APPENDICES

Appendix A POTABLE WATER SERVICING

A.1 WATER DEMAND CALCULATIONS

Half Moon Bay South Phase 8 - Domestic Water Demand Estimates

Project No. 16051657

Based on concept 2 (draft) provided by Korsiak Urban Planning dated 2021-06-28

Densities as per City Guidelines:		
Townhomes	2.7	ppu

Building ID	Amenity Area (m^2)	No. of Units	Population	Daily Rate of Demand (L/cap/d or L/ha/d)	Avg Day Demand		Max Day Demand [1]		Peak Hour Demand [2]	
					(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Back-to-Back Townhomes										
Block 1	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 2	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 3	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 4	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 5	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 6	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 7	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 8	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 9	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 10	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 11	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 12	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 13	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 14	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 15	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 16	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 17	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 18	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Block 19	-	12	32.4	350	7.9	0.13	19.7	0.33	43.3	0.72
Outdoor amenity areas	1956		0	28000	38.0	0.63	57.1	0.95	102.7	1.71
Total Site :		**228.0**	**616**		**187.7**	**3.13**	**431.1**	**7.19**	**925.6**	**15.43**

Average day water demand for residential areas: 350 L/cap/d , 28000/L/ha/d for commercial/amenity areas

The City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:

1 maximum day demand rate = 2.5 x average day demand rate for residential

2 peak hour demand rate = 2.2 x maximum day demand rate for residential

3 Water demand criteria used to estimate peak demand rates for amenity/common areas are as follows:

maximum daily demand rate = 1.5 x average day demand rate

peak hour demand rate = 1.8 x maximum day demand rate

A.2 FIRE FLOW REQUIREMENTS PER FUS GUIDELINES

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401657
Project Name: Mattamy Homes -Half Moon Bay South Phase 8
Date: 7/20/2021
Fire Flow Calculation #: 1
Description: 4 Back-to-Back 12-Unit Townhouse Block (Block 8)
Notes: Worst Case: 3-storey building with slab on grade. Back-to-back townhouse units with fire separation to limit building area to a maximum of 600m2. Building Classification C.

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Ordinary Construction						1	-
2	Determine Ground Floor Area of One Unit	Approx. area of a single storey of a single unit						470	-
	Determine Number of Adjoining Units	-						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	10.1 to 20	21	3	61-90	Wood Frame or Non-Combustible	14%	3536
		East	3.1 to 10	21	3	61-90	Wood Frame or Non-Combustible	19%	
		South	20.1 to 30	27	3	61-90	Wood Frame or Non-Combustible	9%	
		West	20.1 to 30	31	3	91-120	Wood Frame or Non-Combustible	10%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							10000
		Total Required Fire Flow in L/s							166.7
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1200

A.3 HYDRAULIC CAPACITY AND MODELLING BY GEOADVICE (JULY 2021)

Hydraulic Capacity and Modeling Analysis Brazeau Lands

Final Report

Prepared for:
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120 Iber Road, Unit 103
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Prepared by:
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Submission Date: July 28, 2020

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Project: 2019-091-DSE

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	November 7, 2019	Draft	Ben Loewen	Werner de Schaetzen
R1	December 20, 2019	Final	Ben Loewen	Werner de Schaetzen
R2	June 10, 2020	Updated Draft	Ferdinand de Schoutheete	Werner de Schaetzen
R3	July 28, 2020	Final	Ferdinand de Schoutheete	Werner de Schaetzen

Statement of Qualifications and Limitations

This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

Contents

1 Introduction

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Under existing conditions, the development will be serviced by the Barrhaven pressure zone; however, in the future, it will be serviced by pressure zone 3C.

There are 347 single detached dwellings, 279 traditional townhomes and 1 park serviced as part of the development.

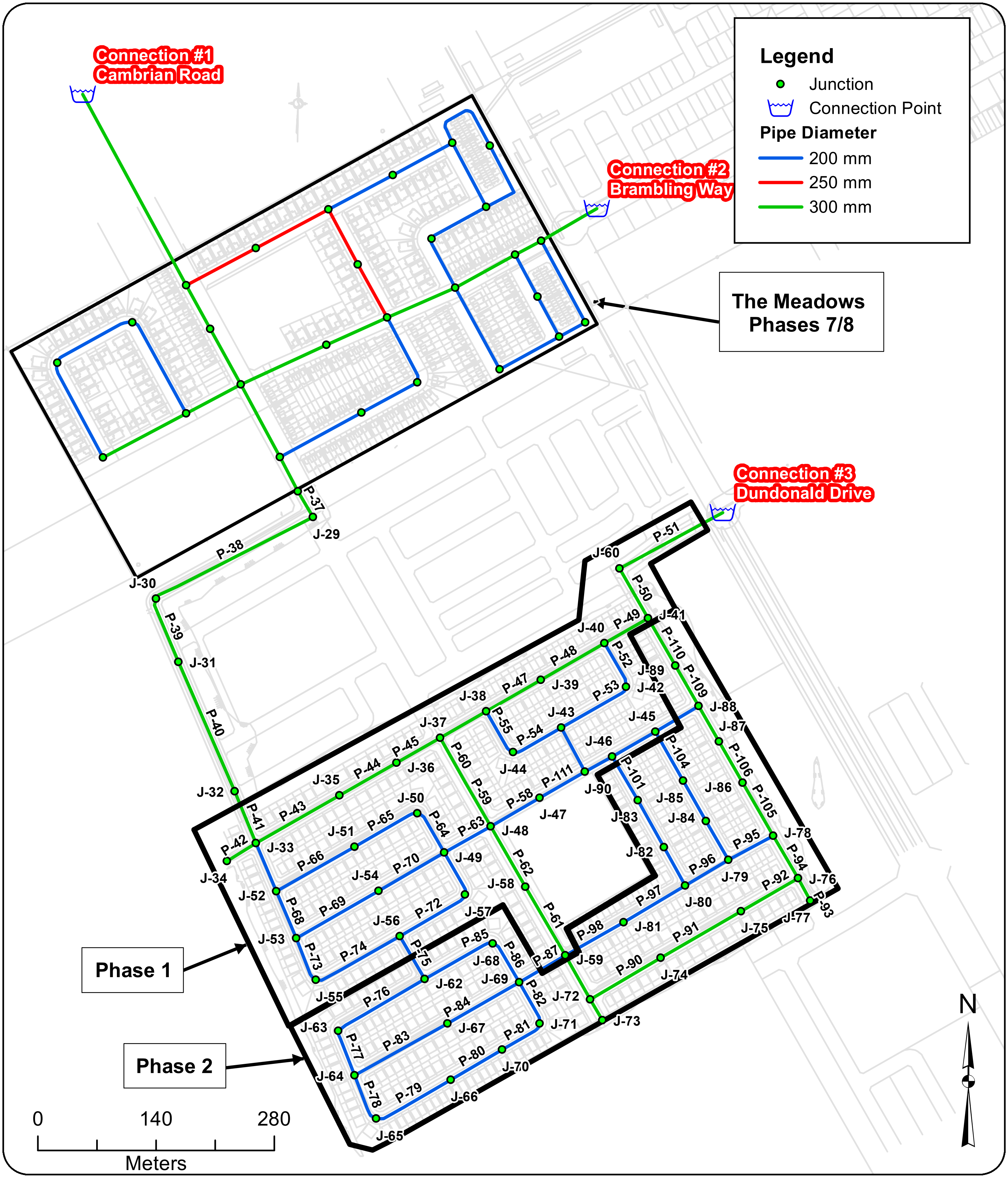
The Brazeau Lands development will have three (3) connections to the City water distribution system:

- Connection 1: Apolune Street and Cambrian Road;
- Connection 2: Jackdaw Avenue and Future Greenbank Road; and
- Connection 3: Dundonald Drive and Future Greenbank Road.

The development site is shown in **Figure 1.1** on the following page, with the final recommended pipe diameters.

This report describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze), a GIS water distribution system modeling and management software application.

The results presented in this memo are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Brazeau Lands Site Layout and Connection Points

Figure 1.1

2 Modeling Considerations

2.1 Water Main Configuration

The water main network was modeled based on the drawing prepared by DSEL (1030_Gen_Rev4.dwg) and provided to GeoAdvice on June 2nd, 2020.

2.2 Elevations

Elevations of the modeled junctions were assigned according to a site grading plan prepared by DSEL (1030_Grad_Rev4.dwg) and provided to GeoAdvice on June 2nd, 2020.

2.3 Consumer Demands

Demand factors used for this analysis were taken according to the City of Ottawa 2010 Design Guidelines *Table 4.2 Consumption Rate for Subdivisions of 501 to 3,000 Persons*. Population densities were assigned according to *Table 4.1 Per Unit Populations* from the City of Ottawa Design Guidelines. A summary of these tables highlighting relevant data for this development is shown in **Table 2.1** below.

Table 2.1: City of Ottawa Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	350	L/c/d
Park	28,000	L/ha/d
Maximum Daily Demand		
Residential	2.5 x avg. day	L/c/d
Park	1.5 x avg. day	L/ha/d
Peak Hour Demand		
Residential	2.2 x max. day	L/c/d
Park	1.8 x max. day	L/ha/d
Minimum Hour Demand		
Residential	0.5 x avg. day	L/c/d
Park	0.5 x avg. day	L/ha/d

Table 2.2 and **Table 2.4** summarize the residential water demand calculations for the Brazeau Lands development.

Table 2.2: Development Population and Demand Calculations – Phase 1

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	172	3.4	585	2.37	5.92	13.03	1.18
Traditional Townhome	133	2.7	360	1.46	3.65	8.02	0.73

***City of Ottawa Design Guidelines**

Table 2.3: Development Population and Demand Calculations – Phases 1&2

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	347	3.4	1,180	4.78	11.95	26.29	2.39
Traditional Townhome	279	2.7	754	3.05	7.64	16.80	1.53

***City of Ottawa Design Guidelines**

Table 2.6 summarizes the non-residential water demand calculations for the Brazeau Lands development (included in both Phase 1 and Phases 1&2).

Table 2.4: Non-Residential Demand Calculations

Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Park	1.72	0.56	0.84	1.51	0.28

Table 2.5 summarizes the demands for the Meadows Phases 7/8 subdivision development located north of the Brazeau Lands and downstream of Connections 1 and 2 (accounted for in the HGLs provided by the City in the boundary conditions request).

Table 2.5: The Meadows Phases 7/8

Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
6.20	13.50	28.50	3.10

Demands were grouped into demand polygons then uniformly distributed to the model nodes located within each polygon. Detailed calculations of demands as well as the illustrated allocation areas are shown in **Appendix A**.

2.4 Fire Flow Demand

Fire flow calculations were completed for all dwelling types in accordance with the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999) and City of Ottawa Technical Bulletin ISTB-2018-02 as summarized in **Appendix B**.

All the single detached dwellings have a minimum separation of 10 m between the backs of adjacent units and are, therefore, subject to the 10,000 L/min (167 L/s) cap outlined in City of Ottawa Technical Bulletin ISDTB-2014-02.

Most of the traditional townhouse dwellings comply with the City of Ottawa Technical Bulletin ISDTB-2014-02 and are, therefore, subject to the 10,000 L/min (167 L/s) cap.

The traditional townhouse dwellings located on Blocks 168 and 384 do not have a minimum separation of 10 m between the backs of adjacent units and therefore do not comply with the provisions under the City of Ottawa Technical Bulletin ISDTB-2014-02. The required fire flow for those blocks were calculated to be 167 L/s based on the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999). The agreement of this calculation with the City of Ottawa cap of 167 L/s is purely coincidental.

At this time, there is not enough information available to calculate the required fire flow of the park. As such, a required fire flow of 250 L/s was assumed for the park. This is a typical, conservative value for similar land use.

Fire flow simulations were completed at each model node in the Brazeau development. The locations of nodes do not necessarily represent hydrant locations.

Detailed FUS fire flow calculations as well as the illustrated spatial allocation of the required fire flows are shown in **Appendix B**.

2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Apolune Street and Cambrian Road;
- Connection 2: Jackdaw Avenue and Future Greenbank Road; and
- Connection 3: Dundonald Drive and Future Greenbank Road.

The above connection points are illustrated in **Figure 1.1**.

Boundary conditions were provided for Peak Hour, Maximum Day plus Fire and Minimum Hour (high pressure check) conditions.

Under existing conditions, the Brazeau Lands development will be serviced by the Barrhaven pressure zone; however, in the future, it will be serviced by pressure zone 3C. As such, boundary conditions were provided under the existing and future pressure zone configurations.

In total, two (2) sets of boundary conditions were provided by the City and can be found in **Appendix C**.

The boundary conditions for the existing pressure zone configuration are more conservative. As such, the results presented in this report are based on the boundary conditions for the existing pressure zone configuration.

Table 2.6 summarizes the boundary conditions used to size the Brazeau Lands water network.

Table 2.6: Existing Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)
Min Hour (max. pressure)	156.4	156.4	156.4
Peak Hour (min. pressure)	135.7	135.6	135.7
Max Day + Fire Flow (167 L/s)	144.0	141.2	142.0
Max Day + Fire Flow (250 L/s)	135.4	129.9	131.5

3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Table 3.1: Model Pipe Characteristics

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
200	204	110
250	250	110
300	297	120

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2.**

Table 3.2: Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-

4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for minimum hour, peak hour and maximum day plus fire flow using InfoWater. Only the existing pressure zone configuration was analyzed, since the boundary conditions are more conservative.

Detailed pipe and junction model input data can be found in **Appendix D**.

4.1 Development Pressure Analysis

Modeled service pressures for the development are summarized in **Table 4.1** below.

Table 4.1: Summary of the Brazeau Lands Available Service Pressures

Phase	Minimum Hour Demand Maximum Pressure	Peak Hour Demand Minimum Pressure
Phase 1	538 kPa (78 psi)	290 kPa (42 psi)
Phases 1&2	538 kPa (78 psi)	**262 kPa (38 psi)**

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi).

Low pressures are predicted at junctions J-66, J-70, J-71, J-72, J-73, J-74, J-75, J-76 and J-77 under peak hour demand. Those low pressures are due to high elevations in the southern part of the Brazeau Lands development and are within 5% of the minimum allowable pressure of 276 kPa (40 psi). The future Zone 3C boundary conditions will provide an additional head of about seven (7) meters at each connection point, and will thus resolve the low PHD pressures at the southern part of the Brazeau Lands development.

Detailed pipe and junction result tables and maps can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

A summary of the minimum available fire flows in the Brazeau Lands development is shown below in **Table 4.2**.

Table 4.2: Summary of the Brazeau Lands Minimum Available Fire Flows

Phase	Required Fire Flow	Minimum Available Flow	Junction ID
Phase 1	167 L/s	177 L/s	J-45
	250 L/s	249 L/s	J-47
Phases 1&2	167 L/s	194 L/s	J-66
	250 L/s	269 L/s	J-47

As shown in the table above, the available fire flow is greater than the required fire flow under both Phase 1 and Phases 1&2 conditions.

A summary of the residual pressures in the Brazeau Lands is shown below in **Table 4.3**. The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

Table 4.3: Summary of the Brazeau Lands Residual Pressures (MDD + FF)

Phase	Maximum Residual Pressure	Average Residual Pressure	Minimum Residual Pressure
Phase 1	365 kPa (53 psi)	296 kPa (43 psi)	140 kPa (20 psi)
Phases 1&2	365 kPa (53 psi)	296 kPa (43 psi)	159 kPa (23 psi)

There is sufficient residual pressure at all the junctions within the Brazeau Lands development.

Detailed fire flow results and figures illustrating the fire flow results can be found in **Appendix F**.

5 Other Servicing Considerations

5.1 Water Supply Security

The City of Ottawa Design Guidelines allow single feed systems for developments up to a total average day demand of 50 m^3/day and require two (2) feeds if the development exceeds 50 m^3/day for supply security, according to Technical Bulletin ISDTB-2014-02.

The Brazeau Lands services a total average day demand of 725 m^3/day; as such, two (2) feeds are required.

5.2 Valves

No comment has been made in this technical memorandum with respect to exact placement of isolation valves within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for number, location, and spacing of isolation valves:

- Tee intersection – two (2) valves
- Cross intersection – three (3) valves
- Valves shall be located 2 m away from the intersection
- 300 m spacing for 150 mm to 400 mm diameter valves
- Gate valves for 100 mm to 300 mm diameter mains
- Butterfly valves for 400 mm and larger diameter mains

Drain valves are not strictly required under the City of Ottawa Design Guidelines for water mains under 600 mm in diameter. The Guidelines indicate that “small diameter water mains shall be drained through hydrant via pumping if needed.”

Air valves are not strictly required under the City of Ottawa Design Guidelines for water mains up to and including 400 mm in diameter. The Guidelines indicate that air removal “can be accomplished by the strategic positioning of hydrant at the high points to remove the air or by installing or utilizing available 50 mm chlorination nozzles in 300 mm and 400 mm chambers.”

The detailed engineering drawings for the Brazeau Lands are expected to identify valves in accordance with the requirements noted above.

5.3 Hydrants

No comment has been made in this technical memorandum with respect to exact placement of hydrants within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for maximum hydrant spacing:

- 125 m for single family unit residential areas on lots where frontage at the street line is 15 m or longer
- 110 m for single family unit residential areas on lots where frontage at the street line is less than 15 m and for residential areas zoned for row housing, doubles or duplexes
- 90 m for institutional, commercial, industrial, apartments and high-density areas

The detailed engineering drawings for the Brazeau Lands development are expected to identify hydrants in accordance with the requirements noted above.

6 Conclusions

The hydraulic capacity and modeling analysis of Phase 1 of the Brazeau Lands development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows, with service pressures expected to range between 290 kPa (42 psi) and 538 kPa (78 psi).
- The proposed water main network is able to deliver fire flows to all junctions.
- Hydraulic modeling was only completed for the existing pressure zone configuration since the boundary conditions are more conservative.

The hydraulic capacity and modeling analysis of Phases 1&2 of the Brazeau Lands development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows except for junctions J-66, J-70, J-71, J-72, J-73, J-74, J-75, J-76 and J-77, with service pressures expected to range between 262 kPa (38 psi) and 538 kPa (78 psi).
- The junctions with low pressures are due to high elevations in the southern part of the Brazeau Lands development and are within 5% of the minimum allowable pressure of 276 kPa (40 psi).
- The future Zone 3C boundary conditions will provide an additional head of about seven (7) meters at each connection point, and will thus resolve the low PHD pressures at the southern part of the Brazeau Lands development.
- The proposed water main network is able to deliver fire flows to all junctions.
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Submission

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July 28, 2020

Werner de Schaetzen, Ph.D., P.Eng.
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Hydraulic Capacity and Modeling Analysis
Brazeau Lands

Final Report

Prepared for:
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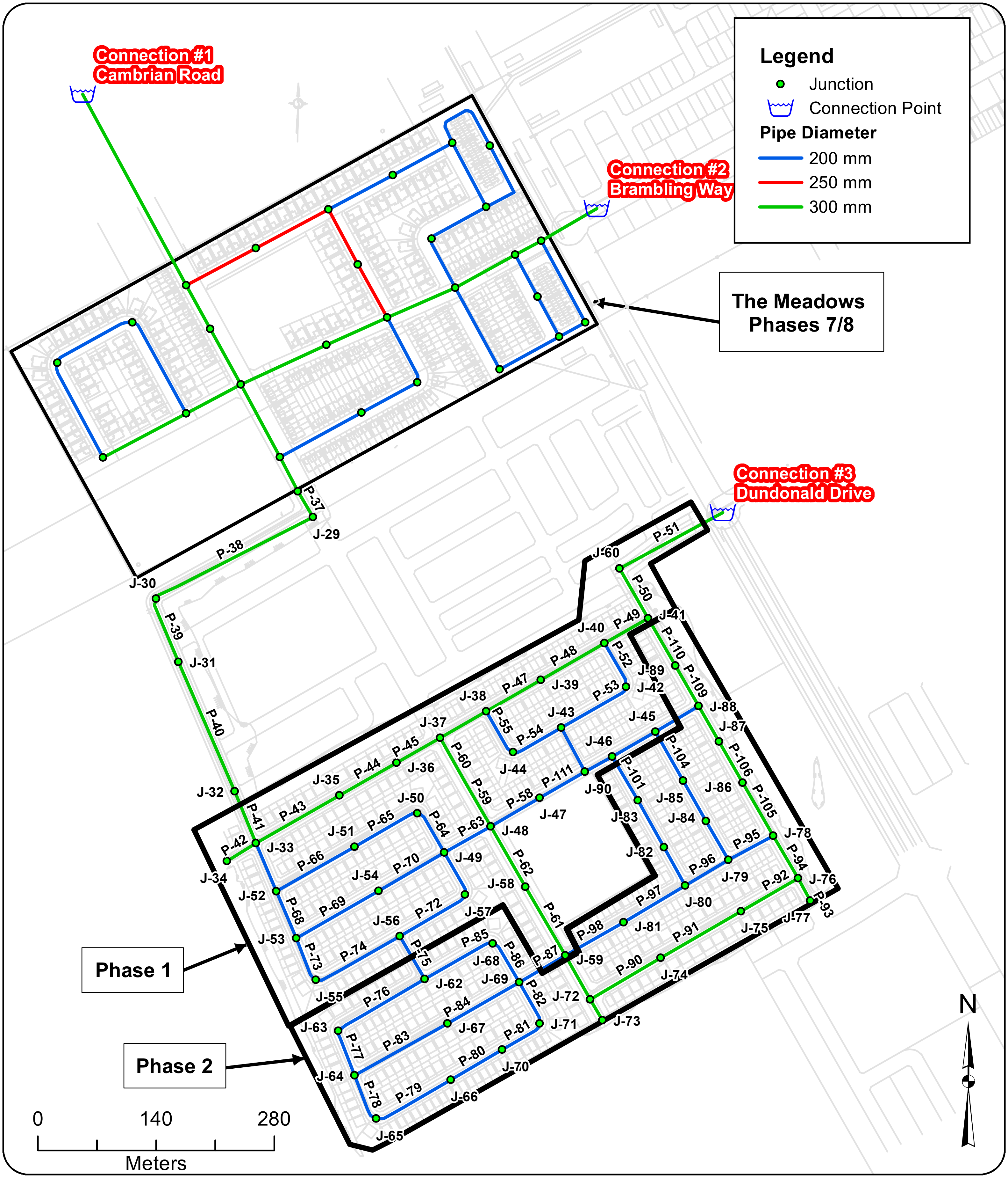

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Peak Hour Demand		
Residential	2.2 x max. day	L/c/d
Park	1.8 x max. day	L/ha/d
Minimum Hour Demand		
Residential	0.5 x avg. day	L/c/d
Park	0.5 x avg. day	L/ha/d

Table 2.2 and **Table 2.4** summarize the residential water demand calculations for the Brazeau Lands development.

Table 2.2: Development Population and Demand Calculations – Phase 1

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	172	3.4	585	2.37	5.92	13.03	1.18
Traditional Townhome	133	2.7	360	1.46	3.65	8.02	0.73

***City of Ottawa Design Guidelines**

Table 2.3: Development Population and Demand Calculations – Phases 1&2

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	347	3.4	1,180	4.78	11.95	26.29	2.39
Traditional Townhome	279	2.7	754	3.05	7.64	16.80	1.53

***City of Ottawa Design Guidelines**

Table 2.6 summarizes the non-residential water demand calculations for the Brazeau Lands development (included in both Phase 1 and Phases 1&2).

Table 2.4: Non-Residential Demand Calculations

Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Park	1.72	0.56	0.84	1.51	0.28

Table 2.5 summarizes the demands for the Meadows Phases 7/8 subdivision development located north of the Brazeau Lands and downstream of Connections 1 and 2 (accounted for in the HGLs provided by the City in the boundary conditions request).

Table 2.5: The Meadows Phases 7/8

Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
6.20	13.50	28.50	3.10

Demands were grouped into demand polygons then uniformly distributed to the model nodes located within each polygon. Detailed calculations of demands as well as the illustrated allocation areas are shown in **Appendix A**.

2.4 Fire Flow Demand

Fire flow calculations were completed for all dwelling types in accordance with the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999) and City of Ottawa Technical Bulletin ISTB-2018-02 as summarized in **Appendix B**.

All the single detached dwellings have a minimum separation of 10 m between the backs of adjacent units and are, therefore, subject to the 10,000 L/min (167 L/s) cap outlined in City of Ottawa Technical Bulletin ISDTB-2014-02.

Most of the traditional townhouse dwellings comply with the City of Ottawa Technical Bulletin ISDTB-2014-02 and are, therefore, subject to the 10,000 L/min (167 L/s) cap.

The traditional townhouse dwellings located on Blocks 168 and 384 do not have a minimum separation of 10 m between the backs of adjacent units and therefore do not comply with the provisions under the City of Ottawa Technical Bulletin ISDTB-2014-02. The required fire flow for those blocks were calculated to be 167 L/s based on the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999). The agreement of this calculation with the City of Ottawa cap of 167 L/s is purely coincidental.

At this time, there is not enough information available to calculate the required fire flow of the park. As such, a required fire flow of 250 L/s was assumed for the park. This is a typical, conservative value for similar land use.

Fire flow simulations were completed at each model node in the Brazeau development. The locations of nodes do not necessarily represent hydrant locations.

Detailed FUS fire flow calculations as well as the illustrated spatial allocation of the required fire flows are shown in **Appendix B**.

2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Apolune Street and Cambrian Road;
- Connection 2: Jackdaw Avenue and Future Greenbank Road; and
- Connection 3: Dundonald Drive and Future Greenbank Road.

The above connection points are illustrated in **Figure 1.1**.

Boundary conditions were provided for Peak Hour, Maximum Day plus Fire and Minimum Hour (high pressure check) conditions.

Under existing conditions, the Brazeau Lands development will be serviced by the Barrhaven pressure zone; however, in the future, it will be serviced by pressure zone 3C. As such, boundary conditions were provided under the existing and future pressure zone configurations.

In total, two (2) sets of boundary conditions were provided by the City and can be found in **Appendix C**.

The boundary conditions for the existing pressure zone configuration are more conservative. As such, the results presented in this report are based on the boundary conditions for the existing pressure zone configuration.

Table 2.6 summarizes the boundary conditions used to size the Brazeau Lands water network.

Table 2.6: Existing Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)
Min Hour (max. pressure)	156.4	156.4	156.4
Peak Hour (min. pressure)	135.7	135.6	135.7
Max Day + Fire Flow (167 L/s)	144.0	141.2	142.0
Max Day + Fire Flow (250 L/s)	135.4	129.9	131.5

3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Table 3.1: Model Pipe Characteristics

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
200	204	110
250	250	110
300	297	120

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2.**

Table 3.2: Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-

4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for minimum hour, peak hour and maximum day plus fire flow using InfoWater. Only the existing pressure zone configuration was analyzed, since the boundary conditions are more conservative.

Detailed pipe and junction model input data can be found in **Appendix D**.

4.1 Development Pressure Analysis

Modeled service pressures for the development are summarized in **Table 4.1** below.

Table 4.1: Summary of the Brazeau Lands Available Service Pressures

Phase	Minimum Hour Demand Maximum Pressure	Peak Hour Demand Minimum Pressure
Phase 1	538 kPa (78 psi)	290 kPa (42 psi)
Phases 1&2	538 kPa (78 psi)	**262 kPa (38 psi)**

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi).

Low pressures are predicted at junctions J-66, J-70, J-71, J-72, J-73, J-74, J-75, J-76 and J-77 under peak hour demand. Those low pressures are due to high elevations in the southern part of the Brazeau Lands development and are within 5% of the minimum allowable pressure of 276 kPa (40 psi). The future Zone 3C boundary conditions will provide an additional head of about seven (7) meters at each connection point, and will thus resolve the low PHD pressures at the southern part of the Brazeau Lands development.

Detailed pipe and junction result tables and maps can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

A summary of the minimum available fire flows in the Brazeau Lands development is shown below in **Table 4.2**.

Table 4.2: Summary of the Brazeau Lands Minimum Available Fire Flows

Phase	Required Fire Flow	Minimum Available Flow	Junction ID
Phase 1	167 L/s	177 L/s	J-45
	250 L/s	249 L/s	J-47
Phases 1&2	167 L/s	194 L/s	J-66
	250 L/s	269 L/s	J-47

As shown in the table above, the available fire flow is greater than the required fire flow under both Phase 1 and Phases 1&2 conditions.

A summary of the residual pressures in the Brazeau Lands is shown below in **Table 4.3**. The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

Table 4.3: Summary of the Brazeau Lands Residual Pressures (MDD + FF)

Phase	Maximum Residual Pressure	Average Residual Pressure	Minimum Residual Pressure
Phase 1	365 kPa (53 psi)	296 kPa (43 psi)	140 kPa (20 psi)
Phases 1&2	365 kPa (53 psi)	296 kPa (43 psi)	159 kPa (23 psi)

There is sufficient residual pressure at all the junctions within the Brazeau Lands development.

Detailed fire flow results and figures illustrating the fire flow results can be found in **Appendix F**.

5 Other Servicing Considerations

5.1 Water Supply Security

The City of Ottawa Design Guidelines allow single feed systems for developments up to a total average day demand of 50 m^3/day and require two (2) feeds if the development exceeds 50 m^3/day for supply security, according to Technical Bulletin ISDTB-2014-02.

The Brazeau Lands services a total average day demand of 725 m^3/day; as such, two (2) feeds are required.

5.2 Valves

No comment has been made in this technical memorandum with respect to exact placement of isolation valves within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for number, location, and spacing of isolation valves:

- Tee intersection – two (2) valves
- Cross intersection – three (3) valves
- Valves shall be located 2 m away from the intersection
- 300 m spacing for 150 mm to 400 mm diameter valves
- Gate valves for 100 mm to 300 mm diameter mains
- Butterfly valves for 400 mm and larger diameter mains

Drain valves are not strictly required under the City of Ottawa Design Guidelines for water mains under 600 mm in diameter. The Guidelines indicate that "small diameter water mains shall be drained through hydrant via pumping if needed."

Air valves are not strictly required under the City of Ottawa Design Guidelines for water mains up to and including 400 mm in diameter. The Guidelines indicate that air removal "can be accomplished by the strategic positioning of hydrant at the high points to remove the air or by installing or utilizing available 50 mm chlorination nozzles in 300 mm and 400 mm chambers."

The detailed engineering drawings for the Brazeau Lands are expected to identify valves in accordance with the requirements noted above.

5.3 Hydrants

No comment has been made in this technical memorandum with respect to exact placement of hydrants within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for maximum hydrant spacing:

- 125 m for single family unit residential areas on lots where frontage at the street line is 15 m or longer
- 110 m for single family unit residential areas on lots where frontage at the street line is less than 15 m and for residential areas zoned for row housing, doubles or duplexes
- 90 m for institutional, commercial, industrial, apartments and high-density areas

The detailed engineering drawings for the Brazeau Lands development are expected to identify hydrants in accordance with the requirements noted above.

6 Conclusions

The hydraulic capacity and modeling analysis of Phase 1 of the Brazeau Lands development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows, with service pressures expected to range between 290 kPa (42 psi) and 538 kPa (78 psi).
- The proposed water main network is able to deliver fire flows to all junctions.
- Hydraulic modeling was only completed for the existing pressure zone configuration since the boundary conditions are more conservative.

The hydraulic capacity and modeling analysis of Phases 1&2 of the Brazeau Lands development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows except for junctions J-66, J-70, J-71, J-72, J-73, J-74, J-75, J-76 and J-77, with service pressures expected to range between 262 kPa (38 psi) and 538 kPa (78 psi).
- The junctions with low pressures are due to high elevations in the southern part of the Brazeau Lands development and are within 5% of the minimum allowable pressure of 276 kPa (40 psi).
- The future Zone 3C boundary conditions will provide an additional head of about seven (7) meters at each connection point, and will thus resolve the low PHD pressures at the southern part of the Brazeau Lands development.
- The proposed water main network is able to deliver fire flows to all junctions.
- Hydraulic modeling was only completed for the existing pressure zone configuration since the boundary conditions are more conservative.

Submission

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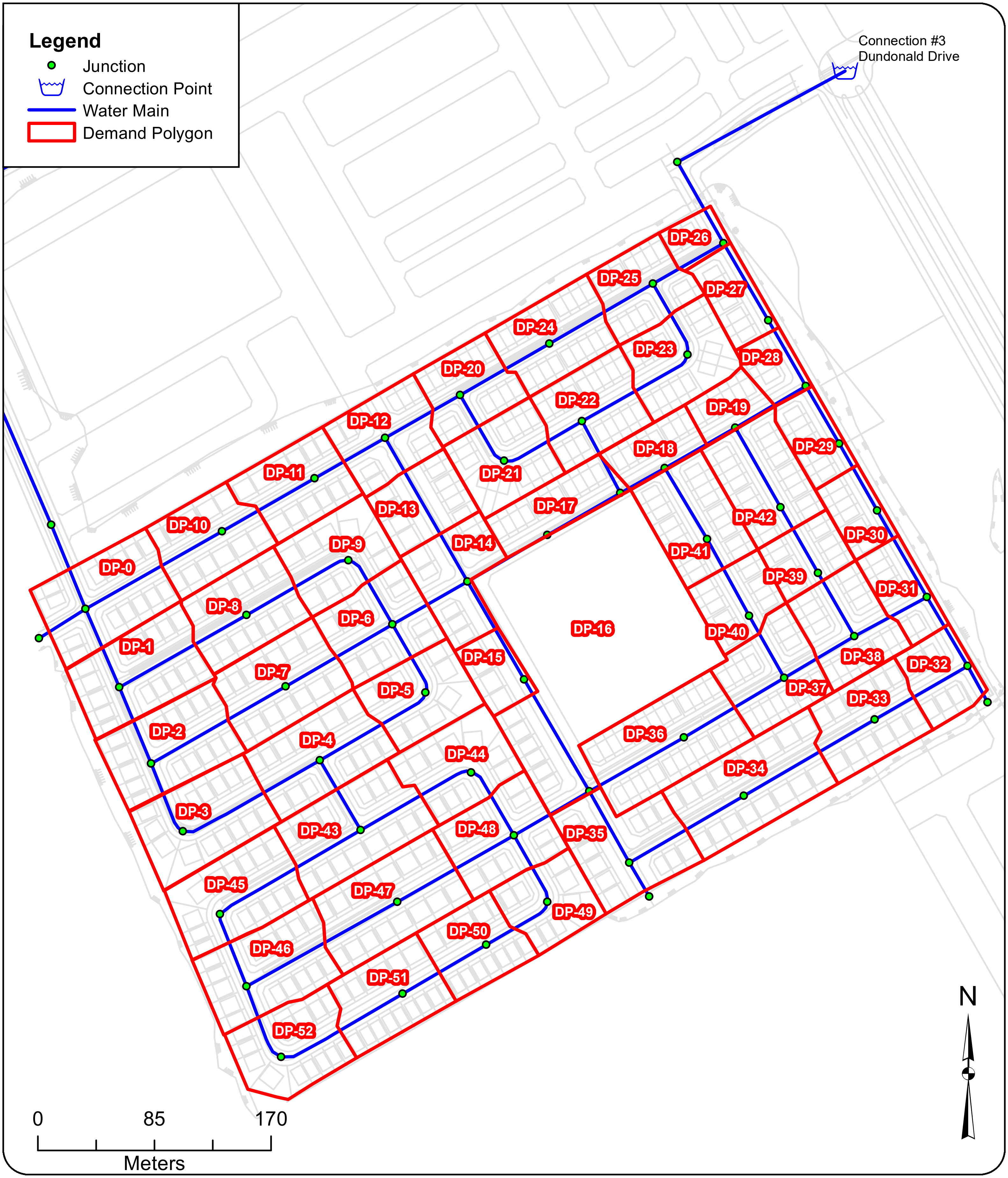
Appendix A Domestic Water Demand Calculations and Allocation

Appendix A Domestic Water Demand Calculations and Allocation



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

Demand Allocation Phases 1&2

Figure A.1

Consumer Water Demands

Phase 1 Residential Demands

Dwelling Type	Number of Units	Population **		Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 2.2 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)				
Single Detached	172	3.4	585	350	204,750	2.37	5.92	167*	13.03	1.18
Traditional Townhome	133	2.7	360		126,000	1.46	3.65	167*	8.02	0.73
Subtotal	**305**		**945**		**330,750**	**3.83**	**9.57**		**21.05**	**1.91**

Phases 1&2 Residential Demands

Dwelling Type	Number of Units	Population **		Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 2.2 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)				
Single Detached	347	3.4	1,180	350	413,000	4.78	11.95	167*	26.29	2.39
Traditional Townhome	279	2.7	754		263,900	3.05	7.64	167*	16.80	1.53
Subtotal	**626**		**1,934**		**676,900**	**7.83**	**19.59**		**43.09**	**3.92**

Non Residential Demands

Property Type	Area (ha)		Average Day Demand			Max Day 1.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 1.8 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
			** (L/ha/d)	(L/d)	(L/s)				
Park w/ Splash Pad	1.72		28,000	48,160	0.56	0.84	250**	1.51	0.28
Subtotal	**1.72**			**48,160**	**0.56**	**0.84**		**1.51**	**0.28**

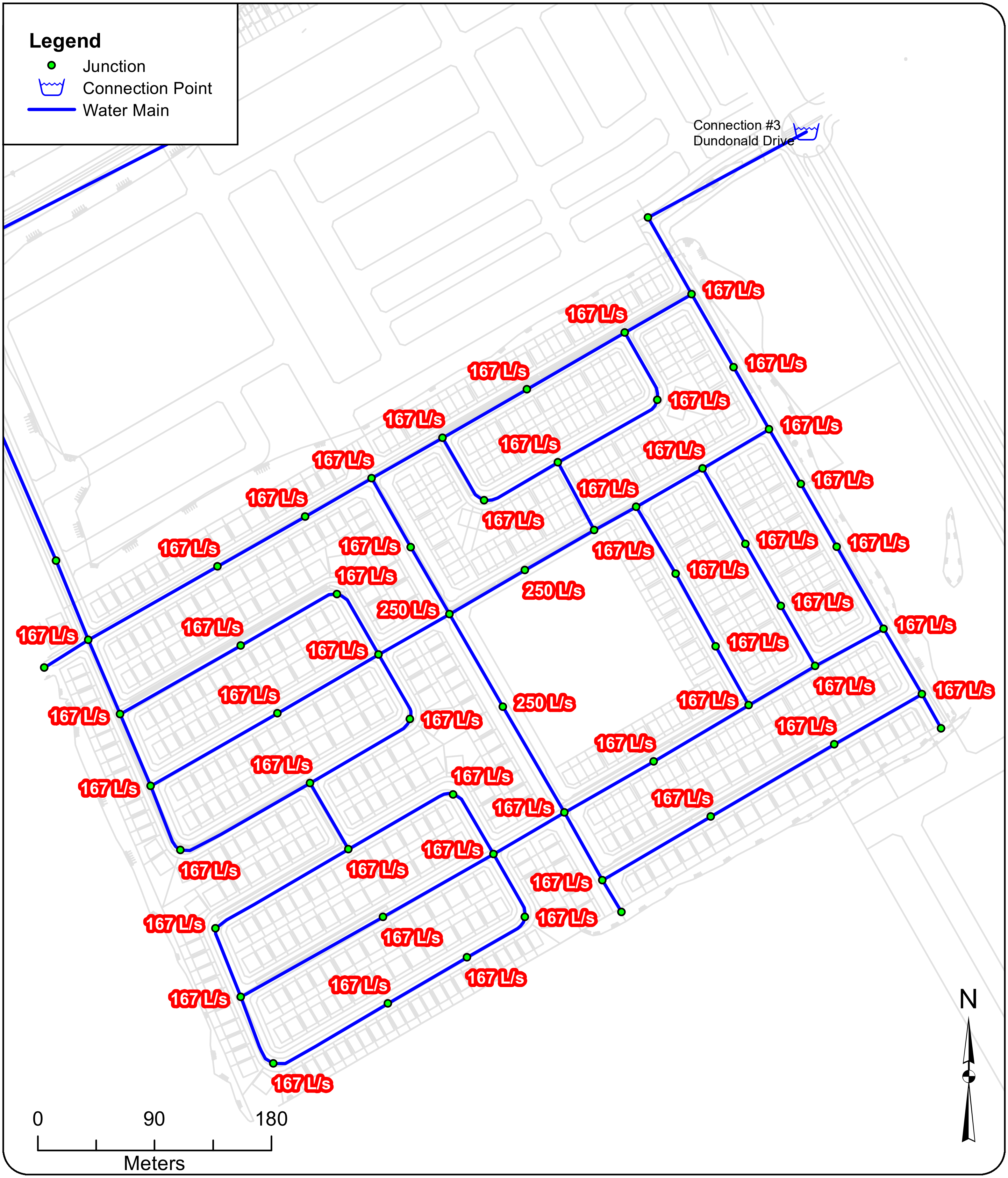
The Meadows Phases 7/8		**ADD (L/s)**	**MDD (L/s)**	**PHD (L/s)**	**MHD (L/s)**
Total Demand:		**6.20**	**13.50**	**28.50**	**3.10**

		ADD (L/s)	**MDD (L/s)**	**PHD (L/s)**	**MHD (L/s)**
Without the Meadows Phases 7/8 Demands	Phase 1	**4.39**	**10.41**	**22.56**	**2.19**
	Phases 1&2	**8.39**	**20.42**	**44.59**	**4.20**
With the Meadows Phases 7/8 Demands	Phase 1	**10.59**	**23.91**	**51.06**	**5.29**
	Phases 1&2	**14.59**	**33.92**	**73.09**	**7.30**

*Based on FUS fire flow calculation

**Assumed based on similar information from previously completed projects, as agreed upon with DSEL

Appendix B FUS Fire Flow Calculations and Allocation



GeoAdvice Engineering Inc.

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Required Fire Flow Phases 1&2

Figure B.1

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands — Blocks 300-313, Single Detached
Zoning: Multi Family Residential
Date: November 6, 2019

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 1927 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The single detached dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 14 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 3854 m^2 (Combined area of 14 units)

The total floor area in m^2 in the building being considered

F = 20,486 L/min **D = 20,000 L/min***

E. Occupancy

Occupancy content hazard: Limited Combustible — -15 % of **D** — **-3,000 L/min** — **E = 17,000 L/min**

F. Sprinkler Protection

Automatic sprinkler protection: None — 0 % of **E** — **0 L/min** — **F = 17,000 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
East	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
North	10.1 to 20 m	Over 120 m-storeys	Wood Frame or Non-Combustible	15%
South	20.1 to 30 m	Over 120 m-storeys	Wood Frame or Non-Combustible	10%
			Total	**41%**

% of **E** — **+ 6,970 L/min** — **G = 23,970 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 23,970 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The single detached dwellings comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	**Duration (hours)**
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	3,854
Required Fire Flow (L/min)	20,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	8%
East (%)	8%
South (%)	15%
West (%)	10%
Total Exposure (%)	41%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands Blocks 173, Traditional Townhouse
Zoning: Multi Family Residential
Date: November 6, 2019

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 474 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 5 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 947 m^2 (Combined area of 5 units)

The total floor area in m^2 in the building being considered

F = 10,156 L/min **D = 10,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,500 L/min** — **E = 8,500 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 8,500 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
East	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
North	10.1 to 20 m	61-90 m-storeys	Wood Frame or Non-Combustible	14%
South	20.1 to 30 m	31-60 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**56%**

% of **E** — **+ 4,760 L/min** — **G = 13,260 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 13,260 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	947
Required Fire Flow (L/min)	10,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	17%
East (%)	17%
South (%)	14%
West (%)	8%
Total Exposure (%)	56%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands
Zoning: Multi Family Residential — Blocks 384, Traditional Townhouse
Date: November 6, 2019

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 380 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 4 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 760 m^2 (Combined area of 4 units)

The total floor area in m^2 in the building being considered

F = 9,095 L/min **D = 9,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,350 L/min** — **E = 7,650 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 7,650 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
East	Beyond 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	0%
North	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
South	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**37%**

% of **E** — **+ 2,831 L/min** — **G = 10,481 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 10,481 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings **do not** comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	**Duration (hours)**
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
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	61-90 m-storeys	14%	13%	10%	0%
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	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	760
Required Fire Flow (L/min)	9,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	12%
East (%)	0%
South (%)	17%
West (%)	8%
Total Exposure (%)	37%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands
Zoning: Multi Family Residential — Blocks 168, Traditional Townhouse
Date: November 6, 2019

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 380 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 4 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 760 m^2 (Combined area of 4 units)

The total floor area in m^2 in the building being considered

F = 9,095 L/min — **D = 9,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,350 L/min** — **E = 7,650 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 7,650 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	30.1 to 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	5%
East	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
North	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
South	Beyond 45 m	31-60 m-storeys	Wood Frame or Non-Combustible	0%
			Total	**34%**

% of **E** — **+ 2,601 L/min** — **G = 10,251 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 10,251 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings **do not** comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	m^3

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	**Duration (hours)**
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	760
Required Fire Flow (L/min)	9,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	5%
East (%)	12%
South (%)	17%
West (%)	0%
Total Exposure (%)	34%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

Appendix C Boundary Conditions

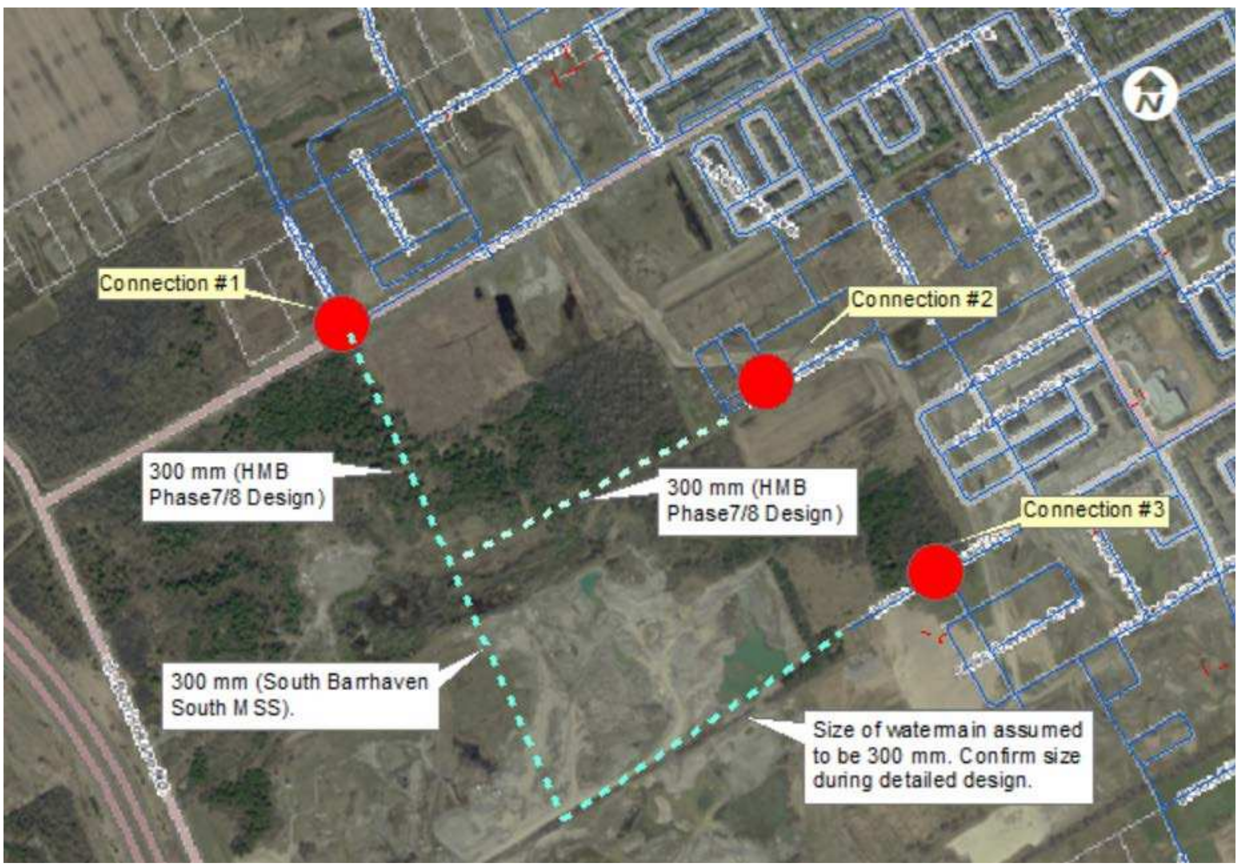
Boundary Conditions for HMB Phases 7 and 8 and Brazeau Lands

Information Provided:

Date provided: September 2019

Scenario	Demand	
	L/min	L/s
Average Daily Demand	846	14.10
Maximum Daily Demand	1961	32.69
Peak Hour	4224	70.40
Fire Flow Demand #1	10000	166.67
Fire Flow Demand #2	15000	250.00
Fire Flow Demand #3	17000	283.33

Location:



Results

Connection 1 - Cambrian Road

Demand Scenario	Existing Barrhaven PZ		Future Zone 3C	
	Head (m)	Pressure[1] (psi)	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	102.9	147.7	77.3
Peak Hour	135.7	60.4	142.8	70.4
Max Day plus Fire (#1)	144.0	72.2	140.0	66.4
Max Day plus Fire (#2)	135.4	59.9	134.9	59.2
Max Day plus Fire (#3)	133.7	57.4	132.5	55.7

[1] Ground Elevation = 93.3 m

Connection 2 - Brambling Way

Demand Scenario	Existing Barrhaven PZ		Future Zone 3C	
	Head (m)	Pressure[1] (psi)	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	100.1	147.7	74.6
Peak Hour	135.6	57.4	142.7	67.5
Max Day plus Fire (#1)	141.2	65.4	139.9	63.5
Max Day plus Fire (#2)	129.9	49.4	134.6	56.0
Max Day plus Fire (#3)	126.6	44.7	132.1	52.4

[1] Ground Elevation = 95.2 m

Connection 3 - Dundonald Drive

Demand Scenario	Existing Barrhaven PZ		Future Zone 3C	
	Head (m)	Pressure[1] (psi)	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	86.5	147.7	61.0
Peak Hour	135.7	43.9	142.6	53.7
Max Day plus Fire (#1)	142.0	52.9	138.6	48.1
Max Day plus Fire (#2)	131.5	38.0	132.2	38.9
Max Day plus Fire (#3)	128.7	34.0	128.9	34.3

[1] Ground Elevation = 104.8 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.

2) A third pump was turned on during all fire simulations under Existing Barrhaven Pressure.
3) Future pipes were added to the water model as shown in the figure above.

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.

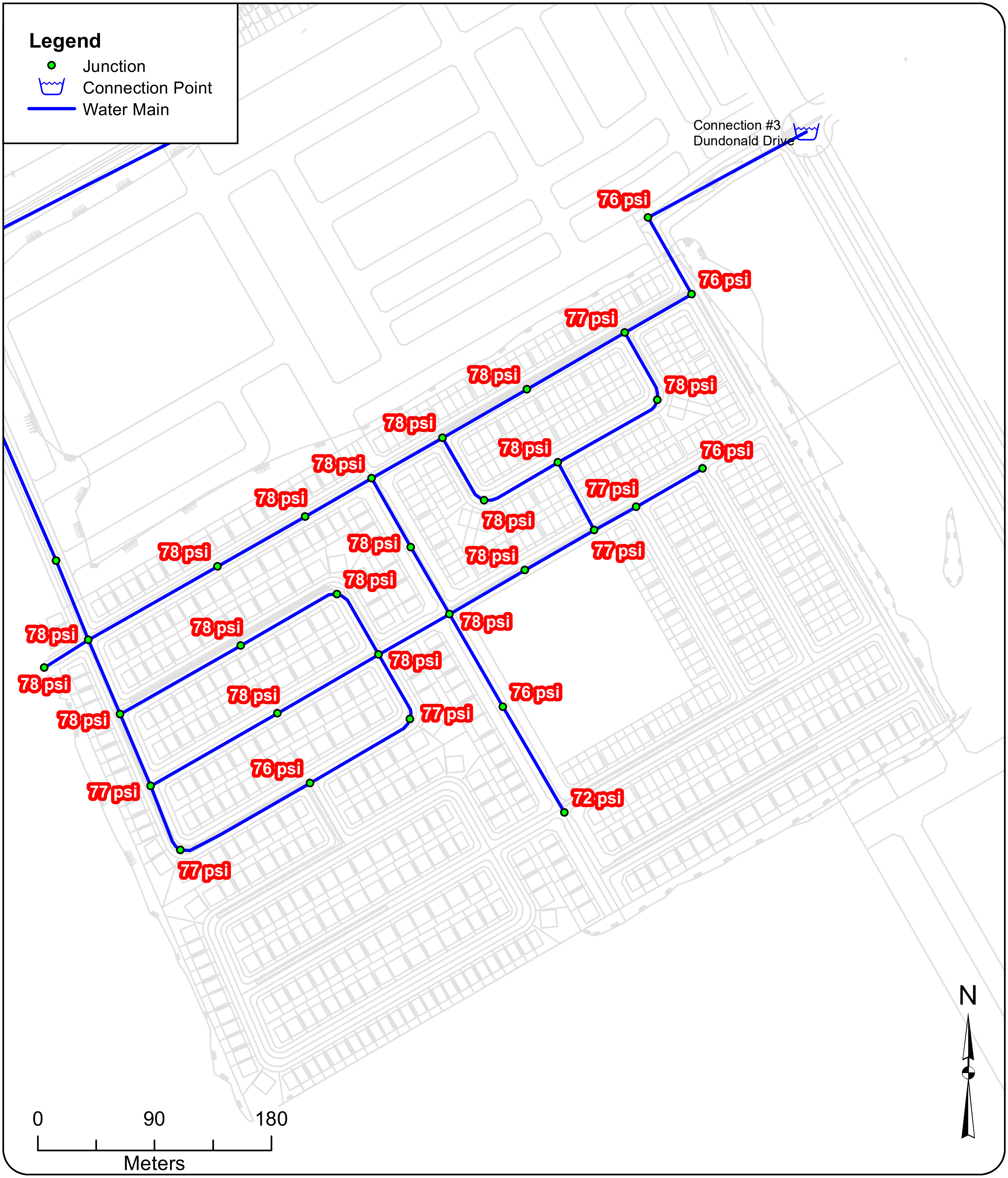
Appendix D Pipe and Junction Model Inputs

Model Inputs - Phases 1 and 2

ID	From	To	Length (m)	Diameter (mm)	Roughness ()
P-100	J-82	J-83	63.79	204	110
P-101	J-83	J-46	60.03	204	110
P-102	J-79	J-84	53.32	204	110
P-103	J-84	J-85	55.04	204	110
P-104	J-85	J-45	66.63	204	110
P-105	J-78	J-86	72.81	297	120
P-106	J-86	J-87	55.90	297	120
P-107	J-87	J-88	48.49	297	120
P-108	J-45	J-88	59.54	204	110
P-109	J-88	J-89	55.04	297	120
P-110	J-89	J-41	65.11	297	120
P-111	J-90	J-47	61.51	204	110
P-112	J-43	J-90	59.19	204	110
P-42	J-33	J-34	40.11	297	120
P-43	J-33	J-35	114.35	297	120
P-44	J-35	J-36	77.83	297	120
P-45	J-36	J-37	59.20	297	120
P-46	J-37	J-38	62.88	297	120
P-47	J-38	J-39	74.92	297	120
P-48	J-39	J-40	87.18	297	120
P-49	J-40	J-41	59.39	297	120
P-50	J-41	J-60	67.93	297	120
P-51	J-60	CONNECTION_3	138.92	297	120
P-52	J-40	J-42	58.39	204	110
P-53	J-42	J-43	83.72	204	110
P-54	J-43	J-44	72.67	204	110
P-55	J-44	J-38	58.67	204	110
P-56	J-45	J-46	59.20	204	110
P-57	J-46	J-90	81.24	204	110
P-58	J-47	J-48	84.62	204	110
P-59	J-48	J-61	59.65	297	120
P-60	J-61	J-37	60.99	297	120
P-61	J-59	J-58	94.07	297	120
P-62	J-58	J-48	82.47	297	120
P-63	J-48	J-49	63.07	204	110
P-64	J-49	J-50	57.71	204	110
P-65	J-50	J-51	84.62	204	110
P-66	J-51	J-52	106.76	204	110
P-67	J-33	J-52	62.05	204	110
P-68	J-52	J-53	60.2	204	110
P-69	J-53	J-54	112.78	204	110
P-70	J-54	J-49	90	204	110
P-71	J-49	J-57	56.32	204	110
P-72	J-57	J-56	92.28	204	110
P-73	J-53	J-55	55.27	204	110
P-74	J-55	J-56	113.38	204	110
P-75	J-56	J-62	58.69	204	110
P-76	J-62	J-63	119.4	204	110
P-77	J-63	J-64	56.35	204	110
P-78	J-64	J-65	58.6	204	110
P-79	J-65	J-66	100.76	204	110
P-80	J-66	J-70	70.42	204	110
P-81	J-70	J-71	55.7	204	110
P-82	J-71	J-69	54.8	204	110
P-83	J-64	J-67	125.85	204	110
P-84	J-67	J-69	97.99	204	110
P-85	J-62	J-68	92.12	204	110
P-86	J-68	J-69	56.42	204	110
P-87	J-69	J-59	63.46	204	110
P-88	J-59	J-72	59.77	297	120
P-89	J-72	J-73	28.67	297	120
P-90	J-72	J-74	96.85	297	120
P-91	J-74	J-75	110.13	297	120
P-92	J-75	J-76	78.16	297	120
P-93	J-77	J-76	30.34	297	120
P-94	J-76	J-78	58.2	297	120
P-95	J-78	J-79	59.97	204	110
P-96	J-79	J-80	59.39	204	110
P-97	J-80	J-81	85.15	204	110
P-98	J-81	J-59	79.25	204	110
P-99	J-80	J-82	51.74	204	110

ID	Elevation (m)	ADD (L/s)
J-33	101.29	0.18
J-34	101.41	0.00
J-35	101.33	0.16
J-36	101.25	0.16
J-37	101.64	0.06
J-38	101.46	0.14
J-39	101.83	0.20
J-40	101.96	0.14
J-41	102.65	0.04
J-42	101.87	0.16
J-43	101.72	0.18
J-44	101.59	0.16
J-45	103.27	0.06
J-46	102.38	0.08
J-47	101.77	0.12
J-48	101.83	0.06
J-49	101.74	0.14
J-50	101.40	0.12
J-51	101.41	0.18
J-52	101.35	0.20
J-53	102.22	0.20
J-54	101.87	0.20
J-55	102.52	0.20
J-56	103.00	0.20
J-57	102.46	0.12
J-58	102.95	0.06
J-59	105.68	0.64
J-60	102.80	0.00
J-61	101.51	0.06
J-62	104.21	0.00
J-63	106.39	0.20
J-64	106.74	0.20
J-65	107.17	0.20
J-66	107.78	0.18
J-67	106.62	0.20
J-68	106.00	0.22
J-69	107.07	0.14
J-70	108.43	0.14
J-71	108.62	0.16
J-72	107.85	0.12
J-73	108.47	0.16
J-74	107.68	0.00
J-75	108.00	0.24
J-76	108.27	0.16
J-77	108.93	0.08
J-78	106.17	0.00
J-79	105.57	0.06
J-80	105.54	0.18
J-81	105.54	0.18
J-82	104.30	0.28
J-83	103.10	0.12
J-84	104.73	0.20
J-85	103.68	0.12
J-86	105.81	0.20
J-87	105.51	0.08
J-88	104.78	0.08
J-89	103.69	0.04
J-90	102.07	0.08

Appendix E MHD and PHD Model Results



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

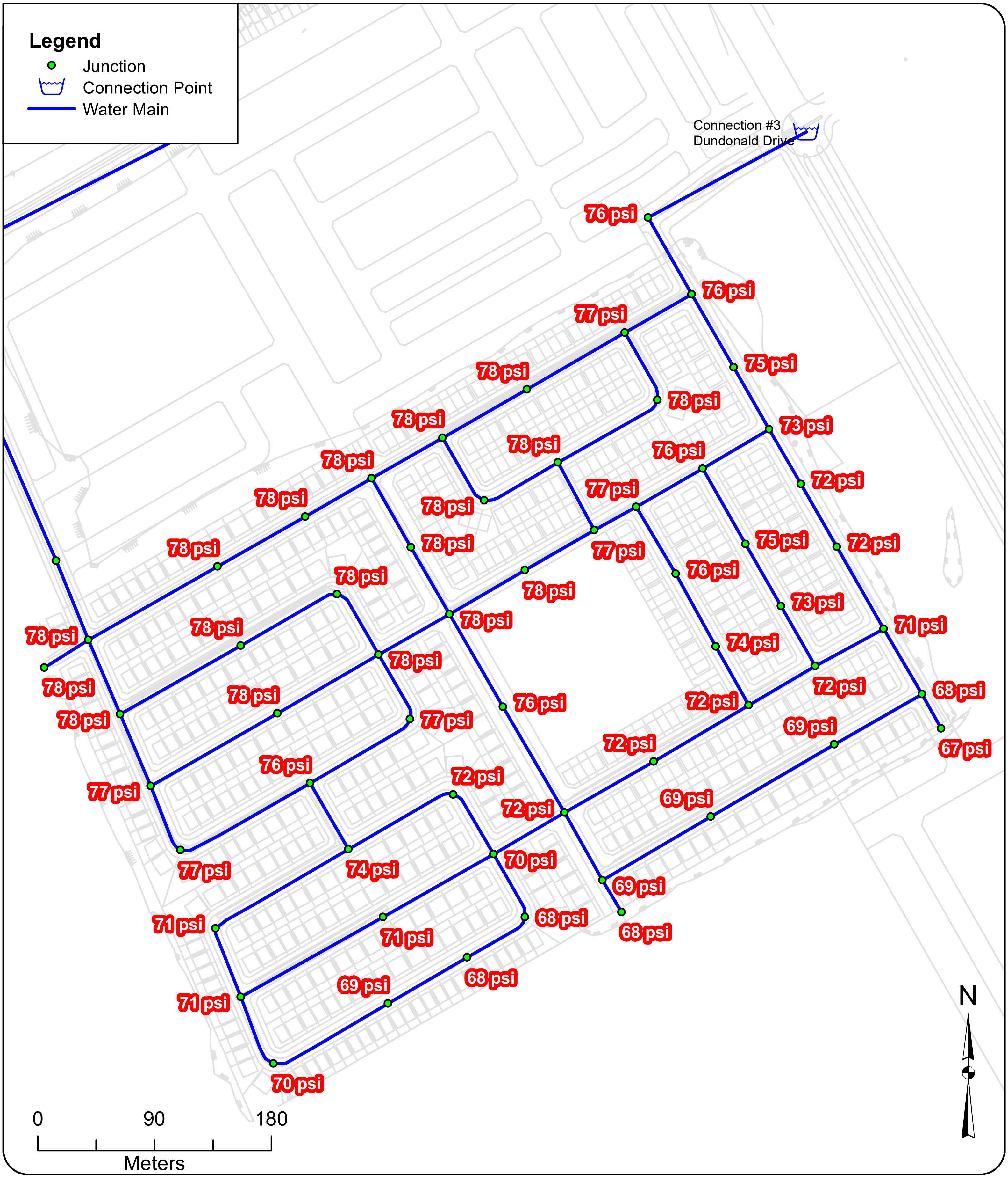
MHD Pressure Results - Phase 1

Figure E.1

Minimum Hour Demand Modeling Results - Phase 1

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-42	J-33	J-34	40.11	297	120	0.00	0.00	0.00	0.00
P-43	J-33	J-35	114.35	297	120	-0.09	0.00	0.00	0.00
P-44	J-35	J-36	77.83	297	120	-0.16	0.00	0.00	0.00
P-45	J-36	J-37	59.20	297	120	-0.25	0.00	0.00	0.00
P-46	J-37	J-38	62.88	297	120	-0.88	0.01	0.00	0.00
P-47	J-38	J-39	74.92	297	120	-1.05	0.02	0.00	0.00
P-48	J-39	J-40	87.18	297	120	-1.15	0.02	0.00	0.00
P-49	J-40	J-41	59.39	297	120	-1.68	0.02	0.00	0.00
P-50	J-41	J-60	67.93	297	120	-1.69	0.02	0.00	0.00
P-51	J-60	CONNECTION_3	138.92	297	120	-1.69	0.02	0.00	0.00
P-52	J-40	J-42	58.39	204	110	0.45	0.01	0.00	0.00
P-53	J-42	J-43	91.90	204	110	0.37	0.01	0.00	0.00
P-54	J-43	J-44	64.49	204	110	-0.02	0.00	0.00	0.00
P-55	J-44	J-38	58.67	204	110	-0.10	0.00	0.00	0.00
P-56	J-45	J-46	59.20	204	110	-0.03	0.00	0.00	0.00
P-57	J-46	J-90	37.06	204	110	-0.08	0.00	0.00	0.00
P-58	J-47	J-48	67.31	204	110	0.16	0.00	0.00	0.00
P-59	J-48	J-61	59.65	297	120	-0.58	0.01	0.00	0.00
P-60	J-61	J-37	60.99	297	120	-0.61	0.01	0.00	0.00
P-61	J-59	J-58	94.07	297	120	-0.32	0.00	0.00	0.00
P-62	J-58	J-48	82.47	297	120	-0.35	0.01	0.00	0.00
P-63	J-48	J-49	63.07	204	110	0.36	0.01	0.00	0.00
P-64	J-49	J-50	57.71	204	110	0.04	0.00	0.00	0.00
P-65	J-50	J-51	84.62	204	110	-0.02	0.00	0.00	0.00
P-66	J-51	J-52	106.76	204	110	-0.11	0.00	0.00	0.00
P-67	J-33	J-52	62.05	204	110	0.42	0.01	0.00	0.00
P-68	J-52	J-53	60.20	204	110	0.21	0.01	0.00	0.00
P-69	J-53	J-54	112.78	204	110	-0.01	0.00	0.00	0.00
P-70	J-54	J-49	90.00	204	110	-0.10	0.00	0.00	0.00
P-71	J-49	J-57	56.32	204	110	0.14	0.00	0.00	0.00
P-72	J-57	J-56	92.28	204	110	0.08	0.00	0.00	0.00
P-73	J-53	J-55	55.27	204	110	0.12	0.00	0.00	0.00
P-74	J-55	J-56	113.38	204	110	0.02	0.00	0.00	0.00
P-111	J-90	J-47	61.51	204	110	0.22	0.01	0.00	0.00
P-112	J-43	J-90	59.19	204	110	0.30	0.01	0.00	0.00

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-33	0.09	101.29	156	78
J-34	0.00	101.41	156	78
J-35	0.08	101.33	156	78
J-36	0.08	101.25	156	78
J-37	0.03	101.64	156	78
J-38	0.07	101.46	156	78
J-39	0.10	101.83	156	78
J-40	0.07	101.96	156	77
J-41	0.02	102.65	156	76
J-42	0.08	101.87	156	78
J-43	0.09	101.72	156	78
J-44	0.08	101.59	156	78
J-45	0.03	103.27	156	76
J-46	0.04	102.38	156	77
J-47	0.06	101.77	156	78
J-48	0.03	101.83	156	78
J-49	0.07	101.74	156	78
J-50	0.06	101.40	156	78
J-51	0.09	101.41	156	78
J-52	0.10	101.35	156	78
J-53	0.10	102.22	156	77
J-54	0.10	101.87	156	78
J-55	0.10	102.52	156	77
J-56	0.10	103.00	156	76
J-57	0.06	102.46	156	77
J-58	0.03	102.95	156	76
J-59	0.32	105.68	156	72
J-60	0.00	102.80	156	76
J-61	0.03	101.51	156	78
J-90	0.00	102.07	156	77



Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

GeoAdvice Engineering Inc.

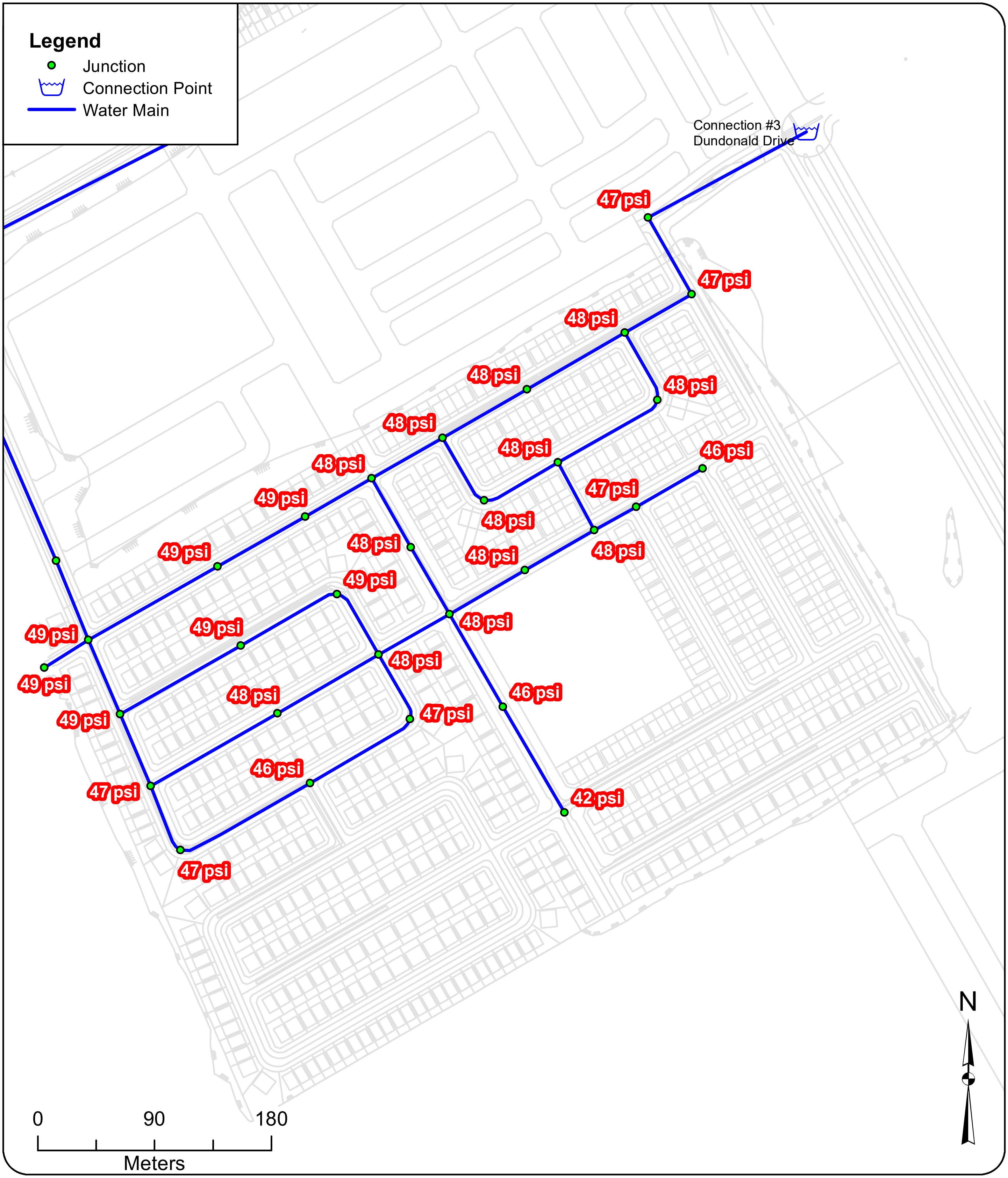
MHD Pressure Results - Phases 1&2

Figure E.2

Minimum Hour Demand Modeling Results - Phases 1 and 2

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-42	J-33	J-34	40.11	297	120	0.00	0.00	0.00	0.00
P-43	J-33	J-35	114.35	297	120	0.35	0.01	0.00	0.00
P-44	J-35	J-36	77.83	297	120	0.28	0.00	0.00	0.00
P-45	J-36	J-37	59.20	297	120	0.20	0.00	0.00	0.00
P-46	J-37	J-38	62.88	297	120	-0.73	0.01	0.00	0.00
P-47	J-38	J-39	74.92	297	120	-0.95	0.01	0.00	0.00
P-48	J-39	J-40	87.18	297	120	-1.05	0.02	0.00	0.00
P-49	J-40	J-41	59.39	297	120	-1.56	0.02	0.00	0.00
P-50	J-41	J-60	67.93	297	120	-3.05	0.04	0.00	0.01
P-51	J-60	CONNECTION_3	138.92	297	120	-3.05	0.04	0.00	0.01
P-52	J-40	J-42	58.39	204	110	0.44	0.01	0.00	0.00
P-53	J-42	J-43	83.72	204	110	0.35	0.01	0.00	0.00
P-54	J-43	J-44	72.67	204	110	-0.07	0.00	0.00	0.00
P-55	J-44	J-38	58.67	204	110	-0.15	0.00	0.00	0.00
P-56	J-45	J-46	59.20	204	110	0.21	0.01	0.00	0.00
P-57	J-46	J-90	81.24	204	110	-0.10	0.00	0.00	0.00
P-58	J-47	J-48	84.62	204	110	0.18	0.01	0.00	0.00
P-59	J-48	J-61	59.65	297	120	-0.87	0.01	0.00	0.00
P-60	J-61	J-37	60.99	297	120	-0.90	0.01	0.00	0.00
P-61	J-59	J-58	94.07	297	120	-0.53	0.01	0.00	0.00
P-62	J-58	J-48	82.47	297	120	-0.56	0.01	0.00	0.00
P-63	J-48	J-49	63.07	204	110	0.45	0.01	0.00	0.00
P-64	J-49	J-50	57.71	204	110	-0.03	0.00	0.00	0.00
P-65	J-50	J-51	84.62	204	110	-0.09	0.00	0.00	0.00
P-66	J-51	J-52	106.76	204	110	-0.18	0.01	0.00	0.00
P-67	J-33	J-52	62.05	204	110	0.62	0.02	0.00	0.00
P-68	J-52	J-53	60.20	204	110	0.33	0.01	0.00	0.00
P-69	J-53	J-54	112.78	204	110	-0.03	0.00	0.00	0.00
P-70	J-54	J-49	90.00	204	110	-0.13	0.00	0.00	0.00
P-71	J-49	J-57	56.32	204	110	0.28	0.01	0.00	0.00
P-72	J-57	J-56	92.28	204	110	0.22	0.01	0.00	0.00
P-73	J-53	J-55	55.27	204	110	0.26	0.01	0.00	0.00
P-74	J-55	J-56	113.38	204	110	0.17	0.01	0.00	0.00
P-111	J-90	J-47	61.51	204	110	0.24	0.01	0.00	0.00
P-112	J-43	J-90	59.19	204	110	0.33	0.01	0.00	0.00
P-75	J-56	J-62	58.69	204	110	0.29	0.01	0.00	0.00
P-76	J-62	J-63	119.4	204	110	0.19	0.01	0.00	0.00
P-77	J-63	J-64	56.35	204	110	0.10	0.00	0.00	0.00
P-78	J-64	J-65	58.6	204	110	0.09	0.00	0.00	0.00
P-79	J-65	J-66	100.76	204	110	0.00	0.00	0.00	0.00
P-80	J-66	J-70	70.42	204	110	-0.10	0.00	0.00	0.00
P-81	J-70	J-71	55.7	204	110	-0.18	0.01	0.00	0.00
P-82	J-71	J-69	54.8	204	110	-0.24	0.01	0.00	0.00
P-83	J-64	J-67	125.85	204	110	-0.09	0.00	0.00	0.00
P-84	J-67	J-69	97.99	204	110	-0.20	0.01	0.00	0.00
P-85	J-62	J-68	92.12	204	110	0.00	0.00	0.00	0.00
P-86	J-68	J-69	56.42	204	110	-0.07	0.00	0.00	0.00
P-87	J-69	J-59	63.46	204	110	-0.59	0.02	0.00	0.00
P-88	J-59	J-72	59.77	297	120	-0.29	0.00	0.00	0.00
P-89	J-72	J-73	28.67	297	120	0.00	0.00	0.00	0.00
P-90	J-72	J-74	96.85	297	120	-0.37	0.01	0.00	0.00
P-91	J-74	J-75	110.13	297	120	-0.49	0.01	0.00	0.00
P-92	J-75	J-76	78.16	297	120	-0.57	0.01	0.00	0.00
P-93	J-77	J-76	30.34	297	120	0.00	0.00	0.00	0.00
P-94	J-76	J-78	58.2	297	120	-0.61	0.01	0.00	0.00
P-95	J-78	J-79	59.97	204	110	0.21	0.01	0.00	0.00
P-96	J-79	J-80	59.39	204	110	0.22	0.01	0.00	0.00
P-97	J-80	J-81	85.15	204	110	0.23	0.01	0.00	0.00
P-98	J-81	J-59	79.25	204	110	0.09	0.00	0.00	0.00
P-99	J-80	J-82	51.74	204	110	-0.10	0.00	0.00	0.00
P-100	J-82	J-83	63.79	204	110	-0.16	0.00	0.00	0.00
P-101	J-83	J-46	60.03	204	110	-0.26	0.01	0.00	0.00
P-102	J-79	J-84	53.32	204	110	-0.09	0.00	0.00	0.00
P-103	J-84	J-85	55.04	204	110	-0.15	0.00	0.00	0.00
P-104	J-85	J-45	66.63	204	110	-0.25	0.01	0.00	0.00
P-105	J-78	J-86	72.81	297	120	-0.86	0.01	0.00	0.00
P-106	J-86	J-87	55.9	297	120	-0.89	0.01	0.00	0.00
P-107	J-87	J-88	48.49	297	120	-0.93	0.01	0.00	0.00
P-108	J-45	J-88	59.54	204	110	-0.49	0.01	0.00	0.00
P-109	J-88	J-89	55.04	297	120	-1.44	0.02	0.00	0.00
P-110	J-89	J-41	65.11	297	120	-1.48	0.02	0.00	0.00

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-33	0.09	101.29	156	78
J-34	0.00	101.41	156	78
J-35	0.08	101.33	156	78
J-36	0.08	101.25	156	78
J-37	0.03	101.64	156	78
J-38	0.07	101.46	156	78
J-39	0.10	101.83	156	78
J-40	0.07	101.96	156	77
J-41	0.02	102.65	156	76
J-42	0.08	101.87	156	78
J-43	0.09	101.72	156	78
J-44	0.08	101.59	156	78
J-45	0.03	103.27	156	76
J-46	0.04	102.38	156	77
J-47	0.06	101.77	156	78
J-48	0.03	101.83	156	78
J-49	0.07	101.74	156	78
J-50	0.06	101.40	156	78
J-51	0.09	101.41	156	78
J-52	0.10	101.35	156	78
J-53	0.10	102.22	156	77
J-54	0.10	101.87	156	78
J-55	0.10	102.52	156	77
J-56	0.10	103.00	156	76
J-57	0.06	102.46	156	77
J-58	0.03	102.95	156	76
J-59	0.32	105.68	156	72
J-60	0.00	102.80	156	76
J-61	0.03	101.51	156	78
J-90	0.00	102.07	156	77
J-62	0.10	104.21	156	74
J-63	0.10	106.39	156	71
J-64	0.10	106.74	156	71
J-65	0.09	107.17	156	70
J-66	0.10	107.78	156	69
J-67	0.11	106.62	156	71
J-68	0.07	106.00	156	72
J-69	0.07	107.07	156	70
J-70	0.08	108.43	156	68
J-71	0.06	108.62	156	68
J-72	0.08	107.85	156	69
J-73	0.00	108.47	156	68
J-74	0.12	107.68	156	69
J-75	0.08	108.00	156	69
J-76	0.04	108.27	156	68
J-77	0.00	108.93	156	67
J-78	0.03	106.17	156	71
J-79	0.09	105.57	156	72
J-80	0.09	105.54	156	72
J-81	0.14	105.54	156	72
J-82	0.06	104.30	156	74
J-83	0.10	103.10	156	76
J-84	0.06	104.73	156	73
J-85	0.10	103.68	156	75
J-86	0.04	105.81	156	72
J-87	0.04	105.51	156	72
J-88	0.02	104.78	156	73
J-89	0.04	103.69	156	75



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

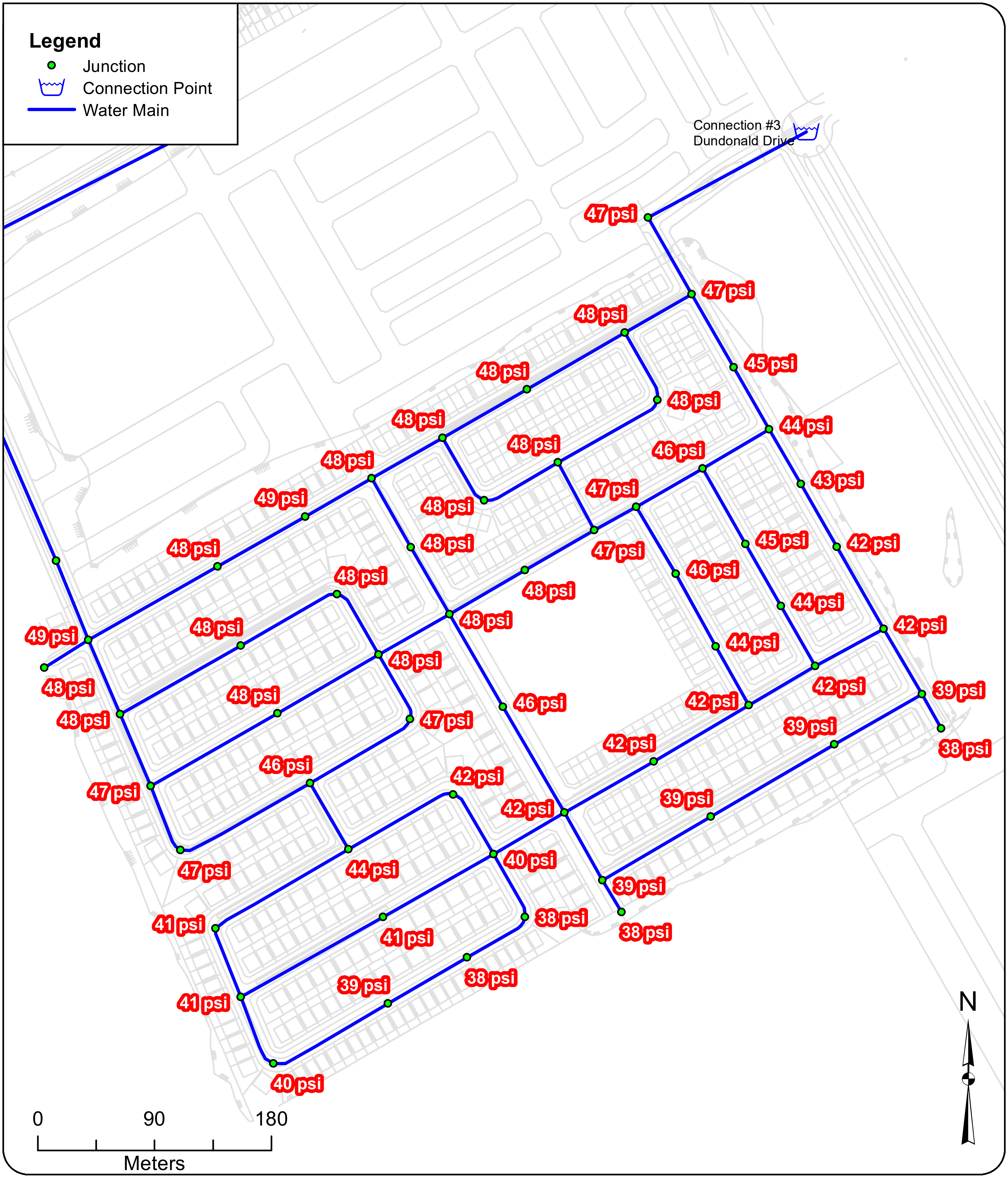
PHD Pressure Results - Phase 1

Figure E.3

Peak Hour Demand Modeling Results - Phase 1

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-42	J-33	J-34	40.11	297	120	0.00	0.00	0.00	0.00
P-43	J-33	J-35	114.35	297	120	-2.53	0.04	0.00	0.01
P-44	J-35	J-36	77.83	297	120	-3.36	0.05	0.00	0.01
P-45	J-36	J-37	59.20	297	120	-4.27	0.06	0.00	0.02
P-46	J-37	J-38	62.88	297	120	-10.16	0.15	0.01	0.11
P-47	J-38	J-39	74.92	297	120	-11.85	0.17	0.01	0.15
P-48	J-39	J-40	87.18	297	120	-13.00	0.19	0.02	0.18
P-49	J-40	J-41	59.39	297	120	-18.81	0.27	0.02	0.35
P-50	J-41	J-60	67.93	297	120	-18.99	0.27	0.02	0.36
P-51	J-60	CONNECTION_3	138.92	297	120	-18.99	0.27	0.05	0.36
P-52	J-40	J-42	58.39	204	110	5.02	0.15	0.01	0.23
P-53	J-42	J-43	91.90	204	110	4.12	0.13	0.01	0.16
P-54	J-43	J-44	64.49	204	110	-0.06	0.00	0.00	0.00
P-55	J-44	J-38	58.67	204	110	-0.91	0.03	0.00	0.01
P-56	J-45	J-46	59.20	204	110	-0.36	0.01	0.00	0.00
P-57	J-46	J-90	37.06	204	110	-0.84	0.03	0.00	0.01
P-58	J-47	J-48	67.31	204	110	1.65	0.05	0.00	0.03
P-59	J-48	J-61	59.65	297	120	-5.28	0.08	0.00	0.03
P-60	J-61	J-37	60.99	297	120	-5.59	0.08	0.00	0.04
P-61	J-59	J-58	94.07	297	120	-1.96	0.03	0.00	0.01
P-62	J-58	J-48	82.47	297	120	-2.26	0.03	0.00	0.01
P-63	J-48	J-49	63.07	204	110	4.29	0.13	0.01	0.17
P-64	J-49	J-50	57.71	204	110	0.63	0.02	0.00	0.00
P-65	J-50	J-51	84.62	204	110	-0.06	0.00	0.00	0.00
P-66	J-51	J-52	106.76	204	110	-1.04	0.03	0.00	0.01
P-67	J-33	J-52	62.05	204	110	4.28	0.13	0.01	0.17
P-68	J-52	J-53	60.20	204	110	2.10	0.06	0.00	0.04
P-69	J-53	J-54	112.78	204	110	-0.21	0.01	0.00	0.00
P-70	J-54	J-49	90.00	204	110	-1.27	0.04	0.00	0.02
P-71	J-49	J-57	56.32	204	110	1.63	0.05	0.00	0.03
P-72	J-57	J-56	92.28	204	110	0.95	0.03	0.00	0.01
P-73	J-53	J-55	55.27	204	110	1.17	0.04	0.00	0.02
P-74	J-55	J-56	113.38	204	110	0.11	0.00	0.00	0.00
P-111	J-90	J-47	61.51	204	110	2.31	0.07	0.00	0.05
P-112	J-43	J-90	59.19	204	110	3.16	0.10	0.01	0.10

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-33	0.99	101.29	136	49
J-34	0.00	101.41	136	49
J-35	0.83	101.33	136	49
J-36	0.91	101.25	136	49
J-37	0.30	101.64	136	48
J-38	0.78	101.46	136	49
J-39	1.15	101.83	136	48
J-40	0.78	101.96	136	48
J-41	0.18	102.65	136	47
J-42	0.90	101.87	136	48
J-43	1.02	101.72	136	48
J-44	0.84	101.59	136	48
J-45	0.36	103.27	136	46
J-46	0.48	102.38	136	47
J-47	0.66	101.77	136	48
J-48	0.38	101.83	136	48
J-49	0.76	101.74	136	48
J-50	0.68	101.40	136	49
J-51	0.99	101.41	136	49
J-52	1.14	101.35	136	49
J-53	1.14	102.22	136	47
J-54	1.06	101.87	136	48
J-55	1.06	102.52	136	47
J-56	1.06	103.00	136	46
J-57	0.68	102.46	136	47
J-58	0.30	102.95	136	46
J-59	1.96	105.68	136	42
J-60	0.00	102.80	136	47
J-61	0.30	101.51	136	48
J-90	0.00	102.07	136	48



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
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PHD Pressure Results - Phases 1&2

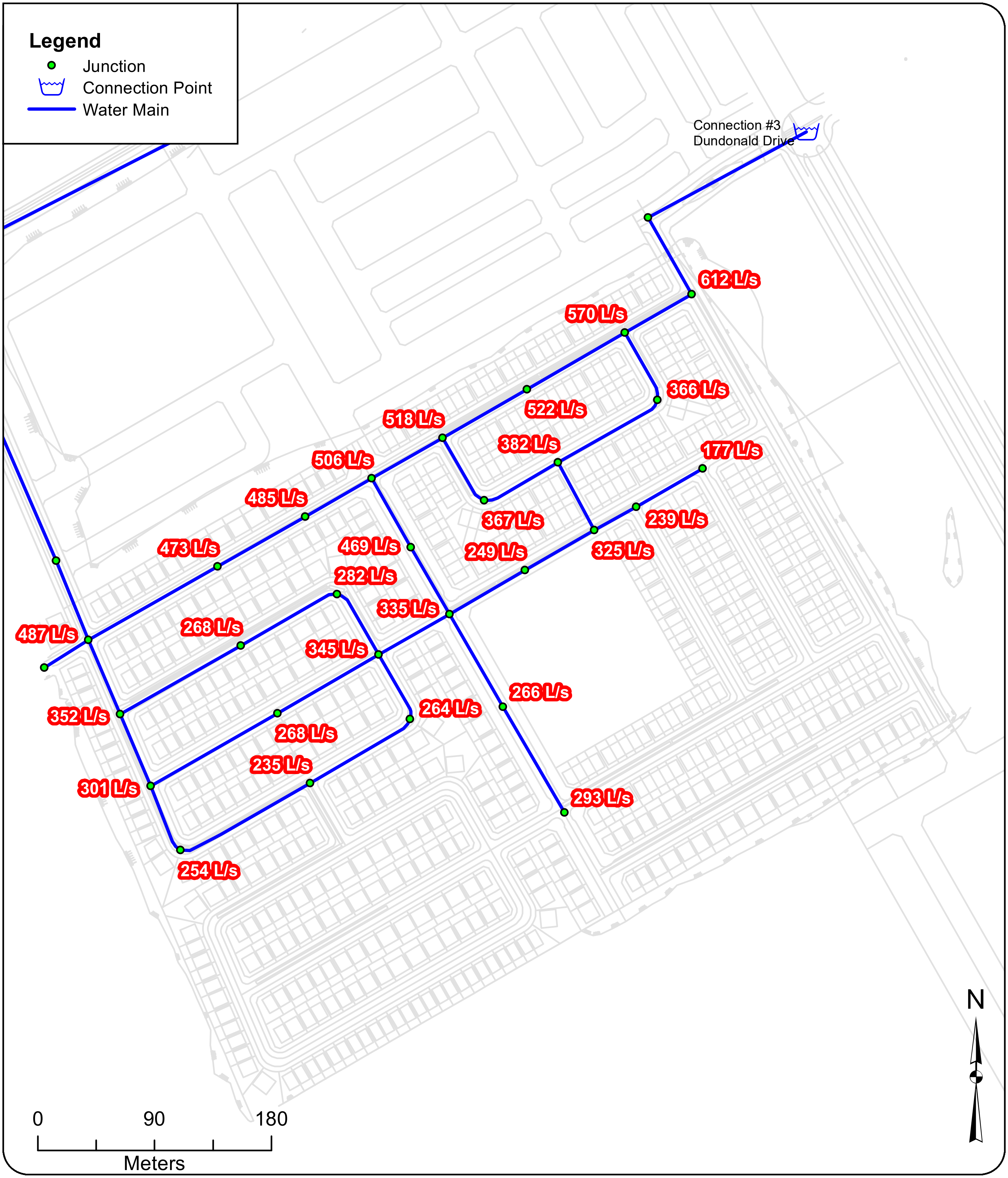
Figure E.4

Peak Hour Demand Modeling Results -Phases 1 and 2

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-42	J-33	J-34	40.11	297	120	0.00	0.00	0.00	0.00
P-43	J-33	J-35	114.35	297	120	3.16	0.05	0.00	0.01
P-44	J-35	J-36	77.83	297	120	2.33	0.03	0.00	0.01
P-45	J-36	J-37	59.20	297	120	1.42	0.02	0.00	0.00
P-46	J-37	J-38	62.88	297	120	-8.04	0.12	0.00	0.07
P-47	J-38	J-39	74.92	297	120	-10.35	0.15	0.01	0.12
P-48	J-39	J-40	87.18	297	120	-11.49	0.17	0.01	0.14
P-49	J-40	J-41	59.39	297	120	-17.00	0.25	0.02	0.29
P-50	J-41	J-60	67.93	297	120	-33.05	0.48	0.07	1.01
P-51	J-60	CONNECTION_3	138.92	297	120	-33.05	0.48	0.14	1.01
P-52	J-40	J-42	58.39	204	110	4.72	0.14	0.01	0.20
P-53	J-42	J-43	83.72	204	110	3.82	0.12	0.01	0.14
P-54	J-43	J-44	72.67	204	110	-0.68	0.02	0.00	0.01
P-55	J-44	J-38	58.67	204	110	-1.52	0.05	0.00	0.02
P-56	J-45	J-46	59.20	204	110	2.27	0.07	0.00	0.05
P-57	J-46	J-90	81.24	204	110	-0.92	0.03	0.00	0.01
P-58	J-47	J-48	84.62	204	110	1.88	0.06	0.00	0.04
P-59	J-48	J-61	59.65	297	120	-8.86	0.13	0.01	0.09
P-60	J-61	J-37	60.99	297	120	-9.16	0.13	0.01	0.09
P-61	J-59	J-58	94.07	297	120	-4.98	0.07	0.00	0.03
P-62	J-58	J-48	82.47	297	120	-5.28	0.08	0.00	0.03
P-63	J-48	J-49	63.07	204	110	5.08	0.16	0.01	0.23
P-64	J-49	J-50	57.71	204	110	-0.22	0.01	0.00	0.00
P-65	J-50	J-51	84.62	204	110	-0.90	0.03	0.00	0.01
P-66	J-51	J-52	106.76	204	110	-1.89	0.06	0.00	0.04
P-67	J-33	J-52	62.05	204	110	6.57	0.20	0.02	0.37
P-68	J-52	J-53	60.20	204	110	3.54	0.11	0.01	0.12
P-69	J-53	J-54	112.78	204	110	-0.41	0.01	0.00	0.00
P-70	J-54	J-49	90.00	204	110	-1.48	0.05	0.00	0.02
P-71	J-49	J-57	56.32	204	110	3.06	0.09	0.01	0.09
P-72	J-57	J-56	92.28	204	110	2.38	0.07	0.01	0.06
P-73	J-53	J-55	55.27	204	110	2.82	0.09	0.00	0.08
P-74	J-55	J-56	113.38	204	110	1.76	0.05	0.00	0.03
P-111	J-90	J-47	61.51	204	110	2.55	0.08	0.00	0.06
P-112	J-43	J-90	59.19	204	110	3.47	0.11	0.01	0.11
P-75	J-56	J-62	58.69	204	110	3.08	0.09	0.01	0.09
P-76	J-62	J-63	119.4	204	110	2.11	0.06	0.01	0.05
P-77	J-63	J-64	56.35	204	110	1.05	0.03	0.00	0.01
P-78	J-64	J-65	58.6	204	110	0.97	0.03	0.00	0.01
P-79	J-65	J-66	100.76	204	110	-0.01	0.00	0.00	0.00
P-80	J-66	J-70	70.42	204	110	-1.15	0.04	0.00	0.01
P-81	J-70	J-71	55.7	204	110	-2.06	0.06	0.00	0.04
P-82	J-71	J-69	54.8	204	110	-2.67	0.08	0.00	0.07
P-83	J-64	J-67	125.85	204	110	-1.06	0.03	0.00	0.01
P-84	J-67	J-69	97.99	204	110	-2.27	0.07	0.01	0.05
P-85	J-62	J-68	92.12	204	110	-0.17	0.01	0.00	0.00
P-86	J-68	J-69	56.42	204	110	-0.93	0.03	0.00	0.01
P-87	J-69	J-59	63.46	204	110	-6.63	0.20	0.02	0.38
P-88	J-59	J-72	59.77	297	120	-2.83	0.04	0.00	0.01
P-89	J-72	J-73	28.67	297	120	0.00	0.00	0.00	0.00
P-90	J-72	J-74	96.85	297	120	-3.74	0.05	0.00	0.02
P-91	J-74	J-75	110.13	297	120	-5.03	0.07	0.00	0.03
P-92	J-75	J-76	78.16	297	120	-5.93	0.09	0.00	0.04
P-93	J-77	J-76	30.34	297	120	0.00	0.00	0.00	0.00
P-94	J-76	J-78	58.2	297	120	-6.39	0.09	0.00	0.05
P-95	J-78	J-79	59.97	204	110	2.36	0.07	0.00	0.06
P-96	J-79	J-80	59.39	204	110	2.34	0.07	0.00	0.05
P-97	J-80	J-81	85.15	204	110	2.34	0.07	0.00	0.05
P-98	J-81	J-59	79.25	204	110	0.78	0.02	0.00	0.01
P-99	J-80	J-82	51.74	204	110	-0.96	0.03	0.00	0.01
P-100	J-82	J-83	63.79	204	110	-1.63	0.05	0.00	0.03
P-101	J-83	J-46	60.03	204	110	-2.71	0.08	0.00	0.07
P-102	J-79	J-84	53.32	204	110	-0.94	0.03	0.00	0.01
P-103	J-84	J-85	55.04	204	110	-1.54	0.05	0.00	0.03
P-104	J-85	J-45	66.63	204	110	-2.62	0.08	0.00	0.07
P-105	J-78	J-86	72.81	297	120	-9.11	0.13	0.01	0.09
P-106	J-86	J-87	55.9	297	120	-9.53	0.14	0.01	0.10
P-107	J-87	J-88	48.49	297	120	-9.95	0.14	0.01	0.11
P-108	J-45	J-88	59.54	204	110	-5.25	0.16	0.01	0.24
P-109	J-88	J-89	55.04	297	120	-15.45	0.22	0.01	0.25
P-110	J-89	J-41	65.11	297	120	-15.87	0.23	0.02	0.26

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-33	0.99	101.29	135	49
J-34	0.00	101.41	135	48
J-35	0.83	101.33	135	49
J-36	0.91	101.25	135	49
J-37	0.30	101.64	135	48
J-38	0.78	101.46	135	48
J-39	1.15	101.83	135	48
J-40	0.78	101.96	135	48
J-41	0.18	102.65	135	47
J-42	0.90	101.87	135	48
J-43	1.02	101.72	135	48
J-44	0.84	101.59	135	48
J-45	0.36	103.27	135	46
J-46	0.48	102.38	135	47
J-47	0.66	101.77	135	48
J-48	0.38	101.83	135	48
J-49	0.76	101.74	135	48
J-50	0.68	101.40	135	48
J-51	0.99	101.41	135	48
J-52	1.14	101.35	135	48
J-53	1.14	102.22	135	47
J-54	1.06	101.87	135	48
J-55	1.06	102.52	135	47
J-56	1.06	103.00	135	46
J-57	0.68	102.46	135	47
J-58	0.30	102.95	135	46
J-59	1.96	105.68	135	42
J-60	0.00	102.80	136	47
J-61	0.30	101.51	135	48
J-90	0.00	102.07	135	47
J-62	1.14	104.21	135	44
J-63	1.06	106.39	135	41
J-64	1.14	106.74	135	41
J-65	0.98	107.17	135	40
J-66	1.14	107.78	135	39
J-67	1.21	106.62	135	41
J-68	0.76	106.00	135	42
J-69	0.76	107.07	135	40
J-70	0.91	108.43	135	38
J-71	0.61	108.62	135	38
J-72	0.91	107.85	135	39
J-73	0.00	108.47	135	38
J-74	1.29	107.68	135	39
J-75	0.91	108.00	135	39
J-76	0.45	108.27	135	39
J-77	0.00	108.93	135	38
J-78	0.36	106.17	135	42
J-79	0.96	105.57	135	42
J-80	0.96	105.54	135	43
J-81	1.56	105.54	135	42
J-82	0.66	104.30	135	44
J-83	1.08	103.10	135	46
J-84	0.60	104.73	135	44
J-85	1.08	103.68	135	45
J-86	0.42	105.81	135	42
J-87	0.42	105.51	135	43
J-88	0.24	104.78	135	44
J-89	0.42	103.69	135	45

Appendix F MDD+FF Model Results



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
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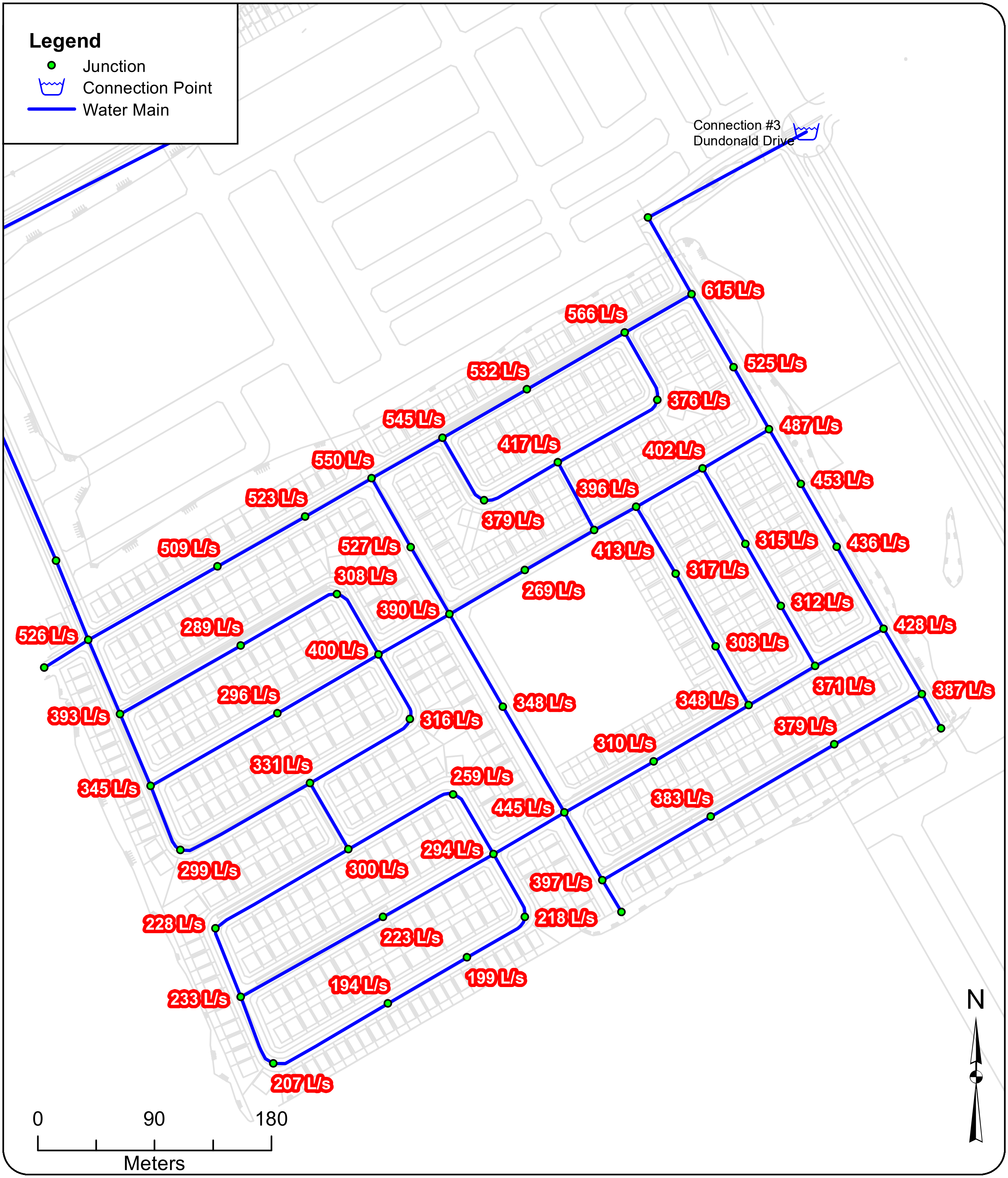
Available Fire Flow @ 20 psi - Phase 1

Figure F.1



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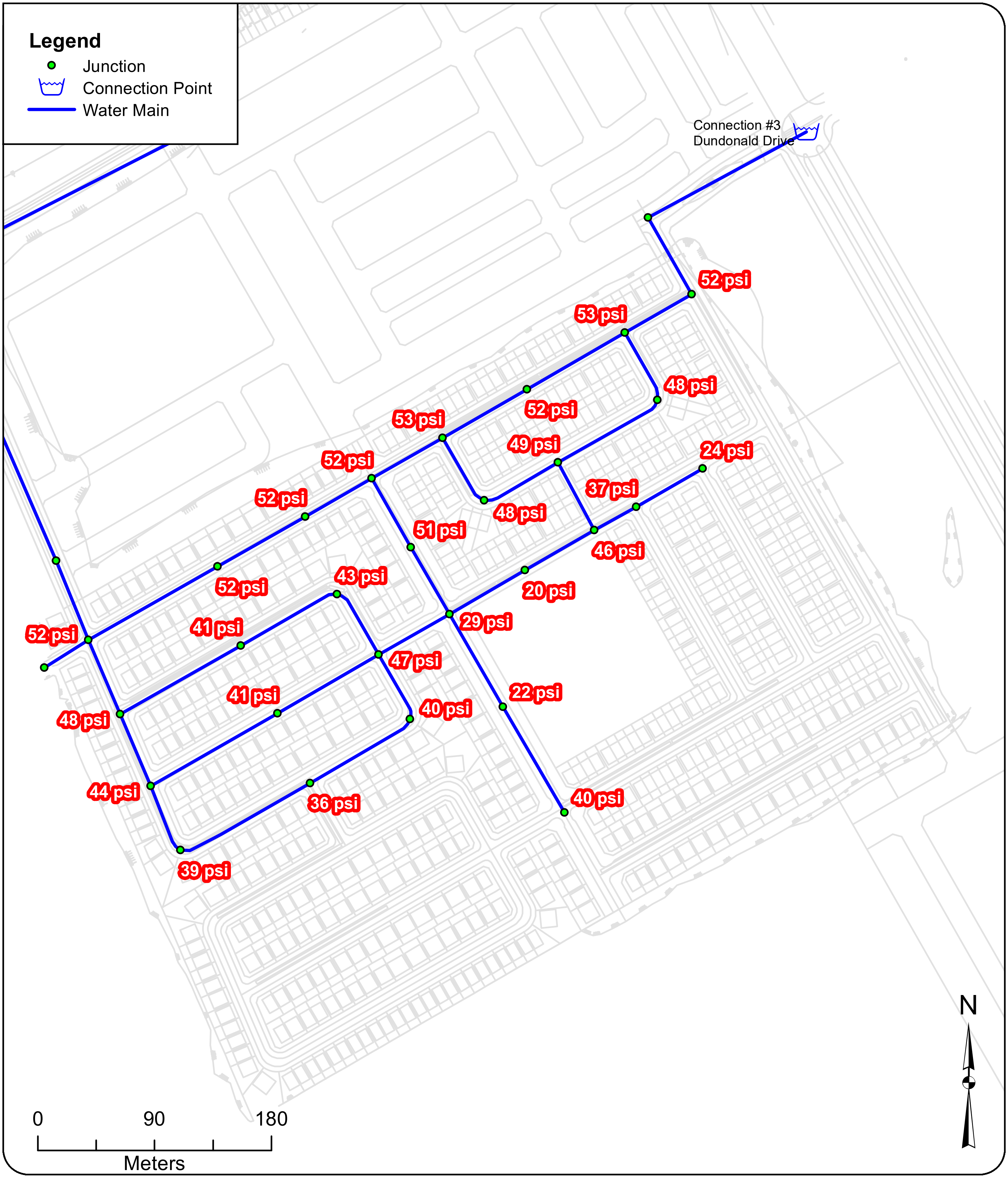
Available Fire Flow @ 20 psi - Phases 1&2

Figure F.2



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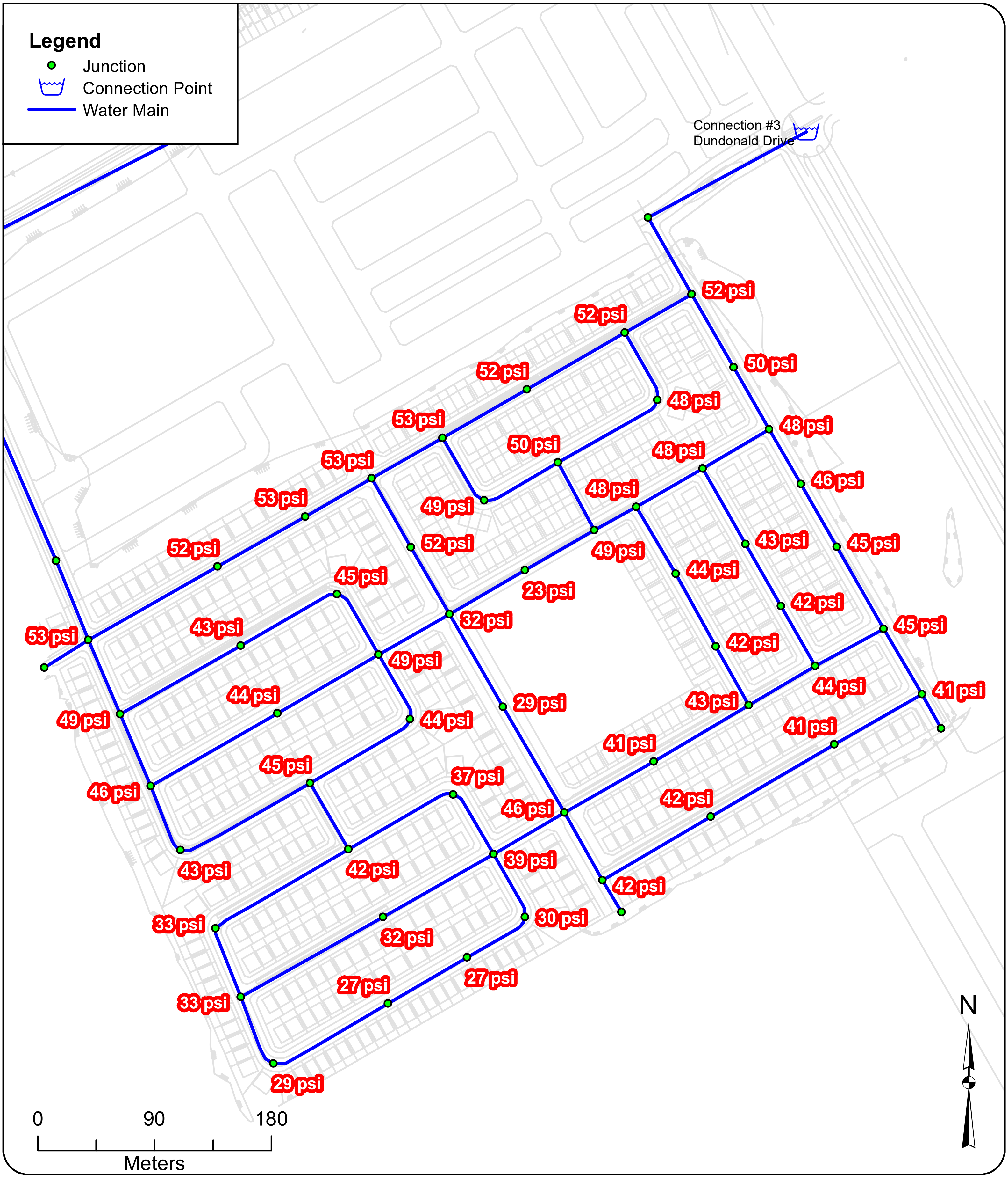
Residual Pressure @ Required Fire Flow - Phase 1

Figure F.3



GeoAdvice Engineering Inc.

