hazeldean
S09	0.0869	10	0.62	76.81	11.5	11.7	0.62	104.19	15.6	20.2	0.78	178.56	33.4	40.3	Uncontrolled - Victor
Foundation					5.4	5.4			5.4	5.4			5.4	5.4	Drainage
Totals	0.9641				146.0	**71.7**			196.1	**99.3**			411.0	**162.2**	
Total pre-development for comparison						*74.1*				*100.6*				*215.4*	

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*

TABLE E6: SUMMARY OF POST DEVELOPMENT STORAGE

Area No.	Area (ha)	Release Rate (L/s)			^{1} Storage Required (m^3) (MRM)			Storage Provided (m^3)					Control Method
		2-yr	5-yr	100-yr	2-yr	5-yr	100-yr	Roof	Surface Ponding	UG Chambers	UG CB/MHs	Total	
S01	0.1752	19.6	25.1	31.1	21.0	29.6	88.5			120.0		120.0	ICD MHF TYPE B
S02	0.1422												
S03	0.0178												
S04	0.2001	22.2	24.5	34.5	25.3	39.5	107.0			122.0		122.0	ICD MHF TYPE B
S05	0.1264												
S06	0.0617												
S07	0.0415												
S08	0.1123												
S09	0.0869												
Foundation		5.4	5.4	5.4									
Totals (all)=	**0.964**	**47.2**	**55.0**	**71.0**	**46.3**	**69.1**	**195.5**	**0.0**	**0.0**	**242.0**	**0.0**	**242.0**	

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**
C_{AVG} = 0.74 (2-yr)
C_{AVG} = 0.74 (5-yr)
C_{AVG} = 0.93 (100-yr, Max 1.0)
Time Interval = 2.00 (mins)
Drainage Area = 0.3352 (hectares)

Duration (min)	Release Rate = 19.6 (L/sec) Return Period = 2 (years) IDF Parameters, A = 732.951 , B = 0.810 (I = A/(T_c+C) , C = 6.199					Release Rate = 25.1 (L/sec) Return Period = 5 (years) IDF Parameters, A = 998.071 0.814 (I = A/(T_c+C) , C = 6.053					Release Rate = 31.1 (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	116.1	19.60	96.5	0.00	230.5	160.0	25.100	134.9	0.00	398.6	345.9	31.100	314.8	0.00
2	133.3	92.6	19.60	73.0	8.75	182.7	126.8	25.100	101.7	12.21	315.0	273.3	31.100	242.2	29.07
4	111.7	77.6	19.60	58.0	13.91	152.5	105.9	25.100	80.8	19.38	262.4	227.7	31.100	196.6	47.18
6	96.6	67.1	19.60	47.5	17.09	131.6	91.3	25.100	66.2	23.84	226.0	196.1	31.100	165.0	59.41
8	85.5	59.3	19.60	39.7	19.07	116.1	80.6	25.100	55.5	26.64	199.2	172.9	31.100	141.8	68.04
10	76.8	53.3	19.60	33.7	20.23	104.2	72.3	25.100	47.2	28.34	178.6	154.9	31.100	123.8	74.31
12	69.9	48.5	19.60	28.9	20.82	94.7	65.7	25.100	40.6	29.26	162.1	140.7	31.100	109.6	78.90
14	64.2	44.6	19.60	25.0	20.99	86.9	60.3	25.100	35.2	29.61	148.7	129.1	31.100	98.0	82.28
16	59.5	41.3	19.60	21.7	20.84	80.5	55.9	25.100	30.8	29.52	137.5	119.4	31.100	88.3	84.73
18	55.5	38.5	19.60	18.9	20.43	75.0	52.0	25.100	26.9	29.10	128.1	111.1	31.100	80.0	86.45
20	52.0	36.1	19.60	16.5	19.82	70.3	48.8	25.100	23.7	28.40	120.0	104.1	31.100	73.0	87.58
22	49.0	34.0	19.60	14.4	19.05	66.1	45.9	25.100	20.8	27.48	112.9	98.0	31.100	66.9	88.24
24	46.4	32.2	19.60	12.6	18.13	62.5	43.4	25.100	18.3	26.37	106.7	92.6	31.100	61.5	88.51
26	44.0	30.6	19.60	11.0	17.10	59.3	41.2	25.100	16.1	25.11	101.2	87.8	31.100	56.7	88.45
28	41.9	29.1	19.60	9.5	15.97	56.5	39.2	25.100	14.1	23.72	96.3	83.5	31.100	52.4	88.10
30	40.0	27.8	19.60	8.2	14.76	53.9	37.4	25.100	12.3	22.20	91.9	79.7	31.100	48.6	87.51
32	38.3	26.6	19.60	7.0	13.46	51.6	35.8	25.100	10.7	20.59	87.9	76.3	31.100	45.2	86.71
34	36.8	25.5	19.60	5.9	12.11	49.5	34.4	25.100	9.3	18.90	84.3	73.1	31.100	42.0	85.72
36	35.4	24.6	19.60	5.0	10.69	47.6	33.0	25.100	7.9	17.12	81.0	70.3	31.100	39.2	84.57
38	34.1	23.6	19.60	4.0	9.23	45.8	31.8	25.100	6.7	15.28	77.9	67.6	31.100	36.5	83.28
40	32.9	22.8	19.60	3.2	7.71	44.2	30.7	25.100	5.6	13.37	75.1	65.2	31.100	34.1	81.86
Max =					**20.99**					**29.61**					**88.51**

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 E8 - Storage Volumes for 2-year, 5-Year and 100-Year Storms

Area No: **Chambers 2**
C_{AVG} = 0.68 (2-yr)
C_{AVG} = 0.68 (5-yr)
C_{AVG} = 0.85 (100-yr, Max 1.0)
Time Interval = 2.00 (mins)
Drainage Area = 0.4297 (hectares)

Duration (min)	Release Rate = 22.2 (L/sec) Return Period = 2 (years) IDF Parameters, A = 732.951 , B = 0.810 (I = A/(T_c+C) , C = 6.199					Release Rate = 24.5 (L/sec) Return Period = 5 (years) IDF Parameters, A = 998.071 0.814 (I = A/(T_c+C) , C = 6.053					Release Rate = 34.5 (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	136.3	22.20	114.1	0.00	230.5	187.8	24.500	163.3	0.00	398.6	406.0	34.500	371.5	0.00
2	133.3	108.6	22.20	86.4	10.37	182.7	148.9	24.500	124.4	14.92	315.0	320.9	34.500	286.4	34.36
4	111.7	91.0	22.20	68.8	16.52	152.5	124.3	24.500	99.8	23.95	262.4	267.3	34.500	232.8	55.87
6	96.6	78.8	22.20	56.6	20.36	131.6	107.2	24.500	82.7	29.78	226.0	230.2	34.500	195.7	70.46
8	85.5	69.6	22.20	47.4	22.77	116.1	94.6	24.500	70.1	33.66	199.2	202.9	34.500	168.4	80.84
10	76.8	62.6	22.20	40.4	24.23	104.2	84.9	24.500	60.4	36.24	178.6	181.9	34.500	147.4	88.43
12	69.9	57.0	22.20	34.8	25.02	94.7	77.2	24.500	52.7	37.92	162.1	165.2	34.500	130.7	94.07
14	64.2	52.3	22.20	30.1	25.32	86.9	70.8	24.500	46.3	38.93	148.7	151.5	34.500	117.0	98.27
16	59.5	48.5	22.20	26.3	25.24	80.5	65.6	24.500	41.1	39.42	137.5	140.1	34.500	105.6	101.39
18	55.5	45.2	22.20	23.0	24.86	75.0	61.1	24.500	36.6	39.52	128.1	130.5	34.500	96.0	103.64
20	52.0	42.4	22.20	20.2	24.24	70.3	57.2	24.500	32.7	39.30	120.0	122.2	34.500	87.7	105.22
22	49.0	39.9	22.20	17.7	23.43	66.1	53.9	24.500	29.4	38.81	112.9	115.0	34.500	80.5	106.24
24	46.4	37.8	22.20	15.6	22.45	62.5	51.0	24.500	26.5	38.11	106.7	108.7	34.500	74.2	106.79
26	44.0	35.9	22.20	13.7	21.34	59.3	48.4	24.500	23.9	37.22	101.2	103.1	34.500	68.6	106.96
28	41.9	34.2	22.20	12.0	20.11	56.5	46.0	24.500	21.5	36.18	96.3	98.1	34.500	63.6	106.79
30	40.0	32.6	22.20	10.4	18.78	53.9	43.9	24.500	19.4	35.00	91.9	93.6	34.500	59.1	106.34
32	38.3	31.2	22.20	9.0	17.36	51.6	42.1	24.500	17.6	33.71	87.9	89.5	34.500	55.0	105.64
34	36.8	30.0	22.20	7.8	15.86	49.5	40.3	24.500	15.8	32.31	84.3	85.8	34.500	51.3	104.72
36	35.4	28.8	22.20	6.6	14.30	47.6	38.8	24.500	14.3	30.82	81.0	82.5	34.500	48.0	103.62
38	34.1	27.8	22.20	5.6	12.67	45.8	37.3	24.500	12.8	29.25	77.9	79.4	34.500	44.9	102.34
40	32.9	26.8	22.20	4.6	10.99	44.2	36.0	24.500	11.5	27.61	75.1	76.5	34.500	42.0	100.91
Max =					**25.32**					**39.52**					**106.96**

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

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		120	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		9	meters
Storage Volume per Chamber		5.0	cubic meters
Storage Volume per End Cap		1.2	cubic meters

System Sizing

Number of Chambers Required	22	each
Number of End Caps Required	8	each
Bed Size (including perimeter stone)	120	square meters
Stone Required (including perimeter stone)	213	metric tonnes
Volume of Excavation	237	cubic meters
Non-woven Filter Fabric Required (20% Safety Factor)	381	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	120	cubic meters

Controlled by Width (Rows)

Maximum Width = 9 meters

2 rows of 6 chambers
2 row of 5 chambers

Maximum Length = 14.5 meters
Maximum Width = 8.9 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		120	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	22	each
Number of End Caps Required	10	each
Bed Size (including perimeter stone)	122	square meters
Stone Required (including perimeter stone)	217	metric tonnes
Volume of Excavation	241	cubic meters
Non-woven Filter Fabric Required (20% Safety Factor)	386	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	122	cubic meters

Controlled by Length

Maximum Length = 13 meters

4 rows of 5 chambers
1 row of 2 chambers

Maximum Length = 12.3 meters
Maximum Width = 11.0 meters

610 mm

305 mm

229 mm

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

Length per Chamber, From Manufacturer (m)	2.184	No Chamber Req'd	22
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)	122.1		

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	1.184
2	0.051	0.097	0.032	2.390
3	0.076	0.145	0.048	3.574
4	0.102	0.194	0.064	4.780
5	0.127	0.242	0.081	5.972
6	0.152	0.291	0.097	7.178
7	0.178	0.339	0.113	8.362
8	0.203	0.388	0.129	9.568
9	0.229	0.436	0.145	10.752
10	0.254	0.544	0.172	13.344
11	0.279	0.652	0.199	15.936
12	0.305	0.759	0.225	18.498
13	0.330	0.866	0.252	21.068
14	0.356	0.973	0.278	23.630
15	0.381	1.079	0.305	26.178
16	0.406	1.184	0.331	28.696
17	0.432	1.290	0.357	31.236
18	0.457	1.395	0.383	33.754
19	0.483	1.499	0.409	36.250
20	0.508	1.603	0.434	38.738
21	0.533	1.706	0.460	41.212
22	0.559	1.809	0.485	43.678
23	0.584	1.911	0.510	46.122
24	0.610	2.013	0.539	48.598
25	0.635	2.114	0.559	50.980
26	0.660	2.214	0.583	53.372
27	0.686	2.314	0.607	55.764
28	0.711	2.416	0.631	58.200
29	0.737	2.511	0.655	60.482
30	0.762	2.608	0.678	62.800
31	0.787	2.705	0.701	65.118
32	0.813	2.800	0.723	67.384
33	0.838	2.895	0.745	69.650
34	0.864	2.989	0.767	71.894
35	0.889	3.081	0.788	74.086
36	0.914	3.173	0.809	76.278
37	0.940	3.263	0.830	78.426
38	0.965	3.352	0.850	80.544
39	0.991	3.440	0.871	82.648
40	1.016	3.526	0.890	84.692
41	1.041	3.611	0.910	86.722
42	1.067	3.694	0.929	88.700
43	1.092	3.775	0.948	90.634
44	1.118	3.855	0.966	92.538
45	1.143	3.932	0.985	94.384
46	1.168	4.007	1.003	96.178
47	1.194	4.080	1.020	97.920
48	1.219	4.150	1.037	99.596
49	1.245	4.216	1.054	101.184
50	1.270	4.276	1.071	102.640
51	1.295	4.331	1.088	103.986
52	1.321	4.385	1.104	105.302
53	1.346	4.436	1.120	106.552
54	1.372	4.486	1.136	107.780
55	1.397	4.534	1.152	108.964
56	1.422	4.583	1.169	110.178
57	1.448	4.631	1.185	111.362
58	1.473	4.680	1.201	112.568
59	1.499	4.728	1.217	113.752
60	1.524	4.777	1.233	114.958
61	1.549	4.825	1.249	116.142
62	1.575	4.874	1.265	117.348
63	1.600	4.922	1.281	118.532
64	1.626	4.971	1.298	119.746
65	1.651	5.019	1.314	120.930
66	1.676	5.068	1.330	122.136

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	122.14
1	0.025	1.184	65	1.651	120.93
2	0.051	2.390	64	1.626	119.75
3	0.076	3.574	63	1.600	118.53
4	0.102	4.780	62	1.575	117.35
5	0.127	5.972	61	1.549	116.14
6	0.152	7.178	60	1.524	114.96
7	0.178	8.362	59	1.499	113.75
8	0.203	9.568	58	1.473	112.57
9	0.229	10.752	57	1.448	111.36
10	0.254	13.344	56	1.422	110.18
11	0.279	15.936	55	1.397	108.96
12	0.305	18.498	54	1.372	107.78
13	0.330	21.068	53	1.346	106.55
14	0.356	23.630	52	1.321	105.30
15	0.381	26.178	51	1.295	103.99
16	0.406	28.696	50	1.270	102.64
17	0.432	31.236	49	1.245	101.18
18	0.457	33.754	48	1.219	99.60
19	0.483	36.250	47	1.194	97.92
20	0.508	38.738	46	1.168	96.18
21	0.533	41.212	45	1.143	94.38
22	0.559	43.678	44	1.118	92.54
23	0.584	46.122	43	1.092	90.63
24	0.610	48.598	42	1.067	88.70
25	0.635	50.980	41	1.041	86.72
26	0.660	53.372	40	1.016	84.69
27	0.686	55.764	39	0.991	82.65
28	0.711	58.200	38	0.965	80.54
29	0.737	60.482	37	0.940	78.43
30	0.762	62.800	36	0.914	76.28
31	0.787	65.118	35	0.889	74.09
32	0.813	67.384	34	0.864	71.89
33	0.838	69.650	33	0.838	69.65
34	0.864	71.894	32	0.813	67.38
35	0.889	74.086	31	0.787	65.12
36	0.914	76.278	30	0.762	62.80
37	0.940	78.426	29	0.737	60.48
38	0.965	80.544	28	0.711	58.20
39	0.991	82.648	27	0.686	55.76
40	1.016	84.692	26	0.660	53.37
41	1.041	86.722	25	0.635	50.98
42	1.067	88.700	24	0.610	48.60
43	1.092	90.634	23	0.584	46.12
44	1.118	92.538	22	0.559	43.68
45	1.143	94.384	21	0.533	41.21
46	1.168	96.178	20	0.508	38.74
47	1.194	97.920	19	0.483	36.25
48	1.219	99.596	18	0.457	33.75
49	1.245	101.184	17	0.432	31.24
50	1.270	102.640	16	0.406	28.70
51	1.295	103.986	15	0.381	26.18
52	1.321	105.302	14	0.356	23.63
53	1.346	106.552	13	0.330	21.07
54	1.372	107.780	12	0.305	18.50
55	1.397	108.964	11	0.279	15.94
56	1.422	110.178	10	0.254	13.34
57	1.448	111.362	9	0.229	10.75
58	1.473	112.568	8	0.203	9.57
59	1.499	113.752	7	0.178	8.36
60	1.524	114.958	6	0.152	7.18
61	1.549	116.142	5	0.127	5.97
62	1.575	117.348	4	0.102	4.78
63	1.600	118.532	3	0.076	3.57
64	1.626	119.746	2	0.051	2.39
65	1.651	120.930	1	0.025	1.18
66	1.676	122.136	0	0.000	0.00

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

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

No Chamber Req'd	22
No End Caps Req'd	10

Total Trench Length (actual) Including End Caps =	75.60
Maximium Trench Volume (m^3)	124.8