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Residual Pressure @ Required Fire Flow - Phases 1&2

Figure F.4

Fire Flow Modeling Results - Phase 1

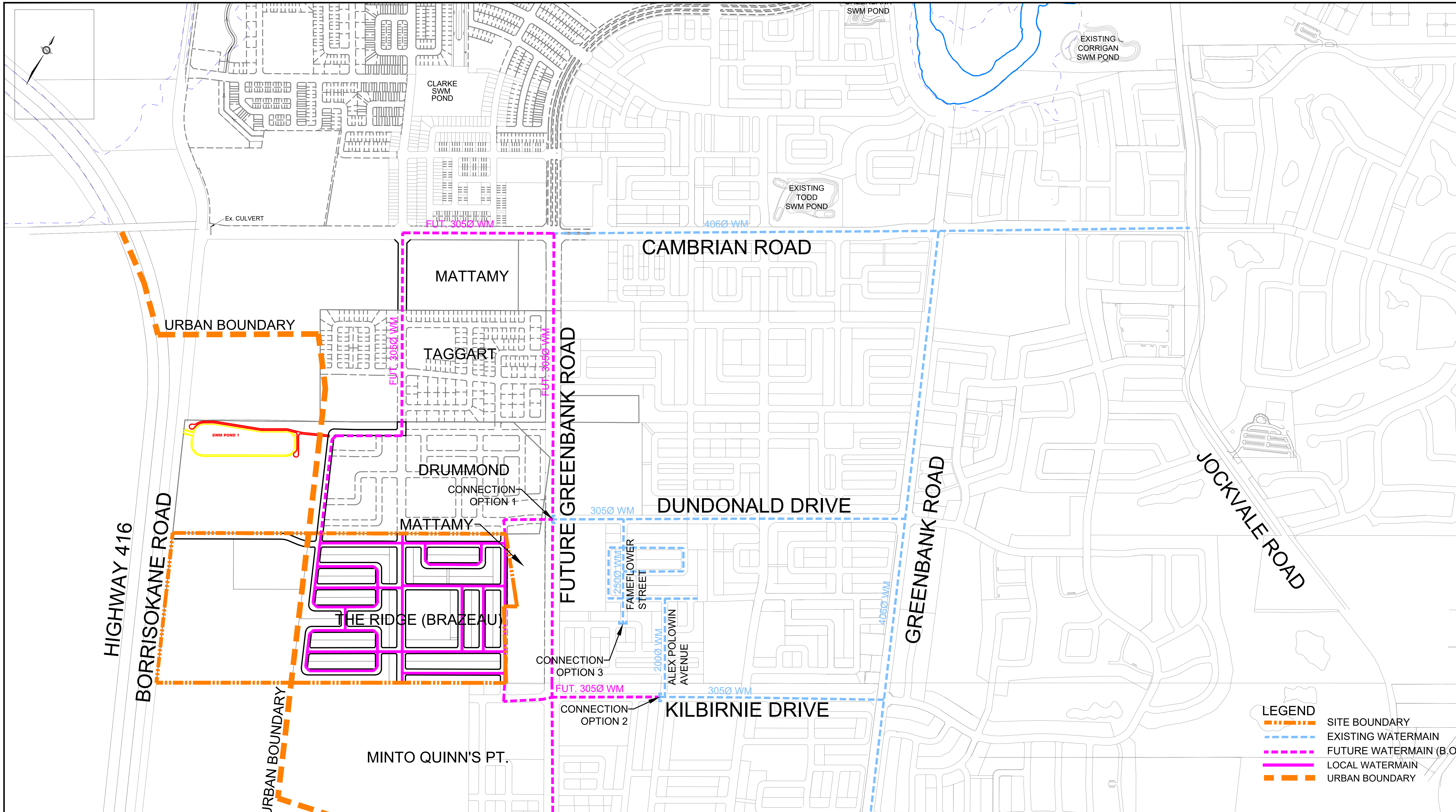
ID	Static Demand (L/s)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
J-33	0.45	167	52	487	20
J-35	0.38	167	52	473	20
J-36	0.41	167	52	485	20
J-37	0.14	167	52	506	20
J-38	0.36	167	53	518	20
J-39	0.52	167	52	522	20
J-40	0.36	167	53	570	20
J-41	0.08	167	52	612	20
J-42	0.41	167	48	366	20
J-43	0.47	167	49	382	20
J-44	0.38	167	48	367	20
J-45	0.16	167	24	177	20
J-46	0.22	167	37	239	20
J-49	0.34	167	47	345	20
J-50	0.31	167	43	282	20
J-51	0.45	167	41	268	20
J-52	0.52	167	48	352	20
J-53	0.52	167	44	301	20
J-54	0.48	167	41	268	20
J-55	0.48	167	39	254	20
J-56	0.48	167	36	235	20
J-57	0.31	167	40	264	20
J-59	1.04	167	40	293	20
J-61	0.14	167	51	469	20
J-90	0.00	167	46	325	20
J-47	0.30	250	20	249	20
J-48	0.17	250	29	335	20
J-58	0.14	250	22	266	20

Fire Flow Modeling Results - Phases 1 and 2

ID	Static Demand (L/s)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
J-33	0.45	167	53	526	20
J-35	0.38	167	52	509	20
J-36	0.41	167	53	523	20
J-37	0.14	167	53	550	20
J-38	0.36	167	53	545	20
J-39	0.52	167	52	532	20
J-40	0.36	167	52	566	20
J-41	0.08	167	52	615	20
J-42	0.41	167	48	376	20
J-43	0.47	167	50	417	20
J-44	0.38	167	49	379	20
J-45	0.16	167	48	402	20
J-46	0.22	167	48	396	20
J-49	0.34	167	49	400	20
J-50	0.31	167	45	308	20
J-51	0.45	167	43	289	20
J-52	0.52	167	49	393	20
J-53	0.52	167	46	345	20
J-54	0.48	167	44	296	20
J-55	0.48	167	43	299	20
J-56	0.48	167	45	331	20
J-57	0.31	167	44	316	20
J-59	1.04	167	46	445	20
J-61	0.14	167	52	527	20
J-62	0.52	167	42	300	20
J-63	0.48	167	33	228	20
J-64	0.52	167	33	233	20
J-65	0.45	167	29	207	20
J-66	0.52	167	27	194	20
J-67	0.55	167	32	223	20
J-68	0.34	167	37	259	20
J-69	0.34	167	39	294	20
J-70	0.41	167	27	199	20
J-71	0.28	167	30	218	20
J-72	0.41	167	42	397	20
J-74	0.58	167	42	383	20
J-75	0.41	167	41	379	20
J-76	0.21	167	41	387	20
J-78	0.16	167	45	428	20
J-79	0.44	167	44	371	20
J-80	0.44	167	43	349	20
J-81	0.71	167	41	310	20
J-82	0.30	167	42	308	20
J-83	0.49	167	44	317	20
J-84	0.27	167	42	312	20
J-85	0.49	167	43	315	20
J-86	0.19	167	45	436	20
J-87	0.19	167	46	453	20
J-88	0.11	167	48	487	20
J-89	0.19	167	50	525	20
J-90	0.00	167	49	413	20
J-47	0.30	250	23	269	20
J-48	0.17	250	32	390	20
J-58	0.14	250	29	348	20

Connection point 1: Existing watermain node off Haiku/ Obsidian street intersection fronting Block 1.

Connection point 2: Existing watermain node on Obsidian street



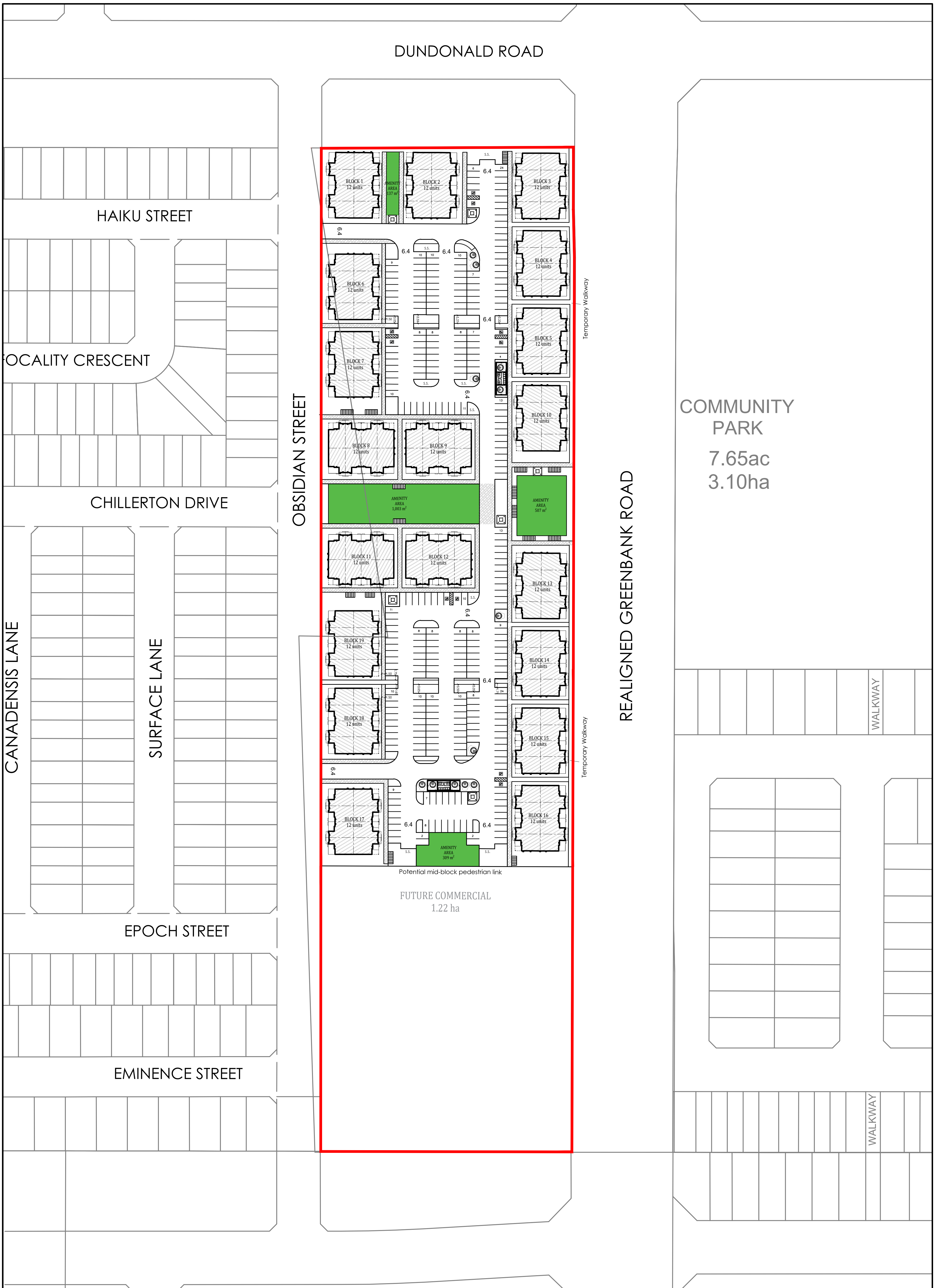
DSEL
david schaeffer engineering ltd

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
TEL: (613) 836-0856
FAX: (613) 836-7183
www.DSEL.ca

CAIVAN - BRAZEAU
WATERMAIN SERVICING PLAN
CITY OF OTTAWA

PROJECT No.:	18-1030
SCALE:	1:10,000
DATE:	APRIL 2020
FIGURE:	WAT-1

Appendix B DRAFT SITE PLAN



HALF MOON BAY SOUTH
Concept 2 DRAFT

City of Ottawa

DWELLING TYPE	UNIT COUNT
Stacked Towns	228

Legend:

Pavers

Site Area: 4.31 ha
Residential Area: 3.09 ha
Commercial Area: 1.22 ha

Density*: 73 UPH

*Density calculated using residential area

Stacked Towns Required Parking:

Residents: 274 (1.2 spaces/unit)
Visitor: 46 (0.2 spaces/unit)
Total: 320 spaces

Stacked Towns Proposed Parking:

Residents: 274 (1.2 spaces/unit)
Visitor: 46 (0.2 spaces/unit)
Total: 320 spaces

Stacked Total Amenity Area:

Required: 1,368m^2 (6m^2 per unit)
Provided: ±1,938m^2 (±8.5m^2 per unit)

Communal Amenity Area:
Required: 684m^2 (50% of total required amenity area)
Provided: ±1,956m^2

Bike Parking: 114 Spots (0.5/unit)

Landscaped Area: 30.1%

Scale 1:1500

June 28, 2021

mattamyHOMES

KORSIAK Urban Planning

206-277 Lakeshore Road East
Oakville, Ontario L6J 1H9
T: 905-257-0227
info@korsiak.com

Appendix C SANITARY SERVICING

C.1 SANITARY SEWER DESIGN SHEET

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

Stantec

SUBDIVISION: HALFMOON BAY PHASE 8

DATE: 7/21/2021
REVISION: 1
DESIGNED BY: MJS
CHECKED BY: DT

FILE NUMBER: 160401657

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
R7A	7	6	0.15	0	12	0	32	0.15	32	3.68	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.15	0.15	0.1	0.4	28.2	200	PVC	SDR 35	1.00	33.4	**1.31%**	1.05	0.30
R10A	10	9	0.57	0	39	0	105	0.57	105	3.59	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.57	0.57	0.2	1.4	100.1	200	PVC	SDR 35	0.40	21.1	**6.68%**	0.67	0.31
R12A	12	11	0.53	0	36	0	97	0.53	97	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.53	0.53	0.2	1.3	102.9	200	PVC	SDR 35	0.40	21.1	**6.19%**	0.67	0.30
R13A	13	11	0.14	0	12	0	32	0.14	32	3.68	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.14	0.14	0.0	0.4	26.5	200	PVC	SDR 35	1.00	33.4	**1.30%**	1.05	0.30
R11A	11	9	0.15	0	12	0	32	0.82	162	3.54	1.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.15	0.82	0.3	2.1	36.1	200	PVC	SDR 35	0.40	21.1	**10.08%**	0.67	0.36
R9A	9	8	0.34	0	18	0	49	1.72	316	3.46	3.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.34	1.72	0.6	4.1	81.5	200	PVC	SDR 35	0.40	21.1	**19.42%**	0.67	0.42
R8B	8	6	0.37	0	27	0	73	2.09	389	3.42	4.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.37	2.09	0.7	5.0	72.1	200	PVC	SDR 35	0.40	21.1	**23.66%**	0.67	0.45
G6A	6	2	0.00	0	0	0	0	2.25	421	3.41	4.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.0	0.04	2.29	0.8	5.4	39.1	200	PVC	SDR 35	0.40	21.1	**25.58%**	0.67	0.47
R5A	5	4	0.13	0	12	0	32	0.13	32	3.68	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.13	0.13	0.0	0.4	22.6	200	PVC	SDR 35	1.00	33.4	**1.29%**	1.05	0.30
R8A	8	4	0.16	0	12	0	32	0.16	32	3.68	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.16	0.16	0.1	0.4	39.3	200	PVC	SDR 35	1.00	33.4	**1.31%**	1.05	0.30
R4A	4	2	0.30	0	24	0	65	0.59	130	3.57	1.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.30	0.59	0.2	1.7	72.2	200	PVC	SDR 35	0.40	21.1	**8.00%**	0.67	0.33
R3A	3	2	0.17	0	24	0	65	0.17	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.17	0.1	0.8	30.3	200	PVC	SDR 35	0.50	23.6	**3.47%**	0.74	0.29
G2A	2	1	0.00	0	0	0	0	3.01	616	3.34	6.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.0	0.04	3.09	1.0	7.7	29.4	200	PVC	SDR 35	0.40	21.1	**36.34%**	0.67	0.52
	1	EX MH 3A	0.00	0	0	0	0	3.01	616	3.34	6.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.0	0.00	3.09	1.0	7.7	3.8	200	PVC	SDR 35	0.40	21.1	**36.34%**	0.67	0.52
																												200							

Appendix D STORMWATER MANAGEMENT

D.1 STORM SEWER DESIGN SHEET

Stantec

HALFMOON BAY PHASE 8	
DATE:	2021-07-21
REVISION:	1
DESIGNED BY:	MJS
CHECKED BY:	DT

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: **160401657**

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr			
a =	732.951	998.071	1174.184	1735.688	MANNING'S n =	0.013	
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00	m
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10	min

BEDDING CLASS = B

LOCATION			DRAINAGE AREA																	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)
L106A	106	105	0.31	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.260	0.260	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				11.31
L108B	108A	108	0.16	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.106	0.106	0.000	0.000	0.000	0.000	0.000	0.000	10.00
L108C, L108A	108	107	0.15	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.108	0.215	0.000	0.000	0.000	0.000	0.000	0.000	10.29
L107A	107	105	0.31	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.267	0.482	0.000	0.000	0.000	0.000	0.000	0.000	12.00
																				12.61
L105C, L105A	105	104	0.33	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.171	0.912	0.000	0.000	0.000	0.000	0.000	0.000	12.61
	104	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.912	0.000	0.000	0.000	0.000	0.000	0.000	13.84
																				14.90
L103A	103A	103	0.11	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.089	0.089	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.29
L103C, L103B	103	101	0.51	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.419	1.420	0.000	0.000	0.000	0.000	0.000	0.000	14.90
																				15.39
L102A, L102B	102	101	0.23	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.191	0.191	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				11.49
L101A	101	100	0.25	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.187	1.798	0.000	0.000	0.000	0.000	0.000	0.000	15.39
	100	EX MH 109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.798	0.000	0.000	0.000	0.000	0.000	0.000	15.77
																				15.90

LOCATION			DRAINAGE AREA							PIPE SELECTION											
AREA ID NUMBER	FROM M.H.	TO M.H.	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
L106A	106	105	76.81	104.19	122.14	178.56	0.0	0.0	55.4	75.5	300	300	CIRCULAR	PVC	-	0.50	68.0	**81.48%**	0.97	0.96	1.31
L108B	108A	108	76.81	104.19	122.14	178.56	0.0	0.0	22.7	17.3	200	200	CIRCULAR	PVC	-	1.00	33.3	**68.16%**	1.05	0.98	0.29
L108C, L108A	108	107	75.69	102.67	120.34	175.92	0.0	0.0	45.1	84.9	300	300	CIRCULAR	PVC	-	0.40	60.8	**74.21%**	0.86	0.83	1.70
L107A	107	105	69.90	94.71	110.98	162.16	0.0	0.0	93.6	36.1	450	450	CIRCULAR	CONCRETE	-	0.40	188.1	**49.75%**	1.15	0.98	0.61
L105C, L105A	105	104	68.05	92.17	107.98	157.76	0.0	0.0	172.5	85.0	525	525	CIRCULAR	CONCRETE	-	0.40	283.8	**60.78%**	1.27	1.15	1.23
	104	103	64.65	87.50	102.50	149.71	0.0	0.0	163.9	72.1	525	525	CIRCULAR	CONCRETE	-	0.40	283.8	**57.75%**	1.27	1.13	1.06
L103A	103A	103	76.81	104.19	122.14	178.56	0.0	0.0	18.9	16.1	200	200	CIRCULAR	PVC	-	1.00	33.3	**56.84%**	1.05	0.93	0.29
L103C, L103B	103	101	62.01	83.89	98.24	143.47	0.0	0.0	244.6	38.1	525	525	CIRCULAR	CONCRETE	-	0.40	283.8	**86.21%**	1.27	1.28	0.50
L102A, L102B	102	101	76.81	104.19	122.14	178.56	0.0	0.0	40.7	72.2	300	300	CIRCULAR	PVC	-	0.40	60.8	**67.01%**	0.86	0.81	1.49
L101A	101	100	60.85	82.30	96.38	140.73	0.0	0.0	303.9	30.2	600	600	CIRCULAR	CONCRETE	-	0.40	405.1	**75.02%**	1.39	1.34	0.37
	100	EX MH 109	60.01	81.15	95.03	138.75	0.0	0.0	299.7	10.4	750	750	CIRCULAR	CONCRETE	-	0.40	734.5	**40.81%**	1.61	1.30	0.13
											750	750									

Appendix E EXTERNAL REPORTS

E.1 DESIGN BRIEF (SITE SERVICING STUDY) FOR THE RIDGE (BRAZEAU LANDS) BY DSEL (JULY 2020)

120 Iber Road, Suite 103
Ottawa, Ontario K2S 1E9
Tel. (613)836-0856
Fax (613) 836-7183
www.DSEL.ca

DESIGN BRIEF

FOR

CAIVAN GREENBANK DEVELOPMENT CORPORATION

THE RIDGE (BRAZEAU LANDS)

3809 BORRISOKANE ROAD

CITY OF OTTAWA

PROJECT NO.: 18-1030
JULY 27TH , 2020
4TH SUBMISSION

DESIGN BRIEF
FOR
CAIVAN GREENBANK DEVELOPMENT CORPORATION

THE RIDGE (BRAZEAU LANDS)

PROJECT NO: 18-1030

TABLE OF CONTENTS

TABLES

APPENDICES

DESIGN BRIEF
FOR
CAIVAN GREENBANK DEVELOPMENT CORPORATION

THE RIDGE (BRAZEAU LANDS)

CITY OF OTTAWA
PROJECT NO: 18-1030

1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) has been retained to prepare the detailed design of the Brazeau Lands development area located at 3809 Borrisokane Road within the Barrhaven South Urban Expansion Area (***BSUEA***) on behalf of Caivan Greenbank Development Corporation (CGDC). This design brief is submitted in support of that development. The development is now being referred to as "The Ridge" Subdivision for marketing purposes.

The proposed development area is illustrated in ***Figure 1*** (see ***Appendix A***) and is located north of Barnsdale Road, east of Highway 416 (and Borrisokane Road), south of Cambrian Road and west of the future New Greenbank Road alignment. The current zoning is Mineral Extraction (ME) and is amended to permit low-rise residential uses. The western portion of the property is outside of the urban boundary and will remain at the current zoning while the eastern side (approximately 24.7 ha) is within the urban boundary and is to be rezoned as noted above. The development will also include a 0.91 ha block for a road connection to Borrisokane Road, a future 0.89 ha right-of-way (ROW) area within the Drummond Lands (also owned by CGDC) for servicing outlets, and a 3.94 ha pond block within the Drummond Lands that will service both properties. The lands are planned to be developed with a mix of detached single homes, townhomes, park blocks, SWM blocks, open space and a road network (see ***Figure 2*** for the lotted legal plan in ***Appendix A***).

This design brief is prepared to demonstrate conformance with the design criteria of the City of Ottawa, background studies, including the Master Servicing Study, and general industry practice.

1.1 Existing Conditions

The Ridge subdivision was previously an aggregate extraction pit operated in accordance with the Ontario Aggregate Resources Act and Regulations. Processes have been undertaken to remove this designation.

The property ground surface is significantly disturbed as a result of the mineral extraction activities that have occurred over the years with stockpiles of materials at various locations and elevations. The eastern portion of the site adjacent to the New Greenbank Road future alignment range in elevations from approximately 108.0m to 104.5m. On-site elevations vary due to the various stockpiles of materials but are general averaging about 99.0m. Drainage is generally conveyed westward towards Borrisokane Road which is owned by, and under the jurisdiction of, the Ministry of Transportation.

The property is within the Jock River watershed and is under the jurisdiction of the Rideau Valley Conservation Authority (RVCA).

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

The following studies were utilized in the preparation of this report.

- Ottawa Sewer Design Guidelines,
  City of Ottawa, *SDG002,* October 2012
  *(**Sewer Design Guidelines**)*
  - Technical Bulletin ISDTB-2014-01
    City of Ottawa, February 5, 2014
    (ITSB-2014-01)
  - Technical Bulletin PIEDTB-2016-01
    City of Ottawa, September 6, 2016
    (PIEDTB-2016-01)
  - Technical Bulletin ISTB-2018-01
    City of Ottawa, March 21, 2018
    (ISTB-2018-01)
  - Technical Bulletin ISTB-2018-04
    City of Ottawa, June 27, 2018
    (ISTB-2018-04)
- Ottawa Design Guidelines – Water Distribution
  City of Ottawa, July 2010.
  *(**Water Supply Guidelines**)*
  - Technical Bulletin ISD-2010-2
    City of Ottawa, December 15, 2010.
    (ISD-2010-2)
  - Technical Bulletin ISDTB-2014-2
    City of Ottawa, May 27, 2014.
    (ISDTB-2014-2)

  - Technical Bulletin ISTB-2018-02
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- Design Guidelines for Sewage Works,
  Ministry of the Environment, Conservation and Parks, 2008. (formerly MOECC)
  *(**MECP Design Guidelines**)*

- Highway Drainage Design Standards (MTO 2008)

- Drainage Management Manual (MTO 1997),
  Ministry of Transportation.
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- Stormwater Planning and Design Manual,
  Ministry of the Environment, March 2003.
  *(**SWMP Design Manual**)*

- City of Ottawa Official Plan,
  adopted by Council 2003.
  *(**Official Plan**)*

- South Nepean Collector: Phase 2 Hydraulics Review / Assessment Technical Memorandum
  Novatech, August 2015
  *(**Novatech SNC Memo**)*

- Master Servicing Study – Barrhaven South Urban Expansion Area, J.L. Richards & Associates Limited, Revision 2, May 2018
  *(**BSUEA MSS**)*

- Servicing Brief – Quinn's Pointe Residential Stages 2, 3 & 4, J.L. Richards & Associates Limited, Revision 1, October 2018 (File No. 26610-001.1)
  *(**Quinn's Pointe Brief**)*

- Stormwater Management Report for Brazeau Subdivision, by J.F. Sabourin and Associates (July 2020)
  *(**JFSA SWM Report**)*

- Pond Design Brief for Brazeau Subdivision, by J.F. Sabourin and Associates (July 2020)
  *(**JFSA Pond Report**)*

- Caivan Brazeau/Drummond Development – LID Design Update, by J.F. Sabourin and Associates (July 2020)
  *(**JFSA LID Analysis**)*

- Geotechnical Investigation, Proposed Residential Development, Brazeau Lands – Borrisokane Road, Paterson Group (January 2019)
  (***Geotechnical Report***)

- Groundwater Infiltration Review, Proposed Residential Development, Brazeau Pit and Drummonds Pit – Borrisokane Road, Paterson Group (August 2019)
  *(**Infiltration Review**)*

- Supplemental Hydrogeological Review, Proposed Residential Development, The Ridge – Borrisokane Road, Paterson Group (March 4, 2020)
  *(**Hydrogeological Review**)*

- Borrisokane Ditch Erosion Assessment: The Ridge (Brazeau) Subdivision, J.F. Sabourin and Associates Inc. (June 2020)
  (***JFSA Erosion Assessment***)

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The ***BSUEA MSS*** provided an overview of the existing watermain infrastructure associated with the BSUEA. The ***BSUEA MSS*** completed an overall assessment of the water supply for the area in order to examine the feasibility of the extension of existing infrastructure that would meet the required City and MECP criteria for the whole of the development area.

The 'Master Watermain" plan (Drawing MWM) from the ***BSUEA MSS*** is provided in ***Appendix B*** and illustrates the existing watermains in proximity to The Ridge development area. In addition, a conceptual watermain plan (Drawing CWM) from the preliminary Servicing Brief for Minto's Quinn's Pointe (Stages 2, 3 & 4) residential area is provided for reference. The proposed watermain servicing connections points for The Ridge development area are as follows:

- Existing 300mm diameter watermain terminating at Dundonald Drive and the future New Greenbank Road alignment;
- Proposed 300mm diameter watermain from the existing Cambrian Road 400mm diameter watermain forming part of the Tamarack Meadows development network located north of The Ridge and Drummond lands.

As adjacent developments to the east are advanced there will be a future required connection to the development from the existing 300mm diameter watermain on Kilbirnie Drive at Alex Polowin Avenue (or future extension location that is dependent upon the advancement of the Quinn's Pointe development).

3.2 Water Supply Servicing Design

The ***BSUEA MSS*** presents overall watermain infrastructure details for the BSUEA. The subject property was deemed serviceable and the ***MSS*** reviewed a number of servicing scenarios (i.e. existing and built-out conditions) that confirmed that the area could be adequately serviced conforming to relevant City and MECP Guidelines and Policies.

The water analysis contained in the ***BSUEA MSS*** utilized system level water demands as developed by the City due to the fact that the number of units and densities resulted in an overall population that would exceed 3,000. The excerpt of the system level demands listed in Table 7-1 of the ***MSS*** can be found in ***Appendix B*** and are summarized as follows:

Table 1A: Water Supply Design Criteria (System Level Demands)

Land Use Type	Consumption Rate
JLR BSUEA MSS, May 2018 for Population Exceeding 3000 Persons	
Single Family Residential	180 L/cap/day
Multi-unit Residential (Townhouse / Back to Back)	198 L/cap/day
Apartment Residential	219 L/cap/day
Commercial	50,000 L/ha/day
Institutional	50,000 L/ha/day
Outdoor Water Demand	1049 L/unit/day (single detached)

The estimated water demands within the ***BSUEA MSS*** were summarized in Table 7-2 (excerpt found in ***Appendix B***). The table summarized a total population of 1,194 for the Brazeau Lands development area along with some commercial and institutional components. Based on the current development concept the water demand table is refined to reflect a revised residential unit count and the removal of the commercial, institutional and high density components. Based on the development layout illustrated in ***Figure 2*** the development area will have 347 single family homes and 279 towns with associated populations of 1,180 and 754 respectively. The adjusted water demands for comparison purposes are summarized in the following table:

Table 1B: Estimated Water Demands - Brazeau Land Updates

Design Parameter	Area (ha)	Units	Pop.	ADD SFH [1]	ADD MLT [2]	ADD APT [3]	ADD COM [4]	ADD INS [5]	Total BSDY	OWD[6]	Total MXDY
From Table 7-2 of MSS	12.72	398	1194	1.56	0.87	0.17	0.39	0.85	3.84	2.67	6.51
Revised per Updated Development Plan (Residential Area)	23.83	626[7]	1934	2.45	1.73	0	0	0	4.18	4.21	8.39
		+228	+740						**+0.34**	+1.54	**+1.88**

1 Daily Demand, Single Family Homes, L/s (see Table 1A for Consumption Rate)
2 Average Daily Demand, Multi-Units (Townhouses and Back to Back Unit) L/s
3 Average Daily Demand, Apartment Units, L/s
4 Average Daily Demand, Commercial, L/s
5 Average Daily Demand, Institutional, L/s
6 Outdoor Water Demand, L/s, calculated as 1,049 L per SFH unit per day per MSS
7 Comprised of 347 Singles Family Homes and 279 Townhouses

With reference to Table 7-2, the overall Total BSDY increased by 0.34 L/s (to 19.00 L/s) which is a 1.8% increase over the previous 18.66 L/s. The total MXDY increases by 1.88 L/s which is a 5.9% increase over the previous 31.48 L/s.

The typical Water Supply Design Criteria used are as summarized in the following table:

Table 1C: Water Supply Design Criteria

Design Parameter	Value
Residential – Single Family	3.4 p/unit
Residential – Semi-Detached	2.7 p/unit
Residential – Townhome	2.7 p/unit
Residential – Average Daily Demand	350 L/p/day
Residential – Maximum Daily Demand	2.5 x Average Daily Demand
Residential – Maximum Hourly Demand	2.2 x Maximum Daily Demand
Residential – Minimum Hourly Demand	0.5 x Average Daily Demand
Commercial / Institutional Average Daily Demand	50,000 L/ha/day
Park Average Daily Demand	28,000 L/ha/day
Commercial / Institutional / Park Maximum Daily Demand	1.5 x Average Daily Demand
Commercial / Institutional / Park Maximum Hour Demand	1.8 x Maximum Daily Demand
Commercial / Institutional / Park Minimum Hourly Demand	0.5 x Average Daily Demand
Fire Flow	Calculated as per the Fire Underwriter's Survey 1999.
Minimum Watermain Size	150 mm diameter
Service Lateral Size	19 mm dia. Copper or equivalent
Minimum Depth of Cover	2.4 m from top of watermain to finished grade
Peak hourly demand operating pressure	275 kPa and 690 kPa
Fire flow operating pressure minimum	140 kPa
Extracted from Section 4: Ottawa Design Guidelines, Water Distribution (July 2010), ISDTB-2010-2	

A boundary condition request was submitted (provided in ***Appendix B*** for reference) in order to obtain water supply parameters for use in the hydraulic modelling assessment of the network. A hydraulic analysis was prepared for the water distribution network to confirm that water supply is available within the required pressure range, under the anticipated demand during average day, peak hour and fire flow conditions and was based on boundary conditions requested from the City of Ottawa. Refer to the *Hydraulic Capacity and Modeling Analysis, Brazeau Lands* prepared by *GeoAdvice Engineering Inc. dated June 10, 2020* ***(GeoAdvice Water Analysis)***, enclosed in ***Appendix B.***

The proposed water layout is shown in the general plan of services overview presented in ***Figures 3, 3A, 3B*** at the back of this report as well as in the GeoAdvice report figures. The Ridge development will initially require a minimum of two watermain feeds to the service the property. Based on the nearby existing infrastructure, and surrounding development plans, it is proposed that an extension of the existing Dundonald Drive 300mm watermain will provide service to the northeast portion of the property. In addition, the second proposed feed to service The Ridge will be through the Drummond Lands from the proposed 300mm watermain that is being advanced for the Tamarack Meadows development north of the property. Ultimately there will be future connections to Greenbank Road and Kilbirnie Drive (to the south) when those development areas are advanced.

3.3 Summary of Hydraulic Modeling Analysis

A complete watermain analysis has been prepared to confirm that the network is sized adequately, which is the greater of maximum day plus fire and maximum hour for both the Phase 1 and Phase 1&2 scenario. Refer to the ***GeoAdvice Report,*** enclosed in ***Appendix B.***

System Pressures

The modeling indicates that the development can be adequately serviced by the proposed watermain network. Modeled service pressures for the development are summarized in the following table. The detailed pipe and junction tables are contained in the ***GeoAdvice Report***, enclosed in ***Appendix B.***

Table 1D: Summary of Available System Pressures

	Minimum Hour Demand Maximum Pressure		Peak Hour Demand Minimum Pressure	
	kPA	psi	kPA	psi
Phase 1	538	78	290	42
Phases 1&2	538	78	262	38

The generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi) as outlined in the City of Ottawa Design Guidelines. Low pressures (slightly below 40 psi) are predicted in the south and southeast area of the site due to higher ground elevations. However, this is without considering provision of the future watermain connection from the Quinn's Pointe development area. Per Section 4.1 of the ***GeoAdvice Report***, this future additional connection (as required by the ***BSUEA MSS***) will provide an additional head of up to seven meters and resolve this low pressure condition. Should the availability of the additional watermain feed not be in place during the advancement of Phase 2 of The Ridge, it would be recommended that oversized service laterals be provided in order to compensate. For now, the current design drawings have demonstrated the requirement of a 25mm water service lateral in the areas that are slightly below the 40psi threshold.

3.4 Fire Flows – Fire Underwriters Survey

Fire Flow requirements are established in the boundary condition request found in ***Appendix B*** as prepared by GeoAdvice. Calculations for the single detached dwellings and traditional townhomes reached the City of Ottawa's cap of 10,000 L/min (167 L/s) as outlined in *ISDTB-2014-02*. At this time, there is not enough information available to calculate the required fire flows of the park so a required fire flow of 250 L/s was assumed, which is a typical requirement for similar land uses. The fire flows are calculated in accordance with the Fire Underwriters Survey's Water Supply for Public

Fire Protection Guideline (1999). Detailed FUS calculations can be found in the GeoAdvice reporting.

Available Fire Flows

The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire. A summary of the available fire flows is presented in the following table. The detailed fire flow reports are found in the ***GeoAdvice Report*** enclosed in ***Appendix B***.

1E: Summary of Available Fire Flows

	Required Fire Flow (L/s)	Minimum Available Flow (L/s)	Junction ID
Phase 1	167	177	J-45
	250	249	J-47
Phase 1 & 2	167	194	J-66
	250	269	J-47

As shown in the above table the model predicts the network will be able to provide all required fire flows within the development limits. Detailed results are included in the ***GeoAdvice Report***, enclosed in ***Appendix B***.

3.5 Water Supply Conclusion

The subject lands have been previously reviewed within the ***BSUEA MSS*** for the BSUEA development areas. The interim condition of The Ridge subdivision can be serviced by City of Ottawa infrastructure through the extension of the existing 300mm watermain from Dundonald Road from the east side of the property and a proposed connection north of the property, through the Drummond Lands, to a new 300mm watermain extension from Cambrian Road. In the interim condition for Phase 2 areas (i.e. only two feeds into the development area) there are pockets of low pressure (slightly below 40psi) areas along the southern boundary that are proposed to have 25mm water service laterals to compensate. Ultimately there will be additional connections to future watermains along Greenbank Road and Kilbirnie Drive (from the south as the Minto Quinn's Pointe development advances) that will alleviate the low pressure condition. See ***Figure WAT-1*** in ***Appendix B*** for the watermain network overview. These extensions are in accordance with the ***MSS*** projected infrastructure. The proposed water supply design conforms to all relevant City and MECP Guidelines and Policies.

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

Sanitary flows from the ***BSUEA*** were proposed to outlet to the existing 900mm diameter Greenbank Road sanitary trunk sewer. The existing South Nepean Collector (SNC) will provide the sanitary outlet for the entire Barrhaven South Community, which includes the BSUEA development area.

Trunk sanitary sewers exist north of the Brazeau Lands area and are located along Cambrian Road (see JLR's *Master Sanitary Drainage Area* plan 'MSAN' in ***Appendix C***). The outlet connection point to existing for the Brazeau Lands is as follows:

- Existing 500 mm / 600 mm / 750 mm diameter sanitary trunk running east on Cambrian Road then extending north along existing Greenbank Road and east to the South Nepean Collector (SNC). The current sewer termination is at the New Greenbank Road alignment.

As per the ***BSUEA MSS*** the subject property is tributary to the existing sanitary trunk sewer along Cambrian Road.

4.2 Wastewater Design

The subject property will be serviced by an internal gravity sanitary sewer system that will generally follow the local road network with select servicing easements and land crossing permissions as required to achieve efficiencies in servicing and grading designs. The wastewater layout can be found in the general plan of services overview presented in ***Figures 3, 3A and 3B*** at the back of this report. The sanitary drainage area plans and design sheets, along with background ***BSUEA MSS*** information, can all be found in ***Appendix C*** for reference.

The ***BSUEA MSS*** proposed that the wastewater outlet from the Brazeau Lands would tie into the off-site Cambrian Road trunk sewer at existing sanitary 'EX MH57A' via the Future Greenbank Road alignment and that is now the intent of The Ridge (Brazeau) design. The *Master Sanitary Drainage Area* plan 'MSAN' from the ***BSUEA MSS*** is provided in ***Appendix C*** for reference. Sanitary flows from the adjacent Drummond Lands were originally proposed to be conveyed to Cambrian Road (MA11 to MA10) through Tamarack's "The Meadows Phase 7 & 8" (***Meadows***) development area at 3640 Greenbank Road (D07-16-18-0011) in the ***BSUEA MSS***. Although there were prior concepts of bringing The Ridge sanitary flows through the Drummond/Tamarack properties, the current sanitary sewer alignments, that are in line with the ***BSUEA MSS,*** are proposed in order to minimize overall sewer depths and alleviate City concerns with alternate routing.

4.2.1 Brazeau (The Ridge) Lands

In the ***BSUEA MSS***, Table 6-3 (provided in ***Appendix C***) summarized the anticipated flows from the "Brazeau Aggregate Extraction Area" lands (i.e. The Ridge development). With the more detailed development concept, the site statistics are refined and the sanitary design sheet found in ***Appendix C*** more accurately reflects the anticipated sanitary flows. As per Section 3.2 of this report, the anticipated unit count for The Ridge is 347 single family homes and 279 townhouse units.
When applying the City of Ottawa wastewater design criteria the estimated peak sanitary flows from The Ridge and other areas tributary to the sewer network results in the following:

i) The Ridge residential area + 4.3 ha of Drummond lands (~31.06 L/s);
ii) Drummond Lands (direct to Greenbank Road (~20.29 L/s);
iii) Mattamy lands adjacent to Future Greenbank Road (residential area of 1.90 ha and commercial area of 2.99 ha) (~4.45 L/s);
iv) Future Brazeau commercial area (13.83 ha) west of the subdivision (~9.05 L/s)
v) Commercial area (ABIC) (~4.84 L/s)

For comparison to the ***MSS*** Table 6-3 values, criteria the estimated peak sanitary flows from The Ridge and Mattamy areas is approximately 49.38 L/s. This would be in comparison to the ***MSS*** sum of the 21.50 L/s (Brazeau Lands flow), 1.8 L/s Mattamy Commercial, and approximately 1.9 L/s Mattamy Residential. For comparison this would be 69.69 L/s versus the 25.2 L/s (i.e. +44.49 L/s) previously summarized in the JLR's Table 6-3.

Table 6-4 in the ***BSUEA MSS*** identified critical residual capacities in existing trunk sanitary sewers associated with the BSUEA area. Specifically, the Cambrian Road sewer is the outlet for the Brazeau Lands property and has a limiting pipe reach from existing MH13A to MH15A with a residual capacity of approximately 52.9 L/s. The additional 44.49 L/s of anticipated sanitary flows uses approximately ~84% of the residual capacity leaving 8.41 L/s. Review of the ***BSUEA MSS*** sanitary design sheet indicates that there are no other sanitary sewer constraints up to the SNC.

4.2.2 Greenbank Road Sewer Alignment

As noted, the sanitary outlet for The Ridge will be along the Future Greenbank Road EA alignment as per the ***BSUEA MSS***. As per JLR's *Master Sanitary Drainage Area* plan 'MSAN' in ***Appendix C*** this alignment is represented by the sewer run from MH900 to EXMH57A on Cambrian Road ranging in size from 250mm to 375mm. The proposed design has a 375mm sanitary (capacities of the design can be seen in the sewer design sheet). MH900 would equate to the MH402A proposed within The Ridge design. Per Section 6.3.1.2 the depth of the sewer at this location was estimated to have a cover depth of approximately 7.43m. Based on The Ridge detailed design, which has taken into consideration all of the site grading and sewer crossing constraints that result from detailed design, the proposed cover is 8.5m at MH402A per the profile drawing for this trunk sewer (See Drawing 61 in ***Appendix C***). The elevated EA road profile results in the greater depth of the sewer at this location. As the sewer progresses northward towards Cambrian Road the depth of cover is gradually reduced as the road profile drops down in elevation. The proposed sanitary sewer is set at either minimum slopes, to mitigate depth of cover, or at slopes to establish flow capacities that are approximately 75%-78% of the proposed sewer's capacity. See markups of the profile drawings in ***Appendix C*** for reference.

4.2.3 Wastewater Design Criteria

The following table summarizes the City design guidelines and criteria applied in the preliminary sanitary design information above and detailed in ***Appendix C***.

Table 2: Wastewater Design Criteria

Design Parameter	Value
Current Design Guidelines	
Residential - Single Family / Townhome	3.4 p/unit & 2.7 p/unit respectively
Residential – Apartment	1.8 p/unit
Average Daily Demand	280 L/d/person
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial / Institutional Flows	28,000 L/ha/day
Commercial / Institutional Peak Factor	1.5
Infiltration and Inflow Allowance	0.33 L/s/ha
Park Flows	28,000 L/ha/d
Park Peaking Factor	1.0
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} A R^{2/3} S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012, and recent residential subdivisions in City of Ottawa.	

4.3 Wastewater Servicing Conclusion

The subject property will be serviced by local sanitary sewers which will outlet to the Future Greenbank Road ROW alignment via new sanitary sewers. The sewer will connect to existing sewers along Cambrian Road as demonstrated in the ***BSUEA MSS*** at 'EX MH57A' per JLR's *Drawing **MSAN***. There is residual capacity in the downstream sewers providing sufficient capacity for the peak sanitary flows for the subject property.

5.0 STORMWATER CONVEYANCE

5.1 Existing Stormwater Drainage

The ***BSUEA*** is tributary to three sub-watersheds as depicted in the 'Figure 3-1' excerpt from the ***BSUEA MSS*** provided in ***Appendix D***. The Brazeau Lands are within the Jock River Subwatershed.

Due to the recent land use for mineral extraction the majority of the land area is lower than the surrounding topography. As identified in the ***BSUEA MSS***, the BSUEA *Existing Condition Report* identified that the original drainage pattern for the development area was northwards via overland flow paths with no defined channels. Per the existing topography characterized within available City of Ottawa base mapping, flows from the subject property will now be ultimately conveyed to the Jock River by storm systems (pipes and ditches as required) along Borrisokane Road.

5.2 Proposed Stormwater Management Strategy

The future flows from the land area are planned to meet the following criteria per the ***BSUEA MSS***:

- Meet the existing flow in the downstream system;
- Meet the quality control target of 80% TSS removal as per the Jock River Reach One Subwatershed Study (Stantec, 2007); and,
- Preserve pre-infiltration condition levels (Section 5.3.4 of ***BSUEA MSS***)

In order to provide drainage conveyance to a Borrisokane Road storm outlet, the site grading will be adjusted to convey flows westward. As noted in the ***BSUEA MSS***, the *Existing Conditions Report* for the BSUEA identified that the culvert downstream of the aggregate properties receives a pre-development flow of 1,300 L/s during the 1:100 year event (see Figure 3-1, and Tables 5-2 and 5-5 in ***Appendix D*** from the ECR noting the constrained culvert CVR-C1). Servicing of both The Ridge and Drummond properties have been developed such that the downstream pre-development flow is not exceeded. Any downstream systems should have sufficient capacity for the pre-development flow.

The ***BSUEA MSS*** conceptualized the following requirements for the development areas:

- The design of the storm drainage system has been undertaken using the dual-drainage approach. The ***BSUEA MSS*** sets out the design criteria for future draft plan and site plan applications for the BSUEA.

- Two (2) separate storm servicing solutions were developed; one conventional servicing strategy and one that incorporates the Etobicoke Exfiltration System (EES) or alternative, which was recommended (see ***BSUEA MSS*** Drawing MST-2 for details and Section 5.2.1 of this report for discussion).
- The downstream boundary conditions or flow criteria to achieve are developed in the ***BSUEA MSS*** and are used in the design constraints.
- Allowable minor system release rates were set at the required storm event and future design should maintain the same release rate criteria.
- Stormwater management facilities have been identified in the stormwater management solution for the aggregate extraction areas.

The stormwater management designs will consist of:

- A storm sewer system designed to capture at least the minimum design capture events required under PIETB-2016-01;
- One dry Stormwater Management (SWM) Pond designed to provide required quantity controls along with oil-grit separator (OGS) units that will provide an Enhanced Level of Protection [80% total suspended solids (TSS) removal] per MECP guidelines. The SWM pond will provide controls to levels which respect any downstream pre-development flows;
- An on-site road network designed to maximize the available storage in the on-site road network for the 100-year design event, where possible, with controlled release of stormwater to the minor storm system; and
- An overland flow route designed to safely convey stormwater runoff flows in excess of the on-site road storage.

5.2.1 Infiltration – Etobicoke Exfiltration System (EES)

Within the ***BSUEA MSS***, Section 5.4.4 discussed the recommendation of distributed infiltration for development areas. An analysis was carried out and summarized in the *Existing Conditions Report* which determined the various contributions of the water budget based on long-term simulation.

The section also notes that the overall pre-development infiltration from the ***BSUEA MSS*** area was determined but that the aggregate extraction areas were excluded in that determination. Ongoing investigations for both the Brazeau and Drummond properties have been completed and are summarized in the attached "*Groundwater Infiltration Review*" memorandum completed by Paterson Group (see ***Appendix D*** for reference). The memorandum summarizes the estimate infiltration rates that could be anticipated throughout the sites for various soil type conditions that were found during their investigations. These values were used during the detailed design determinations.

Section 5.5 of the ***BSUEA MSS*** discusses the various storm servicing strategies for the development areas. The section went through the various options to achieve the required infiltration targets with the preferred arrangement being the Etobicoke Exfiltration System (EES) Infiltration Strategy. Other alternatives were reviewed, however the EES system is the most suitable for the site and is proposed to be implemented in accordance with the City's preference.

A key point of note, as required by the ***MSS***, is that capture of stormwater by the exfiltration system has strategically located insofar as the system is to be installed on local roads (where required to achieve the required infiltration levels) where the surface runoff is less impacted by the City's winter road salting program. Therefore collector and arterial roads will have conventional storm sewer installations that will convey flows to a proposed downstream oil-grit-separator (OGS) units and end-of-line dry pond facility. JFSA has prepared their ***JFSA LID Analysis*** design memo to assess the infiltration volumes anticipated for the EES system proposed. See ***Appendix D*** for the analysis. A visual representation of the EES system and drainage capture areas can be seen in the *Figure 2* of the JFSA technical memorandum and can also be seen in the Storm Drainage Area plans.

As summarized in the JFSA analysis, there will be a total of 24 EES systems implemented within the development area in order to meet the infiltration requirements. The EES units will be installed underneath storm sewers within the ROW in specific areas determined as being suitable based on site constraints. Each system will consist of one or two 250 mm diameter perforated pipes surrounded by a 0.85 m deep by 1.20 m wide clear stone trench. Goss traps will be installed in upstream catchbasins in order to prevent/mitigate debris and potential oils from entering the perforated pipe system. Detail drawings of the proposed EES units provided in Figure 1 of the ***JFSA LID Analysis***. See ***Appendix D*** for the full summary of the design parameters for each EES in Tables A1 and A2 (pipe diameter, system lengths and volumes, inverts etc).

For protection measures of the EES system during construction see Section 7.1.

5.2.2 EES Temporary Monitoring

As per Section 5.5.1.8 of the ***BSUEA MSS*** there are requirements for temporary monitoring of the proposed infiltration system in order to assess and confirm that the EES operates as intended. The objectives of the monitoring will be to estimate the drawdown time of the EES (i.e. time for water levels to drop) to see if the infiltration values projected are in line with the results, and to determine the average rate of capture before runoff is conveyed by the traditional storm sewer system. The final locations and configuration will be coordinated with City staff through this detailed design process as it has been indicated that the City has vetted a "Smart Cover" arrangement through the advancement of the adjacent Minto development area.

Proposed monitoring locations have been circulated to the City and are identified in a markup of the *Figure 2* from the ***JFSA LID Analysis*** provided in ***Appendix D***. The City has concurred with the preliminary locations pending full acceptance of the EES design.

5.3 Post-Development Stormwater Management Targets

Stormwater management requirements for the proposed alternative Stormwater management scheme have been adopted from the ***Jock River SWS***, ***City Standards***, and the ***MECP SWMP Manual***.

Given the general criteria mentioned above, the following specific standards are expected to be required for stormwater management within the subject property:

- Enhanced quality treatment will be provided for stormwater runoff from the subject property, corresponding to a long-term average TSS removal efficiency of 80%, as defined by the MECP prescribed treatment levels;
- Downstream receiving drainage features, culverts, and sewers will be assessed for responses to planned stormwater management outflows, and infrastructure rehabilitation or capacity improvement measures will be planned, as required;
- Storm sewers on local roads are to be designed to provide at least a 2-year level of service without any ponding per the City's latest Technical Bulletin PIEDTB-2016-01;
- Storm sewers on collector roads are to be designed to provide at least a 5-year level of service without any ponding per the City's latest Technical Bulletin PIEDTB-2016-01;
- For less frequent storms (i.e. larger than 2-year or 5-year), the minor system sewer capture will be restricted with the use of inlet control devices to prevent excessive hydraulic surcharges;
- Under full flow conditions, the allowable velocity in storm sewers is to be no less than 0.80 m/s and no greater than 6.0 m/s;
- For the 100-year storm and for all roads, the maximum depth of water (static and/or dynamic) on streets, rear yards, public space and parking areas shall not exceed 0.35 m at the gutter;
- The major system shall be designed with sufficient capacity to allow the excess runoff of a 100-year storm to be conveyed within the public right-of-way ROW, or adjacent to the ROW, provided the water level does not touch any part of the building envelope; must remain below all building openings during the stress test event (100-year + 20%); and must maintain 15 cm vertical clearance between spill elevation on the street and the ground elevation at the nearest building envelope;

- Flow across road intersections shall not be permitted for minor storms (generally 5-year or less);
- When catchbasins are installed in rear yards, safe overland flow routes are to be provided to allow the release of excess flows from such areas. A minimum of 30 cm of vertical clearance is required between the rear yard spill elevation and the ground elevation at the adjacent building envelope; and
- The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m^2/s on all roads.

5.3.1 Quality Control

As per the ***Jock River SWS,*** Enhanced quality treatment will be provided for stormwater runoff from the subject property, corresponding to a long-term average Total Suspended Solid removal efficiency of 80%, as described by the MECP prescribed treatment levels. This will be achieved via the proposed EES system installations (where possible) and OGS unit(s) for all other areas. The location/details of the OGS units near the SWM pond inlet can be seen in '*Storm Drainage Plan'* Drawing No. 88 and SWM Pond Drawings No. 77/79 found in ***Appendix D***.

The ***BSUEA MSS*** reviewed the quality control aspects of the proposed EES installations. Section 5.5.1.3 of the ***MSS*** concludes that based on the EES sizing for the 22mm rainfall (i.e. 95^{th} percentile rainfall event) the storage requirements satisfies the requirements for water quality control per the MECP land uses and further downstream control measures would not be required.

5.3.1.1 EES Infiltration Targets

As a part of the ***BSUEA MSS*** it was determined that pre-development infiltration within the study area accounted for 40% of the overall site's water budget. The City and RVCA determined that pre-development infiltration levels should be maintained under post-development conditions and that the infiltration should be provided across the development and not simply concentrated to one or two locations.

The EES is intended to capture frequent storm events and the initial "first flush" of large storm events by trapping flow in the perforated pipe sub drain and surrounding media. It is also intended to infiltrate runoff from frequent events into the surrounding soils, while runoff from larger events will overtop the capacity of the EES system and would then overflow to the conventional storm sewer system above

As specified by the Master Servicing Study, the proposed development should infiltrate 40% of the annual runoff. As the hourly rainfall data used in this simulation does not extend the full year, the infiltration target for this analysis has been assumed to be 40% of the average simulated rainfall volume (552.0 mm), which is calculated to be 220.8mm or 59,744 m^3 based on the study area. See the ***JFSA LID Analysis*** for full details.

5.3.2 Quantity Control – Dry Pond

The ***BSUEA MSS*** currently shows a stormwater pond servicing scenario on each of The Ridge and Brazeau Lands outside of the urban development area (refer to attached '*Barrhaven South Urban Expansion Area – Master Storm Drainage Plan EES'*) drawing from the ***BSUEA MSS*** for illustration). However, this two pond concept was proposed in the ***BSUEA MSS*** due to the desire at that time in order to not have the two properties 'linked' and therefore they would not be dependent upon one another in order to advance development.

As noted in prior sections of this report, the two properties have now coordinated servicing strategies to the benefit of both properties, as well as the City, as follows (refer to the Storm Drainage Area Plan and Pond Plan in ***Appendix D***):

- The single pond option will be a dry facility with OGS units to treat stormwater requiring treatment. This is in line with the ***MSS***;
- If a pond was proposed within the Brazeau Lands location shown in the ***MSS***, it would have required a large box culvert outlet in order to convey emergency flow out to Borrisokane Road due to topography constraints. Based on an increase in elevation downstream of that outlet, the emergency flows could not be conveyed overland. With the single pond concept on the Drummond Lands, a box culvert would no longer be required due to the more suitable topography at the Drummond outlet and the associated availability of emergency relief;
- A single pond option keeps more infrastructure within the new development areas and minimizes infrastructure proposed within the Borrisokane Road right-of-way (ROW);
- In accordance with the City's typical preference, there will be a reduction in maintenance costs with one less facility to manage.

Similar to the changes associated with the sanitary outlet revision, the only impacted properties are those proponents that are directly benefitting from the changes and would be considered a Minor Change per Section 11.1.1 of the ***BSUEA MSS***.

As noted in the ***Jock River SWS***, quantity control is not required for the Jock River; however, based on past reports (***BSUEA MSS*** and Existing Condition Report), the limited capacity of the ditch infrastructure along Borrisokane Road will require that the stormwater management facility provide a storage volume for quantity control. Any infrastructure upgrades or adjustments relating to the Borrisokane Road ROW will require appropriate permits and approvals from the Ministry of Transportation until such time as the ongoing process for the transfer of the roadway to be under the jurisdiction of the City of Ottawa is completed.

5.3.2.1 Erosion Targets – Borrisokane Road ROW

As requested by City staff an erosion assessment has been completed for the Borrisokane Road ditch outlet. JFSA has prepared a technical memorandum under separate cover entitled "*Borrisokane Ditch Erosion Assessment: The Ridge (Brazeau) Subdivision*" (June 2020) which reviewed the pond outlet for the site (the west ditch of Borrisokane Road north of Cambrian Road). The study concluded that the critical erosion velocity of the receiver is approximately 1.2 m/s which was then converted to a critical discharge threshold using a 1D HEC-RAS model of the ditch which determined that the threshold ranges from 4.20 m^3/s to 7.9 m^3/s for the middle and lower reaches of the ditch. From JFSA's hydrologic modelling of the ditch, under proposed conditions, the peak flow is assessed at 3.82 m^3/s for the 100-year 24-hour SCS event which is lower than the existing threshold range determined.

5.4 Stormwater Management Design

As shown in the *Storm Drainage Area Plan*, the proposed stormwater management design consists of OGS units for quality control and an end-of-line dry SWM pond for quantity control prior to discharge along Borrisokane Road. The pond will be located within the portion of the Drummond quarry land that is between the future Drummond residential area to be developed (within the urban boundary) and Borrisokane Road. The facility will be sized to meet the required level of quantity control based on a restricted outflow of 1,300 L/s as noted in Section 5.2. See the ***JFSA Pond Report*** under separate cover for full details of the SWM pond design.

In accordance with the Paterson ***Hydrogeological Review*** (under separate cover) for the area of the pond, the bottom elevation has been set at an elevation of 96.00m and will be lined as required to mitigate the inflow of perched groundwater in the area due to seasonal conditions.

The SWM pond will outlet to the Borrisokane Road roadside ditch. It is proposed that there will be a new 900mm/1200mm storm sewer installation along Borrisokane Road which extends northward to the vicinity of Cambrian Road where it discharges to the western roadside ditch. The proposed alignment was submitted via the City's Municipal Consent process at the City's request. No significant concerns were raised with the proposal.

5.4.1 Borrisokane Road – Ministry of Transportation Requirements

Borrisokane Road, along the frontage of The Ridge development area and northwards to Cambrian Road, is currently owned by, and under the jurisdiction of, the Ministry of Transportation. As such, any proposed underground stormwater infrastructure or grading/landscaping will require permits to facilitate the design and implementation of those works until such time that the process underway to transfer jurisdiction to the City of Ottawa is complete. We are working directly with MTO for the required permitting.

Culverts:
For any stormwater flows outletting to any existing, or new, Borrisokane Road ROW culverts the stormwater management reporting will evaluate peak flow rates, velocities and headwater levels at pre- and post-development conditions for design and regulatory storms.

Ditches:
For any stormwater flows outletting to existing Borrisokane Road ROW ditches, the stormwater management reporting will evaluate peak flow rates, velocities and depth of flow at pre- and post-development conditions for design and regulatory storms.

Inlet Control Devices:
Insofar as the Ministry has indicated that they do not recognize any benefit from the attenuation of storm water runoff from inlet control devices. In the circumstance where on-site SWM measures do not operate as intended water from the pond will spill to the Borrisokane roadside ditch via a reinforced grassed emergency spillway as shown in the '*SWM Pond'* Drawing No. 76.

5.5 Proposed Minor System

The subject property will be serviced by an internal gravity storm sewer system that follows the local road network and servicing easements as required. The drainage is conveyed within the underground piped sewer system to the proposed SWM pond with select areas of local streets that will have the EES installed to achieve infiltration targets.

Street catchbasins will collect drainage from the streets and front yards, while rear yard catchbasins will capture drainage from backyards. Perforated catch basin leads will be provided in rear yards, to add to the infiltration network, except the last segment where it connects to the right-of-way which will be solid pipe, per City standards.

The preliminary rational method design of the minor system captures drainage for storm events up to and including the 2-year (local) and 5-year (collector) event assuming the use of inlet control devices (ICD) for all catchbasins within the subject property. The peak design flows are calculated based on an average predicted runoff coefficient (C-value) ranging from 0.71 to 0.54 for most of the development area (see storm design sheet in ***Appendix D*** for details. The storm system has also been sized to consider the potential for future commercial lands to the west where required.

The following table summarizes the standards that will be employed in the detailed design of the storm sewer network. The drainage area information can be found in the *Storm Drainage Plans* and rational method design sheets provided in ***Appendix D***.

Table 3: Storm Sewer Design Criteria

Design Parameter	Value
Minor System Design Return Period	1:2 yr (PIEDTB-2016-01) for local roads, without ponding 1:5 yr for collector roads, without ponding
Major System Design Return Period	1:100 year
Intensity Duration Frequency Curve (IDF) 2-year storm event: A=732.951 | B=6.199 | C=0.810 5-year storm event: A = 998.071 | B = 6.053 | C = 0.814	$i = \frac{A}{(t_c + B)^C}$
Minimum Time of Concentration	10 minutes
Rational Method	$Q = CiA$
Storm sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Runoff coefficient for paved and roof areas	0.9
Runoff coefficient for landscaped areas	0.2
Minimum Sewer Size	250 mm diameter
Minimum Manning's 'n' for pipe flow	0.013
Minimum Depth of Cover	1.5 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.8 m/s
Maximum Full Flowing Velocity	6.0 m/s
Clearance from 100-Year Hydraulic Grade Line to Building Opening	0.30 m
Max. Allowable Flow Depth on Municipal Roads	35 cm above gutter (PIEDTB-2016-01)
Extent of Major System	Contained within the ROW, or adjacent to the ROW, provided that the water level not touch any part of the building envelope and remains below the lowest building opening during the stress test event (100-year + 20%) and 15cm vertical clearance is maintained between spill elevation on the street and the ground elevation at the building envelope (PIEDTB-2016-01)
Stormwater Management Model	DDSWMM (release 2.1), SWMHYMO (v. 5.02)
Model Parameters	Fo = 76.2 mm/hr, Fc = 13.2 mm/hr, DCAY = 4.14/hr, D.Stor.Imp. = 1.57 mm, D.Stor.Per. = 4.67 mm
Imperviousness	Based on runoff coefficient (C) where Percent Imperviousness = (C - 0.2) / 0.7 x 100%.
Design Storms	Chicago 3-hour Design Storms and 24-hour SCS Type II Design Storms. Max. Intensity averaged over 10 minutes.
Historical Events	July 1st, 1979, August 4th, 1988 and August 8th, 1996
Climate Change Street Test	20% increase in the 100-year, 3-hour Chicago storm
Design Parameter	**Value**
Extracted from City of Ottawa Sewer Design Guidelines, October 2012, and ISSU,	

5.6 Quality Control (OGS Units)

Enhanced quality treatment for the development, corresponding to a long-term average Total Suspended Solid removal efficiency of 80%, will be achieved via the proposed EES system installations and two OGS unit(s). The location/details of the OGS units near the SWM pond inlet can be seen in '*Storm Drainage Plan'* Drawing No. 88 and SWM Pond Drawings No. 77/79 found in ***Appendix D*** along with the details of the OGS unit sizing provided by Contech. The units have been configured as off-line units to allow for the bypass of larger flows.

5.7 Hydraulic Grade Line Analysis

A detailed hydraulic grade line (HGL) modelling analysis has been completed for the proposed system based on the 100-year 3-hour Chicago, 12-hour SCS, and 24-hour SCS design storms, including historical design storms and climate change stress test as required. The HGL is provided in the plan and profile drawings for the subdivision and details of the modelling can be found in the ***JFSA SWM Report***.

5.8 Proposed Major System

Major system conveyance, or overland flow (OLF), is provided to accommodate flows in excess of the minor system capacity. OLF is accommodated by generally storing stormwater up to the 100-year design event in road sags then routing additional surface flow along the road network and service easements towards the proposed drainage features to the Jock River, as shown in the *Storm Drainage Plans*. Stormwater ultimately discharges to the Borrisokane Road ROW which will require appropriate permits and approvals from the Ministry of Transportation if the process to change the jurisdiction to the City of Ottawa does not occur.

5.9 Stormwater Servicing Conclusions

The stormwater runoff is designed to be captured by an internal gravity sewer system that is to convey flows to an end-of-line dry SWM pond facility and OGS units for the quality control treatment of stormwater flows that originate from collector and arterial roadways due to City salting procedures. An Enhanced Level of protection will be provided for stormwater runoff from the subject property before ultimately being discharged to the Jock River. Quantity control is not required for the Jock River, notwithstanding, some quantity control by on-site and SWM pond storage will be provided due to downstream infrastructure constraints.

Infiltration targets noted in the MSS will be achieved via the installation of the EES system within local ROWs which will also provide Enhanced Level quality control as detailed in the ***MSS***.

6.0 PROPOSED GRADING

The grading design includes a saw-toothed road design with varying road grades in order to maximize available surface storage for management of flows up to the 100-year design event where possible. The proposed site grading has also been developed to optimize earthworks and provide major system conveyance to the end-of-line facility which eventually outlets to the Borrisokane Road ROW and then to the Jock River. Roadway connections to the future New Greenbank Road will be coordinated with that future design based on the Environmental Assessment Study profile for that roadway. Reduced size grading plans are found in ***Appendix E*** in order to provide an overview context for the proposed grading.

The geotechnical review of the site makes note of the significant grade raises that will be found within the development area. No grade raise restrictions are indicated for the site. However, an extensive earthworks program is being undertaken which will be continuously monitored by the geotechnical consultant in order to ensure that appropriate fill material, placement, and compaction are provided throughout the property. The monitoring program is based on the detailed grading proposed and will ultimately be reviewed and signed off by a licensed Geotechnical Engineer. Any grading onto adjacent properties has been coordinated with adjacent landowners for permissions and retaining walls will be implemented where required.

7.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate and topography. The extent of erosions losses is exaggerated during construction where the vegetation has been removed and the top layer of soil is disturbed.

- Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.
- Limit extent of exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with plastic or synthetic mulches.
- Install silt fence to prevent sediment from entering existing ditches.
- No refueling or cleaning of equipment near existing watercourses.
- Provide sediment traps and basins during dewatering.
- Install filter cloth between catch basins and frames.
- Installation of mud mats at construction accesses.

7.1 EES Protection During Construction

From the *Low Impact Development Stormwater Management Planning and Design Guide* prepared by CVC and TRCA (ver 1.0, 2010):

- Prior to site works, the location of LIDs should be marked and vehicles are to avoid the area other than during the installation of the LID. Drainage not to be directed to the LID;
- To minimize siltation in the newly installed EES system, both the upstream and downstream ends of the EES system should be plugged immediately during the construction phase. The upstream plug is to be removed at approximately an occupancy of 80% similar to the Quinn's Pointe development;
- Upland drainage areas need to be properly stabilized with vegetation as soon as possible in order to reduce sediment loads;
- The facility should be excavated to design dimensions from the side using a backhoe or excavator. The base of the facility should be level or match the slope of the above storm sewer;
- The bottom of the facility should be scarified to improve infiltration; and
- Geotextile fabric should be correctly installed to optimize system function. When laying the geotextile, the width should include sufficient material to compensate for perimeter irregularities in the facility and a 150mm minimum top overlap.

8.0 CONCLUSION AND RECOMMENDATIONS

This report provides details on the planned on-site municipal services for the subject property and demonstrates that adequate municipal infrastructure capacity for the planned development of the subject property:

- The subject lands have been reviewed by the ***BSUEA MSS*** and has shown that water supply to the property can be provided. An analysis completed by GeoAdvice also documents the water supply network and results. The network will be expanded through neighboring properties to enhance/meet the water demands of the proposed development as adjacent properties are also developed.

- Sanitary service is to be provided to the subject property via connection to the sanitary sewer located along Cambrian Road through the Future Greenbank Road ROW as per the ***MSS***. With the inclusion of the subject property, the existing downstream sewers have sufficient capacity to accommodate the subject property's proposed sanitary flows.

- Stormwater service is to be provided by capturing stormwater runoff via an internal gravity sewer system that will convey flows to a proposed end-of-line dry SWM pond facility for quantity control. Quality control will be provided for arterial and collector roadway (and select local roadway) drainage via the use of OGS units to an Enhanced Level of protection (80% TSS removal) prior to discharge to the SWM Pond. Quality control for local streets will be provided via the proposed Etobicoke Exfiltration System as documented in the ***MSS***, as well as within the OGS units downstream. Quantity control is not required for the Jock River, however, some quantity control by on-site and SWM pond storage will be provided due to downstream infrastructure constraints. An erosion threshold assessment has been completed by JFSA for the Borrisokane Road west side ditch north of Cambrian Road (pond outlet) and has confirmed that the projected flows are lower than the threshold determined.

- As suggested in the ***BSUEA MSS*** the infiltration will be achieved via use of the preferred EES system. The JFSA reporting demonstrates that the required infiltration targets are met.

- Erosion and sediment control measures will be implemented and maintained throughout construction.

- The design of The Ridge has been completed in general conformance with the City of Ottawa Design Guidelines and criteria presented in other background study documents.

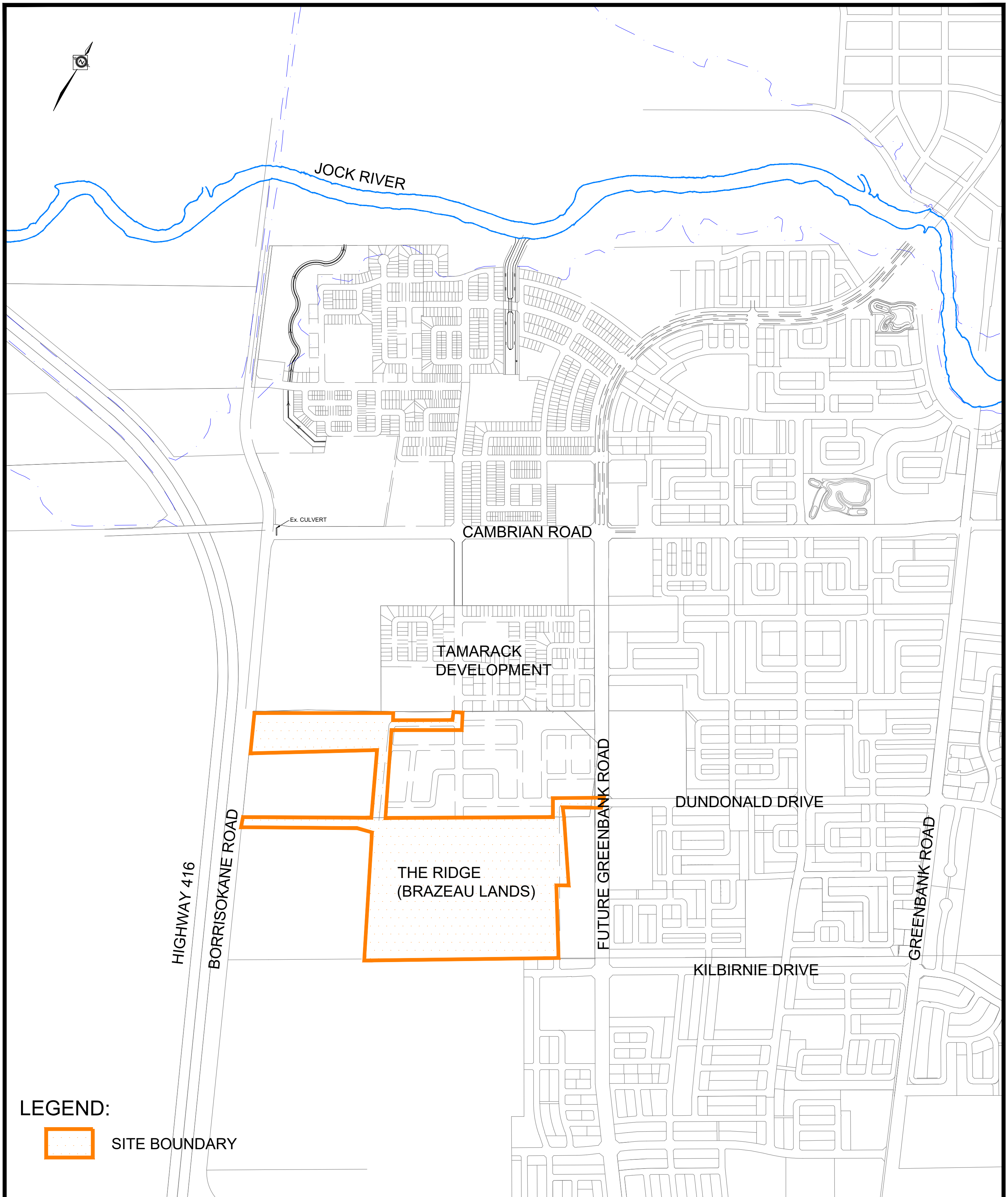
Prepared by,
David Schaeffer Engineering Ltd.

LICENSED PROFESSIONAL ENGINEER
K.L. MURPHY
90475369
July 28/20
PROVINCE OF ONTARIO

Per: Kevin L. Murphy, P.Eng.

2020-07-27_Brazeau_Servicing_Subm4.doc

APPENDIX A



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CAIVAN COMMUNITIES
THE RIDGE (BRAZEAU LANDS)

KEY PLAN

CITY OF OTTAWA

DATE:	SEPT 2019
SCALE:	1:15,000
PROJECT No.:	18-1030
FIGURE:	1

APPROVED UNDER SECTION 51 OF THE PLANNING ACT
BY THE CITY OF OTTAWA THIS ___ DAY OF ________, 2020

STEPHEN WILLIS, MCIP, RPP
GENERAL MANAGER
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT
DEPARTMENT, CITY OF OTTAWA

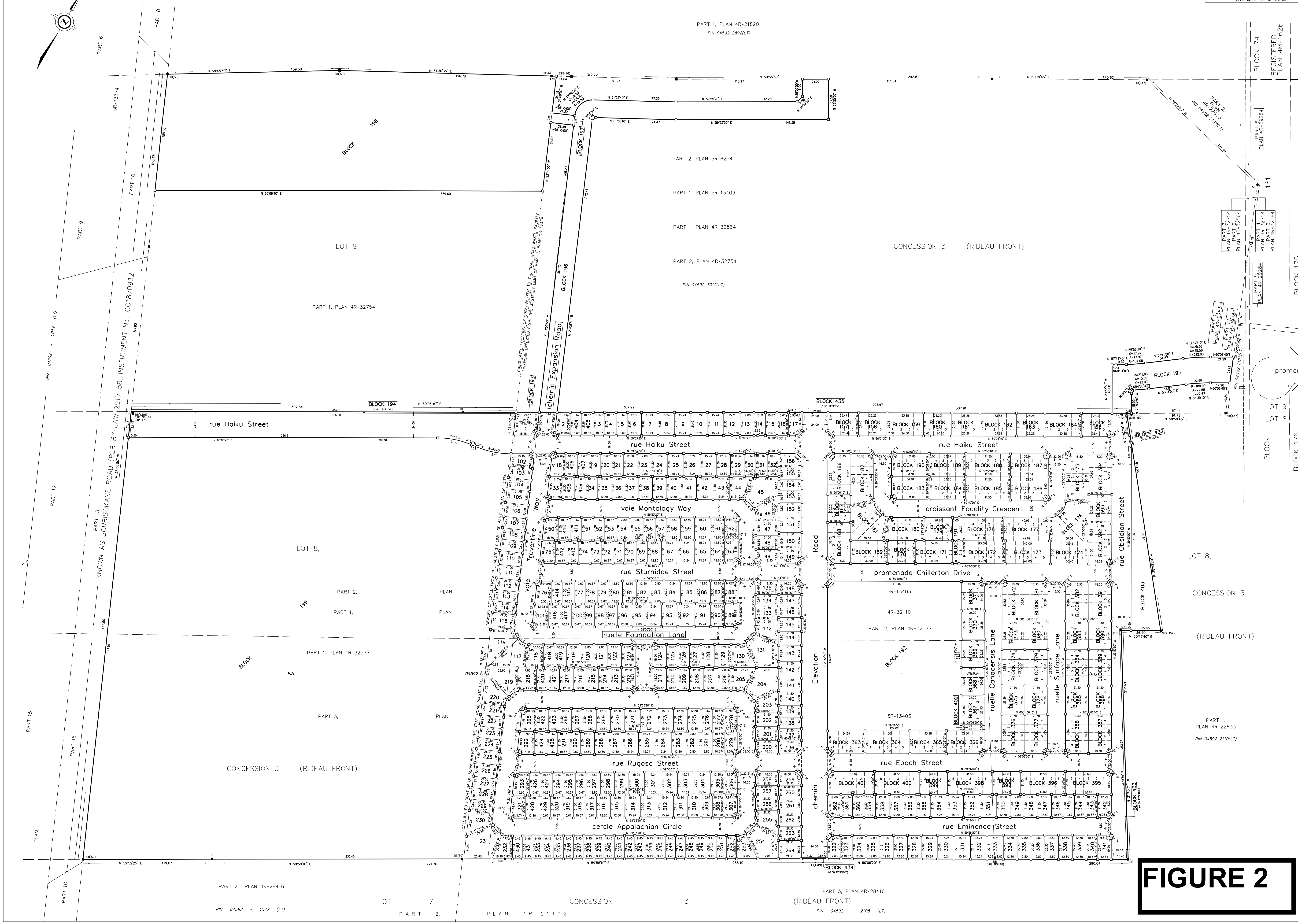

FIGURE 2

PLAN 4M-

I CERTIFY THAT THIS PLAN IS REGISTERED IN THE LAND REGISTRY OFFICE FOR THE LAND TITLES DIVISION OF OTTAWA-CARLETON (No. 4) AT__________ O'CLOCK ON THE_____DAY OF____________, 2020 AND ENTERED IN THE PARCEL REGISTER FOR PROPERTY IDENTIFIER ________________

AND THE REQUIRED CONSENTS ARE REGISTERED AS PLAN DOCUMENT No.________________

LAND REGISTRAR

THIS PLAN COMPRISES ALL OF PIN 04592-2993(LT)

PLAN OF SUBDIVISION OF
PART OF LOT 8 AND PART OF LOT 9 CONCESSION 3 (RIDEAU FRONT)
GEOGRAPHIC TOWNSHIP OF NEPEAN
NOW IN THE
CITY OF OTTAWA

SCALE 1 : 1000

J.D. BARNES LIMITED

METRIC DISTANCES AND/OR COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

CURVE TABLE

LOT/BLOCK	RADIUS	ARC	CHORD	BEARING
44	16.50	5.84	5.81	N70°02′00″E
45	16.50	11.78	11.53	N79°22′30″W
46	16.50	8.36	8.27	N44°24′40″W
115	16.50	2.89	2.89	N28°20′30″W
116	16.50	10.96	10.76	N52°24′00″W
117	16.50	11.04	10.84	N89°23′30″E
118	16.50	2.97	2.97	N65°03′20″E
130	16.50	7.07	7.01	N47°37′20″E
131	16.50	11.75	11.51	N14°57′00″E
132	16.50	7.04	6.98	N17°40′30″W
BLOCK 175	16.50	1.04	1.04	N28°05′50″W
BLOCK 176	16.50	24.25	22.13	N15°48′40″E
BLOCK 177	16.50	0.90	0.90	N59°28′30″E
BLOCK 180	16.50	2.99	2.99	N65°22′00″E
BLOCK 181	16.50	20.06	18.85	N74°36′20″W
BLOCK 182	16.50	2.84	2.84	N34°50′00″W
BLOCK 195	211.06	13.09	13.09	N54°58′00″E
BLOCK 195	188.00	22.68	22.67	N56°39′10″E
BLOCK 195	212.00	25.58	25.56	N56°39′10″E
BLOCK 195	187.06	17.97	17.97	N55°56′30″E
BLOCK 196	16.50	24.35	22.20	N19°06′50″E
BLOCK 199	82.00	32.81	32.59	N71°17′50″E
BLOCK 199	82.00	32.41	32.20	N71°26′00″E
203	16.50	6.83	6.78	N41°45′20″W
204	16.50	12.07	11.80	N74°34′00″W
205	16.50	7.08	7.03	N72°11′10″E
218	16.50	2.37	2.37	N55°46′20″E
219	16.50	11.37	11.15	N31°54′50″E
220	16.50	9.59	9.46	N4°29′00″W
221	16.50	0.63	0.63	N22°13′50″W
230	16.50	8.47	8.38	N38°01′20″W
231	16.50	12.23	11.96	N73°58′00″W
232	16.50	7.17	7.12	N72°20′30″E
253	16.50	7.48	7.42	N46°53′50″E
254	16.50	11.49	11.26	N13°57′40″E
255	16.50	6.89	6.84	N17°56′20″W

NOTES

BEARINGS ARE MTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B, BY REAL TIME NETWORK (RTK) OBSERVATIONS, MTM ZONE 9, NAD83 (ORIGINAL) (2010.0).

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999934.

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORPs): MTM ZONE 9, NAD83 (ORIGINAL).

COORDINATES TO URBAN ACCURACY PER SECTION 14 (2) OF O.REG 216/10.

POINT ID	EASTING	NORTHING
ORP (A)	363 233.75	5 013 711.83
ORP (B)	363 636.22	5 013 943.52

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

LEGEND

■	DENOTES	SURVEY MONUMENT FOUND
□	DENOTES	SURVEY MONUMENT SET
SIB	DENOTES	STANDARD IRON BAR
SSIB	DENOTES	SHORT STANDARD IRON BAR
IB	DENOTES	IRON BAR
PB	DENOTES	PLASTIC BAR
WIT	DENOTES	WITNESS
MEAS	DENOTES	MEASURED
JDB	DENOTES	J.D. BARNES LIMITED

OWNER'S CERTIFICATE - PLAN OF SUBDIVISION

THIS IS TO CERTIFY THAT:

1. LOTS 1 TO 156 BOTH INCLUSIVE, BLOCKS 157 TO 193, INCLUSIVE, BLOCKS 195 TO 199 INCLUSIVE, LOTS 200 TO 362 BOTH INCLUSIVE, BLOCKS 363 TO 403 BOTH INCLUSIVE, LOTS 404 TO 431 BOTH INCLUSIVE, THE STREETS NAMELY: chemin Elevation Road, rue Obsidian Street, promenade Chillerton Drive, rue Sturnidae Street, voie Montology Way, voie Travertine Way, ruelle Foundation Lane, cercle Appalachian Circle, rue Rugosa Street, rue Haiku Street, croissant Focality Crescent, ruelle Canadensis Lane, ruelle Surface Lane, rue Epoch Street, rue Eminence Street AND chemin Expansion Road, AND THE 0.3m RESERVE NAMELY: BLOCK 194, AND BLOCKS 432 TO 436 BOTH INCLUSIVE, HAVE BEEN LAID OUT IN ACCORDANCE WITH OUR INSTRUCTIONS.
2. THE STREETS AND LANES ARE HEREBY DEDICATED TO THE CORPORATION OF THE CITY OF OTTAWA.

DATED THIS __________DAY OF__________2020

BRAZEAU DEVELOPMENT CORPORATION

FRANK CAIRO
President

"I HAVE THE AUTHORITY TO BIND THE CORPORATION"

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ARE CORRECTLY SHOWN.

DATE

PRELIMINARY
C.M. FOX
ONTARIO LAND SURVEYOR

J.D.BARNES LIMITED — SURVEYING, MAPPING, GIS
LAND INFORMATION SPECIALISTS
2430 DON REID DRIVE, SUITE 204, OTTAWA, ON K1H 1E1
T: (613) 731-7244 F: (613) 731-8955 www.jdbarnes.com

DRAWN BY: NS	CHECKED BY: XX	REFERENCE NO.: 18-10-145-00
		DATED: 4/6/2020

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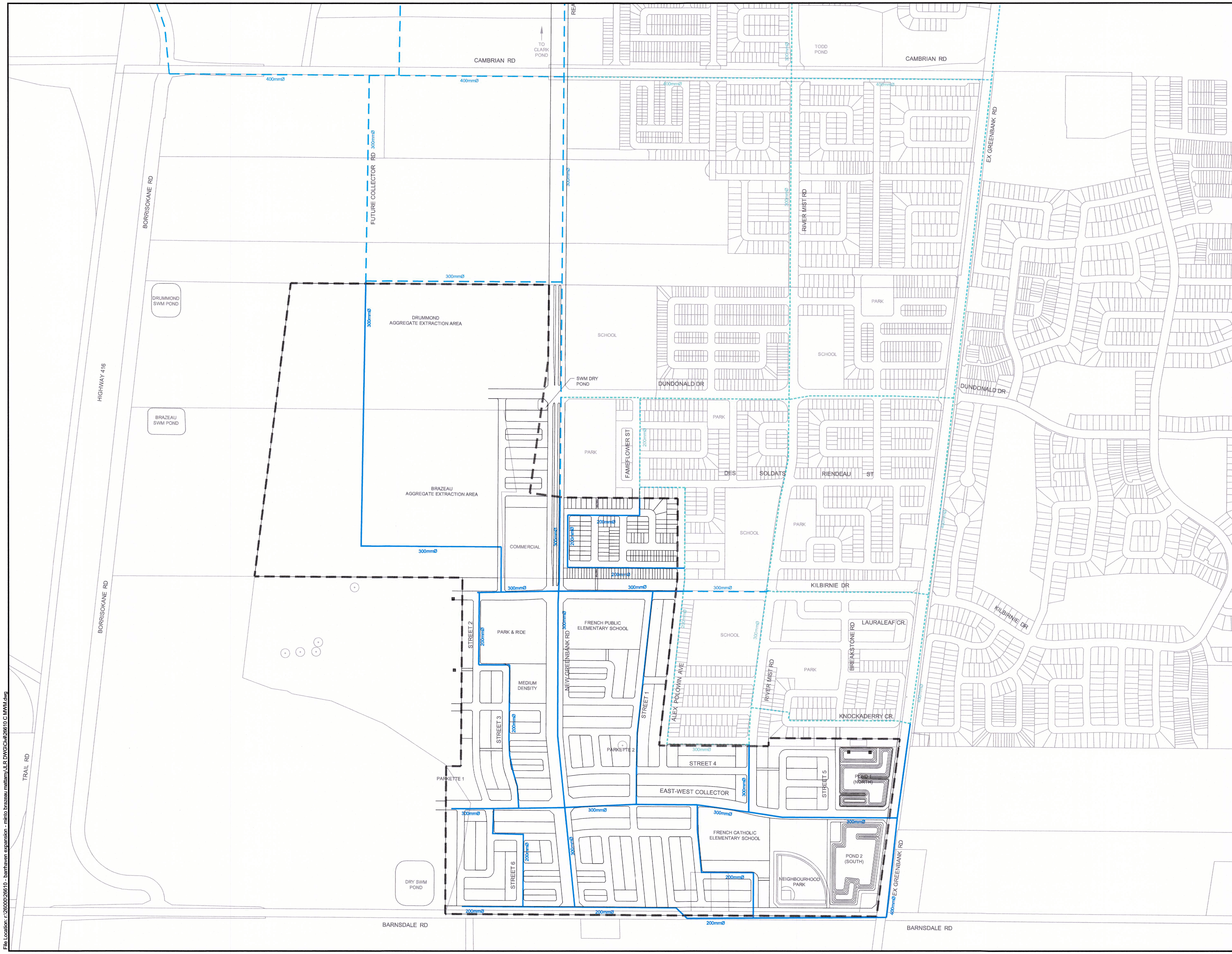
APPENDIX B



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LEGEND

- PROPOSED WATERMAIN, PER 2018 BSUEA MSS
- FUTURE WATERMAIN PER 2014 BS MSS
- EXISTING WATERMAIN
- LIMIT OF STUDY AREA FOR BSUEA

No.	ISSUE / REVISION	DD/MM/YY
4	ISSUED FOR PLANNING COMMITTEE APPROVAL	04/05/18
3	ADDRESS COMMENTS, RE-ISSUE BSUEA MSS 2ND SUBMISSION	26/02/18
2	ISSUED AS PART OF DRAFT MSS	20/09/17
1	ISSUED FOR PRE-TAC WORKING MEETING	31/08/17

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:4000

CLIENT:

CONSULTANT: www.jlrichards.ca

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP: LICENSED PROFESSIONAL ENGINEER M. H. L. DALRYMPLE May 4/18 PROVINCE OF ONTARIO

PROJECT NORTH

PROJECT:

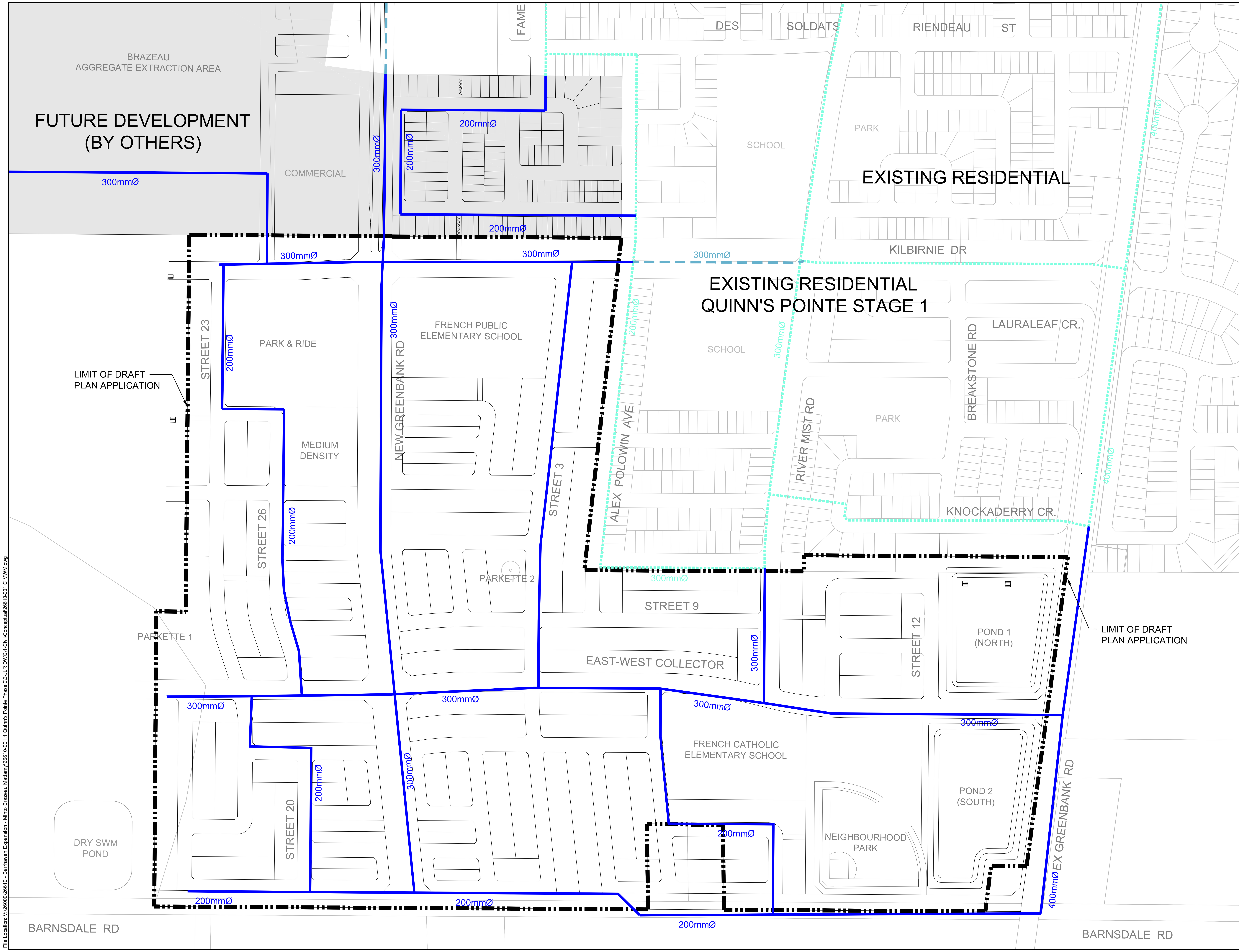
BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

DRAWING:

MASTER WATERMAIN

DESIGN:	JW
DRAWN:	CJM
CHECKED:	LD
JLR #:	26610
DRAWING #:	MWM

PLOT DATE: May 4, 2018 8:43:40 AM



KEY PLAN

QUINN'S POINTE STAGES 2, 3 & 4

LEGEND

- PROPOSED WATERMAIN, PER 2018 BSUEA MSS
- FUTURE WATERMAIN PER 2014 BS MSS
- EXISTING WATERMAIN
- LIMIT OF STUDY AREA FOR BSUEA

No.	ISSUE / REVISION	DD/MM/YY
2	ISSUED FOR SERVICING BRIEF - 2nd SUBMISSION	12/09/18
1	ISSUED WITH SERVICING BRIEF - 1st SUBMISSION	07/08/18

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:2000

CLIENT:

CONSULTANT: www.jlrichards.ca

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP

PROJECT NORTH

PROJECT: MINTO COMMUNITIES INC. QUINN'S POINTE STAGES 2, 3 & 4

DRAWING: BSUEA CONCEPTUAL WATERMAIN

DESIGN: AT
DRAWN: CJM
CHECKED: LD
JLR #: 26610-001.1

DRAWING #: CWM

- Feedermains, which have been provided primarily for the purpose of redundancy, shall meet, at a minimum, the basic day plus fire flow demand.

In addition to the above targets, servicing should be carried out to minimize dead-ends.

7.2.2 Domestic Water Demand

The water demands presented in this section are based on the same unit and population estimates as per the wastewater servicing flows described in Section 6.2.1, which reflects the CDP unit count. The zone/system level criteria for water demands are based on land use type and are in Table 7-1 below. The water demand criteria are consistent with those used in Stantec's Revised Potable Water Servicing Analysis (October 19, 2016). Calculations are summarized below.

Basic Day (BSDY) demands are calculated from the system level water demands for residential, commercial and institutional land uses. Maximum Day (MXDY) demands are calculated by adding an Outdoor Water Demand (OWD) also shown in Table 7-1 below. Peak hour demands result from applying the 72-hour diurnal patterns developed by the City to each type of MXDY demand. The 72-hour diurnal patterns are unique to each type of land use to reflect the different use patterns. The maximum hourly demand observed within the 72-hour patterns is the Peak Hour (PKHR) demand.

The review of the Demonstration Plan (Figure 4-2) has revealed that the number of units and associated densities will result in an overall population that will exceed 3,000. As a result, the water supply analysis presented herein is to be conducted using system level water demands as developed by the City. These system level demands are summarized in Table 7-2.

Table 7-1: Theoretical Water Consumption Rate

Land Use Type	Consumption Rate	Units
Single Family Residential	180	L/cap/day
Multi-unit Residential (Townhouse / Back to Back)	198	
Apartment Residential	219	
Commercial	50,000	L/ha/day
Institutional	50,000	
Outside Water Demand	1,049	L/SFH/day

The above system level demands were applied to each of the blocks depicted on the Demonstration Plan. As previously noted, the Brazeau and Drummond aggregate properties have now been accounted as residential usage. It was assumed that residential densities for both properties would be consistent with those for the BSUEA. Based on this exercise, overall water demands of 18.66 L/s and 31.48 L/s were calculated for the basic day (BSDY) and maximum day

(MXDY), respectively. It should be noted that MXDY of 31.48 L/s includes an outside water usage of 10.15 L/s.

Table 7-2: Estimated Water Demands

Land Use	Area (ha)	Units	Pop.	ADD SFH[4]	ADD MLT[5]	ADD APT[6]	ADD COM[7]	ADD INS[8]	Total BSDY	OWD[9]	Total MXDY
Minto and Mattamy Lands											
Schools	4.55							2.63	2.63		2.63
Commercial	2.13						1.23		1.23		1.23
Medium-Low Density Residential	32.90	1080	3378	4.68	2.60				7.27	8.01	15.29
High Density Residential	0.90	120	216			0.55			0.55		0.55
Total	**40.48**	**1200**	**3594**	**4.68**	**2.60**	**0.55**	**1.23**	**2.63**	**11.69**	**8.01**	**19.71**
Brazeau Aggregate Extraction Area											
Schools	1.47							0.85	0.85		0.85
Commercial	0.67						0.39		0.39		0.39
Medium-Low Density Residential	10.30	360	1126	1.56	0.87				2.42	2.67	5.10
High Density Residential	0.28	38	68			0.17			0.17		0.17
Total	**12.72**	**398**	**1194**	**1.56**	**0.87**	**0.17**	**0.39**	**0.85**	**3.84**		**6.51**
Drummond Aggregate Extraction Area											
Schools	1.25							0.72	0.72		0.72
Commercial	0.57						0.33		0.33		0.33

[4] Daily Demand, Single Family Homes, L/s
[5] Average Daily Demand, Multi-Units (Townhouses and Back to Back Unit) L/s
[6] Average Daily Demand, Apartment Units, L/s
[7] Average Daily Demand, Commercial, L/s
[8] Average Daily Demand, Institutional, L/s

Medium-Low Density Residential	8.72	288	900	1.25	0.69				1.94	2.14	4.07
High Density Residential	0.24	32	58			0.15			0.15		0.15
Total	**10.78**	**320**	**958**	**1.25**	**0.69**	**0.15**	**0.33**	**0.72**	**3.14**	**2.14**	**5.28**
Barrhaven South Urban Expansion Area Totals											
Total	**63.98**	**1918**	**5746**	**7.48**	**4.16**	**0.87**	**1.95**	**4.21**	**18.66**	**10.15**	**31.48**

7.2.3 Watermain Sizing and Roughness

The overall watermain layout for the BSUEA is shown on Drawing MWM. Watermain roughness coefficients were determined using the friction factors presented in Section 4.2.12 of the Design Guidelines and summarized in Table 7-3 below. The internal pipe diameters were modelled based on Section 4.3.5 of the Design Guidelines, as summarized in Table 7-4 below.

Table 7-3: Watermain Roughness Coefficients

Watermain Diameter	C-Factor
150 mm	100
200 to 250 mm	110
300 to 600 mm	120
Over 600 mm	130

Table 7-4: PVC Watermain Internal Diameters

Nominal Diameter	Inside Diameter
150 mm	155 mm
200 mm	204 mm
300 mm	297 mm
400 mm	393 mm

7.2.4 Fire Flow

The City standard in regard to fire protection is the Fire Underwriters Survey and Technical Bulletin ISDTB-2014-02. To evaluate the proposed water distribution system, a fire flow of 13,000 L/min (217 L/s) was used in this system level analysis in accordance with the recommendations of the 2013 Water Master Plan.

September 16, 2019

Sent by email: KMurphy@dsel.ca

David Schaeffer Engineering Ltd.
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

Attention: **Mr. Kevin Murphy, P.Eng.**
Senior Client Manager

Re: Water Distribution Network Boundary Condition Request
Brazeau Land Development
GeoAdvice Project ID: 2019-091-DSE

Dear Mr. Murphy,

In order to carry out the watermain analysis and hydraulic modeling for the Brazeau Land Development in the City of Ottawa, we request the hydraulic boundary conditions (HGL) for the proposed connection points as shown on the attached schematic. Flow conditions are outlined in the attached consumer water demand calculations.

Boundary conditions at the Connection Points 1 and 2 are required for the following demand conditions:

- **Phase 1 (Includes The Meadows Phases 7/8 demands)**
  - Minimum hour demand = 5.23 L/s
  - Average day demand = 10.45 L/s
  - Maximum day demand = 23.56 L/s
  - Maximum day demand + fire flow
    - 167 L/s fire flow = 190.56 L/s
    - 250 L/s fire flow = 273.56 L/s
  - Peak hour demand = 50.30 L/s

- **Phase 1 + 2 (Includes The Meadows Phases 7/8 demands)**
  - Minimum hour demand = 7.05 L/s
  - Average day demand = 14.10 L/s
  - Maximum day demand = 32.69 L/s
  - Maximum day demand + fire flow
    - 167 L/s fire flow = 199.69 L/s
    - 250 L/s fire flow = 282.69 L/s
  - Peak hour demand = 70.37 L/s

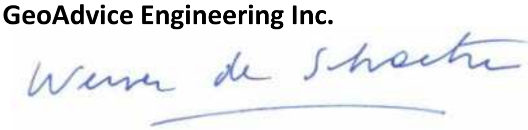
Please note the following:

- Demands from the Meadows Phases 7/8 are included in the above demand conditions. The inclusion of these demands is required due to the location of Connection 1. It is recommended that these demands only be applied to Connection 1. No other development demands were included (e.g. Drummond and Minto).
- The Phase 1 and 2 demands and fire flows should be applied equally between Connection Points 1 and 2.
- The attached FUS calculations have been completed in accordance with the latest City of Ottawa Technical Bulletin ISTB-2018-02 and ISDTB-2014-02 4.2.
- For the traditional townhomes not complying with the conditions of City of Ottawa Technical Bulletin ISDTB-2014-02 4.2 (Blocks 384 and 168), additional FUS calculations were completed, resulting in required fire flows of 167 L/s for each block.

If you have any questions, please do not hesitate to contact me.

Yours truly,

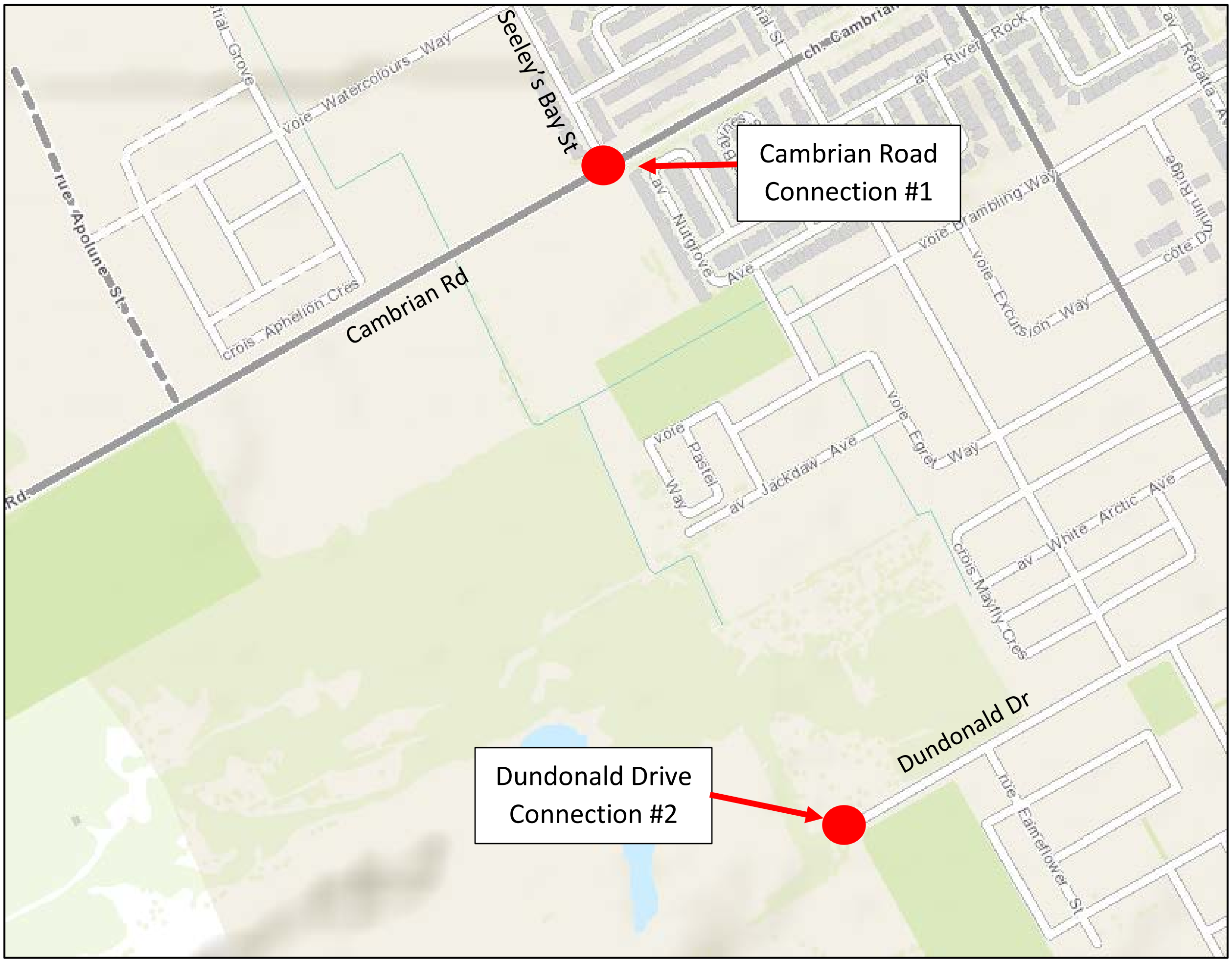
GeoAdvice Engineering Inc.



Werner de Schaetzen, Ph.D., P.Eng.
President and Chief Executive Officer
werner@geoadvice.com
GeoAdvice Engineering Inc.

Attachments: Mark up for connection locations, demand calculations and FUS Fire Flow Calculations

Connection Locations



Consumer Water Demands

Phase 1 Residential Demands

Dwelling Type	Number of Units	Population **		Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 2.2 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)				
Single Detached	162	3.4	551	350	192,850	2.23	5.58	167*	12.28	1.12
Traditional Townhome	133	2.7	360		126,000	1.46	3.65	167*	8.02	0.73
Subtotal	**295**		**911**		**318,850**	**3.69**	**9.23**		**20.30**	**1.85**

Phase 1 + 2 Residential Demands

Dwelling Type	Number of Units	Population **		Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 2.2 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)				
Single Detached	311	3.4	1,058	350	370,300	4.29	10.71	167*	23.57	2.14
Traditional Townhome	279	2.7	754		263,900	3.05	7.64	167*	16.80	1.53
Subtotal	**590**		**1,812**		**634,200**	**7.34**	**18.35**		**40.37**	**3.67**

Phase 1 Non Residential Demands

Property Type	Area (ha)		Average Day Demand			Max Day 1.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 1.8 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
			** (L/ha/d)	(L/d)	(L/s)				
Park	1.72		28,000	48,160	0.56	0.84	250**	1.51	0.28
Subtotal	**1.72**			**48,160**	**0.56**	**0.84**		**1.51**	**0.28**

The Meadows Phases 7/8		**ADD**	**MDD**	**PHD**	**MHD**
Total Demand:		**6.20**	**13.50**	**28.50**	**3.10**

		ADD	**MDD**	**PHD**	**MHD**
Without the Meadows Phases 7/8 Demands	Phase 1	**4.25**	**10.06**	**21.80**	**2.12**
	Phase 1 + 2	**7.90**	**19.19**	**41.88**	**3.95**
With the Meadows Phases 7/8 Demands	Phase 1	**10.45**	**23.56**	**50.30**	**5.23**
	Phase 1 + 2	**14.10**	**32.69**	**70.37**	**7.05**

*Based on FUS fire flow calculation

**Assumed based on similar information from previously completed projects, as agreed upon with DSEL

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands — Blocks 300-313, Single Detached
Zoning: Multi Family Residential
Date: September 16, 2019

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 1927 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The single detached dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 14 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 3854 m^2 (Combined area of 14 units)

The total floor area in m^2 in the building being considered

F = 20,486 L/min **D = 20,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-3,000 L/min** — **E = 17,000 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 17,000 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
East	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
North	10.1 to 20 m	Over 120 m-storeys	Wood Frame or Non-Combustible	15%
South	20.1 to 30 m	Over 120 m-storeys	Wood Frame or Non-Combustible	10%
			Total	**41%**

% of **E** — **+ 6,970 L/min** — **G = 23,970 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 23,970 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.1. The single detached dwellings comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	3,854
Required Fire Flow (L/min)	20,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	8%
East (%)	8%
South (%)	15%
West (%)	10%
Total Exposure (%)	41%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands Blocks 173, Traditional Townhouse
Zoning: Multi Family Residential
Date: September 16, 2019

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 474 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 5 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 947 m^2 (Combined area of 5 units)

The total floor area in m^2 in the building being considered

F = 10,156 L/min **D = 10,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** **-1,500 L/min** **E = 8,500 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** **0 L/min** **F = 8,500 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
East	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
North	10.1 to 20 m	61-90 m-storeys	Wood Frame or Non-Combustible	14%
South	20.1 to 30 m	31-60 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**56%**

% of **E** **+ 4,760 L/min** **G = 13,260 L/min**

H. Wood Shake Charge — No — **0 L/min** **H = 13,260 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	947
Required Fire Flow (L/min)	10,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	17%
East (%)	17%
South (%)	14%
West (%)	8%
Total Exposure (%)	56%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands
Zoning: Multi Family Residential — Blocks 384, Traditional Townhouse
Date: September 16, 2019

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

GeoADVICE

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 380 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 4 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 760 m^2 (Combined area of 4 units)

The total floor area in m^2 in the building being considered

F = 9,095 L/min — **D = 9,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,350 L/min** — **E = 7,650 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 7,650 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
East	Beyond 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	0%
North	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
South	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**37%**

% of **E** — **+ 2,831 L/min** — **G = 10,481 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 10,481 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings **do not** comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	760
Required Fire Flow (L/min)	9,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	12%
East (%)	0%
South (%)	17%
West (%)	8%
Total Exposure (%)	37%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands
Zoning: Multi Family Residential — Blocks 168, Traditional Townhouse
Date: September 16, 2019

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 380 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 4 units is considered in this calculation.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 760 m^2 (Combined area of 4 units)

The total floor area in m^2 in the building being considered

F = 9,095 L/min — **D = 9,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,350 L/min** — **E = 7,650 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 7,650 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	30.1 to 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	5%
East	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
North	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
South	Beyond 45 m	31-60 m-storeys	Wood Frame or Non-Combustible	0%
			Total	**34%**

% of **E** — **+ 2,601 L/min** — **G = 10,251 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 10,251 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings **do not** comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	760
Required Fire Flow (L/min)	9,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	5%
East (%)	12%
South (%)	17%
West (%)	0%
Total Exposure (%)	34%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

Hydraulic Capacity and Modeling Analysis Brazeau Lands

Final Report

Prepared for:
David Schaeffer Engineering Ltd.
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

Prepared by:
GeoAdvice Engineering Inc.
Unit 203, 2502 St. John's Street
Port Moody, BC V3H 2B4

Submission Date: July 28, 2020

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Project: 2019-091-DSE

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	November 7, 2019	Draft	Ben Loewen	Werner de Schaetzen
R1	December 20, 2019	Final	Ben Loewen	Werner de Schaetzen
R2	June 10, 2020	Updated Draft	Ferdinand de Schoutheete	Werner de Schaetzen
R3	July 28, 2020	Final	Ferdinand de Schoutheete	Werner de Schaetzen

Statement of Qualifications and Limitations
This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

Contents

1 Introduction

GeoAdvice Engineering Inc. (“GeoAdvice”) was retained by David Schaeffer Engineering Ltd. (“DSEL”) to size the proposed water main network for the Brazeau Lands development (“Development”) in the City of Ottawa, ON (“City”).

Under existing conditions, the development will be serviced by the Barrhaven pressure zone; however, in the future, it will be serviced by pressure zone 3C.

There are 347 single detached dwellings, 279 traditional townhomes and 1 park serviced as part of the development.

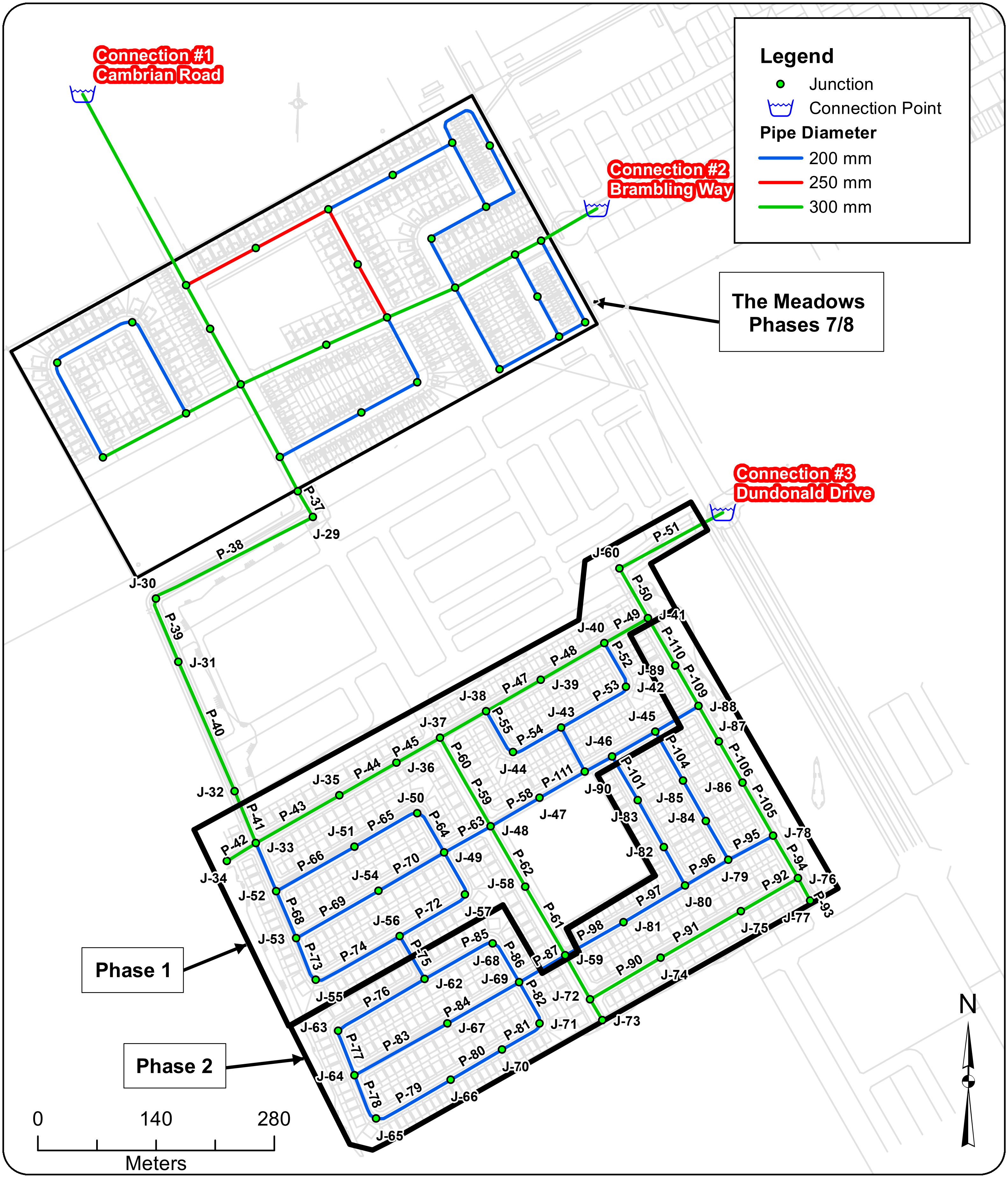
The Brazeau Lands development will have three (3) connections to the City water distribution system:

- Connection 1: Apolune Street and Cambrian Road;
- Connection 2: Jackdaw Avenue and Future Greenbank Road; and
- Connection 3: Dundonald Drive and Future Greenbank Road.

The development site is shown in **Figure 1.1** on the following page, with the final recommended pipe diameters.

This report describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze), a GIS water distribution system modeling and management software application.

The results presented in this memo are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.



![GeoAdvice logo] GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

Brazeau Lands Site Layout and Connection Points

Figure 1.1

2 Modeling Considerations

2.1 Water Main Configuration

The water main network was modeled based on the drawing prepared by DSEL (1030_Gen_Rev4.dwg) and provided to GeoAdvice on June 2nd, 2020.

2.2 Elevations

Elevations of the modeled junctions were assigned according to a site grading plan prepared by DSEL (1030_Grad_Rev4.dwg) and provided to GeoAdvice on June 2nd, 2020.

2.3 Consumer Demands

Demand factors used for this analysis were taken according to the City of Ottawa 2010 Design Guidelines *Table 4.2 Consumption Rate for Subdivisions of 501 to 3,000 Persons*. Population densities were assigned according to *Table 4.1 Per Unit Populations* from the City of Ottawa Design Guidelines. A summary of these tables highlighting relevant data for this development is shown in **Table 2.1** below.

Table 2.1: City of Ottawa Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	350	L/c/d
Park	28,000	L/ha/d
Maximum Daily Demand		
Residential	2.5 x avg. day	L/c/d
Park	1.5 x avg. day	L/ha/d
Peak Hour Demand		
Residential	2.2 x max. day	L/c/d
Park	1.8 x max. day	L/ha/d
Minimum Hour Demand		
Residential	0.5 x avg. day	L/c/d
Park	0.5 x avg. day	L/ha/d

Table 2.2 and **Table 2.4** summarize the residential water demand calculations for the Brazeau Lands development.

Table 2.2: Development Population and Demand Calculations – Phase 1

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	172	3.4	585	2.37	5.92	13.03	1.18
Traditional Townhome	133	2.7	360	1.46	3.65	8.02	0.73

***City of Ottawa Design Guidelines**

Table 2.3: Development Population and Demand Calculations – Phases 1&2

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	347	3.4	1,180	4.78	11.95	26.29	2.39
Traditional Townhome	279	2.7	754	3.05	7.64	16.80	1.53

***City of Ottawa Design Guidelines**

Table 2.6 summarizes the non-residential water demand calculations for the Brazeau Lands development (included in both Phase 1 and Phases 1&2).

Table 2.4: Non-Residential Demand Calculations

Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Park	1.72	0.56	0.84	1.51	0.28

Table 2.5 summarizes the demands for the Meadows Phases 7/8 subdivision development located north of the Brazeau Lands and downstream of Connections 1 and 2 (accounted for in the HGLs provided by the City in the boundary conditions request).

Table 2.5: The Meadows Phases 7/8

Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
6.20	13.50	28.50	3.10

Demands were grouped into demand polygons then uniformly distributed to the model nodes located within each polygon. Detailed calculations of demands as well as the illustrated allocation areas are shown in **Appendix A**.

2.4 Fire Flow Demand

Fire flow calculations were completed for all dwelling types in accordance with the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999) and City of Ottawa Technical Bulletin ISTB-2018-02 as summarized in **Appendix B**.

All the single detached dwellings have a minimum separation of 10 m between the backs of adjacent units and are, therefore, subject to the 10,000 L/min (167 L/s) cap outlined in City of Ottawa Technical Bulletin ISDTB-2014-02.

Most of the traditional townhouse dwellings comply with the City of Ottawa Technical Bulletin ISDTB-2014-02 and are, therefore, subject to the 10,000 L/min (167 L/s) cap.

The traditional townhouse dwellings located on Blocks 168 and 384 do not have a minimum separation of 10 m between the backs of adjacent units and therefore do not comply with the provisions under the City of Ottawa Technical Bulletin ISDTB-2014-02. The required fire flow for those blocks were calculated to be 167 L/s based on the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999). The agreement of this calculation with the City of Ottawa cap of 167 L/s is purely coincidental.

At this time, there is not enough information available to calculate the required fire flow of the park. As such, a required fire flow of 250 L/s was assumed for the park. This is a typical, conservative value for similar land use.

Fire flow simulations were completed at each model node in the Brazeau development. The locations of nodes do not necessarily represent hydrant locations.

Detailed FUS fire flow calculations as well as the illustrated spatial allocation of the required fire flows are shown in **Appendix B**.

2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Apolune Street and Cambrian Road;
- Connection 2: Jackdaw Avenue and Future Greenbank Road; and
- Connection 3: Dundonald Drive and Future Greenbank Road.

The above connection points are illustrated in **Figure 1.1**.

Boundary conditions were provided for Peak Hour, Maximum Day plus Fire and Minimum Hour (high pressure check) conditions.

Under existing conditions, the Brazeau Lands development will be serviced by the Barrhaven pressure zone; however, in the future, it will be serviced by pressure zone 3C. As such, boundary conditions were provided under the existing and future pressure zone configurations.

In total, two (2) sets of boundary conditions were provided by the City and can be found in **Appendix C**.

The boundary conditions for the existing pressure zone configuration are more conservative. As such, the results presented in this report are based on the boundary conditions for the existing pressure zone configuration.

Table 2.6 summarizes the boundary conditions used to size the Brazeau Lands water network.

Table 2.6: Existing Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)
Min Hour (max. pressure)	156.4	156.4	156.4
Peak Hour (min. pressure)	135.7	135.6	135.7
Max Day + Fire Flow (167 L/s)	144.0	141.2	142.0
Max Day + Fire Flow (250 L/s)	135.4	129.9	131.5

3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Table 3.1: Model Pipe Characteristics

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
200	204	110
250	250	110
300	297	120

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2.**

Table 3.2: Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-

4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for minimum hour, peak hour and maximum day plus fire flow using InfoWater. Only the existing pressure zone configuration was analyzed, since the boundary conditions are more conservative.

Detailed pipe and junction model input data can be found in **Appendix D**.

4.1 Development Pressure Analysis

Modeled service pressures for the development are summarized in **Table 4.1** below.

Table 4.1: Summary of the Brazeau Lands Available Service Pressures

Phase	Minimum Hour Demand Maximum Pressure	Peak Hour Demand Minimum Pressure
Phase 1	538 kPa (78 psi)	290 kPa (42 psi)
Phases 1&2	538 kPa (78 psi)	**262 kPa (38 psi)**

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi).

Low pressures are predicted at junctions J-66, J-70, J-71, J-72, J-73, J-74, J-75, J-76 and J-77 under peak hour demand. Those low pressures are due to high elevations in the southern part of the Brazeau Lands development and are within 5% of the minimum allowable pressure of 276 kPa (40 psi). The future Zone 3C boundary conditions will provide an additional head of about seven (7) meters at each connection point, and will thus resolve the low PHD pressures at the southern part of the Brazeau Lands development.

Detailed pipe and junction result tables and maps can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

A summary of the minimum available fire flows in the Brazeau Lands development is shown below in **Table 4.2**.

Table 4.2: Summary of the Brazeau Lands Minimum Available Fire Flows

Phase	Required Fire Flow	Minimum Available Flow	Junction ID
Phase 1	167 L/s	177 L/s	J-45
	250 L/s	249 L/s	J-47
Phases 1&2	167 L/s	194 L/s	J-66
	250 L/s	269 L/s	J-47

As shown in the table above, the available fire flow is greater than the required fire flow under both Phase 1 and Phases 1&2 conditions.

A summary of the residual pressures in the Brazeau Lands is shown below in **Table 4.3**. The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

Table 4.3: Summary of the Brazeau Lands Residual Pressures (MDD + FF)

Phase	Maximum Residual Pressure	Average Residual Pressure	Minimum Residual Pressure
Phase 1	365 kPa (53 psi)	296 kPa (43 psi)	140 kPa (20 psi)
Phases 1&2	365 kPa (53 psi)	296 kPa (43 psi)	159 kPa (23 psi)

There is sufficient residual pressure at all the junctions within the Brazeau Lands development.

Detailed fire flow results and figures illustrating the fire flow results can be found in **Appendix F**.

5 Other Servicing Considerations

5.1 Water Supply Security

The City of Ottawa Design Guidelines allow single feed systems for developments up to a total average day demand of 50 m^3/day and require two (2) feeds if the development exceeds 50 m^3/day for supply security, according to Technical Bulletin ISDTB-2014-02.

The Brazeau Lands services a total average day demand of 725 m^3/day; as such, two (2) feeds are required.

5.2 Valves

No comment has been made in this technical memorandum with respect to exact placement of isolation valves within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for number, location, and spacing of isolation valves:

- Tee intersection – two (2) valves
- Cross intersection – three (3) valves
- Valves shall be located 2 m away from the intersection
- 300 m spacing for 150 mm to 400 mm diameter valves
- Gate valves for 100 mm to 300 mm diameter mains
- Butterfly valves for 400 mm and larger diameter mains

Drain valves are not strictly required under the City of Ottawa Design Guidelines for water mains under 600 mm in diameter. The Guidelines indicate that "small diameter water mains shall be drained through hydrant via pumping if needed."

Air valves are not strictly required under the City of Ottawa Design Guidelines for water mains up to and including 400 mm in diameter. The Guidelines indicate that air removal "can be accomplished by the strategic positioning of hydrant at the high points to remove the air or by installing or utilizing available 50 mm chlorination nozzles in 300 mm and 400 mm chambers."

The detailed engineering drawings for the Brazeau Lands are expected to identify valves in accordance with the requirements noted above.

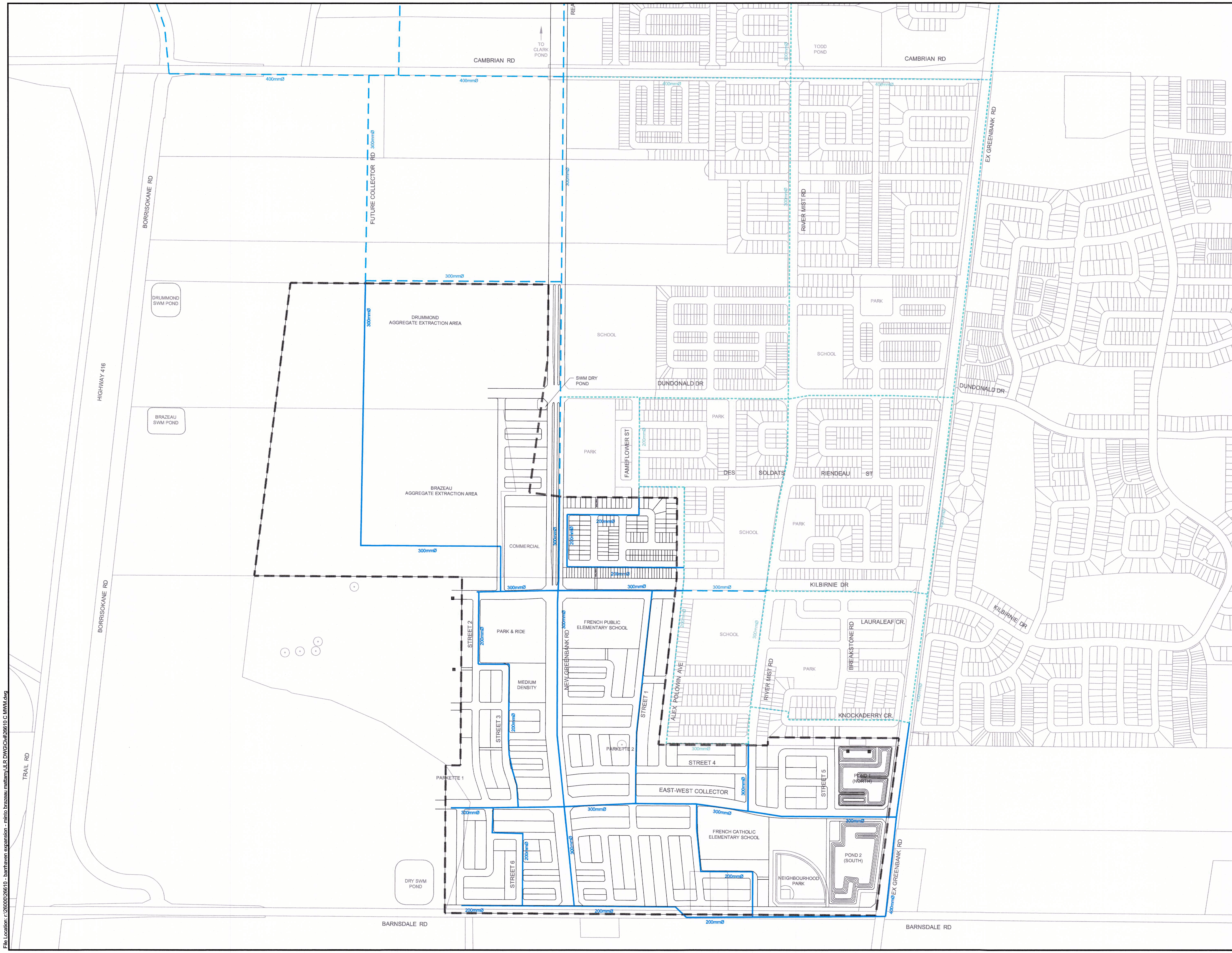
5.3 Hydrants

No comment has been made in this technical memorandum with respect to exact placement of hydrants within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for maximum hydrant spacing:

- 125 m for single family unit residential areas on lots where frontage at the street line is 15 m or longer
- 110 m for single family unit residential areas on lots where frontage at the street line is less than 15 m and for residential areas zoned for row housing, doubles or duplexes
- 90 m for institutional, commercial, industrial, apartments and high-density areas

The detailed engineering drawings for the Brazeau Lands development are expected to identify hydrants in accordance with the requirements noted above.

APPENDIX B



LEGEND

- PROPOSED WATERMAIN, PER 2018 BSUEA MSS
- FUTURE WATERMAIN PER 2014 BS MSS
- EXISTING WATERMAIN
- LIMIT OF STUDY AREA FOR BSUEA

No.	ISSUE / REVISION	DD/MM/YY
4	ISSUED FOR PLANNING COMMITTEE APPROVAL	04/05/18
3	ADDRESS COMMENTS, RE-ISSUE BSUEA MSS 2ND SUBMISSION	26/02/18
2	ISSUED AS PART OF DRAFT MSS	20/09/17
1	ISSUED FOR PRE-TAC WORKING MEETING	31/08/17

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:4000

CLIENT:

CONSULTANT: www.jlrichards.ca

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP: LICENSED PROFESSIONAL ENGINEER M. H. L. DALRYMPLE May 4/18 PROVINCE OF ONTARIO

PROJECT NORTH

PROJECT:

BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

-

DRAWING:

MASTER WATERMAIN

DESIGN: JW

DRAWN: CJM

CHECKED: LD

JLR #: 26610

DRAWING #: MWM

PLOT DATE: May 4, 2018 8:43:40 AM

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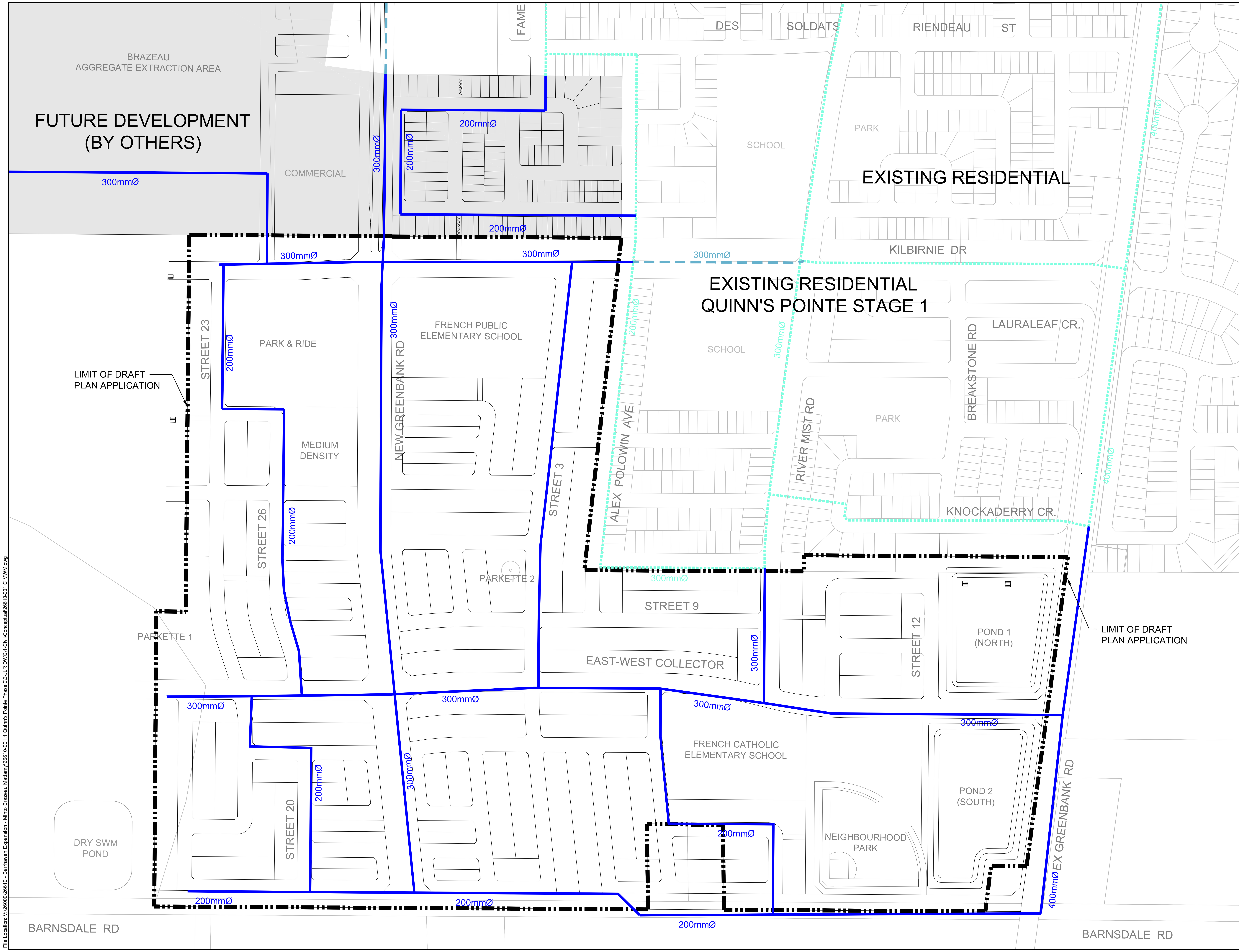
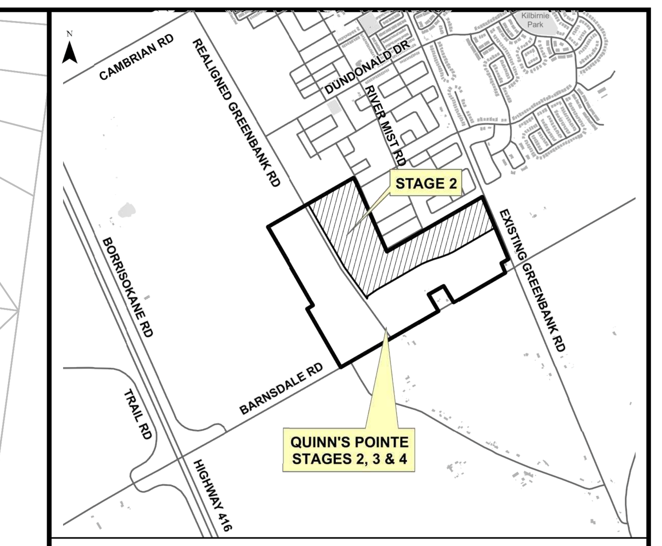




KEY PLAN

LEGEND

- PROPOSED WATERMAIN, PER 2018 BSUEA MSS
- FUTURE WATERMAIN PER 2014 BS MSS
- EXISTING WATERMAIN
- LIMIT OF STUDY AREA FOR BSUEA

No.	ISSUE / REVISION	DD/MM/YY
2	ISSUED FOR SERVICING BRIEF - 2nd SUBMISSION	12/09/18
1	ISSUED WITH SERVICING BRIEF - 1st SUBMISSION	07/08/18

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:2000

CLIENT:

CONSULTANT: www.jlrichards.ca

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP

PROJECT NORTH

PROJECT:

MINTO COMMUNITIES INC.
QUINN'S POINTE STAGES 2, 3 & 4

DRAWING:

BSUEA
CONCEPTUAL WATERMAIN

DESIGN: AT
DRAWN: CJM
CHECKED: LD
JLR #: 26610-001.1

DRAWING #: CWM

PLOT DATE: September 13, 2018 9:22:03 AM

- Feedermains, which have been provided primarily for the purpose of redundancy, shall meet, at a minimum, the basic day plus fire flow demand.

In addition to the above targets, servicing should be carried out to minimize dead-ends.

7.2.2 Domestic Water Demand

The water demands presented in this section are based on the same unit and population estimates as per the wastewater servicing flows described in Section 6.2.1, which reflects the CDP unit count. The zone/system level criteria for water demands are based on land use type and are in Table 7-1 below. The water demand criteria are consistent with those used in Stantec's Revised Potable Water Servicing Analysis (October 19, 2016). Calculations are summarized below.

Basic Day (BSDY) demands are calculated from the system level water demands for residential, commercial and institutional land uses. Maximum Day (MXDY) demands are calculated by adding an Outdoor Water Demand (OWD) also shown in Table 7-1 below. Peak hour demands result from applying the 72-hour diurnal patterns developed by the City to each type of MXDY demand. The 72-hour diurnal patterns are unique to each type of land use to reflect the different use patterns. The maximum hourly demand observed within the 72-hour patterns is the Peak Hour (PKHR) demand.

The review of the Demonstration Plan (Figure 4-2) has revealed that the number of units and associated densities will result in an overall population that will exceed 3,000. As a result, the water supply analysis presented herein is to be conducted using system level water demands as developed by the City. These system level demands are summarized in Table 7-2.

Table 7-1: Theoretical Water Consumption Rate

Land Use Type	Consumption Rate	Units
Single Family Residential	180	L/cap/day
Multi-unit Residential (Townhouse / Back to Back)	198	
Apartment Residential	219	
Commercial	50,000	L/ha/day
Institutional	50,000	
Outside Water Demand	1,049	L/SFH/day

The above system level demands were applied to each of the blocks depicted on the Demonstration Plan. As previously noted, the Brazeau and Drummond aggregate properties have now been accounted as residential usage. It was assumed that residential densities for both properties would be consistent with those for the BSUEA. Based on this exercise, overall water demands of 18.66 L/s and 31.48 L/s were calculated for the basic day (BSDY) and maximum day

(MXDY), respectively. It should be noted that MXDY of 31.48 L/s includes an outside water usage of 10.15 L/s.

Table 7-2: Estimated Water Demands

Land Use	Area (ha)	Units	Pop.	ADD SFH[4]	ADD MLT[5]	ADD APT[6]	ADD COM[7]	ADD INS[8]	Total BSDY	OWD[9]	Total MXDY
Minto and Mattamy Lands											
Schools	4.55							2.63	2.63		2.63
Commercial	2.13						1.23		1.23		1.23
Medium-Low Density Residential	32.90	1080	3378	4.68	2.60				7.27	8.01	15.29
High Density Residential	0.90	120	216			0.55			0.55		0.55
Total	**40.48**	**1200**	**3594**	**4.68**	**2.60**	**0.55**	**1.23**	**2.63**	**11.69**	**8.01**	**19.71**
Brazeau Aggregate Extraction Area											
Schools	1.47							0.85	0.85		0.85
Commercial	0.67						0.39		0.39		0.39
Medium-Low Density Residential	10.30	360	1126	1.56	0.87				2.42	2.67	5.10
High Density Residential	0.28	38	68			0.17			0.17		0.17
Total	**12.72**	**398**	**1194**	**1.56**	**0.87**	**0.17**	**0.39**	**0.85**	**3.84**		**6.51**
Drummond Aggregate Extraction Area											
Schools	1.25							0.72	0.72		0.72
Commercial	0.57						0.33		0.33		0.33

[4] Daily Demand, Single Family Homes, L/s
[5] Average Daily Demand, Multi-Units (Townhouses and Back to Back Unit) L/s
[6] Average Daily Demand, Apartment Units, L/s
[7] Average Daily Demand, Commercial, L/s
[8] Average Daily Demand, Institutional, L/s

Medium-Low Density Residential	8.72	288	900	1.25	0.69				1.94	2.14	4.07
High Density Residential	0.24	32	58			0.15			0.15		0.15
Total	**10.78**	**320**	**958**	**1.25**	**0.69**	**0.15**	**0.33**	**0.72**	**3.14**	**2.14**	**5.28**
Barrhaven South Urban Expansion Area Totals											
Total	**63.98**	**1918**	**5746**	**7.48**	**4.16**	**0.87**	**1.95**	**4.21**	**18.66**	**10.15**	**31.48**

7.2.3 Watermain Sizing and Roughness

The overall watermain layout for the BSUEA is shown on Drawing MWM. Watermain roughness coefficients were determined using the friction factors presented in Section 4.2.12 of the Design Guidelines and summarized in Table 7-3 below. The internal pipe diameters were modelled based on Section 4.3.5 of the Design Guidelines, as summarized in Table 7-4 below.

Table 7-3: Watermain Roughness Coefficients

Watermain Diameter	C-Factor
150 mm	100
200 to 250 mm	110
300 to 600 mm	120
Over 600 mm	130

Table 7-4: PVC Watermain Internal Diameters

Nominal Diameter	Inside Diameter
150 mm	155 mm
200 mm	204 mm
300 mm	297 mm
400 mm	393 mm

7.2.4 Fire Flow

The City standard in regard to fire protection is the Fire Underwriters Survey and Technical Bulletin ISDTB-2014-02. To evaluate the proposed water distribution system, a fire flow of 13,000 L/min (217 L/s) was used in this system level analysis in accordance with the recommendations of the 2013 Water Master Plan.

September 16, 2019

Sent by email: KMurphy@dsel.ca

David Schaeffer Engineering Ltd.
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

Attention: **Mr. Kevin Murphy, P.Eng.**
Senior Client Manager

Re: **Water Distribution Network Boundary Condition Request**
Brazeau Land Development
GeoAdvice Project ID: 2019-091-DSE

Dear Mr. Murphy,

In order to carry out the watermain analysis and hydraulic modeling for the Brazeau Land Development in the City of Ottawa, we request the hydraulic boundary conditions (HGL) for the proposed connection points as shown on the attached schematic. Flow conditions are outlined in the attached consumer water demand calculations.

Boundary conditions at the Connection Points 1 and 2 are required for the following demand conditions:

- **Phase 1 (Includes The Meadows Phases 7/8 demands)**
  - Minimum hour demand = 5.23 L/s
  - Average day demand = 10.45 L/s
  - Maximum day demand = 23.56 L/s
  - Maximum day demand + fire flow
    - 167 L/s fire flow = 190.56 L/s
    - 250 L/s fire flow = 273.56 L/s
  - Peak hour demand = 50.30 L/s

- **Phase 1 + 2 (Includes The Meadows Phases 7/8 demands)**
  - Minimum hour demand = 7.05 L/s
  - Average day demand = 14.10 L/s
  - Maximum day demand = 32.69 L/s
  - Maximum day demand + fire flow
    - 167 L/s fire flow = 199.69 L/s
    - 250 L/s fire flow = 282.69 L/s
  - Peak hour demand = 70.37 L/s

Please note the following:

- Demands from the Meadows Phases 7/8 are included in the above demand conditions. The inclusion of these demands is required due to the location of Connection 1. It is recommended that these demands only be applied to Connection 1. No other development demands were included (e.g. Drummond and Minto).
- The Phase 1 and 2 demands and fire flows should be applied equally between Connection Points 1 and 2.
- The attached FUS calculations have been completed in accordance with the latest City of Ottawa Technical Bulletin ISTB-2018-02 and ISDTB-2014-02 4.2.
- For the traditional townhomes not complying with the conditions of City of Ottawa Technical Bulletin ISDTB-2014-02 4.2 (Blocks 384 and 168), additional FUS calculations were completed, resulting in required fire flows of 167 L/s for each block.

If you have any questions, please do not hesitate to contact me.

Yours truly,

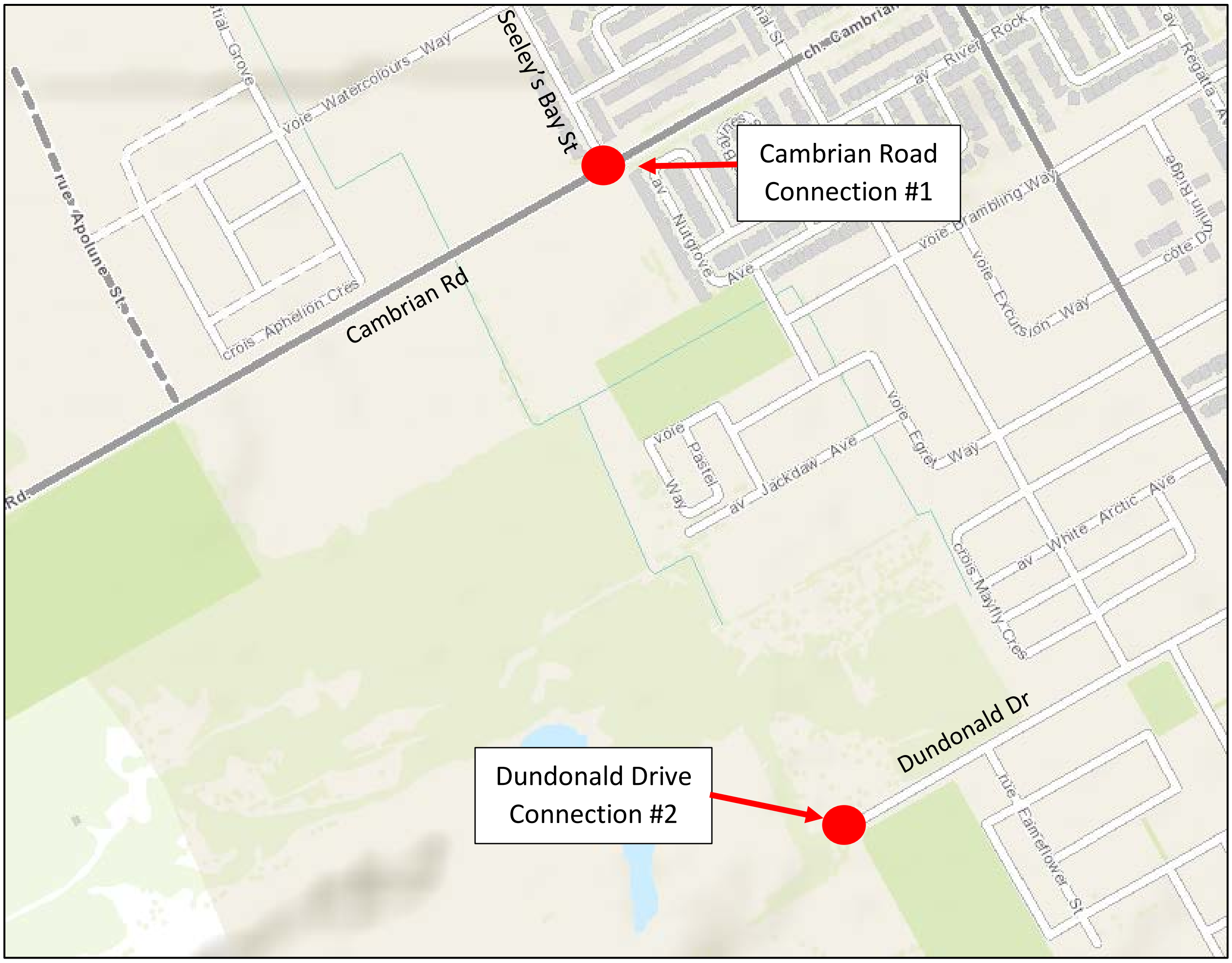
GeoAdvice Engineering Inc.

Werner de Schaetzen

Werner de Schaetzen, Ph.D., P.Eng.
President and Chief Executive Officer
werner@geoadvice.com
GeoAdvice Engineering Inc.

Attachments: Mark up for connection locations, demand calculations and FUS Fire Flow Calculations

Connection Locations



Consumer Water Demands

Phase 1 Residential Demands

Dwelling Type	Number of Units	Population **		Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 2.2 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)				
Single Detached	162	3.4	551	350	192,850	2.23	5.58	167*	12.28	1.12
Traditional Townhome	133	2.7	360		126,000	1.46	3.65	167*	8.02	0.73
Subtotal	**295**		**911**		**318,850**	**3.69**	**9.23**		**20.30**	**1.85**

Phase 1 + 2 Residential Demands

Dwelling Type	Number of Units	Population **		Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 2.2 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)				
Single Detached	311	3.4	1,058	350	370,300	4.29	10.71	167*	23.57	2.14
Traditional Townhome	279	2.7	754		263,900	3.05	7.64	167*	16.80	1.53
Subtotal	**590**		**1,812**		**634,200**	**7.34**	**18.35**		**40.37**	**3.67**

Phase 1 Non Residential Demands

Property Type	Area (ha)		Average Day Demand			Max Day 1.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 1.8 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
			** (L/ha/d)	(L/d)	(L/s)				
Park	1.72		28,000	48,160	0.56	0.84	250**	1.51	0.28
Subtotal	**1.72**			**48,160**	**0.56**	**0.84**		**1.51**	**0.28**

The Meadows Phases 7/8		**ADD**	**MDD**	**PHD**	**MHD**
Total Demand:		**6.20**	**13.50**	**28.50**	**3.10**

		ADD	**MDD**	**PHD**	**MHD**
Without the Meadows Phases 7/8 Demands	Phase 1	**4.25**	**10.06**	**21.80**	**2.12**
	Phase 1 + 2	**7.90**	**19.19**	**41.88**	**3.95**

With the Meadows Phases 7/8 Demands	Phase 1	**10.45**	**23.56**	**50.30**	**5.23**
	Phase 1 + 2	**14.10**	**32.69**	**70.37**	**7.05**

*Based on FUS fire flow calculation

**Assumed based on similar information from previously completed projects, as agreed upon with DSEL

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands — Blocks 300-313, Single Detached
Zoning: Multi Family Residential
Date: September 16, 2019

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 1927 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The single detached dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 14 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 3854 m^2 (Combined area of 14 units)

The total floor area in m^2 in the building being considered

F = 20,486 L/min — **D = 20,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-3,000 L/min** — **E = 17,000 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 17,000 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
East	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
North	10.1 to 20 m	Over 120 m-storeys	Wood Frame or Non-Combustible	15%
South	20.1 to 30 m	Over 120 m-storeys	Wood Frame or Non-Combustible	10%
			Total	**41%**

% of **E** — **+ 6,970 L/min** — **G = 23,970 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 23,970 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.1. The single detached dwellings comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

---

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	3,854
Required Fire Flow (L/min)	20,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	8%
East (%)	8%
South (%)	15%
West (%)	10%
Total Exposure (%)	41%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

Project ID: 2019-091-DSE

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

GeoAdvice

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands — Blocks 173, Traditional Townhouse
Zoning: Multi Family Residential
Date: September 16, 2019

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 474 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 5 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 947 m^2 (Combined area of 5 units)

The total floor area in m^2 in the building being considered

F = 10,156 L/min **D = 10,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,500 L/min** — **E = 8,500 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 8,500 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
East	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
North	10.1 to 20 m	61-90 m-storeys	Wood Frame or Non-Combustible	14%
South	20.1 to 30 m	31-60 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**56%**

% of **E** — **+ 4,760 L/min** — **G = 13,260 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 13,260 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	947
Required Fire Flow (L/min)	10,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	17%
East (%)	17%
South (%)	14%
West (%)	8%
Total Exposure (%)	56%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands
Zoning: Multi Family Residential   Blocks 384, Traditional Townhouse
Date: September 16, 2019

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 380 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 4 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 760 m^2 (Combined area of 4 units)

The total floor area in m^2 in the building being considered

F = 9,095 L/min   **D = 9,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,350 L/min** — **E = 7,650 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 7,650 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
East	Beyond 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	0%
North	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
South	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**37%**

% of **E** — **+ 2,831 L/min** — **G = 10,481 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 10,481 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings **do not** comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	760
Required Fire Flow (L/min)	9,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	12%
East (%)	0%
South (%)	17%
West (%)	8%
Total Exposure (%)	37%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands
Zoning: Multi Family Residential — Blocks 168, Traditional Townhouse
Date: September 16, 2019

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 380 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 4 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 760 m^2 (Combined area of 4 units)

The total floor area in m^2 in the building being considered

F = 9,095 L/min — **D = 9,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,350 L/min** — **E = 7,650 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 7,650 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	30.1 to 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	5%
East	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
North	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
South	Beyond 45 m	31-60 m-storeys	Wood Frame or Non-Combustible	0%
			Total	**34%**

% of **E** — **+ 2,601 L/min** — **G = 10,251 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 10,251 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings **do not** comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	**Duration (hours)**
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	760
Required Fire Flow (L/min)	9,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	5%
East (%)	12%
South (%)	17%
West (%)	0%
Total Exposure (%)	34%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

Hydraulic Capacity and Modeling Analysis Brazeau Lands

Final Report

Prepared for:
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Stittsville, ON K2S 1E9

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Unit 203, 2502 St. John's Street
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Submission Date: July 28, 2020

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Project: 2019-091-DSE

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	November 7, 2019	Draft	Ben Loewen	Werner de Schaetzen
R1	December 20, 2019	Final	Ben Loewen	Werner de Schaetzen
R2	June 10, 2020	Updated Draft	Ferdinand de Schoutheete	Werner de Schaetzen
R3	July 28, 2020	Final	Ferdinand de Schoutheete	Werner de Schaetzen

Statement of Qualifications and Limitations
This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

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There are 347 single detached dwellings, 279 traditional townhomes and 1 park serviced as part of the development.

The Brazeau Lands development will have three (3) connections to the City water distribution system:

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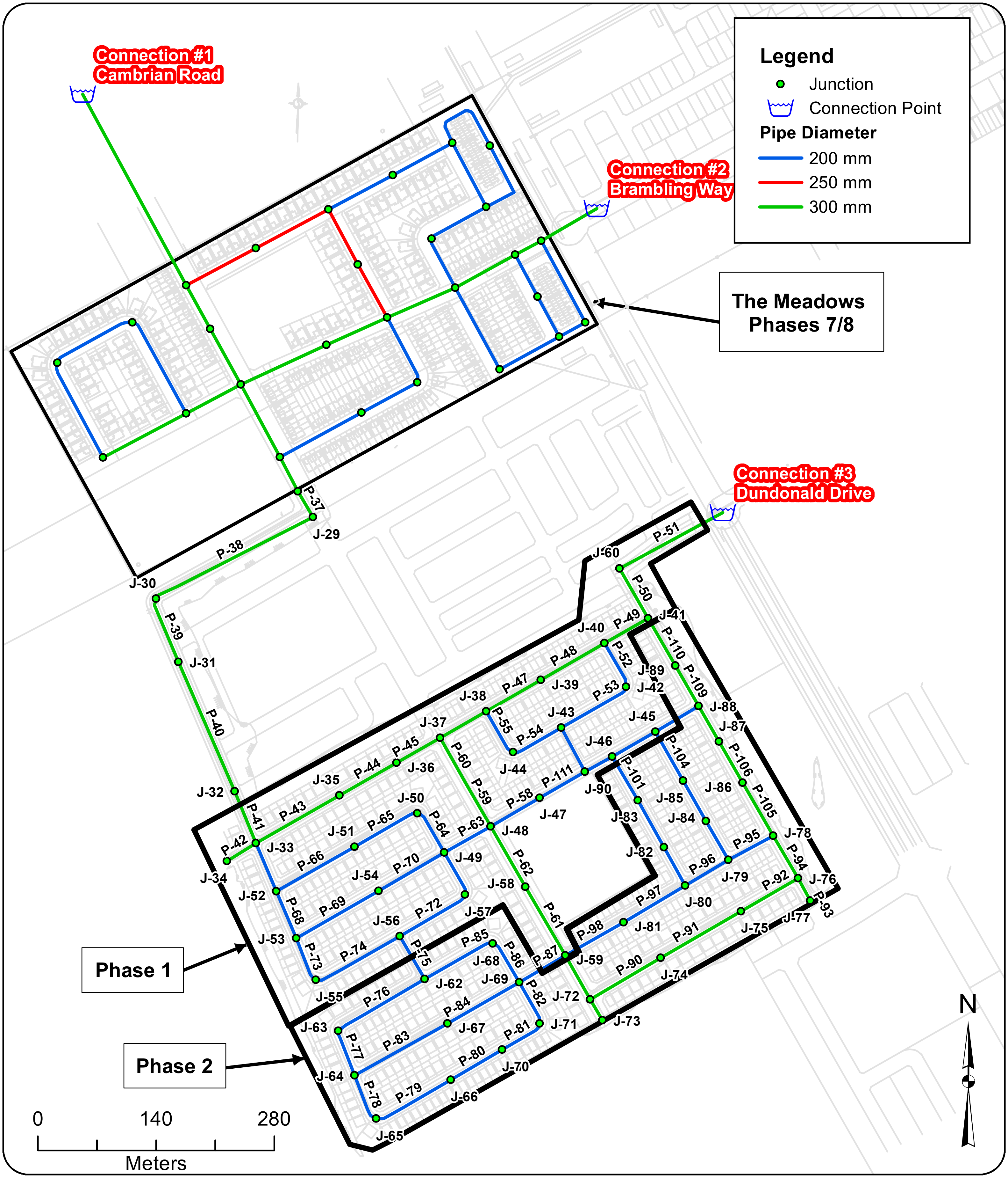
- Connection 2: Jackdaw Avenue and Future Greenbank Road; and
- Connection 3: Dundonald Drive and Future Greenbank Road.

The development site is shown in **Figure 1.1** on the following page, with the final recommended pipe diameters.

This report describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze), a GIS water distribution system modeling and management software application.

The results presented in this memo are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.



Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

GeoAdvice Engineering Inc.

Brazeau Lands Site Layout and Connection Points

Figure 1.1

2 Modeling Considerations

2.1 Water Main Configuration

The water main network was modeled based on the drawing prepared by DSEL (1030_Gen_Rev4.dwg) and provided to GeoAdvice on June 2nd, 2020.

2.2 Elevations

Elevations of the modeled junctions were assigned according to a site grading plan prepared by DSEL (1030_Grad_Rev4.dwg) and provided to GeoAdvice on June 2nd, 2020.

2.3 Consumer Demands

Demand factors used for this analysis were taken according to the City of Ottawa 2010 Design Guidelines *Table 4.2 Consumption Rate for Subdivisions of 501 to 3,000 Persons*. Population densities were assigned according to *Table 4.1 Per Unit Populations* from the City of Ottawa Design Guidelines. A summary of these tables highlighting relevant data for this development is shown in **Table 2.1** below.

Table 2.1: City of Ottawa Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	350	L/c/d
Park	28,000	L/ha/d
Maximum Daily Demand		
Residential	2.5 x avg. day	L/c/d
Park	1.5 x avg. day	L/ha/d
Peak Hour Demand		
Residential	2.2 x max. day	L/c/d
Park	1.8 x max. day	L/ha/d
Minimum Hour Demand		
Residential	0.5 x avg. day	L/c/d
Park	0.5 x avg. day	L/ha/d

Table 2.2 and **Table 2.4** summarize the residential water demand calculations for the Brazeau Lands development.

Table 2.2: Development Population and Demand Calculations – Phase 1

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	172	3.4	585	2.37	5.92	13.03	1.18
Traditional Townhome	133	2.7	360	1.46	3.65	8.02	0.73

***City of Ottawa Design Guidelines**

Table 2.3: Development Population and Demand Calculations – Phases 1&2

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	347	3.4	1,180	4.78	11.95	26.29	2.39
Traditional Townhome	279	2.7	754	3.05	7.64	16.80	1.53

***City of Ottawa Design Guidelines**

Table 2.6 summarizes the non-residential water demand calculations for the Brazeau Lands development (included in both Phase 1 and Phases 1&2).

Table 2.4: Non-Residential Demand Calculations

Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Park	1.72	0.56	0.84	1.51	0.28

Table 2.5 summarizes the demands for the Meadows Phases 7/8 subdivision development located north of the Brazeau Lands and downstream of Connections 1 and 2 (accounted for in the HGLs provided by the City in the boundary conditions request).

Table 2.5: The Meadows Phases 7/8

Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
6.20	13.50	28.50	3.10

Demands were grouped into demand polygons then uniformly distributed to the model nodes located within each polygon. Detailed calculations of demands as well as the illustrated allocation areas are shown in **Appendix A**.

2.4 Fire Flow Demand

Fire flow calculations were completed for all dwelling types in accordance with the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999) and City of Ottawa Technical Bulletin ISTB-2018-02 as summarized in **Appendix B**.

All the single detached dwellings have a minimum separation of 10 m between the backs of adjacent units and are, therefore, subject to the 10,000 L/min (167 L/s) cap outlined in City of Ottawa Technical Bulletin ISDTB-2014-02.

Most of the traditional townhouse dwellings comply with the City of Ottawa Technical Bulletin ISDTB-2014-02 and are, therefore, subject to the 10,000 L/min (167 L/s) cap.

The traditional townhouse dwellings located on Blocks 168 and 384 do not have a minimum separation of 10 m between the backs of adjacent units and therefore do not comply with the provisions under the City of Ottawa Technical Bulletin ISDTB-2014-02. The required fire flow for those blocks were calculated to be 167 L/s based on the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999). The agreement of this calculation with the City of Ottawa cap of 167 L/s is purely coincidental.

At this time, there is not enough information available to calculate the required fire flow of the park. As such, a required fire flow of 250 L/s was assumed for the park. This is a typical, conservative value for similar land use.

Fire flow simulations were completed at each model node in the Brazeau development. The locations of nodes do not necessarily represent hydrant locations.

Detailed FUS fire flow calculations as well as the illustrated spatial allocation of the required fire flows are shown in **Appendix B**.

2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Apolune Street and Cambrian Road;
- Connection 2: Jackdaw Avenue and Future Greenbank Road; and
- Connection 3: Dundonald Drive and Future Greenbank Road.

The above connection points are illustrated in **Figure 1.1**.

Boundary conditions were provided for Peak Hour, Maximum Day plus Fire and Minimum Hour (high pressure check) conditions.

Under existing conditions, the Brazeau Lands development will be serviced by the Barrhaven pressure zone; however, in the future, it will be serviced by pressure zone 3C. As such, boundary conditions were provided under the existing and future pressure zone configurations.

In total, two (2) sets of boundary conditions were provided by the City and can be found in **Appendix C**.

The boundary conditions for the existing pressure zone configuration are more conservative. As such, the results presented in this report are based on the boundary conditions for the existing pressure zone configuration.

Table 2.6 summarizes the boundary conditions used to size the Brazeau Lands water network.

Table 2.6: Existing Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)
Min Hour (max. pressure)	156.4	156.4	156.4
Peak Hour (min. pressure)	135.7	135.6	135.7
Max Day + Fire Flow (167 L/s)	144.0	141.2	142.0
Max Day + Fire Flow (250 L/s)	135.4	129.9	131.5

3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Table 3.1: Model Pipe Characteristics

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
200	204	110
250	250	110
300	297	120

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2.**

Table 3.2: Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-

4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for minimum hour, peak hour and maximum day plus fire flow using InfoWater. Only the existing pressure zone configuration was analyzed, since the boundary conditions are more conservative.

Detailed pipe and junction model input data can be found in **Appendix D**.

4.1 Development Pressure Analysis

Modeled service pressures for the development are summarized in **Table 4.1** below.

Table 4.1: Summary of the Brazeau Lands Available Service Pressures

Phase	Minimum Hour Demand Maximum Pressure	Peak Hour Demand Minimum Pressure
Phase 1	538 kPa (78 psi)	290 kPa (42 psi)
Phases 1&2	538 kPa (78 psi)	**262 kPa (38 psi)**

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi).

Low pressures are predicted at junctions J-66, J-70, J-71, J-72, J-73, J-74, J-75, J-76 and J-77 under peak hour demand. Those low pressures are due to high elevations in the southern part of the Brazeau Lands development and are within 5% of the minimum allowable pressure of 276 kPa (40 psi). The future Zone 3C boundary conditions will provide an additional head of about seven (7) meters at each connection point, and will thus resolve the low PHD pressures at the southern part of the Brazeau Lands development.

Detailed pipe and junction result tables and maps can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

A summary of the minimum available fire flows in the Brazeau Lands development is shown below in **Table 4.2**.

Table 4.2: Summary of the Brazeau Lands Minimum Available Fire Flows

Phase	Required Fire Flow	Minimum Available Flow	Junction ID
Phase 1	167 L/s	177 L/s	J-45
	250 L/s	249 L/s	J-47
Phases 1&2	167 L/s	194 L/s	J-66
	250 L/s	269 L/s	J-47

As shown in the table above, the available fire flow is greater than the required fire flow under both Phase 1 and Phases 1&2 conditions.

A summary of the residual pressures in the Brazeau Lands is shown below in **Table 4.3**. The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

Table 4.3: Summary of the Brazeau Lands Residual Pressures (MDD + FF)

Phase	Maximum Residual Pressure	Average Residual Pressure	Minimum Residual Pressure
Phase 1	365 kPa (53 psi)	296 kPa (43 psi)	140 kPa (20 psi)
Phases 1&2	365 kPa (53 psi)	296 kPa (43 psi)	159 kPa (23 psi)

There is sufficient residual pressure at all the junctions within the Brazeau Lands development.

Detailed fire flow results and figures illustrating the fire flow results can be found in **Appendix F**.

5 Other Servicing Considerations

5.1 Water Supply Security

The City of Ottawa Design Guidelines allow single feed systems for developments up to a total average day demand of 50 m^3/day and require two (2) feeds if the development exceeds 50 m^3/day for supply security, according to Technical Bulletin ISDTB-2014-02.

The Brazeau Lands services a total average day demand of 725 m^3/day; as such, two (2) feeds are required.

5.2 Valves

No comment has been made in this technical memorandum with respect to exact placement of isolation valves within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for number, location, and spacing of isolation valves:

- Tee intersection – two (2) valves
- Cross intersection – three (3) valves
- Valves shall be located 2 m away from the intersection
- 300 m spacing for 150 mm to 400 mm diameter valves
- Gate valves for 100 mm to 300 mm diameter mains
- Butterfly valves for 400 mm and larger diameter mains

Drain valves are not strictly required under the City of Ottawa Design Guidelines for water mains under 600 mm in diameter. The Guidelines indicate that "small diameter water mains shall be drained through hydrant via pumping if needed."

Air valves are not strictly required under the City of Ottawa Design Guidelines for water mains up to and including 400 mm in diameter. The Guidelines indicate that air removal "can be accomplished by the strategic positioning of hydrant at the high points to remove the air or by installing or utilizing available 50 mm chlorination nozzles in 300 mm and 400 mm chambers."

The detailed engineering drawings for the Brazeau Lands are expected to identify valves in accordance with the requirements noted above.

5.3 Hydrants

No comment has been made in this technical memorandum with respect to exact placement of hydrants within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for maximum hydrant spacing:

- 125 m for single family unit residential areas on lots where frontage at the street line is 15 m or longer
- 110 m for single family unit residential areas on lots where frontage at the street line is less than 15 m and for residential areas zoned for row housing, doubles or duplexes
- 90 m for institutional, commercial, industrial, apartments and high-density areas

The detailed engineering drawings for the Brazeau Lands development are expected to identify hydrants in accordance with the requirements noted above.

6 Conclusions

The hydraulic capacity and modeling analysis of Phase 1 of the Brazeau Lands development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows, with service pressures expected to range between 290 kPa (42 psi) and 538 kPa (78 psi).
- The proposed water main network is able to deliver fire flows to all junctions.
- Hydraulic modeling was only completed for the existing pressure zone configuration since the boundary conditions are more conservative.

The hydraulic capacity and modeling analysis of Phases 1&2 of the Brazeau Lands development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows except for junctions J-66, J-70, J-71, J-72, J-73, J-74, J-75, J-76 and J-77, with service pressures expected to range between 262 kPa (38 psi) and 538 kPa (78 psi).
- The junctions with low pressures are due to high elevations in the southern part of the Brazeau Lands development and are within 5% of the minimum allowable pressure of 276 kPa (40 psi).
- The future Zone 3C boundary conditions will provide an additional head of about seven (7) meters at each connection point, and will thus resolve the low PHD pressures at the southern part of the Brazeau Lands development.
- The proposed water main network is able to deliver fire flows to all junctions.
- Hydraulic modeling was only completed for the existing pressure zone configuration since the boundary conditions are more conservative.

Submission

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Hydraulic Capacity and Modeling Analysis Brazeau Lands

Final Report

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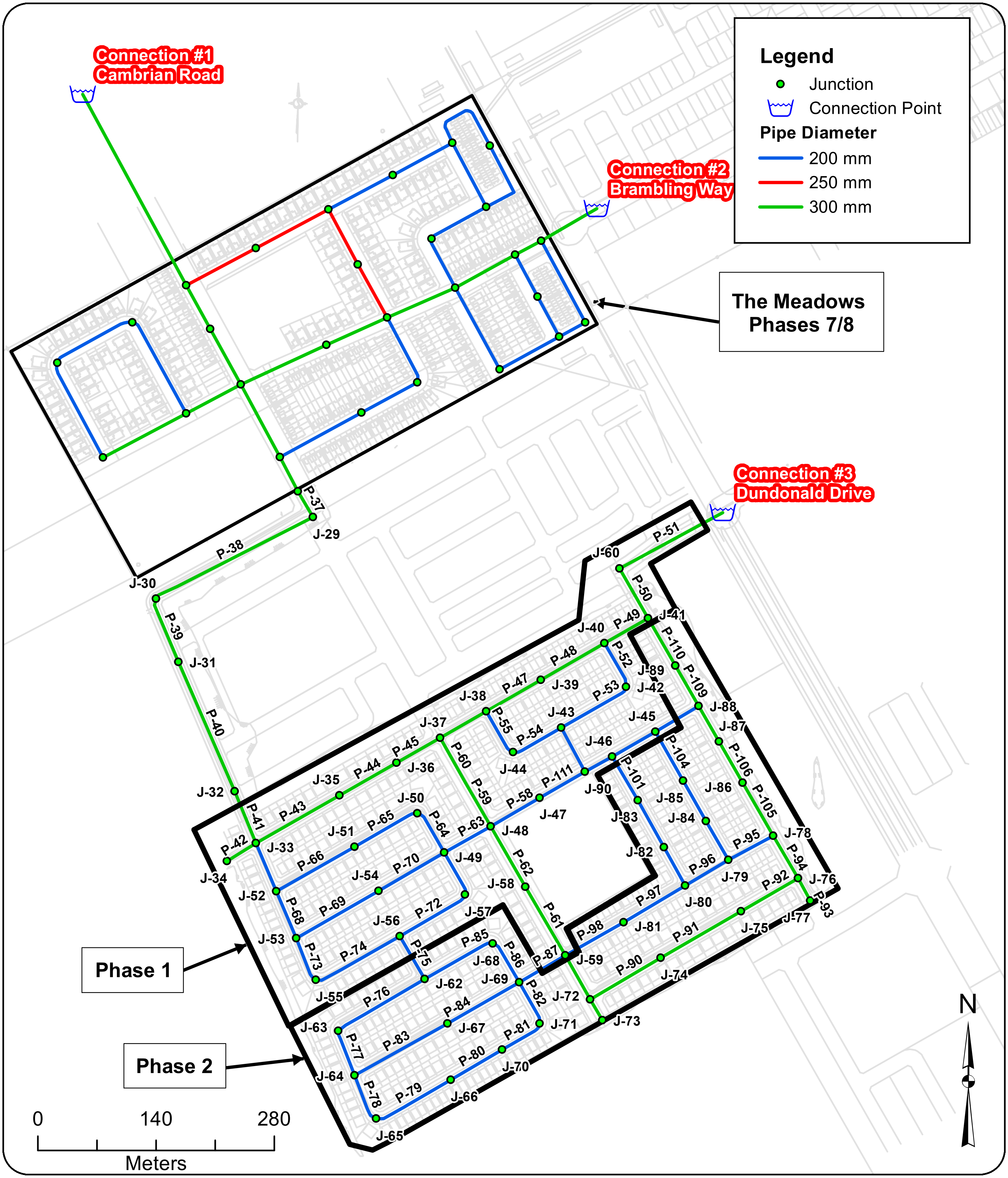

GeoAdvice Engineering Inc.

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Park	1.5 x avg. day	L/ha/d
Peak Hour Demand		
Residential	2.2 x max. day	L/c/d
Park	1.8 x max. day	L/ha/d
Minimum Hour Demand		
Residential	0.5 x avg. day	L/c/d
Park	0.5 x avg. day	L/ha/d

Table 2.2 and **Table 2.4** summarize the residential water demand calculations for the Brazeau Lands development.

Table 2.2: Development Population and Demand Calculations – Phase 1

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
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Traditional Townhome	133	2.7	360	1.46	3.65	8.02	0.73

***City of Ottawa Design Guidelines**

Table 2.3: Development Population and Demand Calculations – Phases 1&2

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Traditional Townhome	279	2.7	754	3.05	7.64	16.80	1.53

***City of Ottawa Design Guidelines**

Table 2.6 summarizes the non-residential water demand calculations for the Brazeau Lands development (included in both Phase 1 and Phases 1&2).

Table 2.4: Non-Residential Demand Calculations

Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Park	1.72	0.56	0.84	1.51	0.28

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At this time, there is not enough information available to calculate the required fire flow of the park. As such, a required fire flow of 250 L/s was assumed for the park. This is a typical, conservative value for similar land use.

Fire flow simulations were completed at each model node in the Brazeau development. The locations of nodes do not necessarily represent hydrant locations.

Detailed FUS fire flow calculations as well as the illustrated spatial allocation of the required fire flows are shown in **Appendix B**.

2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Apolune Street and Cambrian Road;
- Connection 2: Jackdaw Avenue and Future Greenbank Road; and
- Connection 3: Dundonald Drive and Future Greenbank Road.

The above connection points are illustrated in **Figure 1.1**.

Boundary conditions were provided for Peak Hour, Maximum Day plus Fire and Minimum Hour (high pressure check) conditions.

Under existing conditions, the Brazeau Lands development will be serviced by the Barrhaven pressure zone; however, in the future, it will be serviced by pressure zone 3C. As such, boundary conditions were provided under the existing and future pressure zone configurations.

In total, two (2) sets of boundary conditions were provided by the City and can be found in **Appendix C**.

The boundary conditions for the existing pressure zone configuration are more conservative. As such, the results presented in this report are based on the boundary conditions for the existing pressure zone configuration.

Table 2.6 summarizes the boundary conditions used to size the Brazeau Lands water network.

Table 2.6: Existing Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)
Min Hour (max. pressure)	156.4	156.4	156.4
Peak Hour (min. pressure)	135.7	135.6	135.7
Max Day + Fire Flow (167 L/s)	144.0	141.2	142.0
Max Day + Fire Flow (250 L/s)	135.4	129.9	131.5

3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Table 3.1: Model Pipe Characteristics

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
200	204	110
250	250	110
300	297	120

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2.**

Table 3.2: Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-

4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for minimum hour, peak hour and maximum day plus fire flow using InfoWater. Only the existing pressure zone configuration was analyzed, since the boundary conditions are more conservative.

Detailed pipe and junction model input data can be found in **Appendix D**.

4.1 Development Pressure Analysis

Modeled service pressures for the development are summarized in **Table 4.1** below.

Table 4.1: Summary of the Brazeau Lands Available Service Pressures

Phase	Minimum Hour Demand Maximum Pressure	Peak Hour Demand Minimum Pressure
Phase 1	538 kPa (78 psi)	290 kPa (42 psi)
Phases 1&2	538 kPa (78 psi)	**262 kPa (38 psi)**

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi).

Low pressures are predicted at junctions J-66, J-70, J-71, J-72, J-73, J-74, J-75, J-76 and J-77 under peak hour demand. Those low pressures are due to high elevations in the southern part of the Brazeau Lands development and are within 5% of the minimum allowable pressure of 276 kPa (40 psi). The future Zone 3C boundary conditions will provide an additional head of about seven (7) meters at each connection point, and will thus resolve the low PHD pressures at the southern part of the Brazeau Lands development.

Detailed pipe and junction result tables and maps can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

A summary of the minimum available fire flows in the Brazeau Lands development is shown below in **Table 4.2**.

Table 4.2: Summary of the Brazeau Lands Minimum Available Fire Flows

Phase	Required Fire Flow	Minimum Available Flow	Junction ID
Phase 1	167 L/s	177 L/s	J-45
	250 L/s	249 L/s	J-47
Phases 1&2	167 L/s	194 L/s	J-66
	250 L/s	269 L/s	J-47

As shown in the table above, the available fire flow is greater than the required fire flow under both Phase 1 and Phases 1&2 conditions.

A summary of the residual pressures in the Brazeau Lands is shown below in **Table 4.3**. The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

Table 4.3: Summary of the Brazeau Lands Residual Pressures (MDD + FF)

Phase	Maximum Residual Pressure	Average Residual Pressure	Minimum Residual Pressure
Phase 1	365 kPa (53 psi)	296 kPa (43 psi)	140 kPa (20 psi)
Phases 1&2	365 kPa (53 psi)	296 kPa (43 psi)	159 kPa (23 psi)

There is sufficient residual pressure at all the junctions within the Brazeau Lands development.

Detailed fire flow results and figures illustrating the fire flow results can be found in **Appendix F**.

5 Other Servicing Considerations

5.1 Water Supply Security

The City of Ottawa Design Guidelines allow single feed systems for developments up to a total average day demand of 50 m^3/day and require two (2) feeds if the development exceeds 50 m^3/day for supply security, according to Technical Bulletin ISDTB-2014-02.

The Brazeau Lands services a total average day demand of 725 m^3/day; as such, two (2) feeds are required.

5.2 Valves

No comment has been made in this technical memorandum with respect to exact placement of isolation valves within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for number, location, and spacing of isolation valves:

- Tee intersection – two (2) valves
- Cross intersection – three (3) valves
- Valves shall be located 2 m away from the intersection
- 300 m spacing for 150 mm to 400 mm diameter valves
- Gate valves for 100 mm to 300 mm diameter mains
- Butterfly valves for 400 mm and larger diameter mains

Drain valves are not strictly required under the City of Ottawa Design Guidelines for water mains under 600 mm in diameter. The Guidelines indicate that "small diameter water mains shall be drained through hydrant via pumping if needed."

Air valves are not strictly required under the City of Ottawa Design Guidelines for water mains up to and including 400 mm in diameter. The Guidelines indicate that air removal "can be accomplished by the strategic positioning of hydrant at the high points to remove the air or by installing or utilizing available 50 mm chlorination nozzles in 300 mm and 400 mm chambers."

The detailed engineering drawings for the Brazeau Lands are expected to identify valves in accordance with the requirements noted above.

5.3 Hydrants

No comment has been made in this technical memorandum with respect to exact placement of hydrants within the distribution network for the Brazeau Lands other than to summarize the City of Ottawa Design Guidelines for maximum hydrant spacing:

- 125 m for single family unit residential areas on lots where frontage at the street line is 15 m or longer
- 110 m for single family unit residential areas on lots where frontage at the street line is less than 15 m and for residential areas zoned for row housing, doubles or duplexes
- 90 m for institutional, commercial, industrial, apartments and high-density areas

The detailed engineering drawings for the Brazeau Lands development are expected to identify hydrants in accordance with the requirements noted above.

6 Conclusions

The hydraulic capacity and modeling analysis of Phase 1 of the Brazeau Lands development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows, with service pressures expected to range between 290 kPa (42 psi) and 538 kPa (78 psi).
- The proposed water main network is able to deliver fire flows to all junctions.
- Hydraulic modeling was only completed for the existing pressure zone configuration since the boundary conditions are more conservative.

The hydraulic capacity and modeling analysis of Phases 1&2 of the Brazeau Lands development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows except for junctions J-66, J-70, J-71, J-72, J-73, J-74, J-75, J-76 and J-77, with service pressures expected to range between 262 kPa (38 psi) and 538 kPa (78 psi).
- The junctions with low pressures are due to high elevations in the southern part of the Brazeau Lands development and are within 5% of the minimum allowable pressure of 276 kPa (40 psi).
- The future Zone 3C boundary conditions will provide an additional head of about seven (7) meters at each connection point, and will thus resolve the low PHD pressures at the southern part of the Brazeau Lands development.
- The proposed water main network is able to deliver fire flows to all junctions.
- Hydraulic modeling was only completed for the existing pressure zone configuration since the boundary conditions are more conservative.