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	1.216
2	0.051	0.097	0.032	2.454
3	0.076	0.145	0.048	3.670
4	0.102	0.194	0.064	4.908
5	0.127	0.242	0.081	6.134
6	0.152	0.291	0.097	7.372
7	0.178	0.339	0.113	8.588
8	0.203	0.388	0.129	9.826
9	0.229	0.436	0.145	11.042
10	0.254	0.544	0.172	13.688
11	0.279	0.652	0.199	16.334
12	0.305	0.759	0.225	18.948
13	0.330	0.866	0.252	21.572
14	0.356	0.973	0.278	24.186
15	0.381	1.079	0.305	26.788
16	0.406	1.184	0.331	29.358
17	0.432	1.290	0.357	31.950
18	0.457	1.395	0.383	34.520
19	0.483	1.499	0.409	37.068
20	0.508	1.603	0.434	39.606
21	0.533	1.706	0.460	42.132
22	0.559	1.809	0.485	44.648
23	0.584	1.911	0.510	47.142
24	0.610	2.013	0.539	49.676
25	0.635	2.114	0.559	52.098
26	0.660	2.214	0.583	54.538
27	0.686	2.314	0.607	56.978
28	0.711	2.416	0.631	59.462
29	0.737	2.511	0.655	61.792
30	0.762	2.608	0.678	64.156
31	0.787	2.705	0.701	66.520
32	0.813	2.800	0.723	68.830
33	0.838	2.895	0.745	71.140
34	0.864	2.989	0.767	73.428
35	0.889	3.081	0.788	75.662
36	0.914	3.173	0.809	77.896
37	0.940	3.263	0.830	80.086
38	0.965	3.352	0.850	82.244
39	0.991	3.440	0.871	84.390
40	1.016	3.526	0.890	86.472
41	1.041	3.611	0.910	88.542
42	1.067	3.694	0.929	90.558
43	1.092	3.775	0.948	92.530
44	1.118	3.855	0.966	94.470
45	1.143	3.932	0.985	96.354
46	1.168	4.007	1.003	98.184
47	1.194	4.080	1.020	99.960
48	1.219	4.150	1.037	101.670
49	1.245	4.216	1.054	103.292
50	1.270	4.276	1.071	104.782
51	1.295	4.331	1.088	106.162
52	1.321	4.385	1.104	107.510
53	1.346	4.436	1.120	108.792
54	1.372	4.486	1.136	110.052
55	1.397	4.534	1.152	111.268
56	1.422	4.583	1.169	112.516
57	1.448	4.631	1.185	113.732
58	1.473	4.680	1.201	114.970
59	1.499	4.728	1.217	116.186
60	1.524	4.777	1.233	117.424
61	1.549	4.825	1.249	118.640
62	1.575	4.874	1.265	119.878
63	1.600	4.922	1.281	121.094
64	1.626	4.971	1.298	122.342
65	1.651	5.019	1.314	123.558
66	1.676	5.068	1.330	124.796

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	124.80
1	0.025	1.216	65	1.651	123.56
2	0.051	2.454	64	1.626	122.34
3	0.076	3.670	63	1.600	121.09
4	0.102	4.908	62	1.575	119.88
5	0.127	6.134	61	1.549	118.64
6	0.152	7.372	60	1.524	117.42
7	0.178	8.588	59	1.499	116.19
8	0.203	9.826	58	1.473	114.97
9	0.229	11.042	57	1.448	113.73
10	0.254	13.688	56	1.422	112.52
11	0.279	16.334	55	1.397	111.27
12	0.305	18.948	54	1.372	110.05
13	0.330	21.572	53	1.346	108.79
14	0.356	24.186	52	1.321	107.51
15	0.381	26.788	51	1.295	106.16
16	0.406	29.358	50	1.270	104.78
17	0.432	31.950	49	1.245	103.29
18	0.457	34.520	48	1.219	101.67
19	0.483	37.068	47	1.194	99.96
20	0.508	39.606	46	1.168	98.18
21	0.533	42.132	45	1.143	96.35
22	0.559	44.648	44	1.118	94.47
23	0.584	47.142	43	1.092	92.53
24	0.610	49.676	42	1.067	90.56
25	0.635	52.098	41	1.041	88.54
26	0.660	54.538	40	1.016	86.47
27	0.686	56.978	39	0.991	84.39
28	0.711	59.462	38	0.965	82.24
29	0.737	61.792	37	0.940	80.09
30	0.762	64.156	36	0.914	77.90
31	0.787	66.520	35	0.889	75.66
32	0.813	68.830	34	0.864	73.43
33	0.838	71.140	33	0.838	71.14
34	0.864	73.428	32	0.813	68.83
35	0.889	75.662	31	0.787	66.52
36	0.914	77.896	30	0.762	64.16
37	0.940	80.086	29	0.737	61.79
38	0.965	82.244	28	0.711	59.46
39	0.991	84.390	27	0.686	56.98
40	1.016	86.472	26	0.660	54.54
41	1.041	88.542	25	0.635	52.10
42	1.067	90.558	24	0.610	49.68
43	1.092	92.530	23	0.584	47.14
44	1.118	94.470	22	0.559	44.65
45	1.143	96.354	21	0.533	42.13
46	1.168	98.184	20	0.508	39.61
47	1.194	99.960	19	0.483	37.07
48	1.219	101.670	18	0.457	34.52
49	1.245	103.292	17	0.432	31.95
50	1.270	104.782	16	0.406	29.36
51	1.295	106.162	15	0.381	26.79
52	1.321	107.510	14	0.356	24.19
53	1.346	108.792	13	0.330	21.57
54	1.372	110.052	12	0.305	18.95
55	1.397	111.268	11	0.279	16.33
56	1.422	112.516	10	0.254	13.69
57	1.448	113.732	9	0.229	11.04
58	1.473	114.970	8	0.203	9.83
59	1.499	116.186	7	0.178	8.59
60	1.524	117.424	6	0.152	7.37
61	1.549	118.640	5	0.127	6.13
62	1.575	119.878	4	0.102	4.91
63	1.600	121.094	3	0.076	3.67
64	1.626	122.342	2	0.051	2.45
65	1.651	123.558	1	0.025	1.22
66	1.676	124.796	0	0.000	0.00

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

exp.

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	3.31	15.82	109.88	2.20	0.66	0.40	0.01	0.30
STMMH 206	STMMH 205											4	6	2.70	2.7	251.5	250	PVC	1.00	51.09	60.40	1.21	0.38	2.27	0.04	0.31
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	0.62	22.24	46.82	0.95	0.52	0.71	0.11	0.55
CBT2	CB5			0.0415			0.0658	10.71	74.19		2-year				4.9	250	250	HDPE	0.49	22.24	41.63	0.85	0.47	0.78	0.12	0.56
CB5	CBT3			0.0415			0.0658	11.49	71.53		2-year				4.7	250	250	HDPE	0.63	35.09	47.20	0.96	0.51	1.15	0.10	0.53
CBT3	CB2	S06	0.0617	0.1032	0.45	0.077	0.1429	12.63	67.98	5.2	2-year				9.7	250	250	HDPE	1.33	20.53	68.58	1.40	0.82	0.42	0.14	0.59
CB2	STMMH 214			0.1032			0.1429	13.05	66.79		2-year				9.5	299.4	300	PVC	4.28	13.23	198.92	2.83	0.88	0.25	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	1.31	9.92	110.05	1.57	1.10	0.15	0.29	0.70
CB4	STMMH 208	S05	0.1264	0.1264	0.73	0.257	0.2565	10.00	76.81	19.7	2-year				19.7	299.4	300	PVC	0.83	13.17	87.60	1.25	0.84	0.26	0.22	0.67
STMMH 208	STMMH 214			0.3265			0.6737	10.26	75.81		2-year				51.1	366.4	375	PVC	0.81	13.47	148.35	1.43	1.00	0.22	0.34	0.70
STMMH 214	CHAMBERS-2			0.4297			0.8167	13.30	66.09		2-year				54.0	600.0	600	HDPE	2.06	0.97	881.27	3.12	1.50	0.01	0.06	0.48
CHAMBERS-2	STMMH 215			0.4297			0.8167	13.31	66.06		2-year				54.0	300.0	300	HDPE	3.33	1.20	176.46	2.50	1.75	0.01	0.31	0.70
STMMH 215	STMMH 205			0.4297			0.8167	13.32	66.03		2-year				53.9	299.4	300	PVC	1.05	18.39	98.53	1.40	0.99	0.31	0.55	0.71
STMMH 205	STMMH 204			0.4297			0.8167	13.63	65.20		2-year	2	8	3.60	56.8	299.4	300	PVC	0.36	41.62	57.69	0.82	0.85	0.82	0.99	1.03
STMMH 204	STMMH 203			0.4297			0.8167	14.45	63.09		2-year	1	9	4.05	55.6	299.4	300	PVC	0.35	8.55	57.02	0.81	0.84	0.17	0.97	1.04
STMMH 203	STMMH 202			0.4297			0.8167	14.62	62.67		2-year	2	11	4.95	56.1	299.4	300	PVC	0.35	35.07	56.88	0.81	0.83	0.70	0.99	1.03
STMMH 202	STMMH 201			0.4297			0.8167	15.32	61.02		2-year		11	4.95	54.8	299.4	300	PVC	0.35	11.46	56.88	0.81	0.84	0.23	0.96	1.04
STMMH 201	STMH216			0.4297			0.8167	15.55	60.50		2-year		11	4.95	54.4	366.4	375	PVC	1.20	6.31	180.57	1.74	1.22	0.09	0.30	0.70
CB6	STMMH 210	S01	0.1752	0.1752	0.72	0.351	0.3507	10.00	76.81	26.9	2-year				26.9	251.5	250	PVC	0.80	18.61	54.02	1.08	0.77	0.40	0.50	0.71
STMMH 210	STMMH 211			0.1752			0.3507	10.40	75.28		2-year				26.4	299.4	300	PVC	1.17	15.33	104.00	1.48	0.99	0.26	0.25	0.67
CB1	STMMH 211	S02	0.1332	0.1332	0.83	0.307	0.3073	10.00	76.81	23.6	2-year				23.6	251.5	250	PVC	1.75	14.96	79.90	1.60	1.12	0.22	0.30	0.70
STMMH 211	CHAMBERS-1			0.3084			0.6580	10.66	74.35		2-year				48.9	600	600	HDPE	1.15	2.61	658.45	2.33	1.14	0.04	0.07	0.49
CHAMBERS-1	STMMH 212			0.3084			0.6580	10.70	74.22		2-year				48.8	300	300	HDPE	0.48	14.46	67.00	0.95	0.93	0.26	0.73	0.98
STMMH 212	STMMH 216	S03	0.0178	0.3262	0.30		0.6580	10.96	73.30		2-year				48.2	299.4	300	PVC	0.59	6.74	73.86	1.05	0.97	0.12	0.65	0.92
STMMH 216	STMMH 200			0.7559			1.4747	15.64	60.31		2-year				88.9	366.4	375	PVC	0.47	21.14	113.01	1.09	1.07	0.33	0.79	0.98
MHST9001	MHST9002	S10	0.4420	0.4420	0.40	0.4915	0.4915	10.00	76.81	37.7	2-year															
		S09	0.0869	0.5289	0.62	0.1498	0.6413	10.00	76.81	11.5	2-year				49.3	381	375	CONC	0.39	10.37	114.23	0.99	0.70	0.25	0.43	0.71
MHST9002	MHST9003			0.5289			0.6413	10.25	75.87		2-year				48.7	381	375	CONC	0.27	36.60	95.04	0.82	0.58	1.05	0.51	0.71
MHST9003	STMH200			0.5289			0.6413	11.29	72.17		2-year	1	12	5.40	46.3	381	375	CONC	0.37	4.62	111.26	0.97	0.68	0.11	0.42	0.71
STMH200	MHST9004			1.2848	0.40		2.1160	11.41	71.80		2-year				151.9	457	375	CONC	0.30	11.94	162.72	0.87	0.90	0.22	0.93	1.04
MHST9004	MHST9005	S11	0.0490	1.3338			2.1160	11.63	71.08		2-year				150.4	457	450	CONC	0.61	82.95	232.03	1.40	1.29	1.07	0.65	0.92
TOTALS =			**1.3338**			**2.1160**						**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, May 2019.xlsx**	1 of 1

Appendix F – Stormceptor Sizing

Detailed Report from PCSWMM for Stormceptor

STC Product Sheet

STC Standard Model Detail

Detailed Stormceptor Sizing Report – 5924 Hazeldean

Project Information & Location			
Project Name	5924 Hazeldean	**Project Number**	250806
City	Ottawa	**State/ Province**	Ontario
Country	Canada	**Date**	4/30/2019
Designer Information		**EOR Information (optional)**	
Name	Mohammed Ghadban	**Name**	
Company	EXP Services	**Company**	
Phone #	613-688-1899	**Phone #**	
Email	moe.ghadban@exp.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	5924 Hazeldean
Recommended Stormceptor Model	STC 750
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	80
PSD	Fine Distribution
Rainfall Station	OTTAWA MACDONALD-CARTIER INT'L A

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary

Stormceptor Model	% TSS Removal Provided	% Runoff Volume Captured Provided
STC 300	71	90
STC 750	80	97
STC 1000	81	97
STC 1500	82	97
STC 2000	84	99
STC 3000	86	99
STC 4000	88	100
STC 5000	89	100
STC 6000	91	100
STC 9000	93	100
STC 10000	93	100
STC 14000	95	100
StormceptorMAX	Custom	Custom

Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.

Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour).

Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

State/Province	Ontario	**Total Number of Rainfall Events**	4093
Rainfall Station Name	OTTAWA MACDONALD-CARTIER INT'L A	**Total Rainfall (mm)**	20978.1
Station ID #	6000	**Average Annual Rainfall (mm)**	567.0
Coordinates	45°19'N, 75°40'W	**Total Evaporation (mm)**	1216.5
Elevation (ft)	370	**Total Infiltration (mm)**	7589.5
Years of Rainfall Data	37	**Total Rainfall that is Runoff (mm)**	12172.1

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	0.765
Imperviousness %	63.7

Up Stream Storage	
Storage (ha-m)	**Discharge (cms)**
0.000	0.000
0.004	0.054
0.005	0.062
0.012	0.085

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	85.00
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	
Stormceptor Outlet Invert Elev (m)	
Stormceptor Rim Elev (m)	
Normal Water Level Elevation (m)	
Pipe Diameter (mm)	
Pipe Material	
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	**Distribution %**	**Specific Gravity**
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Site Name	5924 Hazeldean

Site Details

Drainage Area

Total Area (ha)	0.765
Imperviousness %	63.7

Surface Characteristics

Width (m)	175.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency

Maintenance Frequency (months) >	12

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (lps)	0

Winter Months

Winter Infiltration	0

TSS Loading Parameters

TSS Loading Function	

Buildup/Wash-off Parameters

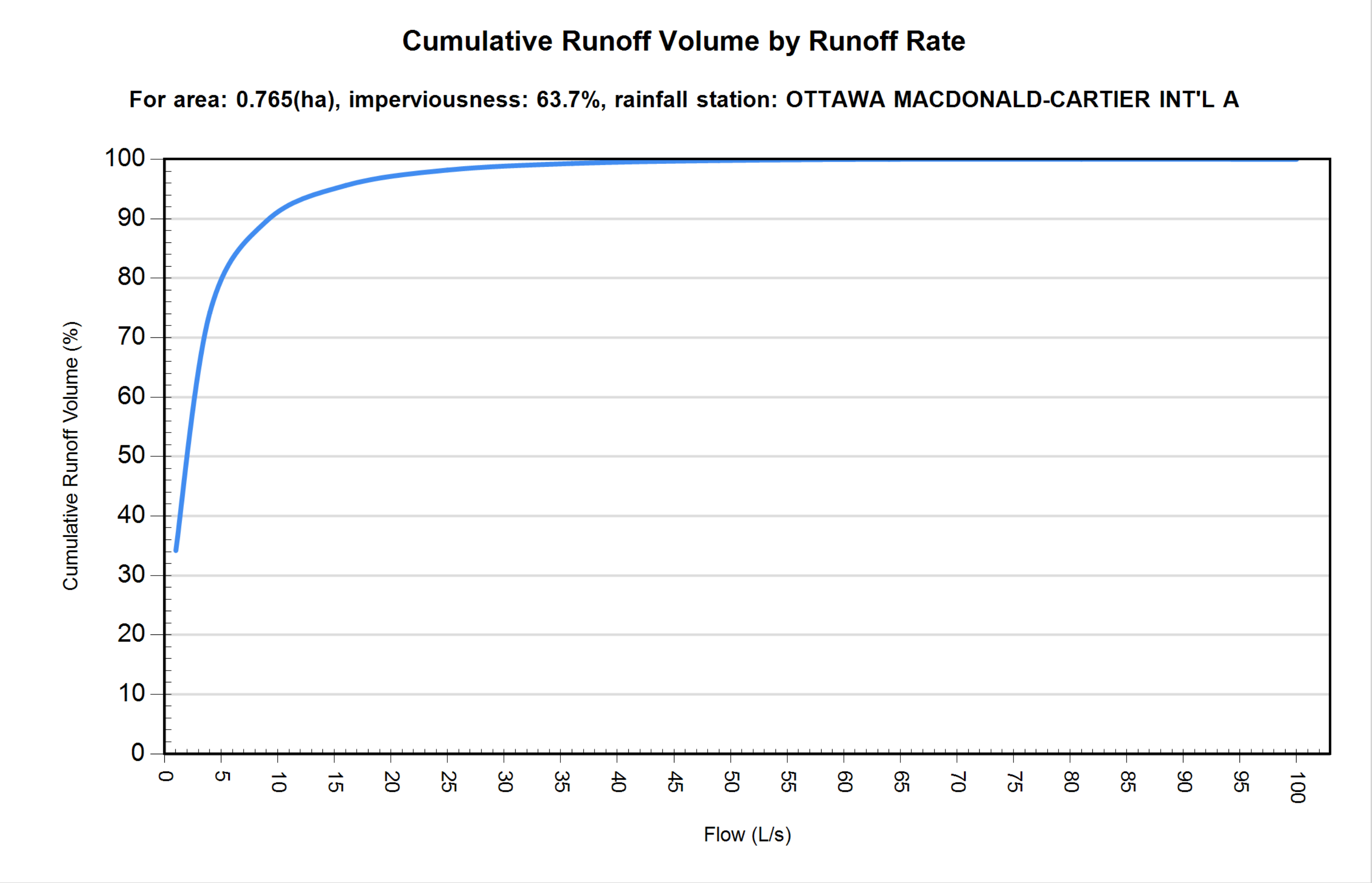
Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