Submission

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July 28, 2020

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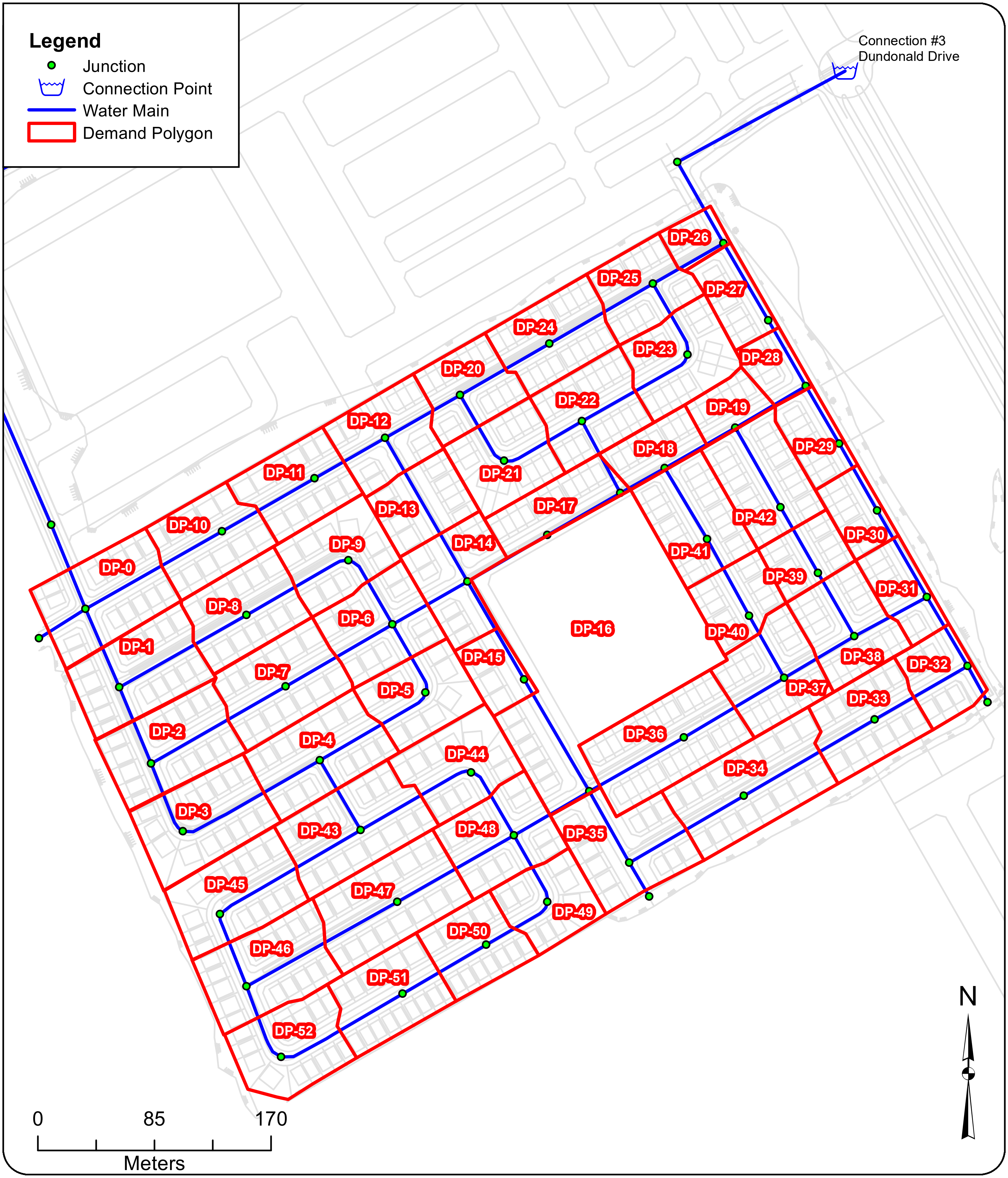
Appendix A Domestic Water Demand Calculations and Allocation

Appendix A Domestic Water Demand Calculations and Allocation



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Demand Allocation Phases 1&2

Figure A.1

Consumer Water Demands

Phase 1 Residential Demands

Dwelling Type	Number of Units	Population **		Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 2.2 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)				
Single Detached	172	3.4	585	350	204,750	2.37	5.92	167*	13.03	1.18
Traditional Townhome	133	2.7	360		126,000	1.46	3.65	167*	8.02	0.73
Subtotal	**305**		**945**		**330,750**	**3.83**	**9.57**		**21.05**	**1.91**

Phases 1&2 Residential Demands

Dwelling Type	Number of Units	Population **		Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 2.2 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)				
Single Detached	347	3.4	1,180	350	413,000	4.78	11.95	167*	26.29	2.39
Traditional Townhome	279	2.7	754		263,900	3.05	7.64	167*	16.80	1.53
Subtotal	**626**		**1,934**		**676,900**	**7.83**	**19.59**		**43.09**	**3.92**

Non Residential Demands

Property Type	Area (ha)		Average Day Demand			Max Day 1.5 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 1.8 x Max Day (L/s)	Min Hour 0.5 x Avg. Day (L/s)
			** (L/ha/d)	(L/d)	(L/s)				
Park w/ Splash Pad	1.72		28,000	48,160	0.56	0.84	250**	1.51	0.28
Subtotal	**1.72**			**48,160**	**0.56**	**0.84**		**1.51**	**0.28**

The Meadows Phases 7/8		**ADD (L/s)**	**MDD (L/s)**	**PHD (L/s)**	**MHD (L/s)**
Total Demand:		**6.20**	**13.50**	**28.50**	**3.10**

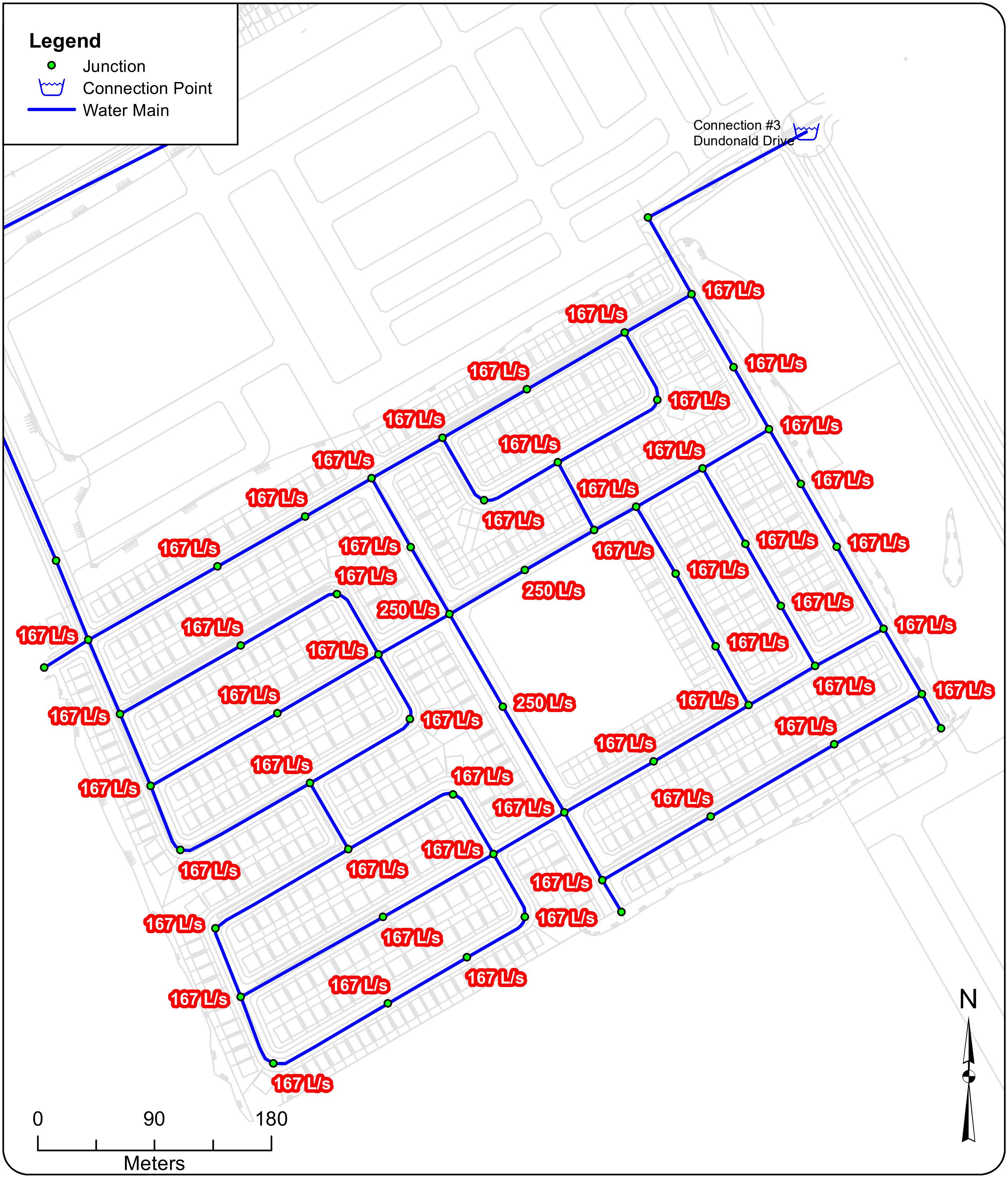
		ADD (L/s)	**MDD (L/s)**	**PHD (L/s)**	**MHD (L/s)**
Without the Meadows Phases 7/8 Demands	Phase 1	**4.39**	**10.41**	**22.56**	**2.19**
	Phases 1&2	**8.39**	**20.42**	**44.59**	**4.20**

With the Meadows Phases 7/8 Demands	Phase 1	**10.59**	**23.91**	**51.06**	**5.29**
	Phases 1&2	**14.59**	**33.92**	**73.09**	**7.30**

*Based on FUS fire flow calculation

**Assumed based on similar information from previously completed projects, as agreed upon with DSEL

Appendix B FUS Fire Flow Calculations and Allocation



GeoAdvice
GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

Required Fire Flow Phases 1&2

Figure B.1

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands — Blocks 300-313, Single Detached
Zoning: Multi Family Residential
Date: November 6, 2019

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 1927 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The single detached dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 14 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 3854 m^2 (Combined area of 14 units)

The total floor area in m^2 in the building being considered

F = 20,486 L/min **D = 20,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-3,000 L/min** — **E = 17,000 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 17,000 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
East	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
North	10.1 to 20 m	Over 120 m-storeys	Wood Frame or Non-Combustible	15%
South	20.1 to 30 m	Over 120 m-storeys	Wood Frame or Non-Combustible	10%
			Total	**41%**

% of **E** — **+ 6,970 L/min** — **G = 23,970 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 23,970 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The single detached dwellings comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	3,854
Required Fire Flow (L/min)	20,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	8%
East (%)	8%
South (%)	15%
West (%)	10%
Total Exposure (%)	41%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands   Blocks 173, Traditional Townhouse
Zoning: Multi Family Residential
Date: November 6, 2019

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 474 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 5 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 947 m^2 (Combined area of 5 units)

The total floor area in m^2 in the building being considered

F = 10,156 L/min **D = 10,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** **-1,500 L/min** **E = 8,500 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** **0 L/min** **F = 8,500 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
East	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
North	10.1 to 20 m	61-90 m-storeys	Wood Frame or Non-Combustible	14%
South	20.1 to 30 m	31-60 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**56%**

% of **E** **+ 4,760 L/min** **G = 13,260 L/min**

H. Wood Shake Charge — No — **0 L/min** **H = 13,260 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	**Duration (hours)**
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	947
Required Fire Flow (L/min)	10,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	17%
East (%)	17%
South (%)	14%
West (%)	8%
Total Exposure (%)	56%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands
Zoning: Multi Family Residential   Blocks 384, Traditional Townhouse
Date: November 6, 2019

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 380 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 4 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 760 m^2 (Combined area of 4 units)

The total floor area in m^2 in the building being considered

F = 9,095 L/min **D = 9,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** **-1,350 L/min** **E = 7,650 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** **0 L/min** **F = 7,650 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
East	Beyond 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	0%
North	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
South	20.1 to 30 m	0-30 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**37%**

% of **E** **+ 2,831 L/min** **G = 10,481 L/min**

H. Wood Shake Charge — No — **0 L/min** **H = 10,481 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings **do not** comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	760
Required Fire Flow (L/min)	9,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	12%
East (%)	0%
South (%)	17%
West (%)	8%
Total Exposure (%)	37%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

Client: David Schaeffer Engineering Ltd.
Project: 2019-091-DSE
Development: Brazeau Lands
Zoning: Multi Family Residential — Blocks 168, Traditional Townhouse
Date: November 6, 2019

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 380 m^2

Note: ground floor area based on drawing provided to GeoAdvice on September 12, 2019.

C. Number of Storeys: 2

Note: all buildings, including adjacent buildings, assumed to be 2 storeys.

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 4 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 760 m^2 (Combined area of 4 units)

The total floor area in m^2 in the building being considered

F = 9,095 L/min **D = 9,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,350 L/min** — **E = 7,650 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 7,650 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
West	30.1 to 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	5%
East	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
North	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
South	Beyond 45 m	31-60 m-storeys	Wood Frame or Non-Combustible	0%
			Total	**34%**

% of **E** — **+ 2,601 L/min** — **G = 10,251 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 10,251 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2014-02 4.2. The townhouse dwellings **do not** comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min***
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Brazeau Lands development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Notes to calculations

Type of Construction	Coefficient	Unit
Wood Frame Construction	1.5	-
Ordinary Construction	1	-
Non-Combustible Construction	0.8	-
Fire Resistive Construction (< 2 hrs)	0.7	-
Fire Resistive Construction (> 2 hrs)	0.6	-

Occupancy Fire Hazard	Factor	Unit
Non-Combustible	-25	%
Limited Combustible	-15	%
Combustible	0	%
Free Burning	15	%
Rapid Burning	25	%

Sprinkler Protection	Factor	Unit
None	0	%
Automatic	-30	%
Automatic + Standard Supply	-40	%
Fully Supervised	-50	%
Fully Supervised + Fire Resistive	-70	%

Zoning
Single Family Residential
Multi Family Residential
Commercial
Institutional
Industrial

Wood Shake Charge	Factor	Unit
Yes	4000	L/min
No	0	L/min

Required Duration of Fire Flow	
Fire Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3000	1.25
4000	1.50
5000	1.75
6000	2.00
7000	2.00
8000	2.00
9000	2.00
10000	2.00
11000	2.25
12000	2.50
13000	2.75
14000	3.00
15000	3.25
16000	3.50
17000	3.75
18000	4.00
19000	4.25
20000	4.50
21000	4.75
22000	5.00
23000	5.25
24000	5.50
25000	5.75
26000	6.00
27000	6.25
28000	6.50
29000	6.75
30000	7.00
31000	7.25
32000	7.50
33000	7.75
34000	8.00
35000	8.25
36000	8.50
37000	8.75
38000	9.00
39000	9.25
40000 and over	9.50

Notes to calculations

Separation Distance	Length-Height Factor of Exposed Wall of Adjacent Structure	Construction of Exposed Wall of Adjacent Structure			
		Wood Frame or Non-Combustible	Ordinary or Fire-Resistive with Unprotected Openings	Ordinary or Fire-Resistive with Semi-Protected Openings	Ordinary or Fire-Resistive with Blank Wall
0.0 to 3 m	0-30 m-storeys	22%	21%	16%	0%
	31-60 m-storeys	23%	22%	17%	0%
	61-90 m-storeys	24%	23%	18%	0%
	91-120 m-storeys	25%	24%	19%	0%
	Over 120 m-storeys	25%	25%	20%	0%
3.1 to 10 m	0-30 m-storeys	17%	15%	11%	0%
	31-60 m-storeys	18%	16%	12%	0%
	61-90 m-storeys	19%	18%	14%	0%
	91-120 m-storeys	20%	19%	15%	0%
	Over 120 m-storeys	20%	19%	15%	0%
10.1 to 20 m	0-30 m-storeys	12%	10%	7%	0%
	31-60 m-storeys	13%	11%	8%	0%
	61-90 m-storeys	14%	13%	10%	0%
	91-120 m-storeys	15%	14%	11%	0%
	Over 120 m-storeys	15%	15%	12%	0%
20.1 to 30 m	0-30 m-storeys	8%	6%	4%	0%
	31-60 m-storeys	8%	7%	5%	0%
	61-90 m-storeys	9%	8%	6%	0%
	91-120 m-storeys	10%	9%	7%	0%
	Over 120 m-storeys	10%	10%	8%	0%
30.1 to 45 m	0-30 m-storeys	5%	5%	5%	0%
	31-60 m-storeys	5%	5%	5%	0%
	61-90 m-storeys	5%	5%	5%	0%
	91-120 m-storeys	5%	5%	5%	0%
	Over 120 m-storeys	5%	5%	5%	0%
Beyond 45 m	0-30 m-storeys	0%	0%	0%	0%
	31-60 m-storeys	0%	0%	0%	0%
	61-90 m-storeys	0%	0%	0%	0%
	91-120 m-storeys	0%	0%	0%	0%
	Over 120 m-storeys	0%	0%	0%	0%
Fire Wall	0-30 m-storeys	10%	10%	10%	10%
	31-60 m-storeys	10%	10%	10%	10%
	61-90 m-storeys	10%	10%	10%	10%
	91-120 m-storeys	10%	10%	10%	10%
	Over 120 m-storeys	10%	10%	10%	10%

Brazeau Lands - FUS Required Fire Flow Summary

Brazeau Lands	
Type of Construction	Wood Frame Construction
Construction Coefficient	1.5
Effective Total Area (m^2)	760
Required Fire Flow (L/min)	9,000
Occupancy Charge	-15
Sprinkler Protection Reduction	0
Exposure (%)	
North (%)	5%
East (%)	12%
South (%)	17%
West (%)	0%
Total Exposure (%)	34%
Wood Shake Charge (L/min)	0
Total Required Fire Flow (L/min)	10,000
Total Required Fire Flow (L/s)	167

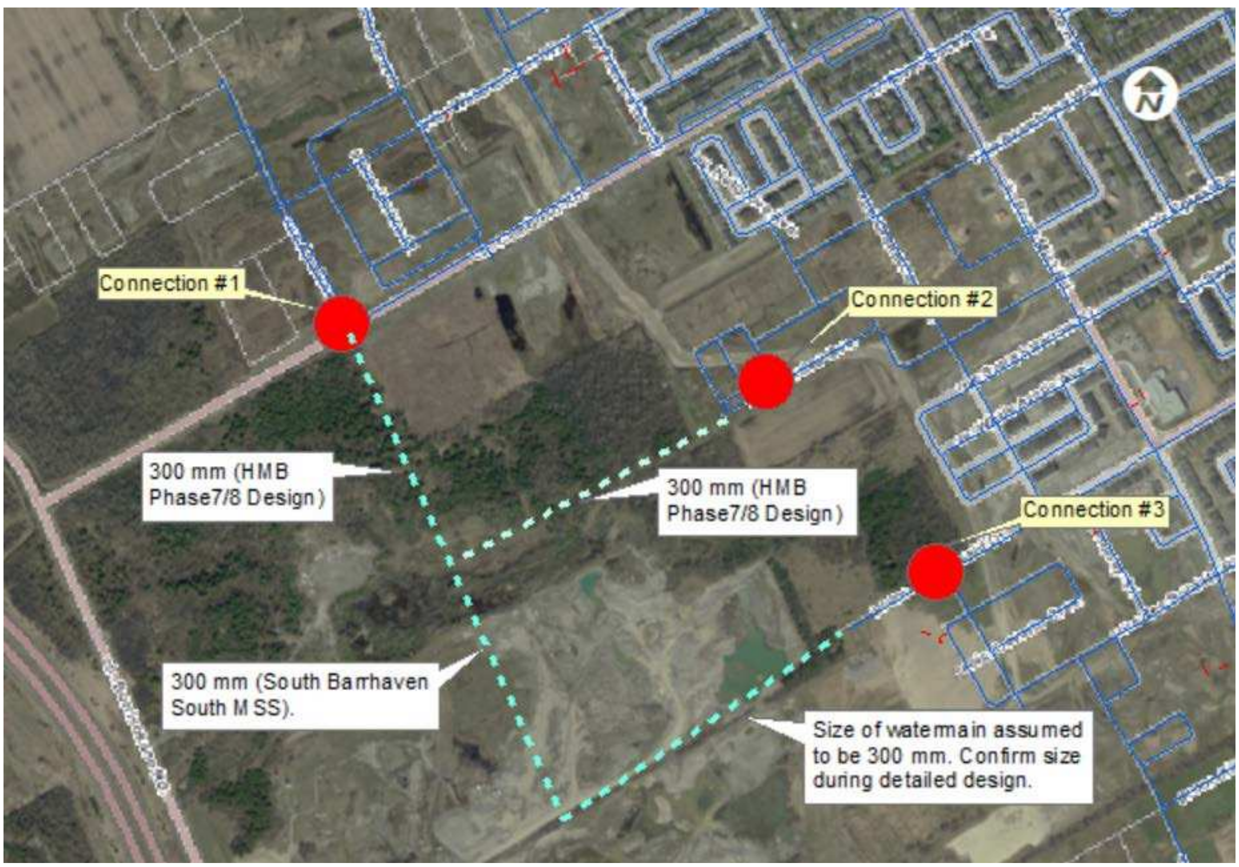
Appendix C Boundary Conditions

Boundary Conditions for HMB Phases 7 and 8 and Brazeau Lands

Information Provided:
Date provided: September 2019

Scenario	Demand	
	L/min	L/s
Average Daily Demand	846	14.10
Maximum Daily Demand	1961	32.69
Peak Hour	4224	70.40
Fire Flow Demand #1	10000	166.67
Fire Flow Demand #2	15000	250.00
Fire Flow Demand #3	17000	283.33

Location:



Results

Connection 1 - Cambrian Road

Demand Scenario	Existing Barrhaven PZ		Future Zone 3C	
	Head (m)	Pressure[1] (psi)	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	102.9	147.7	77.3
Peak Hour	135.7	60.4	142.8	70.4
Max Day plus Fire (#1)	144.0	72.2	140.0	66.4
Max Day plus Fire (#2)	135.4	59.9	134.9	59.2
Max Day plus Fire (#3)	133.7	57.4	132.5	55.7

[1] Ground Elevation = 93.3 m

Connection 2 - Brambling Way

Demand Scenario	Existing Barrhaven PZ		Future Zone 3C	
	Head (m)	Pressure[1] (psi)	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	100.1	147.7	74.6
Peak Hour	135.6	57.4	142.7	67.5
Max Day plus Fire (#1)	141.2	65.4	139.9	63.5
Max Day plus Fire (#2)	129.9	49.4	134.6	56.0
Max Day plus Fire (#3)	126.6	44.7	132.1	52.4

[1] Ground Elevation = 95.2 m

Connection 3 - Dundonald Drive

Demand Scenario	Existing Barrhaven PZ		Future Zone 3C	
	Head (m)	Pressure[1] (psi)	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	86.5	147.7	61.0
Peak Hour	135.7	43.9	142.6	53.7
Max Day plus Fire (#1)	142.0	52.9	138.6	48.1
Max Day plus Fire (#2)	131.5	38.0	132.2	38.9
Max Day plus Fire (#3)	128.7	34.0	128.9	34.3

[1] Ground Elevation = 104.8 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.

2) A third pump was turned on during all fire simulations under Existing Barrhaven Pressure.
3) Future pipes were added to the water model as shown in the figure above.

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.

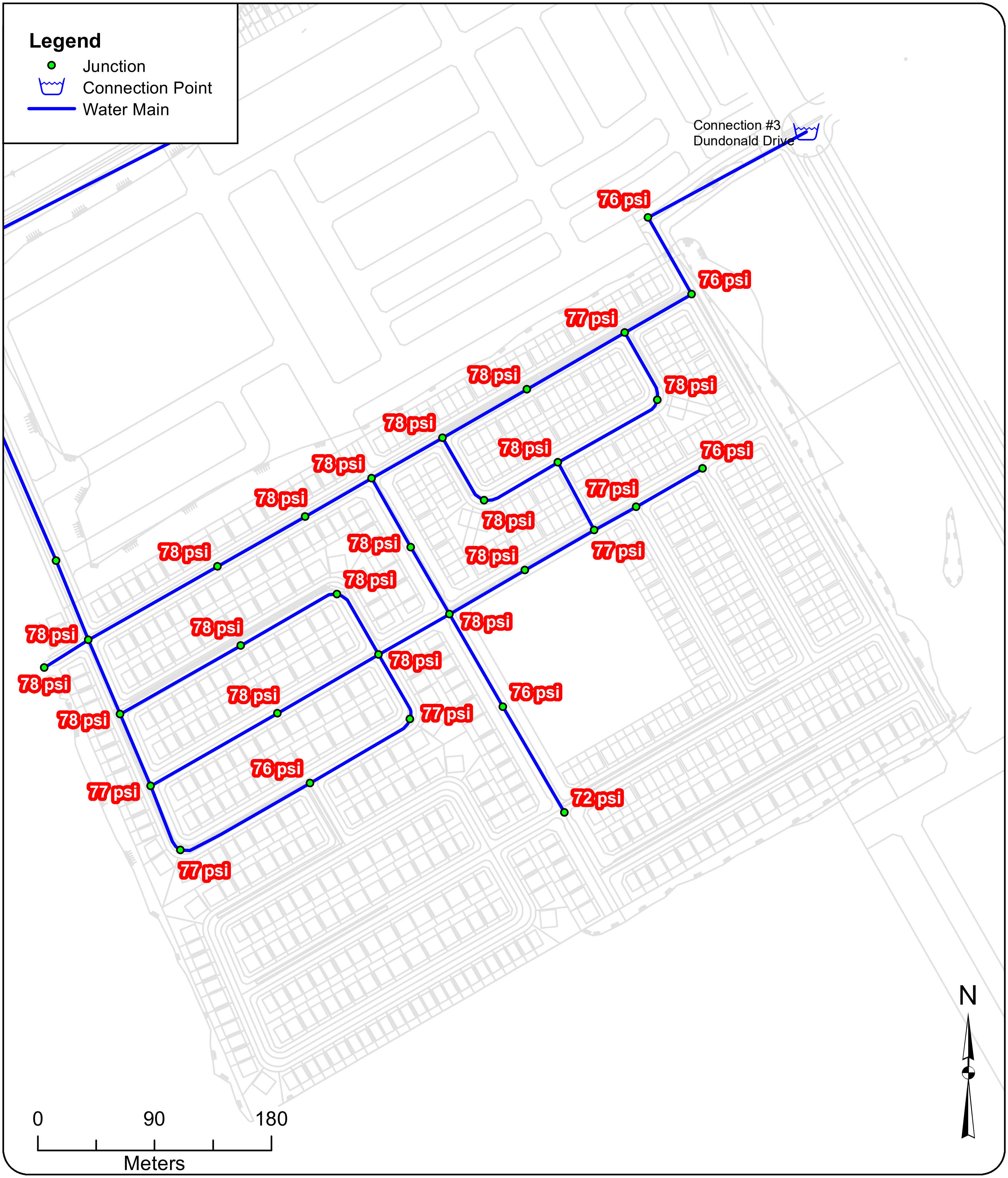
Appendix D Pipe and Junction Model Inputs

Model Inputs - Phases 1 and 2

ID	From	To	Length (m)	Diameter (mm)	Roughness ()
P-100	J-82	J-83	63.79	204	110
P-101	J-83	J-46	60.03	204	110
P-102	J-79	J-84	53.32	204	110
P-103	J-84	J-85	55.04	204	110
P-104	J-85	J-45	66.63	204	110
P-105	J-78	J-86	72.81	297	120
P-106	J-86	J-87	55.90	297	120
P-107	J-87	J-88	48.49	297	120
P-108	J-45	J-88	59.54	204	110
P-109	J-88	J-89	55.04	297	120
P-110	J-89	J-41	65.11	297	120
P-111	J-90	J-47	61.51	204	110
P-112	J-43	J-90	59.19	204	110
P-42	J-33	J-34	40.11	297	120
P-43	J-33	J-35	114.35	297	120
P-44	J-35	J-36	77.83	297	120
P-45	J-36	J-37	59.20	297	120
P-46	J-37	J-38	62.88	297	120
P-47	J-38	J-39	74.92	297	120
P-48	J-39	J-40	87.18	297	120
P-49	J-40	J-41	59.39	297	120
P-50	J-41	J-60	67.93	297	120
P-51	J-60	CONNECTION_3	138.92	297	120
P-52	J-40	J-42	58.39	204	110
P-53	J-42	J-43	83.72	204	110
P-54	J-43	J-44	72.67	204	110
P-55	J-44	J-38	58.67	204	110
P-56	J-45	J-46	59.20	204	110
P-57	J-46	J-90	81.24	204	110
P-58	J-47	J-48	84.62	204	110
P-59	J-48	J-61	59.65	297	120
P-60	J-61	J-37	60.99	297	120
P-61	J-59	J-58	94.07	297	120
P-62	J-58	J-48	82.47	297	120
P-63	J-48	J-49	63.07	204	110
P-64	J-49	J-50	57.71	204	110
P-65	J-50	J-51	84.62	204	110
P-66	J-51	J-52	106.76	204	110
P-67	J-33	J-52	62.05	204	110
P-68	J-52	J-53	60.2	204	110
P-69	J-53	J-54	112.78	204	110
P-70	J-54	J-49	90	204	110
P-71	J-49	J-57	56.32	204	110
P-72	J-57	J-56	92.28	204	110
P-73	J-53	J-55	55.27	204	110
P-74	J-55	J-56	113.38	204	110
P-75	J-56	J-62	58.69	204	110
P-76	J-62	J-63	119.4	204	110
P-77	J-63	J-64	56.35	204	110
P-78	J-64	J-65	58.6	204	110
P-79	J-65	J-66	100.76	204	110
P-80	J-66	J-70	70.42	204	110
P-81	J-70	J-71	55.7	204	110
P-82	J-71	J-69	54.8	204	110
P-83	J-64	J-67	125.85	204	110
P-84	J-67	J-69	97.99	204	110
P-85	J-62	J-68	92.12	204	110
P-86	J-68	J-69	56.42	204	110
P-87	J-69	J-59	63.46	204	110
P-88	J-59	J-72	59.77	297	120
P-89	J-72	J-73	28.67	297	120
P-90	J-72	J-74	96.85	297	120
P-91	J-74	J-75	110.13	297	120
P-92	J-75	J-76	78.16	297	120
P-93	J-77	J-76	30.34	297	120
P-94	J-76	J-78	58.2	297	120
P-95	J-78	J-79	59.97	204	110
P-96	J-79	J-80	59.39	204	110
P-97	J-80	J-81	85.15	204	110
P-98	J-81	J-59	79.25	204	110
P-99	J-80	J-82	51.74	204	110

ID	Elevation (m)	ADD (L/s)
J-33	101.29	0.18
J-34	101.41	0.00
J-35	101.33	0.16
J-36	101.25	0.16
J-37	101.64	0.06
J-38	101.46	0.14
J-39	101.83	0.20
J-40	101.96	0.14
J-41	102.65	0.04
J-42	101.87	0.16
J-43	101.72	0.18
J-44	101.59	0.16
J-45	103.27	0.06
J-46	102.38	0.08
J-47	101.77	0.12
J-48	101.83	0.06
J-49	101.74	0.14
J-50	101.40	0.12
J-51	101.41	0.18
J-52	101.35	0.20
J-53	102.22	0.20
J-54	101.87	0.20
J-55	102.52	0.20
J-56	103.00	0.20
J-57	102.46	0.12
J-58	102.95	0.06
J-59	105.68	0.64
J-60	102.80	0.00
J-61	101.51	0.06
J-62	104.21	0.00
J-63	106.39	0.20
J-64	106.74	0.20
J-65	107.17	0.20
J-66	107.78	0.18
J-67	106.62	0.20
J-68	106.00	0.22
J-69	107.07	0.14
J-70	108.43	0.14
J-71	108.62	0.16
J-72	107.85	0.12
J-73	108.47	0.16
J-74	107.68	0.00
J-75	108.00	0.24
J-76	108.27	0.16
J-77	108.93	0.08
J-78	106.17	0.00
J-79	105.57	0.06
J-80	105.54	0.18
J-81	105.54	0.18
J-82	104.30	0.28
J-83	103.10	0.12
J-84	104.73	0.20
J-85	103.68	0.12
J-86	105.81	0.20
J-87	105.51	0.08
J-88	104.78	0.08
J-89	103.69	0.04
J-90	102.07	0.08

Appendix E MHD and PHD Model Results



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

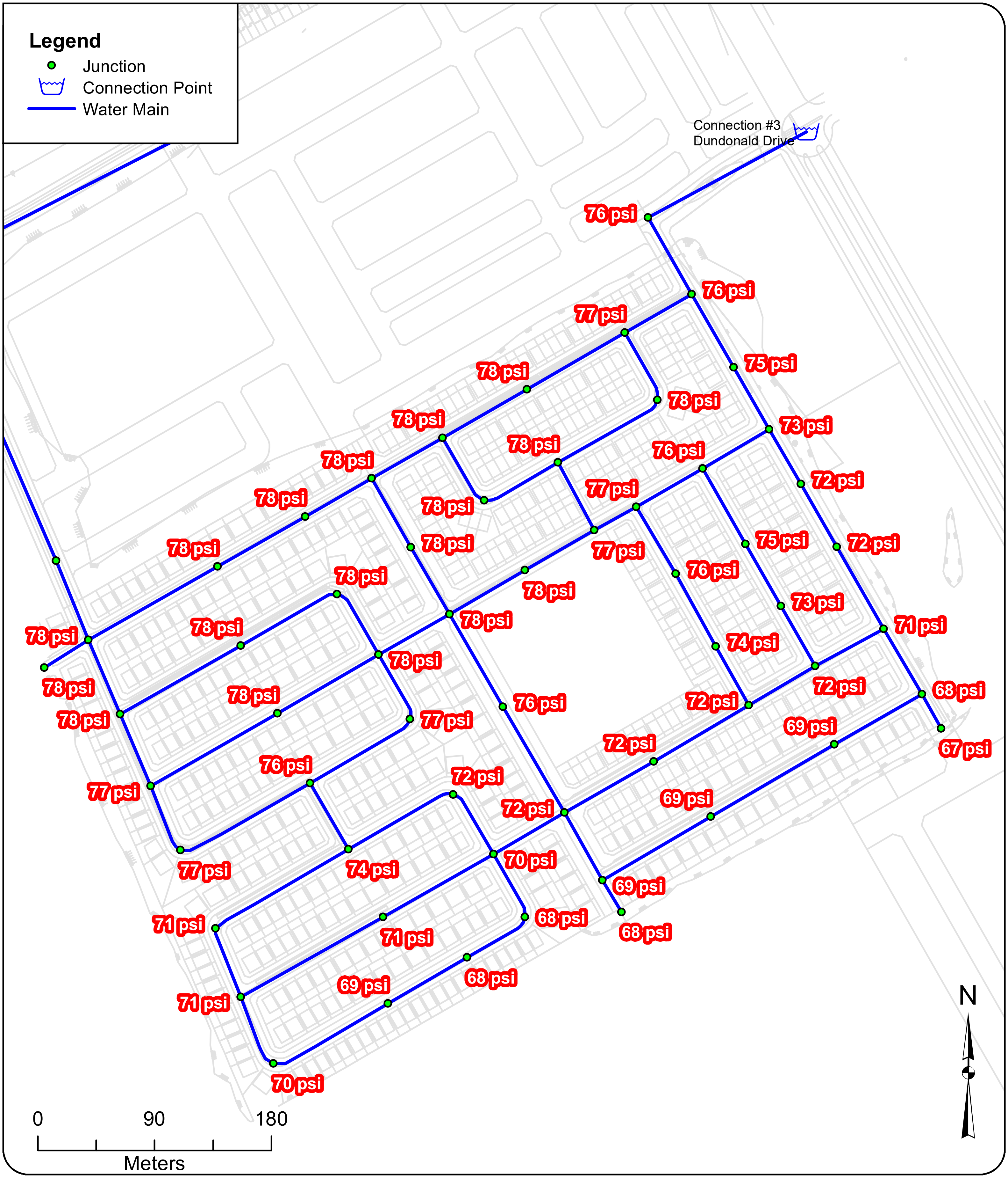
MHD Pressure Results - Phase 1

Figure E.1

Minimum Hour Demand Modeling Results - Phase 1

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-42	J-33	J-34	40.11	297	120	0.00	0.00	0.00	0.00
P-43	J-33	J-35	114.35	297	120	-0.09	0.00	0.00	0.00
P-44	J-35	J-36	77.83	297	120	-0.16	0.00	0.00	0.00
P-45	J-36	J-37	59.20	297	120	-0.25	0.00	0.00	0.00
P-46	J-37	J-38	62.88	297	120	-0.88	0.01	0.00	0.00
P-47	J-38	J-39	74.92	297	120	-1.05	0.02	0.00	0.00
P-48	J-39	J-40	87.18	297	120	-1.15	0.02	0.00	0.00
P-49	J-40	J-41	59.39	297	120	-1.68	0.02	0.00	0.00
P-50	J-41	J-60	67.93	297	120	-1.69	0.02	0.00	0.00
P-51	J-60	CONNECTION_3	138.92	297	120	-1.69	0.02	0.00	0.00
P-52	J-40	J-42	58.39	204	110	0.45	0.01	0.00	0.00
P-53	J-42	J-43	91.90	204	110	0.37	0.01	0.00	0.00
P-54	J-43	J-44	64.49	204	110	-0.02	0.00	0.00	0.00
P-55	J-44	J-38	58.67	204	110	-0.10	0.00	0.00	0.00
P-56	J-45	J-46	59.20	204	110	-0.03	0.00	0.00	0.00
P-57	J-46	J-90	37.06	204	110	-0.08	0.00	0.00	0.00
P-58	J-47	J-48	67.31	204	110	0.16	0.00	0.00	0.00
P-59	J-48	J-61	59.65	297	120	-0.58	0.01	0.00	0.00
P-60	J-61	J-37	60.99	297	120	-0.61	0.01	0.00	0.00
P-61	J-59	J-58	94.07	297	120	-0.32	0.00	0.00	0.00
P-62	J-58	J-48	82.47	297	120	-0.35	0.01	0.00	0.00
P-63	J-48	J-49	63.07	204	110	0.36	0.01	0.00	0.00
P-64	J-49	J-50	57.71	204	110	0.04	0.00	0.00	0.00
P-65	J-50	J-51	84.62	204	110	-0.02	0.00	0.00	0.00
P-66	J-51	J-52	106.76	204	110	-0.11	0.00	0.00	0.00
P-67	J-33	J-52	62.05	204	110	0.42	0.01	0.00	0.00
P-68	J-52	J-53	60.20	204	110	0.21	0.01	0.00	0.00
P-69	J-53	J-54	112.78	204	110	-0.01	0.00	0.00	0.00
P-70	J-54	J-49	90.00	204	110	-0.10	0.00	0.00	0.00
P-71	J-49	J-57	56.32	204	110	0.14	0.00	0.00	0.00
P-72	J-57	J-56	92.28	204	110	0.08	0.00	0.00	0.00
P-73	J-53	J-55	55.27	204	110	0.12	0.00	0.00	0.00
P-74	J-55	J-56	113.38	204	110	0.02	0.00	0.00	0.00
P-111	J-90	J-47	61.51	204	110	0.22	0.01	0.00	0.00
P-112	J-43	J-90	59.19	204	110	0.30	0.01	0.00	0.00

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-33	0.09	101.29	156	78
J-34	0.00	101.41	156	78
J-35	0.08	101.33	156	78
J-36	0.08	101.25	156	78
J-37	0.03	101.64	156	78
J-38	0.07	101.46	156	78
J-39	0.10	101.83	156	78
J-40	0.07	101.96	156	77
J-41	0.02	102.65	156	76
J-42	0.08	101.87	156	78
J-43	0.09	101.72	156	78
J-44	0.08	101.59	156	78
J-45	0.03	103.27	156	76
J-46	0.04	102.38	156	77
J-47	0.06	101.77	156	78
J-48	0.03	101.83	156	78
J-49	0.07	101.74	156	78
J-50	0.06	101.40	156	78
J-51	0.09	101.41	156	78
J-52	0.10	101.35	156	78
J-53	0.10	102.22	156	77
J-54	0.10	101.87	156	78
J-55	0.10	102.52	156	77
J-56	0.10	103.00	156	76
J-57	0.06	102.46	156	77
J-58	0.03	102.95	156	76
J-59	0.32	105.68	156	72
J-60	0.00	102.80	156	76
J-61	0.03	101.51	156	78
J-90	0.00	102.07	156	77



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

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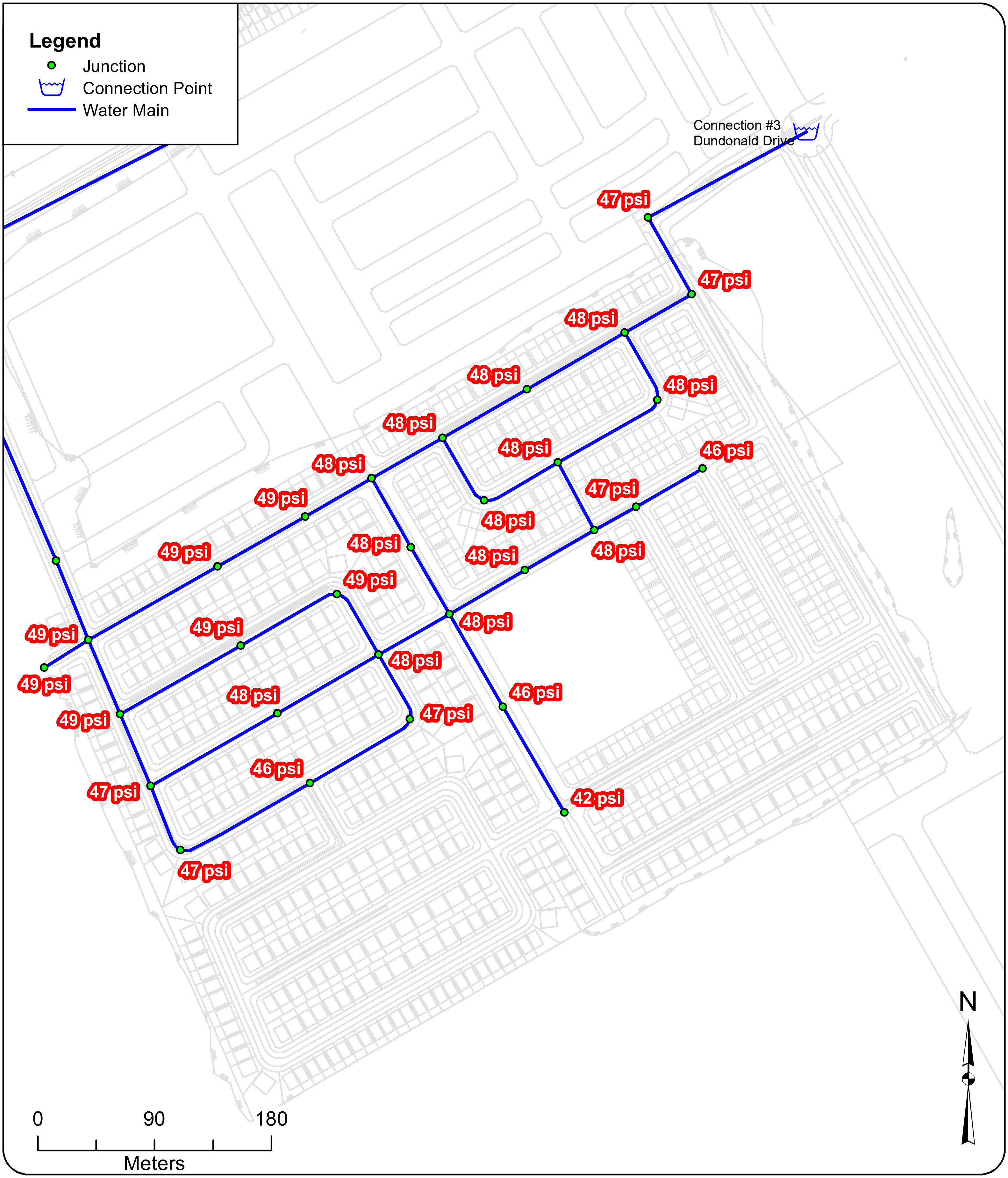
MHD Pressure Results - Phases 1&2

Figure E.2

Minimum Hour Demand Modeling Results - Phases 1 and 2

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-42	J-33	J-34	40.11	297	120	0.00	0.00	0.00	0.00
P-43	J-33	J-35	114.35	297	120	0.35	0.01	0.00	0.00
P-44	J-35	J-36	77.83	297	120	0.28	0.00	0.00	0.00
P-45	J-36	J-37	59.20	297	120	0.20	0.00	0.00	0.00
P-46	J-37	J-38	62.88	297	120	-0.73	0.01	0.00	0.00
P-47	J-38	J-39	74.92	297	120	-0.95	0.01	0.00	0.00
P-48	J-39	J-40	87.18	297	120	-1.05	0.02	0.00	0.00
P-49	J-40	J-41	59.39	297	120	-1.56	0.02	0.00	0.00
P-50	J-41	J-60	67.93	297	120	-3.05	0.04	0.00	0.01
P-51	J-60	CONNECTION_3	138.92	297	120	-3.05	0.04	0.00	0.01
P-52	J-40	J-42	58.39	204	110	0.44	0.01	0.00	0.00
P-53	J-42	J-43	83.72	204	110	0.35	0.01	0.00	0.00
P-54	J-43	J-44	72.67	204	110	-0.07	0.00	0.00	0.00
P-55	J-44	J-38	58.67	204	110	-0.15	0.00	0.00	0.00
P-56	J-45	J-46	59.20	204	110	0.21	0.01	0.00	0.00
P-57	J-46	J-90	81.24	204	110	-0.10	0.00	0.00	0.00
P-58	J-47	J-48	84.62	204	110	0.18	0.01	0.00	0.00
P-59	J-48	J-61	59.65	297	120	-0.87	0.01	0.00	0.00
P-60	J-61	J-37	60.99	297	120	-0.90	0.01	0.00	0.00
P-61	J-59	J-58	94.07	297	120	-0.53	0.01	0.00	0.00
P-62	J-58	J-48	82.47	297	120	-0.56	0.01	0.00	0.00
P-63	J-48	J-49	63.07	204	110	0.45	0.01	0.00	0.00
P-64	J-49	J-50	57.71	204	110	-0.03	0.00	0.00	0.00
P-65	J-50	J-51	84.62	204	110	-0.09	0.00	0.00	0.00
P-66	J-51	J-52	106.76	204	110	-0.18	0.01	0.00	0.00
P-67	J-33	J-52	62.05	204	110	0.62	0.02	0.00	0.00
P-68	J-52	J-53	60.20	204	110	0.33	0.01	0.00	0.00
P-69	J-53	J-54	112.78	204	110	-0.03	0.00	0.00	0.00
P-70	J-54	J-49	90.00	204	110	-0.13	0.00	0.00	0.00
P-71	J-49	J-57	56.32	204	110	0.28	0.01	0.00	0.00
P-72	J-57	J-56	92.28	204	110	0.22	0.01	0.00	0.00
P-73	J-53	J-55	55.27	204	110	0.26	0.01	0.00	0.00
P-74	J-55	J-56	113.38	204	110	0.17	0.01	0.00	0.00
P-111	J-90	J-47	61.51	204	110	0.24	0.01	0.00	0.00
P-112	J-43	J-90	59.19	204	110	0.33	0.01	0.00	0.00
P-75	J-56	J-62	58.69	204	110	0.29	0.01	0.00	0.00
P-76	J-62	J-63	119.4	204	110	0.19	0.01	0.00	0.00
P-77	J-63	J-64	56.35	204	110	0.10	0.00	0.00	0.00
P-78	J-64	J-65	58.6	204	110	0.09	0.00	0.00	0.00
P-79	J-65	J-66	100.76	204	110	0.00	0.00	0.00	0.00
P-80	J-66	J-70	70.42	204	110	-0.10	0.00	0.00	0.00
P-81	J-70	J-71	55.7	204	110	-0.18	0.01	0.00	0.00
P-82	J-71	J-69	54.8	204	110	-0.24	0.01	0.00	0.00
P-83	J-64	J-67	125.85	204	110	-0.09	0.00	0.00	0.00
P-84	J-67	J-69	97.99	204	110	-0.20	0.01	0.00	0.00
P-85	J-62	J-68	92.12	204	110	0.00	0.00	0.00	0.00
P-86	J-68	J-69	56.42	204	110	-0.07	0.00	0.00	0.00
P-87	J-69	J-59	63.46	204	110	-0.59	0.02	0.00	0.00
P-88	J-59	J-72	59.77	297	120	-0.29	0.00	0.00	0.00
P-89	J-72	J-73	28.67	297	120	0.00	0.00	0.00	0.00
P-90	J-72	J-74	96.85	297	120	-0.37	0.01	0.00	0.00
P-91	J-74	J-75	110.13	297	120	-0.49	0.01	0.00	0.00
P-92	J-75	J-76	78.16	297	120	-0.57	0.01	0.00	0.00
P-93	J-77	J-76	30.34	297	120	0.00	0.00	0.00	0.00
P-94	J-76	J-78	58.2	297	120	-0.61	0.01	0.00	0.00
P-95	J-78	J-79	59.97	204	110	0.21	0.01	0.00	0.00
P-96	J-79	J-80	59.39	204	110	0.22	0.01	0.00	0.00
P-97	J-80	J-81	85.15	204	110	0.23	0.01	0.00	0.00
P-98	J-81	J-59	79.25	204	110	0.09	0.00	0.00	0.00
P-99	J-80	J-82	51.74	204	110	-0.10	0.00	0.00	0.00
P-100	J-82	J-83	63.79	204	110	-0.16	0.00	0.00	0.00
P-101	J-83	J-46	60.03	204	110	-0.26	0.01	0.00	0.00
P-102	J-79	J-84	53.32	204	110	-0.09	0.00	0.00	0.00
P-103	J-84	J-85	55.04	204	110	-0.15	0.00	0.00	0.00
P-104	J-85	J-45	66.63	204	110	-0.25	0.01	0.00	0.00
P-105	J-78	J-86	72.81	297	120	-0.86	0.01	0.00	0.00
P-106	J-86	J-87	55.9	297	120	-0.89	0.01	0.00	0.00
P-107	J-87	J-88	48.49	297	120	-0.93	0.01	0.00	0.00
P-108	J-45	J-88	59.54	204	110	-0.49	0.01	0.00	0.00
P-109	J-88	J-89	55.04	297	120	-1.44	0.02	0.00	0.00
P-110	J-89	J-41	65.11	297	120	-1.48	0.02	0.00	0.00

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-33	0.09	101.29	156	78
J-34	0.00	101.41	156	78
J-35	0.08	101.33	156	78
J-36	0.08	101.25	156	78
J-37	0.03	101.64	156	78
J-38	0.07	101.46	156	78
J-39	0.10	101.83	156	78
J-40	0.07	101.96	156	77
J-41	0.02	102.65	156	76
J-42	0.08	101.87	156	78
J-43	0.09	101.72	156	78
J-44	0.08	101.59	156	78
J-45	0.03	103.27	156	76
J-46	0.04	102.38	156	77
J-47	0.06	101.77	156	78
J-48	0.03	101.83	156	78
J-49	0.07	101.74	156	78
J-50	0.06	101.40	156	78
J-51	0.09	101.41	156	78
J-52	0.10	101.35	156	78
J-53	0.10	102.22	156	77
J-54	0.10	101.87	156	78
J-55	0.10	102.52	156	77
J-56	0.10	103.00	156	76
J-57	0.06	102.46	156	77
J-58	0.03	102.95	156	76
J-59	0.32	105.68	156	72
J-60	0.00	102.80	156	76
J-61	0.03	101.51	156	78
J-90	0.00	102.07	156	77
J-62	0.10	104.21	156	74
J-63	0.10	106.39	156	71
J-64	0.10	106.74	156	71
J-65	0.09	107.17	156	70
J-66	0.10	107.78	156	69
J-67	0.11	106.62	156	71
J-68	0.07	106.00	156	72
J-69	0.07	107.07	156	70
J-70	0.08	108.43	156	68
J-71	0.06	108.62	156	68
J-72	0.08	107.85	156	69
J-73	0.00	108.47	156	68
J-74	0.12	107.68	156	69
J-75	0.08	108.00	156	69
J-76	0.04	108.27	156	68
J-77	0.00	108.93	156	67
J-78	0.03	106.17	156	71
J-79	0.09	105.57	156	72
J-80	0.09	105.54	156	72
J-81	0.14	105.54	156	72
J-82	0.06	104.30	156	74
J-83	0.10	103.10	156	76
J-84	0.06	104.73	156	73
J-85	0.10	103.68	156	75
J-86	0.04	105.81	156	72
J-87	0.04	105.51	156	72
J-88	0.02	104.78	156	73
J-89	0.04	103.69	156	75



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

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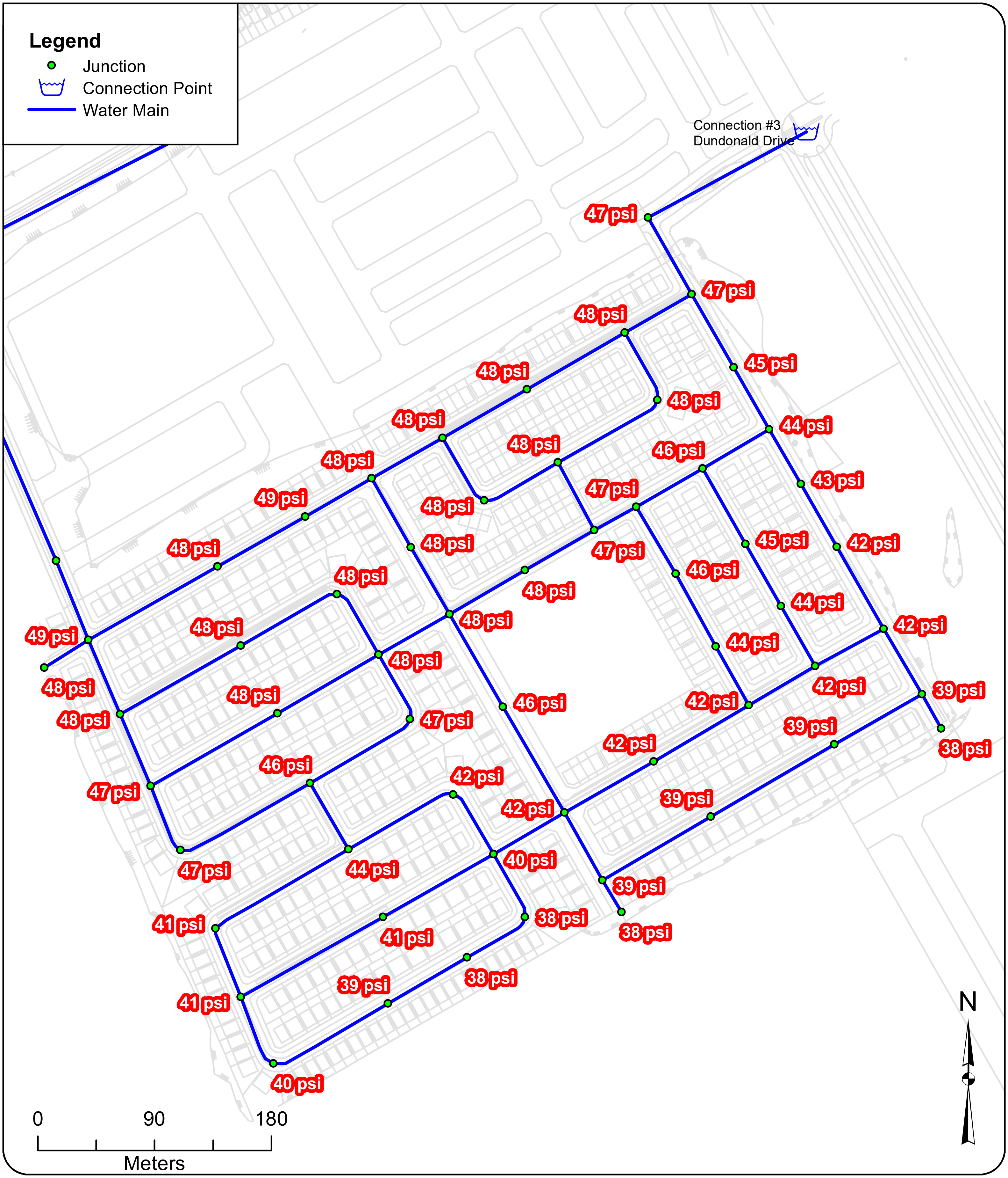
PHD Pressure Results - Phase 1

Figure E.3

Peak Hour Demand Modeling Results - Phase 1

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-42	J-33	J-34	40.11	297	120	0.00	0.00	0.00	0.00
P-43	J-33	J-35	114.35	297	120	-2.53	0.04	0.00	0.01
P-44	J-35	J-36	77.83	297	120	-3.36	0.05	0.00	0.01
P-45	J-36	J-37	59.20	297	120	-4.27	0.06	0.00	0.02
P-46	J-37	J-38	62.88	297	120	-10.16	0.15	0.01	0.11
P-47	J-38	J-39	74.92	297	120	-11.85	0.17	0.01	0.15
P-48	J-39	J-40	87.18	297	120	-13.00	0.19	0.02	0.18
P-49	J-40	J-41	59.39	297	120	-18.81	0.27	0.02	0.35
P-50	J-41	J-60	67.93	297	120	-18.99	0.27	0.02	0.36
P-51	J-60	CONNECTION_3	138.92	297	120	-18.99	0.27	0.05	0.36
P-52	J-40	J-42	58.39	204	110	5.02	0.15	0.01	0.23
P-53	J-42	J-43	91.90	204	110	4.12	0.13	0.01	0.16
P-54	J-43	J-44	64.49	204	110	-0.06	0.00	0.00	0.00
P-55	J-44	J-38	58.67	204	110	-0.91	0.03	0.00	0.01
P-56	J-45	J-46	59.20	204	110	-0.36	0.01	0.00	0.00
P-57	J-46	J-90	37.06	204	110	-0.84	0.03	0.00	0.01
P-58	J-47	J-48	67.31	204	110	1.65	0.05	0.00	0.03
P-59	J-48	J-61	59.65	297	120	-5.28	0.08	0.00	0.03
P-60	J-61	J-37	60.99	297	120	-5.59	0.08	0.00	0.04
P-61	J-59	J-58	94.07	297	120	-1.96	0.03	0.00	0.01
P-62	J-58	J-48	82.47	297	120	-2.26	0.03	0.00	0.01
P-63	J-48	J-49	63.07	204	110	4.29	0.13	0.01	0.17
P-64	J-49	J-50	57.71	204	110	0.63	0.02	0.00	0.00
P-65	J-50	J-51	84.62	204	110	-0.06	0.00	0.00	0.00
P-66	J-51	J-52	106.76	204	110	-1.04	0.03	0.00	0.01
P-67	J-33	J-52	62.05	204	110	4.28	0.13	0.01	0.17
P-68	J-52	J-53	60.20	204	110	2.10	0.06	0.00	0.04
P-69	J-53	J-54	112.78	204	110	-0.21	0.01	0.00	0.00
P-70	J-54	J-49	90.00	204	110	-1.27	0.04	0.00	0.02
P-71	J-49	J-57	56.32	204	110	1.63	0.05	0.00	0.03
P-72	J-57	J-56	92.28	204	110	0.95	0.03	0.00	0.01
P-73	J-53	J-55	55.27	204	110	1.17	0.04	0.00	0.02
P-74	J-55	J-56	113.38	204	110	0.11	0.00	0.00	0.00
P-111	J-90	J-47	61.51	204	110	2.31	0.07	0.00	0.05
P-112	J-43	J-90	59.19	204	110	3.16	0.10	0.01	0.10

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-33	0.99	101.29	136	49
J-34	0.00	101.41	136	49
J-35	0.83	101.33	136	49
J-36	0.91	101.25	136	49
J-37	0.30	101.64	136	48
J-38	0.78	101.46	136	49
J-39	1.15	101.83	136	48
J-40	0.78	101.96	136	48
J-41	0.18	102.65	136	47
J-42	0.90	101.87	136	48
J-43	1.02	101.72	136	48
J-44	0.84	101.59	136	48
J-45	0.36	103.27	136	46
J-46	0.48	102.38	136	47
J-47	0.66	101.77	136	48
J-48	0.38	101.83	136	48
J-49	0.76	101.74	136	48
J-50	0.68	101.40	136	49
J-51	0.99	101.41	136	49
J-52	1.14	101.35	136	49
J-53	1.14	102.22	136	47
J-54	1.06	101.87	136	48
J-55	1.06	102.52	136	47
J-56	1.06	103.00	136	46
J-57	0.68	102.46	136	47
J-58	0.30	102.95	136	46
J-59	1.96	105.68	136	42
J-60	0.00	102.80	136	47
J-61	0.30	101.51	136	48
J-90	0.00	102.07	136	48



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
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Reviewed by: **WdS**

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PHD Pressure Results - Phases 1&2

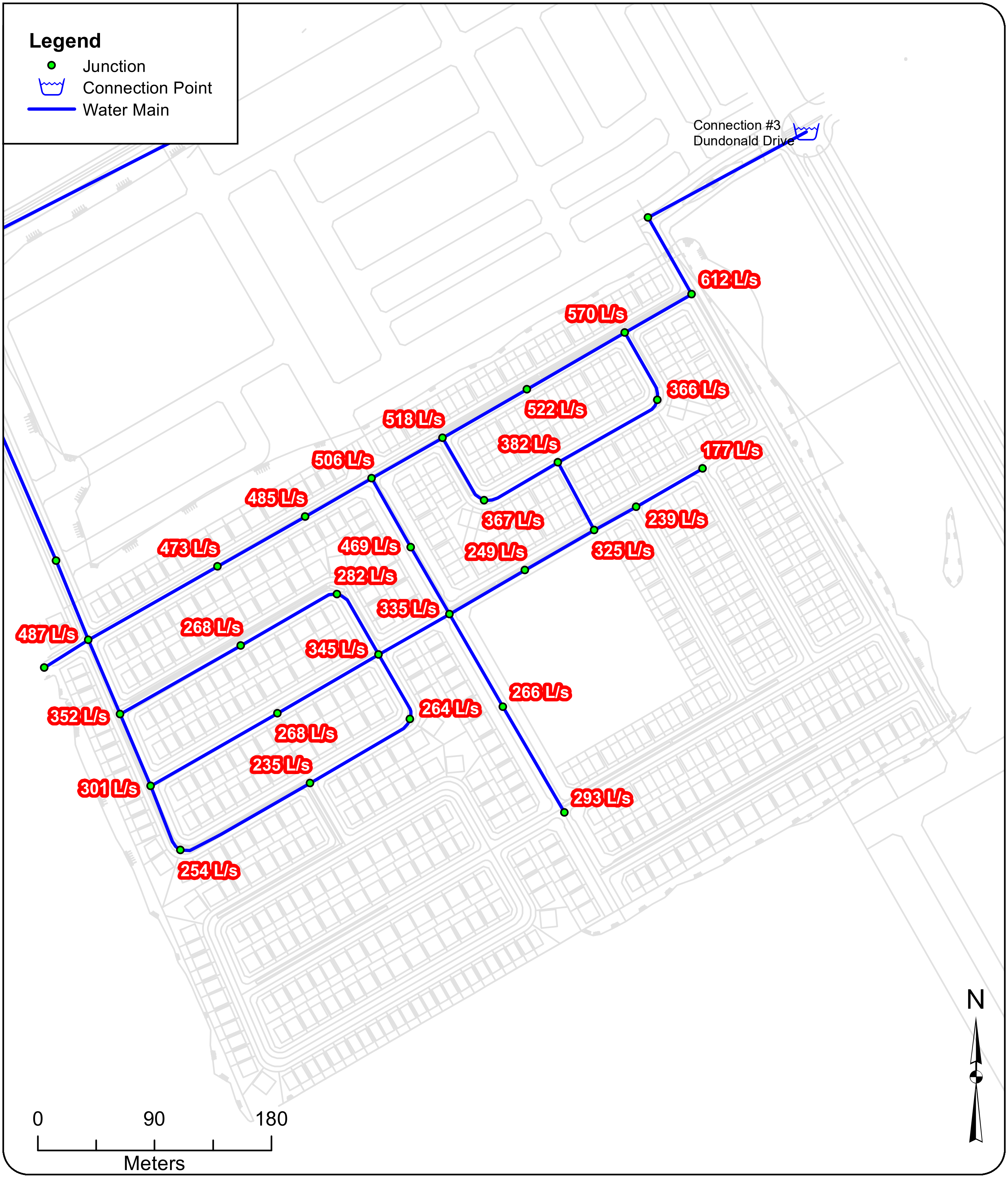
Figure E.4

Peak Hour Demand Modeling Results -Phases 1 and 2

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-42	J-33	J-34	40.11	297	120	0.00	0.00	0.00	0.00
P-43	J-33	J-35	114.35	297	120	3.16	0.05	0.00	0.01
P-44	J-35	J-36	77.83	297	120	2.33	0.03	0.00	0.01
P-45	J-36	J-37	59.20	297	120	1.42	0.02	0.00	0.00
P-46	J-37	J-38	62.88	297	120	-8.04	0.12	0.00	0.07
P-47	J-38	J-39	74.92	297	120	-10.35	0.15	0.01	0.12
P-48	J-39	J-40	87.18	297	120	-11.49	0.17	0.01	0.14
P-49	J-40	J-41	59.39	297	120	-17.00	0.25	0.02	0.29
P-50	J-41	J-60	67.93	297	120	-33.05	0.48	0.07	1.01
P-51	J-60	CONNECTION_3	138.92	297	120	-33.05	0.48	0.14	1.01
P-52	J-40	J-42	58.39	204	110	4.72	0.14	0.01	0.20
P-53	J-42	J-43	83.72	204	110	3.82	0.12	0.01	0.14
P-54	J-43	J-44	72.67	204	110	-0.68	0.02	0.00	0.01
P-55	J-44	J-38	58.67	204	110	-1.52	0.05	0.00	0.02
P-56	J-45	J-46	59.20	204	110	2.27	0.07	0.00	0.05
P-57	J-46	J-90	81.24	204	110	-0.92	0.03	0.00	0.01
P-58	J-47	J-48	84.62	204	110	1.88	0.06	0.00	0.04
P-59	J-48	J-61	59.65	297	120	-8.86	0.13	0.01	0.09
P-60	J-61	J-37	60.99	297	120	-9.16	0.13	0.01	0.09
P-61	J-59	J-58	94.07	297	120	-4.98	0.07	0.00	0.03
P-62	J-58	J-48	82.47	297	120	-5.28	0.08	0.00	0.03
P-63	J-48	J-49	63.07	204	110	5.08	0.16	0.01	0.23
P-64	J-49	J-50	57.71	204	110	-0.22	0.01	0.00	0.00
P-65	J-50	J-51	84.62	204	110	-0.90	0.03	0.00	0.01
P-66	J-51	J-52	106.76	204	110	-1.89	0.06	0.00	0.04
P-67	J-33	J-52	62.05	204	110	6.57	0.20	0.02	0.37
P-68	J-52	J-53	60.20	204	110	3.54	0.11	0.01	0.12
P-69	J-53	J-54	112.78	204	110	-0.41	0.01	0.00	0.00
P-70	J-54	J-49	90.00	204	110	-1.48	0.05	0.00	0.02
P-71	J-49	J-57	56.32	204	110	3.06	0.09	0.01	0.09
P-72	J-57	J-56	92.28	204	110	2.38	0.07	0.01	0.06
P-73	J-53	J-55	55.27	204	110	2.82	0.09	0.00	0.08
P-74	J-55	J-56	113.38	204	110	1.76	0.05	0.00	0.03
P-111	J-90	J-47	61.51	204	110	2.55	0.08	0.00	0.06
P-112	J-43	J-90	59.19	204	110	3.47	0.11	0.01	0.11
P-75	J-56	J-62	58.69	204	110	3.08	0.09	0.01	0.09
P-76	J-62	J-63	119.4	204	110	2.11	0.06	0.01	0.05
P-77	J-63	J-64	56.35	204	110	1.05	0.03	0.00	0.01
P-78	J-64	J-65	58.6	204	110	0.97	0.03	0.00	0.01
P-79	J-65	J-66	100.76	204	110	-0.01	0.00	0.00	0.00
P-80	J-66	J-70	70.42	204	110	-1.15	0.04	0.00	0.01
P-81	J-70	J-71	55.7	204	110	-2.06	0.06	0.00	0.04
P-82	J-71	J-69	54.8	204	110	-2.67	0.08	0.00	0.07
P-83	J-64	J-67	125.85	204	110	-1.06	0.03	0.00	0.01
P-84	J-67	J-69	97.99	204	110	-2.27	0.07	0.01	0.05
P-85	J-62	J-68	92.12	204	110	-0.17	0.01	0.00	0.00
P-86	J-68	J-69	56.42	204	110	-0.93	0.03	0.00	0.01
P-87	J-69	J-59	63.46	204	110	-6.63	0.20	0.02	0.38
P-88	J-59	J-72	59.77	297	120	-2.83	0.04	0.00	0.01
P-89	J-72	J-73	28.67	297	120	0.00	0.00	0.00	0.00
P-90	J-72	J-74	96.85	297	120	-3.74	0.05	0.00	0.02
P-91	J-74	J-75	110.13	297	120	-5.03	0.07	0.00	0.03
P-92	J-75	J-76	78.16	297	120	-5.93	0.09	0.00	0.04
P-93	J-77	J-76	30.34	297	120	0.00	0.00	0.00	0.00
P-94	J-76	J-78	58.2	297	120	-6.39	0.09	0.00	0.05
P-95	J-78	J-79	59.97	204	110	2.36	0.07	0.00	0.06
P-96	J-79	J-80	59.39	204	110	2.34	0.07	0.00	0.05
P-97	J-80	J-81	85.15	204	110	2.34	0.07	0.00	0.05
P-98	J-81	J-59	79.25	204	110	0.78	0.02	0.00	0.01
P-99	J-80	J-82	51.74	204	110	-0.96	0.03	0.00	0.01
P-100	J-82	J-83	63.79	204	110	-1.63	0.05	0.00	0.03
P-101	J-83	J-46	60.03	204	110	-2.71	0.08	0.00	0.07
P-102	J-79	J-84	53.32	204	110	-0.94	0.03	0.00	0.01
P-103	J-84	J-85	55.04	204	110	-1.54	0.05	0.00	0.03
P-104	J-85	J-45	66.63	204	110	-2.62	0.08	0.00	0.07
P-105	J-78	J-86	72.81	297	120	-9.11	0.13	0.01	0.09
P-106	J-86	J-87	55.9	297	120	-9.53	0.14	0.01	0.10
P-107	J-87	J-88	48.49	297	120	-9.95	0.14	0.01	0.11
P-108	J-45	J-88	59.54	204	110	-5.25	0.16	0.01	0.24
P-109	J-88	J-89	55.04	297	120	-15.45	0.22	0.01	0.25
P-110	J-89	J-41	65.11	297	120	-15.87	0.23	0.02	0.26

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-33	0.99	101.29	135	49
J-34	0.00	101.41	135	48
J-35	0.83	101.33	135	49
J-36	0.91	101.25	135	49
J-37	0.30	101.64	135	48
J-38	0.78	101.46	135	48
J-39	1.15	101.83	135	48
J-40	0.78	101.96	135	48
J-41	0.18	102.65	135	47
J-42	0.90	101.87	135	48
J-43	1.02	101.72	135	48
J-44	0.84	101.59	135	48
J-45	0.36	103.27	135	46
J-46	0.48	102.38	135	47
J-47	0.66	101.77	135	48
J-48	0.38	101.83	135	48
J-49	0.76	101.74	135	48
J-50	0.68	101.40	135	48
J-51	0.99	101.41	135	48
J-52	1.14	101.35	135	48
J-53	1.14	102.22	135	47
J-54	1.06	101.87	135	48
J-55	1.06	102.52	135	47
J-56	1.06	103.00	135	46
J-57	0.68	102.46	135	47
J-58	0.30	102.95	135	46
J-59	1.96	105.68	135	42
J-60	0.00	102.80	136	47
J-61	0.30	101.51	135	48
J-90	0.00	102.07	135	47
J-62	1.14	104.21	135	44
J-63	1.06	106.39	135	41
J-64	1.14	106.74	135	41
J-65	0.98	107.17	135	40
J-66	1.14	107.78	135	39
J-67	1.21	106.62	135	41
J-68	0.76	106.00	135	42
J-69	0.76	107.07	135	40
J-70	0.91	108.43	135	38
J-71	0.61	108.62	135	38
J-72	0.91	107.85	135	39
J-73	0.00	108.47	135	38
J-74	1.29	107.68	135	39
J-75	0.91	108.00	135	39
J-76	0.45	108.27	135	39
J-77	0.00	108.93	135	38
J-78	0.36	106.17	135	42
J-79	0.96	105.57	135	42
J-80	0.96	105.54	135	43
J-81	1.56	105.54	135	42
J-82	0.66	104.30	135	44
J-83	1.08	103.10	135	46
J-84	0.60	104.73	135	44
J-85	1.08	103.68	135	45
J-86	0.42	105.81	135	42
J-87	0.42	105.51	135	43
J-88	0.24	104.78	135	44
J-89	0.42	103.69	135	45

Appendix F MDD+FF Model Results



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis of the Brazeau Lands**
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2020**
Created by: **BL**
Reviewed by: **WdS**

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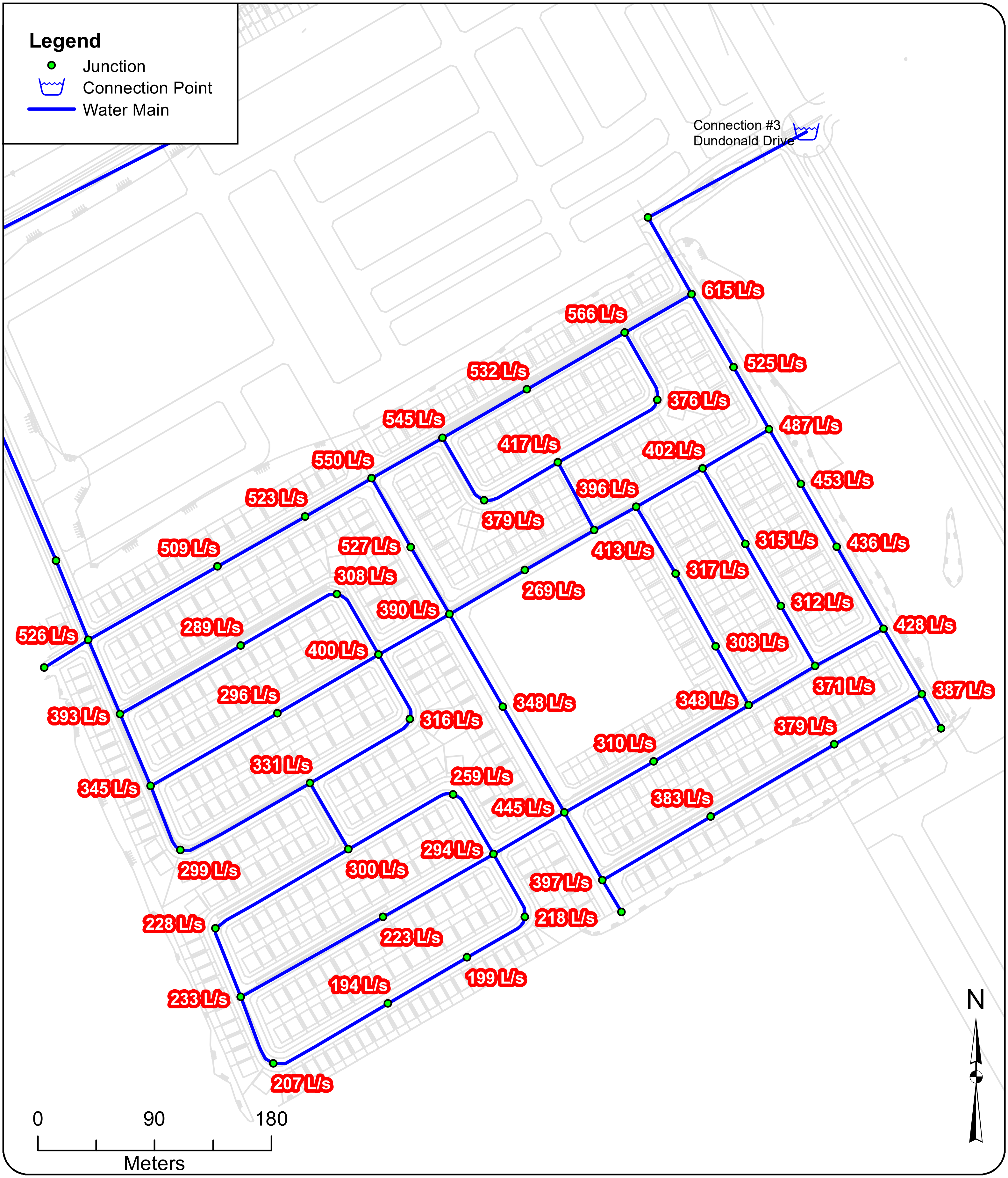
Available Fire Flow @ 20 psi - Phase 1

Figure F.1



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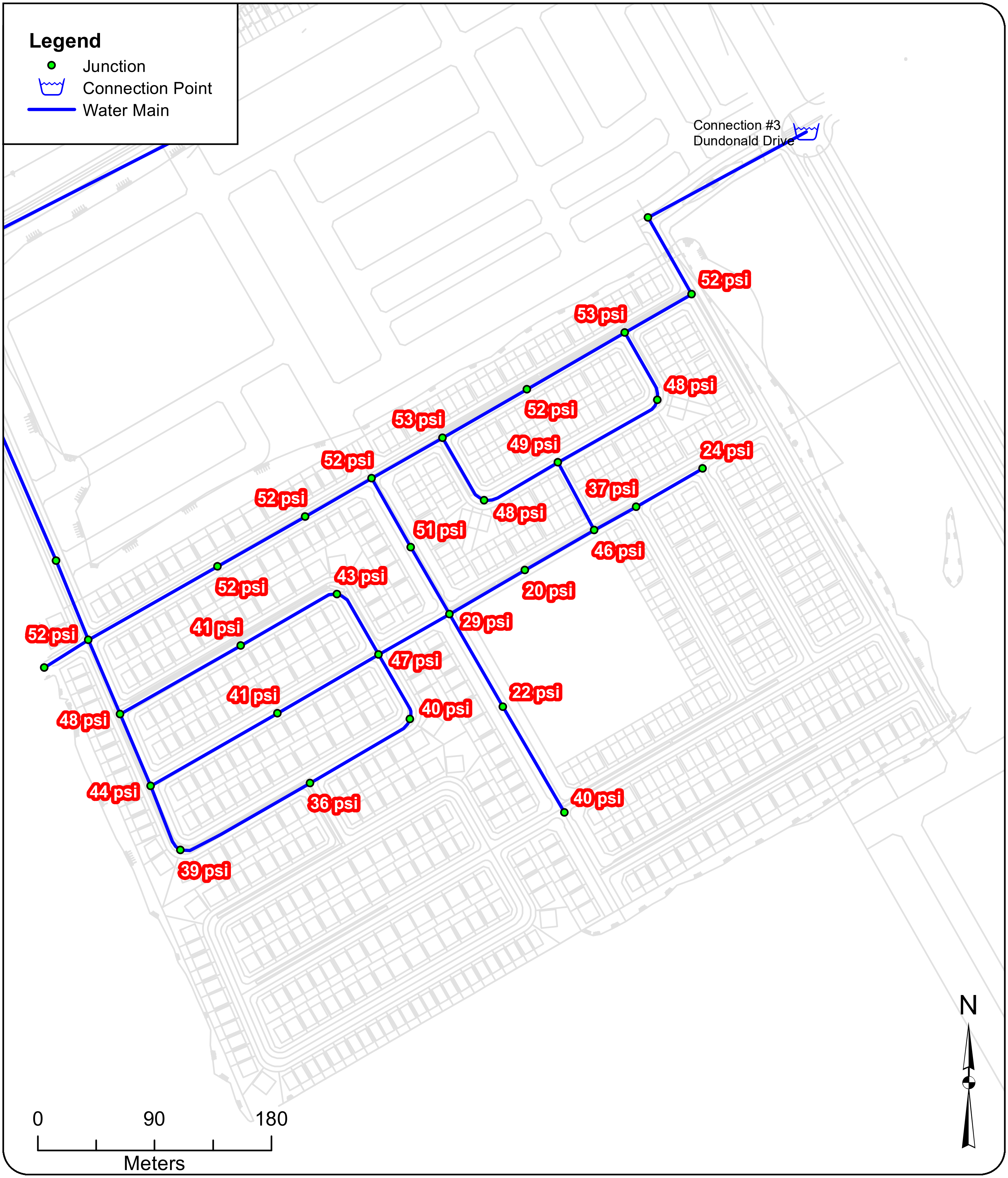
Available Fire Flow @ 20 psi - Phases 1&2

Figure F.2



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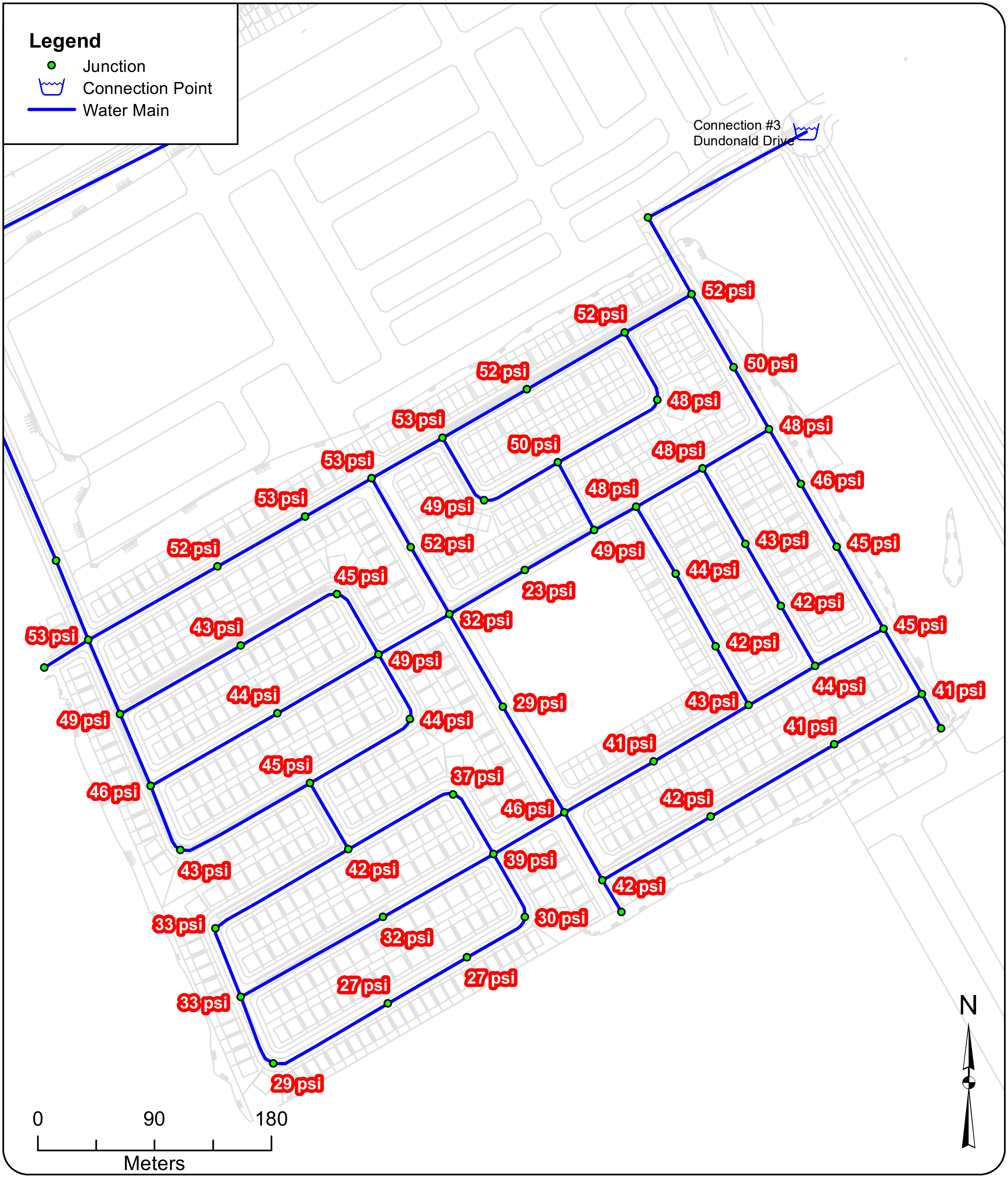
Residual Pressure @ Required Fire Flow - Phase 1

Figure F.3



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Residual Pressure @ Required Fire Flow - Phases 1&2

Figure F.4

Fire Flow Modeling Results - Phase 1

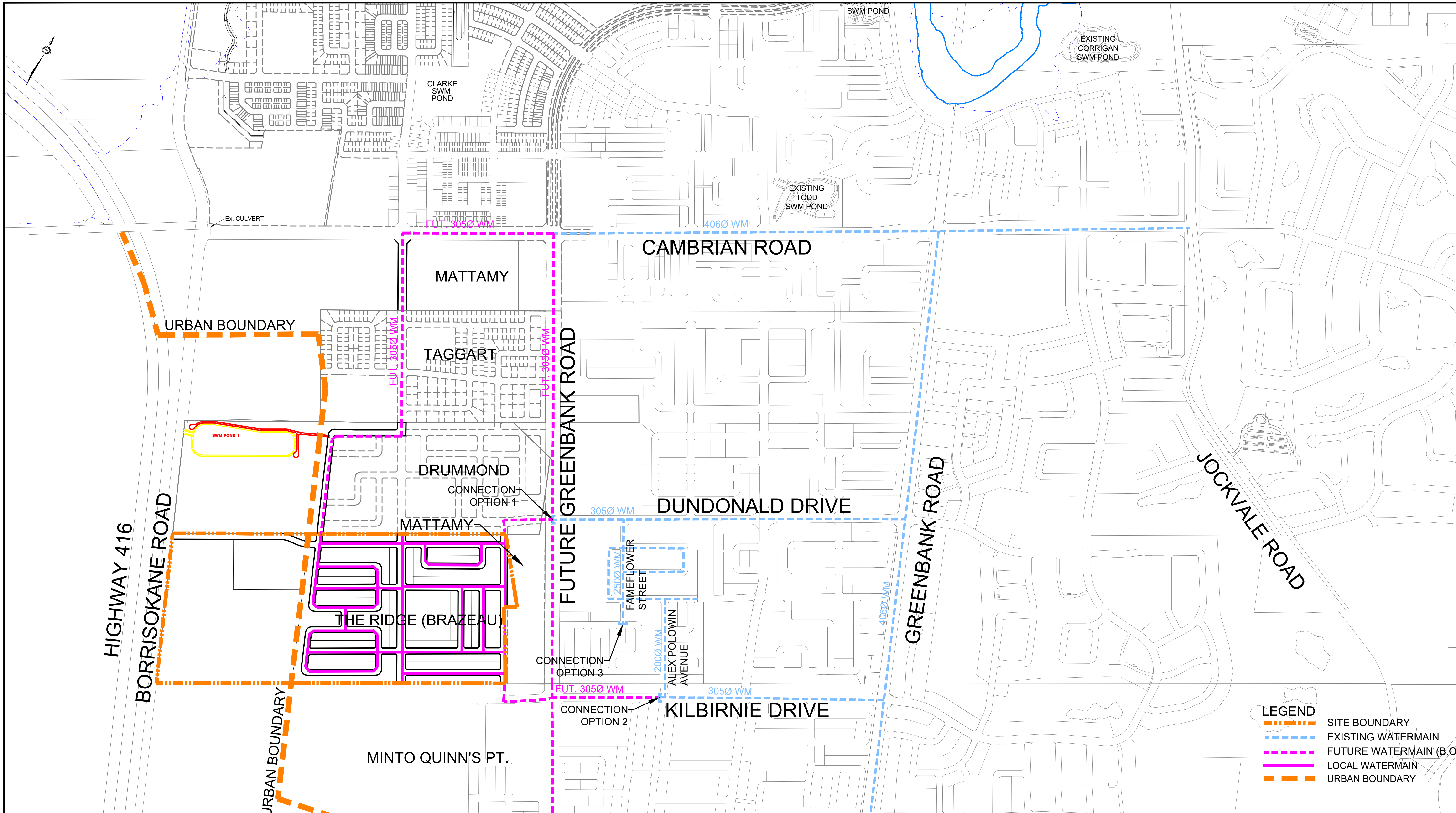
ID	Static Demand (L/s)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
J-33	0.45	167	52	487	20
J-35	0.38	167	52	473	20
J-36	0.41	167	52	485	20
J-37	0.14	167	52	506	20
J-38	0.36	167	53	518	20
J-39	0.52	167	52	522	20
J-40	0.36	167	53	570	20
J-41	0.08	167	52	612	20
J-42	0.41	167	48	366	20
J-43	0.47	167	49	382	20
J-44	0.38	167	48	367	20
J-45	0.16	167	24	177	20
J-46	0.22	167	37	239	20
J-49	0.34	167	47	345	20
J-50	0.31	167	43	282	20
J-51	0.45	167	41	268	20
J-52	0.52	167	48	352	20
J-53	0.52	167	44	301	20
J-54	0.48	167	41	268	20
J-55	0.48	167	39	254	20
J-56	0.48	167	36	235	20
J-57	0.31	167	40	264	20
J-59	1.04	167	40	293	20
J-61	0.14	167	51	469	20
J-90	0.00	167	46	325	20
J-47	0.30	250	20	249	20
J-48	0.17	250	29	335	20
J-58	0.14	250	22	266	20

Fire Flow Modeling Results - Phases 1 and 2

ID	Static Demand (L/s)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
J-33	0.45	167	53	526	20
J-35	0.38	167	52	509	20
J-36	0.41	167	53	523	20
J-37	0.14	167	53	550	20
J-38	0.36	167	53	545	20
J-39	0.52	167	52	532	20
J-40	0.36	167	52	566	20
J-41	0.08	167	52	615	20
J-42	0.41	167	48	376	20
J-43	0.47	167	50	417	20
J-44	0.38	167	49	379	20
J-45	0.16	167	48	402	20
J-46	0.22	167	48	396	20
J-49	0.34	167	49	400	20
J-50	0.31	167	45	308	20
J-51	0.45	167	43	289	20
J-52	0.52	167	49	393	20
J-53	0.52	167	46	345	20
J-54	0.48	167	44	296	20
J-55	0.48	167	43	299	20
J-56	0.48	167	45	331	20
J-57	0.31	167	44	316	20
J-59	1.04	167	46	445	20
J-61	0.14	167	52	527	20
J-62	0.52	167	42	300	20
J-63	0.48	167	33	228	20
J-64	0.52	167	33	233	20
J-65	0.45	167	29	207	20
J-66	0.52	167	27	194	20
J-67	0.55	167	32	223	20
J-68	0.34	167	37	259	20
J-69	0.34	167	39	294	20
J-70	0.41	167	27	199	20
J-71	0.28	167	30	218	20
J-72	0.41	167	42	397	20
J-74	0.58	167	42	383	20
J-75	0.41	167	41	379	20
J-76	0.21	167	41	387	20
J-78	0.16	167	45	428	20
J-79	0.44	167	44	371	20
J-80	0.44	167	43	349	20
J-81	0.71	167	41	310	20
J-82	0.30	167	42	308	20
J-83	0.49	167	44	317	20
J-84	0.27	167	42	312	20
J-85	0.49	167	43	315	20
J-86	0.19	167	45	436	20
J-87	0.19	167	46	453	20
J-88	0.11	167	48	487	20
J-89	0.19	167	50	525	20
J-90	0.00	167	49	413	20
J-47	0.30	250	23	269	20
J-48	0.17	250	32	390	20
J-58	0.14	250	29	348	20

Connection point 1: Existing watermain node off Haiku/ Obsidian street intersection fronting Block 1.

Connection point 2: Existing watermain node on Obsidian street



DSEL
david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
TEL: (613) 836-0856
FAX: (613) 836-7183
www.DSEL.ca

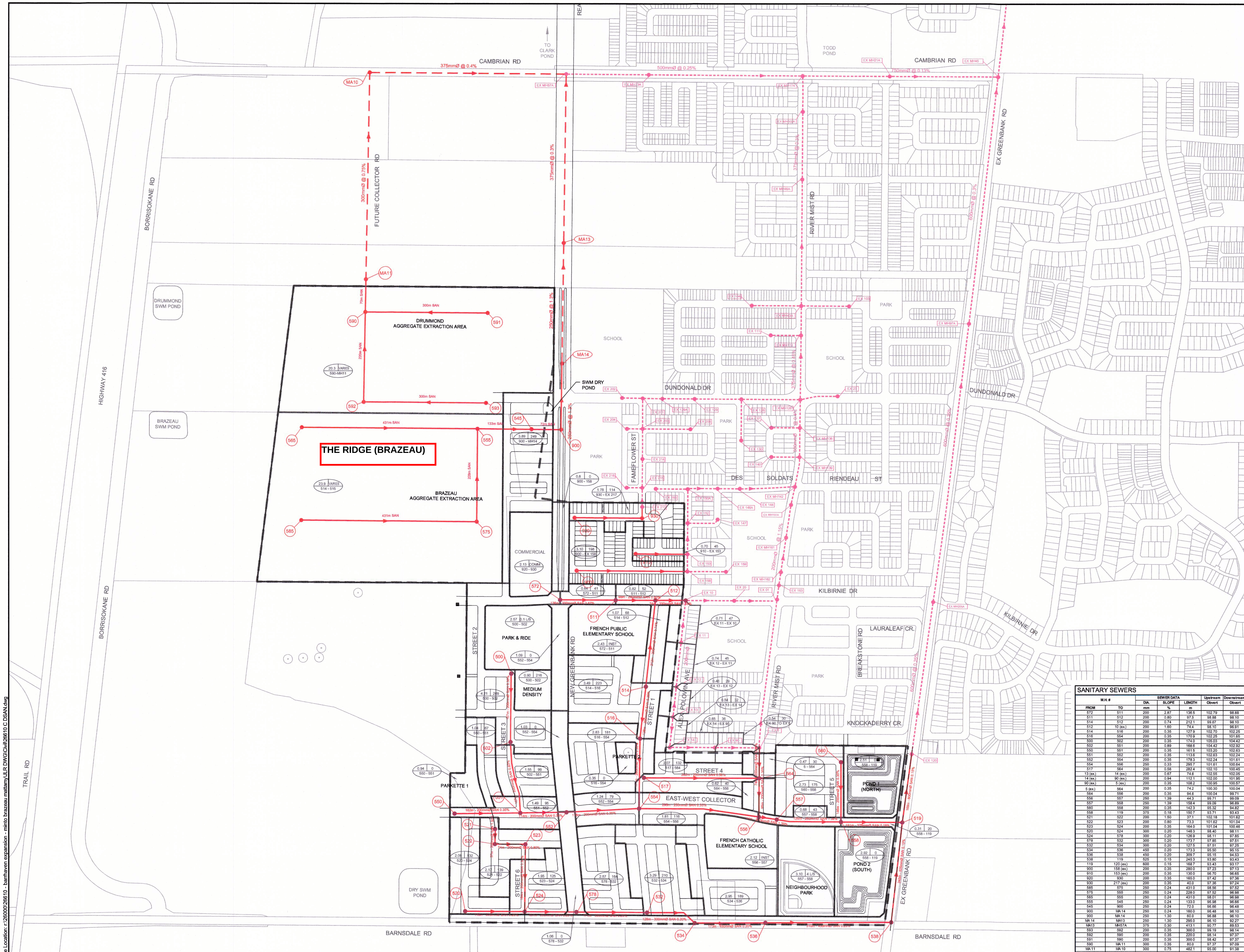
CAIVAN - BRAZEAU

WATERMAIN SERVICING PLAN

CITY OF OTTAWA

PROJECT No.:	18-1030
SCALE:	1:10,000
DATE:	APRIL 2020
FIGURE:	WAT-1

APPENDIX C



SANITARY SEWERS

M.H. #		SEWER DATA			Upstream	Downstream
		DIA.	SLOPE	LENGTH	Obvert	Obvert
FROM	TO	mm	%	m		
572	511	200	2.87	136.5	102.79	98.88
511	512	200	0.80	97.5	98.88	98.10
514	512	200	0.74	212.1	99.67	98.10
512	10 (ex.)	200	1.60	74.4	98.10	96.91
514	516	200	0.35	127.9	102.70	102.25
516	554	200	0.35	170.9	102.25	101.65
500	502	200	0.35	174.0	105.03	104.42
502	551	200	0.89	168.6	104.42	102.92
550	551	200	0.35	161.5	103.20	102.63
551	552	200	0.35	113.6	102.63	102.24
552	554	200	0.35	178.3	102.24	101.61
554	556	250	0.33	295.7	101.61	100.64
517	564	200	0.58	282.4	102.10	100.45
13 (ex.)	14 (ex.)	200	0.67	74.6	102.55	102.05
14 (ex.)	90 (ex.)	200	0.94	112.1	102.00	101.95
90 (ex.)	5 (ex.)	200	0.35	108.2	100.95	100.57
5 (ex.)	564	200	0.35	74.2	100.30	100.04
564	556	200	0.35	94.6	100.04	99.71
556	557	250	1.39	44.3	99.71	99.09
557	558	250	1.39	158.4	99.09	96.89
560	558	200	0.35	142.3	95.32	94.82
558	119	375	0.18	150.7	93.71	93.43
521	522	200	1.50	37.1	102.18	101.62
522	523	200	0.80	73.3	101.62	101.04
523	524	200	0.35	164.0	101.04	100.46
520	524	300	0.20	146.3	98.40	98.11
524	578	300	0.20	126.9	98.11	97.85
578	532	300	0.20	173.7	97.85	97.51
532	534	300	0.20	127.5	97.51	97.25
534	536	450	0.20	173.3	95.50	95.15
536	538	450	0.20	309.7	95.15	94.53
538	119	525	0.15	245.3	93.80	93.43
119	120 (ex.)	600	0.15	168.7	93.43	93.17
900	158 (ex.)	200	0.35	280.0	97.23	97.13
910	153 (ex.)	200	0.35	130.0	96.70	96.65
920	930	200	0.35	165.0	97.42	97.36
930	217 (ex.)	200	0.35	40.0	97.36	97.24
585	575	250	0.24	431.0	98.56	97.52
575	555	250	0.24	228.0	97.52	96.98
565	555	250	0.24	431.0	98.01	96.98
555	545	250	0.24	133.0	96.98	96.66
545	900	250	0.24	72.0	96.66	96.48
900	MA 14	250	0.24	160.0	96.48	96.10
900	MA 14	250	1.30	60.0	96.88	96.10
MA 14	MA13	250	1.30	295.0	96.10	92.27
MA13	MH57A	375	0.30	413.1	90.77	89.53
593	592	200	0.35	300.0	99.19	98.14
592	590	200	0.35	220.0	98.14	97.37
591	590	200	0.35	300.0	98.42	97.37
590	MA 11	300	0.35	80.0	97.37	97.09
MA 11	MA 10	300	0.75	482.1	95.00	91.38
MA 10	MH57A	375	0.41	449.7	91.38	89.53

LEGEND

- PROPOSED SANITARY, PER 2018 BSUEA MSS
- FUTURE SANITARY, PER 2014 BS MSS
- EXISTING SANITARY
- DRAINAGE BOUNDARY
- LIMIT OF STUDY AREA FOR BSUEA
- 0.23 | 5 / 41-32: AREA IN HECTARES; POPULATION; PIPE REACH UPSTREAM MAINTENANCE HOLE TO DOWNSTREAM MAINTENANCE HOLE
- COMM — COMMERCIAL
- INST — INSTITUTIONAL
- VARIES — SEE DESIGN SHEET FOR CONTRIBUTING FLOWS

No.	ISSUE / REVISION	DD/MM/YY
4	ISSUED FOR PLANNING COMMITTEE APPROVAL	04/05/18
3	ADDRESS COMMENTS, RE-ISSUE BSUEA MSS 2ND SUBMISSION	26/02/18
2	ISSUED AS PART OF DRAFT MSS	20/09/17
1	ISSUED FOR PRE-TAC WORKING MEETING	31/08/17

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:4000

CLIENT:

CONSULTANT: www.jlrichards.ca

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP — LICENSED PROFESSIONAL ENGINEER, M. N. L. DALRYMPLE, May 4/18, PROVINCE OF ONTARIO

PROJECT NORTH

PROJECT:

BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

DRAWING:

MASTER SANITARY DRAINAGE AREA

DESIGN: JW

DRAWN: CJM

CHECKED: LD

JLR #: 26610

DRAWING #: MSAN

File Location: r:\26000\26610 - barrhaven expansion - minto brazeau matters\JLR DWG\Civil\26610 C DSAN.dwg

PLOT DATE: May 3, 2018 4:34:47 PM

was assumed to have 4 washbasins that deliver 375 L/d and four (4) water closets that generate 150 L/hr for 10 hr/day resulting in a total flow of 7500 L/day.

Table 6-3: Land Use and Theoretical Wastewater Flows

Land Use	Flow Rate	Area (ha)	Units	Pop.	Average Flow (L/S)	Peak Factor	Infiltration	Total Flows (L/s)
Minto and Mattamy Lands								
Schools	28,000 L/ha/d	4.55			1.50	1.5	1.50	3.8
Park Block	4 L/s	4.39			4.0	1	1.45	5.5
Commercial	28,000 L/ha/d	2.13			0.70	1.5	0.70	1.8
Low-Medium density Residential	280 l/c/d	35.26	1080	3378	11.0	2.92	11.64	43.6
High Density Residential	280 l/c/d	0.90	120	216	0.7	3.51	0.30	2.8
Roads	-	27.00				1	8.91	8.9
Park and Ride		2.57			0.1	1	0.85	1.0
Total		**76.8**	**1200**	**3594**	**17.95**		**25.35**	**67.4**
Brazeau Aggregate Extraction Area								
Schools	28,000 L/ha/d	1.47			0.48	1.5	0.49	1.2
Commercial	28,000 L/ha/d	0.67			0.22	1.5	0.22	0.6
Low-Medium Density Residential	280 l/c/d	10.27	360	1126	3.65	3.21	3.39	15.1
High Density Residential	280 l/c/d	0.28	38	68	0.22	3.63	0.09	0.9
Roads	-	7.95				1	2.62	2.6
Park Block	-	1.48				1	0.49	0.5
Pond Blocks	-	1.78				1	0.59	0.6
Total		**23.9**		**1194**	**4.57**		**7.89**	**21.5**
Drummond Aggregate Extraction Area								
Schools	28,000 L/ha/d	1.25			0.41	1.5	0.41	1.0
Commercial	28,000 L/ha/d	0.57			0.18	1.5	0.19	0.5
Low-Medium Density Residential	280 l/c/d	8.72	288	900	2.92	3.26	2.88	12.4
High Density Residential	280 l/c/d	0.24	32	58	0.19	3.64	0.08	0.8
Roads	-	6.75				1	2.23	2.2

Land Use	Flow Rate	Area (ha)	Units	Pop.	Average Flow (L/S)	Peak Factor	Infiltration	Total Flows (L/s)
Park Blocks	-	1.26				1	0.42	0.4
Pond Blocks	-	1.51				1	0.50	0.5
Total		**20.3**		**958**	**3.70**		**6.71**	**17.8**
Barrhaven South Urban Expansion Area Totals								
Total		**121.0**		**5746**	**26.22**		**40.0**	**106.7**

Based on the land uses presented on the Demonstration Plan (Figure 4-2), the BSUEA would generate a peak wastewater flow of approximately 106.7 L/s.

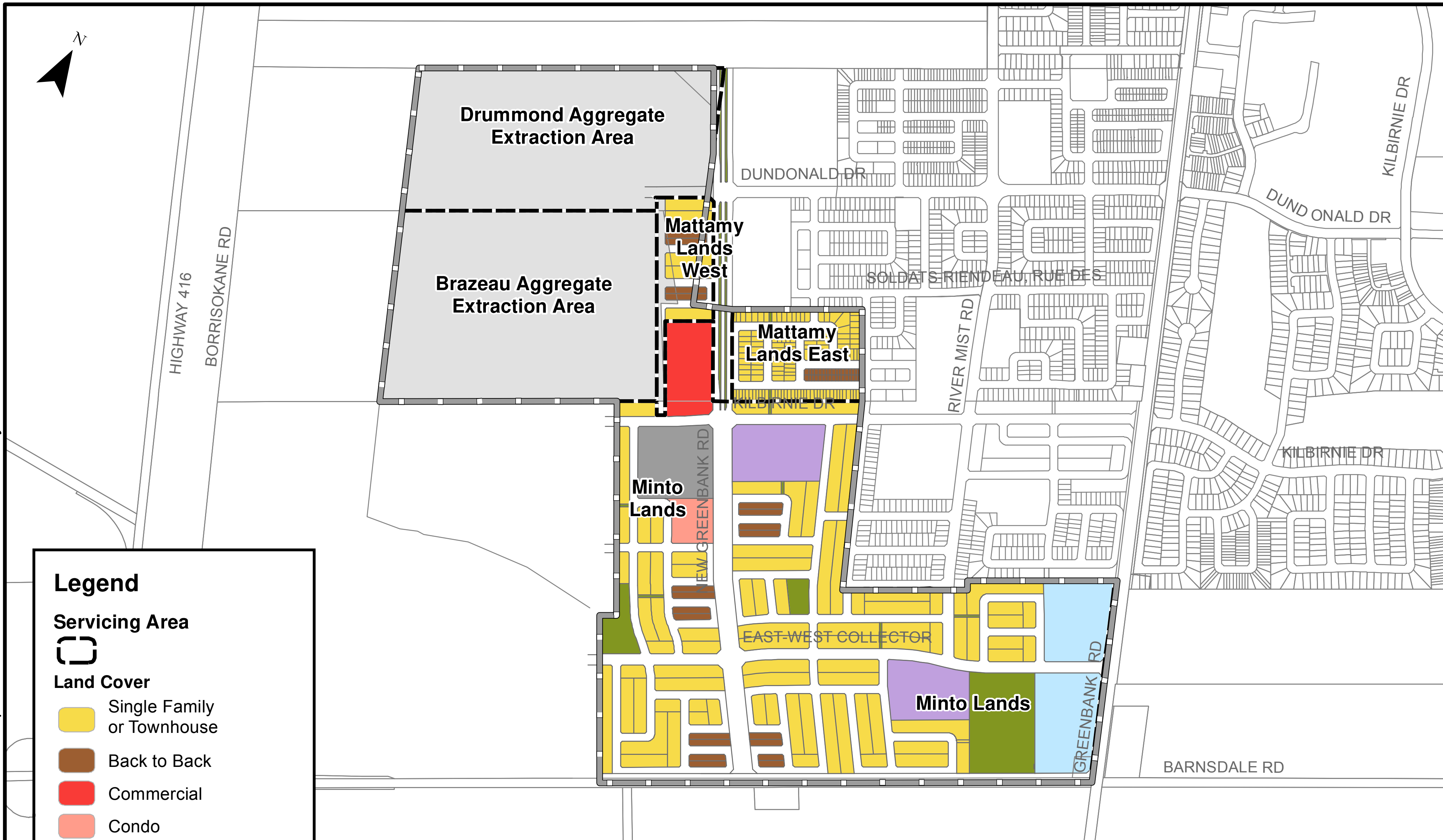
6.3 Wastewater Collection System Strategy

6.3.1 Proposed Sewer System Layout and Sizing

A trunk sanitary sewer system layout was developed based on the ROW corridors identified on the BSUEA Demonstration Plan for the purposes of demonstrating the feasibility of providing wastewater servicing for the BSUEA lands, refer to the Key Servicing Plans. Proposed trunk sanitary sewers were sized based on the aforementioned design criteria and the drainage areas depicted on the Master Sanitary Drainage Area Drawing MSAN, refer to the BSUEA Sanitary Sewer Design Sheet (Appendix J) for detailed calculations. Final configuration and sizing of the wastewater collection system will be confirmed at detailed design of each subdivision stage. At such time, refinements may be implemented.

The proposed BSUEA trunk sanitary sewers will discharge to existing/planned sanitary sewers at the following six (6) locations, as shown on Figure 6-2:

1. The Future Collector Road
2. New Greenbank Road
3. Flameflower Street
4. Alex Polowin Avenue
5. Kilbirnie Drive
6. Greenbank Road



PROJECT:

BARRHAVEN SOUTH URBAN EXPANSION AREA
OTTAWA, ONTARIO

DRAWING:

CDP DEMONSTRATION PLAN AND SERVICING AREAS

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

DESIGN:	BP
DRAWN:	KTK
CHECKED:	GF
JLR #:	26610

DRAWING #:

FIGURE 4-2

File Location: R:\26000\26610 - Barrhaven Expansion - Minto Brazeau Mattamy\JLR DWG\GIS\26610 C CDP.mxd

Plot Date: April 30, 2018 3:27:45 PM

It is noted that the residual capacity in the River Mist Road trunk sanitary sewer has in fact increased with the addition of the BSUEA peak flows. This is the result of adding a relatively small tributary area while reducing the average daily residential flow from 350 L/cap to 280 L/cap combined with diverting some existing drainage areas, located in Quinn's Pointe, away from the outlet.

Table 6-4: Residual Capacity Comparison in the BSC Trunk Sanitary Sewers

Existing Trunk Sanitary Sewer	Limiting Pipe reach	Current Minimum Residual Capacity	Proposed BSUEA Tributary Lands	Proposed BSUEA Tributary Area	Revised Minimum Residual Capacity with inclusion of BSUEA Peak Flow
Cambrian Road	MH 13A to MH15A	51.4 L/s	Drummond, Brazeau, Mattamy West (Residential only)	48 ha	52.9 L/s
River Mist Road	MH 102A to MH 17A	14.4 L/s	Mattamy East, Mattamy West (Commercial only), Northwest corner of Minto	12 ha	30.5 L/s
River Mist Road	MH 1 to MH 163	5.58 L/s	Minto	5 ha	4.63 L/s
Greenbank Road	MH 45 to MH 435A	295.4 L/s	Minto	60 ha	283.2 L/s

With the addition of the BSUEA lands, a total theoretical peak wastewater flow of 403.7 L/s was calculated at the most downstream maintenance hole in the BSC (MH 501A on Greenbank Road), as indicated in the Sanitary Sewer Design Sheet in Appendix J. This calculated theoretical peak flow is less than the 590 L/s allocated for all of the BSC in Stantec's City-wide 2013 Wastewater Collection System Assessment. In this assessment, Stantec created a hydrodynamic model of trunk sanitary sewers (450 mm in diameter and greater) which demonstrated that the existing downstream trunk system could accommodate the theoretical flow of 590 L/s generated by the BSC with no risk of surcharging or basement flooding. Consequently, Stantec concluded that system upgrades were not required to accommodate the anticipated growth in the BSC. Since the Stantec assessment considered a peak flow that was 186 L/s greater than that calculated for the BSC and the BSUEA combined, it is understood that the existing trunk sanitary sewers located downstream of the BSC can accommodate the additional flows generated by the BSUEA.

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

BARRHAVEN SOUTH URBAN EXPANSION (BSUEA)

BSUEA SANITARY SEWER DESIGN SHEET

CITY OF OTTAWA
MINTO COMMUNITIES INC.
JLR NO. 26610

Designed by: A.T
Checked by: H.M

Date : February 2018

			DESIGN PARAMETERS		
Single Family	3.4	pers/unit	q =	280	L/cap/day
Semi-Detached/Townhouse (row)	2.7	pers/unit	I =	0.330	L/s/ha
Apt Units	1.8	pers/unit	Inst. =	28000	L/ha/day
Manning's Coeff, N =	0.013		ICI Peaking Factor* =	1.0/1.5	

*ICI Peaking Factor = 1.5 if ICI in contributing area is >20%, 1.0 if ICI in contributing area is <20%

STREET	M.H. #		RESIDENTIAL: NUMBER OF UNITS					CUMULATIVE		PEAKING	POPUL.	COMMERCIAL			INSTITUTIONAL			(Infiltration) PEAK EXTR.	PLUG	PEAK DES.	SEWER DATA					RESIDUAL	UPSTREAM				DOWNSTREAM				ICI Peaking Factor	
	FROM	TO	SING.	MULT.	APT.	AREA ha	POPUL. peop.	POPUL. peop.	AREA ha	FACTOR	FLOW l/s	AREA ha	CUMM. AREA ha	INST. FLOW l/s	AREA ha	CUMM. AREA ha	INST. FLOW l/s	FLOW l/s	FLOW l/s	FLOW l/s	DIA. mm	SLOPE %	CAPAC. l/s	VEL. m/s	LENGTH m	CAP. l/s	Center Line	Obvert	Invert	Cover	Center Line	Obvert	Invert	Cover	ICI/ TOTAL	P.F
MINTO LANDS WITHIN BSUEA (OUTLETS TO RIVER MIST.)																																				
Kilbirnie Dr.	572	511		10		0.64	27	27	0.64	3.69	0.32		0.00	0.00	2.43	2.43	1.18	1.01		2.52	200	2.87	57.9	1.79	136.50	55.40	107.40	102.79	102.59	4.61	103.50	98.88	98.68	4.62	0.79	1.50
Kilbirnie Dr.	511	512		27		0.82	73	100	1.46	3.59	1.16	0.00	0.00	0.00	0.00	2.43	0.79	1.28		3.24	200	0.80	30.6	0.94	97.52	27.37	103.50	98.88	98.68	4.62	103.40	98.10	97.90	5.30	0.00	1.00
Street 1	514	512	21			1.07	71	71	1.07	3.62	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.35		1.19	200	0.74	29.4	0.91	212.06	28.24	105.60	99.67	99.47	5.93	103.40	98.10	97.90	5.30	0.00	1.00
Kilbirnie Dr.	512	10 (ex.)					0	171	2.53	3.54	1.96	0.00	0.00	0.00	0.00	2.43	0.79	1.64		4.39	200	1.60	43.3	1.33	74.41	38.89	103.40	98.10	97.90	5.30	101.18	96.91	96.71	4.27	0.00	1.00
MINTO LANDS WITHIN BSUEA (OUTLETS TO EXISTING GREENBANK)																																				
Street 1	514	516	14	104		3.49	328	328	3.49	3.45	3.67		0.00	0.00		0.00	0.00	1.15		4.82	200	0.35	20.2	0.62	127.86	15.42	105.60	102.70	102.50	2.90	105.40	102.25	102.05	3.15	0.00	1.00
Street 1	516	554	20	54		3.18	214	542	6.67	3.36	5.91		0.00	0.00		0.00	0.00	2.20		8.11	200	0.35	20.2	0.62	170.90	12.13	105.40	102.25	102.05	3.15	105.20	101.65	101.45	3.55	0.00	1.00
Street 3	500	502	25	70	115	7.16	481	481	7.16	3.39	5.28		0.00	0.00		0.00	0.00	2.36	0.10	7.74	200	0.35	20.2	0.62	174.02	12.50	108.10	105.03	104.827	3.07	107.90	104.42	104.218	3.48	0.00	1.00
Street 3	502	551	8	44		1.55	146	627	8.71	3.34	6.78		0.00	0.00		0.00	0.00	2.87		9.76	200	0.89	32.3	1.00	168.60	22.52	107.90	104.42	104.218	3.48	105.90	102.92	102.717	2.98	0.00	1.00
East-West Collector	550	551	20			1.98	68	68	1.98	3.63	0.80		0.00	0.00		0.00	0.00	0.65		1.45	200	0.35	20.2	0.62	161.54	18.79	105.50	103.20	103.00	2.30	105.90	102.63	102.43	3.27	0.00	1.00
East-West Collector	551	552	22			1.49	75	770	12.18	3.30	8.23		0.00	0.00		0.00	0.00	4.02		12.34	200	0.35	20.2	0.62	113.56	7.90	105.90	102.63	102.43	3.27	106.15	102.24	102.03	3.91	0.00	1.00
East-West Collector	552	554	12	20		3.36	95	865	15.54	3.27	9.17		0.00	0.00		0.00	0.00	5.13		14.40	200	0.35	20.2	0.62	178.26	5.84	106.15	102.24	102.03	3.91	105.20	101.61	101.41	3.59	0.00	1.00
East-West Collector	554	556	11	34		1.81	129	1536	24.02	3.14	15.62		0.00	0.00		0.00	0.00	7.93		23.65	250	0.33	35.6	0.70	295.67	11.99	105.20	101.61	101.36	3.59	103.55	100.64	100.38	2.91	0.00	1.00
Street 4	517	564	20	35		2.07	163	163	2.07	3.54	1.87		0.00	0.00		0.00	0.00	0.68		2.55	200	0.58	26.2	0.81	282.43	23.60	105.30	102.10	101.90	3.20	103.65	100.45	100.25	3.20	0.00	1.00
Alex Polowin Ave.	13 (ex.)	14 (ex.)	12			0.54	41	41	0.54	3.67	0.49		0.00	0.00		0.00	0.00	0.18		0.67	200	0.67	28.0	0.86	74.56	27.34	105.00	102.55	102.35	2.45	105.52	102.05	101.85	3.47	0.00	1.00
Alex Polowin Ave.	14 (ex.)	90 (ex.)	13			0.65	44	85	1.19	3.61	0.99		0.00	0.00		0.00	0.00	0.39		1.39	200	0.94	33.2	1.02	112.06	31.79	105.00	102.00	101.80	3.00	103.96	101.95	101.75	2.01	0.00	1.00
Russet Terrace	90 (ex.)	5 (ex.)	6			0.54	20	105	1.73	3.59	1.22		0.00	0.00		0.00	0.00	0.57		1.79	200	0.35	20.2	0.62	108.16	18.45	103.93	100.95	100.75	2.98	103.80	100.57	100.37	3.23	0.00	1.00
River Mist Rd.	5 (ex.)	564	8			0.47	27	132	2.20	3.57	1.53		0.00	0.00		0.00	0.00	0.73		2.25	200	0.35	20.2	0.62	74.22	17.99	103.90	100.30	100.10	3.60	103.80	100.04	99.84	3.76	0.00	1.00
River Mist Rd.	564	556	7	9		0.64	48	343	4.91	3.44	3.83		0.00	0.00		0.00	0.00	1.62		5.55	200	0.35	20.2	0.62	94.59	14.70	103.65	100.04	99.84	3.61	103.55	99.71	99.51	3.84	0.00	1.00
East-West Collector	556	557					0	1879	28.93	3.09	18.79		0.00	0.00	2.20	2.20	0.71	10.27		29.87	250	1.39	73.1	1.44	44.25	43.27	103.55	99.71	99.46	3.84	102.78	99.09	98.84	3.69	0.07	1.00
East-West Collector	557	558	6			1.12	20	1899	30.05	3.08	18.97		0.00	0.00	2.86	5.06	1.64	11.59	4.00	36.30	250	1.39	73.1	1.44	158.35	36.85	102.78	99.09	98.84	3.69	99.90	96.89	96.64	3.01	0.09	1.00
Street 5	560	558	50			3.09	170	170	3.09	3.54	1.95		0.00	0.00		0.00	0.00	1.02		2.97	200	0.35	20.2	0.62	142.27	17.27	98.80	95.32	95.12	3.48	99.90	94.82	94.62	5.08	0.00	1.00
East-West Collector	558	119				5.74	0	2069	38.88	3.06	20.51		0.00	0.00		5.06	1.64	14.50		40.75	375	0.18	77.6	0.68	150.71	36.85	99.90	93.71	93.32	6.20	99.55	93.43	93.05	6.12	0.00	1.00
Street 6	521	522	24	33		2.17	171	171	2.17	3.54	1.96		0.00	0.00		0.00	0.00	0.72		2.68	200	1.50	41.9	1.29	37.09	39.23	105.18	102.18	101.98	3.00	104.50	101.62	101.42	2.88	0.00	1.00
	522	523					0	171	2.17	3.54	1.96		0.00	0.00		0.00	0.00	0.72		2.68	200	0.80	30.6	0.94	73.27	27.93	104.50	101.62	101.42	2.88	105.11	101.04	100.83	4.07	0.00	1.00
	523	524		71		1.95	192	363	4.12	3.43	4.04		0.00	0.00		0.00	0.00	1.36		5.40	200	0.35	20.2	0.62	164.00	14.84	105.11	101.04	100.83	4.07	103.50	100.46	100.26	3.04	0.00	1.00
Adjacent to Barnsdale Rd	520	524	41			2.06	139	139	2.06	3.56	1.60		0.00	0.00		0.00	0.00	0.68		2.28	300	0.20	45.1	0.62	146.25	42.83	102.80	98.40	98.10	4.40	103.50	98.11	97.80	5.39	0.00	1.00
Adjacent to Barnsdale Rd	524	578					0	502	6.18	3.38	5.50		0.00	0.00		0.00	0.00	2.04		7.54	300	0.20	45.1	0.62	126.92	37.58	103.50	98.11	97.80	5.39	104.92	97.85	97.55	7.07	0.00	1.00
Adjacent to Barnsdale Rd	578	532		87		3.63	235	737	9.81	3.31	7.89		0.00	0.00		0.00	0.00	3.24		11.13	300	0.20	45.1	0.62	173.72	33.98	104.92	97.85	97.55	7.07	103.80	97.51	97.20	6.29	0.00	1.00
Adjacent to Barnsdale Rd	532	534	50	26		3.29	240	977	13.10	3.25	10.27		0.00	0.00		0.00	0.00	4.32		14.60	300	0.20	45.1	0.62	127.45	30.52	103.80	97.51	97.20	6.29	103.00	97.25	96.95	5.75	0.00	1.00
Adjacent to Barnsdale Rd	534	536	55			2.96	187	1164	16.06	3.21	12.09		0.00	0.00		0.00	0.00	5.30		17.39	450	0.20	133.0	0.81	173.27	115.63	103.00	95.50	95.04	7.50	101.56	95.15	94.70	6.41	0.00	1.00
Easement (Barnsdale to E-W Collector)	536	538					0	1164	16.06	3.21	12.09		0.00	0.00		0.00	0.00	5.30		17.39	450	0.20	133.0	0.81	309.73	115.63	101.56	95.15	94.70	6.41	99.75	94.53	94.08	5.22	0.00	1.00
	538	119					0	1164	16.06	3.21	12.09		0.00	0.00		0.00	0.00	5.30		17.39	525	0.15	173.8	0.78	245.34	156.37	99.75	93.80	93.26	5.95	99.55	93.43	92.89	6.12	0.00	1.00
Ex. Greenbank Rd.	119	120 (ex.)					0	3233	54.94	2.93	30.72		0.00	0.00		5.06	1.64	19.80		56.26	600	0.15	248.1	0.85	168.66	191.83	99.55	93.43	92.82	6.12		93.17	92.57		0.00	1.00
																					600	0.25														
MATTAMY LANDS EAST OUTLETS TO DUNDONALD DR. & DES SOLDATS																																				
	900	158 (ex.)	31	51		3.10	243	243	3.10	3.49	2.75	0.00	0.00	0.00		0.00	0.00	1.02		3.77	200	0.35	20.2	0.62	280.00	16.47	106.62	97.23	97.02	9.39	101.03	97.13	97.13	3.90	0.00	1.00
	910	153 (ex.)		28		0.71	76	76	0.71	3.62	0.89	0.00	0.00	0.00		0.00	0.00	0.23		1.12	200	0.35	20.2	0.62	130.00	19.12	104.00	96.70	96.49	7.30	100.35	96.65	96.65	3.70	0.00	1.00
	920	930	36			1.81	122	122	1.81	3.57	1.42	2.13	2.13	1.04		0.00	0.00	1.30		3.75	200	0.35	20.2	0.62	165.00	16.49	106.07	97.42	97.21	8.65	101.70	97.36	97.16	4.34	0.54	1.50
	930	217 (ex.)						122	1.81	3.57	1.42	0.00	2.13	1.04		0.00	0.00	1.30		3.75	200	0.35	20.2	0.62	40.00	16.49	101.70	97.36	97.16	4.34	101.70	97.24	97.04	4.46	0.54	1.50
BRAZEAU AGGREGATE EXTRACTION AREA OUTLETS TO NEW GREENBANK ROAD*																																				
	585	575	178	236	37	21.77	1309	1309	21.77	3.18	13.48	0.68	0.68	0.22	1.45	1.45	0.47	7.89		22.06	250	0.24	30.4	0.60	431.00	8.34		98.56	98.30			97.52	97.27		0.09	1.00
	575	555					0	1309	21.77		0.00		0.68	0.22		1.45	0.47	7.89		8.58	250	0.24	30.4	0.60	228.00	21.82		97.52	97.27			96.98	96.72		0.03	1.00
	565	555					0	0	0.00		0.00		0.00	0.00		0.00	0.00	0.00		0.00	250	0.24	30.4	0.60	431.00	30.39		98.01	97.76			96.98	96.72		0.00	1.00
	555	545					0	1309	21.77		0.00		0.68	0.22		1.45	0.47	7.89		8.58	250	0.24	30.4	0.60	133.00	21.82		96.98	96.72			96.66	96.40		0.03	1.00
	545	900					0	1309	21.77		0.00		0.68	0.22		1.45	0.47	7.89		8.58	250	0.24	30.4	0.60	72.00	21.82	104.31	96.66	96.40	7.65	103.00	96.48	96.23	6.52	0.03	1.00
	900	MA 14																			250	0.24	30.4	0.60	160.00	30.39		96.48	96.23			96.10	95.85			
MATTAMY LANDS WEST OUTLETS TO NEW GREENBANK RD																																				
Realigned Greenbank Rd.	900	MA 14	8	102		3.89	303	1612	25.66	3.13	16.32	0.00	0.68	0.22	0.00	1.45	0.47	9.17		26.18	250	1.30	70.7	1.40	60.00	44.55	104.31	96.88	96.63	7.43	103.00	96.10	95.85	6.90	0.03	1.00
	MA 14	MA13				0.00	0	1612	25.66	3.13	16.32	0.00	0.68	0.22	0.00	1.45	0.47	9.17		26.18	250	1.30	70.7	1.40	295.00	44.50	103.00	96.10	95.85	6.90	95.20	92.27	92.02	2.93	0.03	1.00
	MA13	MH57A						1612	25.66	3.13	16.32		0.68	0.22		1.45	0.47	9.17		26.18	375	0.30	100.2	0.88	413.10	74.00	92.27	90.77	90.39	1.50	93.60	89.53	89.15	4.07	0.03	1.00
DRUMMOND AGGREGATE EXTRACTION AREA OUTLETS TO PROPOSED COLLECTOR RD.*												1																								
	593	592																			200	0.35	20.2	0.62	300.00	20.24		99.19	98.99			98.14	97.94			1.00
	592	590																			200	0.35	20.2	0.62	220.00	20.24		98.14	97.94			97.37	97.17			1.00
	591	590																			200	0.35	20.2	0.62	300.00	20.24		98.42	98.22			97.37	97.17			1.00
	590	MA 11	151	226	31	18.48	1179	1179	18.48	3.20	12.24	0.58	0.58	0.19	0.40	0.40	0.13	6.42		18.98	300	0.35	59.7	0.82	80.00	40.70		97.37	97.07		100.00	97.09	96.79	2.91	0.05	1.00
	MA 11	MA 10					0	1179	18.48	3.20	12.24		0.58	0.19		0.40		6.42		18.85	300	0.75	87.4	1.20	482.10	68.52	100.00	95.00	94.69	5.00	93.50	91.38	91.08	2.12	0.03	1.00
	MA 10	MH57A					0	1179	18.48	3.20	12.24		0.58	0.19		0.40		6.42		18.85	375	0.41	117.3	1.03	449.70	98.47	93.50	91.38	91.00	2.12	93.60	89.53	89.15	4.07		1.00
							0																													

*ONLY FLOW CONTRIBUTIONS FROM BSUEA ARE SHOWN, FOR SANITARY FLOWS FROM OTHER CONTRIBUTING AREAS TRIBUTARY TO CAMBRIAN ROAD, SEE OVERALL SANITARY SPREADSHEET

BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

CITY OF OTTAWA
MINTO COMMUNITIES INC.

JLR NO. 26610

BARRHAVEN SOUTH SANITARY SEWER DESIGN SHEET

Designed by: AT
Checked by:HM

			PROPOSED AND BSUEA DESIGN PARAMETERS		
Single Family	3.4	pers/unit	q =	280	L/cap/day
Semi-Detached/Townhouse (row)	2.7	pers/unit	I =	0.330	L/s/ha
Apt Units	1.8	pers/unit	Inst./Comm. =	28000	L/ha/day
Manning's Coeff. N =	0.013		Commerial PF*=	1.0/1.5	

*1.5 if ICI in contributing area is >20%, 1.0 if ICI in contributing area is <20%

Sources:	
	Half Moon Bay South Subdivision - Phase 4 - Excluding Arterials- Sanitary sewer design sheet prepared by Stantec (2015)
	Quinn's Pointe - Excluding Arterials-Sanitary sewer design sheet prepared by J.L Richards (2015)
	Barrhaven South Master Servicing Study Addendum - Sanitary sewer design sheet prepared Stantec (2014)

Legend

	Proposed
	Proposed by Others
	Existing

TOTAL PEAK FLOW TO MH57A = 112.80 L/s (USING CUMULATIVE AREAS, POPULATIONS AND PEAK FACTORS)

Date: February 2018

STREET	SOURCE	M.H. # FROM	M.H. # TO	RESIDENTIAL NUMBER OF UNITS SING.	MULT.	APT.	AREA TOTAL ha	POPULATION TOTAL peop.	CUMULATIVE POPUL. peop.	CUMULATIVE AREA ha	PEAKING FACTOR	POPUL. FLOW l/s	COMMERCIAL AREA ha	CUMM. AREA ha	INST. FLOW l/s	INSTITUTIONAL AREA ha	CUMM. AREA ha	INST. FLOW l/s	GREEN/UNUSED AREA ha	CUMM. AREA ha	PEAK EXTR. FLOW l/s	PLUG FLOW l/s	PEAK DES. FLOW l/s	SEWER DATA DIA. mm	SLOPE %	CAPAC. l/s	VEL. m/s	LENGTH m	RESIDUAL CAP. l/s	ICI/ TOTAL	ICI* Peaking Factor
CAMBRIAN ROAD OUTLET VIA FUTURE REALIGNED GREENBANK AND FUTURE COLLECTOR																															
Drummond Aggregate Extraction Area		545	MA11	151	226	31.00	18.48	1179	1179	18.48	3.20	12.24	0.58	0.58	0.19	1.23	1.23	0.40		0.00	6.70		19.5	300	0.75	87.4	1.20	300.00	67.85	0.09	1.00
Future Collector Road	Stantec (2014)	MA11	MA10				14.23	1523	2702	32.71	2.98	26.13		0.58	0.19	2.80	4.03	1.31	2.50	2.50	13.14		40.77	300	0.75	87.4	1.20	482.10	46.60	0.12	1.00
Cambrian Rd.	Stantec (2014)	MA10	MH57A				12.81	1371	4073	45.52	2.86	37.76		0.58	0.19	7.22	11.25	3.65	14.49	16.99	24.53		66.13	375	0.40	115.7	1.01	449.70	49.55	0.16	1.00
Brazeau Aggregate Extraction Area + Mattamy Lands		900	MA14	186	368	37.00	25.66	1693	1693	25.66	3.11	17.08	0.68	0.68	0.22	1.45	1.45	0.47		0.00	9.17		26.9	250	1.30	70.7	1.40	350.00	43.80	0.08	1.00
New Greenbank Road	Stantec (2014)	MA14	MA13				4.79	513	2206	30.45	3.04	21.75		0.68	0.33	7.45	8.90	4.33		0.00	13.21		39.61	250	1.30	70.7	1.40	295.00	31.12	0.24	1.50
New Greenbank Road	Stantec (2014)	MA13	MH57A				10.99	1176	3382	41.44	2.92	31.98		0.68	0.22		8.90	2.88	0.53	0.53	17.01		52.10	375	0.30	100.2	0.88	413.10	48.09	0.19	1.00
Cambrian Road	Stantec	MH57A	MH13A				4.29	458	7913	91.25	2.64	67.80	3.44	4.70	1.52	0.00	20.15	6.53		17.52	44.09		119.95	500	0.25	197.0	0.97	216.50	77.01	0.19	1.00
Cambrian Road	Stantec	MH13A	MH15A				6.21	634	8547	97.46	2.62	72.51		4.70	1.52	0.00	20.15	6.53		17.52	46.14		126.70	500	0.20	176.2	0.87	165.20	49.46	0.18	1.00
Cambrian Road	Stantec	MH15A	MH17A				5.61	870	9417	103.07	2.58	78.87		4.70	1.52	0.00	20.15	6.53		17.52	48.00		134.92	600	0.13	231.0	0.79	202.00	96.04	0.17	1.00
QUINN'S POINTE OUTLET TO MH163 RIVER MIST RD.							103.07	9417																							
Kilbirnie Drive		572	511		10		0.64	27	27	0.64	3.69	0.32		0.00	0.00	2.43	2.43	1.18		0.00	1.01		2.52	200	2.87	57.9	1.79	136.50	55.38	0.79	1.50
Kilbirnie Drive		511	512		27		0.82	73	100	1.46	3.59	1.17		0.00	0.00		2.43	1.18		0.00	1.28		3.63	200	0.80	30.6	0.94	97.50	26.97	0.62	1.50
Future Collector Road		514	512	21			1.07	71	71	1.07	3.63	0.83		0.00	0.00		0.00	0.00		0.00	0.35		1.19	200	0.74	29.4	0.91	212.10	28.25	0.00	1.00
Kilbirnie Drive		512	EX10				0.00	0	171	2.53	3.54	1.96		0.00	0.00		2.43	1.18		0.00	1.64		4.78	200	1.60	43.3	1.33	74.00	38.50	0.49	1.50
River Mist Road		EX5	EX4	12			0.55	41	41	0.55	3.67	0.49		0.00	0.00		0.00	0.00		0.00	0.18		0.67	200	0.33	19.8	0.61	74.90	19.10	0.00	1.00
Boddington Street		EX101	EX100	14			0.72	48	48	0.72	3.65	0.57		0.00	0.00		0.00	0.00		0.00	0.24		0.81	200	0.98	33.8	1.04	90.13	33.00	0.00	1.00
Boddington Street		EX100	EX4	8			0.44	27	75	1.16	3.62	0.88		0.00	0.00		0.00	0.00		0.00	0.38		1.26	200	0.91	32.6	1.01	91.40	31.34	0.00	1.00
River Mist Road		EX4	EX3	12			0.53	41	157	2.24	3.55	1.81		0.00	0.00		0.00	0.00		0.00	0.74		2.54	200	0.32	19.4	0.60	74.95	16.82	0.00	1.00
Clonfadda Terrace		EX111	EX110	13			0.62	44	44	0.62	3.66	0.52		0.00	0.00		0.00	0.00		0.00	0.20		0.73	200	1.04	34.8	1.07	76.25	34.10	0.00	1.00
Clonfadda Terrace		EX110	EX3	15			0.64	51	95	1.26	3.60	1.11		0.00	0.00		0.00	0.00		0.00	0.42		1.52	200	0.83	31.2	0.96	108.32	29.67	0.00	1.00
River Mist Road		EX3	EX2	3			0.32	10	262	3.82	3.48	2.96		0.00	0.00		0.00	0.00		0.00	1.26		4.22	200	0.35	20.2	0.62	100.22	16.00	0.00	1.00
River Mist Road		EX2	EX1		14		0.55	38	300	4.37	3.46	3.37		0.00	0.00		0.00	0.00		0.00	1.44		4.81	200	1.77	45.5	1.40	112.11	40.65	0.00	1.00
Alex Polowin Avenue		EX13	EX12	11			0.46	37	37	0.46	3.67	0.44		0.00	0.00		0.00	0.00		0.00	0.15		0.59	200	1.01	34.4	1.06	74.36	33.77	0.00	1.00
Alex Polowin Avenue		EX12	EX11	24			0.74	82	119	1.20	3.58	1.38		0.00	0.00		0.00	0.00		0.00	0.40		1.78	200	2.14	50.1	1.54	107.77	48.32	0.00	1.00
Alex Polowin Avenue		EX11	EX10	17			0.71	58	177	1.91	3.53	2.03		0.00	0.00		0.00	0.00		0.00	0.63		2.66	200	1.65	44.0	1.36	103.97	41.35	0.00	1.00
Kilbirnie Drive		EX10	EX20		14		0.57	38	386	5.01	3.42	4.28		0.00	0.00		2.43	1.18		0.00	2.46		7.92	200	0.32	19.3	0.60	118.98	11.42	0.33	1.50
Block 251 (School)		Stub	EX20				0.00	0	0	0.00	3.80	0.00		0.00	0.00	2.83	2.83	1.38		0.00	0.93		2.31	200	0.32	19.3	0.60	11.00	16.99	1.00	1.50
Kilbirnie Drive		EX20	EX1		15		0.54	41	427	5.55	3.41	4.71		0.00	0.00		5.26	2.56		0.00	3.57		10.84	200	0.32	19.4	0.60	106.01	8.52	0.49	1.50
River Mist Road		EX1	MH163				0.08	0	727	10.00	3.31	7.79		0.00	0.00		5.26	2.56		0.00	5.04		15.39	200	0.32	19.3	0.60	39.41	3.96	0.34	1.50
MH163 TO MH17A RIVERMIST ROAD OUTLETS VIA CAMBRIAN ROAD							10.00	727																							
River Mist Road	Stantec (2015)	MH163	EX162				0.08	0	727	10.08	3.31	7.79		0.00	0.00		5.26	2.56		0.00	5.06		15.41	250	0.85	57.2	1.13	36.30	41.78	0.34	1.50
River Mist Road		EX162	EX161				0.20	0	727	10.28	3.31	7.79		0.00	0.00		5.26	2.56		0.00	5.13		15.48	250	1.15	66.5	1.31	44.40	51.05	0.34	1.50
River Mist Road		EX161A	EX161				0.00	0	0	0.00	3.80	0.00		0.00	0.00		0.00	0.00	0.91	0.91	0.30		0.30	150	1.00	15.9	0.87	14.00	15.59	0.00	1.00
River Mist Road		EX161	151				0.19	0	727	10.47	3.31	7.79		0.00	0.00		5.26	2.56		0.91	5.49		15.84	250	1.15	66.5	1.31	57.70	50.69	0.32	1.50
River Mist Road		EX151A	151				0.00	0	0	0.00	3.80	0.00		0.00	0.00	2.77	2.77	1.35		0.00	0.91		2.26	150	1.00	15.9	0.87	12.70	13.63	1.00	1.50
River Mist Road		151	EX151				0.09	0	727	10.56	3.31	7.79		0.00	0.00		8.03	3.90		0.91	6.44		18.13	300	1.40	119.4	1.64	17.90	101.23	0.41	1.50
River Mist Road		EX151	MH142				0.00	0	727	10.56	3.31	7.79		0.00	0.00		8.03	3.90		0.91	6.44		18.13	300	1.40	119.4	1.64	44.40	101.23	0.41	1.50
Buffalograss Cres.	Stantec (2015)	EX159	EX158		24		0.56	65	65	0.56	3.63	0.77		0.00	0.00		0.00	0.00		0.00	0.18		0.95	200	0.40	21.6	0.67	95.50	20.69	0.00	1.00
Mattamy Lands East		900	EX158	31	51		3.10	243	243	3.10	3.49	2.75		0.00	0.00		0.00	0.00		0.00	1.02		3.77	200	0.35	20.2	0.62	280.00	16.46	0.00	1.00
Alex Polowin ave.		EX158	EX153	0	0		0.13	0	308	3.79	3.46	3.45		0.00	0.00		0.00	0.00		0.00	1.25		4.70	200	0.40	21.6	0.67	45.00	16.94	0.00	1.00
Mattamy Lands East		910	EX153		28		0.71	76	76	0.71	3.62	0.89		0.00	0.00		0.00	0.00		0.00	0.23		1.13	200	0.35	20.2	0.62	130.00	19.12	0.00	1.00
Alex Polowin ave.		EX153	EX152				0.12	0	384	4.62	3.42	4.26		0.00	0.00		0.00	0.00		0.00	1.52		5.79	200	0.80	30.6	0.94	70.00	24.82	0.00	1.00
Alex Polowin ave.		EX152	EX150				0.00	0	384	4.62	3.42	4.26		0.00	0.00		0.00	0.00		0.00	1.52		5.79	200	0.80	30.6	0.94	85.70	24.82	0.00	1.00
Rue Des Soldats Riendeau St.		EX165	EX150	17			0.67	58	58	0.67	3.64	0.68		0.00	0.00		0.00	0.00		0.00	0.22		0.91	200	1.50	41.9	1.29	101.20	41.00	0.00	1.00
Rue Des Soldats Riendeau St.	Stantec (2015)	EX150	EX146	6			0.30	20	462	5.59	3.39	5.08		0.00	0.00		0.00	0.00		0.00	1.84		6.93	200	0.80	30.6	0.94	72.00	23.68	0.00	1.00

BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

CITY OF OTTAWA
MINTO COMMUNITIES INC.
JLR NO. 26610

BARRHAVEN SOUTH SANITARY SEWER DESIGN SHEET

Designed by: AT
Checked by:HM

			PROPOSED AND BSUEA DESIGN PARAMETERS		
Single Family	3.4	pers/unit	q =	280	L/cap/day
Semi-Detached/Townhouse (row)	2.7	pers/unit	I =	0.330	L/s/ha
Apt Units	1.8	pers/unit	Inst./Comm. =	28000	L/ha/day
Manning's Coeff. N =	0.013		Commerial PF*=	1.0/1.5	

*1.5 if ICI in contributing area is >20%, 1.0 if ICI in contributing area is <20%

Sources:
- Half Moon Bay South Subdivision - Phase 4 - Excluding Arterials- Sanitary sewer design sheet prepared by Stantec (2015)
- Quinn's Pointe - Excluding Arterials-Sanitary sewer design sheet prepared by J.L Richards (2015)
- Barrhaven South Master Servicing Study Addendum - Sanitary sewer design sheet prepared Stantec (2014)

Legend: Proposed; Proposed by Others; Existing

Date: February 2018

STREET	SOURCE	M.H. # FROM	M.H. # TO	RESIDENTIAL NUMBER OF UNITS SING.	MULT.	APT.	AREA TOTAL ha	POPULATION TOTAL peop.	CUMULATIVE POPUL. peop.	CUMULATIVE AREA ha	PEAKING FACTOR	POPUL. FLOW l/s	COMMERCIAL AREA ha	CUMM. AREA ha	INST. FLOW l/s	INSTITUTIONAL AREA ha	CUMM. AREA ha	INST. FLOW l/s	GREEN/UNUSED AREA ha	CUMM. AREA ha	PEAK EXTR. FLOW l/s	PLUG FLOW l/s	PEAK DES. FLOW l/s	SEWER DATA DIA. mm	SLOPE %	CAPAC. l/s	VEL. m/s	LENGTH m	RESIDUAL CAP. l/s	ICI/ TOTAL	ICI* Peaking Factor
Remora Way		EX147	EX146	20			0.94	68	68	0.94	3.63	0.80		0.00	0.00		0.00	0.00		0.00	0.31		1.11	200	1.00	34.2	1.06	78.20	33.11	0.00	1.00
Rue Des Soldats Riendeau St.		EX146	EX145	2			0.08	7	537	6.61	3.37	5.86		0.00	0.00		0.00	0.00		0.00	2.18		8.04	200	0.50	24.2	0.75	19.30	16.15	0.00	1.00
Rue Des Soldats Riendeau St.		EX145	EX144				0.07	0	537	6.68	3.37	5.86		0.00	0.00		0.00	0.00		0.00	2.20		8.06	200	0.50	24.2	0.75	35.90	16.13	0.00	1.00
Rue Des Soldats Riendeau St.		EX144	EX143	9			0.54	31	568	7.22	3.36	6.18		0.00	0.00		0.00	0.00		0.00	2.38		8.56	200	0.50	24.2	0.75	114.90	15.63	0.00	1.00
Rue Des Soldats Riendeau St.		EX143	MH142				0.00	0	568	7.22	3.36	6.18		0.00	0.00		0.00	0.00		0.00	2.38		8.56	200	0.40	21.6	0.67	21.50	13.08	0.00	1.00
River Mist Road		MH142	EX139	3			0.26	10	1305	18.04	3.18	13.44		0.00	0.00		8.03	3.90		0.91	8.90		26.25	300	0.40	63.8	0.87	74.80	37.56	0.30	1.50
		EX140	EX139	7			0.40	24	24	0.40	3.70	0.29		0.00	0.00		0.00	0.00		0.00	0.13		0.42	200	0.65	27.6	0.85	67.70	27.17	0.00	1.00
River Mist Road		EX139	EX136	10			0.47	34	1363	18.91	3.17	13.99		0.00	0.00		8.03	3.90		0.91	9.19		27.08	300	0.41	64.6	0.89	64.70	37.51	0.29	1.50
		EX137	EX136	15			0.84	51	51	0.84	3.65	0.60		0.00	0.00		0.00	0.00		0.00	0.28		0.88	200	0.65	27.6	0.85	67.80	26.71	0.00	1.00
River Mist Road		EX136	MH126	4			0.29	14	1428	20.04	3.16	14.60		0.00	0.00		8.03	3.90		0.91	9.56		28.07	300	0.41	64.6	0.89	78.90	36.52	0.28	1.50
Mattamy Lands East		920	930	36			1.83	122	122	1.83	3.58	1.41	2.13	2.13	1.04		0.00	0.00		0.00	1.31		3.76	200	0.35	20.2	0.62	165.00	15.50	0.54	1.50
Mattamy Lands East		930	EX217					0	122	1.83	3.58	1.41		2.13	1.04		0.00	0.00		0.00	1.31		3.76	200	0.36	20.5	0.63	40.00	15.50	0.54	1.50
Flameflower St.		EX217	EX215				0.05	0	122	1.88	3.58	1.41		2.13	1.04		0.00	0.00		0.00	1.32		3.77	200	2.00	48.4	1.49	34.50	44.62	0.53	1.50
Flameflower St.	Stantec (2015)	EX216	EX215		5		0.19	14	14	0.19	3.72	0.17		0.00	0.00		0.00	0.00		0.00	0.06		0.23	200	0.65	27.6	0.85	45.20	27.35	0.00	1.00
Flameflower St.		EX215	EX214		15		0.34	41	177	2.41	3.53	2.03		2.13	1.04		0.00	0.00		0.00	1.50		4.56	200	2.00	48.4	1.49	72.00	43.83	0.47	1.50
Flameflower St.		EX214	EX203		15		0.35	41	218	2.76	3.51	2.48		2.13	1.04		0.00	0.00		0.00	1.61		5.13	200	2.00	48.4	1.49	73.50	43.26	0.44	1.50
Devario Cres.		EX204	EX203				0.54	62	62	0.54	3.64	0.73		0.00	0.00		0.00	0.00	3.10	3.10	1.20		1.93	200	1.50	41.9	1.29	36.50	39.97	0.00	1.00
Devario Cres.		EX208	EX203				2.50	187	187	2.50	3.53	2.14		0.00	0.00		0.00	0.00		0.00	0.83		2.96	200	0.40	21.6	0.67	120.00	18.68	0.00	1.00
Flameflower St.		EX203	EX201				0.12	0	467	5.92	3.39	5.13		2.13	0.69		0.00	0.00		3.10	3.68		9.50	200	0.40	21.6	0.67	73.70	12.14	0.19	1.00
Dundonald Dr.		EX202	EX201	4			0.53	14	14	0.53	3.72	0.17		0.00	0.00		0.00	0.00		0.00	0.17		0.34	200	3.25	61.7	1.90	50.00	61.34	0.00	1.00
Dundonald Dr.		EX201	EX129A	3			0.21	10	491	6.66	3.38	5.38		2.13	0.69		0.00	0.00		3.10	3.92		10.00	200	0.40	21.6	0.67	47.80	11.64	0.18	1.00
Dundonald Dr.		EX129A	EX129	18			0.75	61	552	7.41	3.36	6.01		2.13	0.69		0.00	0.00		3.10	4.17		10.87	200	0.40	21.6	0.67	100.90	10.77	0.17	1.00
Dundonald Dr.		EX129	EX128	11			0.58	37	589	7.99	3.35	6.39		2.13	0.69		0.00	0.00		3.10	4.36		11.45	200	0.40	21.6	0.67	91.70	10.19	0.16	1.00
Lamprey St.		EX130	EX128				1.16	85	85	1.16	3.61	0.99		0.00	0.00		0.00	0.00	0.40	0.40	0.51		1.51	200	0.50	24.2	0.75	96.50	22.69	0.00	1.00
Dundonald Dr.		EX128	EX127	9			0.37	31	705	9.52	3.31	7.57		2.13	0.69		0.00	0.00		3.50	5.00		13.26	200	0.50	24.2	0.75	49.80	10.93	0.14	1.00
Dundonald Dr.		EX127	MH126	13			0.66	44	749	10.18	3.30	8.01		2.13	0.69		0.00	0.00		3.50	5.22		13.92	200	0.32	19.4	0.60	97.80	5.43	0.13	1.00
Dundonald Dr.		EX23	MH126				1.06	71	71	1.06	3.63	0.83		0.00	0.00		0.00	0.00		0.00	0.35		1.18	200	1.47	41.5	1.28	89.30	40.30	0.00	1.00
School		EX123A	EX123				0.00	0	0	0.00	3.80	0.00		0.00	0.00	2.06	2.06	1.00		0.00	0.68		1.68	250	0.89	58.5	1.16	15.80	56.85	1.00	1.50
River Mist. Dr.		MH126	EX123		5		0.29	14	2262	31.57	3.03	22.25		2.13	1.04		8.03	3.90		4.41	15.23		42.41	375	0.45	122.7	1.08	122.00	80.29	0.22	1.50
River Mist. Rd.		EX123	MH112		7		0.34	19	2281	31.91	3.03	22.42		2.13	1.04		10.09	4.90		4.41	16.02		44.38	375	0.42	118.5	1.04	90.30	74.16	0.25	1.50
White Arctic Ave.		EX111	MH112				3.39	378	378	3.39	3.43	4.20		0.00	0.00		0.00	0.00		0.00	1.12		5.32	200	0.32	19.4	0.60	74.80	14.04	0.00	1.00

BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

CITY OF OTTAWA
MINTO COMMUNITIES INC.
JLR NO. 26610

BARRHAVEN SOUTH SANITARY SEWER DESIGN SHEET

Designed by: AT
Checked by:HM

			PROPOSED AND BSUEA DESIGN PARAMETERS		
Single Family	3.4	pers/unit	q =	280	L/cap/day
Semi-Detached/Townhouse (row)	2.7	pers/unit	I =	0.330	L/s/ha
Apt Units	1.8	pers/unit	Inst./Comm. =	28000	L/ha/day
Manning's Coeff. N =	0.013		Commerial PF*=	1.0/1.5	

*1.5 if ICI in contributing area is >20%, 1.0 if ICI in contributing area is <20%

Sources:	
	Half Moon Bay South Subdivision - Phase 4 - Excluding Arterials- Sanitary sewer design sheet prepared by Stantec (2015)
	Quinn's Pointe - Excluding Arterials-Sanitary sewer design sheet prepared by J.L Richards (2015)
	Barrhaven South Master Servicing Study Addendum - Sanitary sewer design sheet prepared Stantec (2014)

Legend

	Proposed
	Proposed by Others
	Existing

Date: February 2018

STREET	SOURCE	M.H. #		RESIDENTIAL: NUMBER OF UNITS			AREA	POPULATION	CUMULATIVE		PEAKING FACTOR	POPUL. FLOW	COMMERCIAL			INSTITUTIONAL			GREEN/UNUSED		PEAK EXTR. FLOW	PLUG FLOW	PEAK DES. FLOW	SEWER DATA					RESIDUAL CAP.	ICI/ TOTAL	ICI* Peaking Factor
		FROM	TO	SING.	MULT.	APT.	TOTAL ha	TOTAL peop.	POPUL. peop.	AREA ha		l/s	AREA ha	CUMM. AREA ha	INST. FLOW l/s	AREA ha	CUMM. AREA ha	INST. FLOW l/s	AREA ha	CUMM. AREA ha	l/s	l/s	l/s	DIA. mm	SLOPE %	CAPAC. l/s	VEL. m/s	LENGTH m	l/s		
River Mist. Rd.		MH112	EX102				0.14	0	2659	35.44	2.99	25.76		2.13	1.04		10.09	4.90		4.41	17.18		48.88	375	0.31	101.8	0.89	68.00	52.96	0.23	1.50
Dutchmans Way		EX103	EX102	18			0.80	61	61	0.80	3.64	0.72		0.00	0.00		0.00	0.00		0.00	0.26		0.98	200	2.02	48.6	1.50	120.00	47.65	0.00	1.00
Song Sparrow St.		EX104	EX102				3.83	386	386	3.83	3.42	4.28		0.00	0.00		0.00	0.00		0.00	1.26		5.55	200	0.44	22.7	0.70	114.60	17.15	0.00	1.00
River Mist Road	Stantec (2015)	EX102	EX101				0.07	0	3106	40.14	2.94	29.63		2.13	1.04		10.09	4.90		4.41	18.73		54.30	375	0.29	98.5	0.86	34.00	44.20	0.22	1.50
	Stantec (2014)	EX101	MH43A				0.00	0	3106	40.14	2.94	29.63		2.13	1.04		10.09	4.90		4.41	18.73		54.30	375	0.30	100.2	0.88	38.00	45.88	0.22	1.50
		MH43A	MH44A				6.56	352	3458	46.70	2.91	32.63		2.13	0.69		10.09	3.27		4.41	20.90		57.49	375	0.30	100.2	0.88	81.00	42.70	0.19	1.00
		MH44A	MH45A				0.00	0	3458	46.70	2.91	32.63		2.13	0.69		10.09	3.27		4.41	20.90		57.49	375	0.30	100.2	0.88	64.00	42.70	0.19	1.00
		MH45A	MH46A				0.00	0	3458	46.70	2.91	32.63		2.13	0.69		10.09	3.27		4.41	20.90		57.49	375	0.30	100.2	0.88	85.00	42.70	0.19	1.00
		MH46A	MH47A				8.40	562	4020	55.10	2.87	37.33		2.13	0.69		10.09	3.27	1.60	6.01	24.20		65.49	375	0.30	100.2	0.88	41.00	34.70	0.17	1.00
		MH47A	MH101A				0.00	0	4020	55.10	2.87	37.33		2.13	0.69		10.09	3.27		6.01	24.20		65.49	375	0.30	100.2	0.88	64.00	34.70	0.17	1.00
		MH101A	MH102A				0.00	0	4020	55.10	2.87	37.33		2.13	0.69		10.09	3.27		6.01	24.20		65.49	375	0.30	100.2	0.88	64.00	34.70	0.17	1.00
River Mist Road	Stantec (2014)	MH102A	MH17A				5.24	420	4440	60.34	2.83	40.78		2.13	0.69		10.09	3.27		6.01	25.93		70.67	375	0.30	100.2	0.88	81.00	29.52	0.16	1.00
CAMBRIAN RD. FROM MH17A TO MH45A							60.34	4440																							
Cambrian Rd.	Stantec (2014)	MH17A	MH21A				26.01	1956	15813	189.42	2.76	141.19		6.83	2.21	2.96	33.20	10.76	5.10	28.63	75.72		229.88	750	0.13	419.5	0.92	204.30	189.62	0.16	1.00
Cambrian Rd.	Stantec (2014)	MH21A	MH45				7.04	408	16221	196.46	2.74	144.25		6.83	2.21		33.20	10.76	0.00	28.63	78.04		235.26	750	0.13	419.5	0.92	277.80	184.24	0.15	1.00
MINTO LANDS WITHIN BSUEA OUTLETS TO 120 (QUINN'S POINTE) EXISTING GREENBANK RD.							196.46																								
Future Collector		514	516	16	104		3.49	335	335	3.49	3.45	3.74		0.00	0.00	0.00	0.00	0.00		0.00	1.15		4.89	200	0.35	20.2	0.62	127.90	15.35	0.00	1.00
Future Collector		516	554	20	54		3.18	214	549	6.67	3.36	5.98		0.00	0.00	0.00	0.00	0.00		0.00	2.20		8.18	200	0.35	20.2	0.62	170.90	12.06	0.00	1.00
Future Collector																0.00															
Future Collector		500	502	25	70	115	7.16	481	481	7.16	3.39	5.28		0.00	0.00	0.00	0.00	0.00		0.00	2.36	0.10	7.74	200	0.35	20.2	0.62	174.00	11.41	0.00	1.00
Future Collector		502	551	8	44		1.55	146	627	8.71	3.34	6.78		0.00	0.00	0.00	0.00	0.00		0.00	2.87		9.76	200	0.88	32.1	0.99	171.30	20.22	0.00	1.00
East-West Collector		550	551	20			1.98	68	68	1.98	3.63	0.80		0.00	0.00	0.00	0.00	0.00		0.00	0.65		1.45	200	0.35	20.2	0.62	99.90	18.73	0.00	1.00
East-West Collector		551	552	22	0		1.49	75	770	12.18	3.30	8.23		0.00	0.00	0.00	0.00	0.00		0.00	4.02		12.34	200	0.35	20.2	0.62	175.00	7.90	0.00	1.00
East-West Collector		552	554	12	20		3.36	95	865	15.54	3.27	9.17		0.00	0.00	0.00	0.00	0.00		0.00	5.13		14.40	200	0.35	20.2	0.62	178.30	3.37	0.00	1.00
East-West Collector		554	556	11	34		1.81	129	1543	24.02	3.14	15.68		0.00	0.00	0.00	0.00	0.00		0.00	7.93		23.71	250	0.33	35.6	0.70	295.60	9.15	0.00	1.00
Future Collector		517	564	20	35		2.07	163	163	2.07	3.54	1.87		0.00	0.00	0.00	0.00	0.00		0.00	0.68		2.55	200	0.59	26.3	0.81	280.00	23.71	0.00	1.00
Alex Polowin Ave.		13	14	12	0		0.54	41	41	0.54	3.67	0.49		0.00	0.00	0.00	0.00	0.00		0.00	0.00		0.49	200	0.67	28.0	0.86	74.56	27.53	0.00	1.00
Alex Polowin Ave.		14	90	13	0		0.65	44	85	1.19	3.61	0.99		0.00	0.00	0.00	0.00	0.00		0.00	0.00		0.99	200	0.94	33.1	1.02	112.06	32.13	0.00	1.00
Alex Polowin Ave.		90	5	11	0		0.54	37	122	1.73	3.58	1.41		0.00	0.00	0.00	0.00	0.00		0.00	0.00		1.41	200	0.35	20.3	0.63	108.16	18.87	0.00	1.00
River Mist Road		5	563	0			0.00	0	122	1.73	3.58	1.41		0.00	0.00	0.00	0.00	0.00		0.00	0.00		1.41	200	0.42	22.2	0.68	80.00	20.76	0.00	1.00
River Mist Road		563	564	8			0.47	27	149	2.20	3.55	1.72		0.00	0.00	0.00	0.00	0.00		0.00	0.73		2.44	200	0.42	22.2	0.68	50.00	19.73	0.00	1.00
River Mist Road		564	556	7	9		0.64	48	360	4.91	3.43	4.01		0.00	0.00		0.00	0.00		0.00	1.62		5.63	200	0.35	20.2	0.62	95.00	14.62	0.00	1.00
East-West Collector		556	557						1903	28.93	3.08	19.01		0.00	0.00	2.20	2.20	0.71		0.00	10.27		30.09	300	1.39	118.9	1.63	44.30	84.53	0.07	1.00
East-West Collector		557	558	6			1.12	20	1923	30.05	3.08	19.19		0.00	0.00	2.86	5.06	1.64		0.00	11.59	4.00	36.42	300	1.39	118.9	1.63	158.40	80.38	0.14	1.00
Future Collector		560	558	50	0		3.09	170	170	3.09	3.54	1.95		0.00	0.00		0.00	0.00		0.00	1.02		2.97	200	0.35	20.2	0.62	150.00	17.27	0.00	1.00
East-West Collector		558	119				5.74	0	2093	38.88	3.06	20.73		0.00	0.00		5.06	1.64		0.00	14.50		40.97	450	0.13	107.2	0.65	150.00	63.75	0.12	1.00
Future Collector		521	522	24	33		2.17	171	171	2.17	3.54	1.96		0.00	0.00		0.00	0.00		0.00	0.72		2.68	200	1.26	38.4	1.18	230.00	35.74	0.00	1.00
		522	523						171	2.17				0.00	0.00		0.00	0.00		0.00											
		523	524		71		1.95	192	363	4.12				0.00	0.00		0.00	0.00		0.00										0.00	1.00
Future Collector		520	524	41			2.06	139	139	2.06	3.56	1.60		0.00	0.00		0.00	0.00		0.00	0.68		2.28	200	0.26	17.4	0.54	72.20	15.16	0.00	1.00
Future Collector		524	578		0		0.00	0	502	6.18	3.38	5.50		0.00	0.00		0.00	0.00		0.00	2.04		7.54	300	0.20	45.1	0.62	200.90	37.58	0.00	1.00
Future Collector		578	532		87		3.63	235	737	9.81	3.31	7.89		0.00	0.00		0.00	0.00		0.00	3.24		11.13	300	0.20	45.1	0.62	173.70	33.98	0.00	1.00
Future Collector		532	534	50	26		3.29	240	977	13.10	3.25	10.27		0.00	0.00		0.00	0.00		0.00	4.32		14.60	300	0.20	45.1	0.62	127.45	30.52	0.00	1.00
Future Collector		534	536	55			2.96	187	1164	16.06	3.21	12.09		0.00	0.00		0.00	0.00		0.00	5.30		17.39	450	0.20	133.0	0.81	173.27	115.63	0.00	1.00
Future Collector		536	538				0.00	0	1164	16.06	3.21	12.09		0.00	0.00	0.00	0.00	0.00		0.00	5.30		17.39	450	0.20	133.0	0.81	309.73	115.63	0.00	1.00
		538	119	0			0.00	0	1164	16.06	3.21	12.09		0.00	0.00		0.00	0.00		0.00	5.30		17.39	525	0.15	173.8	0.78	245.34	156.37	0.00	1.00
Greenbank Rd.		119	EX120					0	3257	54.94	2.93	30.92		0.00	0.00		5.06	1.64		0.00	19.80		56.46	600	0.15	248.1	0.85	168.66	187.53	0.08	1.00
QUINN'S POINTE OUTLETS TO MH205A EXISTING GREENBANK RD.							54.94	3257																							
Greenbank Road		EX120	EX121				0.22	0	3257	55.16	2.93	30.92		0.00	0.00	0.00	5.06	1.64		0.00	19.87		56.53	600	0.16	259.0	0.89	58.09	202.51	0.08	1.00
Greenbank Road		EX121	EX122				0.28	0	3640	61.99	2.90	34.16		0.00	0.00	0.00	6.63	2.15		0.00	22.64		63.05	600	0.33	369.2	1.27	75.27	306.17	0.10	1.00

BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

CITY OF OTTAWA
MINTO COMMUNITIES INC.

JLR NO. 26610

BARRHAVEN SOUTH SANITARY SEWER DESIGN SHEET

Designed by: AT
Checked by:HM

			PROPOSED AND BSUEA DESIGN PARAMETERS		
Single Family	3.4	pers/unit	q =	280	L/cap/day
Semi-Detached/Townhouse (row)	2.7	pers/unit	I =	0.330	L/s/ha
Apt Units	1.8	pers/unit	Inst./Comm. =	28000	L/ha/day
Manning's Coeff. N =	0.013		Commerial PF*=	1.0/1.5	

*1.5 if ICI in contributing area is >20%, 1.0 if ICI in contributing area is <20%

Sources:	
	Half Moon Bay South Subdivision - Phase 4 - Excluding Arterials- Sanitary sewer design sheet prepared by Stantec (2015)
	Quinn's Pointe - Excluding Arterials-Sanitary sewer design sheet prepared by J.L Richards (2015)
	Barrhaven South Master Servicing Study Addendum - Sanitary sewer design sheet prepared Stantec (2014)

Legend	
	Proposed
	Proposed by Others
	Existing

Date: February 2018

STREET	SOURCE	M.H. # FROM	M.H. # TO	RESIDENTIAL NUMBER OF UNITS SING.	MULT.	APT.	AREA TOTAL ha	POPULATION TOTAL peop.	CUMULATIVE POPUL. peop.	CUMULATIVE AREA ha	PEAKING FACTOR	POPUL. FLOW l/s	COMMERCIAL AREA ha	CUMM. AREA ha	INST. FLOW l/s	INSTITUTIONAL AREA ha	CUMM. AREA ha	INST. FLOW l/s	GREEN/UNUSED AREA ha	CUMM. AREA ha	PEAK EXTR. FLOW l/s	PLUG FLOW l/s	PEAK DES. FLOW l/s	SEWER DATA DIA. mm	SLOPE %	CAPAC. l/s	VEL. m/s	LENGTH m	RESIDUAL CAP. l/s	ICI/ TOTAL	ICI* Peaking Factor
Greenbank Road		EX122	EX123R				0.45	0	3640	62.44	2.90	34.16		0.00	0.00	0.00	6.63	2.15		0.00	22.79		63.20	600	0.21	291.1	1.00	121.02	227.90	0.10	1.00
Easement		EX44	EX123R				0.00	0	259	2.62	3.48	2.93		0.00	0.00	0.00	0.00	0.00		0.00	0.86		3.79	300	0.35	59.9	0.82	19.00	56.12	0.00	1.00
Greenbank Road		EX123R	MH205A				0.43	0	3899	65.49	2.87	36.32		0.00	0.00	0.00	6.63	2.15		0.00	23.80		66.37	600	0.25	319.2	1.09	120.80	252.85	0.09	1.00
Kilbirnie Drive	JLR (2016)	EX24	MH205A		3		0.11	8	224	2.15	3.50	2.54		0.00	0.00	0.00	0.00	0.00		0.00	0.71		3.25	200	0.71	28.8	0.89	28.70	25.59	0.00	1.00
Existing Greenbank Road		MH205A	EX98A					0	4123	67.64	2.86	38.18		0.00	0.00	0.00	6.63	2.15		0.00	24.51		73.94	600	0.25	320.3	1.10	126.00	246.34	0.09	1.00
EXISTING GREENBANK RD. FROM MH 98A TO MH45A							6.15	484																							
Existing Greenbank Road	IBI	EX98A	MH99A				0.00	0	4123	67.64	2.86	38.18		0.00	0.00		6.63	2.15		0.00	24.51		73.94	600	0.25	320.3		125.00	246.34	0.09	1.00
Existing Greenbank Road	IBI	MH99A	MH100A				0.00	0	4123	67.64	2.86	38.18		0.00	0.00		6.63	2.15		0.00	24.51		73.94	600	0.25	320.3		108.00	246.34	0.09	1.00
Existing Greenbank Road	IBI	MH100A	MH204A				0.00	0	4123	67.64	2.86	38.18		0.00	0.00		6.63	2.15		0.00	24.51		73.94	600	0.25	320.3		105.00	246.34	0.09	1.00
Existing Greenbank Road	IBI	MH204A	MH206A				0.00	0	4123	67.64	2.86	38.18		0.00	0.00		6.63	2.15		0.00	24.51		73.94	600	0.25	320.3		103.00	246.34	0.09	1.00
Existing Greenbank Road	IBI	MH206A	MH97A				0.00	0	4123	67.64	2.86	38.18		0.00	0.00		6.63	2.15		0.00	24.51		73.94	600	0.25	320.3		125.00	246.34	0.09	1.00
Existing Greenbank Road	IBI	MH97A	MH96A				19.95	1631	5754	87.59	2.75	51.29		0.00	0.00		6.63	2.15	0.81	0.81	31.36		93.90	600	0.30	350.8		98.00	256.95	0.07	1.00
Existing Greenbank Road	IBI	MH96A	MH95A				0.00	0	5754	87.59	2.75	51.29		0.00	0.00		6.63	2.15		0.81	31.36		93.90	600	0.30	350.8		129.00	256.95	0.07	1.00
Existing Greenbank Road	IBI	MH95A	MH201A				0.00	0	5754	87.59	2.75	51.29		0.00	0.00		6.63	2.15		0.81	31.36		93.90	600	0.30	350.8		123.00	256.95	0.07	1.00
Existing Greenbank Road	IBI	MH201A	MH201B				12.13	787	6541	99.72	2.71	57.40		0.00	0.00		6.63	2.15		0.81	35.36		104.01	600	0.30	350.8		124.00	246.83	0.06	1.00
Existing Greenbank Road	IBI	MH201B	MH200A				0.00	0	6541	99.72	2.71	57.40		0.00	0.00		6.63	2.15		0.81	35.36		104.01	600	0.30	350.8		68.00	246.83	0.06	1.00
Existing Greenbank Road	IBI	MH200A	MH200C				0.00	0	6541	99.72	2.71	57.40		0.00	0.00		6.63	2.15		0.81	35.36		104.01	600	0.50	452.9		48.00	348.93	0.06	1.00
Existing Greenbank Road	IBI	MH200C	MH45				0.00	0	6541	99.72	2.71	57.40		0.00	0.00		6.63	2.15		0.81	35.36		104.01	600	0.12	221.9		26.00	117.88	0.06	1.00
Existing Greenbank Road	Stantec (2014)	MH45	MH435A				5.12	548	23310	301.30	2.27	171.38		6.83	2.21		39.83	12.91	0.00	29.44	124.54		320.14	900	0.10	597.2		296.00	277.08	0.12	1.00
North																															
	↓	MA9	MA8				22.23	2378	2378	22.23	3.02	23.28	0.00	0.00	0.00	2.45	2.45	0.79	9.54	9.54	11.29		35.37	450	0.11	98.4		507.50	63.03	0.07	1.00
		MA8	MA7				2.88	308	2686	25.11	2.99	25.99	0.00	0.00	0.00	0.00	2.45	0.79	0.78	10.32	12.50		39.29	450	0.11	98.4		317.10	59.11	0.06	1.00
		MA7	MA6				18.50	1979	4665	43.61	2.82	42.61	0.00	0.00	0.00	0.00	2.45	0.79	0.00	10.32	18.61		62.01	450	0.11	98.4		573.10	36.39	0.04	1.00
Realigned Greenbank Road		MA6	MA5				21.68	2320	6985	65.29	2.69	60.80	0.00	0.00	0.00	0.00	2.45	0.79	0.00	10.32	25.76		87.36	525	0.10	140.5		473.90	53.14	0.03	1.00
Realigned Greenbank Road		MA5	MA4				9.53	1020	8005	74.82	2.64	68.49	0.00	0.00	0.00	0.00	2.45	0.79	0.00	10.32	28.90		98.19	525	0.10	140.5		439.40	42.31	0.03	1.00
Realigned Greenbank Road		MA4	MH521A				8.07	863	8868	82.89	2.61	74.87	0.00	0.00	0.00	0.00	2.45	0.79	2.42	12.74	32.37		108.03	525	0.10	140.5		530.70	32.47	0.02	1.00
		MH521A	MH522A				3.80	231	9099	86.69	2.60	76.56	0.00	0.00	0.00	0.00	2.45	0.79	0.02	12.76	33.63		110.98	600	0.10	201.5		49.90	90.52	0.02	1.00
		MH522A	MH435A				0.00	0	9099	86.69	2.60	76.56	0.00	0.00	0.00	0.00	2.45	0.79	0.00	12.76	33.63		110.98	600	0.10	201.5		11.10	90.52	0.02	1.00
		MH435A	MH501A				0.00	0	32409	387.99	2.16	226.39	0.00	6.83	2.21	0.00	42.28	13.70	0.00	42.20	158.17		409.57	900	0.10	597.0		13.30	187.43	0.10	1.00

Sanitary design calculation for the proposed HMB phase 8 site by DSEL (2020)

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Drummond Future Road																													
	Plug	305A	0.89				67	0.89	67	3.63	0.79		0.00		0.00		0.00	0.00	0.89	0.89	0.29	1.08	8.0	200	0.35	19.40	0.06	0.62	0.33
To Expansion Road, Pipe 305A - 306A								0.89	67				0.00		0.00		0.00			0.89									
Future Residential																													
	Ctrl 3A	109A	1.90				162	1.90	162	3.54	1.86		0.00		0.00		0.00	0.00	1.90	1.90	0.63	2.49	11.0	200	0.35	19.40	0.13	0.62	0.42
To Obsidian Street, Pipe 109A - 400A								1.90	162				0.00		0.00		0.00			1.90									
Focality Crescent																													
	107A	108A	0.14	3		3	9	0.14	9	3.74	0.11		0.00		0.00		0.00	0.00	0.14	0.14	0.05	0.16	12.5	200	2.45	51.34	0.00	1.63	0.36
	108A	110A	0.17	5		5	14	0.31	23	3.70	0.28		0.00		0.00		0.00	0.00	0.17	0.31	0.10	0.38	50.5	200	0.35	19.40	0.02	0.62	0.24
To Haiku Street, Pipe 110A - 1100A								0.31	23				0.00		0.00		0.00			0.31									
	107A	112A	0.45	18		18	49	0.45	49	3.65	0.58		0.00		0.00		0.00	0.00	0.45	0.45	0.15	0.73	73.5	200	0.70	27.44	0.03	0.87	0.37
	112A	113A	0.43	16		16	44	0.88	93	3.60	1.09		0.00		0.00		0.00	0.00	0.43	0.88	0.29	1.38	70.5	200	0.35	19.40	0.07	0.62	0.36
	113A	114A	0.12	3		3	9	1.00	102	3.59	1.19		0.00		0.00		0.00	0.00	0.12	1.00	0.33	1.52	12.5	200	0.35	19.40	0.08	0.62	0.36
	114A	115A	0.18	5		5	14	1.18	116	3.58	1.35		0.00		0.00		0.00	0.00	0.18	1.18	0.39	1.74	50.5	200	0.40	20.74	0.08	0.66	0.40
To Haiku Street, Pipe 115A - 111A								1.18	116				0.00		0.00		0.00			1.18									
Sturnidae Street																													
	124A	125A	0.60	18	18		62	0.60	62	3.64	0.73		0.00		0.00		0.00	0.00	0.60	0.60	0.20	0.93	101.0	200	0.65	26.44	0.04	0.84	0.39
	125A	126A	0.50	12	12		41	1.10	103	3.59	1.20		0.00		0.00		0.00	0.00	0.50	1.10	0.36	1.56	91.0	200	0.35	19.40	0.08	0.62	0.37
Contribution From Montology Way, Pipe 123A - 126A								0.81	63				0.00		0.00		0.00		0.81	1.91									
	126A	106A						1.91	166	3.54	1.91		0.00		0.00		0.00	0.00	0.00	1.91	0.63	2.54	63.0	200	0.35	19.40	0.13	0.62	0.42
To Elevation Road, Pipe 106A - 116A								1.91	166				0.00		0.00		0.00			1.91									
Park																													
	Ctrl 4A	104A						0.00					0.00		0.00	1.72	1.72	0.19	1.72	1.72	0.57	0.75	10.5	200	0.35	19.40	0.04	0.62	0.29
To Chillerton Drive, Pipe 104A - 106A								0.00	0				0.00		0.00		1.72			1.72									
Canadensis Lane																													
	229A	230A	0.42	15		15	41	0.42	41	3.67	0.49		0.00		0.00		0.00	0.00	0.42	0.42	0.14	0.63	73.5	200	2.00	46.38	0.01	1.48	0.51
	230A	103A	0.48	18		18	49	0.90	90	3.60	1.05		0.00		0.00		0.00	0.00	0.48	0.90	0.30	1.35	90.0	200	3.00	56.81	0.02	1.81	0.75
To Chillerton Drive, Pipe 103A - 104A								0.90	90				0.00		0.00		0.00			0.90									
Surface Lane																													
	227A	228A	0.47	18		18	49	0.47	49	3.65	0.58		0.00		0.00		0.00	0.00	0.47	0.47	0.16	0.74	72.5	200	2.00	46.38	0.02	1.48	0.53
	228A	102A	0.48	18		18	49	0.95	98	3.60	1.14		0.00		0.00		0.00	0.00	0.48	0.95	0.31	1.46	90.0	200	0.85	30.24	0.05	0.96	0.49
To Chillerton Drive, Pipe 102A - 103A								0.95	98				0.00		0.00		0.00			0.95									
Chillerton Drive																													
	101A	102A	0.14	3		3	9	0.14	9	3.74	0.11		0.00		0.00		0.00	0.00	0.14	0.14	0.05	0.16	25.5	200	2.60	52.89	0.00	1.68	0.34
Contribution From Surface Lane, Pipe 228A - 102A								0.95	98				0.00		0.00		0.00		0.95	1.09									
	102A	103A	0.22	7		7	19	1.31	126	3.57	1.46		0.00		0.00		0.00	0.00	0.22	1.31	0.43	1.89	59.0	200	1.70	42.76	0.04	1.36	0.67
Contribution From Canadensis Lane, Pipe 230A - 103A								0.90	90				0.00		0.00		0.00		0.90	2.21									
	103A	104A	0.46	14		14	38	2.67	254	3.49	2.87		0.00		0.00		0.00	0.00	0.46	2.67	0.88	3.75	120.0	200	0.50	23.19	0.16	0.74	0.54
Contribution From Park, Pipe 4A - 104A								0.00	0				0.00		0.00		1.72		1.72	4.39									
	104A	106A	0.08	1		1	3	2.75	257	3.49	2.90		0.00		0.00		1.72	0.19	0.08	4.47	1.48	4.56	45.5	200	0.35	19.40	0.24	0.62	0.50
To Elevation Road, Pipe 106A - 116A								2.75	257				0.00		0.00		1.72			4.47									

DESIGN PARAMETERS

Park Flow = 9300 L/ha/da 0.10764 l/s/Ha
Average Daily Flow = 280 l/p/day
Comm/Inst Flow = 28000 L/ha/da 0.3241 l/s/Ha
Industrial Flow = 35000 L/ha/da 0.40509 l/s/Ha
Max Res. Peak Factor = 3.80
Commercial/Inst./Park Peak Factor = 1.00
Institutional = 0.32 l/s/Ha

Industrial Peak Factor = as per MOE Graph
Extraneous Flow = 0.330 L/s/ha
Minimum Velocity = 0.600 m/s
Manning's n = (Conc) 0.013 (Pvc) 0.013
Townhouse coeff= 2.7
Single house coeff= 3.4

Designed: SLM
Checked: ADF
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 80-83

PROJECT: Ciavan Communities - Brazeau Phase 1
LOCATION: City of Ottawa
File Ref: 18-1030
Date: 27 Jul 2020
Sheet No. 1 of 6

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

Ottawa

LOCATION: STREET	FROM M.H.	TO M.H.	RESIDENTIAL: AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	COMM: AREA (ha)	COMM: ACCU. AREA (ha)	INSTIT: AREA (ha)	INSTIT: ACCU. AREA (ha)	PARK: AREA (ha)	PARK: ACCU. AREA (ha)	C+I+I: PEAK FLOW (l/s)	INFILTRATION: TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE: DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Epoch Street																													
	220A	221A	0.42	10		10	27	0.42	27	3.69	0.32		0.00		0.00		0.00	0.00	0.42	0.42	0.14	0.46	77.5	200	0.95	31.97	0.01	1.02	0.35
	221A	222A	0.49	18		18	49	0.91	76	3.62	0.89		0.00		0.00		0.00	0.00	0.49	0.91	0.30	1.19	93.0	200	0.35	19.40	0.06	0.62	0.34
	222A	223A	0.52	20		20	54	1.43	130	3.57	1.50		0.00		0.00		0.00	0.00	0.52	1.43	0.47	1.98	100.5	200	0.35	19.40	0.10	0.62	0.40
To Elevation Road, Pipe 223A - 105A								1.43	130				0.00		0.00		0.00			1.43									
Eminence Street																													
	215A	216A	0.49	12	12		41	0.49	41	3.67	0.49		0.00		0.00		0.00	0.00	0.49	0.49	0.16	0.65	75.5	200	0.85	30.24	0.02	0.96	0.39
	216A	217A	0.72	17	17		58	1.21	99	3.60	1.15		0.00		0.00		0.00	0.00	0.72	1.21	0.40	1.55	113.5	200	0.35	19.40	0.08	0.62	0.37
	217A	219A	0.45	12	12		41	1.66	140	3.56	1.62		0.00		0.00		0.00	0.00	0.45	1.66	0.55	2.16	83.5	200	0.35	19.40	0.11	0.62	0.41
To Elevation Road, Pipe 219A - 223A								1.66	140				0.00		0.00		0.00			1.66									
Elevation Road																													
	218A	219A	0.13	2	2		7	0.13	7	3.74	0.08		0.00		0.00		0.00	0.00	0.13	0.13	0.04	0.13	24.0	200	2.65	53.39	0.00	1.70	0.35
Contribution From Eminence Street, Pipe 217A - 219A								1.66	140				0.00		0.00		0.00		1.66	1.79									
	219A	223A	0.23	4	4		14	2.02	161	3.54	1.85		0.00		0.00		0.00	0.00	0.23	2.02	0.67	2.52	59.0	200	0.85	30.24	0.08	0.96	0.58
Contribution From Epoch Street, Pipe 222A - 223A								1.43	130				0.00		0.00		0.00		1.43	3.45									
	223A	105A	0.42	6	6		21	3.87	312	3.46	3.50		0.00		0.00		0.00	0.00	0.42	3.87	1.28	4.77	82.5	200	0.70	27.44	0.17	0.87	0.65
	105A	106A	0.42	7	7		24	4.29	336	3.45	3.75		0.00		0.00		0.00	0.00	0.42	4.29	1.42	5.17	94.0	200	1.30	37.40	0.14	1.19	0.83
Contribution From Chillerton Drive, Pipe 104A - 106A								2.75	257				0.00		0.00		1.72		4.47	8.76									
Contribution From Sturnidae Street, Pipe 126A - 106A								1.91	166				0.00		0.00		0.00		1.91	10.67									
			0.35	11		11	30	9.30	789				0.00		0.00		1.72		0.35	11.02									
	106A	116A	0.35	8	8		28	9.65	817	3.28	8.69		0.00		0.00		1.72	0.19	0.35	11.37	3.75	12.63	118.0	200	0.35	19.40	0.65	0.62	0.66
To Haiku Street, Pipe 116A - 1160A								9.65	817				0.00		0.00		1.72			11.37									
			1.57				118	1.57	118				0.00		0.00		0.00		1.57	1.57									
	309A	310A	5.67				595	7.24	713	3.31	7.65		0.00		0.00		0.00	0.00	5.67	7.24	2.39	10.04	15.0	250	0.25	29.73	0.34	0.61	0.55
To Expansion Road, Pipe 310A - 1311A								7.24	713				0.00		0.00		0.00			7.24									
Drummond Future Road																													
	301A	302A	1.27				95	1.27	95	3.60	1.11		0.00		0.00		0.00	0.00	1.27	1.27	0.42	1.53	94.5	200	0.35	19.40	0.08	0.62	0.36
To Expansion Road, Pipe 302A - 1180A								1.27	95				0.00		0.00		0.00			1.27									
Drummond Future Road																													
			0.22				23	0.22	23				0.00		0.00	1.45	1.45		1.67	1.67									
	1303A	3031A	0.61				46	0.83	69	3.63	0.81		0.00		0.00		1.45	0.16	0.61	2.28	0.75	1.72	108.0	200	0.35	19.40	0.09	0.62	0.38
To Expansion Road, Pipe 3031A - 302A								0.83	69				0.00		0.00		1.45			2.28									
Expansion Road																													
			0.16				17	0.16	17				0.00		0.00		0.00		0.16	0.16									
	303A	3031A	0.19				14	0.35	31	3.68	0.37		0.00		0.00		0.00	0.00	0.19	0.35	0.12	0.49	65.0	200	0.65	26.44	0.02	0.84	0.32
Contribution From Drummond Future Road, Pipe 1303A - 3031A								0.83	69				0.00		0.00		1.45		2.28	2.63									
	3031A	302A	0.22				17	1.40	117	3.58	1.36		0.00		0.00		1.45	0.16	0.22	2.85	0.94	2.45	59.0	200	0.35	19.40	0.13	0.62	0.42
Contribution From Expansion Road, Pipe 301A - 302A								1.27	95				0.00		0.00		0.00		1.27	4.12									
	302A	1180A	0.20				15	2.87	227	3.50	2.58		0.00		0.00		1.45	0.16	0.20	4.32	1.43	4.16	49.5	200	0.35	19.40	0.21	0.62	0.49
	1180A	118A						2.87	227	3.50	2.58		0.00		0.00		1.45	0.16	0.00	4.32	1.43	4.16	11.0	200	0.35	19.40	0.21	0.62	0.49
To Haiku Street, Pipe 118A - 117A								2.87	227				0.00		0.00		1.45			4.32									

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	3.80			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

Industrial Peak Factor = as per MOE Graph
Extraneous Flow = 0.330 L/s/ha
Minimum Velocity = 0.600 m/s
Manning's n = (Conc) 0.013 (Pvc) 0.013
Townhouse coeff= 2.7
Single house coeff= 3.4

Designed: SLM
Checked: ADF
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 80-83

PROJECT: **Ciavan Communities - Brazeau Phase 1**
LOCATION: **City of Ottawa**
File Ref: 18-1030
Date: **27 Jul 2020**
Sheet No. 2 of 6

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

Ottawa

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
			0.19				20	0.19	20				0.00		0.00		0.00		0.19	0.19									
	303A	305A	0.21				16	0.40	36	3.67	0.43		0.00		0.00		0.00	0.00	0.21	0.40	0.13	0.56	69.5	200	2.45	51.34	0.01	1.63	0.52
Contribution From Drummond Future Road, Pipe 1305A - 305A								0.89	67				0.00		0.00		0.00		0.89	1.29									
			0.13				14	1.42	117				0.00		0.00		0.00		0.13	1.42									
	305A	306A	0.16				12	1.58	129	3.57	1.49		0.00		0.00		0.00	0.00	0.16	1.58	0.52	2.01	53.5	200	0.35	19.40	0.10	0.62	0.40
	306A	307A	0.13				10	1.71	139	3.56	1.60		0.00		0.00		0.00	0.00	0.13	1.71	0.56	2.17	10.5	200	0.35	19.40	0.11	0.62	0.41
	307A	308A	0.41				31	2.12	170	3.54	1.95		0.00		0.00		0.00	0.00	0.41	2.12	0.70	2.65	78.0	200	0.35	19.40	0.14	0.62	0.43
	308A	3033A	0.39				29	2.51	199	3.52	2.27		0.00		0.00		0.00	0.00	0.39	2.51	0.83	3.10	67.0	200	0.35	19.40	0.16	0.62	0.45
	3033A	310A	0.31				23	2.82	222	3.50	2.52		0.00		0.00		0.00	0.00	0.31	2.82	0.93	3.45	62.0	200	0.40	20.74	0.17	0.66	0.49
Contribution From Drummond Future Road, Pipe 309A - 310A								7.24	713.00				0.00		0.00		0.00		0.00	7.24									
			0.07				5	10.13	940				0.00		0.00		0.00		0.07	10.13									
	310A	1311A	1.22				128	11.35	1068	3.23	11.16		0.00		0.00		0.00	0.00	1.22	11.35	3.75	14.91	111.5	250	0.25	29.73	0.50	0.61	0.61
	1311A	1312A						11.35	1068	3.23	11.16		0.00		0.00		0.00	0.00	0.00	11.35	3.75	14.91	111.0	250	0.25	29.73	0.50	0.61	0.61
	1312A	1313A	4.04				424	15.39	1492	3.14	15.21		0.00		0.00		0.00	0.00	4.04	15.39	5.08	20.29	108.5	250	0.25	29.73	0.68	0.61	0.65
	1313A	405A						15.39	1492	3.14	15.21		0.00		0.00		0.00	0.00	0.00	15.39	5.08	20.29	89.0	250	0.25	29.73	0.68	0.61	0.65
To Future Greenbank Road, Pipe 405A - 406A								15.39	1492				0.00		0.00		0.00			15.39									
Drummond Commercial																													
	1321A	3211A						0.00				7.40	7.40		0.00		0.00	2.40	7.40	7.40	2.44	4.84	11.0	200	0.50	23.19	0.21	0.74	0.58
To Haiku Street, Pipe 3211A - 133A								0.00	0				7.40		0.00		0.00			7.40									
Brazeau Commercial																													
	Ctrl 1A	132A						0.00				13.83	13.83		0.00		0.00	4.48	13.83	13.83	4.56	9.05	15.5	200	0.35	19.40	0.47	0.62	0.60
To Haiku Street, Pipe 132A - 3211A								0.00	0				13.83		0.00		0.00			13.83									
Haiku Street																													
Contribution From Brazeau Commercial, Pipe 1A - 132A								0.00	0				13.83		0.00		0.00		13.83	13.83									
	132A	3211A	0.69				0	0.69	0				13.83		0.00		0.00	4.48	0.69	14.52	4.79	9.27	63.5	200	0.35	19.40	0.48	0.62	0.61
Contribution From Drummond Commercial, Pipe 1321A - 3211A								0.00	0				7.40		0.00		0.00		7.40	21.92									
	3211A	133A						0.69	0				21.23		0.00		0.00	6.88	0.00	21.92	7.23	14.11	9.5	200	0.35	19.40	0.73	0.62	0.67
	133A	134A	0.16				0	0.85	0				21.23		0.00		0.00	6.88	0.16	22.08	7.29	14.17	61.5	200	0.35	19.40	0.73	0.62	0.67
	134A	135A	0.06				0	0.91	0				21.23		0.00		0.00	6.88	0.06	22.14	7.31	14.19	39.5	200	0.35	19.40	0.73	0.62	0.67
To Haiku Street, Pipe 135A - 118A								0.91	0				21.23		0.00		0.00			22.14									
Montology Way																													
	1260A	127A	0.24	3	3		11	0.24	11	3.73	0.13		0.00		0.00		0.00	0.00	0.24	0.24	0.08	0.21	37.5	200	0.65	26.44	0.01	0.84	0.24
	127A	128A	0.13	2	2		7	0.37	18	3.71	0.22		0.00		0.00		0.00	0.00	0.13	0.37	0.12	0.34	12.5	200	0.35	19.40	0.02	0.62	0.23
	128A	129A	0.48	12	12		41	0.85	59	3.64	0.70		0.00		0.00		0.00	0.00	0.48	0.85	0.28	0.98	76.5	200	0.35	19.40	0.05	0.62	0.32
	129A	130A	0.60	17	17		58	1.45	117	3.58	1.36		0.00		0.00		0.00	0.00	0.60	1.45	0.48	1.84	102.0	200	0.35	19.40	0.09	0.62	0.39
	130A	131A						1.45	117	3.58	1.36		0.00		0.00		0.00	0.00	0.00	1.45	0.48	1.84	7.5	200	0.35	19.40	0.09	0.62	0.39
To Montology Way, Pipe 131A - 135A								1.45	117				0.00		0.00		0.00			1.45									
Rugosa Street																													
	211A	204A	0.49	12	12		41	0.49	41	3.67	0.49		0.00		0.00		0.00	0.00	0.49	0.49	0.16	0.65	89.0	200	0.80	29.34	0.02	0.93	0.37
	204A	205A	0.74	19	19		65	1.23	106	3.59	1.23		0.00		0.00		0.00	0.00	0.74	1.23	0.41	1.64	120.0	200	0.35	19.40	0.08	0.62	0.37
	205A	206A						1.23	106	3.59	1.23		0.00		0.00		0.00	0.00	0.00	1.23	0.41	1.64	13.5	200	0.35	19.40	0.08	0.62	0.37
To Appalachian Circle, Pipe 206A - 207A								1.23	106				0.00		0.00		0.00			1.23									

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha	
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow = 0.330 L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity = 0.600 m/s
Max Res. Peak Factor =	3.80				Manning's n = (Conc) 0.013 (Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff= 2.7
Institutional =	0.32	l/s/Ha			Single house coeff= 3.4

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1
Checked: ADF	LOCATION: City of Ottawa
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 80-83	File Ref: 18-1030 / Date: 27 Jul 2020 / Sheet No. 3 of 6

1030_SAN_slm.xlsx

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Appalachian Circle																													
	209A	210A	0.08	1	1		4	0.08	4	3.76	0.05		0.00		0.00		0.00	0.00	0.08	0.08	0.03	0.08	12.5	200	2.95	56.33	0.00	1.79	0.29
	210A	211A	0.20	4	4		14	0.28	18	3.71	0.22		0.00		0.00		0.00	0.00	0.20	0.28	0.09	0.31	50.5	200	3.80	63.94	0.00	2.04	0.52
	211A	212A	0.19	4	4		14	0.47	32	3.68	0.38		0.00		0.00		0.00	0.00	0.19	0.47	0.16	0.54	50.0	200	0.45	22.00	0.02	0.70	0.29
	212A	213A	0.09	1	1		4	0.56	36	3.67	0.43		0.00		0.00		0.00	0.00	0.09	0.56	0.18	0.61	12.5	200	1.55	40.83	0.02	1.30	0.47
	213A	214A	0.53	14	14		48	1.09	84	3.61	0.98		0.00		0.00		0.00	0.00	0.53	1.09	0.36	1.34	86.5	200	2.35	50.28	0.03	1.60	0.68
To Foundation Lane, Pipe 214A - 119A								1.09	84				0.00		0.00		0.00			1.09									
	209A	201A	0.58	18	18		62	0.58	62	3.64	0.73		0.00		0.00		0.00	0.00	0.58	0.58	0.19	0.92	93.5	200	0.65	26.44	0.03	0.84	0.39
	201A	202A	0.69	22	22		75	1.27	137	3.56	1.58		0.00		0.00		0.00	0.00	0.69	1.27	0.42	2.00	116.5	200	0.95	31.97	0.06	1.02	0.56
	202A	203A	0.18	3	3		11	1.45	148	3.55	1.70		0.00		0.00		0.00	0.00	0.18	1.45	0.48	2.18	13.5	200	0.80	29.34	0.07	0.93	0.54
	203A	206A	0.17	4	4		14	1.62	162	3.54	1.86		0.00		0.00		0.00	0.00	0.17	1.62	0.53	2.40	50.5	200	1.10	34.40	0.07	1.09	0.62
Contribution From Rugosa Street, Pipe 205A - 206A								1.23	106				0.00		0.00		0.00		1.23	2.85									
	206A	207A	0.20	5	5		17	3.05	285	3.47	3.21		0.00		0.00		0.00	0.00	0.20	3.05	1.01	4.21	50.5	200	0.35	19.40	0.22	0.62	0.49
	207A	208A	0.12	2	2		7	3.17	292	3.47	3.28		0.00		0.00		0.00	0.00	0.12	3.17	1.05	4.33	12.0	200	0.35	19.40	0.22	0.62	0.50
	208A	214A	0.65	18	18		62	3.82	354	3.44	3.94		0.00		0.00		0.00	0.00	0.65	3.82	1.26	5.20	112.5	200	1.90	45.21	0.12	1.44	0.95
To Unknown Road1 - 07, Pipe 214A - 119A								3.82	354				0.00		0.00		0.00			3.82									
Foundation Lane																													
Contribution From Appalachian Circle, Pipe 208A - 214A								3.82	354				0.00		0.00		0.00		3.82	3.82									
Contribution From Appalachian Circle, Pipe 213A - 214A								1.09	84				0.00		0.00		0.00		1.09	4.91									
	214A	119A	0.08				0	4.99	438	3.40	4.83		0.00		0.00		0.00	0.00	0.08	4.99	1.65	6.48	59.0	200	0.35	19.40	0.33	0.62	0.55
To Montology Way, Pipe 119A - 120A								4.99	438				0.00		0.00		0.00			4.99									
Travertine Way																													
	119A	122A	0.52	13	13		45	0.52	45	3.66	0.53		0.00		0.00		0.00	0.00	0.52	0.52	0.17	0.71	86.5	200	0.65	26.44	0.03	0.84	0.36
	122A	123A	0.09	1	1		4	0.61	49	3.65	0.58		0.00		0.00		0.00	0.00	0.09	0.61	0.20	0.78	12.5	200	1.50	40.17	0.02	1.28	0.50
	123A	126A	0.20	4	4		14	0.81	63	3.63	0.74		0.00		0.00		0.00	0.00	0.20	0.81	0.27	1.01	50.0	200	3.20	58.67	0.02	1.87	0.70
To Sturnidae Street, Pipe 126A - 106A								0.81	63				0.00		0.00		0.00			0.81									
Contribution From Foundation Lane, Pipe 214A - 119A								4.99	438				0.00		0.00		0.00		4.99	4.99									
	119A	120A	0.60	17	17		58	5.59	496	3.38	5.43		0.00		0.00		0.00	0.00	0.60	5.59	1.84	7.28	103.5	200	0.35	19.40	0.38	0.62	0.57
	120A	121A	0.14	2	2		7	5.73	503	3.38	5.51		0.00		0.00		0.00	0.00	0.14	5.73	1.89	7.40	13.5	200	0.35	19.40	0.38	0.62	0.57
	121A	131A	0.43	10	10		34	6.16	537	3.37	5.86		0.00		0.00		0.00	0.00	0.43	6.16	2.03	7.89	110.0	200	0.90	31.12	0.25	0.99	0.82
Contribution From Montology Way, Pipe 130A - 131A								1.45	117				0.00		0.00		0.00		1.45	7.61									
	131A	135A	0.19	4	4		14	7.80	668	3.32	7.20		0.00		0.00		0.00	0.00	0.19	7.80	2.57	9.77	58.5	200	0.35	19.40	0.50	0.62	0.62
To Haiku Street, Pipe 135A - 118A								7.80	668				0.00		0.00		0.00			7.80									
Haiku Street																													
Contribution From Montology Way, Pipe 131A - 135A								7.80	668				0.00		0.00		0.00		7.80	7.80									
Contribution From Haiku Street, Pipe 134A - 135A								0.91	0				21.23		0.00		0.00		22.14	29.94									
	135A	118A						8.71	668	3.32	7.20		21.23		0.00		0.00	6.88	0.00	29.94	9.88	23.96	6.5	250	0.25	29.73	0.81	0.61	0.67
Contribution From Expansion Road, Pipe 1180A - 118A								2.87	227				0.00		0.00		1.45		4.32	34.26									
	118A	117A						11.58	895	3.26	9.47		21.23		0.00		1.45	7.04	0.00	29.94	9.88	26.38	119.0	300	0.20	43.25	0.61	0.61	0.64
Contribution From Haiku Street - Local Sewer, Pipe 118A - 117A								0.70	65				0.00		0.00		0.00			0.70									
	117A	116A						12.28	960	3.25	10.11		21.23		0.00		1.45	7.04	0.00	30.64	10.11	27.26	125.5	375	0.15	67.91	0.40	0.61	0.58
Contribution From Elevation Road, Pipe 106A - 116A								9.65	817				0.00		0.00		1.72		11.37	42.01									
	116A	1160A						21.93	1777	3.10	17.85		21.23		0.00		3.17	7.22	0.00	42.01	13.86	38.94	17.0	375	0.15	67.91	0.57	0.61	0.63
To Haiku Street, Pipe 1160A - 1150A								21.93	1777				21.23		0.00		3.17			42.01									

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	3.80			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