TSS Availability Parameters

Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate

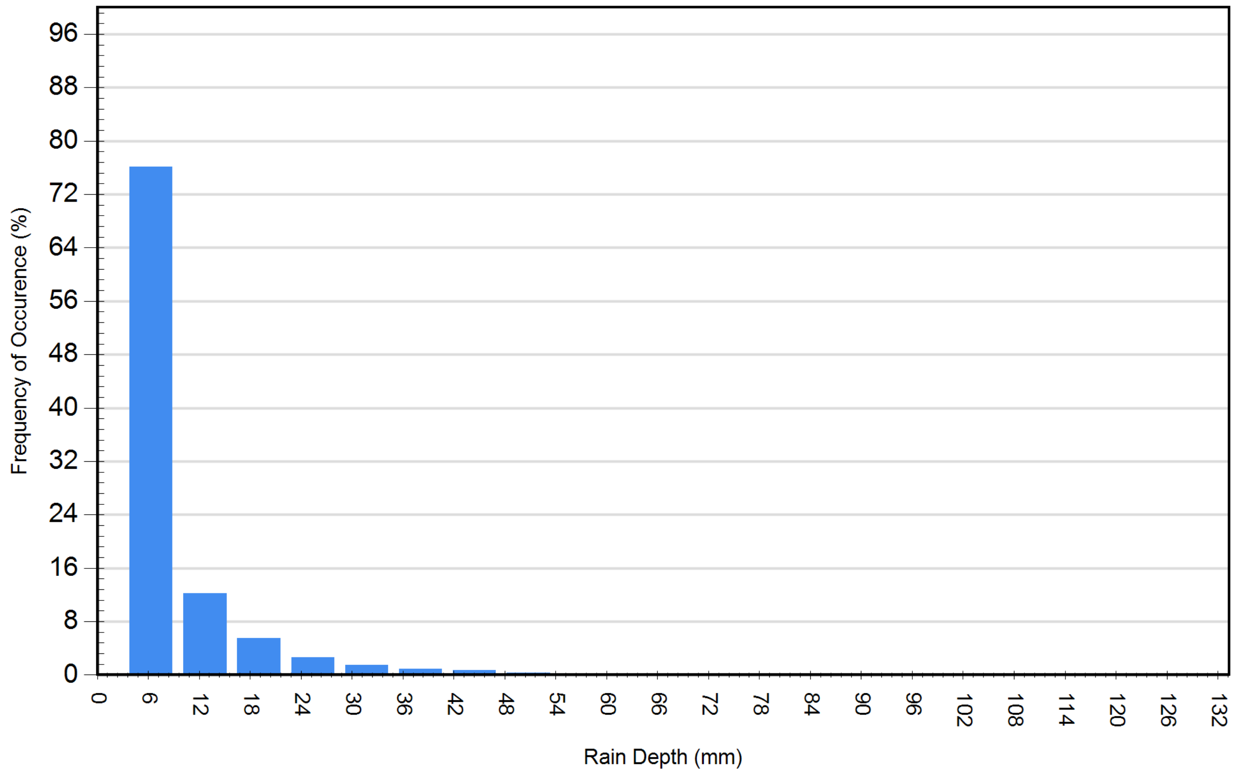
Runoff Rate (L/s)	Runoff Volume (m³)	Volume Over (m³)	Cumulative Runoff Volume (%)
1	32042	61613	34.2
4	69495	24160	74.2
9	83909	9752	89.6
16	89579	4079	95.6
25	91982	1676	98.2
36	93023	635	99.3
49	93487	172	99.8
64	93653	6	100.0
81	93659	0	100.0
100	93659	0	100.0



Rainfall Event Analysis

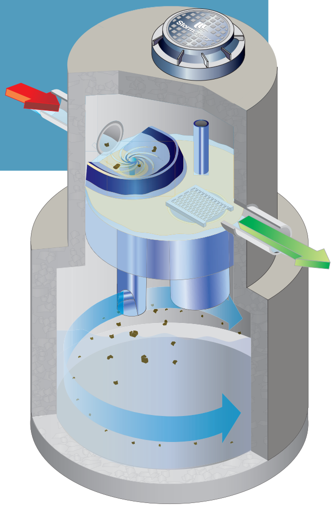
Rainfall Depth (mm)	No. of Events	Percentage of Total Events (%)	Total Volume (mm)	Percentage of Annual Volume (%)
6.35	3113	76.1	5230	24.9
12.70	501	12.2	4497	21.4
19.05	225	5.5	3469	16.5
25.40	105	2.6	2317	11.0
31.75	62	1.5	1765	8.4
38.10	35	0.9	1206	5.8
44.45	28	0.7	1163	5.5
50.80	12	0.3	557	2.7
57.15	7	0.2	378	1.8
63.50	1	0.0	63	0.3
69.85	1	0.0	64	0.3
76.20	1	0.0	76	0.4
82.55	0	0.0	0	0.0
88.90	1	0.0	84	0.4
95.25	0	0.0	0	0.0
101.60	0	0.0	0	0.0
107.95	0	0.0	0	0.0
114.30	1	0.0	109	0.5
120.65	0	0.0	0	0.0
127.00	0	0.0	0	0.0

Frequency of Occurence by Rainfall Depths



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Stormceptor® STC



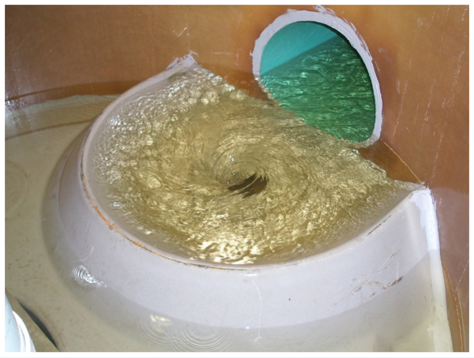
The calm *during* the storm

When it rains, oils, sediment and other contaminants are washed from paved surfaces directly into our storm drains and waterways. Non-point source pollution such as stormwater now accounts for 80% of water pollution in North America and governments are responding with demanding regulations to protect our water resources.

Removing more pollutants

Stormceptor removes more pollutants from stormwater than any other separator.

- Maintains continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate
- Designed to remove a wide range of particle sizes, as well as free oils, heavy metals and nutrients that attach to fine sediment
- Can be designed to remove a specific particle size distribution (PSD)



A calm treatment environment

- Stormceptor slows incoming stormwater to create a non-turbulent treatment environment, allowing free oils and debris to rise, and sediment to settle
- Scour prevention technology ensures pollutants are captured and contained during all rainfall events, even extreme storms

Proven performance

With more than 20 years of industry experience, Stormceptor has been performance tested and verified by some of the most stringent technology evaluation programs in North America. Stormceptor has been performance verified through numerous verification programs, including;

- NJCAT
- Washington ECOLOGY
- EN858 Class 2

PCSWMM for Stormceptor – *Advanced online sizing & design software*

The most accurate, easy to use design tool available.

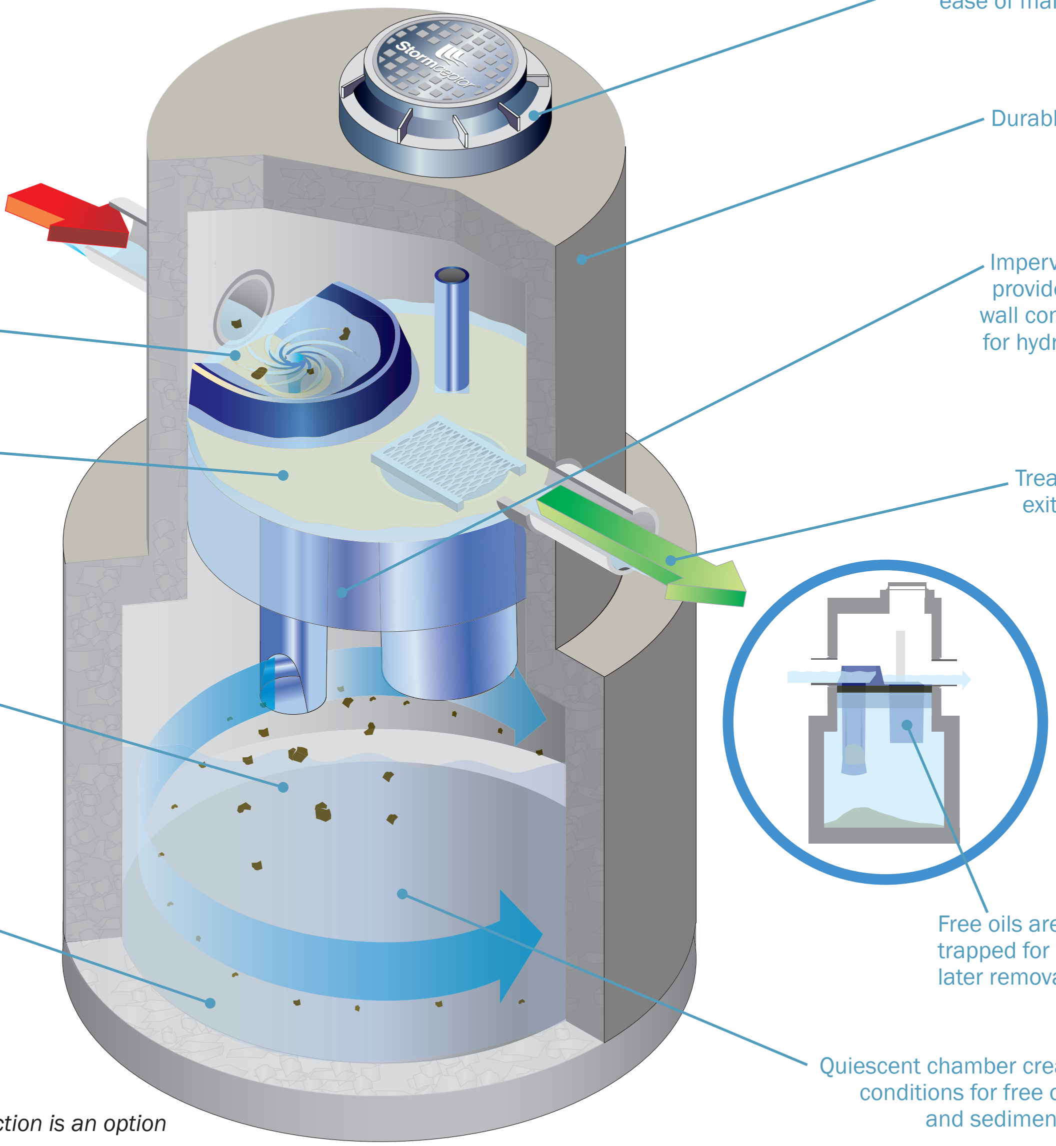
- This continuous simulation modeling software combines localized rainfall data from over 1,900 weather stations across North America allowing for region-specific design with a selection of particle sizes to design the best Stormceptor for your site
- Within a single project, multiple Stormceptor units can be sized and the information revisited as project parameters change
- Provides a summary report that includes projected performance calculations

  www.imbriumsystems.com/PCSWMMforStormceptor

With over 40,000 units operating worldwide, Stormceptor performs and protects every day, in every storm.

Stormceptor® STC

The calm *during* the storm



Weir directs water into lower chamber

Patented technology prevents captured pollutant from scouring

Captures and stores a wide range of particle sizes, from 20 to 2,000 microns, for later removal

Sediment lies dormant for later removal

Surface access for ease of maintenance

Durable precast concrete

Impervious liner provides double wall containment for hydrocarbons

Treated water exits the unit

Free oils are trapped for later removal

Quiescent chamber creates ideal conditions for free oils to rise and sediment to settle

* *Fiberglass construction is an option*

Easy to install

Small footprint saves time and money with limited disruption to your site.

Seamless

Minimal drop between inlet and outlet pipes makes Stormceptor ideal for retrofits and new development projects.

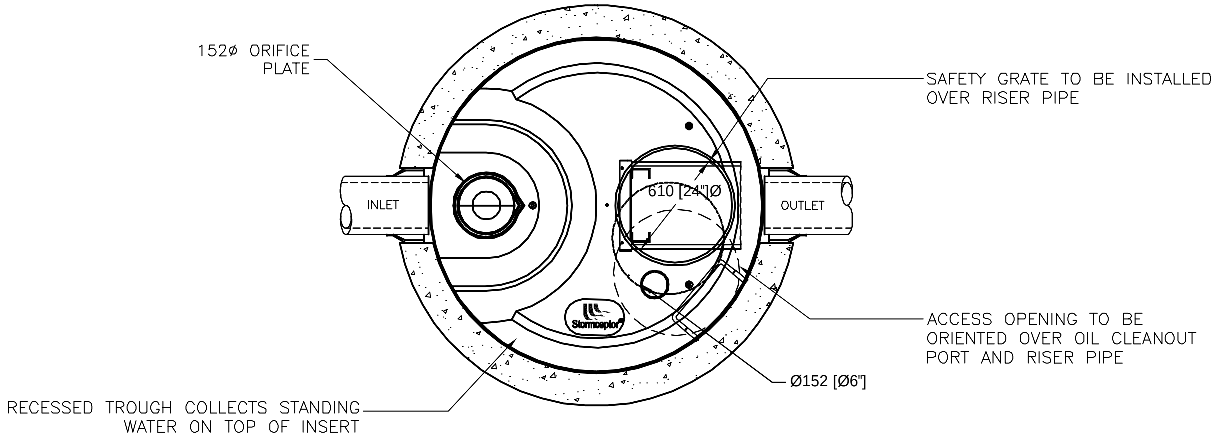
Flexible

Multiple inlets can connect to a single unit.

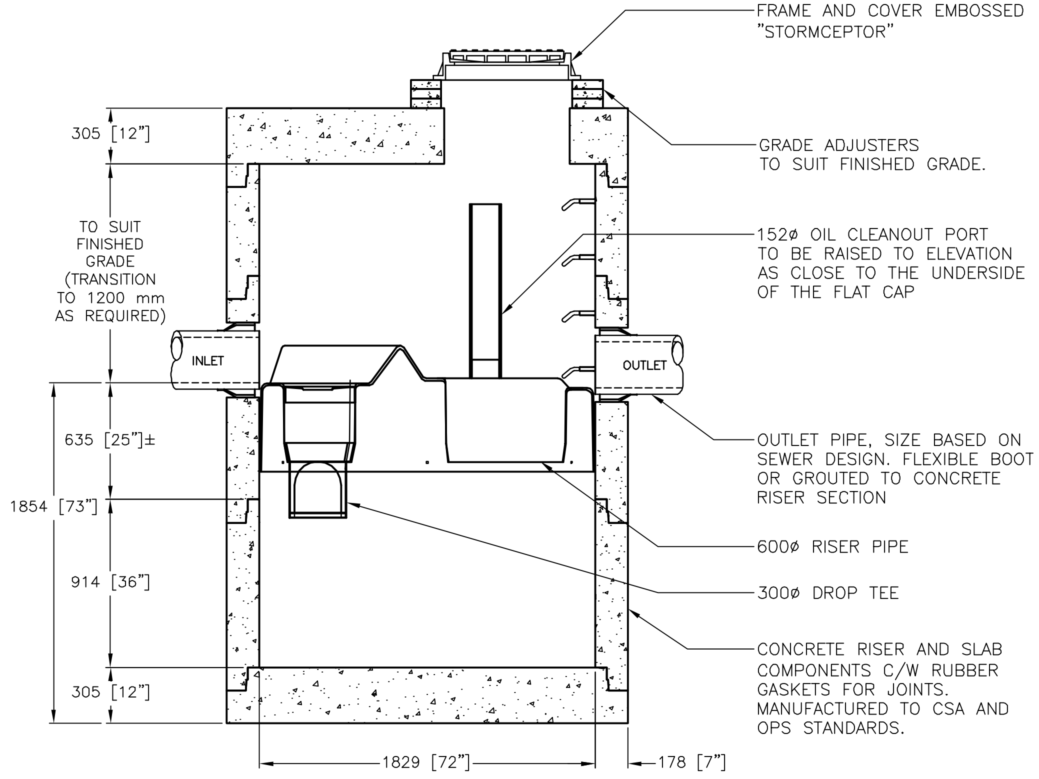
Can be used as a bend structure.