Industrial Peak Factor = as per MOE Graph

Extraneous Flow = 0.330 L/s/ha

Minimum Velocity = 0.600 m/s

Manning's n = (Conc) 0.013 (Pvc) 0.013

Townhouse coeff= 2.7

Single house coeff= 3.4

Designed: SLM

Checked: ADF

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 80-83

PROJECT: **Ciavan Communities - Brazeau Phase 1**

LOCATION: **City of Ottawa**

File Ref: 18-1030

Date: **27 Jul 2020**

Sheet No. 4 of 6

1030_SAN_slm.xlsx

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Haiku Street - Local Sewer																													
	109A	1100A	0.20	6		6	17	0.20	17	3.71	0.20		0.00		0.00		0.00	0.00	0.20	0.20	0.07	0.27	55.5	200	1.00	32.80	0.01	1.04	0.30
To Haiku Street, Pipe 1100A - 109A								0.20	17				0.00		0.00		0.00			0.20									
	1150A	1160A	0.24	6		6	17	0.24	17	3.71	0.20		0.00		0.00		0.00	0.00	0.24	0.24	0.08	0.28	41.5	200	0.65	26.44	0.01	0.84	0.27
To Haiku Street, Pipe 1160A - 115A								0.24	17				0.00		0.00		0.00			0.24									
	110A	111A	0.41	16		16	44	0.41	44	3.66	0.52		0.00		0.00		0.00	0.00	0.41	0.41	0.14	0.66	74.5	200	0.65	26.44	0.02	0.84	0.35
To Haiku Street, Pipe 111A - 110A								0.41	44				0.00		0.00		0.00			0.41									
	111A	115A	0.49	19		19	52	0.49	52	3.65	0.61		0.00		0.00		0.00	0.00	0.49	0.49	0.16	0.78	87.5	200	0.65	26.44	0.03	0.84	0.37
To Haiku Street, Pipe 115A - 111A								0.49	52				0.00		0.00		0.00			0.49									
	118A	117A	0.70	19	19		65	0.70	65	3.63	0.77		0.00		0.00		0.00	0.00	0.70	0.70	0.23	1.00	119.0	200	0.65	26.44	0.04	0.84	0.40
To Haiku Street, Pipe 117A - 116A								0.70	65				0.00		0.00		0.00			0.70									
	117A	116A	0.67	15	15		51	0.67	51	3.65	0.60		0.00		0.00		0.00	0.00	0.67	0.67	0.22	0.82	125.5	200	0.65	26.44	0.03	0.84	0.38
To Haiku Street, Pipe 116A - 1160A								0.67	51				0.00		0.00		0.00			0.67									
Haiku Street																													
Contribution From Haiku Street, Pipe 116A - 1160A								22.60	1828				21.23		0.00		3.17		42.68	42.68									
Contribution From Haiku Street - Local Sewer, Pipe 1150A - 1160A								0.24	17.00				0.00		0.00		0.00		0.00	0.24									
	1160A	1150A						22.84	1845	3.09	18.48		21.23		0.00		3.17	7.22	0.00	42.92	14.16	39.86	41.5	375	0.15	67.91	0.59	0.61	0.64
	1150A	115A						22.84	1845	3.09	18.48		21.23		0.00		3.17	7.22	0.00	42.92	14.16	39.86	4.5	375	0.15	67.91	0.59	0.61	0.64
Contribution From Focality Crescent, Pipe 114A - 115A								1.18	116				0.00		0.00		0.00		1.18	44.10									
Contribution From Haiku Street - Local Sewer, Pipe 111A - 115A								0.67	51.00				0.00		0.00		0.00		0.00	0.67									
	115A	111A						24.69	2012	3.07	20.00		21.23		0.00		3.17	7.22	0.00	44.77	14.77	41.99	87.5	375	0.15	67.91	0.62	0.61	0.65
Contribution From Haiku Street - Local Sewer, Pipe 110A - 111A								0.70	65.00				0.00		0.00		0.00		0.00	0.70									
	111A	110A						25.39	2077	3.06	20.59		21.23		0.00		3.17	7.22	0.00	45.47	15.01	42.81	74.5	375	0.15	67.91	0.63	0.61	0.65
Contribution From Focality Crescent, Pipe 108A - 110A								0.31	23				0.00		0.00		0.00		0.31	45.78									
	110A	1100A						25.70	2100	3.06	20.79		21.23		0.00		3.17	7.22	0.00	45.78	15.11	43.12	4.0	375	0.15	67.91	0.64	0.61	0.65
Contribution From Haiku Street - Local Sewer, Pipe 109A - 1100A								0.20	17.00				0.00		0.00		0.00		0.00	0.20									
	1100A	109A						25.90	2117	3.05	20.95		21.23		0.00		3.17	7.22	0.00	45.98	15.17	43.34	55.5	375	0.15	67.91	0.64	0.61	0.65
To Obsidian Street, Pipe 109A - 400A								25.90	2117				21.23		0.00		3.17			45.98									
Future Commercial																													
	2A	2250A						0.00				2.99	2.99		0.00		0.00	0.97	2.99	2.99	0.99	1.96	11.0	200	0.35	19.40	0.10	0.62	0.39
To Obsidian Street, Pipe 2250A - 226A								0.00	0				2.99		0.00		0.00			2.99									
Obsidian Street																													
	224A	225A	0.33	9		9	25	0.33	25	3.69	0.30		0.00		0.00		0.00	0.00	0.33	0.33	0.11	0.41	75.0	200	0.65	26.44	0.02	0.84	0.30
	225A	2250A	0.27	8		8	22	0.60	47	3.66	0.56		0.00		0.00		0.00	0.00	0.27	0.60	0.20	0.75	67.5	200	0.90	31.12	0.02	0.99	0.41
Contribution From Future Commercial, Pipe 2A - 2250A								0.00	0				2.99		0.00		0.00		2.99	3.59									
	2250A	226A	0.15	3		3	9	0.75	56	3.64	0.66		2.99		0.00		0.00	0.97	0.15	3.74	1.23	2.86	46.0	200	1.40	38.81	0.07	1.24	0.71
	226A	109A	0.34	9		9	25	1.09	81	3.61	0.95		2.99		0.00		0.00	0.97	0.34	4.08	1.35	3.26	92.0	200	1.60	41.49	0.08	1.32	0.78
Contribution From Haiku Street, Pipe 1100A - 109A								25.90	2117				21.23		0.00		3.17		45.98	50.06									
Contribution From Future Residential, Pipe 3A - 109A								1.90	162				0.00		0.00		0.00		1.90	51.96									
	109A	400A	0.09				0	28.98	2360	3.02	23.12		24.22		0.00		3.17	8.19	0.09	52.05	17.18	48.49	63.0	375	0.15	67.91	0.71	0.61	0.67
To Drummond Future Road , Pipe 400A - 401A								28.98	2360				24.22		0.00		3.17			52.05									

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	3.80			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

Industrial Peak Factor = as per MOE Graph
Extraneous Flow = 0.330 L/s/ha
Minimum Velocity = 0.600 m/s
Manning's n = (Conc) 0.013 (Pvc) 0.013
Townhouse coeff= 2.7
Single house coeff= 3.4

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1	
Checked: ADF	LOCATION: City of Ottawa	
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 80-83	File Ref: 18-1030	Date: 27 Jul 2020
	Sheet No. 5 of 6	

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Drummond Future Road																													
Contribution From Obsidian Street, Pipe 109A - 400A								28.98	2360				24.22		0.00		3.17		52.05	52.05									
	400A	401A	0.24				25	29.22	2385	3.02	23.34		24.22		0.00		3.17	8.19	0.24	52.29	17.26	48.79	72.5	375	0.15	67.91	0.72	0.61	0.67
	401A	402A	0.14				15	29.36	2400	3.02	23.48		24.22		0.00		3.17	8.19	0.14	52.43	17.30	48.97	62.0	375	0.15	67.91	0.72	0.61	0.67
To future Greenbank Road, Pipe 402A - 403A								29.36	2400				24.22		0.00		3.17			52.43									
Future Greenbank Road																													
Contribution From Drummond Future Road, Pipe 401A - 402A								29.36	2400				24.22		0.00		3.17		52.43	52.43									
	402A	403A	0.38				0	29.74	2400	3.02	23.48		24.22		0.00		3.17	8.19	0.38	52.81	17.43	49.09	80.0	375	0.15	67.91	0.72	0.61	0.67
	403A	404A	0.33				0	30.07	2400	3.02	23.48		24.22		0.00		3.17	8.19	0.33	53.14	17.54	49.20	80.0	375	0.15	67.91	0.72	0.61	0.67
	404A	405A	0.33				0	30.40	2400	3.02	23.48		24.22		0.00		3.17	8.19	0.33	53.47	17.65	49.31	81.0	375	0.15	67.91	0.73	0.61	0.67
Contribution From Expansion Road, Pipe 1313A - 405A							0	15.39	1492				0.00		0.00		0.00		0.00	15.39									
	405A	406A	0.25				0	46.04	3892	2.88	36.26		24.22		0.00		3.17	8.19	0.25	69.11	22.81	67.26	59.5	375	0.25	87.67	0.77	0.79	0.87
	406A	407A	0.35				0	46.39	3892	2.88	36.26		24.22	6.06	6.06		3.17	10.15	6.41	75.52	24.92	71.34	83.5	375	0.30	96.03	0.74	0.87	0.95
	407A	408A	0.46				0	46.85	3892	2.88	36.26		24.22		6.06		3.17	10.15	0.46	75.98	25.07	71.49	110.0	375	0.30	96.03	0.74	0.87	0.95
	408A	409A	0.40				0	47.25	3892	2.88	36.26		24.22		6.06		3.17	10.15	0.40	76.38	25.21	71.62	96.5	375	0.30	96.03	0.75	0.87	0.95
	409A	410A	0.51				0	47.76	3892	2.88	36.26		24.22		6.06		3.17	10.15	0.51	76.89	25.37	71.79	120.0	375	0.30	96.03	0.75	0.87	0.95
	410A	570A	0.30				0	48.06	3892	2.88	36.26		24.22		6.06		3.17	10.15	0.30	77.19	25.47	71.89	63.0	375	0.30	96.03	0.75	0.87	0.95
	570A	57A						48.06	3892	2.88	36.26		24.22		6.06		3.17	10.15	0.00	77.19	25.47	71.89	15.0	375	0.50	123.98	0.58	1.12	1.16

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	3.80			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

Industrial Peak Factor = as per MOE Graph

Extraneous Flow = 0.330 L/s/ha

Minimum Velocity = 0.600 m/s

Manning's n = (Conc) 0.013 (Pvc) 0.013

Townhouse coeff= 2.7

Single house coeff= 3.4

Designed: SLM

Checked: ADF

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 80-83

PROJECT: **Ciavan Communities - Brazeau Phase 1**

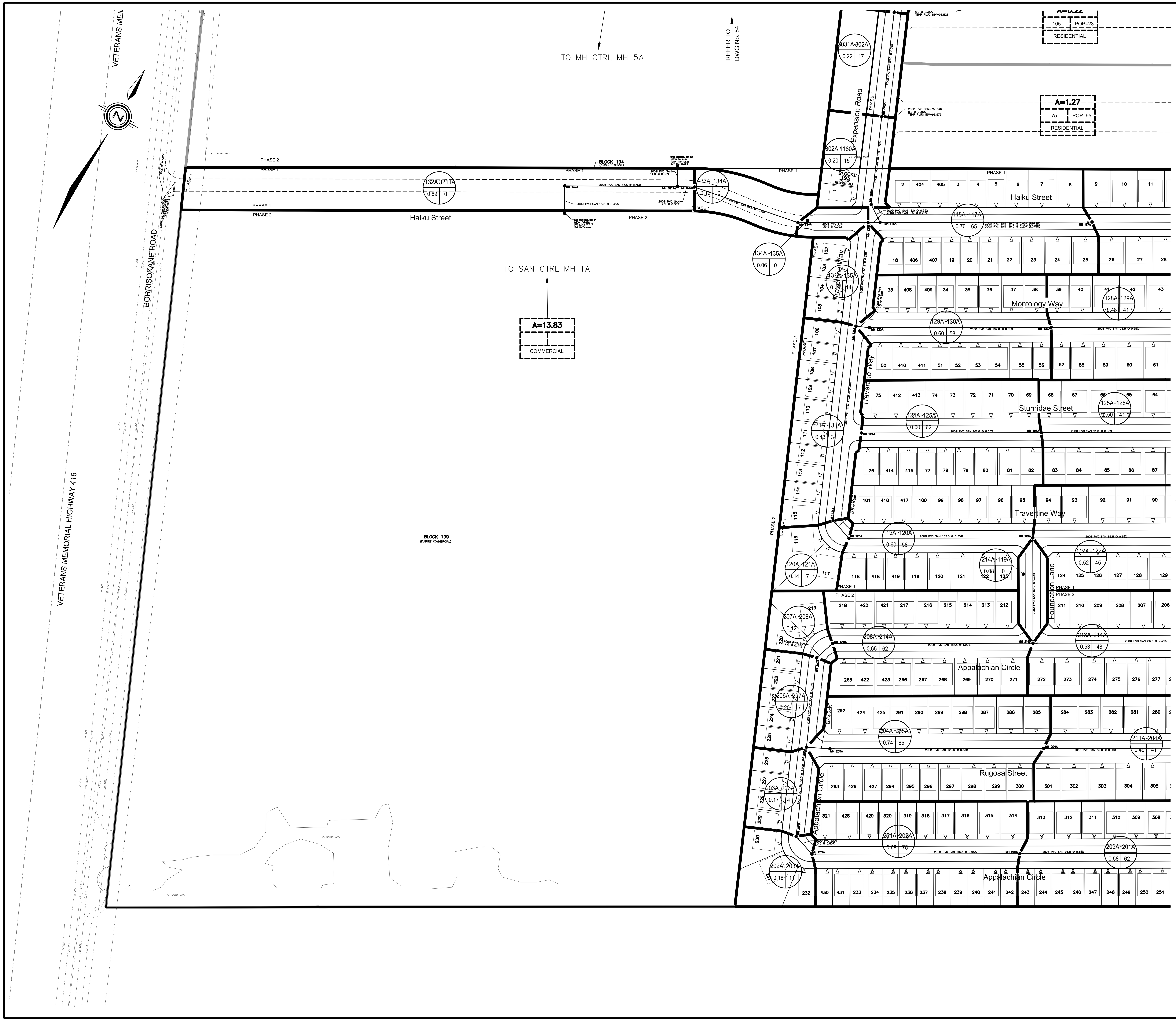
LOCATION: **City of Ottawa**

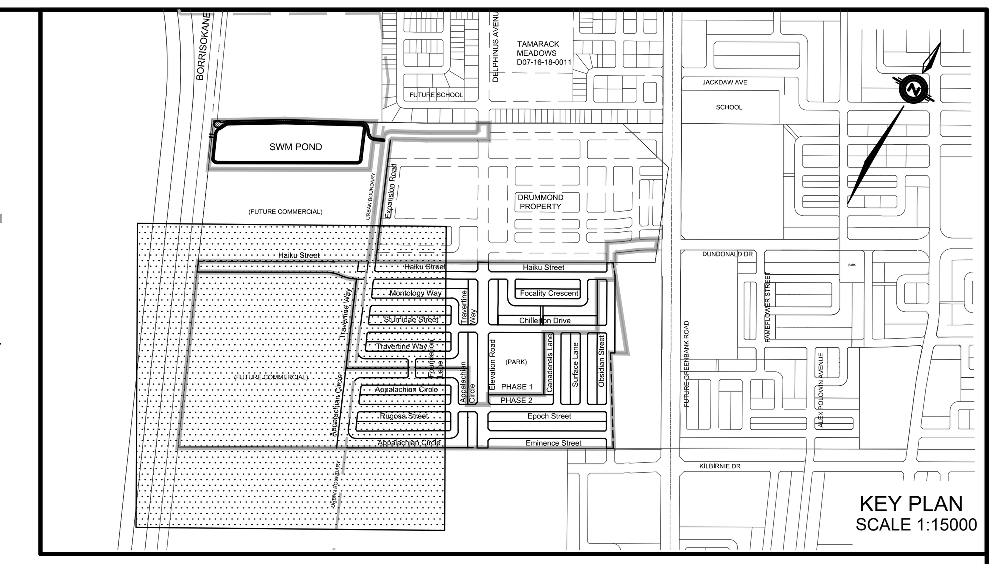
File Ref: 18-1030

Date: **27 Jul 2020**

Sheet No. 6 of 6

1030_SAN_slm.xlsx





LEGEND

SANITARY DRAINAGE BOUNDARY

SANITARY SUB-DRAINAGE BOUNDARY

SANITARY DRAINAGE BOUNDARY (OTHER PHASES)

UPSTREAM MH TO DOWNSTREAM MH — 43A - 44A

AREA IN HECTARES — 0.78

DENOTES PARK

POPULATION — 61

UPSTREAM MH TO DOWNSTREAM MH (OTHER PHASES) — 309A-310A

AREA IN HECTARES (OTHER PHASES) — 12.96

POPULATION (OTHER PHASES) — 1102

EXTERNAL AREA IN HECTARES — A=53.63

EXTERNAL POPULATION — POP=5730

DENSITY (PERSONS/HECTARE) — 107

EXTERNAL LAND USE — RESIDENTIAL

MAINTENANCE HOLE — MH202A

CAP

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20-07-27	5TH SUBMISSION
5	A.D.F.	20-06-15	4TH SUBMISSION
4	A.D.F.	20-04-24	3RD SUBMISSION
3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION

JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION

CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710

ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

DSEL
david schaeffer engineering ltd
120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 2020-07-27 PROVINCE OF ONTARIO

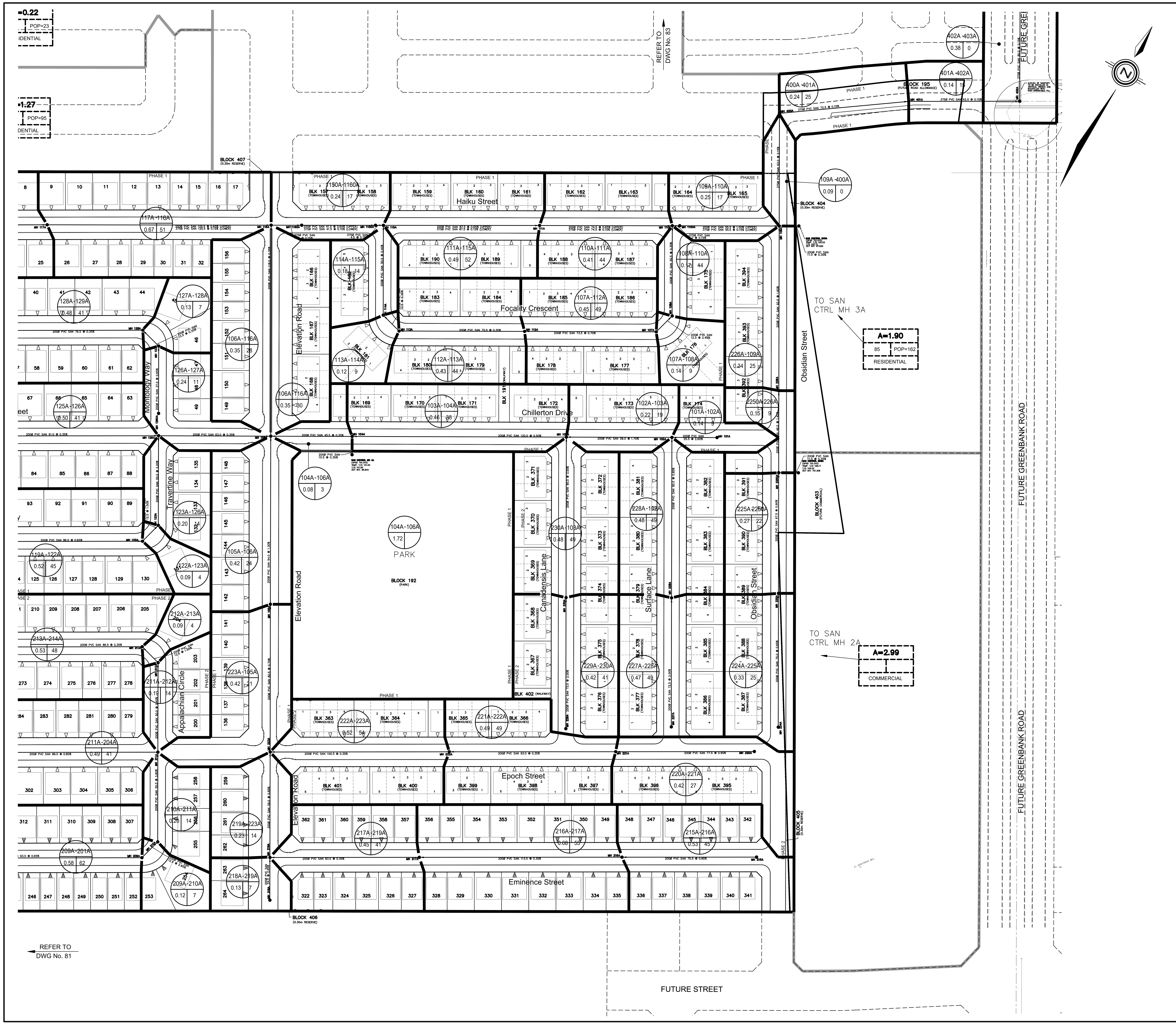
Ottawa CITY OF OTTAWA

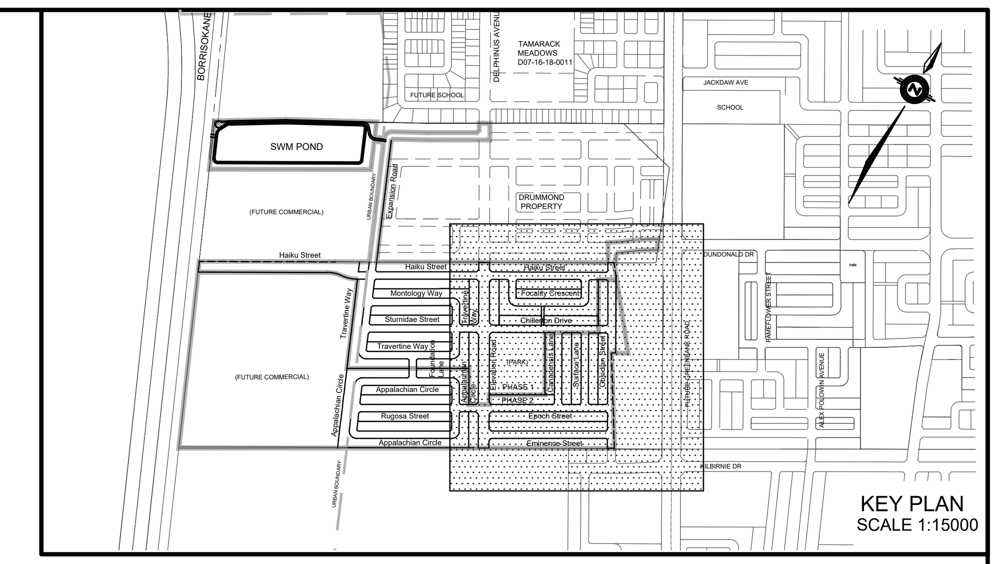
SANITARY DRAINAGE PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.	
SCALE: HORIZ. 1:1000 (0 10 20 30 40)		SHEET No. 81

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005





LEGEND

SANITARY DRAINAGE BOUNDARY	
SANITARY SUB-DRAINAGE BOUNDARY	
SANITARY DRAINAGE BOUNDARY (OTHER PHASES)	
UPSTREAM MH TO DOWNSTREAM MH	43A - 44A
AREA IN HECTARES	0.78
DENOTES PARK	
POPULATION	61
UPSTREAM MH TO DOWNSTREAM MH (OTHER PHASES)	309A-310A
AREA IN HECTARES (OTHER PHASES)	12.96
POPULATION (OTHER PHASES)	1102
EXTERNAL AREA IN HECTARES	A=53.63
EXTERNAL POPULATION	107 POP=5739
DENSITY (PERSONS/HECTARE)	
EXTERNAL LAND USE	RESIDENTIAL
MAINTENANCE HOLE	MH202A
CAP	

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20-07-27	5TH SUBMISSION
5	A.D.F.	20-06-15	4TH SUBMISSION
4	A.D.F.	20-04-24	3RD SUBMISSION
3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

DSEL
david schaeffer engineering ltd
120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 2020-07-27 PROVINCE OF ONTARIO

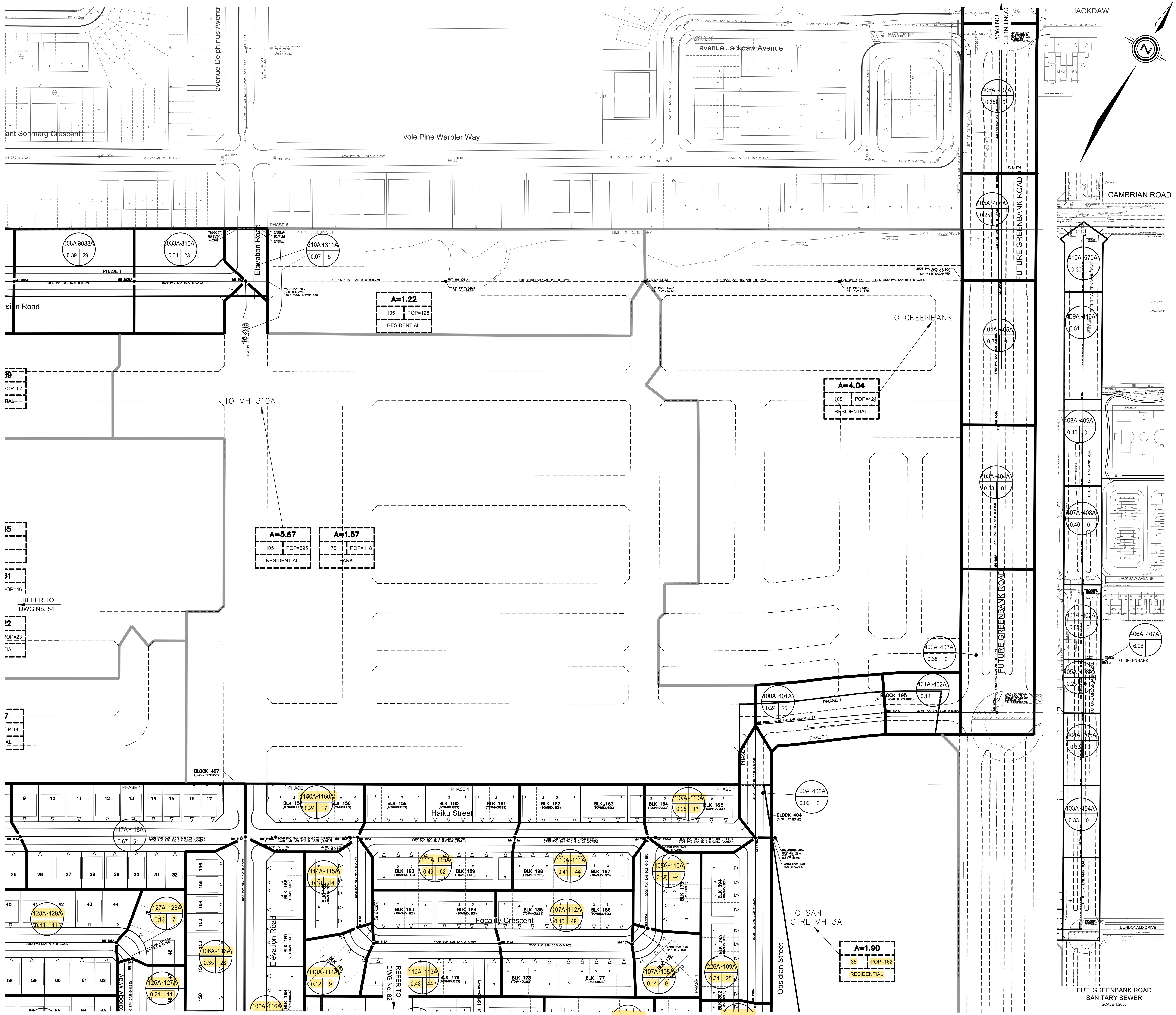
CITY OF OTTAWA

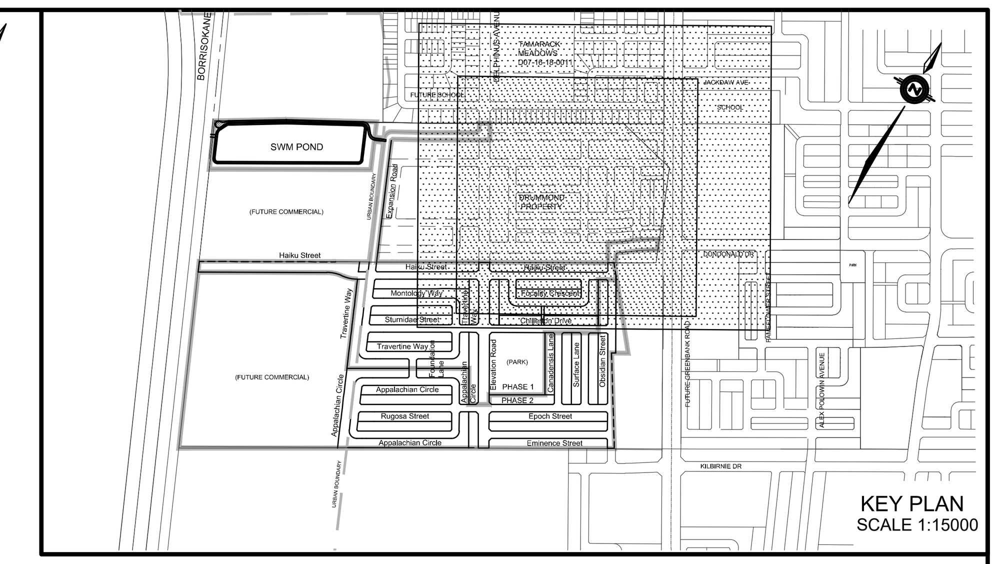
SANITARY DRAINAGE PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No.	18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: HORIZ. 1:1000 (0 10 20 30 40)		SHEET No.	82

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005





LEGEND

SANITARY DRAINAGE BOUNDARY

SANITARY SUB-DRAINAGE BOUNDARY

SANITARY DRAINAGE BOUNDARY (OTHER PHASES)

UPSTREAM MH TO DOWNSTREAM MH — 43A - 44A

AREA IN HECTARES — 0.78

DENOTES PARK

POPULATION — 61

UPSTREAM MH TO DOWNSTREAM MH (OTHER PHASES) — 309A-310A

AREA IN HECTARES (OTHER PHASES) — 12.96

POPULATION (OTHER PHASES) — 1102

EXTERNAL AREA IN HECTARES — A=53.63

EXTERNAL POPULATION — POP=5739

DENSITY (PERSONS/HECTARE) — 107

EXTERNAL LAND USE — RESIDENTIAL

MAINTENANCE HOLE — MH202A

CAP

NOT FOR CONSTRUCTION

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TOPOGRAPHIC INFORMATION
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LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

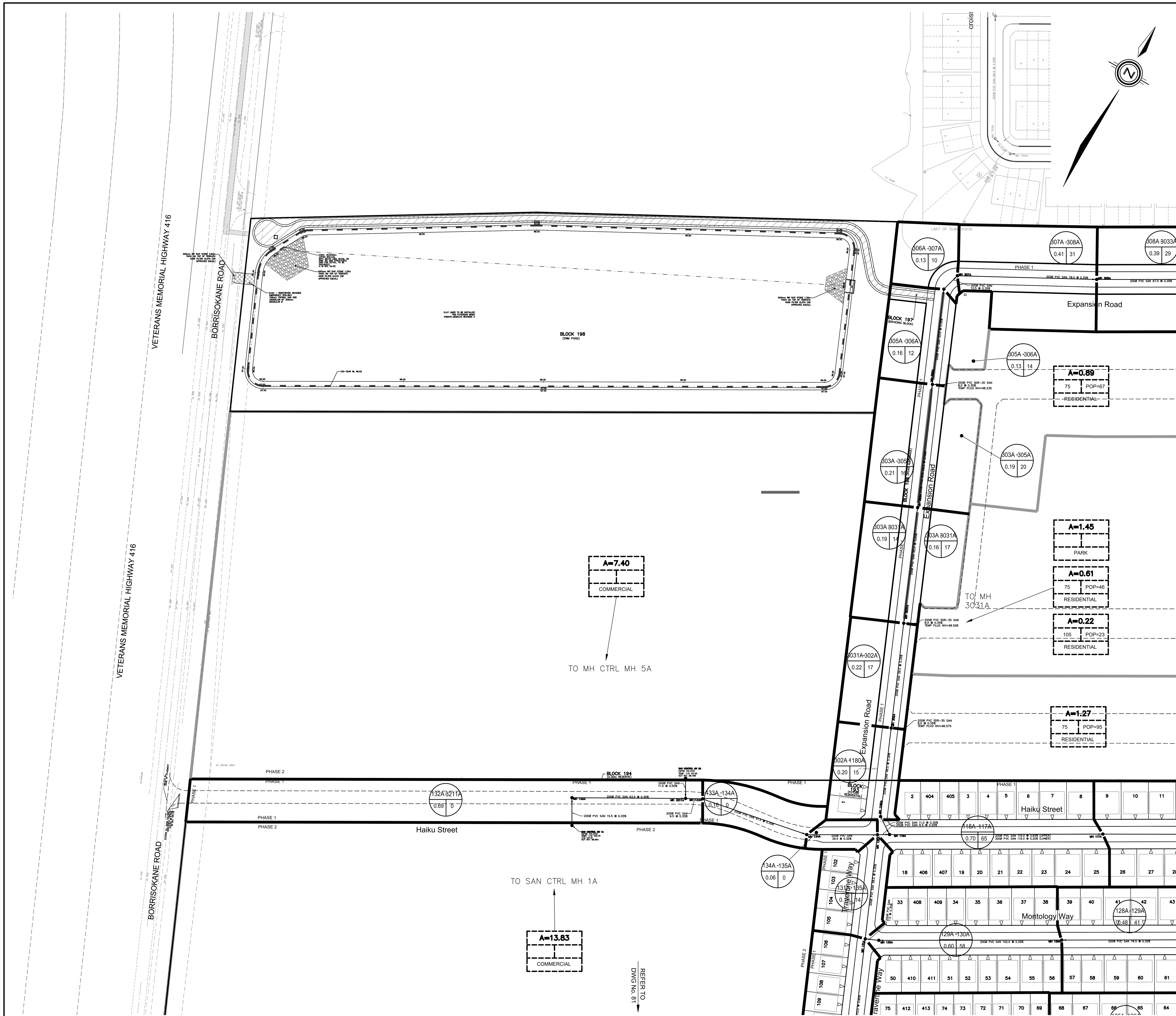
Ottawa CITY OF OTTAWA

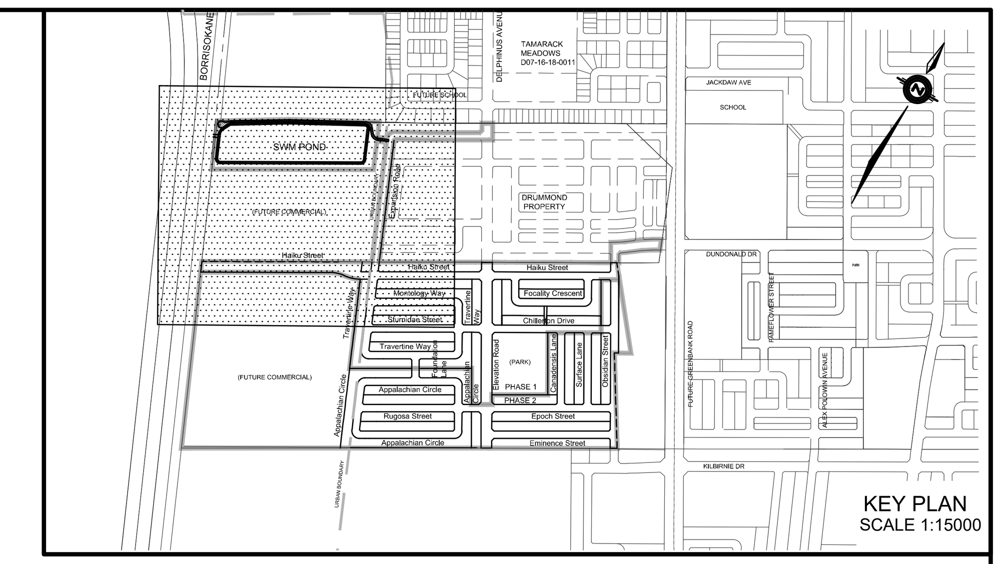
SANITARY DRAINAGE PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.	
SCALE: HORIZ. 1:1000		SHEET No. 83

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005





LEGEND

SANITARY DRAINAGE BOUNDARY
SANITARY SUB-DRAINAGE BOUNDARY
SANITARY DRAINAGE BOUNDARY (OTHER PHASES)
UPSTREAM MH TO DOWNSTREAM MH — 43A - 44A
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EXTERNAL AREA IN HECTARES — A=53.63
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EXTERNAL LAND USE — RESIDENTIAL
MAINTENANCE HOLE — MH202A
CAP

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TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

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LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
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2020-07-27
PROVINCE OF ONTARIO

Ottawa CITY OF OTTAWA

SANITARY DRAINAGE PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.	
SCALE: HORIZ. 1:1000		SHEET No. 84

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005

6.3.1.1 Future Collector Road (west of new Greenbank Road) Outlet

The Drummond Aggregate Extraction Area will be serviced by a connection (at MA11) to the planned trunk sanitary sewer on the Future Collector Road. This planned trunk sanitary sewer will outlet to the planned Cambrian Road trunk sanitary sewer, located west of New Greenbank Road, as identified in the 2014 BSMSSA. The proposed BSUEA sanitary sewer system within the Drummond property was conceptually sized to be 200 mm in diameter with a slope of 0.35% assuming that the development of the Aggregate Extraction Area would generally consists of a residential land usage. Although a demonstration plan is not currently available for this area, a high level trunk sanitary sewer layout was developed for the property.

Per the Draft 2014 BSMSSA, the specified obvert elevation of 95.00 m at maintenance hole MA11, which is located at the northern limit of the BSUEA, is proposed to be respected. Based on this outlet obvert elevation and based on a high level sewer layout concept, which would cross above the future storm sewer system, an upstream obvert elevation of 99.20 m would result at MH 593 within the southeastern corner of the Drummond Aggregate Extraction Area. As discussed in Section 5.7.5, the existing Drummond Aggregate Extraction Area must be reinstated to a minimum elevation of 104.0 m. Allowing for a 3.0m cover over the sanitary sewer system, would require a reinstated elevation of approximately 102.2m, which would still be within the minimum required reinstatement elevation of 104.0 m.

6.3.1.2 New Greenbank Road Outlet

The Brazeau Aggregate Extraction Area will be serviced by a connection (at MA14) to the planned trunk sanitary sewer on the New Greenbank Road. This planned trunk sanitary sewer will outlet to the existing Cambrian Road trunk sanitary sewer, located east of New Greenbank Road, as identified in the 2014 BSMSSA.

The proposed BSUEA sanitary sewer system within the Brazeau property was conceptually sized to be 250 mm in diameter with a slope of 0.24% assuming that the development of the Aggregate Extraction Area would generally consists of a residential land usage. Although a demonstration plan is not currently available for this area, a high level sanitary sewer layout was developed for the property.

Per the Draft 2014 BSMSSA, the specified obvert elevation of 96.10 m at maintenance hole MA14, which is located at the northern limit of the BSUEA, is proposed to be respected. Based on this outlet obvert elevation and based on the high level sewer layout developed for the site, an upstream sanitary sewer obvert elevation of 98.55 m would result at MH 585 within the southwest corner of the Brazeau Aggregate Extraction Area.

As discussed in Section 5.7.5, the existing Brazeau Aggregate Extraction Area must be reinstated to a minimum elevation of 97.0 m. However, when accounting for a 3.0 m cover over the sanitary sewers in the westerly half of the property, a minimum reinstated elevation of approximately 101.55 m would be required. Similarly, when accounting for a 3.0 m cover over the storm sewer system (as described in Section 5.7.5) in the easterly half of the site, a minimum reinstated elevation of approximately 102.5 m would be required. Per the available existing topography of the Brazeau lands, the lowest topography appears to be approximately 98.0 m. Consequently, to service the Brazeau Aggregate Extraction Area with gravity sewers, with an allowable 3.0 m cover, it is anticipated that some areas may require as much as 4.5 m of fill.

Wastewater generated by Mattamy Lands West, will outlet to the planned 250 mm diameter sanitary sewer on New Greenbank Road at MA14. The planned New Greenbank Road sanitary sewer will discharge to the Cambrian Road trunk sanitary sewer as per the Draft 2014 BSMSSA.

A southerly extension of the 250 mm diameter New Greenbank Road trunk sanitary sewer will be required to service the proposed BSUEA tributary area. A new trunk sanitary sewer segment is proposed from MH 900 to MA14, as shown on the Key Servicing Plan. This proposed sewer segment is much shallower than the planned portion of the trunk downstream of MA 14 where cover depth is in the range of 6.9 m. The proposed sewer segment will have a proposed cover depth of 7.43 m.

6.3.1.3 Flameflower Street Outlet

The 2 ha commercial block located west of New Greenbank Road as well as a 2 ha portion of Mattamy Lands East will be serviced by a connection to the existing 200 mm diameter sanitary sewer located on Fameflower Street at MH EX 217. The existing Fameflower street sewer conveys wastewater to the Dundonald Drive sanitary sewer which ultimately outlets to the existing River Mist Road trunk sanitary sewer.

A 200 mm diameter local sanitary sewer is proposed to service the residential and commercial development. A drop maintenance hole is expected at MH 920 due to the relatively high elevation of the commercial block and New Greenbank Road compared to the residential development, as shown on the Master Grading Plan, Drawing MG1.

6.3.1.4 Alex Polowin Avenue Outlet

Wastewater generated by 5 ha of Mattamy Lands East will be conveyed to the existing 200 mm diameter sanitary sewer on Alex Polowin via two (2) connection points: MH EX153 and MH EX158. The existing Alex Polowin sewer will convey wastewater northerly to the Des Soldats Reindeau Street sanitary sewer which ultimately outlets to the River Mist Road trunk sanitary sewer.

Two (2) parallel local 200 mm diameter sanitary sewers are proposed to convey wastewater generated in the BSUEA tributary area to the proposed outlet locations.

6.3.1.5 Kilbirnie Drive Outlet

Residential development and the school fronting the Kilbirnie Drive extension as well as the northern portions of Alex Polowin (south of Kilbirnie) and Street 1, in the Minto Lands, will be serviced by a connection at MH 10 to the existing 200 mm

ANY DISTURBED AREA DURING CONSTRUCTION TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE AUTHORITIES HAVING JURISDICTION

CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION

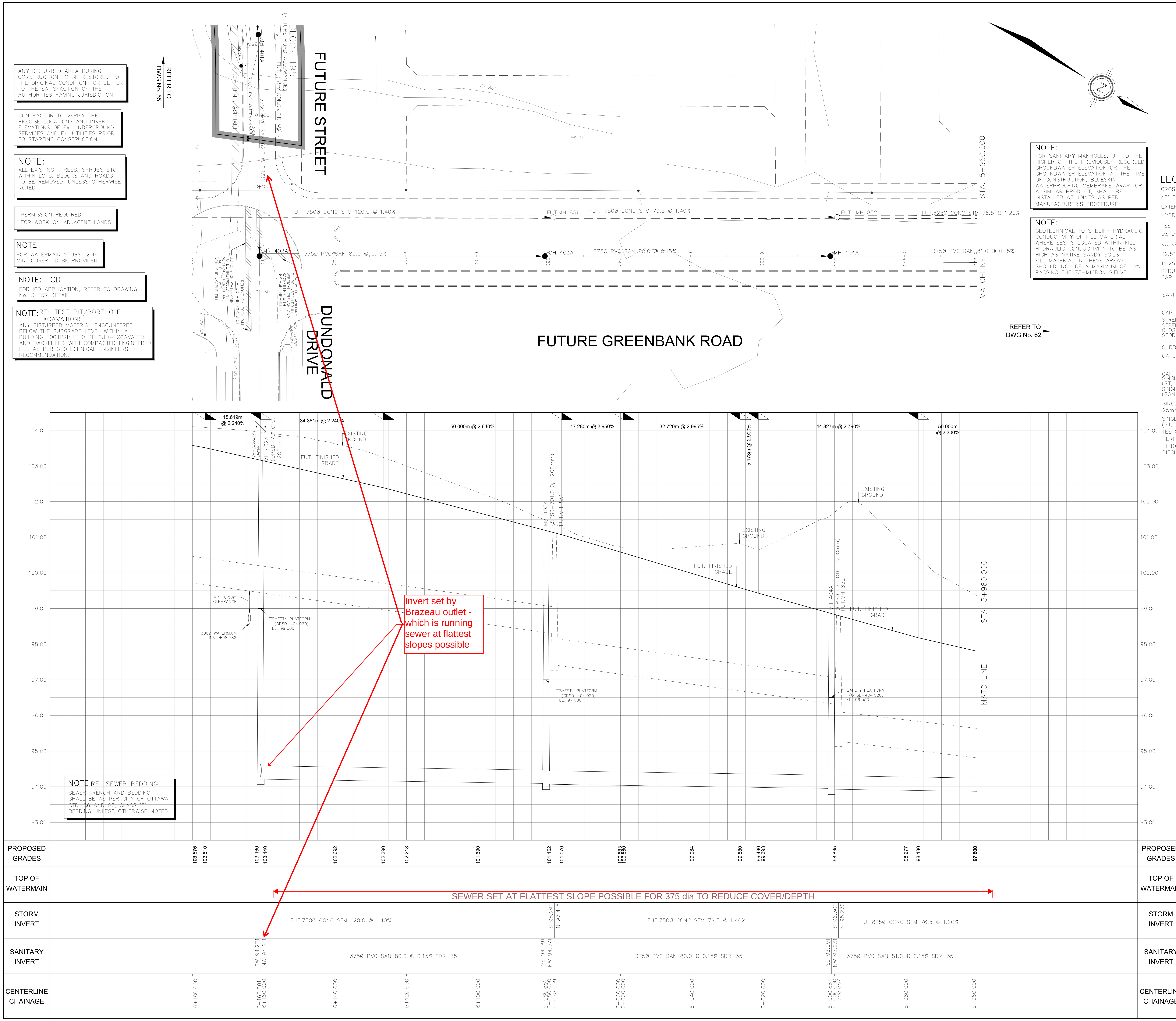
NOTE:
ALL EXISTING TREES, SHRUBS ETC. WITHIN LOTS, BLOCKS AND ROADS TO BE REMOVED, UNLESS OTHERWISE NOTED

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE
FOR WATERMAIN STUBS, 2.4m MIN. COVER TO BE PROVIDED

NOTE: ICD
FOR ICD APPLICATION, REFER TO DRAWING No. 3 FOR DETAIL

NOTE: RE: TEST PIT/BOREHOLE EXCAVATIONS
ANY DISTURBED MATERIAL ENCOUNTERED BELOW THE SUBGRADE LEVEL WITHIN A BUILDING FOOTPRINT TO BE SUB-EXCAVATED AND BACKFILLED WITH COMPACTED ENGINEERED FILL AS PER GEOTECHNICAL ENGINEERS RECOMMENDATION.



NOTE:
FOR SANITARY MANHOLES, UP TO THE HIGHER OF THE PREVIOUSLY RECORDED GROUNDWATER ELEVATION OR THE GROUNDWATER ELEVATION AT THE TIME OF CONSTRUCTION, BLUESKIN WATERPROOFING MEMBRANE WRAP, OR A SIMILAR PRODUCT, SHALL BE INSTALLED AT JOINTS AS PER MANUFACTURER'S PROCEDURE

NOTE:
GEOTECHNICAL TO SPECIFY HYDRAULIC CONDUCTIVITY OF FILL MATERIAL WHERE EES IS LOCATED WITHIN FILL. HYDRAULIC CONDUCTIVITY TO BE AS HIGH AS NATIVE SANDY SOILS. FILL MATERIAL IN THESE AREAS SHOULD INCLUDE A MAXIMUM OF 10% PASSING THE 75-MICRON SIEVE

KEY PLAN
SCALE 1:15000

LEGEND

CROSS; 45° BEND; LATERAL; HYDRANT, VALVE & VB; TEE; VALVE & VC; VALVE & VB; 22.5° BEND; 11.25° BEND; REDUCER; CAP; SANITARY MAINTENANCE HOLE; CAP; STREET CATCHBASIN & LEAD; STREET CATCHBASIN WITH CLOSED LID & LEAD; STORM MAINTENANCE HOLE; CURB INLET CATCHBASIN & LEAD; CATCHBASIN/ MAINTENANCE HOLE; INTERCONNECTED CATCH BASIN & LEADS; CAP; SINGLE SERVICE LOCATION (ST, SAN & WM); SINGLE SERVICE LOCATION (SAN & WM); SINGLE SERVICE LOCATION (ST, SAN & 25mmØ PEX TUBING AWWA C-904 WM); SINGLE SERVICE LOCATION (ST, SAN & WM); TEE CATCHBASIN; PERFORATED PIPE; ELBOW CATCHBASIN; DITCH AND CULVERT

HYDRO TRANSFORMER; STREET LIGHT STANDARD; CONCRETE SIDEWALK; CURB & DEPRESSED CURB; ASPHALT SIDEWALK; CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED); NOISE BARRIER (2.5m UNLESS OTHERWISE NOTED); DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL); CONSTRUCTION FENCE; POST AND RAIL FENCE; PHASING LIMITS; PROPERTY BOUNDARY; BOREHOLE (BH); TEST PIT (TP); AUGER HOLE (AH); MONITORING WELL LOCATION; CONCEPTUAL WELL LOCATION (AS PER GEOTECHNICAL REPORT); TOP OF FOUNDATION ELEVATION; FINISHED FLOOR ELEVATION; UNDERSIDE OF FOOTING ELEVATION; NUMBER OF RISERS; UNITS REQUIRING PRESSURE REDUCING VALVES; WALKOUT UNITS; SLAB ON GRADE; OVERLAND FLOW DIRECTION; EXTERNAL OVERLAND FLOW DIRECTION; EMERGENCY OVERLAND FLOW DIRECTION; TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6, SC7, SC7.1, SC7.2, SC7.3); PREVIOUS PHASES; CLAY SEAL (REFER TO GENERAL NOTES. No. 18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS); MIN. USF AS PER GEOTECHNICAL CONSULTANT'S RECOMMENDATION

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
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2	A.D.F.	19-10-04	1ST SUBMISSION
1	A.D.F.	19-09-19	ISSUED FOR CLIENT REVIEW

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

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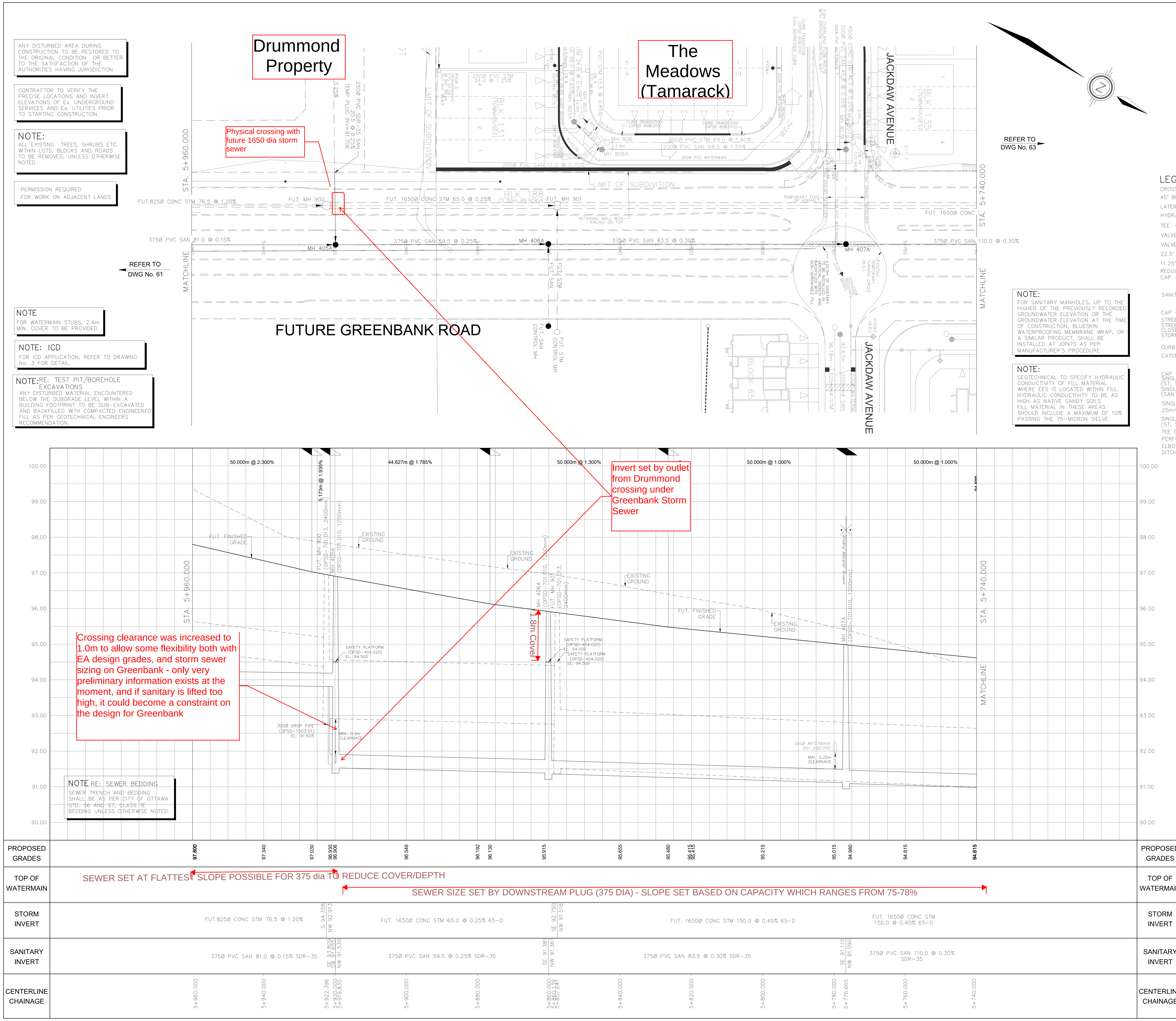
LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 PROVINCE OF ONTARIO

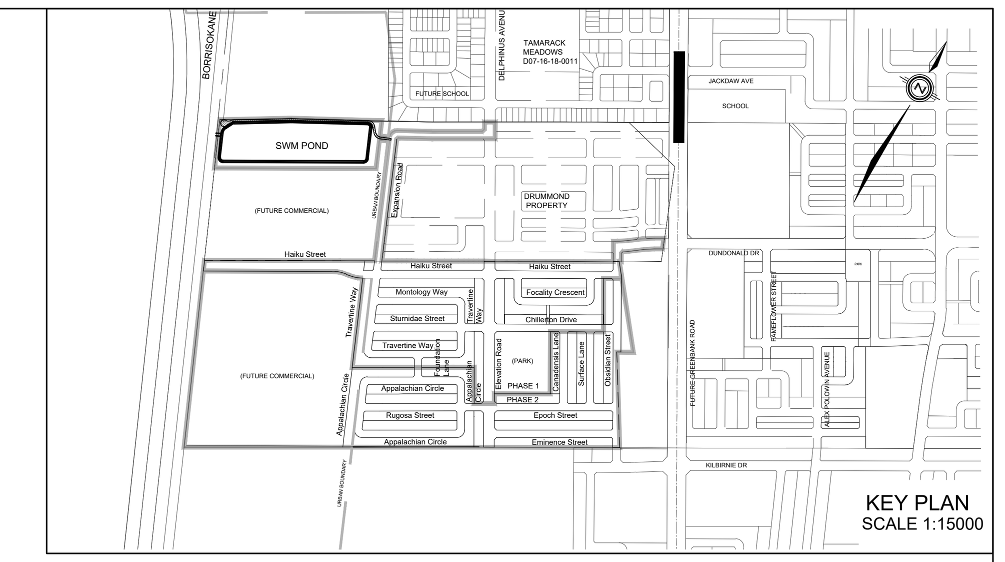
CITY OF OTTAWA

PLAN AND PROFILE OF
Greenbank Road
(STA. 6+180.000 TO STA. 5+960.000)

DRAWN BY: G.G.G. CHECKED BY: A.D.F.
DESIGNED BY: C.M.K. CHECKED BY: A.D.F.
SCALE: VERT. 1:50 HORZ. 1:500
PROJECT No. 18-1030
SHEET No. 61

CITY PLAN No. 17803
CITY FILE No. D07-16-19-0005





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LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 PROVINCE OF ONTARIO

CITY OF OTTAWA

PLAN AND PROFILE OF
Greenbank Road
(STA. 5+960.000 TO STA. 5+740.000)

DRAWN BY: G.G.G. CHECKED BY: A.D.F.
DESIGNED BY: C.M.K. CHECKED BY: A.D.F.
SCALE: VERT. 1:50 HORZ. 1:500
PROJECT No. 18-1030
SHEET No. 62

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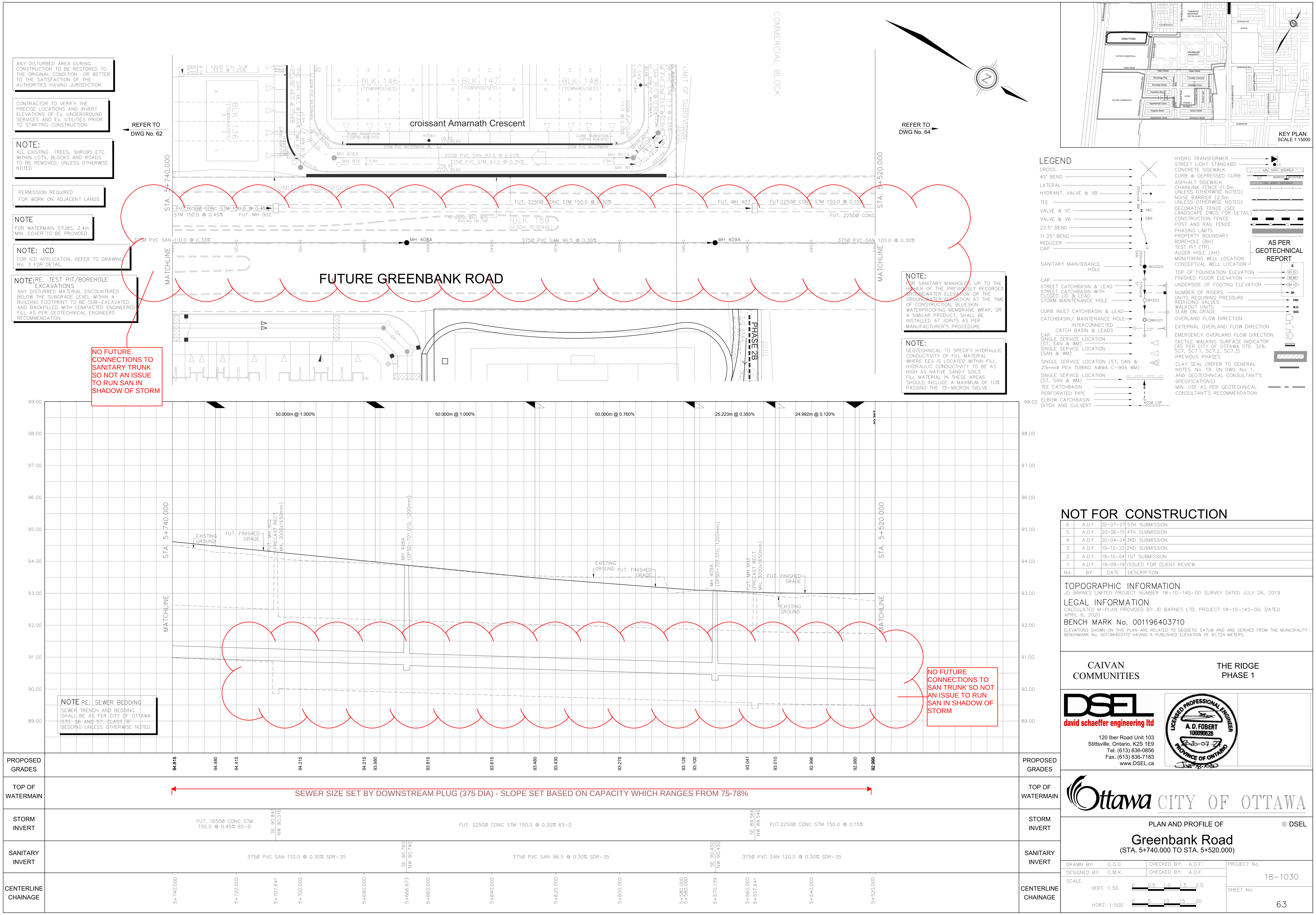
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CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION
NOTE: ALL EXISTING TREES, SHRUBS ETC. WITHIN LOTS, BLOCKS AND ROADS TO BE REMOVED, UNLESS OTHERWISE NOTED
PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS
NOTE FOR WATERMAIN STUBS, 2.4m MIN. COVER TO BE PROVIDED
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NOTE: RE: TEST PIT/BOREHOLE EXCAVATIONS ANY DISTURBED MATERIAL ENCOUNTERED BELOW THE SUBGRADE LEVEL WITHIN A BUILDING FOOTPRINT TO BE SUB-EXCAVATED AND BACKFILLED WITH COMPACTED ENGINEERED FILL AS PER GEOTECHNICAL ENGINEERS RECOMMENDATION.
NO FUTURE CONNECTIONS TO SANITARY TRUNK SO NOT AN ISSUE TO RUN SAN IN SHADOW OF STORM
REFER TO DWG No. 62
REFER TO DWG No. 64
croissant Amarnath Crescent
BLK 146 (TOWNHOUSES)
BLK 147 (TOWNHOUSES)
BLK 148 (TOWNHOUSES)
BLK 136 (TOWNHOUSES)
BLK 189 (0.30m RESERVE)
COMMERCIAL BLOCK
LIMIT OF SUBDIVISION
FUTURE GREENBANK ROAD
PHASE 2B
STA. 5+740.000
STA. 5+520.000
MATCHLINE
FUT. 1650Ø CONC STM 150.0 @ 0.45%
FUT. MH 902
FUT. 2250Ø CONC STM 150.0 @ 0.30%
FUT. MH 903
FUT.2250Ø CONC STM 150.0 @ 0.15%
375Ø PVC SAN 110.0 @ 0.30%
MH 408A
375Ø PVC SAN 96.5 @ 0.30%
MH 409A
375Ø PVC SAN 120.0 @ 0.30%
NOTE: FOR SANITARY MANHOLES, UP TO THE HIGHER OF THE PREVIOUSLY RECORDED GROUNDWATER ELEVATION OR THE GROUNDWATER ELEVATION AT THE TIME OF CONSTRUCTION, BLUESKIN WATERPROOFING MEMBRANE WRAP, OR A SIMILAR PRODUCT, SHALL BE INSTALLED AT JOINTS AS PER MANUFACTURER'S PROCEDURE
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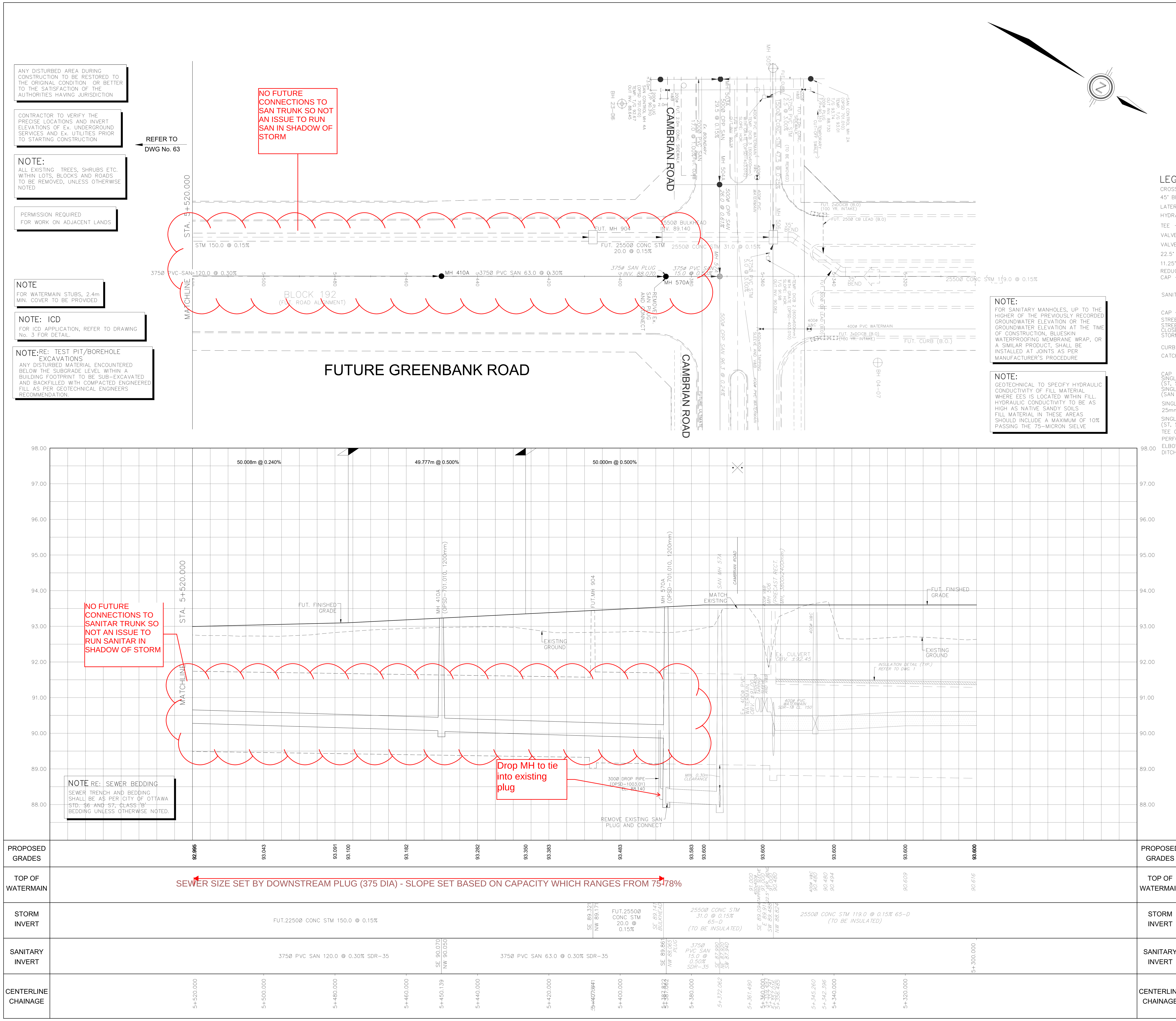
LEGEND
AS PER GEOTECHNICAL REPORT
KEY PLAN SCALE 1:15000
50.000m @ 1.000%
50.000m @ 1.000%
50.000m @ 0.760%
25.223m @ 0.355%
24.992m @ 0.120%
EXISTING GROUND
FUT. FINISHED GRADE
NOTE RE: SEWER BEDDING SEWER TRENCH AND BEDDING SHALL BE AS PER CITY OF OTTAWA STD. S6 AND S7, CLASS 'B' BEDDING UNLESS OTHERWISE NOTED.
NO FUTURE CONNECTIONS TO SAN TRUNK SO NOT AN ISSUE TO RUN SAN IN SHADOW OF STORM
PROPOSED GRADES
94.615 94.480 94.415 94.215 94.015 93.980 93.815 93.615 93.480 93.430 93.278 93.126 93.100 93.041 93.010 92.996 92.980 92.995
TOP OF WATERMAIN
SEWER SIZE SET BY DOWNSTREAM PLUG (375 DIA) - SLOPE SET BASED ON CAPACITY WHICH RANGES FROM 75-78%
STORM INVERT
FUT. 1650Ø CONC STM 150.0 @ 0.45% 65-D
FUT. 2250Ø CONC STM 150.0 @ 0.30% 65-D
FUT.2250Ø CONC STM 150.0 @ 0.15%
SANITARY INVERT
375Ø PVC SAN 110.0 @ 0.30% SDR-35
375Ø PVC SAN 96.5 @ 0.30% SDR-35
375Ø PVC SAN 120.0 @ 0.30% SDR-35
CENTERLINE CHAINAGE
5+740.000 5+720.000 5+707.641 5+700.000 5+680.000 5+666.673 5+660.000 5+640.000 5+620.000 5+600.000 5+580.000 5+570.139 5+560.000 5+557.641 5+540.000 5+520.000
NOT FOR CONSTRUCTION
6 A.D.F. 20-07-27 5TH SUBMISSION
5 A.D.F. 20-06-15 4TH SUBMISSION
4 A.D.F. 20-04-24 3RD SUBMISSION
3 A.D.F. 19-12-23 2ND SUBMISSION
2 A.D.F. 19-10-04 1ST SUBMISSION
1 A.D.F. 19-09-19 ISSUED FOR CLIENT REVIEW
No. BY DATE DESCRIPTION
TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019
LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020
BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.
CAIVAN COMMUNITIES
THE RIDGE PHASE 1
DSEL david schaeffer engineering ltd
120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca
LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 PROVINCE OF ONTARIO
CITY OF OTTAWA
PLAN AND PROFILE OF
Greenbank Road
(STA. 5+740.000 TO STA. 5+520.000)
© DSEL
DRAWN BY: G.C.G. CHECKED BY: A.D.F.
DESIGNED BY: C.M.K. CHECKED BY: A.D.F.
SCALE: VERT. 1:50 HORZ. 1:500
PROJECT No. 18-1030
SHEET No. 63
CITY PLAN No. 17803
CITY FILE No. D07-16-19-0005



NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20-07-27	5TH SUBMISSION
5	A.D.F.	20-06-15	4TH SUBMISSION
4	A.D.F.	20-04-24	3RD SUBMISSION
3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION
1	A.D.F.	19-09-19	ISSUED FOR CLIENT REVIEW

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

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LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 PROVINCE OF ONTARIO

CITY OF OTTAWA

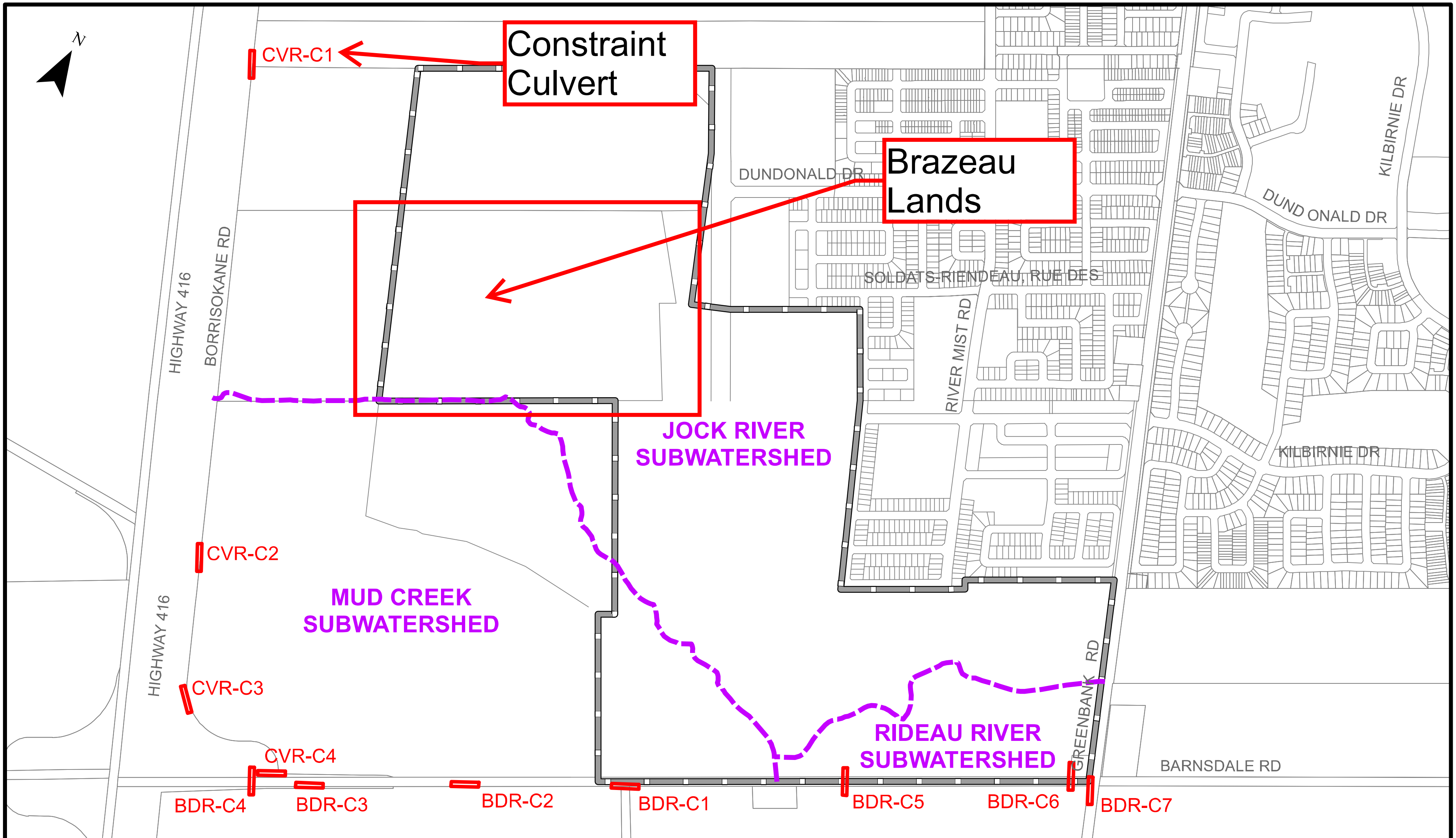
PLAN AND PROFILE OF

Greenbank Road
(STA. 5+520.000 TO STA. 5+300.000)

DRAWN BY: G.C.G. | CHECKED BY: A.D.F.
DESIGNED BY: C.M.K. | CHECKED BY: A.D.F.
SCALE: VERT. 1:50 HORZ. 1:500
PROJECT No. 18-1030
SHEET No. 64

CITY PLAN No. 17803
CITY FILE No. D07-16-19-0005

APPENDIX D



Legend

- Culvert
- Subwatershed Limits

Study Area

PROJECT:

BARRHAVEN SOUTH URBAN EXPANSION AREA
OTTAWA, ONTARIO

DRAWING:

BSUEA EXTENTS, DRAINAGE DIVIDE AND CULVERTS

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

DESIGN:	BP
DRAWN:	KTK
CHECKED:	GF
JLR #:	26610

DRAWING #:

FIGURE 3-1

File Location: R:\26000\26610 - Barrhaven Expansion - Minto Brazeau Mattamy\JLR DWG\GIS\26610 C BSUEA EXTENTS.mxd

Plot Date: September 12, 2017 8:45:23 AM

Table 5-1: Inventory of Model Boundary Water Crossings

Culvert ID	Location	Type	Size (mm)
CR-C1	On Cambrian Road, 910 m east of Borrisokane Road, carries Clarke West Municipal Drain	Circ. CSP	1650
CR-C2	On Cambrian Road at Borrisokane Road	Circ. CSP	N/A
BDR-C4	On Barnsdale Road, 50 m west of Borrisokane Road	Circ. CSP	1200
BDR-C5	On Barnsdale Road, 500 m west of the existing Greenbank Road	Circ. CSP	500
BDR-C6	On Barnsdale Road, 60 m west of the existing Greenbank Road	Circ. CSP	400

It should be noted that culvert CR-C2 was not included as part of the topographical survey and size is currently unknown.

The 2014 Barrhaven South Master Servicing Study Draft Addendum (Draft 2014 BSMSSA) prepared by Stantec, notes that water crossing CR-C1 is to be replaced with storm sewers when the Clarke West Municipal Drain is enclosed as part of the adjacent development and the Clarke Stormwater Management Facility is constructed. The Draft 2014 BSMSSA also indicated that culvert CR-C2 is to be maintained, and will accommodate flows from the existing catchment area south of Cambrian Road up to the 1:100 year event. Should future development occur south of the woodlot draining to CR-C2, grading and servicing from the future development area in the vicinity of the woodlot should be developed to maximize overland sheet flow drainage (not channelized) towards the woodlot.

Table 5-2: Inventory of Model Water Crossings (Internal)

Culvert ID	Location	Type	Size (mm)
CVR-C1	East of Borrisokane Road along the north corner of the BSUEA	Circ. CSP	500
CVR-C2	East of Borrisokane Road at Field Entrance	Circ. CSP	450
CVR-C3	East of Borrisokane Road at Field Entrance	Circ. CSP	400
CVR-C4	Borrisokane Road Crossing north of Barnsdale Road	Circ. CSP	1200
BDR-C1	Viewbank Road Crossing	Circ. CSP	400
BDR-C2	Field Entrance Crossing South of Barnsdale Road	Circ. CSP	400
BDR-C3	Field Entrance Crossing South of Barnsdale Road	Circ. CSP	500
BDR-C7	Barnsdale Road Crossing close to the existing Greenbank Road Intersection	Circ. CSP	500

Table 5-2, above, summarizes the various culvert crossings within the BSUEA. As shown above, all the culverts are 500 mm in diameter or less with the exception of CVR-C4, which is 1200 mm in diameter.

B5.5.1 Storm Distribution

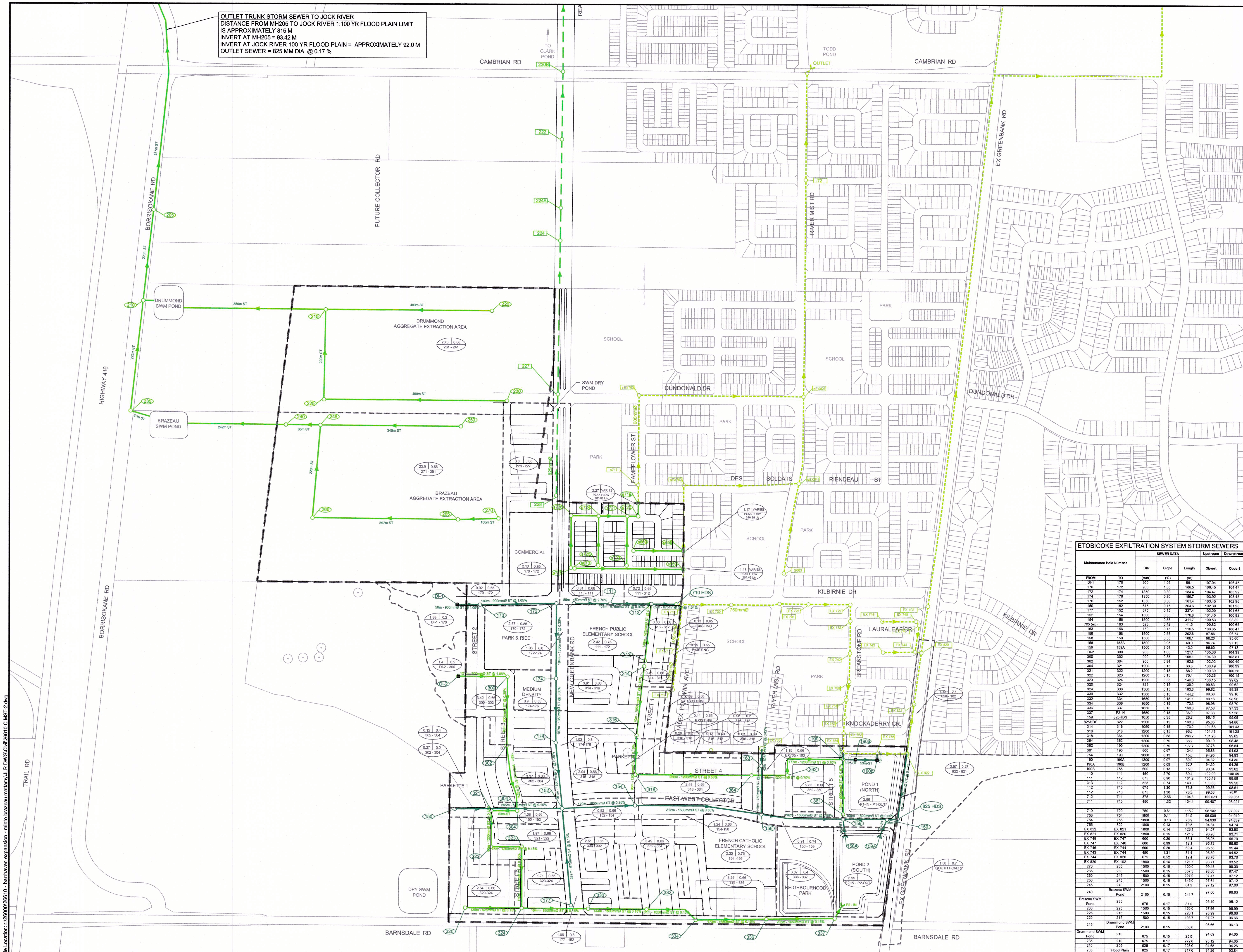
The hydrological response of the BSUEA and abutting lands was simulated under a 6 hour, 12 hour and 24 hour SCS Type II storm distribution. The SCS Type II storm distribution was developed by the American Soil Conservation Service and is generally used for estimating flows in rural areas. The critical storm event under pre-development conditions, with the highest peak runoff, was found to occur under the 12 hour SCS Type II storm distribution.

B5.6 Modeling Results

The pre-development SWMHYMO simulation results, predicting flows at each of the culverts for the critical storm event, are shown in Table 5-5, below. The estimated capacity and level of service of each culvert is also provided. The details of culvert CR-C2, crossing Cambrian Road at Borrisokane Road, could not be obtained in the field due to obstructions and/or structural failure. Hence, the capacity and level of service at this culvert could not be confirmed.

Table 5-5: Hydrological Simulation Results at Culvert Locations (12 hour SCS Type II storm)

Culvert ID	Flow (m^3/s) at culvert location for return period (recurrence)						Estimated Culvert Capacity (m^3/s)	Estimated Level of Service (years)
	1:2 yr	1:5 yr	1:10 yr	1:25 yr	1:50 yr	1:100 yr		
CR-C1	0.3	0.7	1.0	1.6	2.0	2.5	5.5	1:100
CR-C2	0.2	0.4	0.7	1.0	1.3	1.6	N/A	N/A
CVR-C1	0.1	0.3	0.5	0.8	1.0	1.3	0.4	1:5
CVR-C2	0.0	0.1	0.1	0.2	0.2	0.3	0.2	1:25
CVR-C3	0.0	0.1	0.2	0.2	0.3	0.4	0.3	1:50
CVR-C4	0.2	0.4	0.6	0.9	1.1	1.4	2.6	1:100
BDR-C1	0.0	0.0	0.1	0.1	0.1	0.2	0.2	1:100
BDR-C2	0.0	0.1	0.1	0.1	0.2	0.2	0.2	1:50
BDR-C3	0.1	0.1	0.1	0.2	0.2	0.3	0.5	1:100
BDR-C4	0.2	0.4	0.6	0.9	1.2	1.5	2.6	1:100
BDR-C5	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1:100
BDR-C6	0.0	0.0	0.1	0.1	0.2	0.2	0.2	1:100
BDR-C7	0.1	0.1	0.1	0.2	0.3	0.4	0.3	1:50
Total Flow to Thomas Baxter Municipal Drain	0.2	0.5	0.7	1.1	1.3	1.6	N/A	N/A



ETOBICOKE EXFILTRATION SYSTEM STORM SEWERS

Maintenance Hole Number		SEWER DATA			Upstream	Downstream
		Dia	Slope	Length	Obvert	Obvert
FROM	TO	(mm)	(%)	(m)		
DI-1	170	900	1.05	56.1	107.04	106.45
170	172	900	1.05	188.5	106.45	104.47
172	174	1350	0.30	184.4	104.47	103.92
174	176	1350	0.30	156.7	103.92	103.45
176	152	1350	0.30	161.4	103.45	102.96
150	152	675	0.15	264.6	102.30	101.90
177	152	675	0.15	237.4	102.00	101.65
152	154	1500	0.35	178.8	101.45	100.82
154	156	1500	0.55	311.7	100.53	98.82
705 (ex.)	163	525	0.42	41.5	100.82	100.65
163	156	750	0.15	118.5	100.65	100.47
156	158	1500	0.55	202.6	97.86	96.74
158	159	1500	0.55	108.1	96.20	95.60
158	158A	1500	0.95	40.0	96.74	97.13
159	159A	1500	3.54	43.0	95.60	97.13
DI-2	300	900	1.05	121.1	105.66	104.39
300	302	900	0.35	168.1	104.39	103.81
302	304	900	0.94	162.6	102.02	100.49
304	321	1200	0.15	63.3	100.49	100.39
321	322	1200	0.15	88.2	100.39	100.26
322	323	1200	0.15	75.4	100.26	100.15
323	324	1200	0.35	149.8	100.15	99.62
320	324	825	0.15	139.2	99.83	99.62
324	330	1500	0.15	163.6	99.62	99.38
330	332	1500	0.15	144.2	99.38	99.16
332	334	1650	0.15	131.1	99.16	98.96
334	336	1650	0.15	173.3	98.96	98.70
336	337	1650	0.15	168.8	97.58	97.33
337	P2-IN	1650	0.15	36.0	97.33	97.28
159	825HDS	1050	0.35	26.2	95.15	95.05
825HDS	822	1200	0.12	160.8	95.05	94.86
314	316	1050	0.15	170.2	101.68	101.43
316	318	1200	0.15	96.0	101.43	101.28
318	364	1200	0.58	286.2	101.28	99.62
364	362	1200	0.70	88.2	99.10	98.48
362	190	1200	0.70	177.7	97.78	96.54
361	190	600	0.67	134.4	95.83	94.93
754	190	1800	0.13	15.0	94.95	94.93
190	190A	1200	0.07	30.0	94.32	94.30
190A	190B	1200	0.09	52.7	94.30	94.25
190B	755	600	0.13	15.3	93.64	93.62
110	111	450	2.70	89.4	102.90	100.49
111	112	675	0.90	101.2	100.49	99.58
313	112	525	0.74	140.0	100.60	99.56
112	710	675	1.30	73.3	99.56	98.61
112	710	675	1.30	73.3	99.56	98.61
712	711	375	2.56	104.3	102.031	99.361
711	710	450	1.32	104.4	99.407	98.027
710	720	750	0.61	115.2	98.102	97.397
753	754	1800	0.11	54.9	95.008	94.949
754	755	1800	0.13	76.9	94.939	94.839
755	822	1800	0.13	79.5	94.84	94.74
EX. 822	EX. 821	1800	0.14	123.1	94.07	93.90
EX. 821	EX. 820	1800	0.15	121.9	93.90	93.71
EX. 748	EX. 747	600	0.20	83.1	95.95	95.79
EX. 747	EX. 746	600	0.99	12.1	95.72	95.60
EX. 746	EX. 744	600	0.20	69.4	95.58	95.44
EX. 743	EX. 744	450	1.31	81.4	95.59	94.52
EX. 744	EX. 820	675	0.52	12.4	93.76	93.70
EX. 820	EX. 102	1800	0.16	121.7	93.71	93.52
270	265	1500	0.15	100.0	99.45	99.30
265	260	1500	0.15	357.3	98.00	97.47
260	245	1500	0.15	227.9	97.47	97.12
250	245	1500	0.15	345.0	97.64	97.12
245	240	2100	0.15	84.9	97.12	97.00
240	Brazeau SWM Pond	2100	0.15	241.7	97.00	96.63
Brazeau SWM Pond	235	675	0.17	37.0	95.19	95.12
230	225	1500	0.15	450.0	97.66	96.99
225	215	1500	0.15	220.1	96.99	96.66
220	215	1500	0.15	408.7	97.27	96.66
215	Drummond SWM Pond	2100	0.15	350.0	96.66	96.13
Drummond SWM Pond	210	675	0.15	25.0	94.69	94.65
235	210	675	0.17	272.0	95.12	94.65
210	205	825	0.17	223.0	94.65	94.26
205	Flood Plain	825	0.17	817.0	94.26	92.84
900	227 (ex.)	975	0.15	120.0	97.93	97.75

LEGEND

- PROPOSED STORM (EES SYSTEM), PER 2018 BSUEA MSS
- PROPOSED STORM (CONVENTIONAL), PER 2018 BSUEA MSS
- FUTURE STORM, PER 2014 BS MSS
- EXISTING STORM
- DRAINAGE BOUNDARY
- LIMIT OF STUDY AREA FOR BSUEA
- 710 HDS — HYDROLOGY DYNAMIC SEPARATOR
- AREA IN HECTARES*
- RUNOFF COEFFICIENT*
- PIPE REACH UPSTREAM MAINTENANCE HOLE TO DOWNSTREAM MAINTENANCE HOLE

* IF RED, AREAS DESIGNATED AS COMMERCIAL, SCHOOLS OR PARKS

NOTE:

ROADWAYS WITHIN A DRAINAGE AREA WHICH IS TRIBUTARY TO AN EES SEWER, ARE TO BE DESIGNED WITH EES SEWERS. CONVERSELY, ROADWAYS WITHIN A DRAINAGE AREA WHICH IS TRIBUTARY TO A CONVENTIONAL SEWER, ARE TO BE DESIGNED WITH CONVENTIONAL SEWERS.

No.	ISSUE / REVISION	DD/MM/YY
4	ISSUED FOR PLANNING COMMITTEE APPROVAL	04/05/18
3	ADDRESS COMMENTS, RE-ISSUE BSUEA MSS 2ND SUBMISSION	26/02/18
2	ISSUED AS PART OF DRAFT MSS	20/09/17
1	ISSUED FOR PRE-TAC WORKING MEETING	31/08/17

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:4000

CLIENT:

CONSULTANT: www.jlrichards.ca

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP: LICENSED PROFESSIONAL ENGINEER M. L. DALRYMPLE May 4/18 PROVINCE OF ONTARIO

PROJECT NORTH

PROJECT: BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

DRAWING: MASTER STORM DRAINAGE PLAN EES

DESIGN: JW
DRAWN: CJM
CHECKED: LD
JLR #: 26610
DRAWING #: MST-2

PLOT DATE: May 4, 2018 8:44:19 AM

File Location: r:\26000\26610 - barrhaven expansion - minto brazeau mattamy\JLR DWGS\Civil\26610 C MST-2.dwg

re: **Groundwater Infiltration Review**
Proposed Residential Development
Brazeau Pit and Drummonds Pit- Borrisokane Road - Ottawa

to: Caivan Communities - **Mr. Andrew Finnson** - afinnson@caivan.com

date: August 30, 2019

file: PG4504-MEMO.06 Revision 1

Paterson Group (Paterson) has prepared the current memorandum report to provide a review of the hydrogeological characteristics in support of groundwater infiltration recommendations for the aforementioned site.

Background Information

It is currently understood that the proposed residential development consists of a mixture of single family and townhouse style residential dwellings. It is also understood that the development will be serviced by municipal infrastructure that outlets to a stormwater management pond.

The field program for the geotechnical investigation at the Brazeau Pit was completed between November 16, 2018 and April 10, 2019. At that time, a total of 12 boreholes and 15 test pits were advanced to a maximum depth of 5.9 m below existing grade. The results of the investigation indicated that, in general, the subsurface profile consisted of a thin layer of fill material overlying a deposit of silty sand/sand with varying amounts of gravel and cobbles. A thick layer of fill material was encountered within the southeast portion of the subject site and primarily consisted of silty sand with varying amounts of clay, gravel, cobbles, organics and construction debris. This was typically underlain by a till deposit composed of a silty sand matrix with gravel, cobbles and boulders. A very stiff to stiff silty clay layer was noted between the silty sand/sand and till deposits at select boreholes within the western portion of the property. A DCPT test was completed at one borehole location and encountered practical refusal at a depth of 23.5 m. However, bedrock was not conclusively encountered as part of the geotechnical investigations for the proposed development.

The field program for the geotechnical investigation at the Drummonds Pit was completed between July 22 and July 26, 2019. At that time, a total of 8 boreholes and 14 test pits were advanced to a maximum depth of 11.3 m below existing grade. The results of the investigation indicated that, in general, the subsurface profile consisted of a fill material comprised of silty sand to sand and/or silty clay with varying amounts of gravel, cobbles and boulders. Depending on the depth of excavation during the extraction of the aggregate material, the above noted fill material is underlain by either silty sand/sand with varying amounts of gravel, cobbles and boulders or a glacial till deposit composed of a silty sand to silty clay matrix with varying amounts of gravel, cobbles and boulders. A very stiff to stiff silty clay layer was noted underlying the silty sand/sand or fill material at select test holes. A DCPT test was completed at one borehole location and encountered practical refusal at a depth of 11.6 m.

Bedrock was not conclusively encountered as part of the geotechnical investigations for the proposed development. However, based on available mapping, the site is located in an area where bedrock consists of dolomite of the Oxford formation, with overburden thickness ranging from 15 to 25 m.

Hydrogeological Setting

The subject site is located primarily within the Jock Downstream Reach subwatershed of the Jock watershed, with a negligible percentage of the property being located within the Mud Creek subwatershed of the Lower Rideau watershed.

Hydraulic Conductivity and Infiltration Values

Hydraulic conductivity testing was not completed as part of the geotechnical investigations for the proposed development. However, testing completed directly south of the subject site as part of the Community Development Plan (CDP) determined that the hydraulic conductivity of the silty sand/sand deposit ranged from 3.0×10^{-6} to 4.8×10^{-4} m/sec. The hydraulic conductivity values obtained from within the till deposit were slightly lower, and ranged from 5.0×10^{-7} to 7.6×10^{-5} m/sec. The values obtained from the field testing to the south are consistent with published values, and are considered applicable to the materials encountered at the subject site. With regards to the silty clay layer noted underlying the silty sand/sand deposit, hydraulic conductivity values were anticipated to range from 1.0×10^{-9} to 1.0×10^{-7} m/sec, and were based on published values. Due to the variability in the fill material noted on site, hydraulic conductivity values are anticipated to range from 1.0×10^{-7} to 1.0×10^{-4} m/sec and is dependant on the ratio of silty sand/sand to silty clay within the material. **For infiltration system design purposes, it is recommended to use an infiltration rate of 75 mm/hr for the Brazeau Pit site and an infiltration rate of 50 mm/hr for the Drummond Pit site.**

Based on discussions with David Schaeffer Engineering Ltd., it is understood that a version of the Etobicoke exfiltration system is being proposed for the development in order to ensure infiltration volumes to the underlying aquifer systems be maintained. The exfiltration system is proposed to be installed below the curb lines of the development and placed over native silty sand/sand, free-draining sand material 1.5 m in thickness or a silty sand/sand to silty clay fill material. **It is understood that the subject area is required to meet post-development infiltration levels of 40% of the area precipitation. It is further understood that the annual precipitation for the area is 844 mm, so a post-development infiltration level of 40% would require that a minimum infiltration of 338 mm be achieved for the subject site.**

Water Levels and Flow Directions

Water levels obtained at the time of the geotechnical investigations ranged from 0 to 9.1 m depth below existing grade. Based on the recovered water levels, it is expected that the local groundwater flow direction trends to the north towards the Jock River, located approximately 1.4 km north from the north property boundary of the Drummonds Pit. This is corroborated by the groundwater divide separating the Jock Downstream Reach subwatershed and the Mud Creek subwatershed located at the southern boundary of the Brazeau Pit. Its location at the southern edge of the property would suggest that groundwater flows north, away from the divide.

Groundwater Recharge and Discharge

The presence of overburden soils with moderate to high hydraulic conductivity overlying the bedrock aquifer units are considered to provide the potential for significant groundwater recharge within the study area. The Kars esker is considered to transmit large quantities of water that are recharged through the infiltration of precipitation within the non-cohesive material comprising the original overburden materials in the area. The subject site represents a small portion of the existing zone identified by the Mississippi-Rideau Source Protection Region (MRSPR) as a zone of significant groundwater recharge.

Recommendations

As previously discussed, existing conditions at the subject site currently allow for significant volumes of recharge to occur. As such, it is recommended that measures be taken as part of the proposed development to ensure that infiltration volumes to the underlying aquifer systems be maintained. In accomplishing this, the following are some of the potential measures that could be implemented at the subject site:

- ❑ Transport the water using a modified version of the Etobicoke exfiltration system for the development with a minimum 1 m vertical separation between the base of the system and the seasonally high water table to allow for adequate infiltration.

- ❑ Allocate land for City parks, providing opportunities to allow clean water to infiltrate into the overburden aquifer system.

- ❑ Promote infiltration of clean water from rooftops by directing stormwater to grassed areas as opposed to driveways and/or municipal infrastructure.

- ❑ Implement Low Impact Development (LID) measures in conjunction with BMP for stormwater quality and quantity control to assist in infiltrating clean water, treating salt impacted water where required or redirecting salt impacted water away from infiltration locations.

It is important to note that not all of the above may necessarily need to be employed at the subject site, and that the measures required to maintain existing infiltration will be dependant on the final design of the proposed development.

We trust that this information satisfies your requirements.

Best Regards,

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
Aug.30/2019
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Mike Killam, P.Eng.

David J. Gilbert, P.Eng.

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Ottawa. ON
Paris. ON
Gatineau. QC
Montréal. QC
Québec. QC

July 29, 2020 Project Number: P1800

David Schaeffer Engineering Limited
120 Iber Road, Unit 103
Stittsville, ON
K2S 1E9

Attention: **Mr. Kevin Murphy, P.Eng.**

Subject: **The Ridge (Brazeau): Low Impact Development (LID) Design**

Introduction

As a part of the detailed design of the Ridge (Brazeau) subdivision, located in Barrhaven within the City of Ottawa, J.F. Sabourin and Associates Inc. (JFSA) were commissioned to complete an in-depth analysis of the proposed development and its Low Impact Development (LID) measures to ensure that the site's infiltration targets will be met post-development. The detailed study area consists of 28.78 ha, which includes 27.06 ha of the Ridge residential development and 1.72 ha of parklands surrounded by the residential development, lands external to the site have not been considered in this LID analysis. Ultimately, this stormwater infrastructure will service a total drainage area of 71.75 ha. A detailed PCSWMM hydrologic/hydraulic model was developed to replicate the proposed developments water budget using historical rainfall data. The following memo outlines the proposed developments water budget and the aquifer recharge benefits that the LID's provide.

Site Infiltration Targets

As a part of the Master Servicing Study Barrhaven South Urban Expansion Area report completed by J.L. Richards in May 2018, it was determined that pre-development aquifer recharge within the study area accounted for 40% of the overall sites water budget. The City and RVCA determined that pre-development aquifer recharge levels should be maintained under post-development conditions and that the infiltration should be provided across the development and not simply concentrated to one or two locations. The City and RVCA determined that the preferred infiltration servicing strategy for this area would be Etobicoke Exfiltration Systems (EES) and that these systems should be limited only to local roads and their respective catchments, with the intent to prohibit any infiltration of roadway runoff from either collector or arterial roads due to the salting practices applied at those locations.

Etobicoke Exfiltration System (EES) Design

Within the Ridge development, there will be a total of 24 EESs implemented, to meet the aquifer recharge requirements outlined above. The EES units will be installed underneath storm sewers within the right-of-way (ROW) in specific areas as determined by David Schaeffer Engineering (DSEL) as a part of the developments detailed design. Each system will consist of one 250 mm diameter perforated pipes surrounded by a 0.85 m deep by 1.20 m wide clear stone trench. Detailed drawings of the proposed EES units are provided in Figure 1. The location of each EES and its respective design geometries are indicated in Figure 2. Figure 3 outlines the total drainage area to each of the units and the respective runoff coefficients. Based on the areas provided in Figure 3 the EES units will service a total drainage area of 18.49 ha (64.2% of the total development).

Table A1 to A3 in Attachment A provides a full summary of the design parameters for each EES. Note that there are no LID measures proposed on private property (residential rear yards) or within the parklands.

Modelling Approach

The model used for this water budget analysis builds on the existing detailed PCSWMM model of the Ridge (Brazeau) development, which was created as a part of the stormwater management analysis. All components of this model remain unaltered, such as subcatchment parameters, SWM pond configuration, catch basins and the major and minor systems, with the only exception being the removal of the large undetailed external lands that were simulated using SWMHYMO, that were included in the SWM analysis to ensure the ultimate SWM design is sufficient. For details regarding all model's parameters, refer to JFSA's "Stormwater Management Report for The Ridge (Brazeau) Subdivision", July 2020.

The storage provided by each of the EESs has been represented in the model as storage nodes, with appropriate depth/area curves assigned to each EES based on the detailed design parameters. A porosity of 0.4 has been assumed for all EES, and as all units will contain a perforated PVC pipe to help disperse the runoff throughout the entire system, the storage volume provided by these pipes has also been accounted for in the EES storage volume curves.

The soil infiltration rate for the site, determined by Paterson Group (see below), was reduced by a factor of safety of 2.5 as per the guidance from Credit Valley and Toronto and Region Conservation Authorities on Low Impact Development. A specific outlet curve (depth/flow relationship) was developed for each EES, based on its respective geometry. Note that this analysis only considered infiltration through the bottom of the EES, resulting in a conservative estimate for the total infiltration benefits provided by each EES. The total flow through each outlet curve was then used to determine the total aquifer recharge provided by each EES.

The proposed EESs were connected to their respective maintenance holes in the model through an orifice of 250 mm with a discharge coefficient of 0.82 (short pipe) to reflect any restriction that the proposed perforated pipe could have on conveying flow from the maintenance hole to the EES. Each perforated pipe has been reviewed for the more frequent events to ensure that the pipe inlet is not obstructing flows from getting into the system. Note that all EESs are named after the maintenance hole that they are connected to.

Soil Infiltration Rate

Paterson Group conducted soil infiltration testing within the vicinity of the proposed EES measures, which determined a soil infiltration rate of 75 mm/hr for the Ridge (Brazeau) site. Email correspondence indicating the infiltration rate obtained by Paterson for the subject site has been included in Attachment A. For the subcatchments within the development, default Hortons infiltration values have been applied as per the City of Ottawa Sewer Design Guidelines (2012).

Evaporation & Evapotranspiration Parameters

To ensure that the depression storage within the models subcatchments can regenerate after the first rainfall event, monthly evaporation rates have been applied. The Master Servicing Study provided no documentation on the surface evaporation rates used in that analysis, and as such monthly evaporation rates applied in this model are as per those specified in the City of Ottawa's PCSWMM Carp River model documentation. A summary of these monthly values can be found in Attachment A Table A4.

To ensure that evapotranspiration is appropriately accounted for in the continuous simulation water budget, the groundwater routine within the model's hydrologic algorithm has been activated. Groundwater parameters have been applied as specified for type A soils in the J L Richards Master Servicing Study. Excerpts from this report regarding the groundwater parameters have been provided in Attachment A.

EES Drawdown Times

As indicated above all EES units will have a maximum depth of 850 mm with an assumed porosity of 0.4. Based on the site soil infiltration rate of 75 mm/hr, determined by Paterson in the field, and assuming only bottom infiltration, this equates to a full EES having a drawdown time of approximately 4.5 hours. Applying a safety factor of 2.5 to the site infiltration rate, the draw downtime is 11.3 hours, with both values being substantially less than 24 - 48-hour maximum drawdown times generally permitted.

Continuous Simulations

The detailed PCSWMM model was run for 39 years, from 1967 to 2007, using hourly rainfall data from Environment Canada's Ottawa International Airport station. Note that there was no data available for the years 2001 and 2005 in this data set. The hourly rainfall data used in this analysis is a heavily reviewed and vetted product sold by Environment Canada, and only includes rainfall data and does not include any snowfall that occurred during this window. The yearly operational window for this rain gauge consistently started on April 1st, but the end of operation varied from year to year and was either the last day of October or November. For consistency, all simulations were run from April 1st to December 2nd, note an additional 2 days were added to the simulation to ensure any volume still contained within the EESs was able to infiltrate out of the system.

Table A5 in Attachment A provides a full summary of the rainfall data used in this analysis. From this rainfall data, it is seen that the average yearly simulated rainfall for this window is 552.0 mm. Based on Environment Canada normals data for the Ottawa MacDonald Cartier International Airport, the annual average rainfall is 758.2 mm. Reducing this window to include only the months of April to October, the average total rainfall is 585.6 mm, see Table A6 in Attachment A for full details. Note that this normals analysis was completed for the years 1981 to 2010, The discrepancy between the hourly rainfall data and the normals summary may be simply in part due to the difference in years analyzed. As specified by the Master Servicing Study, the proposed development should infiltrate 40% of the annual runoff. As the hourly rainfall data used in this simulation does not extend the full year, the infiltration target for this analysis has been assumed to be 40% of the average simulated rainfall volume (552.0 mm), which is calculated to be 220.8 mm or 63,564 m^3 based on the 28.78 ha study area.

Simulation Results

Table 1 outlines the average simulated infiltration volumes for each of the proposed EESs contained within the development, as per the model simulations from 1967 - 2007. From this analysis, it was found that on average each EES will infiltrate approximately 1,132 m^3 / 3.9 mm, and all EESs on average will infiltrate 27,180 m^3 / 94.4 mm per year, based on the simulated window (April- Nov). Infiltration volumes for each EES for each year have been provided in Tables B1 in Attachment B. Also provided in Attachment B are full summaries of the surface runoff, surface evaporation, surface infiltration and groundwater evapotranspiration for each of the subcatchments within the model for each simulated year. Note that the surface infiltration volumes have not been considered as "truly infiltrated" in this water budget analysis, as these volumes are simply an indicator of the rainfall volume that is passed to the groundwater module. This volume will then either evapotranspirate or infiltrate into the groundwater aquifer, based on the program's groundwater algorithms.

Table 1: EES Infiltration Summary (April - November)

EES ID	Average Infiltration (m^3)
ESS_MH_102	1,057
ESS_MH_103	1,915
ESS_MH_104	1,068
ESS_MH_108	25
ESS_MH_109	725
ESS_MH_110	852
ESS_MH_111	1,398
ESS_MH_114	966
ESS_MH_119	2,036
ESS_MH_120	329
ESS_MH_121	1,241
ESS_MH_125	995
ESS_MH_127	1,246
ESS_MH_128	250
ESS_MH_129	1,304
ESS_MH_130	797
ESS_MH_204	1,554
ESS_MH_208	1,769
ESS_MH_215	1,336
ESS_MH_217	2,329
ESS_MH_218	884
ESS_MH_222	1,779
ESS_MH_223	537
ESS_MH_227	787
Average	1,132
Total	27,180
Total* (mm)	147

*Based on the 18.49 ha serviced by the EES units

Table 1 above outlines that the proposed EESs within the development will on average infiltrate 27,180 m³ / 147 mm (26.6% the total precipitation) for the 18.49 ha area serviced by the EES units. Table 2 outlines the water budget breakdown of the development based on the 39 years of simulations, this includes evaporation, evapotranspiration, infiltration, and runoff from the various components within the development.

From this analysis, the pervious surfaces within the development will infiltrate 38,375 m³ / 133.3 mm (24.1% of the total precipitation) for the full development area of 28.78 ha. As stated above 64.2% of the development (18.49 ha) will be serviced by EES units and also have infiltration from the pervious lands, while the remaining 35.8% (10.29 ha) will only have infiltration from the previous lands. Below is a simplified calculation of the sites total infiltration percentage based on the average model results:

$$\left[(\%EES_{infil} + \%Natural_{infil}) \times \%Area\ with\ EES\right] + \left[\%Natural_{infil} \times \%Area\ without\ EES\right]$$
$$[(26.6\% + 24.1\%) \times 64.2\%] + [24.1\% * 35.8\%] = 41.1\%$$

In a more detailed approach adding the average infiltration volumes provided by the EESs and the pervious surfaces results in the average total infiltration for the site to be 65,554 m^3 / 227.8 mm (41.3% of the total precipitation). This exceeds the 40% infiltration requirement set out by the Master Servicing study by 2,010 m^3 / 7mm (1.3% of the total precipitation).

The development subcatchments have an average annual runoff volume of 55,977m^3 with 64.2% of this area serviced by EES units, simply assuming the runoff from the site is uniform this results in 35,937 m^3 reaching the EES units. From this analysis it was found that the EES units will on average infiltrate 27,180 m^3, meaning that the EES units will infiltrate approximately 75% of the runoff from the areas that they service.

Table 2: The Ridge Development - Water Budget Summary

Year	Rainfall		Subcatchments						Ground water				EES		Water Budget Summary					
	[1]	[2]	[3]		[4]		[5]		[6]		[5]-[6]		[7]		[3]-[7]		[4]+[6]		[5]-[6]+[7]	
	(mm)	(m^3)	Surface Runoff		Surface Evaporation		Surface Infiltration		Evapotranspiration		Subsurface		EES Infiltration		Total Runoff		Total Evaporation		Total Aquifer	
1967	373	107,340	40,265	38%	10,454	10%	56,869	53%	20,729	19%	36,139	34%	19,179	18%	21,086	20%	31,183	29%	55,318	52%
1968	520.6	149,816	53,338	36%	21,952	15%	76,422	51%	45,033	30%	31,388	21%	25,347	17%	27,991	19%	66,985	45%	56,735	38%
1969	499	143,600	49,386	34%	20,908	15%	73,745	51%	44,954	31%	28,791	20%	26,413	18%	22,973	16%	65,862	46%	55,204	38%
1970	538.1	154,852	56,100	36%	23,784	15%	76,492	49%	42,804	28%	33,687	22%	26,199	17%	29,901	19%	66,589	43%	59,886	39%
1971	491	141,298	46,149	33%	24,923	18%	71,390	51%	42,667	30%	28,723	20%	23,859	17%	22,290	16%	67,590	48%	52,582	37%
1972	764.1	219,889	82,866	38%	30,572	14%	108,956	50%	41,313	19%	67,642	31%	36,460	17%	46,406	21%	71,885	33%	104,102	47%
1973	670.1	192,838	70,759	37%	25,134	13%	97,932	51%	43,946	23%	53,986	28%	32,889	17%	37,870	20%	69,080	36%	86,875	45%
1974	332.1	95,570	30,368	32%	17,808	19%	48,763	51%	44,506	47%	4,257	4%	16,829	18%	13,539	14%	62,314	65%	21,086	22%
1975	497.7	143,226	52,486	37%	18,873	13%	72,803	51%	42,106	29%	30,697	21%	24,106	17%	28,380	20%	60,979	43%	54,803	38%
1976	467.5	134,535	43,633	32%	23,144	17%	69,601	52%	43,872	33%	25,729	19%	24,113	18%	19,520	15%	67,017	50%	49,842	37%
1977	587.6	169,097	59,672	35%	23,955	14%	87,052	51%	43,783	26%	43,268	26%	30,955	18%	28,717	17%	67,738	40%	74,223	44%
1978	558.2	160,636	55,528	35%	25,001	16%	81,849	51%	43,755	27%	38,094	24%	27,382	17%	28,146	18%	68,756	43%	65,476	41%
1979	753.6	216,867	81,846	38%	26,018	12%	110,150	51%	44,303	20%	65,846	30%	33,426	15%	48,420	22%	70,322	32%	99,272	46%
1980	555	159,715	53,735	34%	24,744	15%	83,133	52%	43,662	27%	39,471	25%	28,304	18%	25,431	16%	68,407	43%	67,775	42%
1981	840.9	241,990	94,132	39%	32,336	13%	117,734	49%	41,352	17%	76,382	32%	36,938	15%	57,194	24%	73,688	30%	113,320	47%
1982	542.6	156,147	53,734	34%	21,748	14%	81,131	52%	44,145	28%	36,986	24%	28,768	18%	24,966	16%	65,892	42%	65,754	42%
1983	537	154,535	52,092	34%	23,333	15%	80,591	52%	43,903	28%	36,689	24%	28,624	19%	23,468	15%	67,236	44%	65,313	42%
1984	416.2	119,772	42,213	35%	14,107	12%	63,276	53%	42,761	36%	20,515	17%	21,782	18%	20,431	17%	56,867	47%	42,297	35%
1985	456	131,226	45,258	34%	20,781	16%	67,467	51%	44,655	34%	22,812	17%	21,710	17%	23,548	18%	65,436	50%	44,522	34%
1986	814	234,249	84,342	36%	29,981	13%	122,192	52%	42,294	18%	79,899	34%	38,383	16%	45,959	20%	72,275	31%	118,282	50%
1987	602.9	173,500	59,880	35%	25,558	15%	89,563	52%	43,429	25%	46,134	27%	30,087	17%	29,793	17%	68,987	40%	76,221	44%
1988	610.2	175,600	63,539	36%	25,595	15%	87,953	50%	43,380	25%	44,573	25%	30,450	17%	33,089	19%	68,976	39%	75,023	43%
1989	512.8	147,571	49,875	34%	22,284	15%	75,953	51%	44,145	30%	31,809	22%	26,088	18%	23,787	16%	66,428	45%	57,897	39%
1990	651.2	187,399	63,580	34%	28,129	15%	96,309	51%	41,296	22%	55,013	29%	32,552	17%	31,028	17%	69,425	37%	87,565	47%
1991	520.4	149,758	50,115	33%	21,662	14%	78,522	52%	44,408	30%	34,115	23%	27,819	19%	22,296	15%	66,070	44%	61,934	41%
1992	621.2	178,766	64,452	36%	26,027	15%	89,086	50%	42,112	24%	46,973	26%	30,907	17%	33,545	19%	68,140	38%	77,880	44%
1993	643.5	185,183	61,607	33%	27,758	15%	96,182	52%	41,821	23%	54,361	29%	33,872	18%	27,735	15%	69,579	38%	88,233	48%
1994	514.5	148,060	51,997	35%	21,793	15%	76,544	52%	45,331	31%	31,213	21%	24,170	16%	27,827	19%	67,124	45%	55,383	37%
1995	443.6	127,657	48,088	38%	13,357	10%	66,651	52%	45,166	35%	21,485	17%	17,640	14%	30,448	24%	58,523	46%	39,125	31%
1996	476.8	137,211	46,882	34%	20,284	15%	70,721	52%	44,614	33%	26,106	19%	24,902	18%	21,980	16%	64,898	47%	51,008	37%
1997	363.6	104,635	34,658	33%	16,197	15%	54,460	52%	44,375	42%	10,085	10%	20,046	19%	14,612	14%	60,572	58%	30,131	29%
1998	440.3	126,707	41,297	33%	22,506	18%	65,344	52%	42,749	34%	22,595	18%	22,234	18%	19,063	15%	65,255	52%	44,829	35%
1999	424.4	122,132	41,317	34%	19,163	16%	63,818	52%	44,162	36%	19,656	16%	20,691	17%	20,626	17%	63,325	52%	40,347	33%
2000	535.9	154,219	50,446	33%	25,837	17%	79,800	52%	41,901	27%	37,900	25%	25,665	17%	24,781	16%	67,738	44%	63,565	41%
2001	-	-	-		-		-		-				-							
2002	551.5	158,708	61,050	38%	19,621	12%	79,923	50%	46,159	29%	33,764	21%	26,040	16%	35,010	22%	65,779	41%	59,804	38%
2003	554.6	159,600	54,033	34%	24,069	15%	83,542	52%	42,697	27%	40,846	26%	27,547	17%	26,486	17%	66,766	42%	68,393	43%
2004	573.3	164,982	65,130	39%	24,295	15%	77,742	47%	43,942	27%	33,801	20%	22,565	14%	42,565	26%	68,237	41%	56,366	34%
2005	-	-	-		-		-		-				-							
2006	723.4	208,177	73,841	35%	28,434	14%	108,758	52%	42,536	20%	66,222	32%	37,829	18%	36,012	17%	70,970	34%	104,051	50%
2007	550.7	158,478	53,395	34%	25,838	16%	81,708	52%	42,752	27%	38,957	25%	27,239	17%	26,156	17%	68,590	43%	66,196	42%
Average	552.0	158,860	55,977	35.1%	23,025	14.6%	81,285	51.3%	42,911	28.1%	38,375	23.1%	27,180	17.2%	28,797	17.9%	65,935	42.7%	65,554	40.3%

Notes:

Total drainage area 28.78 ha

Surface Infiltration not considered as a part of the total aquifer recharge, as this value is simply the volume that is passed to the groundwater component

Erosion & Sediment Control During & After Construction

Silt and erosion control strategies shall be implemented during construction activities to optimize the operations of the LID once implemented and minimize the siltation of the systems during construction. The following measures should be implemented:

- Prior to site works, locations of the LIDs should be marked and vehicles to avoid this area other than during the installation of the LID drainage not to be directed to LID.
- Prior to the completion of landscape works, catch basins not connected to the LID practices can be used during construction for drainage.
- Heavy equipment and traffic should avoid travelling over the proposed location of the facility to minimize the compaction of the soil.
- To minimize siltation during construction, the EES units should be constructed with upstream and downstream plugs. During construction, these plugs will be implanted preventing sediments from entering the units. Once an occupancy of 80% is achieved, the upstream plug will then be removed and the EES units allow to operate as intended.
- Facilities should be kept “off-line” until construction is complete. They should never serve as a sediment control device during site construction. Sediment should be prevented from entering the infiltration facility using super silt fence, diversion berms or other means.
- Upland drainage areas need to be properly stabilized with a thick layer of vegetation, particularly immediately following construction, to reduce sediment loads.
- The facility should be excavated to design dimensions from the side using a backhoe or excavator. The base of the facility should be level or nearly level.
- The bottom of the facility should be scarified to improve infiltration. An optional 150 mm of sand could be spread for the bottom filter layer. The monitoring well should be anchored and stone should be added to the facility in 0.3-metre lifts.
- Geotextile fabric should be correctly installed in the soakaway or infiltration trench excavation. Large tree roots should be trimmed flush with the sides of the facility to prevent puncturing or tearing of the fabric during subsequent installation procedures. When laying out the geotextile, the width should include sufficient material to compensate for perimeter irregularities in the facility and for a 150 mm minimum top overlap. Voids may occur between the fabric and the excavated sides of the facility. Natural soils should be placed in any voids to ensure fabric conformity to the excavation sides

Conclusion

In summary, the detailed PCSWMM model of the proposed Ridge (Brazeau) development has been updated to include the EES measures proposed within the site. Continuous simulations using 39 years of historical rainfall data determined that the proposed water budget for the Ridge subdivision would be 18% surface runoff, 42% evaporation and 40% infiltration. From this analysis, it was found that the proposed EESs within the development will on average infiltrate 27180 m^3 / 94.4 mm (17% of the total precipitation) while the pervious surfaces within the development will infiltrate 38,375 m^3 / 133.3 mm (23% of the total precipitation). Adding the infiltration provided by the EESs and the pervious surfaces yearly results in the average total infiltration for the site to be 65,554 m^3 / 227.8 mm (41.3% of the total precipitation). This exceeds the 40% infiltration requirement set out by the Master Servicing study by 2010 m^3 / 7mm (1.3% of the total precipitation), confirming that the proposed development will not adversely affect the existing groundwater recharge and existing infiltration budget.

Yours truly,
J.F Sabourin and Associates Inc.

Jonathon Burnett, B.Eng, P.Eng
Water Resources Engineer

LICENSED PROFESSIONAL ENGINEER
J. J. BURNETT
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PROVINCE OF ONTARIO

cc: J.F Sabourin, M.Eng, P.Eng
Director of Water Resources Projects

Figures

Figure 1: Exfiltration System Details
Figure 2: Exfiltration System Locations
Figure 3: Exfiltration System Drainage Areas

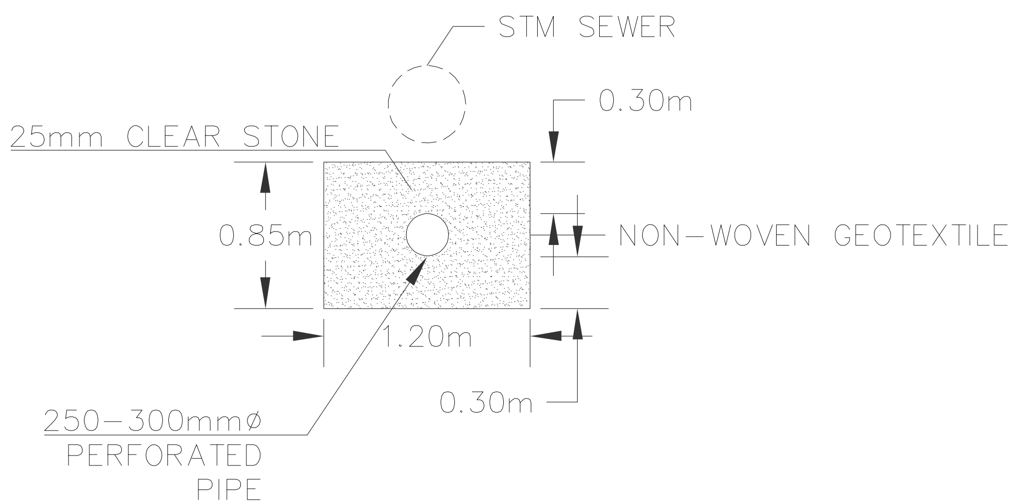
Tables

Table 1: EES Infiltration Summary (April - November)
Table 2: Water Budget Summary

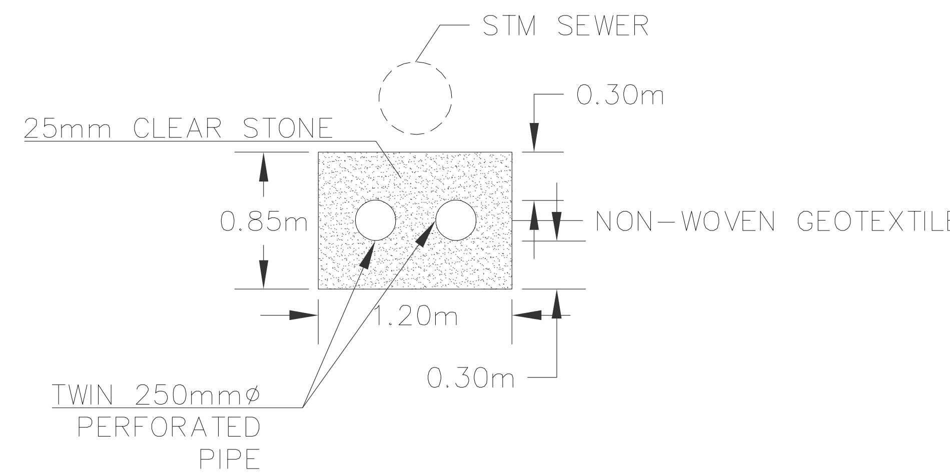
Attachments

Attachment A: Continuous Simulation Parameters & Background Information
Attachment B: Continuous Simulation Results

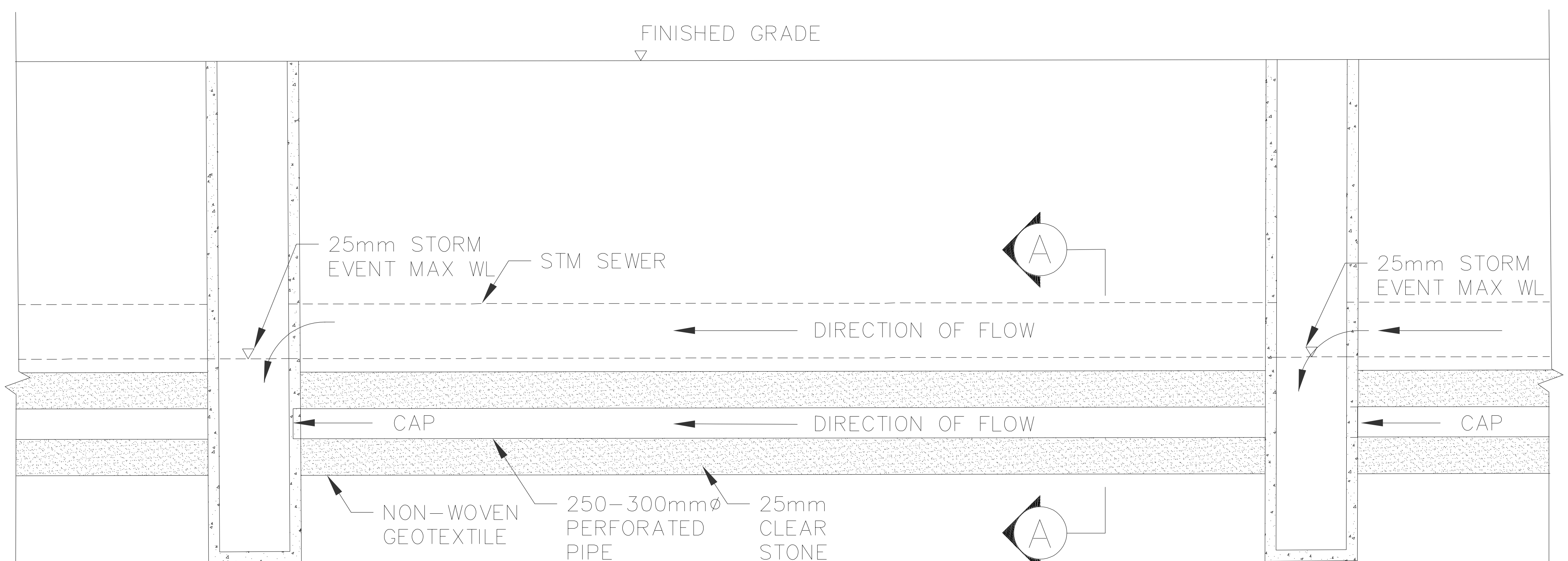
EXFILTRATION TRENCH – ROADS



SECTION DETAIL A
SCALE: N.T.S.



SECTION DETAIL A
SCALE: N.T.S.



PROFILE
SCALE: N.T.S.

SCALE : NTS

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WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
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CLIENT : DAVID SCHAEFFER ENGINEERING LTD.

PROJECT : THE RIDGE PHASE 1 SUBDIVISION

BY	DATE	DESCRIPTION	BY

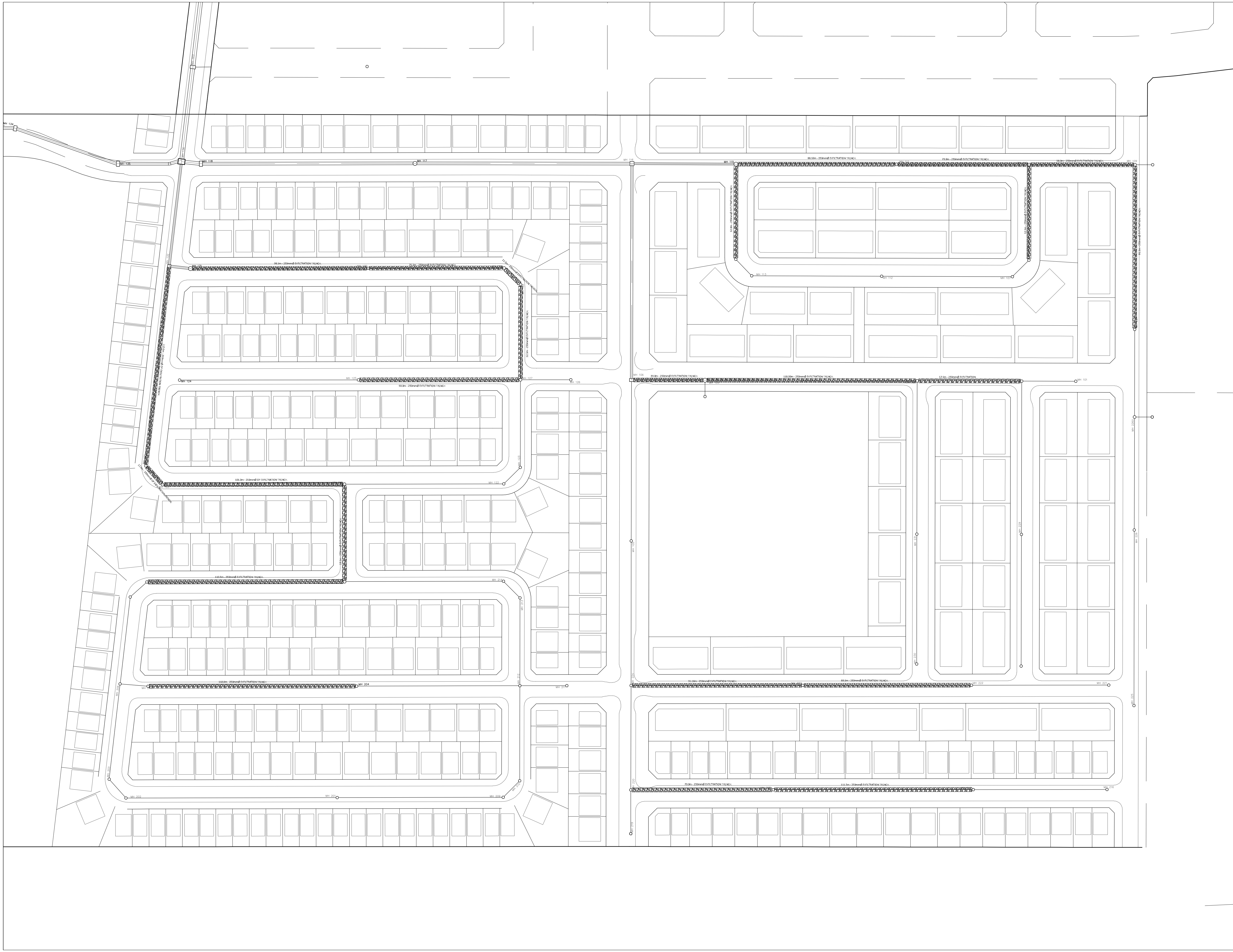
EXFILTRATION
SYSTEM DETAILS

FIGURE 1

DESIGNED:
DRAWN: BL
VERIFIED: JFS
APPROVED: JFS

DRAWING REF.
1800–19\202001 LID Subm3\Design\CAD\Figure 1 & 2.dwg

DATE: APRIL 2020
PROJECT No.: 1800



LEGEND:

Etobicoke Exfiltration System

SCALE :

0 40 80 120

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CLIENT :
DAVID SCHAEFFER
ENGINEERING LTD.

PROJECT :
THE RIDGE PHASE 1
SUBDIVISION

BY	DATE	DESCRIPTION	BY

EXFILTRATION
SYSTEM LOCATIONS

FIGURE 2

DESIGNED:	
DRAWN:	BL
VERIFIED:	JB
APPROVED:	JB

DRAWING REF.
1800-19\202001 LID Subm3\
Design\CAD\Figure 1 & 2.dwg

DATE	PROJECT No.
JULY 2020	1800

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CAIVAN COMMUNITIES - THE RIDGE PHASE 1

CITY OF OTTAWA

EES DRAINAGE FIGURE

SCALE:	1:2000	PROJECT No.:	18-1030
DATE:	JULY 2020	FIGURE:	3

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Attachment A

Continuous Simulation Parameters & Background Information

Table A1 - Etobikoe Exfiltration System - Parameters

Parameter	EES_MH_204	EES_MH_208	EES_MH_215	EES_MH_119	EES_MH_120	EES_MH_121	EES_MH_125	EES_MH_127	EES_MH_128	EES_MH_129	EES_MH_130	EES_MH_217	EES_MH_218	EES_MH_223	EES_MH_222	EES_MH_102	EES_MH_103	EES_MH_104	EES_MH_227	EES_MH_109	EES_MH_110	EES_MH_111	EES_MH_114	EES_MH_108
Number of Pipes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pipe Diameter (mm)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Pipe Length (m)	110	110.5	53.5	101	12.5	112	90	52.5	11	75.5	98.5	111.5	79	95.5	89.5	57.5	118	39	91.5	58	73	88.5	52	52.5
Pipe Volume (m^3)	5.40	5.42	2.63	4.96	0.61	5.50	4.42	2.58	0.54	3.71	4.84	5.47	3.88	4.69	4.39	2.82	5.79	1.91	4.49	2.85	3.58	4.34	2.55	2.58
Trench Width (m)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Trench Height (m)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Trench Length (m)	110	110.5	53.5	101	12.5	112	90	52.5	11	75.5	98.5	111.5	79	95.5	89.5	57.5	118	39	91.5	58	73	88.5	52	52.5
Void Ratio	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Trench Volume (m^3)	42.72	42.91	20.78	39.22	4.85	43.50	34.95	20.39	4.27	29.32	38.25	43.30	30.68	37.09	34.76	22.33	45.83	15.15	35.54	22.53	28.35	34.37	20.19	20.39
Total Volume (m^3)	48.12	48.34	23.40	44.18	5.47	48.99	39.37	22.97	4.81	33.03	43.09	48.78	34.56	41.78	39.15	25.15	51.62	17.06	40.03	25.37	31.93	38.71	22.75	22.97
Infiltration Rate (mm/hr)	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Safety Factor	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Bottom Area (m^2)	132	132.6	64.2	121.2	15	134.4	108	63	13.2	90.6	118.2	133.8	94.8	114.6	107.4	69	141.6	46.8	109.8	69.6	87.6	106.2	62.4	63
Infiltration Flow Rate (m^3/s)	0.00110	0.00111	0.00054	0.00101	0.00013	0.00112	0.00090	0.00053	0.00011	0.00076	0.00099	0.00112	0.00079	0.00096	0.00090	0.00058	0.00118	0.00039	0.00092	0.00058	0.00073	0.00089	0.00052	0.00053
MH Invert	103.579	102.671	100.303	99.144	98.878	98.79	98.481	98.177	98.039	97.923	97.732	104.573	104.327	102.148	102.311	99.917	98.755	97.975	100.759	99.151	98.346	97.925	98.296	98.908
New MH Invert	103.029	102.121	99.753	98.594	98.328	98.24	97.931	97.627	97.489	97.373	97.182	104.023	103.777	101.598	101.761	99.367	98.205	97.425	100.209	98.601	97.796	97.375	97.746	98.358
Pipe Elevation	102.979	102.071	99.703	98.544	98.278	98.19	97.881	97.577	97.439	97.323	97.132	103.973	103.727	101.548	101.711	99.317	98.155	97.375	100.159	98.551	97.746	97.325	97.696	98.308
EES Bottom	102.679	101.771	99.403	98.244	97.978	97.89	97.581	97.277	97.139	97.023	96.832	103.673	103.427	101.248	101.411	99.017	97.855	97.075	99.859	98.251	97.446	97.025	97.396	98.008

Table A2 - Etobikoe Exfiltration System - Infiltration Curves
(m^3/s)

Depth	EES_MH_204	EES_MH_208	EES_MH_215	EES_MH_119	EES_MH_120	EES_MH_121	EES_MH_125	EES_MH_127	EES_MH_128	EES_MH_129	EES_MH_130	EES_MH_217	EES_MH_218	EES_MH_223	EES_MH_222	EES_MH_102	EES_MH_103	EES_MH_104	EES_MH_227	EES_MH_109	EES_MH_110	EES_MH_111	EES_MH_114	EES_MH_108
0.000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.005	0.00110	0.00111	0.00054	0.00101	0.00013	0.00112	0.00090	0.00053	0.00011	0.00076	0.00099	0.00112	0.00079	0.00096	0.00090	0.00058	0.00118	0.00039	0.00092	0.00058	0.00073	0.00089	0.00052	0.00053
5.000	0.00110	0.00111	0.00054	0.00101	0.00013	0.00112	0.00090	0.00053	0.00011	0.00076	0.00099	0.00112	0.00079	0.00096	0.00090	0.00058	0.00118	0.00039	0.00092	0.00058	0.00073	0.00089	0.00052	0.00053

Table A3 - Etobikoe Exfiltration System - Storage Curves
(m^2)

Depth	EES_MH_204	EES_MH_208	EES_MH_215	EES_MH_119	EES_MH_120	EES_MH_121	EES_MH_125	EES_MH_127	EES_MH_128	EES_MH_129	EES_MH_130	EES_MH_217	EES_MH_218	EES_MH_223	EES_MH_222	EES_MH_102	EES_MH_103	EES_MH_104	EES_MH_227	EES_MH_109	EES_MH_110	EES_MH_111	EES_MH_114	EES_MH_108
0.000	56.61	56.87	27.53	51.98	6.43	57.64	46.32	27.02	5.66	38.86	50.69	57.38	40.66	49.15	46.06	29.59	60.73	20.07	47.09	29.85	37.57	45.55	26.76	27.02
0.850	56.61	56.87	27.53	51.98	6.43	57.64	46.32	27.02	5.66	38.86	50.69	57.38	40.66	49.15	46.06	29.59	60.73	20.07	47.09	29.85	37.57	45.55	26.76	27.02
0.851	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
5.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Table A4 - Monthly Evaporation

Month	Evaporation Rate (mm/Day)
January	0.0000
February	0.0000
March	0.0000
April	1.1330
May	2.5160
June	3.9330
July	4.5160
August	3.8710
September	2.3670
October	1.3870
November	0.2000
December	0.0000

Source:

Table 10- MODEL DEVELOPMENT PROGRAM – CARP RIVER RESTORATION PLAN - Appendices, City of Ottawa (Feb 2014)

**Table A5 - Historical Rainfall Data Summary:
Ottawa International Airport**

Year	Rainfall Volume (mm)
1967	373.0
1968	520.6
1969	499.0
1970	538.1
1971	491.0
1972	764.1
1973	670.1
1974	332.1
1975	497.7
1976	467.5
1977	587.6
1978	558.2
1979	753.6
1980	555.0
1981	840.9
1982	542.6
1983	537.0
1984	416.2
1985	456.0
1986	814.0
1987	602.9
1988	610.2
1989	512.8
1990	651.2
1991	520.4
1992	621.2
1993	643.5
1994	514.5
1995	443.6
1996	476.8
1997	363.6
1998	440.3
1999	424.4
2000	535.9
2001	
2002	551.5
2003	554.6
2004	573.3
2005	
2006	723.4
2007	550.7
Average	552.0
Total	21529.1

	No Data Available

Ottawa International Airport
1981 to 2010 Canadian Climate Normals Station Data

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall (mm)	25.0	18.7	31.1	63.0	80.1	92.8	91.9	85.5	90.1	82.2	64.5	33.5	**758.2**
Snowfall (cm)	53.9	43.3	38.3	11.3	0.2	0.0	0.0	0.0	0.0	3.7	20.2	52.5	**223.5**
Precipitation (mm)	65.4	54.3	64.4	74.5	80.3	92.8	91.9	85.5	90.1	86.1	81.9	76.4	**943.4**

Source:

https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=ottawa&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=4337&dispBack=0#station-metadata

From: David Gilbert <DGilbert@Patersongroup.ca>
Sent: August 29, 2019 5:30 PM
To: Susan Murphy <susan.murphy@caivan.com>; Steve Pichette <SPichette@dsel.ca>
Cc: Michael Killam <MKillam@Patersongroup.ca>
Subject: Drummonds and Brazeau Pit - Infiltration information

Hi guys,

I spoke with Bobby Pettigrew at JL Richards and he used 40% of area precipitation to be infiltrated over a 30 year period using the infiltration system. Annual precipitation in water budget was noted to be 844 mm, so infiltration of 40% would be 338 mm. He noted that this amount was equivalent to full infiltration of a 22 mm rain event. The infiltration rate for system design for Brazeau Pit is 75 mm/hour and for Drummond Pit is 50 mm/hour. We are working on the groundwater contour plan based on our current groundwater observations for both sites. This drawing should be ready tomorrow.

Dave

David Gilbert, P.Eng.
Senior Geotechnical Engineer
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solution oriented engineering
over 60 years serving our clients

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3.0 GROUNDWATER

3.1 Groundwater Parameters

Parameter	Units	Description
Aquifer Name	-	Name of the aquifer representing soil conditions. Four Aquifers were created based on different soil conditions from OSG mapping. Only two of the aquifers are used within the study area.
Receiving Node	-	Name of the receiving node for groundwater outflow to baseflow. This is based on the groundwater subwatershed delineation.
Surface Elevation	m	Elevation of the ground surface for the subcatchment was averaged from the Patterson report. **Value: 107**
Coefficients		The coefficients were set for the saturated groundwater zone to represent a storage reservoir where outflow is linear proportional to the water table depth without surface water interaction. It was considered that the nearest open water channels were sufficiently far to have negligible impact on groundwater levels. The groundwater equation used is: $f_G = A1\ (d_L - h_{sw})$ Where: f_G = groundwater flow d_L = depth of the lower saturated subsurface zone h_{sw} = height of surface water above the bottom of the groundwater zone A1 = Calibration factor (estimated at 0.05) **Value: 0.05**
Surface Water Depth	m	Set as 0.5 metres to allow flow from the water table to surrounding watercourses. **Value: 0.5**

Aquifer	Description	Clay content (%)	Sand content (%)
A	Sand	5	92
B	Sandy Loam	10	65
C (not used)	Sandy Clay Loam	28	60
D (not used)	Clay Loam	34	33

Parameter	Units	Description
Initial Elevation	m	Initial elevation of the water table **Value: 95.5**
		All other parameters used as per the receiving node or aquifer

3.2 Aquifer Parameters

Parameter	Units	Description / Values
Porosity	Fraction	The following values were used for the volumetric water content of the soil at saturation (i.e. volume of water per total volume):
Wilting Point	Fraction	This is soil moisture contact at which plants cannot obtain sufficient moisture from the soil to meet transpiration requirements and they will die. It is roughly equivalent to the moisture content of soil at 15 atmospheres. The following values were used:
Field Capacity	Fraction	Considered to be the amount of water a well-drained soil holds after free water has drained off. The following values were used:
Conductivity	mm/hr	Within the Aquifer Parameters, the soil saturated conductivity is a governing parameter of the percolation rate between the upper unsaturated soil layer and the lower saturated soil layer. This is not the same as any hydraulic conductivity used for the surface infiltration. The values have been selected from the SPAW calculator and are:

Soil Group	A	B	C	D
Porosity	0.436	0.450	0.432	0.472

(Source: SPAW Calculator)

Soil Group	A	B	C	D
Wilting Point	0.050	0.081	0.183	0.213

(Source: SPAW Calculator)

Soil Group	A	B	C	D
Field Capacity	0.094	0.179	0.283	0.350

(Source: SPAW Calculator)

Soil Group	A	B	C	D
Conductivity (mm/hr)	114	50.3	7.8	4.6

(Source: SPAW Calculator)

<table>
<tr><th>Parameter</th><th>Units</th><th>Description / Values</th></tr>
<tr><td>Conductivity Slope</td><td>-</td><td>Conductivity slope measures the rate at which a soil's hydraulic conductivity decreases with decreasing moisture content. Regression analysis has shown it can be estimated with the following relationship:
Conductivity Slope = 0.48(% Sand) + 0.85(% Clay)
Based on this relationship the following values were used:
<table><tr><th>Soil Group</th><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>Conductivity Slope</td><td>48</td><td>40</td><td>53</td><td>45</td></tr></table></td></tr>
<tr><td>Tension Slope</td><td></td><td>Used for backward compatibility in the software and not used in this model</td></tr>
<tr><td>Upper Evaporation Factor</td><td>Fraction</td><td>This factor determines the fraction of available subsurface evaporation rate used in the upper subsurface zone (compared to the lower subsurface zone). A higher evaporation rate is associated with looser soils, lower water table elevations and shallow root zones. It was assumed that in all soils 80% of the available subsurface evaporation would be used in the upper zone due to the depth of the water table.
Value: 0.8</td></tr>
<tr><td>Lower Evaporative Depth</td><td>m</td><td>The depth of the lower subsurface zone which can be used for evapotranspiration should be approximate to the expected average depth of root penetration. The following values were used:
<table><tr><th>Soil Group</th><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>Evaporative Depth (m)</td><td>1.5</td><td>2.4</td><td>3.0</td><td>5.2</td></tr></table>(Source: Shah et al 2007 from EPA 2015)</td></tr>
<tr><td>Lower Groundwater Loss Rate</td><td>mm/hr</td><td>This is the rate of percolation from the lower subsurface zone to a deep aquifer and is approximate to the rate at which the water table elevation will drop over a prolonged dry period. The saturated hydraulic conductivity of a compacted clay soil was used in all cases.
Value: 0.004</td></tr>
<tr><td>Bottom Elevation</td><td>m</td><td>The elevation of the bedrock as averaged from the Patterson 2016 report.
Value: 85</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Units</th><th>Description / Values</th></tr>
<tr><td>Unsaturated Zone Moisture</td><td></td><td>The moisture content of the unsaturated upper subsurface zone at the start of the simulation. Cannot be less than the wilting point and cannot be more that porosity. Assumed to be an approximate value between the wilting point and porosity fractions.

<table><tr><th>Soil Group</th><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>Evaporative Depth (m)</td><td>0.25</td><td>0.22</td><td>0.32</td><td>0.35</td></tr></table></td></tr>
</table>

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Attachment B

Continuous Simulation Results

The Ridge (Brazeau):
Low Impact Development (LID) Design
July 2020

Table B1 - Yearly Precipitation

Year	Rainfall (mm)	Rainfall (m^3)
1967	373	107,340
1968	520.6	149,816
1969	499	143,600
1970	538.1	154,852
1971	491	141,298
1972	764.1	219,889
1973	670.1	192,838
1974	332.1	95,570
1975	497.7	143,226
1976	467.5	134,535
1977	587.6	169,097
1978	558.2	160,636
1979	753.6	216,867
1980	555	159,715
1981	840.9	241,990
1982	542.6	156,147
1983	537	154,535
1984	416.2	119,772
1985	456	131,226
1986	814	234,249
1987	602.9	173,500
1988	610.2	175,600
1989	512.8	147,571
1990	651.2	187,399
1991	520.4	149,758
1992	621.2	178,766
1993	643.5	185,183
1994	514.5	148,060
1995	443.6	127,657
1996	476.8	137,211
1997	363.6	104,635
1998	440.3	126,707
1999	424.4	122,132
2000	535.9	154,219
2001	-	-
2002	551.5	158,708
2003	554.6	159,600
2004	573.3	164,982
2005	-	-
2006	723.4	208,177
2007	550.7	158,478
Average	552.0	158,860

Notes:

Total drainage area 28.78 ha

Table B2 - Etobicoke Exfiltration System
Yearly Infiltration Volumes (m³)

Node	MH_102	MH_103	MH_104	MH_108	MH_109	MH_110	MH_111	MH_114	MH_119	MH_120	MH_121	MH_125	MH_127	MH_128	MH_129	MH_130	MH_204	MH_208	MH_215	MH_217	MH_218	MH_222	MH_223	MH_227	Total
1967	757	1376	566	23	528	611	993	674	1433	211	944	714	838	169	930	594	1145	1280	884	1587	694	1248	407	573	**19,179**
1968	970	1790	895	31	695	817	1337	885	1840	302	1222	950	1129	233	1181	815	1478	1666	1201	2097	887	1616	564	746	**25,347**
1969	1042	1846	908	22	693	781	1325	1014	1985	333	1124	919	1248	241	1220	649	1613	1746	1340	2439	870	1822	458	775	**26,413**
1970	1030	1825	927	58	686	801	1310	961	2008	326	1136	942	1223	249	1278	659	1558	1698	1309	2327	865	1765	514	744	**26,199**
1971	925	1653	898	19	619	725	1239	883	1810	321	982	848	1162	228	1086	594	1414	1553	1265	2180	726	1620	433	676	**23,859**
1972	1410	2582	1245	77	996	1162	1896	1299	2655	420	1725	1364	1619	325	1732	1111	2147	2397	1735	3113	1212	2375	764	1099	**36,460**
1973	1272	2298	1053	66	896	1045	1671	1222	2360	382	1511	1231	1465	279	1506	987	1990	2161	1585	2913	1120	2194	702	980	**32,889**
1974	676	1186	696	8	429	494	861	608	1370	239	649	573	885	180	830	328	944	1088	954	1501	478	1145	240	467	**16,829**
1975	916	1650	1226	53	640	750	1197	848	1786	295	1038	883	1106	218	1138	658	1393	1531	1204	2086	745	1571	491	683	**24,106**
1976	963	1726	913	0	645	743	1244	851	1906	306	1053	861	1170	237	1198	622	1363	1583	1240	2078	739	1604	385	683	**24,113**
1977	1210	2173	1066	28	802	947	1565	1164	2312	377	1378	1097	1418	277	1479	842	1821	2019	1536	2807	1072	2104	592	869	**30,955**
1978	1075	1966	993	25	729	872	1444	942	2065	339	1313	1000	1257	264	1345	884	1510	1793	1336	2298	888	1783	501	760	**27,382**
1979	1289	2362	1023	64	928	1101	1718	1171	2397	351	1669	1306	1394	274	1622	1172	1952	2180	1484	2829	1132	2160	831	1017	**33,426**
1980	1128	2046	1005	0	744	888	1483	979	2210	338	1346	1026	1315	264	1467	870	1543	1854	1390	2366	902	1844	508	788	**28,304**
1981	1414	2579	1302	72	1006	1173	1927	1302	2735	451	1666	1365	1718	345	1727	1088	2144	2394	1867	3169	1198	2400	777	1119	**36,938**
1982	1136	2049	1027	5	759	889	1482	1029	2234	357	1290	1035	1361	275	1409	803	1639	1886	1464	2471	924	1899	528	817	**28,768**
1983	1140	2019	1080	0	746	859	1454	1052	2256	362	1213	1009	1396	272	1392	708	1611	1858	1499	2569	888	1952	466	823	**28,624**
1984	846	1559	1105	8	575	692	1126	738	1596	222	1110	803	904	184	1061	758	1199	1419	936	1747	776	1372	451	595	**21,782**
1985	838	1571	701	15	581	712	1157	744	1543	242	1164	821	900	180	1078	877	1191	1439	953	1773	767	1377	488	598	**21,710**
1986	1472	2710	1319	27	1076	1283	1981	1298	2864	445	1821	1513	1707	348	1879	1260	2186	2477	1832	3102	1314	2402	919	1148	**38,383**
1987	1183	2104	1087	18	794	928	1538	1104	2294	385	1262	1088	1439	280	1427	764	1744	1948	1570	2704	948	2026	578	874	**30,087**
1988	1171	2119	1125	66	817	940	1552	1130	2213	405	1316	1104	1432	290	1354	824	1781	1995	1587	2706	996	2023	608	896	**30,450**
1989	1022	1831	942	16	703	813	1330	961	1992	331	1129	954	1233	245	1245	662	1531	1703	1327	2312	815	1747	488	756	**26,088**
1990	1285	2304	1127	13	874	1010	1677	1184	2452	392	1469	1182	1495	299	1564	865	1930	2144	1613	2861	1053	2178	619	962	**32,552**
1991	1089	1957	1076	0	743	860	1414	999	2123	359	1204	995	1348	279	1322	720	1605	1812	1459	2432	893	1853	481	796	**27,819**
1992	1203	2171	1053	52	819	967	1576	1148	2278	379	1390	1122	1416	276	1430	885	1803	2034	1550	2768	1032	2075	583	897	**30,907**
1993	1351	2429	1281	0	896	1033	1750	1217	2606	445	1514	1204	1636	331	1635	935	1883	2225	1744	2947	1027	2249	555	979	**33,872**
1994	919	1699	862	20	660	802	1254	831	1734	293	1154	944	1079	223	1117	825	1391	1570	1166	1989	816	1526	611	685	**24,170**
1995	681	1225	598	36	491	565	893	630	1339	198	798	680	775	158	871	485	1035	1137	813	1490	568	1140	429	605	**17,640**
1996	959	1737	1311	13	653	770	1274	856	1896	299	1112	893	1164	233	1206	681	1378	1598	1239	2068	796	1594	470	702	**24,902**
1997	821	1453	726	0	519	596	1043	745	1588	240	915	690	935	187	1046	518	1125	1326	993	1814	564	1388	253	561	**20,046**
1998	856	1569	1220	0	561	690	1162	757	1624	266	1057	785	999	208	1073	750	1187	1423	1055	1842	728	1425	417	580	**22,234**
1999	800	1469	1189	3	527	651	1084	685	1542	233	1012	750	935	192	1029	706	1059	1319	975	1632	662	1288	403	546	**20,691**
2000	995	1809	949	5	697	817	1345	909	1906	324	1186	948	1198	241	1216	795	1442	1671	1286	2186	819	1672	497	752	**25,665**
2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
2002	972	1839	1340	26	723	860	1353	832	1861	259	1360	1000	1056	219	1274	1009	1418	1676	1113	1972	919	1556	626	777	**26,040**
2003	1047	1909	1527	6	752	882	1405	926	2030	326	1256	1045	1230	248	1329	844	1548	1748	1297	2215	869	1717	577	814	**27,547**
2004	844	1529	1271	70	595	705	1131	775	1650	295	964	827	1045	215	1050	643	1259	1419	1106	1870	716	1426	488	672	**22,565**
2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
2006	1456	2661	2012	11	995	1166	1937	1324	2786	435	1794	1366	1653	334	1810	1185	2084	2437	1773	3129	1238	2418	740	1085	**37,829**
2007	1065	1903	1013	8	699	824	1393	996	2111	348	1168	959	1314	262	1318	718	1569	1766	1414	2457	839	1838	482	775	**27,239**
Average	**1,057**	**1,915**	**1,068**	**25**	**725**	**852**	**1,398**	**966**	**2,036**	**329**	**1,241**	**995**	**1,246**	**250**	**1,304**	**797**	**1,554**	**1,769**	**1,336**	**2,329**	**884**	**1,779**	**537**	**787**	**27,180**

Table B3 - Subcatchments
Yearly Runoff Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A102NE	0.1339	292	393	365	400	344	590	508	225	374	330	442	407	587	407	655	405	395	313	336	627	447	458	372	477	377	467	467	384	347	351	262	313	309	379	-	436	404	438	-	555	401	**411**
A103NE	0.1353	340	456	423	463	400	682	590	262	434	383	514	471	681	472	755	471	458	364	390	728	518	532	431	555	437	540	542	445	404	407	304	363	358	439	-	502	470	505	-	645	466	**477**
A103SW	0.0582	135	182	169	186	159	273	235	104	173	153	205	188	272	189	302	188	183	145	156	290	207	212	172	221	174	216	216	178	160	162	121	145	143	176	-	201	187	202	-	257	186	**190**
A104NE	0.1378	332	446	414	454	391	668	577	256	425	375	502	461	667	462	740	461	448	356	382	713	507	520	422	543	428	529	530	435	395	398	297	354	350	430	-	492	459	495	-	630	456	**467**
A104NW	0.0471	67	91	84	93	79	138	117	52	86	76	102	94	136	94	155	93	91	72	77	144	103	105	85	110	87	108	107	88	80	81	60	72	71	87	-	104	93	104	-	128	92	**95**
A104SE	0.0528	128	172	160	175	150	258	222	99	164	145	194	178	257	178	285	177	173	137	147	274	196	200	163	209	165	204	204	168	152	154	115	138	136	166	-	189	177	191	-	243	176	**180**
A104SW	0.0473	116	155	144	158	136	232	201	89	148	131	175	161	232	161	257	160	156	124	133	248	177	181	147	189	149	184	185	152	137	139	104	124	122	150	-	171	160	172	-	220	159	**163**
A105NE	0.0577	134	180	167	183	157	270	233	103	171	151	202	186	269	186	299	186	181	143	154	287	204	209	170	218	172	213	214	176	159	160	120	143	142	173	-	199	185	200	-	254	184	**188**
A105NW	0.1045	265	356	330	361	312	532	461	204	339	299	401	367	532	368	589	368	357	284	304	569	404	415	337	433	341	421	423	347	315	318	237	282	279	343	-	391	366	393	-	503	363	**372**
A105SE	0.0582	135	182	168	185	159	272	235	104	173	152	204	188	271	188	301	187	182	144	155	289	206	211	171	220	174	215	216	177	160	162	121	144	143	175	-	200	187	202	-	256	185	**190**
A105SW	0.1044	282	378	351	384	332	564	490	217	360	317	426	390	565	392	624	391	379	302	324	605	430	441	358	461	363	448	450	369	335	338	252	300	297	364	-	414	389	417	-	535	386	**395**
A106N1	0.0845	223	299	278	304	262	447	387	172	285	251	337	309	447	310	494	309	300	239	256	478	340	349	283	364	287	354	356	292	265	267	199	238	235	288	-	328	308	330	-	423	306	**313**
A106N2	0.0773	209	281	260	285	246	419	363	161	267	236	316	290	419	291	463	290	282	224	240	449	319	327	266	342	269	332	334	274	249	251	187	223	220	270	-	308	289	309	-	397	287	**293**
A106NE	0.0626	155	208	193	211	182	311	269	119	198	174	234	215	311	215	344	215	208	166	178	332	236	242	197	253	199	246	247	203	184	185	138	165	163	200	-	229	214	230	-	294	212	**217**
A106NW	0.0644	166	222	206	226	195	332	288	127	211	186	250	229	332	230	367	229	223	177	190	355	252	259	210	270	213	263	264	217	197	198	148	176	174	214	-	244	228	245	-	314	227	**232**
A106R1	0.0465	7	10	8	20	6	29	20	3	17	0	9	9	26	1	42	3	0	3	7	9	7	20	5	6	0	17	0	9	12	4	0	1	3	2	-	16	2	39	-	5	4	**10**
A106R2	0.1506	12	18	11	40	10	66	42	3	30	0	14	22	46	0	97	2	0	3	5	13	6	37	9	5	0	42	0	9	15	5	0	0	0	2	-	47	3	93	-	5	3	**18**
A106SE	0.073	200	268	249	272	235	400	347	154	255	225	302	277	400	278	442	277	269	214	230	429	305	313	254	327	257	317	319	262	238	240	179	213	211	259	-	294	276	295	-	379	274	**280**
A106SW	0.0666	174	233	216	237	204	348	302	134	222	196	263	241	348	242	385	241	234	186	200	373	265	272	221	284	224	276	277	228	206	208	155	185	183	225	-	256	240	258	-	330	238	**244**
A108N1	0.052	73	98	91	101	85	150	127	56	93	82	110	102	147	101	168	101	99	78	84	156	111	114	92	118	94	118	116	95	86	87	65	78	77	94	-	112	101	113	-	138	100	**103**
A108NE	0.0393	96	129	120	132	113	193	167	74	123	109	146	134	193	134	214	133	130	103	111	206	147	151	122	157	124	153	154	126	114	115	86	103	102	125	-	142	133	143	-	183	132	**135**
A108NW	0.0287	47	63	59	65	55	96	82	36	60	53	71	66	94	65	107	65	63	50	54	100	72	73	60	76	60	75	75	61	55	56	42	50	50	61	-	71	65	72	-	89	64	**66**
A108R1	0.2228	22	31	21	68	18	107	68	7	53	0	26	35	78	0	160	4	0	7	13	25	16	65	15	11	0	67	0	18	31	11	0	0	2	5	-	72	5	152	-	10	7	**31**
A108R2	0.1143	10	15	10	33	8	53	34	3	26	0	12	17	38	0	78	2	0	3	5	11	6	31	7	5	0	33	0	8	14	5	0	0	1	2	-	37	2	75	-	4	3	**15**
A108SE	0.1135	262	351	326	357	308	526	455	201	334	295	395	363	525	363	584	363	352	281	300	561	399	409	332	428	337	416	417	343	311	314	234	278	275	338	-	388	361	390	-	496	359	**367**
A108SW	0.0507	104	140	130	143	123	211	181	80	134	118	158	145	210	145	234	145	141	111	120	224	160	163	133	170	134	167	167	137	124	125	94	112	110	135	-	156	144	157	-	198	143	**147**
A109NE	0.0292	42	56	52	58	49	86	73	32	54	47	63	59	85	58	97	58	57	45	48	90	64	65	53	68	54	68	67	55	49	50	38	45	44	54	-	65	58	65	-	79	57	**59**
A109NW	0.0533	127	171	158	174	149	255	221	98	162	143	192	176	255	177	283	176	171	136	146	272	194	199	161	207	164	202	203	167	151	152	114	136	134	164	-	188	176	189	-	241	174	**178**
A109SE	0.0936	217	291	270	296	255	436	376	167	277	244	327	301	435	301	483	300	292	232	249	465	330	339	275	354	279	345	346	284	257	260	194	231	229	280	-	321	299	323	-	411	297	**304**
A110NE	0.1026	251	337	312	342	295	504	436	193	320	283	379	348	503	349	558	348	338	269	288	538	382	392	318	409	323	399	400	329	298	301	224	267	264	324	-	371	346	373	-	476	344	**352**
A110NW	0.0866	215	288	267	293	252	431	373	165	274	242	324	298	430	298	477	297	289	230	246	460	327	336	272	350	276	341	342	281	255	257	192	229	226	278	-	317	296	319	-	407	294	**301**
A110R1	0.0385	5	7	5	15	4	22	15	2	12	0	6	7	19	0	33	2	0	2	5	7	5	15	3	4	0	13	0	6	9	3	0	1	2	1	-	13	1	31	-	3	3	**7**
A110R10	0.0379	5	8	6	16	4	23	15	2	13	0	7	7	20	0	34	2	0	2	5	7	5	16	4	4	0	14	0	7	9	3	0	1	2	1	-	13	2	32	-	4	3	**8**
A110R2	0.0357	5	7	5	14	4	21	14	2	11	0	6	7	17	0	30	2	0	2	4	6	4	14	3	3	0	12	0	6	8	3	0	1	2	1	-	12	1	28	-	3	2	**7**
A110R3	0.0389	5	7	6	15	4	22	15	2	13	0	6	7	19	0	33	2	0	2	5	7	5	15	3	4	0	14	0	6	9	3	0	1	2	1	-	13	1	31	-	3	3	**7**
A110R4	0.0471	6	9	7	19	5	27	18	3	15	0	8	9	23	0	40	2	0	3	6	8	6	18	4	5	0	16	0	8	11	4	0	1	2	2	-	16	2	38	-	4	3	**9**
A110R5	0.0452	6	9	7	19	5	27	18	3	16	0	8	9	24	0	40	3	0	3	6	9	6	19	4	5	0	16	0	8	11	4	0	1	3	2	-	16	2	38	-	4	4	**9**
A110R6	0.0418	6	8	6	17	5	25	17	3	14	0	7	8	22	0	37	2	0	3	6	8	6	17	4	5	0	15	0	8	10	4	0	1	2	2	-	15	2	35	-	4	3	**8**
A110R7	0.0456	6	9	7	19	5	27	18	3	16	0	8	9	24	0	41	3	0	3	6	9	6	19	4	5	0	16	0	8	11	4	0	1	3	2	-	16	2	38	-	4	4	**9**
A110R8	0.0591	8	12	9	25	7	36	24	4	20	0	11	11	31	1	53	3	0	4	8	12	8	24	6	7	0	21	0	11	15	5	0	2	3	2	-	21	2	49	-	6	5	**12**
A110R9	0.0323	4	6	4	12	3	18	12	2	10	0	5	6	14	0	26	1	0	2	3	5	3	11	3	3	0	11	0	4	6	2	0	0	1	1	-	11	1	25	-	2	2	**6**
A110SE	0.0587	149	201	186	204	176	300	260	115	191	169	226	207	300	208	332	207	202	160	172	320	228	234	190	244	193	238	239	196	178	179	134	160	158	193	-	220	207	222	-	284	205	**210**
A110SW	0.0824	193	260	241	264	227	389	336	149	247	218	292	268	388	269	431	268	261	207	222	414	295	302	245	316	249	308	308	253	230	232	173	206	204	250	-	287	267	288	-	367	265	**271**
A111NW	0.0905	218	293	272	298	257	438	379	168	279	246	330	303	438	303	486	302	294	234	251	468	333	341	277	356	281	347	348	286	259	262	195	233	230	282	-	323	301	325	-	414	299	**306**
A111SE	0.0869	215	289	268	294	253	432	374	166	275	243	325	299	432	299	478	298	290	231	247	461	328	337	273	352	277	342	343	282	256	258	192	229	227	278	-	318	297	320	-	409	295	**302**
A112NE	0.1184	282	378	351	385	331	566	489	217	360	318	426	391	565	392	627	390	380	302	324	604	429	441	358	460	363	448	449	369	335	337	252	300	297	364	-	417	389	419	-	534	386	**395**
A112NW	0.0531	132	177	164	179	155	264	228	101	168	148	199	182	264	183	292	182	177	141	151	282	201	206	167	215	169	209	210	172	156	158	118	140	139	170	-	194	182	195	-	250	180	**185**
A112R3	0.0559	9	13	10	26	8	37	25	4	21	0	11	12	34	1	53	4	0	5	9	13	9	25	6	8	1	22	0	13	16	6	1	3	5	2	-	20	3	49	-	7	6	**13**
A112R4	0.0976	13	18	14	39	10	56	38	6	31	0	16	18	47	1	83	4	0	5	12	17	12	38	9	9	0	34	0	15	22	8	0	2	4	3	-	33	4	78	-	8	7	**18**
A112SE	0.1192	295	397	368	403	347	593	513	227	377	333	446	410	592	410	656	409	398	316	339	633	450	462	375	482	380	470	471	387	351	354	264	315	311	382	-	436	408	439	-	560	405	**414**
A112SW	0.0441	115	155	143	157	135	231	200	89	147	130	174	160	231	160	255	160	155	123	132	247	176	180	146	188	148	183	184	151	137	138	103	123	121	149	-	170	159	171	-	218	158	**162**
A112WK	0.0389	41	56	52	58	49	88	73	32	54	47	63	59	85	58	99	58	56	44	48	89	64	65	53	68	54	68	66	55	49	50	37	45	44	54	-	66	57	67	-	79	57	**59**
A113R1	0.1345	13	19	13	42	11	66	42	5	33	0	16	21	49	0	97	3	0	4	9	16	10	40	9	7	0	41	0	12	19	7	0	0	1	3	-	44	3	92	-	7	5	**20**
A113R2	0.0836	11	16	12	33	9	48	32	5	27	0	14	16	41	1	71	4	0	5	10	15	10	32	7	8	0	29	0	13	19	7	0	1	4	3	-	29	3	67	-	7	6	**16**
A114NE	0.0293	76	102	94	103	89	152	131	58	97	85	114	105	152	105	168	105	102	81	87	162	116	118	96	124	97	120	121	99	90	91	68	81	80	98	-	112	105	112	-	144	104	**106**
A114R1	0.0675	11	15	12	31	9	44	30	5	26	0	14	14	40	2	64	5	0	6	11	15	11	30	8	9	1	26	0	15	19	7	1	3	6	3	-	24	3	59	-	8	7	**15**
A114R2	0.0534	6	9	7	20	5	29	19	3	16	0	8	9	23	0	43	2	0	3	5	8	6	19	4	4	0	18	0	7	10	4	0	0	1	2	-	18	2	41	-	4	3	**9**
A114R3	0.0736	10	14	10	29	8	42	28	4	24	0	12	14	36	1	62	3	0	4	9	13	9	28	7	7	0	26	0	12	16	6	0	1	3	2	-	25	3	59	-	6	5	**14**
A114R4	0.1447	21	30	23	61	17	89	60	9	51	0	26	29	78	2	130	8	0	10	20	29	21	60	14	17	1	53	0	27	36	13	1	4	9	5	-	51	6	121	-	15	12	**30**
A114SE	0.1052	227	305	283	311	267	459	394	175	290	256	343	316	456	316	508	315	307	242	261	486	347	355	288	370	292	362	362	298	269	272	203	243	240	294	-	339	314	341	-	431	311	**319**
A114SW	0.1843	438	588	545	598	515	880	761	337	560	494	662	608	879	609	976	607	590	469	503	939	668	685	556	715	564	697	699	574	521	525	391	466	462	566	-	649	605	652	-	831	600	**615**
A115NE	0.08	188	252	234	256	221	377	326	145	240	212	284	261	377	261	418	260	253	201	216	402	286	294	238	306	242	299	299	246	223	225	168	200	198	243	-	278	259	280	-	356	257	**264**
A115NW	0.0502	125	168	155	170	147	250	216	96	159	141	189	173	250	173	277	173	168	133	143	267	190	195	158	203	161	198	199	163	148	149	112	133	132	161	-	184	172	185	-	237	171	**175**
A115R1	0.0441	5	8	6	16	4	24	16	2	13	0	7	8	19	0	36	1	0	2	4	7	5	16	4	4	0	15	0	6	9	3	0	0	1	1	-	15	1	34	-	3	3	**8**
A115R2	0.0429	6	8	6	17	5	25	16	2	14	0	7	8	21	0	36	2	0	2	5	8	5	17	4	4	0	15	0	7	10	3	0	1	2	1	-	15	2	34	-	4	3	**8**
A115R3	0.0346	4	6	5	14	4	20	13	2	11	0	6	6	17	0	29	1	0	2	4	6	4	13	3	3	0	12	0	5	8	3	0	1	1	1	-	12	1	28	-	3	2	**6**
A115R4	0.0355	5	7	5	15	4	21	14	2	12	0	6	7	19	0	32	2	0	2	5	7	5	15	3	4	0	13	0	6	9	3	0	1	2	1	-	12	1	30	-	4	3	**7**
A115R5	0.05	7	10	8	21	6	30	20	3	17	0	9	10	26	1	45	3	0	3	7	10	7	20	5	6	0	18	0	9	12	4	0	1	3	2	-	17	2	42	-	5	4	**10**
A115R6	0.0405	6	8	6	17	5	24	16	3	14	0	7	8	21	0	36	2	0	3	5	8	6	17	4	4	0	15	0	7	10	4	0	1	2	1	-	14	2	34	-	4	3	**8**
A115SE	0.0218	33	44	41	45	38	67	57	25	42	37	49	46	66	46	75	45	44	35	38	70	50	51	42	53	42	53	52	43	39	39	29	35	35	42	-	50	45	51	-	62	45	**46**
A115SW	0.0392	57	78	72	80	67	118	100	44	74	65	87	81	116	80	132	80	78	61	66	123	88	90	73	94	74	93	92	75	68	69	52	62	61	75	-	88	79	89	-	109	79	**81**
A115W1	0.0351	73	99	92	101	86	148	128	57	94	83	111	102	147	102	165	102	99	78	84	157	112	115	93	120	95	117	117	96	87	88	66	79	78	95	-	110	101	110	-	139	101	**103**
A116E1	0.037	75	101	93	103	88	152	130	58	96	85	113	104	151	104	168	104	101	80	86	160	114	117	95	122	96	120	120	98	89	90	67	80	79	97	-	112	104	113	-	142	103	**105**
A116NE	0.081	190	256	237	260	224	383	331	147	243	215	288	264	382	265	424	264	257	204	219	408	291	298	242	311	245	303	304	250	226	228	170	203	201	246	-	282	263	284	-	361	261	**267**
A116NW	0.0753	182	244	226	248	214	365	315	140	232	205	275	252	364	252	404	252	245	194	209	389	277	284	231	296	234	289	290	238	216	218	162	194	192	235	-	269	251	270	-	344	249	**255**
A116R1	0.1084	9	12	8	28	7	47	29	2	22	0	10	15	32	0	70	1	0	2	3	9	4	26	6	3	0	30	0	6	10	4	0	0	0	1	-	34	2	67	-	3	2	**13**
A116R2	0.1022	6	9	5	22	4	40	24	0	15	0	6	13	24	0	56	0	0	1	1	6	1	19	4	1	0	25	0	3	4	2	0	0	0	1	-	30	1	54	-	2	1	**10**
A116R3	0.0796	9	14	10	30	8	44	29	4	24	0	12	14	35	0	64	3	0	4	8	13	9	29	7	7	0	27	0	11	16	6	0	1	2	2	-	27	3	61	-	6	5	**14**
A116R4	0.059	7	10	7	22	6	32	21	3	17	0	9	10	26	0	47	2	0	3	6	9	6	21	5	5	0	20	0	8	11	4	0	0	2	2	-	20	2	45	-	4	3	**10**
A116R5	0.069	7	11	7	23	6	35	23	3	18	0	9	11	26	0	52	2	0	3	5	9	6	22	5	4	0	22	0	7	11	4	0	0	1	2	-	23	2	49	-	4	3	**11**
A116R6	0.066	9	13	10	28	8	40	27	4	23	0	12	13	35	1	59	4	0	4	9	13	9	27	6	7	0	24	0	12	16	6	0	2	4	2	-	23	3	55	-	7	5	**13**
A116R7	0.062	9	13	10	26	7	38	25	4	21	0	11	12	33	1	55	3	0	4	8	12	9	26	6	7	0	22	0	11	15	6	0	2	4	2	-	22	3	52	-	6	5	**13**
A116SE	0.0791	168	226	209	230	197	339	291	129	215	189	254	233	337	233	376	233	226	179	193	360	256	262	213	274	216	268	268	220	199	201	150	179	177	217	-	250	232	252	-	318	230	**236**
A116SW	0.0762	204	273	254	277	240	408	354	157	260	230	308	282	408	283	451	282	274	218	234	437	311	319	259	333	262	323	325	267	242	244	182	217	215	263	-	300	281	301	-	386	279	**286**
A117NE	0.0839	200	268	249	273	235	401	347	154	255	225	302	277	400	277	445	277	269	214	229	428	304	312	253	326	257	318	318	261	237	239	178	213	210	258	-	296	276	297	-	379	274	**280**
A117NW	0.0821	198	266	247	270	233	398	344	152	253	223	299	275	397	275	441	274	267	212	227	424	302	310	251	323	255	315	316	259	235	237	177	211	209	256	-	293	273	295	-	376	271	**278**
A117R1	0.085	8	12	8	27	7	42	27	3	21	0	10	14	31	0	61	2	0	3	5	10	6	25	6	5	0	26	0	7	12	4	0	0	1	2	-	28	2	58	-	4	3	**12**
A117R2	0.062	8	12	9	24	7	36	24	4	20	0	10	11	30	0	53	3	0	3	7	11	8	24	5	6	0	22	0	10	14	5	0	1	3	2	-	21	2	49	-	5	4	**12**
A117R3	0.094	13	19	15	39	11	57	38	6	33	0	17	18	50	1	84	5	0	6	13	19	13	39	9	11	1	34	0	17	23	8	1	3	6	3	-	33	4	78	-	9	8	**19**
A117R4	0.068	10	14	11	28	8	41	28	4	23	0	12	13	36	1	61	4	0	4	9	13	10	28	7	8	1	25	0	13	17	6	0	2	4	3	-	24	3	57	-	7	6	**14**
A117SE	0.0768	188	252	234	256	221	377	326	145	240	212	284	260	376	261	417	260	253	201	216	402	286	294	238	307	242	299	299	246	223	225	168	200	198	243	-	278	259	279	-	356	257	**264**
A117SW	0.0856	221	296	274	300	259	442	383	170	282	249	333	306	442	306	489	305	297	236	253	473	336	345	280	360	284	350	352	289	262	264	197	235	232	285	-	325	304	327	-	418	302	**309**
A117W1	0.079	204	274	254	278	240	409	354	157	260	230	308	283	408	283	452	282	275	218	234	437	311	319	259	333	262	324	325	267	242	244	182	218	215	264	-	300	282	302	-	387	279	**286**
A117W2	0.087	213	286	265	291	250	428	370	164	272	240	322	296	427	296	474	295	287	228	245	456	325	333	270	348	274	339	340	279	253	255	190	227	225	275	-	315	294	317	-	404	292	**299**
A119NE	0.1464	353	474	440	482	415	709	613	272	451	398	534	490	708	491	786	489	476	378	406	757	538	552	448	577	455	562	563	463	420	423	316	376	372	457	-	523	488	525	-	670	484	**496**
A119NW	0.1135	274	368	341	374	322	550	475	211	350	309	414	380	549	380	609	379	369	293	314	587	417	428	348	447	352	435	437	359	325	328	245	292	289	354	-	405	378	407	-	519	375	**384**
A119R1	0.16	3	9	4	23	2	47	23	0	12	0	3	14	25	0	69	0	0	0	0	4	0	16	2	0	0	28	0	1	0	0	0	0	0	0	-	43	0	61	-	1	0	**10**
A119R2	0.228	27	40	29	84	22	124	82	11	68	0	34	40	100	1	183	8	0	11	23	36	24	81	19	19	0	76	0	30	44	16	0	2	6	7	-	77	8	173	-	17	13	**39**
A119R3	0.147	16	23	16	50	13	76	50	6	40	0	19	25	59	0	112	4	0	6	12	20	13	48	11	10	0	47	0	16	25	9	0	1	2	4	-	49	4	106	-	9	7	**23**
A119SE	0.0602	143	193	179	196	169	288	249	111	183	162	217	199	288	200	320	199	194	153	165	308	219	224	182	234	185	228	229	188	170	172	128	153	152	186	-	212	198	214	-	272	197	**202**
A119SW	0.092	225	302	280	307	265	452	391	173	288	254	340	313	451	313	501	312	304	241	259	483	344	352	286	368	290	358	359	295	267	270	201	240	238	291	-	333	311	335	-	427	309	**316**
A121NE	0.062	111	150	139	153	131	227	194	86	143	126	168	156	224	155	253	154	151	119	128	239	170	174	141	181	143	179	178	146	132	134	100	120	118	144	-	168	154	170	-	211	153	**157**
A121NW	0.099	236	316	293	322	277	473	409	181	301	266	356	327	472	327	525	326	317	252	271	505	359	368	299	385	303	375	376	309	280	282	211	251	248	305	-	349	326	351	-	447	323	**331**
A121R1	0.042	5	7	5	14	4	22	14	2	11	0	6	7	17	0	32	1	0	2	3	6	4	14	3	3	0	13	0	4	7	3	0	0	1	1	-	14	1	30	-	3	2	**7**

Table B3 - Subcatchments

Yearly Runoff Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A121R2	0.072	8	12	9	26	7	39	26	4	21	0	11	13	31	0	58	2	0	3	7	11	8	26	6	6	0	24	0	9	14	5	0	1	2	2	-	24	2	55	-	5	4	**12**
A121R3	0.044	5	7	5	15	4	23	15	2	12	0	6	7	17	0	34	1	0	2	4	6	4	14	3	3	0	14	0	5	7	3	0	0	1	1	-	15	1	32	-	3	2	**7**
A121R4	0.059	6	9	7	20	5	31	20	2	16	0	8	10	23	0	44	2	0	2	4	7	5	19	5	4	0	19	0	6	9	3	0	0	1	2	-	20	2	42	-	3	3	**9**
A121S1	0.154	361	483	448	492	424	724	626	277	460	406	544	500	723	500	803	499	485	386	414	772	549	564	457	589	464	573	575	472	429	432	322	383	379	465	-	534	497	537	-	683	494	**506**
A121SE	0.122	226	305	283	312	266	461	395	175	290	256	343	317	457	316	513	314	307	242	261	486	347	355	288	370	292	363	362	298	269	272	203	243	240	294	-	342	314	344	-	431	311	**320**
A121SW	0.077	181	243	225	247	212	363	314	139	231	204	273	251	362	251	403	250	244	193	208	387	276	283	229	295	233	288	288	237	215	217	162	193	191	234	-	268	250	269	-	343	248	**254**
A122NE	0.1276	295	395	366	402	346	592	512	226	376	331	445	408	591	409	657	408	396	316	338	631	448	461	374	481	379	468	469	386	350	353	263	313	310	380	-	437	406	439	-	558	403	**413**
A122R1	0.0732	4	7	4	16	3	29	17	0	11	0	5	9	17	0	40	0	0	1	0	4	1	14	3	1	0	18	0	2	3	1	0	0	0	0	-	22	1	39	-	2	1	**7**
A122R2	0.2135	12	19	11	46	9	82	49	0	32	0	13	26	50	0	116	0	0	2	1	12	3	40	9	2	0	51	0	7	8	4	0	0	0	1	-	63	2	112	-	4	2	**20**
A124NE	0.0469	101	135	126	138	119	203	175	78	129	114	152	140	202	140	226	140	136	108	116	216	154	158	128	165	130	161	161	132	120	121	90	108	106	130	-	150	139	151	-	191	138	**142**
A124NW	0.131	312	419	389	426	367	627	542	240	399	352	472	433	626	434	695	432	421	334	359	669	476	488	396	509	402	497	498	409	370	374	279	333	329	404	-	462	431	465	-	592	428	**438**
A124R1	0.0918	11	16	12	34	9	50	33	5	27	0	14	16	40	0	74	3	0	4	9	14	10	33	8	8	0	31	0	12	18	6	0	1	3	3	-	31	3	70	-	7	5	**16**
A124R2	0.136	15	22	15	47	12	71	46	6	37	0	18	23	54	0	104	4	0	6	11	19	12	45	10	9	0	43	0	15	23	8	0	1	2	4	-	45	4	99	-	8	6	**22**
A124SE	0.0469	119	160	148	163	140	239	207	92	152	134	180	165	239	166	265	165	161	128	137	256	182	187	151	195	154	189	190	156	142	143	107	127	126	154	-	176	165	177	-	226	163	**167**
A124SW	0.136	351	471	437	478	412	703	609	270	448	395	530	486	702	487	777	486	472	375	403	752	535	548	445	572	451	557	559	459	416	420	313	374	370	453	-	517	484	520	-	665	481	**492**
A125E1	0.0575	90	121	113	125	106	185	157	69	116	102	136	126	182	125	206	125	122	96	103	193	138	141	114	147	116	145	144	118	106	108	81	97	95	117	-	138	124	139	-	171	124	**127**
A125NE	0.0478	115	155	144	158	136	232	201	89	148	130	175	160	232	161	257	160	156	124	133	248	176	181	147	189	149	184	184	151	137	138	103	123	122	150	-	171	160	172	-	219	158	**162**
A125NW	0.0931	234	314	291	319	275	469	406	180	298	263	353	324	468	325	519	324	315	250	268	501	356	366	297	382	301	371	373	306	278	280	209	249	246	302	-	345	323	347	-	443	320	**328**
A125R1	0.1047	12	18	13	39	10	57	38	5	31	0	16	18	46	0	84	3	0	5	11	16	11	37	9	9	0	35	0	14	21	7	0	1	3	3	-	35	3	80	-	8	6	**18**
A125R2	0.1093	13	19	14	40	11	59	39	5	32	0	16	19	48	0	88	4	0	5	11	17	12	39	9	9	0	36	0	14	21	8	0	1	3	3	-	37	4	83	-	8	6	**19**
A125SE	0.0476	124	167	155	170	146	249	216	96	159	140	188	173	249	173	276	172	168	133	143	267	190	195	158	203	160	198	199	163	148	149	111	133	131	161	-	183	172	184	-	236	171	**175**
A125SW	0.0931	246	330	306	335	289	492	427	189	314	277	372	341	492	342	545	341	331	263	282	527	375	385	312	401	317	390	392	322	292	295	220	262	259	318	-	362	339	364	-	466	337	**345**
A126E1	0.0331	88	118	109	119	103	175	152	67	112	99	132	121	175	122	194	121	118	94	101	188	134	137	111	143	113	139	140	115	104	105	78	93	92	113	-	129	121	130	-	166	120	**123**
A126NE	0.0333	51	69	64	71	60	105	89	39	65	58	77	72	103	71	117	71	69	54	59	109	78	80	65	83	66	82	81	67	60	61	46	55	54	66	-	78	71	79	-	97	70	**72**
A126NW	0.0258	39	52	48	54	45	80	67	30	50	44	58	54	78	54	89	54	52	41	44	83	59	61	49	63	50	62	62	51	46	46	35	42	41	50	-	59	53	60	-	73	53	**55**
A126R1	0.0977	11	16	11	33	9	51	33	4	27	0	13	16	39	0	75	3	0	4	8	13	9	32	7	7	0	31	0	10	16	6	0	0	2	3	-	32	3	71	-	6	5	**16**
A126SE	0.032	64	86	80	88	75	130	111	49	82	72	97	89	128	89	144	88	86	68	73	137	98	100	81	104	82	102	102	84	76	77	57	69	68	83	-	96	88	96	-	121	88	**90**
A126SW	0.0259	50	67	62	69	59	101	87	39	64	56	76	70	100	70	113	69	68	53	57	107	76	78	63	81	64	80	80	66	59	60	45	54	53	65	-	75	69	76	-	95	69	**70**
A126W1	0.0767	195	262	243	266	230	392	339	150	250	220	295	271	391	272	433	271	263	209	224	419	298	305	248	319	251	311	312	256	232	234	175	208	206	253	-	288	270	290	-	371	268	**274**
A129NE	0.1715	408	547	507	556	479	819	708	314	521	459	616	566	818	566	908	565	549	437	468	874	621	638	517	666	525	648	650	534	484	488	364	434	429	527	-	604	563	607	-	773	558	**572**
A129NW	0.0657	158	213	197	216	186	318	275	122	202	179	240	220	318	220	353	220	214	170	182	340	242	248	201	259	204	252	253	208	188	190	142	169	167	205	-	234	219	236	-	301	217	**222**
A129R1	0.123	15	21	16	45	12	67	44	6	37	0	18	22	54	1	99	4	0	6	12	19	13	44	10	10	0	41	0	16	24	9	0	1	3	4	-	42	4	94	-	9	7	**21**
A129R2	0.1272	14	20	14	43	11	65	43	5	34	0	17	21	50	0	97	3	0	5	10	17	11	41	10	9	0	40	0	13	21	8	0	0	2	3	-	42	4	92	-	8	6	**20**
A129SE	0.097	187	252	233	257	220	379	325	144	239	211	283	261	376	260	422	259	253	200	215	400	286	292	237	305	241	299	298	245	221	224	168	200	198	242	-	281	258	283	-	355	256	**263**
A129SW	0.0642	155	208	193	211	182	311	269	119	198	175	234	215	310	215	345	215	209	166	178	332	236	242	197	253	199	246	247	203	184	186	138	165	163	200	-	229	214	230	-	294	212	**217**
A130NE	0.15	372	499	463	507	437	746	645	286	475	419	562	516	745	516	826	515	501	398	427	797	566	581	472	607	478	591	593	487	442	445	332	396	392	480	-	549	513	552	-	705	509	**522**
A130NW	0.047	112	151	140	153	132	226	195	86	143	127	170	156	225	156	250	155	151	120	129	240	171	175	142	183	144	179	179	147	133	134	100	120	118	145	-	166	155	167	-	213	154	**158**
A130R1	0.175	19	28	20	60	16	91	59	7	47	0	23	29	70	0	134	5	0	7	14	24	16	57	13	12	0	56	0	19	29	11	0	1	3	5	-	58	5	127	-	11	8	**28**
A130SE	0.147	345	463	430	471	406	693	599	266	441	389	521	479	692	480	769	478	465	369	396	739	526	540	438	563	444	549	550	452	410	413	308	368	364	446	-	511	477	514	-	654	473	**484**
A130SW	0.055	136	183	170	186	160	274	237	105	174	154	206	189	274	190	303	189	184	146	157	293	208	214	173	223	176	217	218	179	162	164	122	146	144	177	-	202	189	203	-	259	187	**192**
A132N1	0.029	43	59	54	60	51	89	76	34	56	49	66	61	88	61	100	60	59	46	50	93	67	68	55	71	56	70	69	57	51	52	39	47	46	56	-	67	60	67	-	83	60	**61**
A132NE	0.028	50	68	63	69	59	102	87	39	64	57	76	70	101	70	114	70	68	54	58	108	77	79	64	82	65	81	80	66	60	60	45	54	53	65	-	76	70	77	-	95	69	**71**
A132NW	0.033	86	116	108	118	102	173	150	67	110	97	131	120	173	120	191	120	117	92	99	185	132	135	110	141	111	137	138	113	102	104	77	92	91	112	-	127	119	128	-	164	118	**121**
A132R1	0.088	10	14	10	30	8	46	30	4	24	0	12	15	35	0	67	2	0	4	7	12	8	29	7	6	0	28	0	9	15	5	0	0	1	2	-	29	3	64	-	5	4	**14**
A132R2	0.1119	12	18	12	38	10	58	38	5	30	0	15	19	44	0	85	3	0	4	9	15	10	36	8	8	0	36	0	12	19	7	0	0	2	3	-	37	3	81	-	7	5	**18**
A132R3	0.1145	13	20	14	42	11	62	41	6	34	0	17	20	50	0	92	4	0	5	11	18	12	41	9	9	0	38	0	15	22	8	0	1	3	3	-	39	4	87	-	8	6	**20**
A132R4	0.101	12	17	13	37	10	55	36	5	30	0	15	18	44	0	81	3	0	5	10	16	11	36	8	8	0	34	0	13	20	7	0	1	3	3	-	34	3	77	-	7	6	**17**
A132SE	0.033	62	84	78	86	73	127	109	48	80	71	95	87	126	87	141	87	85	67	72	134	96	98	79	102	81	100	100	82	74	75	56	67	66	81	-	94	86	95	-	119	86	**88**
A132SW	0.048	111	149	138	152	131	223	193	86	142	125	168	154	223	154	248	154	150	119	128	238	169	174	141	181	143	177	177	146	132	133	99	118	117	144	-	165	153	166	-	211	152	**156**
A133NE	0.0433	53	72	67	75	63	111	93	41	69	60	81	75	108	74	125	74	72	57	61	114	82	84	68	87	69	87	85	70	63	64	48	58	57	69	-	84	74	84	-	101	73	**76**
A133NW	0.0948	117	158	146	163	137	243	204	90	150	132	177	165	238	163	274	162	159	125	134	250	179	183	149	190	151	190	187	154	138	140	105	126	124	152	-	183	162	185	-	222	161	**166**
A133SE	0.06	52	70	65	73	61	110	91	40	67	59	79	74	107	72	127	72	71	55	60	111	80	81	66	85	67	85	83	68	62	62	47	56	55	68	-	85	72	85	-	99	71	**74**
A133SW	0.132	114	155	143	161	134	243	201	88	147	129	173	162	234	159	280	159	155	122	131	245	175	179	146	186	147	188	183	150	135	137	103	123	122	149	-	187	158	188	-	217	157	**163**
A133W1	0.0432	53	72	67	74	63	111	93	41	69	60	81	75	108	74	125	74	72	57	61	114	82	83	68	87	69	87	85	70	63	64	48	57	57	69	-	84	74	84	-	101	73	**76**
A133W2	0.06	52	70	65	73	61	110	91	40	67	59	79	74	107	72	127	72	71	55	60	111	80	81	66	85	67	85	83	68	62	62	47	56	55	68	-	85	72	85	-	99	71	**74**
A133W3	0.0616	86	116	108	120	101	178	151	67	111	98	130	122	175	120	200	120	117	92	99	185	132	135	110	140	111	140	138	113	102	104	78	93	92	112	-	133	119	134	-	164	118	**122**
A133W4	0.088	88	119	110	123	103	185	154	68	113	100	133	124	180	123	211	122	119	94	101	189	135	138	112	143	113	144	141	116	104	106	79	95	93	114	-	141	122	142	-	167	121	**125**
A134NE	0.047	34	47	43	49	40	74	61	27	44	39	52	49	71	48	86	48	47	37	40	74	53	54	44	56	44	57	55	45	41	41	31	37	37	45	-	58	48	58	-	65	47	**49**
A134NW	0.126	117	159	147	165	138	248	206	91	151	133	178	166	240	164	285	163	159	125	135	252	180	184	150	191	152	193	188	155	139	141	106	127	125	153	-	191	163	191	-	223	162	**168**
A134SE	0.025	36	48	45	50	42	74	63	28	46	41	54	50	73	50	83	50	49	38	41	77	55	56	46	58	46	58	57	47	42	43	32	39	38	47	-	55	50	56	-	68	49	**51**
A134SW	0.115	115	156	144	162	135	242	202	89	148	130	174	163	235	160	276	159	156	123	132	246	176	180	146	187	148	188	184	151	136	138	103	124	122	149	-	185	159	186	-	218	158	**164**
A135R1	0.023	3	4	3	9	2	13	8	1	7	0	3	4	10	0	19	1	0	1	2	4	2	8	2	2	0	8	0	3	5	2	0	0	1	1	-	8	1	18	-	2	1	**4**
A136NE	0.031	57	76	71	78	67	115	99	44	73	64	86	79	114	79	128	79	77	61	65	121	87	89	72	92	73	91	91	74	67	68	51	61	60	74	-	86	78	86	-	108	78	**80**
A136NE1	0.024	43	58	54	60	51	88	75	33	55	49	65	60	87	60	98	60	59	46	50	93	66	68	55	70	56	69	69	57	51	52	39	46	46	56	-	65	60	66	-	82	59	**61**
A136NW	0.039	99	134	124	136	117	199	173	77	127	112	150	138	199	138	221	138	134	106	114	213	152	156	126	162	128	158	159	130	118	119	89	106	105	129	-	147	137	148	-	189	136	**140**
A136NW1	0.025	45	61	56	62	53	92	78	35	58	51	68	63	91	63	102	62	61	48	52	96	69	70	57	73	58	72	72	59	53	54	40	48	48	58	-	68	62	68	-	85	62	**63**
A136NW2	0.033	84	113	105	115	99	169	146	65	108	95	127	117	169	117	187	117	114	90	97	181	129	132	107	137	109	134	135	111	100	101	75	90	89	109	-	124	117	125	-	160	116	**118**
A136R1	0.034	5	7	6	15	4	21	14	2	12	0	6	7	19	0	31	2	0	2	5	7	5	14	3	4	0	13	0	7	9	3	0	1	2	1	-	12	1	29	-	4	3	**7**
A136SE	0.028	42	57	52	58	49	86	73	32	54	47	63	59	85	58	97	58	57	45	48	90	64	66	53	68	54	68	67	55	50	50	38	45	45	54	-	65	58	65	-	80	58	**59**
A201NE	0.1387	321	431	400	438	377	645	558	247	410	362	485	446	644	446	716	445	433	344	369	688	489	502	407	524	413	511	512	420	381	385	287	342	338	415	-	476	443	479	-	609	440	**451**
A201S1	0.098	249	335	310	340	293	500	433	192	318	281	377	345	499	346	553	345	336	267	286	534	380	390	316	407	321	396	397	326	296	299	223	265	263	322	-	368	344	370	-	473	342	**350**
A201SW	0.133	334	448	416	455	393	670	580	257	426	376	505	463	669	464	741	463	450	358	383	716	509	522	424	545	430	531	532	437	397	400	298	356	352	432	-	493	461	495	-	633	458	**468**
A203NE	0.103	238	318	295	324	279	477	413	182	303	267	358	329	476	329	529	329	319	254	272	509	361	371	301	388	306	377	378	311	282	284	212	252	249	306	-	352	327	353	-	450	325	**333**
A203NW	0.098	217	292	271	298	256	439	378	168	278	246	329	303	437	303	486	301	294	233	250	466	332	340	276	355	280	347	347	285	258	261	195	233	230	282	-	324	301	326	-	413	298	**306**
A203R1	0.116	5	9	5	21	3	41	23	0	14	0	5	13	23	0	57	0	0	1	0	5	0	18	3	0	0	25	0	2	1	1	0	0	0	0	-	33	0	54	-	2	0	**9**
A203R2	0.088	6	9	6	22	5	37	23	1	16	0	7	12	25	0	54	1	0	2	2	7	3	20	5	2	0	23	0	5	7	3	0	0	0	1	-	27	1	52	-	2	1	**10**
A203R3	0.111	12	18	12	38	10	57	37	5	30	0	15	19	44	0	85	3	0	4	9	15	10	36	8	8	0	35	0	12	19	7	0	0	2	3	-	37	3	80	-	7	5	**17**
A204E1	0.1535	370	498	461	506	436	744	643	285	473	418	560	514	743	515	824	513	499	397	426	794	565	580	470	605	477	589	591	485	440	444	331	395	391	479	-	548	512	551	-	703	508	**520**
A204E2	0.1536	401	538	499	546	471	803	696	309	512	452	606	556	803	557	888	556	540	429	461	859	611	627	509	655	516	637	639	525	476	480	358	427	423	518	-	590	554	594	-	760	550	**562**
A204NE	0.096	250	336	312	341	294	502	435	193	320	282	378	347	502	348	555	347	337	268	288	537	382	392	318	409	322	398	399	328	298	300	224	267	264	324	-	369	346	371	-	475	343	**351**
A204NW	0.107	276	370	344	376	324	553	479	212	352	311	417	383	553	384	612	382	372	295	317	591	422	432	350	450	355	438	440	362	328	331	247	294	291	357	-	407	381	409	-	523	378	**387**
A204R1	0.136	15	22	15	47	12	71	46	6	37	0	18	23	54	0	104	4	0	6	11	19	12	45	10	9	0	43	0	15	23	8	0	1	2	4	-	45	4	99	-	8	6	**22**
A204R2	0.0665	8	11	8	24	6	36	24	3	20	0	10	12	29	0	53	2	0	3	7	10	7	24	5	5	0	22	0	9	13	5	0	1	2	2	-	22	2	50	-	5	4	**11**
A204R3	0.1353	16	23	17	50	13	74	49	7	40	0	20	24	59	1	109	4	0	6	13	21	14	48	11	11	0	45	0	17	26	10	0	1	4	4	-	46	4	103	-	10	8	**23**
A204R4	0.0808	10	15	11	32	9	46	31	5	26	0	13	15	39	1	69	3	0	5	10	14	10	31	7	8	0	28	0	13	18	7	0	1	3	3	-	28	3	64	-	7	6	**15**
A204R5	0.0731	8	12	8	25	7	38	25	3	20	0	10	12	29	0	56	2	0	3	6	10	7	24	6	5	0	23	0	8	12	4	0	0	1	2	-	24	2	53	-	4	3	**12**
A204SE	0.096	235	315	292	320	276	471	408	181	300	265	355	326	471	326	522	325	316	251	270	503	358	367	298	383	302	373	374	307	279	281	210	250	247	303	-	347	324	349	-	445	322	**329**
A205SE	0.109	260	349	323	354	305	522	451	200	332	293	392	360	521	361	578	360	350	278	298	556	396	406	330	424	334	413	414	340	308	311	232	277	274	336	-	384	359	387	-	493	356	**365**
A205SW	0.037	49	67	62	69	58	102	86	38	63	56	75	69	100	69	115	68	67	53	57	106	76	77	63	80	64	80	79	65	58	59	44	53	52	64	-	77	68	77	-	94	68	**70**
A206NE	0.138	324	435	403	442	381	651	563	249	414	365	489	449	650	450	722	449	436	347	372	694	494	506	411	529	417	515	516	424	385	388	290	346	341	419	-	480	447	483	-	614	444	**455**
A206R1	0.078	9	13	10	29	7	43	28	4	23	0	11	14	34	0	61	2	0	4	7	11	8	27	6	6	0	26	0	10	14	5	0	0	2	2	-	27	3	58	-	5	4	**13**
A208NW	0.183	435	583	541	593	511	873	755	334	555	490	657	603	872	604	968	602	585	466	499	932	662	680	552	710	560	691	693	569	517	521	388	462	458	562	-	644	600	647	-	824	596	**610**
A208R1	0.092	10	15	10	32	8	48	31	4	25	0	12	16	37	0	70	2	0	4	8	13	8	30	7	6	0	29	0	10	16	6	0	0	2	2	-	31	3	67	-	6	4	**15**
A208R2	0.11408	12	18	13	39	10	59	38	5	31	0	15	19	45	0	87	3	0	5	9	15	10	37	9	8	0	36	0	12	19	7	0	0	2	3	-	38	3	82	-	7	5	**18**
A208R3	0.11995	14	21	15	44	12	65	43	6	35	0	18	21	52	1	96	4	0	6	12	19	13	43	10	10	0	40	0	15	23	8	0	1	3	4	-	40	4	91	-	9	7	**21**
A208R4	0.06381	8	11	8	23	6	35	23	3	19	0	9	11	28	0	51	2	0	3	6	10	7	23	5	5	0	21	0	8	12	4	0	1	2	2	-	21	2	48	-	5	4	**11**
A208R5	0.04895	6	8	6	18	5	27	18	2	14	0	7	9	21	0	39	2	0	2	5	8	5	17	4	4	0	16	0	6	10	3	0	0	1	1	-	16	2	37	-	4	3	**8**
A208R6	0.03693	4	7	5	14	4	20	14	2	11	0	6	7	17	0	30	1	0	2	4	6	4	13	3	3	0	12	0	5	7	3	0	0	1	1	-	13	1	28	-	3	2	**6**
A208SE	0.135	264	356	330	363	311	536	460	204	338	299	400	368	531	368	596	366	357	282	304	566	404	414	336	431	340	423	422	347	313	317	237	283	280	343	-	397	365	399	-	502	363	**372**
A209NW	0.1408	349	468	434	476	410	700	606	268	446	393	527	484	699	485	775	483	470	374	401	748	532	546	443	570	449	555	556	457	414	418	312	372	368	451	-	515	482	518	-	662	478	**490**
A209R1	0.05338	6	9	7	20	5	29	19	3	16	0	8	9	23	0	43	2	0	3	5	8	6	19	4	4	0	18	0	7	10	4	0	0	1	2	-	18	2	41	-	4	3	**9**
A209SE	0.11198	270	363	336	368	317	542	469	208	345	304	408	375	542	375	601	374	364	289	310	579	412	422	343	441	348	429	431	354	321	324	241	288	285	349	-	400	373	402	-	512	370	**379**
A210NW	0.0605	96	130	121	134	114	198	169	75	124	109	146	136	195	135	221	134	131	103	111	207	148	151	123	158	125	156	154	127	114	116	87	104	103	126	-	148	134	149	-	184	133	**137**
A210SE	0.1357	323	433	401	440	379	648	560	248	412	363	487	447	647	448	718	447	434	345	370	691	491	504	409	527	415	513	514	422	383	386	288	343	340	417	-	477	445	480	-	611	442	**453**