DRAWING NOT TO BE USED FOR CONSTRUCTION

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS:
United States Patent No. 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690 • 7,582,216 • 7,666,303 | Australia Patent No. 693,164 • 707,133 • 729,096 • 779,401 • 289,647 • 2008,279,378 • 2008,288,900 | Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 | Indonesian Patent No. 007058 | Japan Patent No. 3581233 • 9-11476 | Korea Patent No. 10-1451593 • 0519212 | Malaysia Patent No. 118987 | New Zealand Patent No. 314,646 • 583,583 • 583,008 | South African Patent No. 2010/00683 • 2010/01796 |



PLAN VIEW



SECTION VIEW

Stormceptor®

imbrium®
WWW.IMBRIUMSYSTEMS.COM
407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9
TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

STC 750
STANDARD MODEL

####

REV #	DATE	REVISION DESCRIPTION	BY

SHEET NUMBER
1
OF 1

DATE:######## SCALE: 40
PROJECT No.: #####
DRAWN: ###
CHECKED: ###

I:\IMBRIUM\PRODUCTS\STORMCEPTOR\STORMCEPTOR STC40 DRAWINGS & DETAILS\STANDARD DETAILS\METRIC\STC 750.DWG 4/12/2019 1:22 PM

Appendix G – PCSWMM Data

Input File (Details)

Output File (Status)

```
[TITLE]


[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             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[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
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
S01              Chicago_3h_100yr CB6              0.1752   74.881   67.889   1        0
S02              Chicago_3h_100yr CB1              0.1422   90.313   47.247   1        0
S03              Chicago_3h_100yr CB1              0.0178   14.898   79.785   1        0
S04              Chicago_3h_100yr cb3              0.2001   78.81    70.265   1        0
S05              Chicago_3h_100yr CB4              0.1264   75.078   53.154   1        0
S06              Chicago_3h_100yr CBT1             0.0617   35.121   52.372   1        0
S07              Chicago_3h_100yr CBE1             0.0415   52.32    54.62    1        0
S08              Chicago_3h_100yr OF-HAZELDEAN     0.1123   50.1     140.375  1        0
S09              Chicago_3h_100yr OF-VICTOR        0.0869   60.124   96.556   1        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
S01              0.013      0.2        1.57       4.67       20         OUTLET
S02              0.013      0.2        1.57       4.67       20         OUTLET
S03              0.013      0.2        1.57       4.67       20         OUTLET
S04              0.013      0.2        1.57       4.67       20         OUTLET
S05              0.013      0.2        1.57       4.67       20         OUTLET
S06              0.013      0.2        1.57       4.67       20         OUTLET
S07              0.013      0.2        1.57       4.67       20         OUTLET
S08              0.013      0.2        1.57       4.67       20         OUTLET
S09              0.013      0.2        1.57       4.67       20         OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
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              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
;;-------------- ---------- ---------- ---------- ---------- ----------
201              111.343    2.32       0          0          0
202              111.456    2.547      0          0          0
203              111.608    1.378      0          0          0
204              111.698    1.325      0          0          0
205              111.876    2.224      0          0          0
206              112.417    2.333      0          0          0
207              113.284    2.166      0          0          0
208              112.69     1.81       0          0          0
210              112.16     2.04       0          0          0
```

```
211              111.81     2.29       0          0          0
212              111.42     2.519      0          0          0
214              112.58     2.02       0          0          0
215              112.128    2.172      0          0          0
216              111.324    2.39       0          0          0
CB1              112.4      1.4        0          0          0
CB3              112.85     1.4        0          0          0
CB4              112.809    1.191      0          0          0
CB5              114.004    1.596      0          0          0
CB6              112.5      1.4        0          0          0
CB7              113.462    1.538      0          0          0
CBE1             114.25     0.65       0          0          0
CBT1             113.784    1.366      0          0          0
CBT2             114.113    1.287      0          0          0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
200              111.26     FREE                          NO
OF-HAZELDEAN     114        FREE                          NO
OF-VICTOR        113        FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                                 Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                                Frac.    Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- -----------------------
CHAMBERS-1       111.49   2.61     0        TABULAR    STORAGE-2                  0        0
CHAMBERS-2       112.27   2.23     0        TABULAR    STORAGE-2                  0        0

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
C1               207              206              15.819     0.013      113.284    112.477    0          0
C10              CB5              CBT1             35.089     0.013      114.004    113.784    0          0
C11              CBT1             CB7              20.525     0.013      113.784    113.512    0          0
C12              CHAMBERS-2       215              8.22       0.013      112.27     112.188    0          0
C12_1            CB7              214              13.136     0.013      113.462    112.901    0          0
C12_2            214              CHAMBERS-2       1          0.013      112.58     112.56     0          0
C13              CHAMBERS-2       215              1          0.013      112.56     112.52     0          0
C15              CBE1             CBT2             22.237     0.01       114.25     114.113    0          0
C16              210              211              15.342     0.013      112.37     112.19     0          0
C17              211              CHAMBERS-1       2.2        0.013      111.81     111.78     0          0
C18              CHAMBERS-1       212              14.46      0.013      111.78     111.71     0          0
C19              CB4              208              13.169     0.013      112.809    112.7      0          0
C2               206              205              51.151     0.013      112.417    111.906    0          0
C20              CB1              211              16.041     0.013      112.4      112.12     0          0
C21              CB6              210              11.287     0.013      112.5      112.41     0          0
C22              CHAMBERS-1       212              24.608     0.013      111.49     111.42     0          0
C23              CBT2             CB5              22.237     0.01       114.113    114.004    0          0
C3               205              204              41.506     0.013      111.876    111.728    0          0
C4               204              203              8.526      0.013      111.698    111.668    0          0
```

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C5               203              202              35.069     0.013      111.608    111.486    0          0
C6               202              201              11.458     0.013      111.456    111.418    0          0
C7_1             201              216              6.436      0.013      111.343    111.324    0          0
C7_2             216              200              21.019     0.013      111.324    111.26     0          0
C8               CB3              208              9.923      0.013      112.85     112.72     0          0
C9               208              214              13.568     0.013      112.69     112.58     0          0

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet          Qcoeff/                     Flap
;;Name           Node             Node             Height     Type            QTable           Qexpon     Gate
;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ---------- ----
C14              215              205              112.128    TABULAR/DEPTH   IPEX-MHF-TYPEB              NO
C7               212              216              111.42     TABULAR/DEPTH   IPEX-MHF-TYPEB              NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C1               CIRCULAR     0.25             0          0          0          1
C10              CIRCULAR     0.25             0          0          0          1
C11              CIRCULAR     0.25             0          0          0          1
C12              CIRCULAR     0.1              0          0          0          1
C12_1            CIRCULAR     0.3              0          0          0          1
C12_2            CIRCULAR     0.6              0          0          0          1
C13              CIRCULAR     0.3              0          0          0          1
C15              CIRCULAR     0.25             0          0          0          1
C16              CIRCULAR     0.3              0          0          0          1
C17              CIRCULAR     0.6              0          0          0          1
C18              CIRCULAR     0.375            0          0          0          1
C19              CIRCULAR     0.3              0          0          0          1
C2               CIRCULAR     0.25             0          0          0          1
C20              CIRCULAR     0.25             0          0          0          1
C21              CIRCULAR     0.25             0          0          0          1
C22              CIRCULAR     0.1              0          0          0          1
C23              CIRCULAR     0.25             0          0          0          1
C3               CIRCULAR     0.3              0          0          0          1
C4               CIRCULAR     0.3              0          0          0          1
C5               CIRCULAR     0.3              0          0          0          1
C6               CIRCULAR     0.3              0          0          0          1
C7_1             CIRCULAR     0.375            0          0          0          1
C7_2             CIRCULAR     0.375            0          0          0          1
C8               CIRCULAR     0.3              0          0          0          1
C9               CIRCULAR     0.375            0          0          0          1

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

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 lmf
;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-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

STORAGE-1        Storage    0          72.8735
STORAGE-1                   0.025      72.8735
STORAGE-1                   0.051      72.8735
STORAGE-1                   0.076      72.8735
STORAGE-1                   0.102      72.8735
STORAGE-1                   0.127      72.8735
STORAGE-1                   0.152      72.8735
STORAGE-1                   0.178      72.8735
STORAGE-1                   0.203      72.8735
STORAGE-1                   0.229      72.8735
STORAGE-1                   0.254      72.8735
STORAGE-1                   0.279      72.8735
STORAGE-1                   0.305      72.8735
```

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STORAGE-1                   0.33       72.8735
STORAGE-1                   0.356      72.8735
STORAGE-1                   0.381      72.8735
STORAGE-1                   0.406      72.8735
STORAGE-1                   0.432      72.8735
STORAGE-1                   0.457      72.8735
STORAGE-1                   0.483      72.8735
STORAGE-1                   0.508      72.8735
STORAGE-1                   0.533      72.8735
STORAGE-1                   0.559      72.8735
STORAGE-1                   0.584      72.8735
STORAGE-1                   0.61       72.8735
STORAGE-1                   0.635      72.8735
STORAGE-1                   0.66       72.8735
STORAGE-1                   0.686      72.8735
STORAGE-1                   0.711      72.8735
STORAGE-1                   0.737      72.8735
STORAGE-1                   0.762      72.8735
STORAGE-1                   0.787      72.8735
STORAGE-1                   0.813      72.8735
STORAGE-1                   0.838      72.8735
STORAGE-1                   0.864      72.8735
STORAGE-1                   0.889      72.8735
STORAGE-1                   0.914      72.8735
STORAGE-1                   0.94       72.8735
STORAGE-1                   0.965      72.8735
STORAGE-1                   0.991      72.8735
STORAGE-1                   1.016      72.8735
STORAGE-1                   1.041      72.8735
STORAGE-1                   1.067      72.8735
STORAGE-1                   1.092      72.8735
STORAGE-1                   1.118      72.8735
STORAGE-1                   1.143      72.8735
STORAGE-1                   1.168      72.8735
STORAGE-1                   1.194      72.8735
STORAGE-1                   1.219      72.8735
STORAGE-1                   1.245      72.8735
STORAGE-1                   1.27       72.8735
STORAGE-1                   1.295      72.8735
STORAGE-1                   1.321      72.8735
STORAGE-1                   1.346      72.8735
STORAGE-1                   1.372      72.8735
STORAGE-1                   1.397      72.8735
STORAGE-1                   1.422      72.8735
STORAGE-1                   1.448      72.8735
STORAGE-1                   1.473      72.8735
STORAGE-1                   1.499      72.8735
STORAGE-1                   1.524      72.8735
STORAGE-1                   1.549      72.8735
STORAGE-1                   1.575      72.8735
STORAGE-1                   1.6        72.8735
STORAGE-1                   1.626      72.8735
STORAGE-1                   1.651      72.8735
```

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STORAGE-1                   1.676      72.8735
STORAGE-1                   1.67601    0
STORAGE-1                   3          0

;AREA-DEPTH FOR
;mc-3500 CHAMBERS
STORAGE-2        Storage    0          74.4606
STORAGE-2                   0.025      74.4606
STORAGE-2                   0.051      74.4606
STORAGE-2                   0.076      74.4606
STORAGE-2                   0.102      74.4606
STORAGE-2                   0.127      74.4606
STORAGE-2                   0.152      74.4606
STORAGE-2                   0.178      74.4606
STORAGE-2                   0.203      74.4606
STORAGE-2                   0.229      74.4606
STORAGE-2                   0.254      74.4606
STORAGE-2                   0.279      74.4606
STORAGE-2                   0.305      74.4606
STORAGE-2                   0.33       74.4606
STORAGE-2                   0.356      74.4606
STORAGE-2                   0.381      74.4606
STORAGE-2                   0.406      74.4606
STORAGE-2                   0.432      74.4606
STORAGE-2                   0.457      74.4606
STORAGE-2                   0.483      74.4606
STORAGE-2                   0.508      74.4606
STORAGE-2                   0.533      74.4606
STORAGE-2                   0.559      74.4606
STORAGE-2                   0.584      74.4606
STORAGE-2                   0.61       74.4606
STORAGE-2                   0.635      74.4606
STORAGE-2                   0.66       74.4606
STORAGE-2                   0.686      74.4606
STORAGE-2                   0.711      74.4606
STORAGE-2                   0.737      74.4606
STORAGE-2                   0.762      74.4606
STORAGE-2                   0.787      74.4606
STORAGE-2                   0.813      74.4606
STORAGE-2                   0.838      74.4606
STORAGE-2                   0.864      74.4606
STORAGE-2                   0.889      74.4606
STORAGE-2                   0.914      74.4606
STORAGE-2                   0.94       74.4606
STORAGE-2                   0.965      74.4606
STORAGE-2                   0.991      74.4606
STORAGE-2                   1.016      74.4606
STORAGE-2                   1.041      74.4606
STORAGE-2                   1.067      74.4606
STORAGE-2                   1.092      74.4606
STORAGE-2                   1.118      74.4606
STORAGE-2                   1.143      74.4606
STORAGE-2                   1.168      74.4606
```

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STORAGE-2                   1.194      74.4606
STORAGE-2                   1.219      74.4606
STORAGE-2                   1.245      74.4606
STORAGE-2                   1.27       74.4606
STORAGE-2                   1.295      74.4606
STORAGE-2                   1.321      74.4606
STORAGE-2                   1.346      74.4606
STORAGE-2                   1.372      74.4606
STORAGE-2                   1.397      74.4606
STORAGE-2                   1.422      74.4606
STORAGE-2                   1.448      74.4606
STORAGE-2                   1.473      74.4606
STORAGE-2                   1.499      74.4606
STORAGE-2                   1.524      74.4606
STORAGE-2                   1.549      74.4606
STORAGE-2                   1.575      74.4606
STORAGE-2                   1.6        74.4606
STORAGE-2                   1.626      74.4606
STORAGE-2                   1.651      74.4606
STORAGE-2                   1.676      74.4606
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       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
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Node       211              STMH
Node       212              STMH
Node       214              STMH
Node       215              STMH
Node       216              STMH
Node       CB1              CB
Node       CB3              CB
Node       CB4              CB
Node       CB5              STMH
Node       CB6              CB
Node       CB7              CB
Node       CBT1             STMH
Node       200              STMH
Link       C1               STORM
Link       C10              STORM
Link       C11              STORM
Link       C12              SUBDRAIN
Link       C12_1            STORM
Link       C12_2            STORM
Link       C13              STORM
Link       C15              STORM
Link       C16              STORM
Link       C17              STORM
Link       C18              STORM
Link       C19              STORM
Link       C2               STORM
Link       C20              STORM
Link       C21              STORM
Link       C22              SUBDRAIN
Link       C23              STORM
Link       C3               STORM
Link       C4               STORM
Link       C5               STORM
Link       C6               STORM
Link       C7_1             STORM
Link       C7_2             STORM
Link       C8               STORM
Link       C9               STORM
Link       C14              ICD
Link       C7               ICD

[MAP]
DIMENSIONS       350079.75047764  5015229.65584977 350243.673203113 5015373.12886023
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
201              350209.335       5015299.052
202              350201.692       5015307.586
203              350194.468       5015341.9
204              350186.244       5015339.654
205              350155.307       5015311.988
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206              350117.229       5015277.84
207              350127.782       5015266.057
208              350152.381       5015293.925
210              350192.735       5015301.458
211              350203.38        5015290.412
212              350216.879       5015293.723
214              350161.42        5015283.807
215              350167.59        5015298.284
216              350215.638       5015300.361
CB1              350215.017       5015301.442
CB3              350143.947       5015299.152
CB4              350159.568       5015304.959
CB5              350129.074       5015236.82
CB6              350191.863       5015320.653
CB7              350170.306       5015274.133
CBE1             350099.944       5015270.421
CBT1             350155.089       5015260.363
CBT2             350114.509       5015253.621
200              350236.222       5015304.607
OF-HAZELDEAN     350113.127       5015320.07
OF-VICTOR        350214.747       5015360.624
CHAMBERS-1       350199.465       5015282.365
CHAMBERS-2       350164.004       5015291.083

[VERTICES]
;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
C12              350164.484       5015291.443
C12              350166.523       5015296.812
C12              350167.468       5015297.816
C12_2            350162.53        5015284.929
C13              350166.26        5015297.077
C17              350197.354       5015284.801
C18              350201.352       5015280.29
C22              350199.352       5015281.657
C22              350201.346       5015279.649
C22              350216.288       5015292.54

[POLYGONS]
;;Subcatchment   X-Coord          Y-Coord
;;-------------- ---------------- ----------------
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	350215.801	5015305.006
S02	350227.775	5015301.507
S02	350228.295	5015297.318
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	350087.202	5015283.722
S08	350141.937	5015332.743
S08	350142.147	5015332.509
S08	350180.229	5015366.607
S08	350180.347	5015366.601
S08	350182.743	5015356.675
S08	350182.595	5015356.647
S08	350148.071	5015325.743
S08	350093.341	5015276.753
S08	350087.202	5015283.722
S09	350182.743	5015356.675
S09	350180.347	5015366.601
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              350227.775       5015301.507     
S09              350215.801       5015305.006     
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 210 to Node 201 (Chamber2-outlet)" C14 C3 C4 C5 C6
"Node 210 to Node 201 (Chamber2-outlet)" C7_1 C7_2
"Node CB1 to Node TEE(202-201) Chamber 1" C20 C17 C18 C7
"Node 207 to Node 200" C1 C2 C3 C4 C5
"Node 207 to Node 200" C6 C7_1 C7_2
```

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


*************
Element Count
*************
Number of rain gages ...... 3
Number of subcatchments ... 9
Number of nodes ........... 28
Number of links ........... 27
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
-----------------------------------------------------------------------------------------------------------
S01                        0.18     67.89     74.88    1.0000 Chicago_3h_100yr     CB6
S02                        0.14     47.25     90.31    1.0000 Chicago_3h_100yr     CB1
S03                        0.02     79.78     14.90    1.0000 Chicago_3h_100yr     CB1
S04                        0.20     70.27     78.81    1.0000 Chicago_3h_100yr     CB3
S05                        0.13     53.15     75.08    1.0000 Chicago_3h_100yr     CB4
S06                        0.06     52.37     35.12    1.0000 Chicago_3h_100yr     CBT1
S07                        0.04     54.62     52.32    1.0000 Chicago_3h_100yr     CBE1
S08                        0.11    124.78     50.20    1.0000 Chicago_3h_100yr     OF-HAZELDEAN
S09                        0.09     96.56     60.12    1.0000 Chicago_3h_100yr     OF-VICTOR


************
Node Summary
************
                                         Invert      Max.    Ponded    External
Name                 Type                 Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
201                  JUNCTION            111.34      2.32       0.0
202                  JUNCTION            111.46      2.55       0.0
203                  JUNCTION            111.61      1.38       0.0    Yes
204                  JUNCTION            111.70      1.32       0.0    Yes
```

```
205                  JUNCTION            111.88      2.22       0.0    Yes
206                  JUNCTION            112.42      2.33       0.0    Yes
207                  JUNCTION            113.28      2.17       0.0    Yes
208                  JUNCTION            112.69      1.81       0.0
210                  JUNCTION            112.16      2.04       0.0
211                  JUNCTION            111.81      2.29       0.0
212                  JUNCTION            111.42      2.52       0.0
214                  JUNCTION            112.58      2.02       0.0
215                  JUNCTION            112.13      2.17       0.0
216                  JUNCTION            111.32      2.39       0.0
CB1                  JUNCTION            112.40      1.40       0.0
CB3                  JUNCTION            112.85      1.40       0.0
CB4                  JUNCTION            112.81      1.19       0.0
CB5                  JUNCTION            114.00      1.60       0.0
CB6                  JUNCTION            112.50      1.40       0.0
CB7                  JUNCTION            113.46      1.54       0.0
CBE1                 JUNCTION            114.25      0.65       0.0
CBT1                 JUNCTION            113.78      1.37       0.0
CBT2                 JUNCTION            114.11      1.29       0.0
200                  OUTFALL             111.26      0.38       0.0
OF-HAZELDEAN         OUTFALL             114.00      0.00       0.0
OF-VICTOR            OUTFALL             113.00      0.00       0.0
CHAMBERS-1           STORAGE             111.49      2.61       0.0
CHAMBERS-2           STORAGE             112.27      2.23       0.0


************
Link Summary
************
Name             From Node        To Node          Type                Length    %Slope Roughness
---------------------------------------------------------------------------------------------
C1               207              206              CONDUIT               15.8    5.1081    0.0130
C10              CB5              CBT1             CONDUIT               35.1    0.6270    0.0130
C11              CBT1             CB7              CONDUIT               20.5    1.3253    0.0130
C12              CHAMBERS-2       215              CONDUIT                8.2    0.9976    0.0130
C12_1            CB7              214              CONDUIT               13.1    4.2746    0.0130
C12_2            214              CHAMBERS-2       CONDUIT                1.0    2.0004    0.0130
C13              CHAMBERS-2       215              CONDUIT                1.0    4.0032    0.0130
C15              CBE1             CBT2             CONDUIT               22.2    0.6161    0.0100
C16              210              211              CONDUIT               15.3    1.1733    0.0130
C17              211              CHAMBERS-1       CONDUIT                2.2    1.3638    0.0130
C18              CHAMBERS-1       212              CONDUIT               14.5    0.4841    0.0130
C19              CB4              208              CONDUIT               13.2    0.8277    0.0130
C2               206              205              CONDUIT               51.2    0.9991    0.0130
C20              CB1              211              CONDUIT               16.0    1.7458    0.0130
C21              CB6              210              CONDUIT               11.3    0.7974    0.0130
C22              CHAMBERS-1       212              CONDUIT               24.6    0.2845    0.0130
C23              CBT2             CB5              CONDUIT               22.2    0.4902    0.0100
C3               205              204              CONDUIT               41.5    0.3566    0.0130
C4               204              203              CONDUIT                8.5    0.3519    0.0130
C5               203              202              CONDUIT               35.1    0.3479    0.0130
C6               202              201              CONDUIT               11.5    0.3316    0.0130
C7_1             201              216              CONDUIT                6.4    0.2952    0.0130
```

```
C7_2             216              200              CONDUIT           21.0    0.3045    0.0130
C8               CB3              208              CONDUIT            9.9    1.3102    0.0130
C9               208              214              CONDUIT           13.6    0.8108    0.0130
C14              215              205              OUTLET
C7               212              216              OUTLET


*********************
Cross Section Summary
*********************
                                        Full     Full     Hyd.     Max.   No. of     Full
Conduit          Shape                 Depth     Area     Rad.    Width  Barrels     Flow
---------------------------------------------------------------------------------------
C1               CIRCULAR               0.25     0.05     0.06     0.25        1   134.41
C10              CIRCULAR               0.25     0.05     0.06     0.25        1    47.09
C11              CIRCULAR               0.25     0.05     0.06     0.25        1    68.46
C12              CIRCULAR               0.10     0.01     0.03     0.10        1     5.16
C12_1            CIRCULAR               0.30     0.07     0.07     0.30        1   199.94
C12_2            CIRCULAR               0.60     0.28     0.15     0.60        1   868.48
C13              CIRCULAR               0.30     0.07     0.07     0.30        1   193.49
C15              CIRCULAR               0.25     0.05     0.06     0.25        1    60.68
C16              CIRCULAR               0.30     0.07     0.07     0.30        1   104.75
C17              CIRCULAR               0.60     0.28     0.15     0.60        1   717.09
C18              CIRCULAR               0.38     0.11     0.09     0.38        1   122.00
C19              CIRCULAR               0.30     0.07     0.07     0.30        1    87.98
C2               CIRCULAR               0.25     0.05     0.06     0.25        1    59.44
C20              CIRCULAR               0.25     0.05     0.06     0.25        1    78.58
C21              CIRCULAR               0.25     0.05     0.06     0.25        1    53.11
C22              CIRCULAR               0.10     0.01     0.03     0.10        1     2.76
C23              CIRCULAR               0.25     0.05     0.06     0.25        1    54.13
C3               CIRCULAR               0.30     0.07     0.07     0.30        1    57.75
C4               CIRCULAR               0.30     0.07     0.07     0.30        1    57.36
C5               CIRCULAR               0.30     0.07     0.07     0.30        1    57.04
C6               CIRCULAR               0.30     0.07     0.07     0.30        1    55.69
C7_1             CIRCULAR               0.38     0.11     0.09     0.38        1    95.27
C7_2             CIRCULAR               0.38     0.11     0.09     0.38        1    96.75
C8               CIRCULAR               0.30     0.07     0.07     0.30        1   110.69
C9               CIRCULAR               0.38     0.11     0.09     0.38        1   157.88


*********************************************************
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 ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.069        71.708
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.013        13.486
Surface Runoff ...........         0.056        58.333
Final Storage ............         0.001         0.818
Continuity Error (%) .....        -1.297


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.056         0.563
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.011         0.110
External Outflow .........         0.068         0.676
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.004
Continuity Error (%) .....        -1.024


*************************
Highest Continuity Errors
*************************
Node 214 (-1.59%)
```

```
***************************
Time-Step Critical Elements
***************************
Link C7_1 (48.33%)
Link C13 (22.13%)
Link C12 (17.12%)
Link C12_2 (9.37%)


********************************
Highest Flow Instability Indexes
********************************
Link C13 (9)
Link C12_2 (7)
Link C18 (5)
Link C9 (4)
Link C8 (3)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     2.41 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :    -0.00
Average Iterations per Step :     2.12
Percent Not Converging      :     0.59


***************************
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
--------------------------------------------------------------------------------------------------------
S01                       71.71       0.00       0.00      11.02      60.52        0.11    81.99   0.844
S02                       71.71       0.00       0.00       4.21      67.09        0.10    69.50   0.936
S03                       71.71       0.00       0.00      36.90      37.78        0.01     7.78   0.527
S04                       71.71       0.00       0.00       9.29      62.20        0.12    94.75   0.867
S05                       71.71       0.00       0.00      10.92      60.63        0.08    59.40   0.846
S06                       71.71       0.00       0.00      28.56      43.94        0.03    25.56   0.613
S07                       71.71       0.00       0.00      20.77      51.72        0.02    19.00   0.721
S08                       71.71       0.00       0.00      21.75      50.67        0.06    50.77   0.707
S09                       71.71       0.00       0.00      17.37      54.83        0.05    40.35   0.765


******************
```

```
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
---------------------------------------------------------------------------------
201                  JUNCTION     0.14     0.23   111.57     0  01:24        0.23
202                  JUNCTION     0.12     0.19   111.65     0  01:24        0.19
203                  JUNCTION     0.13     0.21   111.82     0  01:24        0.21
204                  JUNCTION     0.11     0.18   111.88     0  01:23        0.18
205                  JUNCTION     0.12     0.20   112.08     0  01:23        0.20
206                  JUNCTION     0.03     0.03   112.44     0  03:41        0.03
207                  JUNCTION     0.01     0.01   113.30     0  04:39        0.01
208                  JUNCTION     0.22     1.14   113.83     0  01:22        1.14
210                  JUNCTION     0.30     0.76   112.92     0  01:22        0.76
211                  JUNCTION     0.27     1.11   112.92     0  01:23        1.11
212                  JUNCTION     0.50     1.50   112.92     0  01:23        1.50
214                  JUNCTION     0.25     1.24   113.82     0  01:22        1.24
215                  JUNCTION     0.50     1.69   113.82     0  01:22        1.69
216                  JUNCTION     0.15     0.24   111.56     0  01:24        0.24
CB1                  JUNCTION     0.09     0.53   112.93     0  01:22        0.53
CB3                  JUNCTION     0.17     0.98   113.83     0  01:22        0.98
CB4                  JUNCTION     0.17     1.02   113.83     0  01:22        1.02
CB5                  JUNCTION     0.02     0.11   114.11     0  01:10        0.11
CB6                  JUNCTION     0.09     0.43   112.93     0  01:22        0.43
CB7                  JUNCTION     0.04     0.36   113.83     0  01:22        0.36
CBE1                 JUNCTION     0.02     0.10   114.35     0  01:10        0.10
CBT1                 JUNCTION     0.03     0.14   113.93     0  01:10        0.14
CBT2                 JUNCTION     0.02     0.10   114.22     0  01:10        0.10
200                  OUTFALL      0.13     0.21   111.47     0  01:24        0.21
OF-HAZELDEAN         OUTFALL      0.00     0.00   114.00     0  00:00        0.00
OF-VICTOR            OUTFALL      0.00     0.00   113.00     0  00:00        0.00
CHAMBERS-1           STORAGE      0.50     1.43   112.92     0  01:23        1.43
CHAMBERS-2           STORAGE      0.45     1.55   113.82     0  01:22        1.55


*******************
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
-------------------------------------------------------------------------------------------------
201                  JUNCTION      0.00    48.62     0  01:24           0       0.364       0.030
202                  JUNCTION      0.00    48.62     0  01:24           0       0.364       0.051
203                  JUNCTION      1.91    48.63     0  01:23      0.0413       0.364       0.118
204                  JUNCTION      0.85    46.72     0  01:23      0.0184       0.323       0.036
205                  JUNCTION      0.85    45.88     0  01:22      0.0184       0.305       0.098
```

```
  206                  JUNCTION       0.85      1.49     0  04:22      0.0184      0.0322       0.546
  207                  JUNCTION       0.64      0.64     0  00:00      0.0138      0.0138       0.198
  208                  JUNCTION       0.00    153.68     0  01:10           0       0.201      -0.181
  210                  JUNCTION       0.00     81.95     0  01:10           0       0.106       0.284
  211                  JUNCTION       0.00    157.52     0  01:09           0       0.208      -0.768
  212                  JUNCTION       0.00     49.99     0  01:05           0       0.208      -0.134
  214                  JUNCTION       0.00    196.82     0  01:10           0       0.251      -1.566
  215                  JUNCTION       0.00     74.78     0  01:04           0       0.254      -0.690
  216                  JUNCTION       0.00     79.99     0  01:24           0       0.572       0.038
  CB1                  JUNCTION      77.28     77.28     0  01:10       0.102       0.102       0.275
  CB3                  JUNCTION      94.75     94.75     0  01:10       0.125       0.125      -0.042
  CB4                  JUNCTION      59.40     59.40     0  01:10      0.0767      0.0767      -0.160
  CB5                  JUNCTION       0.00     18.85     0  01:10           0      0.0215       0.015
  CB6                  JUNCTION      81.99     81.99     0  01:10       0.106       0.106       0.224
  CB7                  JUNCTION       0.00     43.56     0  01:10           0      0.0484      -0.335
  CBE1                 JUNCTION      19.00     19.00     0  01:10      0.0215      0.0215       0.006
  CBT1                 JUNCTION      25.56     43.98     0  01:10      0.0271      0.0486       0.453
  CBT2                 JUNCTION       0.00     18.94     0  01:10           0      0.0215      -0.001
  200                  OUTFALL        0.00     79.99     0  01:24           0       0.571       0.000
  OF-HAZELDEAN         OUTFALL       50.77     50.77     0  01:10      0.0569       0.057       0.000
  OF-VICTOR            OUTFALL       40.35     40.35     0  01:10      0.0477      0.0477       0.000
  CHAMBERS-1           STORAGE        0.00    157.41     0  01:09           0       0.209       0.052
  CHAMBERS-2           STORAGE        0.00    198.35     0  01:09           0       0.256       0.277


  **********************
  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        1.07          0.764        0.671
  210                  JUNCTION        0.63          0.254        1.276
  211                  JUNCTION        0.88          0.430        1.180
  212                  JUNCTION        1.46          0.831        1.023
  214                  JUNCTION        0.92          0.623        0.776
  215                  JUNCTION        1.37          1.003        0.477
  CB1                  JUNCTION        0.69          0.281        0.869
  CB3                  JUNCTION        0.99          0.683        0.417
  CB4                  JUNCTION        1.03          0.722        0.169
  CB6                  JUNCTION        0.64          0.184        0.966
  CB7                  JUNCTION        0.25          0.064        1.174


  *********************
  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
  --------------------------------------------------------------------------
  CHAMBERS-1              6.00      0.00      0  00:00       0.000   -1.180
  CHAMBERS-2              6.00      0.00      0  00:00       0.000   -0.676


  **********************
  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
  --------------------------------------------------------------------------------------------------
  CHAMBERS-1               0.036       0     0     0         0.000       0       0  00:00      49.99
  CHAMBERS-2               0.034       0     0     0         0.000       0       0  00:00      74.78


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

  -----------------------------------------------------------
                         Flow       Avg       Max       Total
                         Freq      Flow      Flow      Volume
  Outfall Node           Pcnt       LPS       LPS    10^6 ltr
  -----------------------------------------------------------
  200                   99.63     37.18     79.99       0.571
  OF-HAZELDEAN          72.53      7.91     50.77       0.057
  OF-VICTOR             72.73      6.63     40.35       0.048
  -----------------------------------------------------------
  System                81.63     51.72    156.81       0.676


  ********************
  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
  -----------------------------------------------------------------------------
  C1                   CONDUIT      0.64      0  04:22      0.70    0.00    0.05
  C10                  CONDUIT     18.70      0  01:10      0.75    0.40    0.51
  C11                  CONDUIT     43.56      0  01:10      1.48    0.64    0.67
  C12                  CONDUIT     10.13      0  01:00      1.29    1.96    1.00
  C12_1                CONDUIT     43.55      0  01:10      2.12    0.22    1.00
```

```
C12_2                CONDUIT    198.35     0  01:09      2.15    0.23    1.00
C13                  CONDUIT     74.78     0  01:04      1.93    0.39    1.00
C15                  CONDUIT     18.94     0  01:10      1.04    0.31    0.40
C16                  CONDUIT     80.91     0  01:09      1.63    0.77    1.00
C17                  CONDUIT    157.41     0  01:09      1.81    0.22    1.00
C18                  CONDUIT     48.88     0  01:05      0.82    0.40    1.00
C19                  CONDUIT     59.19     0  01:10      0.95    0.67    1.00
C2                   CONDUIT      1.49     0  03:50      0.51    0.03    0.40
C20                  CONDUIT     77.29     0  01:09      1.82    0.98    1.00
C21                  CONDUIT     81.95     0  01:10      1.70    1.54    1.00
C22                  CONDUIT      5.62     0  00:59      0.72    2.04    1.00
C23                  CONDUIT     18.85     0  01:10      0.95    0.35    0.42
C3                   CONDUIT     45.87     0  01:23      1.01    0.79    0.61
C4                   CONDUIT     46.72     0  01:23      1.09    0.81    0.58
C5                   CONDUIT     48.62     0  01:24      1.03    0.85    0.63
C6                   CONDUIT     48.62     0  01:24      1.08    0.87    0.61
C7_1                 CONDUIT     48.63     0  01:24      0.67    0.51    0.62
C7_2                 CONDUIT     79.99     0  01:24      1.17    0.83    0.59
C8                   CONDUIT     94.49     0  01:10      1.51    0.85    1.00
C9                   CONDUIT    153.74     0  01:10      1.88    0.97    1.00
C14                  DUMMY       43.54     0  01:22
C7                   DUMMY       31.38     0  01:23


***************************
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
-------------------------------------------------------------------------------------
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  0.01  0.00  0.99  0.00  0.00  0.00  0.99  0.00
C11                    1.00   0.00  0.00  0.00  0.09  0.00  0.00  0.91  0.09  0.00
C12                    1.00   0.01  0.00  0.00  0.54  0.00  0.00  0.45  0.00  0.00
C12_1                  1.00   0.00  0.00  0.00  0.21  0.02  0.00  0.77  0.10  0.00
C12_2                  1.00   0.00  0.00  0.00  0.47  0.03  0.00  0.50  0.00  0.00
C13                    1.00   0.44  0.00  0.00  0.45  0.04  0.00  0.07  0.00  0.00
C15                    1.00   0.00  0.00  0.00  0.31  0.69  0.00  0.00  0.89  0.00
C16                    1.00   0.02  0.00  0.00  0.20  0.01  0.00  0.77  0.04  0.00
C17                    1.00   0.00  0.00  0.00  0.54  0.03  0.00  0.43  0.01  0.00
C18                    1.00   0.37  0.00  0.00  0.55  0.00  0.00  0.08  0.01  0.00
C19                    1.00   0.00  0.00  0.00  0.68  0.01  0.00  0.31  0.22  0.00
C2                     1.00   0.00  0.00  0.00  0.74  0.01  0.00  0.24  0.55  0.00
C20                    1.00   0.00  0.00  0.00  0.25  0.02  0.00  0.73  0.06  0.00
C21                    1.00   0.00  0.00  0.00  0.15  0.00  0.00  0.84  0.02  0.00
C22                    1.00   0.01  0.00  0.00  0.85  0.14  0.00  0.00  0.00  0.00
C23                    1.00   0.00  0.00  0.00  0.73  0.27  0.00  0.00  0.75  0.00
C3                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  0.00
C4                     1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00  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                   1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.00  0.00
C7_2                   1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.00  0.00
C8                     1.00   0.00  0.00  0.00  0.33  0.07  0.00  0.60  0.03  0.00
C9                     1.00   0.00  0.00  0.00  0.65  0.35  0.00  0.00  0.05  0.00


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

----------------------------------------------------------------------------
                                                           Hours        Hours
                       --------- Hours Full --------   Above Full   Capacity
Conduit                 Both Ends  Upstream  Dnstream   Normal Flow   Limited
----------------------------------------------------------------------------
C11                          0.01      0.01      0.25       0.01          0.01
C12                          1.74      2.73      1.74       1.22          0.09
C12_1                        0.25      0.25      0.92       0.01          0.01
C12_2                        0.94      0.94      0.96       0.01          0.01
C13                          1.32      1.32      1.37       0.01          0.01
C16                          0.63      0.63      0.88       0.01          0.01
C17                          0.99      0.99      1.04       0.01          0.01
C18                          1.36      1.36      1.46       0.01          0.01
C19                          1.03      1.03      1.15       0.01          0.01
C20                          0.69      0.69      1.05       0.01          0.01
C21                          0.54      0.64      0.65       0.15          0.03
C22                          2.15      3.37      2.15       1.61          0.28
C8                           0.99      0.99      1.12       0.01          0.01
C9                           1.07      1.07      1.19       0.01          0.01


Analysis begun on:  Thu May 16 14:42:49 2019
Analysis ended on:  Thu May 16 14:42:49 2019
Total elapsed time: < 1 sec
```

Appendix H – Correspondence

Correspondence from City of Ottawa

BOUNDARY CONDITIONS

Boundary Conditions For: 5924 Hazeldean Rd

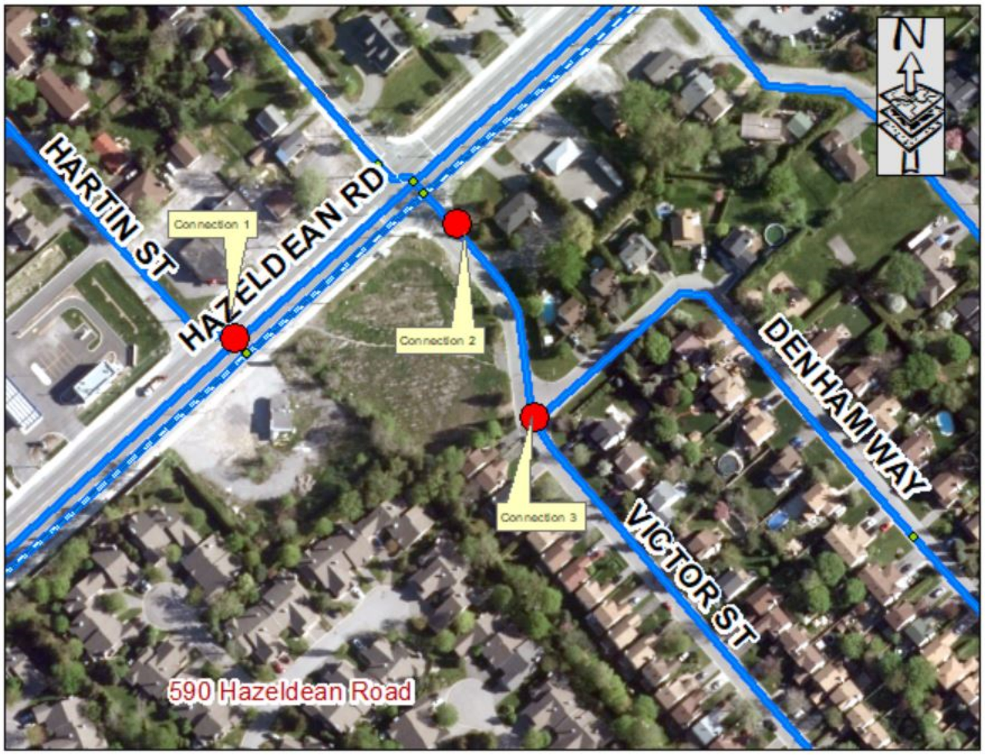
Date of Boundary Conditions: 2019-Mar-28

Provided Information:

Scenario	Demand	
	L/min	L/s
Average Daily Demand	45.6	0.76
Maximum Daily Demand	207.6	3.5
Peak Hour	313.2	5.2
Fire Flow #1 Demand	166.7	10,000

Number Of Connections: 3

Location:



BOUNDARY CONDITIONS

Results:

Connection #: 1

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.7	66.3
Peak Hour	157.4	61.3
Max Day Plus Fire (10,000) L/min	157.3	62.5

[1] Elevation: **114.36 m**

Connection #: 2

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.9	68.1
Peak Hour	157.4	63.1
Max Day Plus Fire (10,000) L/min	156.5	61.8

[1] Elevation: **113.015 m**

Connection #: 3

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.9	66.7
Peak Hour	157.3	61.6
Max Day Plus Fire (10,000) L/min	147.5	47.6

[1] Elevation: **113.94 m**

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:

a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.

b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

3) Two different connections for this development are required. If both developments are on the same main, ensure to have an isolation valve in between the two connection in order to ensure continuous water service.

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)

Volume III:
TEMPEST™
INLET CONTROL
DEVICES

Municipal Technical
Manual Series

SECOND EDITION

LMF (Low to Medium Flow) ICD

HF (High Flow) ICD

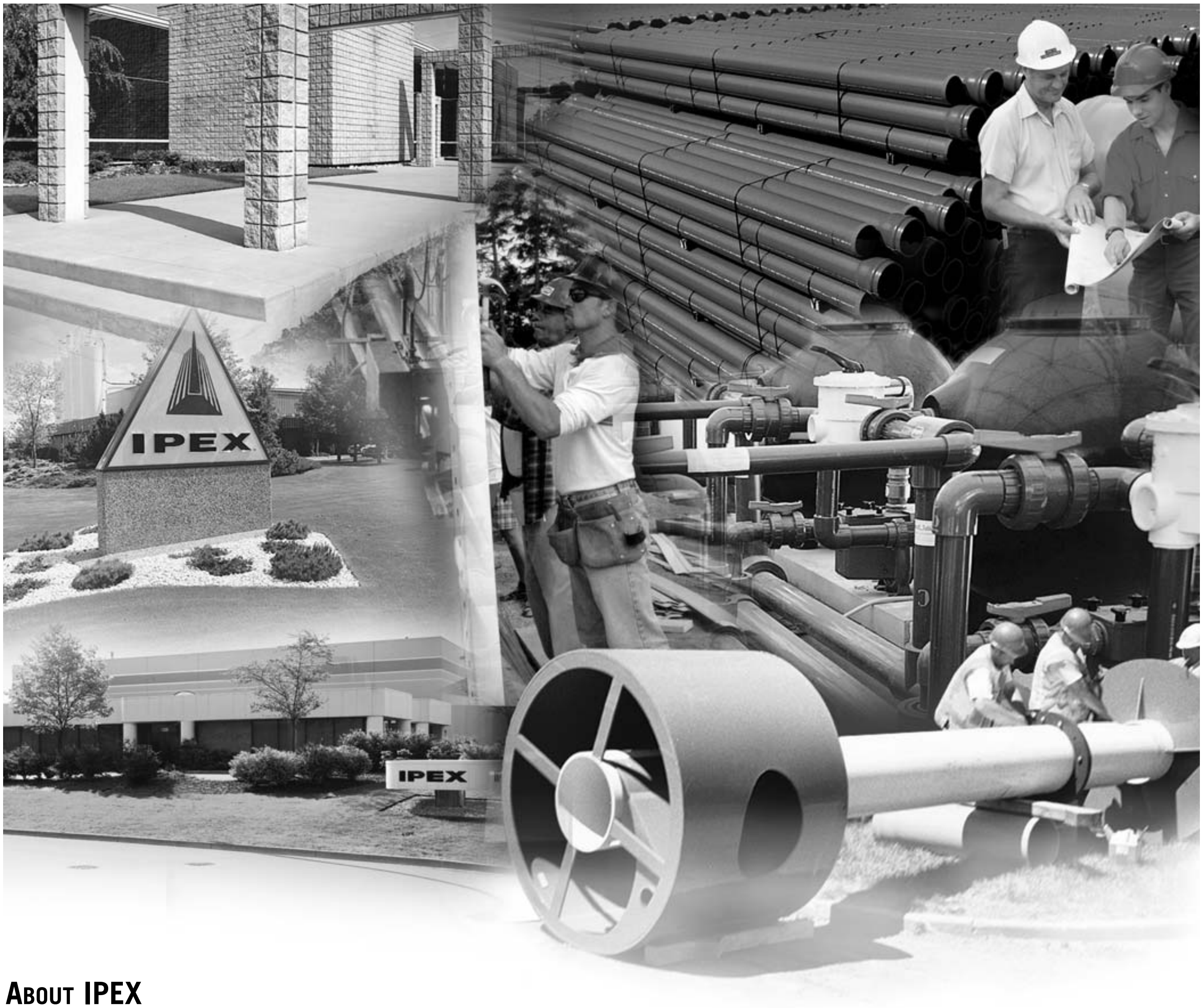
MHF (Medium to High Flow) ICD

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.

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TEMPEST INLET CONTROL DEVICES Technical Manual
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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:

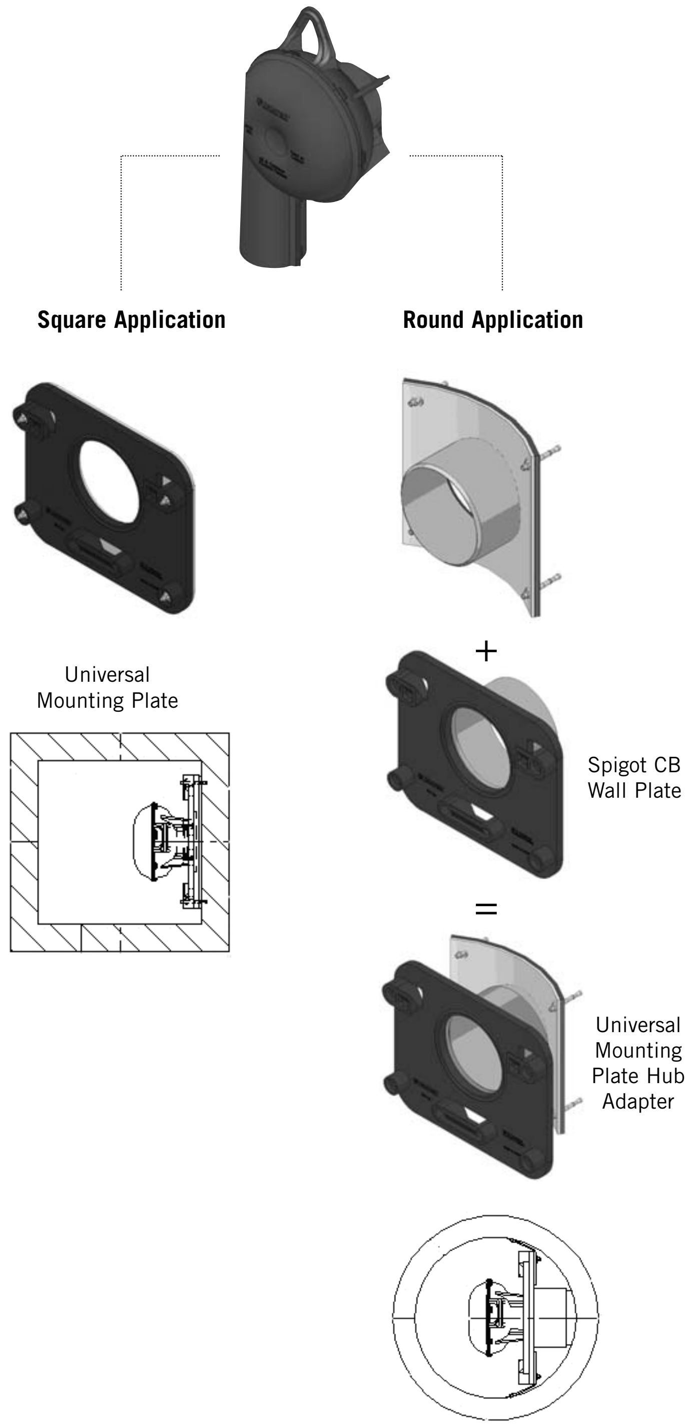


Chart 1: LMF 14 Preset Flow Curves

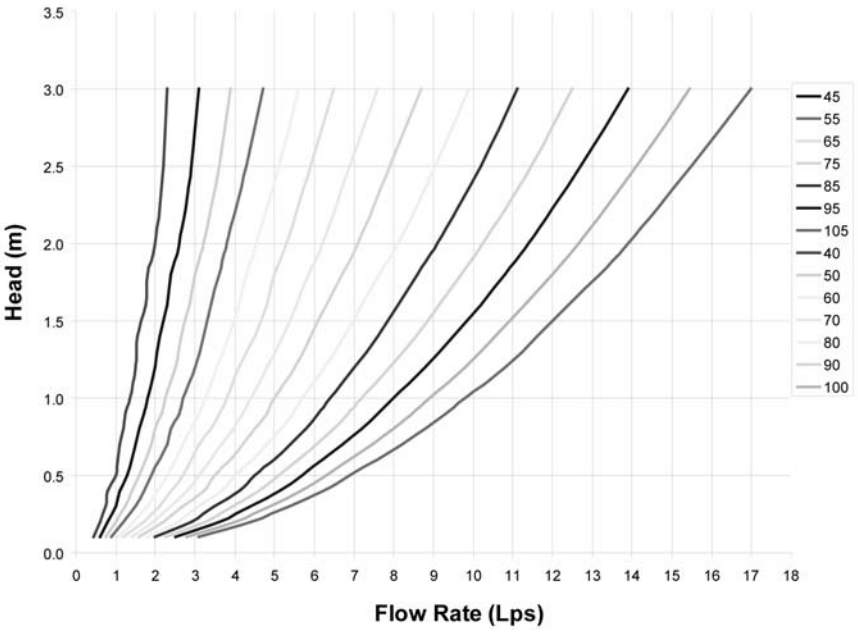
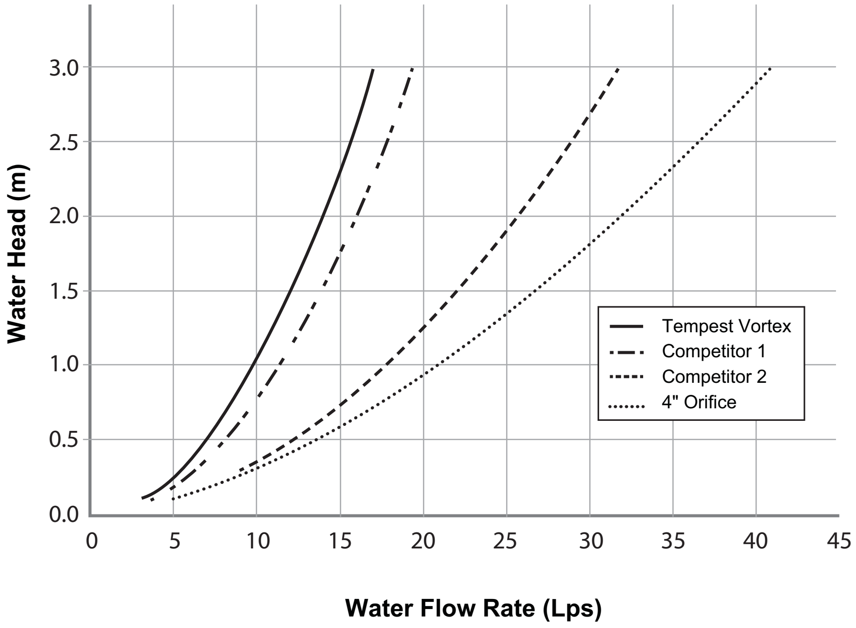


Chart 2: LMF Flow vs. ICD Alternatives



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

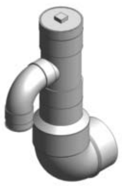
Product Description

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.

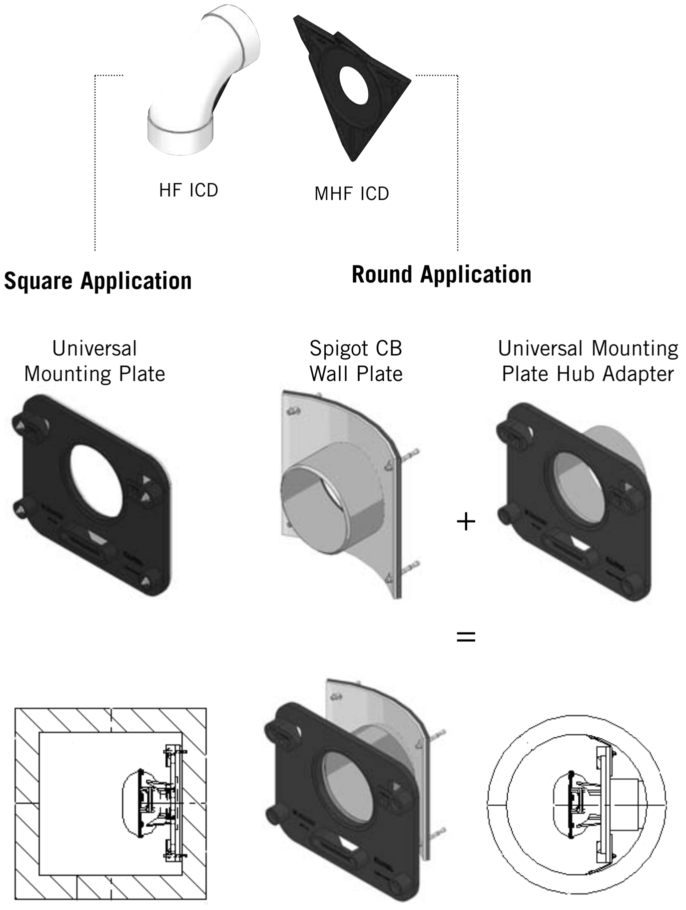
TEMPEST MHF (Medium to High Flow): The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

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:



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

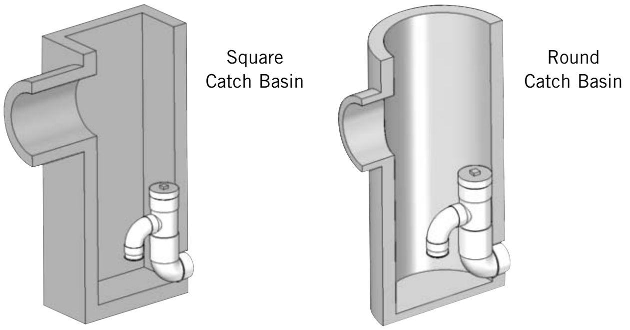
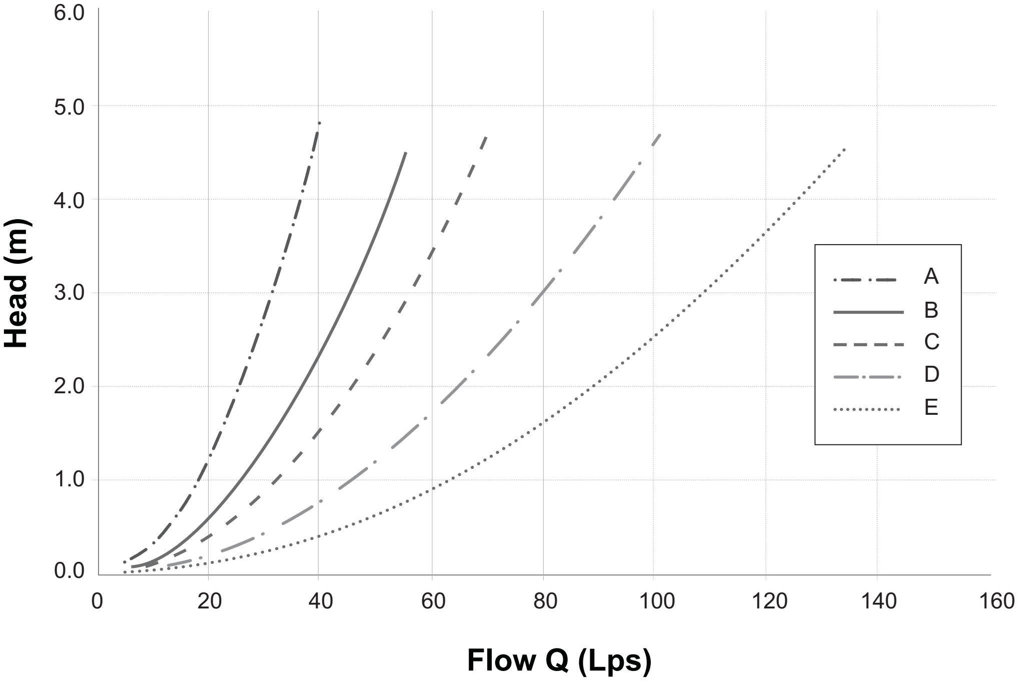


Chart 3: HF & MHF Preset Flow Curves



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.

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IPEX

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 ft³ (m³)	Total System Cumulative Storage ft³ (m³)
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 ft³ (m³)	Total System Cumulative Storage ft³ (m³)
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)

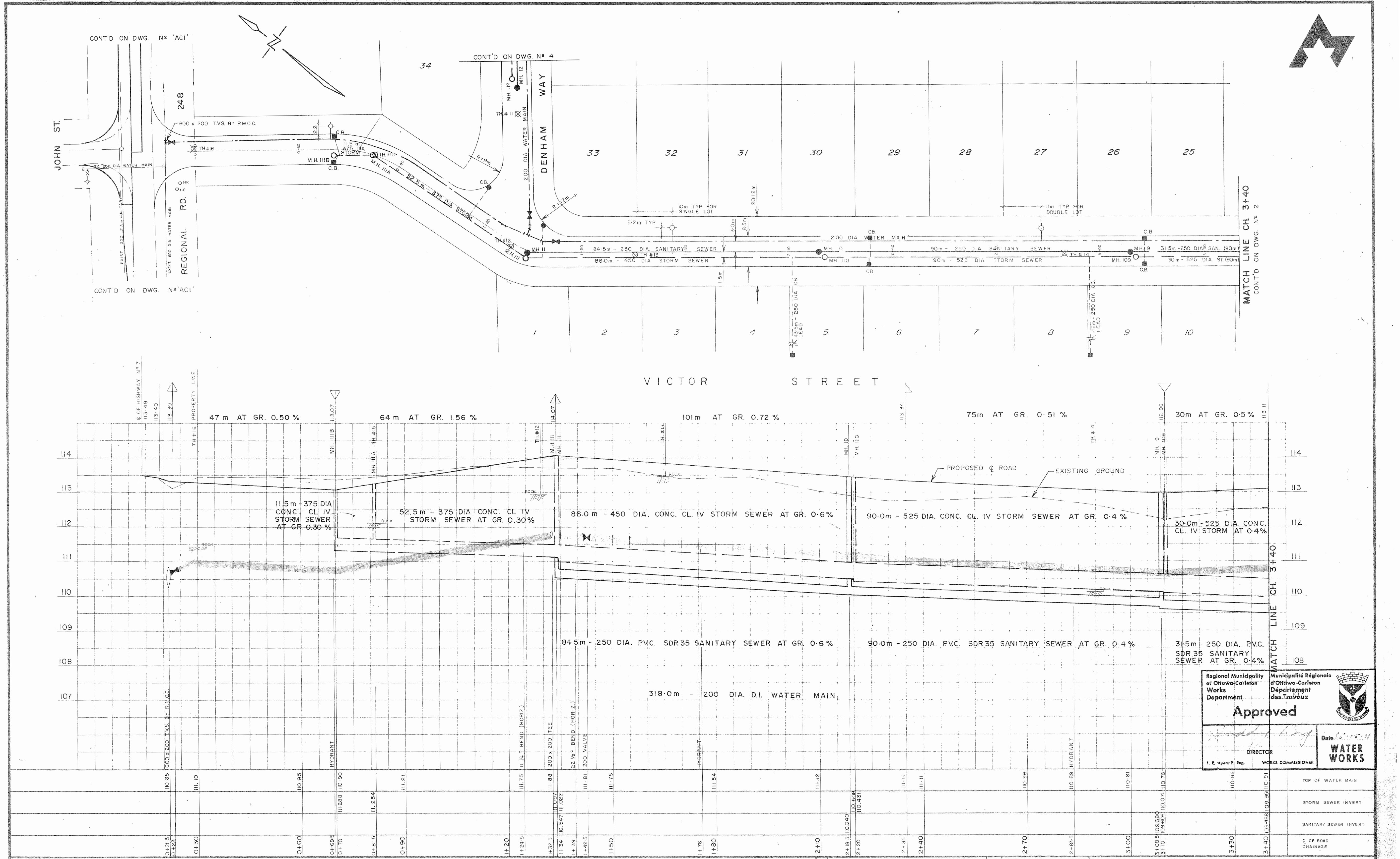
NOTE: Add 0.56 ft³ (0.016 m³) of storage for each additional inch (25 mm) of stone foundation.
Contact StormTech for cumulative volume spreadsheets in digital format.

Appendix J – Background Information

Plan & Profile – Victor Street (Oliver Mangione McCalla, Dwg 83-3638-1. 11x17 Reduction)

Site Services Plan – Amber Terrace (McIntosh Perry, Dwg C1.2. 11x17 Reduction)

Plan & Profile – Hazeldean Road Widening (McCormick Rankin. Dwg 022. 11x17 Reduction)



Regional Municipality of Ottawa-Carleton Works Department
Municipalité Régionale d'Ottawa-Carleton Département des Travaux

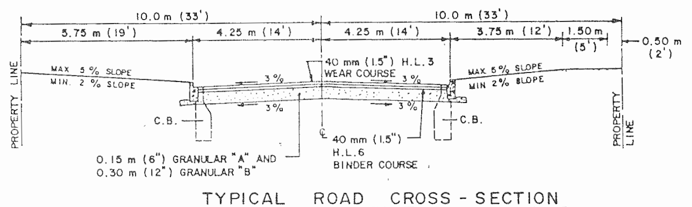
Approved

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

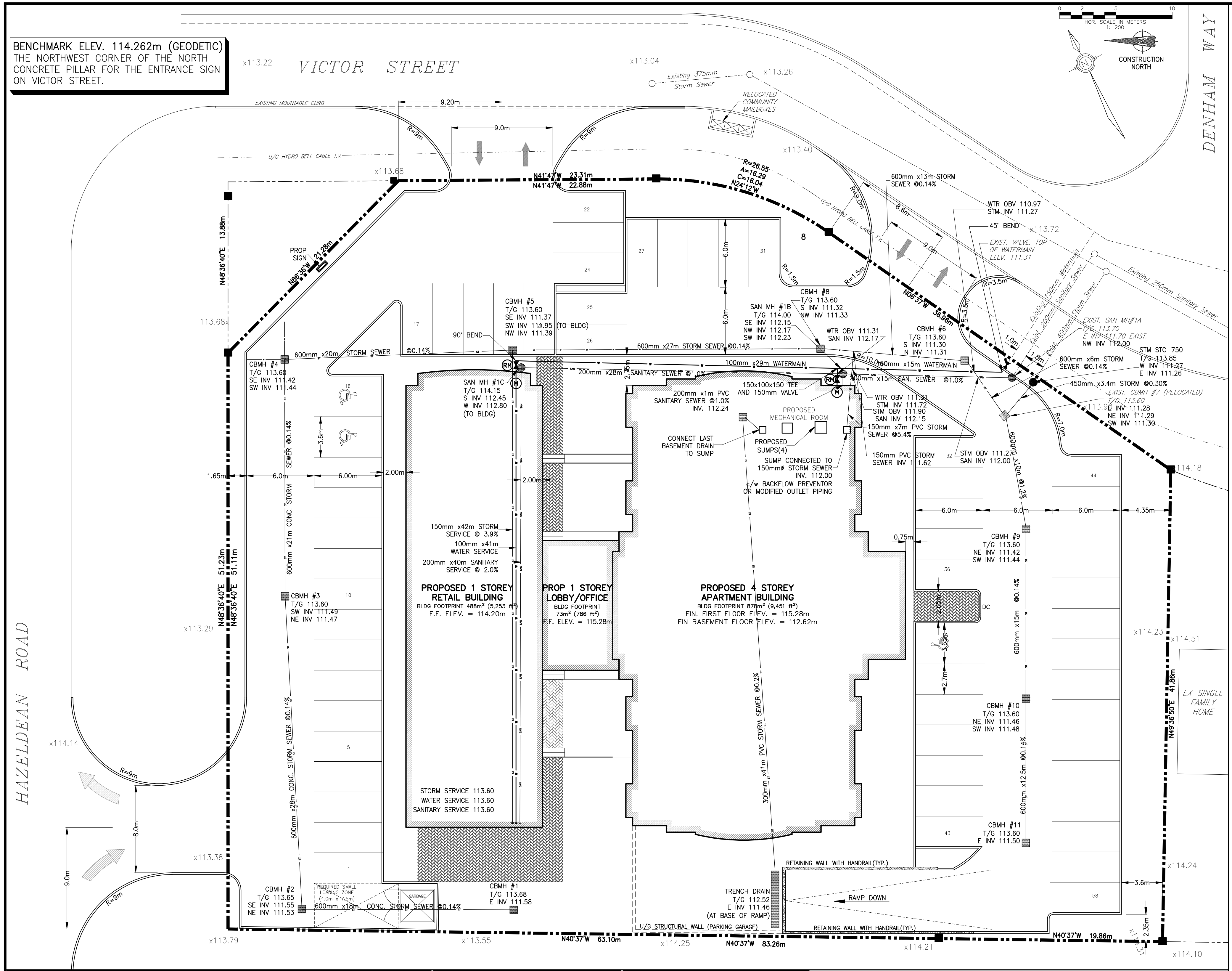
DATE AUGUST, 1984

SCALE HORIZ - 1:500 VERT. - 1:50

DRAWING No. 83-3638-1

REV 2

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

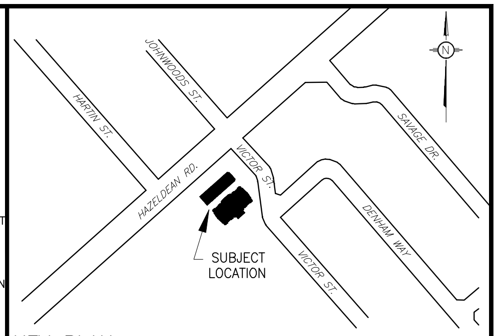
1. THE SITE GRADING CONTRACTOR IS RESPONSIBLE FOR ENSURING SEDIMENT AND EROSION CONTROL STRUCTURES ARE INSTALLED AS SHOWN. CARE SHALL BE TAKEN AT THE REMOVAL STAGE TO ENSURE THAT ANY SILT THAT HAS ACCUMULATED IS PROPERLY HANDLED AND DISPOSED OF.
2. AT THE DISCRETION OF THE PROJECT MANAGER OR MUNICIPAL 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
×85.53	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

ALL ELEVATIONS ON THIS PLAN ARE GEODETIC

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

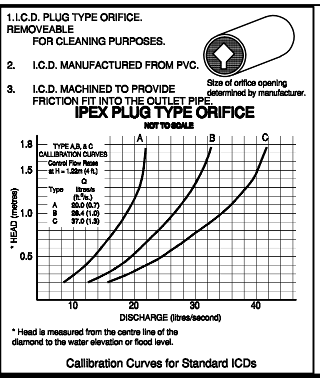
SCHEDULE OF CITY OF OTTAWA STANDARD DRAWINGS

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

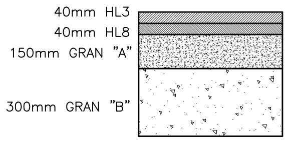
LOCATION	STATION	FINISHED GRADE	TOP OF SERVICE	DEPTH
CONNECTION	1+000	113.85	111.31	2.54
@45° BEND	1+000.5	113.70	111.30	2.40
TEE @ APT BLDG	1+015.1	114.05	111.65	2.40
@ APT. BLDG		114.10	111.70	2.40
90° BEND	1+043.6	114.15	111.75	2.40
@ RETAIL BLDG		114.15	111.75	2.40
@ TERMINATION (UNDER BLDG SLAB)	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.



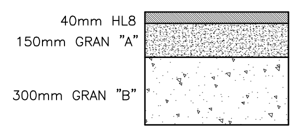
* Head is measured from the centre line of the diamond to the water elevation or flood level.

Callibration Curves for Standard ICDs



HEAVY DUTY PAVEMENT CROSS-SECTION

NOT TO SCALE



ASPHALT PARKING CROSS-SECTION

NOT TO SCALE

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

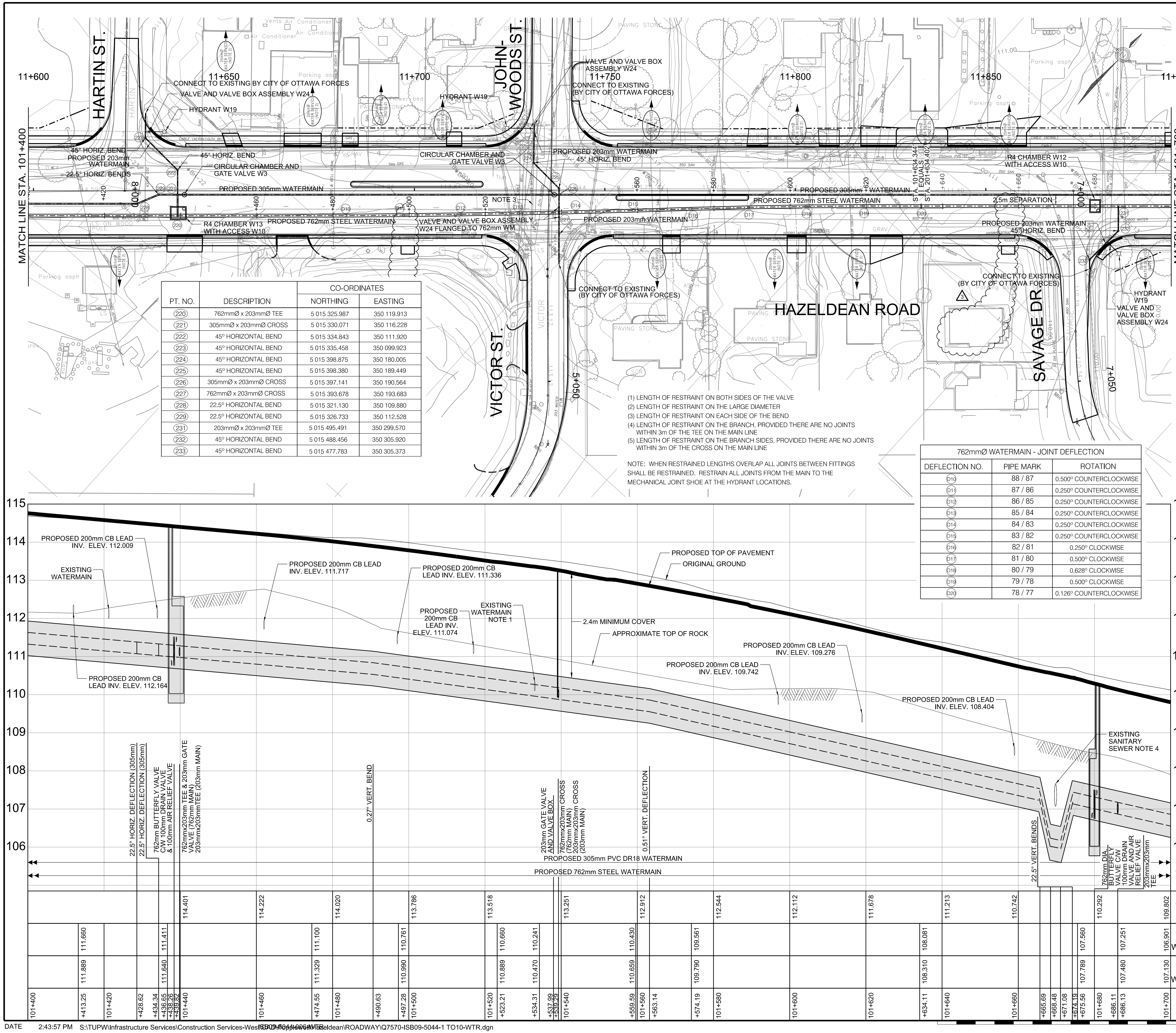
McINTOSH PERRY Consulting Engineers Ltd.
115 Walgreen Rd., R.R. #3, Carp ON. K0A 1L0
Tel.: (613) 836-2184 Fax: (613) 836-3742

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]

TITLE FRAME: 709mm x 534mm City of Ottawa 2008

Consultant Drawing Number



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

HAZELDEAN ROAD WIDENING
100m EAST OF CARP ROAD TO 100m WEST OF IBER ROAD

Ottawa

Contract No. ISB09-5044
Dwg. No. 022

762mm WATERMAIN
STA. 101+400 TO STA. 101+700

Sheet 22 of 148
Asset No.

B. MASON, P.Eng.
Manager - Design and Construction West

S. HARISH, P.Eng.
Project Manager, Infrastructure Services

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

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.	09/03/2010

THESE DESIGN DOCUMENTS ARE PREPARED SOLELY FOR THE USE BY THE PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS ENTERED INTO A CONTRACT AND THERE ARE NO REPRESENTATIONS OF ANY KIND MADE BY THE DESIGN PROFESSIONAL TO ANY PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS NOT ENTERED INTO A CONTRACT

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

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)		

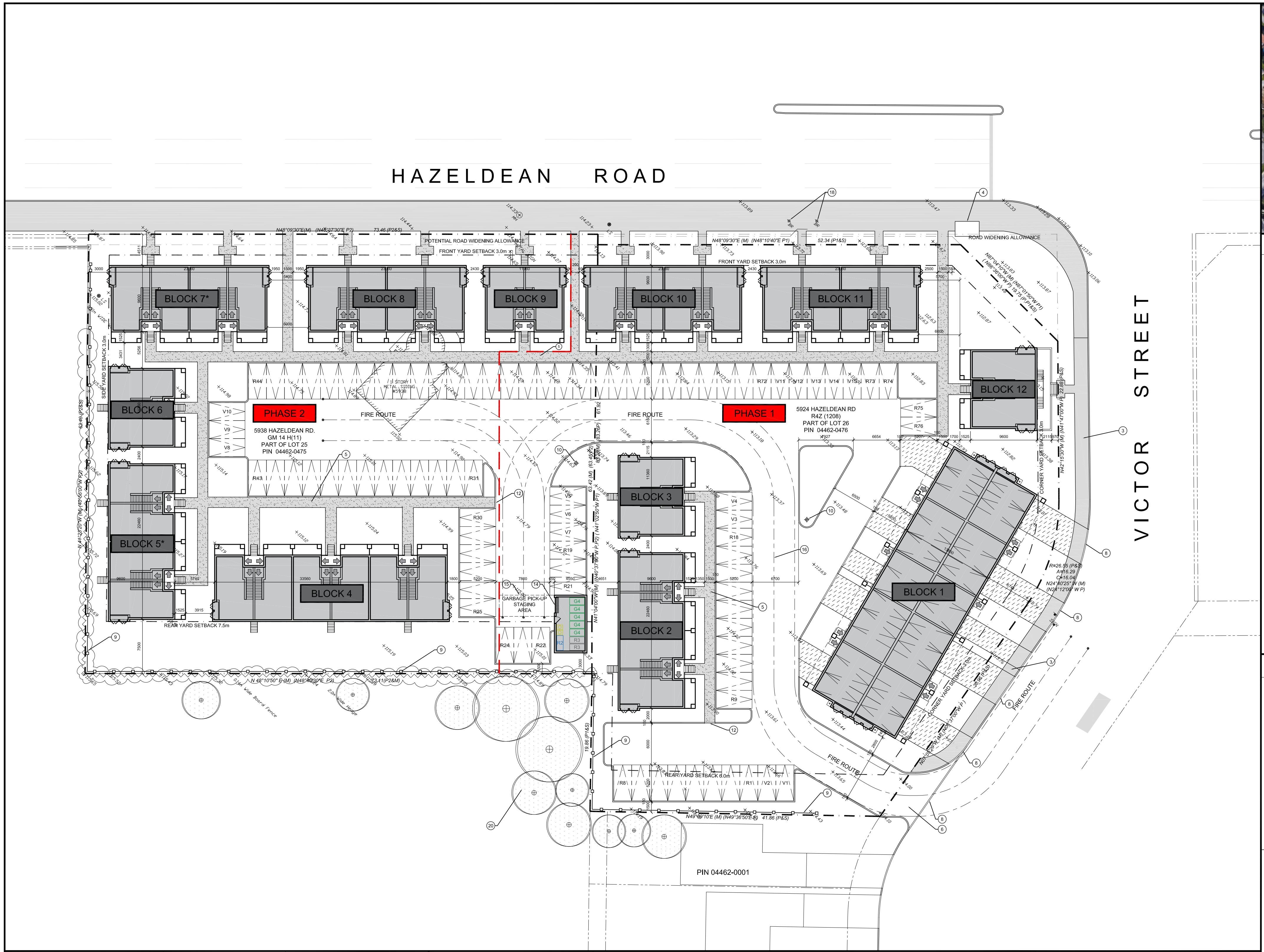
Appendix K – Drawings

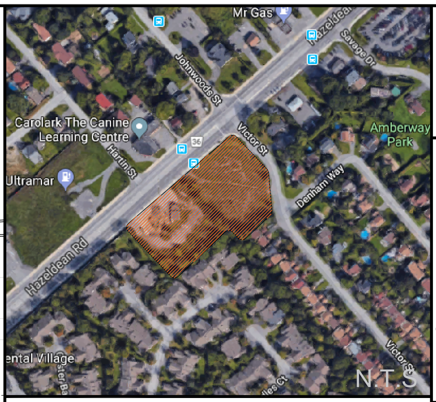
Other Drawings (All 11x17 Reduction, Scale: NTS)

- **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, Rev2**
- **Legends and Notes, Drawing C001, Rev2**
- **Site Servicing Plan, Drawing C100, Rev2**
- **Grading Plan, Drawing C200, Rev2**
- **Erosion & Sediment Control Plan, Drawing C300, Rev2**
- **Post Development Storm Drainage Plan, Drawing C400, Rev2**
- **Detail Sheet, Drawing C700, Rev2**





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.

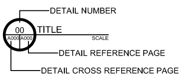
ALL CONTRACTORS MUST COMPLY WITH ALL PERTINENT CODES AND BY-LAWS.

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.



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.

PROJECT NOTES

- ① --
- ② --
- 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 --
- ⑧ 150mm WIDE MOUNTABLE CURB
- ⑨ 2.5m. HIGH PRIVACY FENCE
- ⑩ NEW FIRE HYDRANT (EXACT LOCATION TO BE CONFIRMED BY CIVIL ENGINEER)
- ⑪ --
- ⑫ PROVIDE DEPRESSED SIDEWALK
- ⑬ --
- 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 (35,000 lbs.)
- ⑰ --
- 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 TO BE PROTECTED DURING CONSTRUCTION (EXACT LOCATION, SIZE AND NUMBER TO BE DETERMINED BY SURVEYOR)

LEGEND

UNIT ENTRY POINT	➡	ORGANICS BIN	O
TRAFFIC FLOW	⇒	EXISTING TREES	◎
3 YRD. GARBAGE BIN	G3	FIRE HYDRANT	⊕
4 YRD. GARBAGE BIN	G4	NEW LIGHT STANDARD	⬣
3 YRD. FIBROUS RECYCLING BIN	R3	EXISTING LIGHT STANDARD	◎ LS
2 YRD. GLASS AND PLASTIC RECYCLING BIN	R2	VISITOR PARKING	V#
		RESIDENT PARKING	R#
TYPICAL PARKING SPACE	2600 × 5200	GEODETIC ELEVATION MARKER	+115.03

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

- * BLOCKS 5 AND 7 WILL REQUIRE THE REDUCTION OF UNPROTECTED OPENINGS TO 17.25 % (LIMITING DISTANCE 5.5m)
- ** 6000mm DRIVE AISLES WILL BE SUBJECT TO APPROVAL OF A MINOR VARIANCE ALLOWING DRIVE AISLES NARROWER THAN 6700mm
- *** BLOCK 1 AND 4 WILL BE SUBJECT TO THE APPROVAL OF A MINOR VARIANCE ALLOWING MORE THAN 8 UNITS PER BLOCK OF TOWNHOUSES

PROJECT DEVELOPER
GNCR DEVELOPMENTS

Konaklar Mh. Akasyalı Sk.
No:26 34330
Beşiktaş İstanbul Turkey

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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	4931.0 SQ. M.
5924 HAZELDEAN RD STITTSVILLE, ONTARIO, CANADA K2S1B9	

ZONING (5938)	GM14 H[11]
MAX BUILDING HEIGHT	11.0 M.
LOT AREA	4647.0 SQ. M.
5938 HAZELDEAN RD STITTSVILLE, ONTARIO, CANADA K2S1B9	

SITE AREA	
TOTAL SITE AREA	9,578.0 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) -	1,077 SQFT	22	23,716 SQFT
STACKED TOWN TYPE B (2A) -	968 SQFT	16	15,488 SQFT
STACKED TOWN TYPE C (1B) -	1,278 SQFT	22	28,116 SQFT
STACKED TOWN TYPE D (2B) -	1,168 SQFT	16	18,688 SQFT
TRADITIONAL TOWN TYPE A -	1,524 SQFT	4	6,096 SQFT
TRADITIONAL TOWN TYPE B -	1,506 SQFT	4	6,024 SQFT
TRADITIONAL TOWN TYPE C -	1,154 SQFT	2	2,308 SQFT
TOTAL -		86	100,436 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	15
TRADITIONAL TOWNS		
RESIDENTIAL:	10	14
VISITOR:	2	10

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	-	2,968.5
PARKING LOT	-	2,996.2
SIDEWALKS	-	542.3
DRIVEWAYS	-	262.5
LOT AREA		
PHASE 1	-	5,123.9
PHASE 2	-	4,454.1
TOTAL	-	9,578.0
LANDSCAPE SPACE	-	3,350.8
TOTAL LANDSCAPE SPACE (%)	-	35.0

DRAFT

No.	DESCRIPTION	DATE
1	-- -- -- -- -- --	-- -- --

REVISIONS:

ARCHITECT SEAL:
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-0
PROJECT No. 1831	

D0

PLOT DATE: Wednesday, May 08, 2019

Plan No.: #______

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

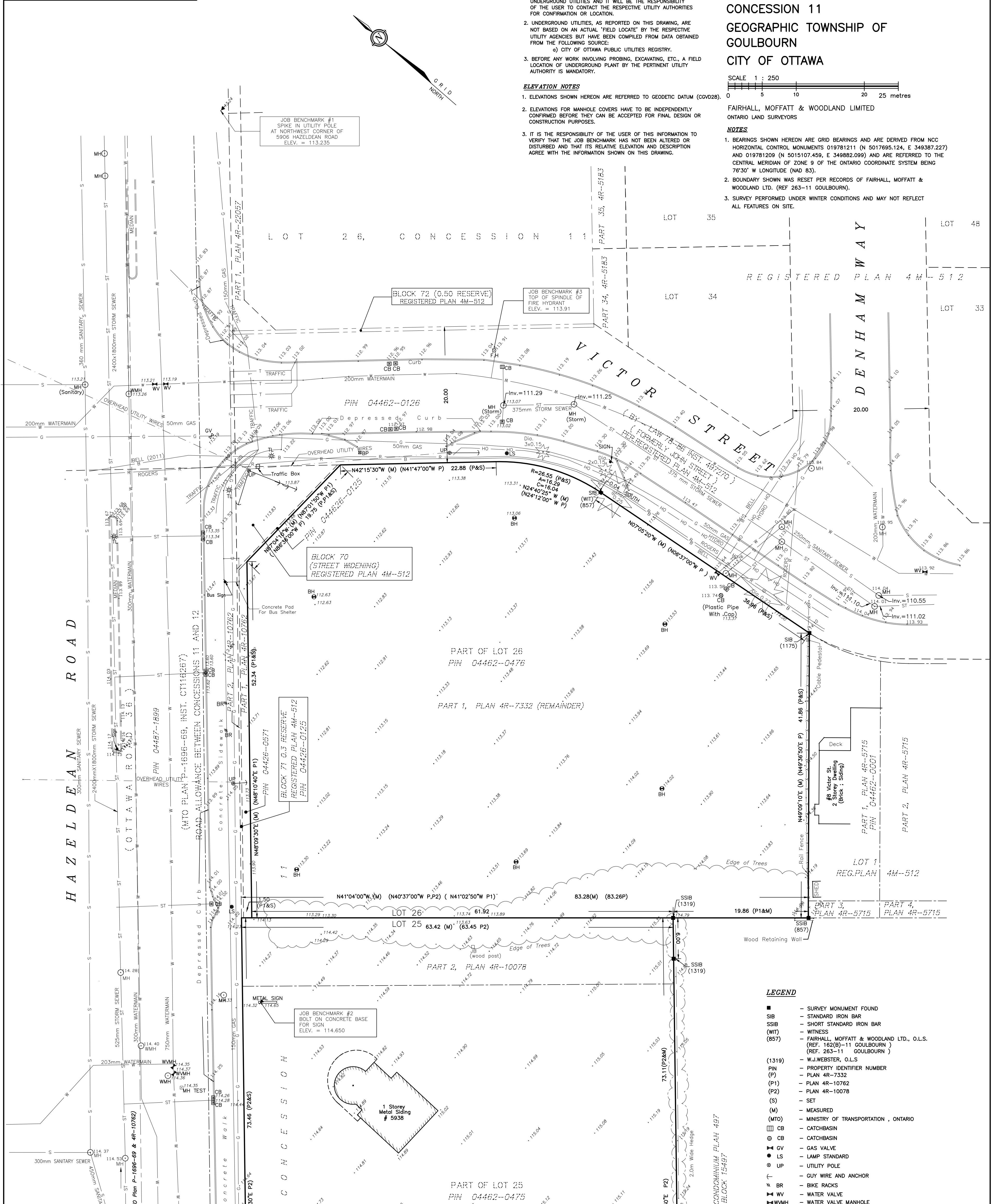
1. THIS DRAWING CANNOT BE ACCEPTED AS ACKNOWLEDGING ALL OF THE UNDERGROUND UTILITIES AND IT WILL BE THE RESPONSIBILITY OF THE USER TO CONTACT THE RESPECTIVE UTILITY AUTHORITIES FOR CONFIRMATION OR LOCATION.
2. UNDERGROUND UTILITIES, AS REPORTED ON THIS DRAWING, ARE NOT BASED ON AN ACTUAL 'FIELD LOCATE' 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
O T T A W A
ONTARIO LAND SURVEYORS
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.