Table B3 - Subcatchments

Yearly Runoff Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A211R1	0.0326	4	5	4	11	3	17	11	1	9	0	4	6	13	0	25	1	0	1	3	5	3	11	3	2	0	11	0	4	6	2	0	0	1	1	-	11	1	24	-	2	2	**5**
A211R2	0.1526	15	22	15	48	12	74	48	5	37	0	18	24	55	0	110	3	0	5	10	18	11	45	11	8	0	46	0	13	22	8	0	0	2	3	-	50	4	105	-	7	5	**22**
A211R3	0.08025	2	5	3	13	1	26	14	0	7	0	2	8	14	0	36	0	0	0	0	3	0	10	2	0	0	16	0	1	0	0	0	0	0	0	-	22	0	33	-	1	0	**6**
A213NE	0.1207	287	385	357	391	337	576	498	221	366	323	433	398	575	399	639	397	386	307	329	615	437	449	364	468	369	456	457	376	341	344	256	305	302	371	-	425	396	427	-	544	393	**403**
A214NE	0.1165	289	387	359	393	339	579	501	222	369	325	436	400	578	401	641	400	389	309	331	618	440	451	366	471	372	459	460	378	343	346	258	307	304	373	-	426	398	428	-	547	395	**405**
A214NW	0.119	291	391	362	397	342	584	505	224	372	328	440	404	583	404	647	403	392	312	334	624	443	455	369	475	375	463	464	381	346	349	260	310	307	376	-	430	402	432	-	552	399	**408**
A214SE	0.0937	174	235	218	240	205	355	303	134	223	197	264	243	351	243	394	242	236	186	200	374	267	273	222	284	225	279	278	229	207	209	156	187	185	226	-	263	241	265	-	331	239	**246**
A214SW	0.1075	256	343	319	349	301	514	444	197	327	288	387	355	513	356	570	354	345	274	294	548	390	400	325	418	329	407	408	335	304	306	229	273	270	331	-	379	353	381	-	485	351	**359**
A215NE	0.0554	83	112	104	115	98	171	145	64	107	94	126	117	168	116	191	115	113	89	95	178	127	130	106	135	107	134	133	109	98	100	75	89	88	108	-	128	115	129	-	158	114	**117**
A215NW	0.0554	83	112	104	115	98	171	145	64	107	94	126	117	168	116	191	115	113	89	95	178	127	130	106	135	107	134	133	109	98	100	75	89	88	108	-	128	115	129	-	158	114	**117**
A215SE	0.0271	65	87	81	88	76	130	112	50	83	73	98	90	130	90	144	90	87	69	74	139	99	101	82	106	83	103	103	85	77	78	58	69	68	84	-	96	89	96	-	123	89	**91**
A215SW	0.063	148	199	184	202	174	298	257	114	189	167	224	206	297	206	330	205	200	158	170	317	226	232	188	242	191	236	236	194	176	177	132	158	156	192	-	219	205	221	-	281	203	**208**
A216E1	0.0308	46	62	58	64	54	95	80	36	59	52	70	65	93	64	106	64	63	49	53	99	71	72	59	75	59	74	74	61	55	55	41	50	49	60	-	71	64	71	-	88	63	**65**
A216NE	0.0918	222	298	276	303	261	445	385	171	283	250	335	308	444	308	493	307	299	237	255	475	338	347	281	362	285	353	354	291	263	266	198	237	234	287	-	328	306	330	-	421	304	**311**
A216NW	0.0893	218	293	272	298	257	438	379	168	279	246	330	303	438	303	485	303	294	234	251	468	333	341	277	356	281	347	348	286	259	262	195	233	230	282	-	323	301	324	-	414	299	**306**
A216R1	0.048	5	7	5	15	4	23	15	2	12	0	6	8	17	0	35	1	0	2	3	6	3	14	3	3	0	15	0	4	7	2	0	0	0	1	-	16	1	33	-	2	2	**7**
A216R2	0.0407	4	6	4	13	3	20	13	1	10	0	5	6	15	0	29	1	0	1	3	5	3	12	3	2	0	12	0	4	6	2	0	0	0	1	-	13	1	28	-	2	1	**6**
A216R3	0.0597	8	12	9	24	7	35	24	4	20	0	10	11	31	1	53	3	0	4	8	12	8	24	6	6	0	21	0	10	14	5	0	1	3	2	-	21	2	49	-	6	5	**12**
A216R4	0.0548	8	11	8	22	6	32	22	3	18	0	10	10	28	1	49	3	0	3	7	11	8	22	5	6	0	20	0	10	13	5	0	1	3	2	-	19	2	45	-	5	4	**11**
A216SE	0.0888	229	308	285	312	269	459	398	176	293	258	346	318	459	318	508	317	309	245	263	491	349	358	291	374	295	364	365	300	272	274	205	244	242	296	-	338	316	340	-	435	314	**321**
A216SW	0.0924	241	323	300	328	283	483	418	185	308	272	364	334	483	335	534	334	325	258	277	517	367	377	306	394	310	383	384	316	286	289	215	257	254	312	-	355	333	357	-	457	330	**338**
A217NE	0.1516	366	491	455	499	430	734	635	281	467	412	553	507	733	508	814	507	493	392	420	784	558	572	464	597	471	582	583	479	434	438	327	390	385	473	-	541	505	544	-	694	501	**513**
A217NW	0.0784	189	254	235	258	222	380	328	146	242	213	286	262	379	263	421	262	255	203	217	405	288	296	240	309	243	301	302	248	225	227	169	202	199	245	-	280	261	281	-	359	259	**265**
A217R1	0.0605	6	9	6	19	5	30	19	2	15	0	7	10	22	0	44	1	0	2	4	7	4	18	4	3	0	18	0	5	9	3	0	0	1	1	-	20	2	42	-	3	2	**9**
A217R2	0.068	7	11	7	23	6	35	23	3	18	0	9	11	27	0	52	2	0	3	5	9	6	22	5	5	0	22	0	7	11	4	0	0	1	2	-	22	2	49	-	4	3	**11**
A217R3	0.0677	7	11	7	23	6	35	23	3	18	0	9	11	26	0	51	2	0	3	5	9	6	22	5	4	0	21	0	7	11	4	0	0	1	2	-	22	2	49	-	4	3	**11**
A217R4	0.0502	5	7	5	16	4	24	16	2	12	0	6	8	18	0	36	1	0	2	3	6	4	15	3	3	0	15	0	4	7	3	0	0	1	1	-	16	1	34	-	2	2	**7**
A217R5	0.0836	12	17	12	34	10	49	33	5	28	0	15	16	43	1	74	4	0	5	11	16	12	34	8	9	1	30	0	15	20	7	0	2	5	3	-	29	3	69	-	8	6	**17**
A217R6	0.0875	12	17	13	36	10	52	35	6	29	0	15	17	45	1	78	5	0	5	11	17	12	35	8	9	1	31	0	15	21	8	0	2	5	3	-	30	3	72	-	8	7	**17**
A217R7	0.086	12	17	13	35	10	51	34	5	29	0	15	16	44	1	76	5	0	5	11	17	12	35	8	9	1	31	0	15	21	8	0	2	5	3	-	30	3	71	-	8	7	**17**
A217R8	0.0631	9	13	9	26	7	37	25	4	21	0	11	12	32	1	56	3	0	4	8	12	9	25	6	7	0	23	0	11	15	6	0	2	4	2	-	22	2	52	-	6	5	**13**
A217SE	0.1515	395	530	492	538	465	792	686	304	505	445	597	548	792	549	876	548	532	423	454	847	602	618	502	645	509	628	630	518	470	473	353	421	416	511	-	582	546	585	-	749	542	**554**
A217SW	0.0784	212	285	264	289	250	425	368	163	271	239	321	294	425	295	469	294	286	227	244	455	323	332	269	347	273	337	338	278	252	254	190	226	224	274	-	312	293	314	-	402	291	**298**
A218NE	0.0513	117	158	146	160	138	236	204	90	150	132	177	163	235	163	262	163	158	125	135	251	179	183	149	191	151	187	187	154	139	141	105	125	124	152	-	174	162	175	-	223	161	**165**
A218SE	0.0517	130	175	162	178	153	261	226	100	166	147	197	181	261	181	289	180	176	139	150	279	199	204	165	212	168	207	208	171	154	156	116	139	137	168	-	192	180	193	-	247	178	**183**
A218W3	0.036	74	100	92	102	87	150	129	57	95	84	112	103	149	103	166	103	100	79	85	159	113	116	94	121	95	118	118	97	88	89	66	79	78	96	-	111	102	111	-	141	102	**104**
A220NE	0.0464	127	171	158	173	150	254	221	98	162	143	192	176	255	177	281	176	171	136	146	273	194	199	162	208	164	202	203	167	151	152	114	136	134	165	-	187	176	188	-	241	174	**178**
A220NW	0.0577	115	155	144	158	135	234	200	89	147	130	174	161	231	160	259	160	156	123	132	247	176	180	146	188	148	184	184	151	136	138	103	124	122	149	-	173	159	174	-	219	158	**162**
A220SW	0.1254	314	422	391	428	370	630	546	242	401	354	475	435	630	436	698	435	423	337	361	674	479	492	399	513	404	499	501	412	374	376	281	334	331	406	-	464	434	466	-	596	430	**441**
A221NE	0.0326	82	110	102	112	96	165	142	63	105	93	124	114	164	114	182	114	111	88	94	176	125	128	104	134	106	130	131	108	97	98	73	88	87	106	-	121	113	122	-	156	113	**115**
A221SE	0.0561	82	111	103	114	97	169	143	63	106	93	124	116	166	115	190	114	111	88	95	176	126	129	105	134	106	133	131	108	97	99	74	89	87	107	-	127	114	128	-	156	113	**116**
A222E1	0.0245	36	48	45	50	42	74	63	28	46	41	54	50	73	50	83	50	49	38	41	77	55	56	46	58	46	58	57	47	42	43	32	39	38	47	-	55	50	56	-	68	49	**51**
A222E2	0.0438	109	146	135	148	128	218	188	84	139	122	164	151	218	151	241	150	146	116	125	233	165	170	138	177	140	173	173	142	129	130	97	116	114	140	-	160	150	161	-	206	149	**152**
A222E3	0.0327	48	65	60	67	56	99	84	37	62	54	72	67	97	67	111	66	65	51	55	103	73	75	61	78	62	77	77	63	57	58	43	52	51	62	-	74	66	74	-	91	66	**68**
A222E4	0.1176	288	386	358	392	338	577	499	221	367	324	435	399	576	400	639	398	387	308	330	616	438	450	365	469	370	457	459	377	342	344	257	306	303	372	-	425	397	427	-	545	394	**404**
A222NE	0.0643	157	211	196	215	185	316	273	121	201	178	238	219	316	219	350	219	212	168	181	337	240	246	200	257	203	250	251	206	187	189	141	168	166	204	-	233	217	234	-	299	216	**221**
A222NW	0.1299	322	432	401	439	378	646	559	248	411	363	486	446	645	447	715	446	434	345	370	690	491	503	409	525	414	512	513	422	382	386	288	343	339	416	-	475	444	478	-	611	441	**452**
A222R1	0.0305	4	5	4	11	3	17	11	2	9	0	4	5	13	0	25	1	0	1	3	5	3	11	2	2	0	10	0	4	6	2	0	0	1	1	-	10	1	23	-	2	2	**5**
A222R2	0.0477	6	9	7	19	5	27	18	3	15	0	8	9	23	0	40	2	0	3	6	9	6	18	4	5	0	17	0	8	11	4	0	1	2	2	-	16	2	38	-	4	3	**9**
A222R3	0.0352	5	7	5	14	4	20	14	2	11	0	6	7	17	0	30	2	0	2	4	6	4	14	3	3	0	12	0	6	8	3	0	1	2	1	-	12	1	28	-	3	2	**7**
A222R4	0.1161	14	20	15	43	11	64	42	6	35	0	17	20	51	1	94	4	0	6	12	18	12	42	10	10	0	39	0	15	23	8	0	1	3	3	-	39	4	88	-	8	7	**20**
A222R5	0.095	12	18	14	37	10	55	37	5	31	0	16	18	46	1	81	4	0	5	11	17	12	37	8	9	0	33	0	15	21	8	0	2	4	3	-	33	4	76	-	8	6	**18**
A222R6	0.1075	14	20	15	42	11	62	41	6	35	0	18	20	52	1	91	5	0	6	13	19	13	41	10	10	0	37	0	17	24	9	0	2	5	4	-	37	4	86	-	9	7	**20**
A222R7	0.0913	12	17	13	36	10	53	35	5	29	0	15	17	44	1	78	4	0	5	11	16	11	35	8	9	0	32	0	14	20	7	0	2	4	3	-	31	3	73	-	8	6	**17**
A222R8	0.1058	14	20	15	42	11	61	41	6	34	0	17	20	51	1	90	5	0	6	13	19	13	41	9	10	0	37	0	17	23	9	0	2	5	4	-	36	4	84	-	9	7	**20**
A222R9	0.1117	13	19	14	41	11	61	40	6	33	0	17	20	49	0	90	4	0	5	11	18	12	40	9	9	0	37	0	15	22	8	0	1	3	3	-	38	4	85	-	8	6	**19**
A222SE	0.0762	181	243	226	247	213	364	315	140	232	204	274	252	364	252	404	251	244	194	208	389	276	284	230	296	233	288	289	238	215	217	162	193	191	234	-	269	250	270	-	344	248	**255**
A222SW	0.1301	318	427	396	434	374	639	552	245	406	358	481	441	638	442	707	441	428	341	365	682	485	498	404	519	410	506	507	417	378	381	284	339	335	411	-	470	439	473	-	603	436	**446**
A223NE	0.0668	163	220	204	223	192	329	284	126	209	185	247	227	328	227	364	227	221	175	188	351	250	256	208	267	211	260	261	214	194	196	146	175	173	212	-	242	226	243	-	310	224	**230**
A223SE	0.0645	162	218	202	221	191	326	282	125	207	183	245	225	325	226	360	225	219	174	186	348	248	254	206	265	209	258	259	213	193	194	145	173	171	210	-	239	224	241	-	308	222	**228**
A223SW	0.0711	146	197	182	201	172	296	254	113	187	165	221	204	294	204	329	203	198	156	168	313	224	229	186	238	188	234	233	192	173	175	131	157	155	190	-	219	202	220	-	278	201	**206**
A224NE	0.0624	141	189	176	193	165	284	244	108	180	159	213	196	282	196	315	195	190	150	162	302	215	220	179	230	181	224	225	185	167	169	126	151	149	182	-	209	195	211	-	267	193	**198**
A224NW	0.0992	252	338	314	344	297	506	438	194	322	284	381	350	505	350	560	349	340	270	290	541	384	394	320	412	325	401	402	330	300	302	225	269	266	326	-	372	348	374	-	478	346	**354**
A224R1	0.1117	12	18	12	38	10	58	38	5	30	0	15	19	45	0	85	3	0	5	9	15	10	37	9	8	0	36	0	12	19	7	0	0	2	3	-	37	3	81	-	7	5	**18**
A224R2	0.032	5	7	6	15	4	21	14	2	12	0	6	7	19	1	30	2	0	3	5	7	5	14	4	4	0	12	0	7	9	3	0	1	3	1	-	11	1	28	-	4	3	**7**
A224SW	0.0581	89	120	111	123	105	183	155	69	114	101	135	125	180	124	204	123	121	95	102	191	136	139	113	145	115	144	142	117	105	107	80	96	94	116	-	137	123	138	-	169	122	**126**
A225NE	0.0682	111	150	139	154	131	228	194	86	143	126	168	156	225	155	254	154	151	119	128	239	170	174	142	181	143	179	178	146	132	134	100	120	118	144	-	170	154	171	-	211	153	**157**
A225NW	0.1231	289	388	360	395	340	581	502	223	369	326	437	401	580	402	644	401	390	309	332	620	441	452	367	472	372	460	461	379	343	346	259	308	305	374	-	428	399	431	-	548	396	**406**
A225SE	0.0748	122	165	153	169	143	250	213	94	157	138	185	171	246	170	279	169	165	130	140	262	187	191	155	199	157	197	195	160	144	147	110	131	129	158	-	186	169	188	-	232	168	**172**
A226NE	0.068	113	153	142	157	133	232	197	87	145	128	171	159	229	158	258	157	153	121	130	243	173	177	144	184	146	182	181	149	134	136	102	122	120	147	-	172	157	174	-	215	155	**160**
A226NW	0.1354	327	438	406	445	384	656	567	251	417	368	493	453	655	454	727	452	440	350	375	700	498	511	414	533	420	519	521	428	388	391	292	348	344	422	-	483	451	486	-	619	447	**458**
A227NE	0.0287	48	64	60	66	56	98	83	37	61	54	72	67	96	67	109	66	65	51	55	102	73	75	61	78	62	77	76	63	57	57	43	51	51	62	-	73	66	73	-	91	66	**67**
A227NW	0.0646	107	145	134	149	126	220	187	83	138	122	163	151	217	150	246	149	146	115	124	231	165	168	137	175	139	173	172	141	127	129	97	116	114	140	-	164	149	165	-	204	148	**152**
A227SE	0.0679	113	152	141	156	133	231	197	87	145	128	171	159	228	157	258	157	153	121	130	242	173	177	144	184	146	182	181	148	134	136	102	122	120	147	-	172	156	173	-	215	155	**160**
A227SW	0.0984	234	315	292	320	275	471	407	180	299	264	354	325	470	326	522	325	316	251	269	502	357	367	297	382	302	373	374	307	278	281	210	250	247	303	-	347	324	349	-	445	321	**329**
A228NE	0.1045	252	338	314	344	296	506	438	194	322	284	381	350	505	350	561	349	340	270	290	540	384	394	320	411	325	401	402	330	299	302	225	269	266	326	-	373	348	375	-	478	345	**354**
A228NW	0.1369	335	450	417	457	394	673	582	258	428	378	506	465	672	466	745	464	452	359	385	718	511	524	425	547	431	533	534	439	398	401	300	357	353	433	-	495	463	498	-	636	459	**470**
A228R1	0.0632	7	11	8	23	6	34	23	3	19	0	9	11	28	0	51	2	0	3	6	10	7	22	5	5	0	21	0	8	12	4	0	1	2	2	-	21	2	48	-	5	4	**11**
A228R2	0.1043	14	20	15	42	11	61	40	6	34	0	17	20	51	1	89	5	0	6	13	19	13	41	9	10	0	37	0	17	23	9	0	2	5	4	-	36	4	83	-	9	7	**20**
A228SE	0.0654	102	138	128	141	120	210	178	79	131	116	155	143	207	142	234	142	138	109	118	219	157	160	130	167	132	165	163	134	121	123	92	110	108	133	-	156	141	157	-	194	140	**144**
A229N2	0.0307	79	107	99	108	93	159	138	61	101	89	120	110	159	110	176	110	107	85	91	170	121	124	101	129	102	126	127	104	94	95	71	85	84	103	-	117	110	118	-	150	109	**111**
A229NE	0.0591	110	148	137	152	129	224	191	85	141	124	166	154	222	153	249	152	149	117	127	236	168	172	140	179	142	176	176	144	130	132	99	118	117	143	-	166	152	167	-	209	151	**155**
A229NW	0.0601	155	208	193	212	182	311	269	119	198	175	234	215	311	216	344	215	209	166	178	332	237	243	197	253	200	246	247	203	184	186	139	166	164	201	-	229	214	230	-	294	213	**218**
A229R1	0.1224	18	25	19	52	15	75	50	8	43	0	22	24	66	1	110	7	0	8	17	25	18	51	12	14	1	45	0	23	31	11	1	3	8	5	-	43	5	103	-	12	10	**25**
A229R2	0.0799	10	15	11	32	9	46	31	5	26	0	13	15	39	1	68	3	0	4	9	14	10	31	7	8	0	28	0	13	18	6	0	1	3	3	-	27	3	64	-	7	5	**15**
A229SE	0.1047	253	339	314	345	297	507	439	194	323	285	382	350	506	351	562	350	340	270	290	541	385	395	321	412	325	402	403	331	300	303	226	269	266	327	-	374	349	376	-	479	346	**354**
A229SW	0.1401	343	460	427	468	403	688	595	264	438	387	518	476	687	476	762	475	462	367	394	735	523	536	435	560	441	545	547	449	407	411	307	366	362	443	-	507	474	510	-	650	470	**481**
A230NE	0.1102	270	362	336	368	317	542	468	208	345	304	408	374	541	375	600	374	364	289	310	578	411	422	342	440	347	429	430	353	320	323	241	288	285	349	-	399	373	401	-	512	370	**379**
A230NW	0.0787	162	218	202	222	190	327	281	125	207	183	245	225	325	225	364	224	219	173	186	347	247	253	206	264	208	259	258	212	192	194	145	173	171	210	-	242	224	244	-	307	222	**228**
A230R1	0.0373	4	6	4	13	3	19	13	2	10	0	5	6	15	0	28	1	0	1	3	5	3	12	3	3	0	12	0	4	6	2	0	0	1	1	-	12	1	27	-	2	2	**6**
A230R2	0.0266	4	6	5	12	4	18	12	2	10	0	5	6	16	1	25	2	0	2	4	6	4	12	3	4	0	10	0	6	8	3	0	1	2	1	-	10	1	23	-	3	3	**6**
A230R3	0.0632	7	11	8	23	6	34	23	3	19	0	9	11	28	0	51	2	0	3	6	10	7	22	5	5	0	21	0	8	12	4	0	1	2	2	-	21	2	48	-	5	4	**11**
A230R4	0.0984	13	19	14	39	11	57	38	6	32	0	16	18	48	1	84	4	0	6	12	18	12	38	9	10	0	34	0	16	22	8	0	2	4	3	-	34	4	79	-	8	7	**19**
A230WK	0.0128	2	3	2	6	2	9	6	1	5	0	3	3	8	0	12	1	0	1	2	3	2	6	2	2	0	5	0	3	4	1	0	1	1	1	-	5	1	11	-	2	2	**3**
A231N1	0.0597	109	147	136	150	128	222	190	84	140	123	165	153	220	152	247	151	148	117	125	234	167	171	139	178	141	175	174	143	129	131	98	117	116	142	-	165	151	166	-	207	150	**154**
A231NE	0.0603	156	209	194	212	183	312	270	120	199	175	235	216	312	216	345	216	210	167	179	334	237	243	198	254	200	247	248	204	185	186	139	166	164	201	-	229	215	231	-	295	213	**218**
A231NW	0.0466	120	162	150	164	141	241	209	93	154	136	182	167	241	167	267	167	162	129	138	258	184	188	153	196	155	191	192	158	143	144	108	128	127	156	-	177	166	178	-	228	165	**169**
A231R1	0.0242	4	6	4	11	3	16	11	2	9	0	5	5	15	1	23	2	0	2	4	5	4	11	3	3	0	9	0	6	7	3	0	1	2	1	-	9	1	21	-	3	3	**6**
A231R2	0.0334	4	6	5	13	4	19	13	2	11	0	5	6	16	0	28	1	0	2	4	6	4	13	3	3	0	12	0	5	7	3	0	1	1	1	-	11	1	27	-	3	2	**6**
A231R3	0.0319	4	6	4	12	3	17	11	2	9	0	5	6	14	0	26	1	0	1	3	5	3	11	3	3	0	11	0	4	6	2	0	0	1	1	-	11	1	24	-	2	2	**5**
A231R4	0.0319	4	6	4	12	3	17	11	2	9	0	5	6	14	0	26	1	0	1	3	5	3	11	3	3	0	11	0	4	6	2	0	0	1	1	-	11	1	24	-	2	2	**5**
A231R5	0.1171	17	24	19	50	14	72	48	8	41	0	21	23	63	1	105	7	0	8	16	23	17	49	12	13	1	43	0	22	29	11	1	3	7	4	-	41	5	98	-	12	10	**24**
A231R6	0.0912	12	17	13	36	10	53	35	5	29	0	15	17	44	1	77	4	0	5	11	16	11	35	8	9	0	32	0	14	20	7	0	2	4	3	-	31	3	73	-	8	6	**17**
A231SE	0.1067	257	345	320	351	303	517	447	198	329	290	389	357	516	358	573	357	347	276	296	552	392	403	327	420	331	409	410	337	306	308	230	274	271	333	-	381	355	383	-	488	353	**361**

Table B3 - Subcatchments

Yearly Runoff Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A231SW	0.1371	331	444	412	451	389	664	574	255	422	373	500	459	663	460	736	458	446	354	380	709	504	517	420	540	426	526	527	433	393	396	296	352	349	428	-	489	457	492	-	627	453	**464**
A302NE	0.02	36	48	45	50	42	73	63	28	46	41	54	50	72	50	82	50	49	38	41	77	55	56	46	59	46	58	57	47	43	43	32	39	38	47	-	54	50	55	-	68	49	**51**
A302NW	0.02	36	48	45	50	42	73	63	28	46	41	54	50	72	50	82	50	49	38	41	77	55	56	46	59	46	58	57	47	43	43	32	39	38	47	-	54	50	55	-	68	49	**51**
A302NW1	0.026	66	89	83	91	78	133	115	51	85	75	100	92	133	92	147	92	90	71	76	142	101	104	84	108	85	106	106	87	79	80	59	71	70	86	-	98	92	99	-	126	91	**93**
A302R1	0.063	9	13	10	27	8	39	26	4	22	0	12	13	34	1	57	4	0	4	9	13	9	27	6	7	1	23	0	12	16	6	0	2	4	2	-	22	3	53	-	7	6	**13**
A302SE	0.028	50	68	63	70	59	103	88	39	65	57	76	70	101	70	114	70	68	54	58	108	77	79	64	82	65	81	80	66	60	60	45	54	53	65	-	76	70	77	-	96	69	**71**
A302SW	0.028	50	68	63	70	59	103	88	39	65	57	76	70	101	70	114	70	68	54	58	108	77	79	64	82	65	81	80	66	60	60	45	54	53	65	-	76	70	77	-	96	69	**71**
A302SW1	0.037	94	127	118	129	111	189	164	73	121	107	143	131	189	131	210	131	128	101	109	202	144	148	120	154	122	150	151	124	112	113	85	101	100	122	-	139	131	140	-	179	130	**133**
A303NE1	0.025	45	61	56	62	53	92	78	35	58	51	68	63	91	63	102	62	61	48	52	96	69	70	57	73	58	72	72	59	53	54	40	48	48	58	-	68	62	69	-	85	62	**63**
A303NW1	0.025	45	61	56	62	53	92	78	35	58	51	68	63	91	63	102	62	61	48	52	96	69	70	57	73	58	72	72	59	53	54	40	48	48	58	-	68	62	69	-	85	62	**63**
A303NW2	0.032	82	110	102	112	96	164	142	63	104	92	124	113	164	114	181	113	110	87	94	175	125	128	104	133	105	130	130	107	97	98	73	87	86	106	-	120	113	121	-	155	112	**115**
A303R1	0.102	15	21	17	44	12	64	43	7	36	0	19	21	56	1	92	6	0	7	14	21	15	43	10	12	1	38	0	20	26	9	1	3	7	4	-	36	4	86	-	11	9	**21**
A303R2	0.088	13	18	14	38	11	55	37	6	31	0	16	18	48	1	79	5	0	6	12	18	13	37	9	10	1	32	0	17	22	8	1	3	6	3	-	31	4	74	-	9	8	**18**
A303SE	0.03	54	73	67	74	63	110	94	42	69	61	82	75	109	75	122	75	73	58	62	116	83	84	69	88	70	87	86	71	64	65	48	58	57	70	-	82	75	82	-	102	74	**76**
A303SE1	0.044	79	107	99	109	93	161	138	61	101	89	120	111	159	110	180	110	107	84	91	170	121	124	101	129	102	127	126	104	94	95	71	85	84	103	-	120	109	121	-	150	109	**112**
A303SW	0.03	54	73	67	74	63	110	94	42	69	61	82	75	109	75	122	75	73	58	62	116	83	84	69	88	70	87	86	71	64	65	48	58	57	70	-	82	75	82	-	102	74	**76**
A303SW1	0.044	79	107	99	109	93	161	138	61	101	89	120	111	159	110	180	110	107	84	91	170	121	124	101	129	102	127	126	104	94	95	71	85	84	103	-	120	109	121	-	150	109	**112**
A303SW2	0.056	143	192	178	195	168	287	248	110	183	161	216	199	286	199	317	198	193	153	164	306	218	224	182	233	184	227	228	187	170	171	128	153	151	185	-	211	198	212	-	271	196	**201**
A303SW3	0.039	99	134	124	136	117	200	173	77	127	112	151	139	199	138	221	138	134	106	114	213	152	156	126	162	128	158	159	131	118	119	89	107	105	129	-	147	138	148	-	189	137	**140**
A306NE	0.111	268	360	334	366	315	538	465	206	342	302	405	372	537	373	596	371	361	287	308	574	409	419	340	437	345	426	427	351	318	321	240	286	283	347	-	396	370	399	-	508	367	**376**
A306NW	0.156	376	504	467	512	442	754	653	289	480	423	567	521	753	521	836	520	505	402	431	805	572	587	477	613	483	597	599	492	447	450	335	399	395	485	-	555	518	558	-	712	514	**527**
A306R2	0.127	18	27	21	55	15	79	53	8	45	0	24	26	70	2	115	8	0	9	18	26	19	54	13	15	1	47	0	25	32	12	1	4	8	5	-	45	5	107	-	13	11	**27**
A306SE	0.051	91	124	115	127	108	187	160	71	118	104	139	128	185	128	208	127	124	98	105	197	140	144	117	149	118	147	146	120	108	110	82	99	97	119	-	139	127	140	-	174	126	**129**
A306SW	0.051	91	124	115	127	108	187	160	71	118	104	139	128	185	128	208	127	124	98	105	197	140	144	117	149	118	147	146	120	108	110	82	99	97	119	-	139	127	140	-	174	126	**129**
A306SW1	0.064	163	220	204	223	192	328	283	126	209	184	247	227	327	227	362	226	221	175	188	350	250	256	208	266	210	260	261	214	194	196	146	175	173	212	-	241	226	243	-	310	224	**229**
A310NE	0.043	104	139	129	142	122	208	180	80	133	117	157	144	208	144	231	144	140	111	119	222	158	162	132	169	134	165	165	136	123	124	93	111	109	134	-	153	143	154	-	197	142	**146**
A310NE1	0.028	68	91	84	93	80	136	118	52	87	76	102	94	136	94	151	94	91	72	78	145	103	106	86	110	87	108	108	89	80	81	61	72	72	88	-	100	94	101	-	129	93	**95**
A310NW	0.054	130	175	162	178	153	261	226	100	166	147	197	181	261	181	290	180	175	139	150	279	198	204	165	213	168	207	208	171	155	156	116	139	137	168	-	193	180	194	-	247	178	**183**
A310R1	0.044	6	9	7	19	5	27	18	3	16	0	8	9	24	1	40	3	0	3	6	9	6	19	4	5	0	16	0	9	11	4	0	1	3	2	-	15	2	37	-	5	4	**9**
A310SE	0.034	82	110	102	112	97	165	143	63	105	93	124	114	165	114	183	114	111	88	94	176	125	129	104	134	106	131	131	108	98	98	74	88	87	106	-	122	114	122	-	156	113	**115**
A310SW	0.054	130	175	162	178	153	261	226	100	166	147	197	181	261	181	290	180	175	139	150	279	198	204	165	213	168	207	208	171	155	156	116	139	137	168	-	193	180	194	-	247	178	**183**
A311NE	0.12	290	389	361	395	341	582	503	223	370	327	438	402	581	403	645	401	390	310	333	621	442	453	368	473	373	461	462	380	344	347	259	309	306	375	-	429	400	431	-	550	397	**407**
A311NW	0.067	162	217	201	220	190	324	281	124	206	182	244	224	324	224	359	224	218	173	186	346	246	253	205	264	208	257	258	212	192	193	144	172	170	209	-	239	223	240	-	306	221	**227**
A311R1	0.107	16	22	17	46	13	67	45	7	38	0	20	22	58	1	96	6	0	7	15	22	16	45	11	13	1	39	0	21	27	10	1	3	7	4	-	38	5	90	-	11	9	**22**
A311SE	0.119	287	385	357	391	337	576	498	221	366	323	434	398	575	399	638	397	386	307	329	615	437	449	364	468	369	456	458	376	341	344	256	306	302	371	-	424	396	427	-	544	393	**403**
A311SW	0.067	162	217	201	220	190	324	281	124	206	182	244	224	324	224	359	224	218	173	186	346	246	253	205	264	208	257	258	212	192	193	144	172	170	209	-	239	223	240	-	306	221	**227**
APOND2	0.019	35	48	44	49	42	72	62	27	45	40	54	49	71	49	80	49	48	38	41	76	54	55	45	58	46	57	57	46	42	42	32	38	38	46	-	53	49	54	-	67	49	**50**
A104PK	1.72	876	258	504	214	236	429	761	448	716	496	425	633	756	507	745	385	504	819	368	845	507	247	505	364	838	223	589	579	821	364	421	347	635	675	-	847	885	485	-	573	401	**544**
Total	**28.778**	**40,265**	**53,338**	**49,386**	**56,100**	**46,149**	**82,866**	**70,759**	**30,368**	**52,486**	**43,633**	**59,672**	**55,528**	**81,846**	**53,735**	**94,132**	**53,734**	**52,092**	**42,213**	**45,258**	**84,342**	**59,880**	**63,539**	**49,875**	**63,580**	**50,115**	**64,452**	**61,607**	**51,997**	**48,088**	**46,882**	**34,658**	**41,297**	**41,317**	**50,446**	**-**	**61,050**	**54,033**	**65,130**	**-**	**73,841**	**53,395**	**55,977**

Table B4 - Subcatchments
Yearly Surface Evaporation Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A102NE	0.1339	43	79	86	91	97	109	94	75	77	93	90	102	94	95	115	84	91	60	79	106	97	94	89	105	90	96	112	82	49	79	66	89	77	105	-	72	97	89	-	99	98	88
A103NE	0.1353	50	92	100	106	113	127	110	88	90	109	105	119	110	111	135	98	106	70	92	124	114	109	104	123	104	112	131	96	58	92	77	104	90	122	-	84	113	104	-	116	115	103
A103SW	0.0582	20	36	39	42	45	50	43	35	35	43	41	47	43	44	53	38	42	27	36	49	45	43	41	48	41	44	51	38	23	36	30	41	35	48	-	33	44	41	-	46	45	41
A104NE	0.1378	49	90	98	103	111	124	108	86	88	107	103	116	108	109	132	96	104	68	90	122	111	107	102	120	102	110	128	94	56	90	75	102	89	120	-	82	111	102	-	113	112	101
A104NW	0.0471	10	18	20	21	22	25	22	17	18	21	21	23	22	22	26	19	21	14	18	24	22	21	20	24	20	22	26	19	11	18	15	20	18	24	-	16	22	20	-	23	22	20
A104SE	0.0528	19	34	37	39	42	47	41	33	33	40	39	44	41	41	50	36	39	26	34	46	42	41	39	46	39	42	49	36	21	34	29	39	34	45	-	31	42	39	-	43	43	38
A104SW	0.0473	17	31	34	36	39	43	37	30	30	37	36	40	37	38	46	33	36	24	31	42	39	37	35	42	36	38	44	33	20	31	26	35	31	42	-	28	38	35	-	39	39	35
A105NE	0.0577	20	36	39	41	44	50	43	34	35	43	41	46	43	43	53	38	42	27	36	49	44	43	41	48	41	44	51	38	23	36	30	41	35	48	-	33	44	41	-	45	45	40
A105NW	0.1045	40	73	78	83	89	100	87	69	70	86	83	93	86	87	106	77	84	55	72	98	89	86	82	97	82	88	103	76	45	72	61	82	71	96	-	66	89	82	-	91	90	81
A105SE	0.0582	20	36	39	42	45	50	43	35	35	43	41	47	43	44	53	39	42	27	36	49	45	43	41	49	41	44	51	38	23	36	30	41	36	48	-	33	45	41	-	46	45	41
A105SW	0.1044	42	77	84	88	95	106	92	74	75	91	88	99	92	93	113	82	89	58	77	104	95	92	87	103	87	94	109	81	48	77	64	88	76	102	-	70	95	87	-	97	96	86
A106N1	0.0845	33	61	66	70	75	84	73	58	59	72	69	78	72	73	89	64	70	46	61	82	75	72	69	81	69	74	86	63	38	60	51	69	60	81	-	55	75	69	-	76	76	68
A106N2	0.0773	31	57	62	65	70	79	68	54	55	67	65	73	68	69	83	60	66	43	57	77	70	68	64	76	65	69	81	59	36	57	48	65	56	76	-	52	70	64	-	72	71	64
A106NE	0.0626	23	42	46	48	52	58	50	40	41	50	48	54	50	51	62	45	49	32	42	57	52	50	48	56	48	51	60	44	26	42	35	48	42	56	-	38	52	48	-	53	53	47
A106NW	0.0644	25	45	49	52	56	62	54	43	44	53	52	58	54	55	66	48	52	34	45	61	56	54	51	60	51	55	64	47	28	45	38	51	44	60	-	41	56	51	-	57	56	51
A106R1	0.0465	11	20	21	23	24	27	24	19	19	23	23	26	24	24	29	21	23	15	20	27	24	24	22	27	22	24	28	21	12	20	17	22	19	26	-	18	24	22	-	25	25	22
A106R2	0.1506	26	48	52	55	59	66	58	46	47	57	55	62	58	58	70	51	55	36	48	65	59	57	54	64	55	59	68	50	30	48	40	54	47	64	-	44	59	54	-	61	60	54
A106SE	0.073	30	54	59	62	67	75	65	52	53	64	62	70	65	66	79	58	63	41	54	73	67	65	61	73	62	66	77	57	34	54	45	62	53	72	-	49	67	61	-	68	68	61
A106SW	0.0666	26	47	51	54	58	65	56	45	46	56	54	61	56	57	69	50	54	36	47	64	58	56	53	63	53	57	67	49	30	47	39	53	46	63	-	43	58	53	-	59	59	53
A108N1	0.052	11	19	21	22	24	27	23	18	19	23	22	25	23	23	28	21	22	15	19	26	24	23	22	26	22	24	27	20	12	19	16	22	19	26	-	18	24	22	-	24	24	22
A108NE	0.0393	14	26	28	30	32	36	31	25	25	31	30	33	31	31	38	28	30	20	26	35	32	31	29	35	29	32	37	27	16	26	22	29	25	34	-	24	32	29	-	33	32	29
A108NW	0.0287	7	12	14	14	15	17	15	12	12	15	14	16	15	15	18	13	14	9	12	17	15	15	14	17	14	15	18	13	8	12	10	14	12	17	-	11	15	14	-	16	16	14
A108R1	0.2228	43	79	86	91	98	109	95	76	77	94	91	102	95	95	116	84	91	60	79	107	98	94	90	106	90	96	112	83	50	79	66	90	78	105	-	72	97	89	-	100	99	89
A108R2	0.1143	21	39	42	44	47	53	46	37	38	45	44	50	46	46	56	41	44	29	38	52	48	46	44	52	44	47	55	40	24	38	32	44	38	51	-	35	47	44	-	49	48	43
A108SE	0.1135	39	72	78	82	88	99	86	68	70	85	82	92	85	86	105	76	83	54	71	97	88	85	81	95	81	87	101	75	45	71	60	81	70	95	-	65	88	81	-	90	89	80
A108SW	0.0507	15	28	30	32	34	39	33	27	27	33	32	36	33	34	41	30	32	21	28	38	35	33	32	37	32	34	40	29	18	28	23	32	27	37	-	25	34	32	-	35	35	31
A109NE	0.0292	6	11	12	13	14	15	13	11	11	13	13	14	13	13	16	12	13	8	11	15	14	13	13	15	13	14	16	12	7	11	9	13	11	15	-	10	14	13	-	14	14	12
A109NW	0.0533	19	34	37	39	42	47	41	33	33	41	39	44	41	41	50	36	40	26	34	46	42	41	39	46	39	42	49	36	21	34	29	39	34	46	-	31	42	39	-	43	43	38
A109SE	0.0936	32	59	64	67	72	81	70	56	57	69	67	76	70	71	86	62	68	44	58	79	72	70	66	78	67	71	83	61	37	58	49	66	58	78	-	53	72	66	-	74	73	66
A110NE	0.1026	37	68	74	78	84	94	81	65	66	80	78	88	81	82	99	72	78	52	68	92	84	81	77	91	77	83	96	71	43	68	57	77	67	90	-	62	84	77	-	86	85	76
A110NW	0.0866	32	58	63	67	72	80	70	56	57	69	66	75	69	70	85	62	67	44	58	79	72	69	66	78	66	71	83	61	36	58	49	66	57	77	-	53	71	66	-	73	73	65
A110R1	0.0385	9	16	17	18	19	22	19	15	15	19	18	20	19	19	23	17	18	12	16	21	19	19	18	21	18	19	22	16	10	16	13	18	15	21	-	14	19	18	-	20	20	18
A110R10	0.0379	9	16	18	19	20	22	19	15	16	19	18	21	19	19	24	17	19	12	16	22	20	19	18	22	18	20	23	17	10	16	14	18	16	21	-	15	20	18	-	20	20	18
A110R2	0.0357	8	15	16	17	18	20	17	14	14	17	17	19	17	18	21	16	17	11	15	20	18	17	17	20	17	18	21	15	9	15	12	17	14	19	-	13	18	16	-	18	18	16
A110R3	0.0389	9	16	17	18	20	22	19	15	16	19	18	20	19	19	23	17	18	12	16	21	20	19	18	21	18	19	23	17	10	16	13	18	16	21	-	14	19	18	-	20	20	18
A110R4	0.0471	11	19	21	22	24	27	23	18	19	23	22	25	23	23	28	20	22	15	19	26	24	23	22	26	22	23	27	20	12	19	16	22	19	26	-	17	24	22	-	24	24	22
A110R5	0.0452	11	19	21	22	24	27	23	18	19	23	22	25	23	23	28	21	22	15	19	26	24	23	22	26	22	23	27	20	12	19	16	22	19	26	-	18	24	22	-	24	24	22
A110R6	0.0418	10	18	19	21	22	25	21	17	17	21	20	23	21	22	26	19	21	14	18	24	22	21	20	24	20	22	25	19	11	18	15	20	18	24	-	16	22	20	-	23	22	20
A110R7	0.0456	11	20	21	22	24	27	23	19	19	23	22	25	23	23	28	21	22	15	19	26	24	23	22	26	22	24	28	20	12	19	16	22	19	26	-	18	24	22	-	25	24	22
A110R8	0.0591	14	25	27	29	31	35	30	24	25	30	29	33	30	30	37	27	29	19	25	34	31	30	29	34	29	31	36	26	16	25	21	29	25	34	-	23	31	29	-	32	32	28
A110R9	0.0323	7	13	14	15	16	17	15	12	12	15	14	16	15	15	18	13	15	10	13	17	16	15	14	17	14	15	18	13	8	13	11	14	12	17	-	11	15	14	-	16	16	14
A110SE	0.0587	22	40	44	46	50	56	48	39	39	48	46	52	48	49	59	43	47	31	40	55	50	48	46	54	46	49	57	42	25	40	34	46	40	54	-	37	50	46	-	51	50	45
A110SW	0.0824	29	53	57	60	64	72	63	50	51	62	60	68	63	63	77	56	60	40	52	71	65	62	59	70	59	64	74	55	33	52	44	59	51	70	-	48	64	59	-	66	65	59
A111NW	0.0905	32	59	64	68	73	82	71	57	58	70	68	76	71	71	86	63	68	45	59	80	73	70	67	79	67	72	84	62	37	59	49	67	58	79	-	54	73	67	-	75	74	66
A111SE	0.0869	32	59	63	67	72	81	70	56	57	69	67	75	70	70	85	62	67	44	58	79	72	69	66	78	66	71	83	61	37	58	49	66	57	78	-	53	72	66	-	74	73	65
A112NE	0.1184	42	77	83	88	94	105	91	73	74	90	87	98	91	92	112	81	88	58	76	103	94	91	86	102	87	93	108	80	48	76	64	87	75	101	-	69	94	86	-	96	95	86
A112NW	0.0531	20	36	39	41	44	49	43	34	35	42	41	46	43	43	52	38	41	27	36	48	44	42	40	48	40	43	51	37	22	36	30	40	35	47	-	32	44	40	-	45	44	40
A112R3	0.0559	14	25	27	29	31	34	30	24	24	29	28	32	30	30	36	26	29	19	25	33	31	30	28	33	28	30	35	26	16	25	21	28	24	33	-	23	30	28	-	31	31	28
A112R4	0.0976	22	40	43	46	49	55	48	38	39	47	46	51	48	48	58	42	46	30	40	54	49	47	45	53	45	49	57	42	25	40	33	45	39	53	-	36	49	45	-	50	50	45
A112SE	0.1192	44	80	87	92	99	111	96	77	78	95	91	103	96	97	117	85	92	61	80	108	99	95	91	107	91	98	114	84	50	80	67	91	79	106	-	73	98	91	-	101	100	90
A112SW	0.0441	17	31	34	36	38	43	37	30	30	37	36	40	37	38	46	33	36	24	31	42	39	37	35	42	35	38	44	33	20	31	26	35	31	41	-	28	38	35	-	39	39	35
A112WK	0.0389	6	11	12	13	14	15	13	11	11	13	13	14	13	13	16	12	13	8	11	15	14	13	12	15	12	13	16	11	7	11	9	12	11	15	-	10	13	12	-	14	14	12
A113R1	0.1345	26	48	52	55	59	66	57	46	47	56	55	61	57	57	70	51	55	36	48	64	59	57	54	64	54	58	68	50	30	48	40	54	47	63	-	43	59	54	-	60	60	53
A113R2	0.0836	19	34	37	39	42	47	41	33	33	40	39	44	41	41	50	36	39	26	34	46	42	41	39	46	39	42	48	36	21	34	29	39	34	45	-	31	42	39	-	43	43	38
A114NE	0.0293	11	20	22	23	25	28	24	19	20	24	23	26	24	25	30	22	24	15	20	28	25	24	23	27	23	25	29	21	13	20	17	23	20	27	-	19	25	23	-	26	25	23
A114R1	0.0675	16	30	33	35	37	41	36	29	29	35	34	39	36	36	44	32	35	23	30	40	37	36	34	40	34	37	43	31	19	30	25	34	29	40	-	27	37	34	-	38	37	34
A114R2	0.0534	11	21	23	24	26	29	25	20	20	25	24	27	25	25	30	22	24	16	21	28	26	25	24	28	24	25	30	22	13	21	17	24	20	28	-	19	26	24	-	26	26	23
A114R3	0.0736	17	30	33	35	37	41	36	29	29	36	34	39	36	36	44	32	35	23	30	41	37	36	34	40	34	37	43	31	19	30	25	34	30	40	-	27	37	34	-	38	38	34
A114R4	0.1447	34	62	67	71	76	85	74	59	60	73	70	80	74	74	90	66	71	47	62	83	76	73	70	83	70	75	88	65	39	62	52	70	61	82	-	56	76	70	-	78	77	69
A114SE	0.1052	33	61	66	70	75	84	73	58	59	72	69	78	73	73	89	65	70	46	61	82	75	72	69	81	69	74	86	64	38	61	51	69	60	81	-	55	75	69	-	77	76	68
A114SW	0.1843	65	119	129	137	146	164	142	114	116	141	136	153	142	144	174	127	137	90	119	161	147	141	135	159	135	145	169	125	75	119	100	135	117	158	-	108	146	135	-	150	148	133
A115NE	0.08	28	51	55	58	63	70	61	49	49	60	58	66	61	61	74	54	59	39	51	69	63	60	58	68	58	62	72	53	32	51	43	58	50	68	-	46	62	57	-	64	63	57
A115NW	0.0502	18	34	36	39	41	46	40	32	33	40	38	43	40	41	49	36	39	25	34	45	41	40	38	45	38	41	48	35	21	34	28	38	33	45	-	31	41	38	-	42	42	38
A115R1	0.0441	9	17	19	20	21	24	21	16	17	20	20	22	21	21	25	18	20	13	17	23	21	21	19	23	20	21	24	18	11	17	14	20	17	23	-	16	21	19	-	22	22	19
A115R2	0.0429	10	18	19	20	22	24	21	17	17	21	20	23	21	21	26	19	20	13	17	24	22	21	20	23	20	21	25	18	11	17	15	20	17	23	-	16	22	20	-	22	22	20
A115R3	0.0346	8	14	15	16	17	19	17	14	14	17	16	18	17	17	21	15	16	11	14	19	17	17	16	19	16	17	20	15	9	14	12	16	14	19	-	13	17	16	-	18	18	16
A115R4	0.0355	8	15	16	17	19	21	18	15	15	18	17	20	18	18	22	16	17	12	15	20	19	18	17	20	17	18	22	16	9	15	13	17	15	20	-	14	19	17	-	19	19	17
A115R5	0.05	12	21	23	25	26	29	26	20	21	25	24	28	26	26	31	23	25	16	21	29	26	25	24	29	24	26	30	22	13	21	18	24	21	28	-	19	26	24	-	27	27	24
A115R6	0.0405	10	17	19	20	21	24	21	17	17	20	20	22	21	21	25	18	20	13	17	23	21	21	20	23	20	21	25	18	11	17	14	20	17	23	-	16	21	20	-	22	22	19
A115SE	0.0218	5	9	9	10	11	12	10	8	8	10	10	11	10	10	13	9	10	7	9	12	11	10	10	12	10	11	12	9	5	9	7	10	9	12	-	8	11	10	-	11	11	10
A115SW	0.0392	8	15	17	18	19	21	18	15	15	18	17	20	18	18	22	16	18	12	15	21	19	18	17	20	17	19	22	16	10	15	13	17	15	20	-	14	19	17	-	19	19	17
A115W1	0.0351	11	20	21	23	24	27	24	19	19	23	22	25	24	24	29	21	23	15	20	27	24	23	22	26	22	24	28	21	12	20	16	22	19	26	-	18	24	22	-	25	25	22
A116E1	0.037	11	20	22	23	25	28	24	19	20	24	23	26	24	24	29	21	23	15	20	27	25	24	23	27	23	24	28	21	13	20	17	23	20	27	-	18	25	23	-	25	25	23
A116NE	0.081	28	51	56	59	63	71	61	49	50	61	59	66	61	62	75	55	59	39	51	69	63	61	58	69	58	63	73	54	32	51	43	58	50	68	-	47	63	58	-	65	64	58
A116NW	0.0753	27	49	53	57	61	68	59	47	48	58	56	63	59	59	72	52	57	37	49	66	61	59	56	66	56	60	70	52	31	49	41	56	48	65	-	45	60	56	-	62	61	55
A116R1	0.1084	19	35	38	40	43	48	41	33	34	41	40	45	41	42	51	37	40	26	34	47	43	41	39	46	39	42	49	36	22	35	29	39	34	46	-	32	43	39	-	44	43	39
A116R2	0.1022	15	27	29	31	33	37	32	26	26	32	31	35	32	33	40	29	31	21	27	37	33	32	31	36	31	33	38	28	17	27	23	31	27	36	-	25	33	31	-	34	34	30
A116R3	0.0796	17	31	34	36	38	43	37	30	30	37	35	40	37	37	45	33	36	24	31	42	38	37	35	42	35	38	44	33	19	31	26	35	31	41	-	28	38	35	-	39	39	35
A116R4	0.059	13	23	25	27	28	32	28	22	23	27	26	30	28	28	34	24	27	17	23	31	28	27	26	31	26	28	33	24	14	23	19	26	23	31	-	21	28	26	-	29	29	26
A116R5	0.069	14	26	28	30	32	36	31	25	25	30	29	33	31	31	38	27	30	20	26	35	32	31	29	34	29	31	37	27	16	26	22	29	25	34	-	23	32	29	-	33	32	29
A116R6	0.066	15	28	31	32	35	39	34	27	28	33	32	36	34	34	41	30	33	21	28	38	35	34	32	38	32	34	40	30	18	28	24	32	28	37	-	26	35	32	-	36	35	32
A116R7	0.062	15	27	29	30	33	37	32	25	26	31	30	34	32	32	39	28	31	20	26	36	33	32	30	35	30	32	38	28	17	26	22	30	26	35	-	24	33	30	-	33	33	30
A116SE	0.0791	25	45	49	52	56	62	54	43	44	53	52	58	54	54	66	48	52	34	45	61	56	54	51	60	51	55	64	47	28	45	38	51	44	60	-	41	55	51	-	57	56	51
A116SW	0.0762	30	56	60	64	68	76	66	53	54	65	63	71	66	67	81	59	64	42	55	75	68	66	63	74	63	67	79	58	35	55	46	63	54	74	-	50	68	63	-	70	69	62
A117NE	0.0839	30	54	59	62	67	75	65	52	53	64	62	70	65	65	79	58	62	41	54	73	67	64	61	72	61	66	77	57	34	54	45	61	53	72	-	49	66	61	-	68	67	61
A117NW	0.0821	29	54	58	62	66	74	64	51	52	63	61	69	64	65	78	57	62	41	54	72	66	64	61	72	61	65	76	56	34	54	45	61	53	71	-	49	66	61	-	68	67	60
A117R1	0.085	17	30	33	35	37	42	36	29	29	36	34	39	36	36	44	32	35	23	30	41	37	36	34	40	34	37	43	32	19	30	25	34	30	40	-	27	37	34	-	38	38	34
A117R2	0.062	14	25	27	29	31	35	30	24	25	30	29	33	30	30	37	27	29	19	25	34	31	30	29	34	29	31	36	27	16	25	21	29	25	34	-	23	31	29	-	32	32	28
A117R3	0.094	22	40	44	46	49	55	48	38	39	47	46	52	48	48	59	43	46	30	40	54	50	48	45	54	46	49	57	42	25	40	34	46	39	53	-	36	49	45	-	51	50	45
A117R4	0.068	16	29	31	33	36	40	35	28	28	34	33	37	35	35	42	31	34	22	29	39	36	35	33	39	33	35	41	30	18	29	24	33	29	39	-	26	36	33	-	37	36	33
A117SE	0.0768	28	51	55	58	63	70	61	49	50	60	58	66	61	61	74	54	59	39	51	69	63	61	58	68	58	62	72	53	32	51	43	58	50	68	-	46	63	58	-	64	64	57
A117SW	0.0856	33	60	65	69	74	83	72	57	58	71	68	77	71	72	87	64	69	45	60	81	74	71	68	80	68	73	85	63	38	60	50	68	59	80	-	54	74	68	-	75	75	67
A117W1	0.079	30	55	60	63	68	76	66	53	54	65	63	71	66	66	80	59	64	42	55	74	68	65	62	74	63	67	78	58	35	55	46	62	54	73	-	50	68	62	-	69	69	62
A117W2	0.087	32	58	62	66	71	79	69	55	56	68	66	74	69	69	84	61	66	44	57	78	71	68	65	77	65	70	82	60	36	57	48	65	57	76	-	52	71	65	-	72	72	65
A119NE	0.1464	52	96	104	110	118	132	115	91	93	113	109	123	114	115	140	102	110	73	95	129	118	114	108	128	109	117	136	100	60	95	80	109	94	127	-	87	118	108	-	121	119	107
A119NW	0.1135	41	74	80	85	91	102	89	71	72	88	85	96	89	90	108	79	86	56	74	100	92	88	84	99	84	90	105	78	47	74	62	84	73	99	-	68	91	84	-	93	93	83
A119R1	0.16	15	28	31	33	35	39	34	27	28	33	32	36	34	34	41	30	33	21	28	38	35	34	32	38	32	34	40	30	18	28	24	32	28	38	-	26	35	32	-	36	35	32
A119R2	0.228	49	89	97	102	110	123	107	85	87	105	102	115	107	107	130	95	103	68	89	120	110	106	101	119	101	108	126	93	56	89	74	101	87	118	-	81	109	101	-	112	111	100
A119R3	0.147	30	55	59	63	67	75	66	52	53	65	63	71	66	66	80	58	63	42	55	74	68	65	62	73	62	67	78	57	34	55	46	62	54	73	-	50	67	62	-	69	68	61
A119SE	0.0602	21	39	42	44	48	53	46	37	38	46	44	50	46	47	57	41	45	29	39	52	48	46	44	52	44	47	55	40	24	39	32	44	38	51	-	35	48	44	-	49	48	43
A119SW	0.092	33	61	66	70	75	84	73	58	59	72	69	78	73	73	89	65	70	46	61	82	75	72	69	81	69	74	86	64	38	61	51	69	60	81	-	55	75	69	-	77	76	68
A121NE	0.062	16	30	32	34	37	41	36	28	29	35	34	38	36	36	43	32	34	22	30	40	37	35	34	40	34	36	42	31	19	30	25	34	29	39	-	27	36	34	-	37	37	33
A121NW	0.099	35	64	69	73	78	88	76	61	62	75	73	82	76	77	93	68	74	48	64	86	79	76	72	85	72	78	91	67	40	64	53	72	63	85	-	58	78	72	-	80	80	72
A121R1	0.042	9	16	17	18	19	22	19	15	15	18	18	20	19	19	23	17	18	12	16	21	19	19	18	21	18	19	22	16	10	16	13	18	15	21	-	14	19	18	-	20	20	18
A121R2	0.072	15	28	30	32	35	39	34	27	27	33	32	36	34	34	41	30	32	21	28	38	35	34	32	38	32	34	40	29	18	28	23	32	28	37	-	26	35	32	-	35	35	32
A121R3	0.044	9	16	18	19	20	23	20	16	16	19	19	21	20	20	24	17	19	12	16	22	20	20	19	22	19	20	23	17	10	16	14	19	16	22	-	15	20	19	-	21	20	18
A121R4	0.059	11	21	23	24	26	29	25	20	20	25	24	27	25	25	30	22	24	16	21	28	26	25	24	28	24	25	30	22	13	21	17	24	20	28	-	19	26	24	-	26	26	23
A121S1	0.154	54	99	107	113	121	136	118	94	96	116	112	127	117	119	144	105	114	75	98	133	121	117	111	131	112	120	140	103	62	98	82	112	97	131	-	89	121	111	-	124	123	110
A121SE	0.122	33	61	66	70	75	84	73	58	59	72	69	78	73	73	89	65	70	46	61	82	75	72	69	81	69	74	86	63	38	61	51	69	60	81	-	55	75	69	-	76	76	68
A121SW	0.077	27	49	53	56	60	68	59	47	48	58	56	63	58	59	71	52	56	37	49	66	60	58	55	65	56	60	69	51	31	49	41	56	48	65	-	45	60	55	-	62	61	55

Table B4 - Subcatchments

Yearly Surface Evaporation Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A122NE	0.1276	44	81	87	92	99	111	96	77	78	95	92	104	96	97	117	85	93	61	80	108	99	95	91	107	91	98	114	84	50	80	67	91	79	107	-	73	99	91	-	101	100	90
A122R1	0.0732	11	20	21	22	24	27	23	19	19	23	22	25	23	23	28	21	22	15	19	26	24	23	22	26	22	24	28	20	12	19	16	22	19	26	-	18	24	22	-	24	24	22
A122R2	0.2135	31	57	62	65	70	78	68	54	55	67	65	73	68	68	83	60	65	43	56	76	70	68	64	76	64	69	80	59	36	57	47	64	56	75	-	52	70	64	-	71	71	64
A124NE	0.0469	15	27	30	31	34	38	33	26	27	32	31	35	33	33	40	29	31	21	27	37	34	32	31	36	31	33	39	29	17	27	23	31	27	36	-	25	33	31	-	34	34	31
A124NW	0.131	46	84	91	97	104	116	101	81	82	100	96	109	101	102	123	90	97	64	84	114	104	100	95	113	96	103	120	88	53	84	71	96	83	112	-	77	104	95	-	106	105	94
A124R1	0.0918	20	36	39	41	44	49	43	34	35	42	41	46	43	43	52	38	41	27	36	48	44	43	41	48	41	44	51	38	22	36	30	41	35	48	-	33	44	41	-	45	45	40
A124R2	0.136	28	51	55	58	62	70	61	48	49	60	58	65	61	61	74	54	58	38	50	68	63	60	57	68	57	62	72	53	32	51	42	57	50	67	-	46	62	57	-	64	63	57
A124SE	0.0469	18	32	35	37	40	45	39	31	32	38	37	42	39	39	47	34	37	25	32	44	40	38	37	43	37	39	46	34	20	32	27	37	32	43	-	29	40	37	-	41	40	36
A124SW	0.136	52	95	103	109	117	131	114	91	92	112	108	122	113	115	139	101	110	72	95	128	117	113	107	127	108	116	135	99	60	95	79	108	93	126	-	86	117	107	-	120	118	106
A125E1	0.0575	13	24	26	27	29	33	29	23	23	28	27	31	29	29	35	25	28	18	24	32	30	28	27	32	27	29	34	25	15	24	20	27	23	32	-	22	29	27	-	30	30	27
A125NE	0.0478	17	31	34	36	38	43	37	30	30	37	36	40	37	38	45	33	36	24	31	42	38	37	35	42	35	38	44	33	20	31	26	35	31	41	-	28	38	35	-	39	39	35
A125NW	0.0931	35	64	69	73	78	88	76	61	62	75	72	82	76	77	93	67	73	48	63	86	78	75	72	85	72	77	90	66	40	63	53	72	62	84	-	58	78	72	-	80	79	71
A125R1	0.1047	22	41	44	47	50	56	49	39	40	48	47	53	49	49	60	43	47	31	41	55	50	49	46	55	46	50	58	43	26	41	34	46	40	54	-	37	50	46	-	52	51	46
A125R2	0.1093	23	43	46	49	53	59	51	41	42	50	49	55	51	51	62	45	49	32	43	58	53	51	48	57	48	52	61	45	27	43	36	48	42	57	-	39	52	48	-	54	53	48
A125SE	0.0476	18	34	36	39	41	46	40	32	33	40	38	43	40	41	49	36	39	25	34	45	41	40	38	45	38	41	48	35	21	34	28	38	33	45	-	31	41	38	-	42	42	38
A125SW	0.0931	37	67	72	77	82	92	80	64	65	79	76	86	80	81	98	71	77	51	67	90	83	79	76	89	76	81	95	70	42	67	56	76	66	89	-	61	82	76	-	84	83	75
A126E1	0.0331	13	24	26	27	29	33	28	23	23	28	27	31	28	29	35	25	27	18	24	32	29	28	27	32	27	29	34	25	15	24	20	27	23	31	-	22	29	27	-	30	30	27
A126NE	0.0333	7	14	15	16	17	19	16	13	13	16	15	17	16	16	20	14	16	10	14	18	17	16	15	18	15	17	19	14	9	14	11	15	13	18	-	12	17	15	-	17	17	15
A126NW	0.0258	6	10	11	12	13	14	12	10	10	12	12	13	12	12	15	11	12	8	10	14	13	12	12	14	12	13	15	11	6	10	9	12	10	14	-	9	13	12	-	13	13	12
A126R1	0.0977	20	37	39	42	45	50	44	35	36	43	42	47	44	44	53	39	42	28	36	49	45	43	41	49	41	44	52	38	23	36	30	41	36	48	-	33	45	41	-	46	45	41
A126SE	0.032	9	17	18	20	21	23	20	16	17	20	19	22	20	21	25	18	20	13	17	23	21	20	19	23	19	21	24	18	11	17	14	19	17	23	-	16	21	19	-	21	21	19
A126SW	0.0259	7	13	14	15	16	18	16	13	13	16	15	17	16	16	19	14	15	10	13	18	16	16	15	18	15	16	19	14	8	13	11	15	13	18	-	12	16	15	-	17	17	15
A126W1	0.0767	29	53	57	61	65	73	63	50	51	62	60	68	63	64	77	56	61	40	53	71	65	63	60	71	60	64	75	55	33	53	44	60	52	70	-	48	65	60	-	67	66	59
A129NE	0.1715	61	111	120	127	136	153	133	106	108	131	126	143	132	134	162	118	128	84	111	150	137	132	125	148	126	135	157	116	69	111	93	126	109	147	-	101	136	125	-	140	138	124
A129NW	0.0657	24	43	47	49	53	59	51	41	42	51	49	55	51	52	63	46	50	33	43	58	53	51	49	57	49	52	61	45	27	43	36	49	42	57	-	39	53	49	-	54	54	48
A129R1	0.123	26	48	52	55	59	66	58	46	47	57	55	62	57	58	70	51	55	36	48	65	59	57	54	64	54	59	68	50	30	48	40	54	47	64	-	44	59	54	-	61	60	54
A129R2	0.1272	26	48	51	55	58	65	57	45	46	56	54	61	57	57	69	50	55	36	47	64	58	57	54	63	54	58	67	50	30	47	40	54	47	63	-	43	58	54	-	60	59	53
A129SE	0.097	27	50	54	57	62	69	60	48	49	59	57	64	60	60	73	53	58	38	50	67	62	59	57	67	57	61	71	52	31	50	42	57	49	66	-	45	61	56	-	63	62	56
A129SW	0.0642	23	42	46	48	52	58	50	40	41	50	48	54	50	51	61	45	48	32	42	57	52	50	47	56	48	51	60	44	26	42	35	48	41	56	-	38	52	47	-	53	52	47
A130NE	0.15	55	101	109	116	124	139	121	96	98	119	115	130	120	122	147	107	116	76	101	136	125	120	114	135	114	123	143	105	63	101	84	114	99	134	-	92	124	114	-	127	126	113
A130NW	0.047	17	30	33	35	37	42	36	29	29	36	34	39	36	36	44	32	35	23	30	41	37	36	34	40	34	37	43	32	19	30	25	34	30	40	-	27	37	34	-	38	38	34
A130R1	0.175	36	65	71	75	80	90	78	62	64	77	74	84	78	78	95	69	75	49	65	88	80	78	74	87	74	79	92	68	41	65	54	74	64	87	-	59	80	74	-	82	81	73
A130SE	0.147	51	94	101	107	115	129	112	89	91	110	107	120	112	113	137	99	108	71	93	126	115	111	106	125	106	114	133	98	59	93	78	106	92	124	-	85	115	106	-	118	117	105
A130SW	0.055	20	37	40	42	45	51	44	35	36	44	42	47	44	44	54	39	43	28	37	50	46	44	42	49	42	45	52	39	23	37	31	42	36	49	-	34	45	42	-	46	46	41
A132N1	0.029	6	12	13	13	14	16	14	11	11	14	13	15	14	14	17	12	13	9	12	16	14	14	13	15	13	14	16	12	7	12	10	13	11	15	-	11	14	13	-	15	14	13
A132NE	0.028	7	13	15	15	17	18	16	13	13	16	15	17	16	16	20	14	15	10	13	18	17	16	15	18	15	16	19	14	8	13	11	15	13	18	-	12	16	15	-	17	17	15
A132NW	0.033	13	23	25	27	29	32	28	22	23	27	27	30	28	28	34	25	27	18	23	31	29	28	26	31	26	28	33	24	15	23	19	26	23	31	-	21	29	26	-	29	29	26
A132R1	0.088	18	33	36	38	40	45	39	31	32	39	37	42	39	39	48	35	38	25	33	44	40	39	37	44	37	40	46	34	21	33	27	37	32	43	-	30	40	37	-	41	41	37
A132R2	0.1119	23	42	45	48	51	57	50	40	41	49	48	54	50	50	61	44	48	32	42	56	51	50	47	56	47	51	59	44	26	42	35	47	41	55	-	38	51	47	-	53	52	47
A132R3	0.1145	25	45	49	51	55	62	54	43	44	53	51	58	54	54	65	48	52	34	45	60	55	53	51	60	51	54	63	47	28	45	37	51	44	59	-	41	55	51	-	56	56	50
A132R4	0.101	22	40	43	45	49	54	47	38	39	47	45	51	47	47	58	42	45	30	39	53	49	47	45	53	45	48	56	41	25	39	33	45	39	52	-	36	48	45	-	50	49	44
A132SE	0.033	9	17	18	19	21	23	20	16	16	20	19	21	20	20	24	18	19	13	17	23	21	20	19	22	19	20	24	17	10	17	14	19	16	22	-	15	20	19	-	21	21	19
A132SW	0.048	16	30	33	35	37	42	36	29	29	36	34	39	36	36	44	32	35	23	30	41	37	36	34	40	34	37	43	31	19	30	25	34	30	40	-	27	37	34	-	38	38	34
A133NE	0.0433	8	14	15	16	17	20	17	14	14	17	16	18	17	17	21	15	16	11	14	19	17	17	16	19	16	17	20	15	9	14	12	16	14	19	-	13	17	16	-	18	18	16
A133NW	0.0948	17	31	34	36	38	43	37	30	30	37	35	40	37	37	45	33	36	23	31	42	38	37	35	42	35	38	44	32	19	31	26	35	30	41	-	28	38	35	-	39	39	35
A133SE	0.06	8	14	15	16	17	19	17	13	13	16	16	18	17	17	20	15	16	10	14	19	17	16	16	18	16	17	20	14	9	14	12	16	14	18	-	13	17	16	-	17	17	15
A133SW	0.132	17	30	33	35	37	42	36	29	30	36	35	39	36	37	44	32	35	23	30	41	37	36	34	41	34	37	43	32	19	30	25	34	30	40	-	28	37	34	-	38	38	34
A133W1	0.0432	8	14	15	16	17	19	17	14	14	17	16	18	17	17	21	15	16	11	14	19	17	17	16	19	16	17	20	15	9	14	12	16	14	19	-	13	17	16	-	18	18	16
A133W2	0.06	8	14	15	16	17	19	17	13	13	16	16	18	17	17	20	15	16	10	14	19	17	16	16	18	16	17	20	14	9	14	12	16	14	18	-	13	17	16	-	17	17	15
A133W3	0.0616	13	23	25	26	28	32	27	22	22	27	26	29	27	28	33	24	26	17	23	31	28	27	26	31	26	28	32	24	14	23	19	26	22	30	-	21	28	26	-	29	29	26
A133W4	0.088	13	23	25	27	29	32	28	22	23	28	27	30	28	28	34	25	27	18	23	31	29	28	26	31	27	28	33	24	15	23	20	26	23	31	-	21	29	26	-	29	29	26
A134NE	0.047	5	9	10	11	11	13	11	9	9	11	10	12	11	11	13	10	11	7	9	12	11	11	10	12	10	11	13	10	6	9	8	10	9	12	-	8	11	10	-	12	11	10
A134NW	0.126	17	31	34	36	38	43	37	30	30	37	36	40	37	38	46	33	36	24	31	42	39	37	35	42	35	38	44	33	20	31	26	35	31	41	-	28	38	35	-	39	39	35
A134SE	0.025	5	10	10	11	12	13	11	9	9	11	11	12	11	11	14	10	11	7	9	13	12	11	11	13	11	12	13	10	6	9	8	11	9	13	-	9	12	11	-	12	12	11
A134SW	0.115	17	31	33	35	38	42	37	29	30	36	35	39	37	37	45	32	35	23	30	41	38	36	35	41	35	37	43	32	19	30	26	35	30	41	-	28	37	34	-	38	38	34
A135R1	0.023	5	9	10	10	11	12	11	9	9	11	10	12	11	11	13	10	10	7	9	12	11	11	10	12	10	11	13	9	6	9	7	10	9	12	-	8	11	10	-	11	11	10
A136NE	0.031	8	15	16	17	19	21	18	14	15	18	17	19	18	18	22	16	17	11	15	20	19	18	17	20	17	18	21	16	9	15	13	17	15	20	-	14	19	17	-	19	19	17
A136NE1	0.024	6	11	12	13	14	16	14	11	11	14	13	15	14	14	17	12	13	9	11	15	14	14	13	15	13	14	16	12	7	11	10	13	11	15	-	10	14	13	-	14	14	13
A136NW	0.039	15	27	29	31	33	37	32	26	26	32	31	35	32	32	39	29	31	20	27	36	33	32	30	36	30	33	38	28	17	27	22	30	26	36	-	24	33	30	-	34	33	30
A136NW1	0.025	7	12	13	14	15	16	14	11	12	14	14	15	14	14	17	13	14	9	12	16	15	14	14	16	14	15	17	12	7	12	10	14	12	16	-	11	15	14	-	15	15	13
A136NW2	0.033	12	23	25	26	28	31	27	22	22	27	26	29	27	27	33	24	26	17	23	31	28	27	26	30	26	28	32	24	14	23	19	26	22	30	-	21	28	26	-	28	28	25
A136R1	0.034	8	15	16	17	18	20	17	14	14	17	17	19	17	17	21	15	17	11	14	20	18	17	16	19	16	18	21	15	9	14	12	16	14	19	-	13	18	16	-	18	18	16
A136SE	0.028	6	11	12	13	14	15	13	11	11	13	13	14	13	13	16	12	13	8	11	15	14	13	13	15	13	14	16	12	7	11	9	13	11	15	-	10	14	13	-	14	14	12
A201NE	0.1387	48	87	94	100	107	120	104	83	85	103	99	112	104	105	127	92	100	66	87	117	107	103	98	116	99	106	123	91	54	87	73	99	85	115	-	79	107	98	-	109	108	97
A201S1	0.098	37	68	73	78	83	93	81	65	66	80	77	87	81	82	99	72	78	51	67	91	84	80	77	90	77	82	96	71	42	67	57	77	67	90	-	62	83	76	-	85	84	76
A201SW	0.133	50	91	98	104	111	125	108	87	88	107	103	117	108	109	132	96	105	69	90	122	112	108	103	121	103	110	129	95	57	90	76	103	89	120	-	82	111	102	-	114	113	102
A203NE	0.103	36	65	71	75	80	90	78	62	63	77	74	84	78	78	95	69	75	49	65	88	80	77	74	87	74	79	92	68	41	65	54	74	64	86	-	59	80	74	-	82	81	73
A203NW	0.098	32	59	63	67	72	81	70	56	57	69	67	75	70	71	86	62	68	44	58	79	72	70	66	78	66	71	83	61	37	58	49	66	57	78	-	53	72	66	-	74	73	66
A203R1	0.116	15	27	29	31	33	37	32	26	26	31	30	34	32	32	39	28	31	20	27	36	33	32	30	36	30	33	38	28	17	27	22	30	26	35	-	24	33	30	-	34	33	30
A203R2	0.088	15	27	29	31	33	36	32	25	26	31	30	34	32	32	39	28	31	20	26	36	33	32	30	35	30	32	38	28	17	26	22	30	26	35	-	24	33	30	-	33	33	30
A203R3	0.111	23	42	45	48	51	57	50	40	40	49	47	53	50	50	60	44	48	31	41	56	51	49	47	55	47	50	59	43	26	41	35	47	41	55	-	38	51	47	-	52	52	46
A204E1	0.1535	55	100	109	115	123	138	120	96	98	119	114	129	120	121	146	107	116	76	100	135	124	119	113	134	114	122	142	105	63	100	84	114	98	133	-	91	123	113	-	126	125	112
A204E2	0.1536	60	109	118	125	134	150	130	104	106	129	124	140	130	131	159	116	125	82	108	147	134	129	123	145	123	132	154	114	68	108	91	123	107	144	-	99	133	123	-	137	136	122
A204NE	0.096	37	68	74	78	84	94	81	65	66	80	78	88	81	82	99	72	78	52	68	92	84	81	77	91	77	83	96	71	43	68	57	77	67	90	-	62	84	77	-	86	85	76
A204NW	0.107	41	75	81	86	92	103	89	71	73	88	85	96	89	90	109	79	86	57	74	101	92	89	85	100	85	91	106	78	47	74	62	85	73	99	-	68	92	84	-	94	93	84
A204R1	0.136	28	51	55	58	62	70	61	48	49	60	58	65	61	61	74	54	58	38	50	68	63	60	57	68	57	62	72	53	32	51	42	57	50	67	-	46	62	57	-	64	63	57
A204R2	0.0665	14	26	28	30	32	36	31	25	25	31	30	33	31	31	38	28	30	20	26	35	32	31	29	35	29	32	37	27	16	26	22	29	26	34	-	24	32	29	-	33	32	29
A204R3	0.1353	29	53	57	61	65	73	63	51	52	62	60	68	63	64	77	56	61	40	53	71	65	63	60	71	60	64	75	55	33	53	44	60	52	70	-	48	65	60	-	67	66	59
A204R4	0.0808	18	33	36	38	41	45	40	32	32	39	38	43	40	40	48	35	38	25	33	45	41	39	37	44	37	40	47	35	21	33	28	37	32	44	-	30	40	37	-	42	41	37
A204R5	0.0731	15	27	30	31	34	38	33	26	27	32	31	35	33	33	40	29	31	21	27	37	34	32	31	36	31	33	39	29	17	27	23	31	27	36	-	25	33	31	-	34	34	31
A204SE	0.096	35	64	69	73	78	88	76	61	62	75	73	82	76	77	93	68	73	48	63	86	79	76	72	85	72	78	90	67	40	63	53	72	63	85	-	58	78	72	-	80	79	71
A205SE	0.109	38	70	76	81	86	97	84	67	68	83	80	90	84	85	102	75	81	53	70	95	87	83	79	94	80	85	100	73	44	70	59	80	69	93	-	64	86	79	-	88	87	79
A205SW	0.037	7	13	14	15	16	18	16	13	13	15	15	17	16	16	19	14	15	10	13	18	16	16	15	18	15	16	19	14	8	13	11	15	13	17	-	12	16	15	-	16	16	15
A206NE	0.138	48	88	95	101	108	121	105	84	85	104	100	113	105	106	128	93	101	67	88	118	108	104	99	117	100	107	124	92	55	88	73	100	86	117	-	80	108	99	-	110	109	98
A206R1	0.078	16	29	31	33	36	40	35	28	28	34	33	37	35	35	42	31	33	22	29	39	36	34	33	39	33	35	41	30	18	29	24	33	28	38	-	26	35	33	-	36	36	32
A208NW	0.183	65	119	128	136	146	163	142	113	115	140	135	152	141	143	173	126	137	90	118	160	146	141	134	158	134	144	168	124	74	118	99	134	116	157	-	108	145	134	-	149	148	133
A208R1	0.092	19	34	37	39	42	47	41	33	33	40	39	44	41	41	50	36	40	26	34	46	42	41	39	46	39	42	49	36	21	34	29	39	34	45	-	31	42	39	-	43	43	38
A208R2	0.11408	23	43	46	49	52	59	51	41	42	50	49	55	51	51	62	45	49	32	42	57	52	51	48	57	48	52	60	45	27	42	36	48	42	56	-	39	52	48	-	54	53	48
A208R3	0.11995	26	47	51	54	58	65	56	45	46	55	54	60	56	56	68	50	54	36	47	63	58	56	53	63	53	57	66	49	29	47	39	53	46	62	-	43	57	53	-	59	59	53
A208R4	0.06381	14	25	27	29	31	34	30	24	24	29	28	32	30	30	36	27	29	19	25	34	31	30	28	33	28	30	35	26	16	25	21	28	24	33	-	23	31	28	-	31	31	28
A208R5	0.04895	11	19	21	22	24	26	23	18	19	23	22	25	23	23	28	20	22	15	19	26	24	23	22	26	22	23	27	20	12	19	16	22	19	25	-	17	23	22	-	24	24	21
A208R6	0.03693	8	14	16	17	18	20	17	14	14	17	16	19	17	17	21	15	17	11	14	19	18	17	16	19	16	18	20	15	9	14	12	16	14	19	-	13	18	16	-	18	18	16
A208SE	0.135	39	71	77	81	87	98	85	68	69	84	81	91	85	85	103	75	82	54	71	96	88	84	80	95	80	86	101	74	44	71	59	80	70	94	-	64	87	80	-	89	88	79
A209NW	0.1408	52	95	103	109	116	131	113	90	92	112	108	122	113	114	138	101	109	72	94	128	117	112	107	126	107	115	134	99	59	94	79	107	93	126	-	86	116	107	-	119	118	106
A209R1	0.05338	11	21	23	24	26	29	25	20	20	25	24	27	25	25	30	22	24	16	21	28	26	25	24	28	24	25	30	22	13	21	17	24	20	28	-	19	26	24	-	26	26	23
A209SE	0.11198	40	73	79	84	90	101	88	70	71	87	84	94	87	88	107	78	85	56	73	99	90	87	83	98	83	89	104	77	46	73	61	83	72	97	-	67	90	83	-	92	91	82
A210NW	0.0605	14	26	28	30	32	35	31	25	25	30	29	33	31	31	38	27	30	19	26	35	32	31	29	34	29	31	36	27	16	26	22	29	25	34	-	23	32	29	-	32	32	29
A210SE	0.1357	48	88	95	101	108	121	105	84	85	104	100	113	105	106	128	93	101	67	87	118	108	104	99	117	99	107	124	92	55	87	73	100	86	116	-	80	108	99	-	110	109	98
A211R1	0.0326	7	12	13	14	15	17	15	12	12	14	14	16	15	15	18	13	14	9	12	16	15	14	14	16	14	15	17	13	8	12	10	14	12	16	-	11	15	14	-	15	15	14
A211R2	0.1526	30	54	59	62	67	75	65	52	53	64	62	70	65	65	79	58	62	41	54	73	67	65	61	73	61	66	77	57	34	54	45	61	53	72	-	49	66	61	-	68	68	61
A211R3	0.08025	9	16	17	18	19	21	19	15	15	18	18	20	19	19	23	17	18	12	16	21	19	19	18	21	18	19	22	16	10	16	13	18	15	21	-	14	19	18	-	20	19	17
A213NE	0.1207	43	78	85	90	96	108	93	75	76	92	89	100	93	94	114	83	90	59	78	105	96	93	88	104	88	95	111	82	49	78	65	88	77	104	-	71	96	88	-	98	97	87
A214NE	0.1165	43	79	85	90	96	108	94	75	76	93	89	101	94	94	114	83	90	59	78	106	97	93	89	105	89	95	111	82	49	78	66	89	77	104	-	71	96	89	-	99	98	88
A214NW	0.119	43	79	86	91	97	109	94	75	77	93	90	102	94	95	115	84	91	60	79	106	97	94	89	105	90	96	112	83	49	79	66	90	78	105	-	72	97	89	-	99	98	88
A214SE	0.0937	26	47	51	54	57	64	56	45	45	55	53	60	56	56	68	50	54	35	46	63	58	55	53	62	53	57	66	49	29	46	39	53	46	62	-	42	57	53	-	59	58	52
A214SW	0.1075	38	69	75	80	85	96	83	66	67	82	79	89	83	84	101	74	80	53	69	94	86	82	78	93	79	84	98	73	43	69	58	79	68	92	-	63	85	78	-	87	86	78
A215NE	0.0554	12	22	24	25	27	30	26	21	21	26	25	28	26	27	32	23	25	17	22	30	27	26	25	30	25	27	31	23	14	22	18	25	22	29	-	20	27	25	-	28	28	25
A215NW	0.0554	12	22	24	25	27	30	26	21	21	26	25	28	26	27	32	23	25	17	22	30	27	26	25	30	25	27	31	23	14	22	18	25	22	29	-	20	27	25	-	28	28	25
A215SE	0.0271	10	17	19	20	21	24	21	17	17	21	20	22	21	21	25	18	20	13	17	23	21	21	20	23	20	21	25	18	11	17	15	20	17	23	-	16	21	20	-	22	22	19
A215SW	0.063	22	40	43	46	49	55	48	38	39	47	46	51	48	48	58	42	46	30	40	54	49	47	45	53	45	49	57	42	25	40	33	45	39	53	-	36	49	45	-	50	50	45

Table B4 - Subcatchments

Yearly Surface Evaporation Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A216E1	0.0308	7	12	13	14	15	17	15	12	12	15	14	16	15	15	18	13	14	9	12	17	15	15	14	16	14	15	17	13	8	12	10	14	12	16	-	11	15	14	-	15	15	**14**
A216NE	0.0918	33	60	65	69	74	83	72	57	58	71	68	77	72	72	88	64	69	45	60	81	74	71	68	80	68	73	85	63	38	60	50	68	59	80	-	55	74	68	-	75	75	**67**
A216NW	0.0893	32	59	64	68	73	82	71	57	58	70	68	76	71	71	86	63	68	45	59	80	73	70	67	79	67	72	84	62	37	59	50	67	58	79	-	54	73	67	-	75	74	**66**
A216R1	0.048	9	17	18	20	21	23	20	16	17	20	19	22	20	21	25	18	20	13	17	23	21	20	19	23	19	21	24	18	11	17	14	19	17	23	-	16	21	19	-	22	21	**19**
A216R2	0.0407	8	14	16	17	18	20	17	14	14	17	17	19	17	17	21	15	17	11	14	19	18	17	16	19	16	18	20	15	9	14	12	16	14	19	-	13	18	16	-	18	18	**16**
A216R3	0.0597	14	26	28	29	31	35	31	24	25	30	29	33	31	31	37	27	29	19	25	34	32	30	29	34	29	31	36	27	16	25	21	29	25	34	-	23	31	29	-	32	32	**29**
A216R4	0.0548	13	24	25	27	29	32	28	22	23	28	27	30	28	28	34	25	27	18	23	32	29	28	27	31	27	29	33	25	15	23	20	27	23	31	-	21	29	27	-	30	29	**26**
A216SE	0.0888	34	62	67	71	76	86	74	59	60	73	71	80	74	75	91	66	71	47	62	84	77	74	70	83	70	75	88	65	39	62	52	70	61	82	-	56	76	70	-	78	77	**69**
A216SW	0.0924	36	66	71	75	80	90	78	63	64	77	75	84	78	79	96	70	76	50	65	88	81	78	74	87	74	80	93	68	41	65	55	74	64	87	-	60	80	74	-	82	82	**73**
A217NE	0.1516	54	99	107	114	122	137	119	95	96	117	113	128	118	120	145	105	114	75	99	134	122	118	112	132	112	121	141	104	62	99	83	112	97	132	-	90	122	112	-	125	124	**111**
A217NW	0.0784	28	51	56	59	63	71	61	49	50	61	59	66	61	62	75	55	59	39	51	69	63	61	58	68	58	62	73	54	32	51	43	58	50	68	-	47	63	58	-	65	64	**57**
A217R1	0.0605	12	22	23	25	26	30	26	21	21	25	25	28	26	26	31	23	25	16	21	29	26	26	24	29	24	26	30	22	13	21	18	24	21	28	-	20	26	24	-	27	27	**24**
A217R2	0.068	14	25	28	29	31	35	30	24	25	30	29	33	30	31	37	27	29	19	25	34	31	30	29	34	29	31	36	27	16	25	21	29	25	34	-	23	31	29	-	32	32	**28**
A217R3	0.0677	14	25	27	29	31	35	30	24	25	30	29	33	30	30	37	27	29	19	25	34	31	30	29	34	29	31	36	26	16	25	21	29	25	34	-	23	31	29	-	32	32	**28**
A217R4	0.0502	10	18	19	21	22	25	21	17	17	21	20	23	21	21	26	19	21	14	18	24	22	21	20	24	20	22	25	19	11	18	15	20	18	24	-	16	22	20	-	22	22	**20**
A217R5	0.0836	20	36	39	41	44	49	43	34	35	42	41	46	43	43	52	38	41	27	36	48	44	43	40	48	41	44	51	37	22	36	30	41	35	47	-	33	44	40	-	45	45	**40**
A217R6	0.0875	21	38	41	43	46	52	45	36	37	44	43	48	45	45	55	40	43	28	37	51	46	45	42	50	42	46	53	39	23	37	31	42	37	50	-	34	46	42	-	47	47	**42**
A217R7	0.086	20	37	40	42	45	51	44	35	36	43	42	47	44	44	54	39	42	28	37	50	45	44	42	49	42	45	52	39	23	37	31	42	36	49	-	33	45	42	-	46	46	**41**
A217R8	0.0631	15	27	29	31	33	37	32	26	26	32	31	35	32	33	39	29	31	21	27	36	33	32	31	36	31	33	38	28	17	27	23	31	27	36	-	25	33	31	-	34	34	**30**
A217SE	0.1515	59	108	116	123	132	148	128	103	104	127	123	138	128	129	157	114	124	81	107	145	133	128	121	143	122	131	152	112	67	107	90	122	106	143	-	98	132	121	-	135	134	**120**
A217SW	0.0784	32	58	63	66	71	80	69	55	56	68	66	74	69	70	84	61	67	44	58	78	71	69	65	77	65	70	82	60	36	58	48	65	57	77	-	52	71	65	-	73	72	**65**
A218NE	0.0513	17	32	34	36	39	44	38	30	31	37	36	41	38	38	46	34	36	24	31	43	39	38	36	42	36	38	45	33	20	31	26	36	31	42	-	29	39	36	-	40	39	**35**
A218SE	0.0517	19	35	38	40	43	48	42	34	34	41	40	45	42	42	51	37	40	27	35	47	43	42	40	47	40	43	50	37	22	35	29	40	34	47	-	32	43	40	-	44	44	**39**
A218W3	0.036	11	20	22	23	24	27	24	19	19	23	23	26	24	24	29	21	23	15	20	27	25	24	22	27	23	24	28	21	12	20	17	23	19	26	-	18	24	22	-	25	25	**22**
A220NE	0.0464	19	35	37	40	42	48	41	33	34	41	39	44	41	42	50	37	40	26	34	47	43	41	39	46	39	42	49	36	22	34	29	39	34	46	-	31	42	39	-	43	43	**39**
A220NW	0.0577	17	31	33	35	38	42	37	29	30	36	35	40	37	37	45	33	35	23	31	41	38	37	35	41	35	37	44	32	19	31	26	35	30	41	-	28	38	35	-	39	38	**34**
A220SW	0.1254	47	86	93	98	105	118	103	82	83	101	98	110	102	103	125	91	99	65	85	116	106	102	97	114	97	104	122	90	54	85	72	97	84	114	-	78	105	97	-	108	107	**96**
A221NE	0.0326	12	22	24	25	27	31	26	21	22	26	25	28	26	27	32	24	26	17	22	30	27	26	25	30	25	27	31	23	14	22	18	25	22	29	-	20	27	25	-	28	28	**25**
A221SE	0.0561	12	22	24	25	27	30	26	21	21	26	25	28	26	26	32	23	25	17	22	29	27	26	25	29	25	27	31	23	14	22	18	25	21	29	-	20	27	25	-	28	27	**24**
A222E1	0.0245	5	10	10	11	12	13	11	9	9	11	11	12	11	12	14	10	11	7	10	13	12	11	11	13	11	12	14	10	6	10	8	11	9	13	-	9	12	11	-	12	12	**11**
A222E2	0.0438	16	30	32	34	36	41	35	28	29	35	34	38	35	36	43	31	34	22	29	40	36	35	33	39	33	36	42	31	18	29	25	33	29	39	-	27	36	33	-	37	37	**33**
A222E3	0.0327	7	13	14	15	16	18	15	12	12	15	15	16	15	15	19	14	15	10	13	17	16	15	14	17	14	16	18	13	8	13	11	14	12	17	-	12	16	14	-	16	16	**14**
A222E4	0.1176	43	78	85	89	96	108	93	74	76	92	89	100	93	94	114	83	90	59	78	105	96	93	88	104	88	95	111	82	49	78	65	88	77	104	-	71	96	88	-	98	97	**87**
A222NE	0.0643	23	43	46	49	52	59	51	41	41	50	49	55	51	51	62	45	49	32	42	57	53	51	48	57	48	52	60	44	27	42	36	48	42	56	-	39	52	48	-	54	53	**48**
A222NW	0.1299	48	88	95	100	107	120	104	83	85	103	100	112	104	105	128	93	101	66	87	118	108	104	99	117	99	106	124	91	55	87	73	99	86	116	-	79	107	99	-	110	109	**98**
A222R1	0.0305	7	12	13	14	15	16	14	11	12	14	14	15	14	14	17	13	14	9	12	16	15	14	13	16	14	15	17	12	7	12	10	13	12	16	-	11	15	13	-	15	15	**13**
A222R2	0.0477	11	20	21	22	24	27	23	19	19	23	22	25	23	23	28	21	22	15	19	26	24	23	22	26	22	24	28	20	12	19	16	22	19	26	-	18	24	22	-	25	24	**22**
A222R3	0.0352	8	14	16	17	18	20	17	14	14	17	16	19	17	17	21	15	17	11	14	19	18	17	16	19	16	18	20	15	9	14	12	16	14	19	-	13	18	16	-	18	18	**16**
A222R4	0.1161	25	45	49	52	56	62	54	43	44	54	52	58	54	55	66	48	52	34	45	61	56	54	51	61	51	55	64	47	28	45	38	51	45	60	-	41	56	51	-	57	57	**51**
A222R5	0.095	21	39	42	45	48	53	46	37	38	46	44	50	46	47	57	41	45	29	39	52	48	46	44	52	44	47	55	41	24	39	32	44	38	52	-	35	48	44	-	49	48	**44**
A222R6	0.1075	24	44	48	51	54	61	53	42	43	52	50	57	53	53	64	47	51	33	44	59	54	52	50	59	50	53	62	46	28	44	37	50	43	58	-	40	54	50	-	56	55	**49**
A222R7	0.0913	20	37	40	43	46	51	45	36	36	44	43	48	45	45	54	40	43	28	37	50	46	44	42	50	42	45	53	39	23	37	31	42	37	49	-	34	46	42	-	47	47	**42**
A222R8	0.1058	24	43	47	50	53	60	52	41	42	51	49	56	52	52	63	46	50	33	43	58	53	51	49	58	49	53	61	45	27	43	36	49	42	57	-	39	53	49	-	55	54	**48**
A222R9	0.1117	24	44	47	50	54	60	52	42	43	52	50	56	52	52	64	46	50	33	43	59	54	52	49	58	49	53	62	46	27	44	36	49	43	58	-	40	53	49	-	55	54	**49**
A222SE	0.0762	27	49	53	56	60	68	59	47	48	58	56	63	59	59	72	52	57	37	49	66	61	58	56	66	56	60	70	51	31	49	41	56	48	65	-	45	60	56	-	62	61	**55**
A222SW	0.1301	47	86	94	99	106	119	103	82	84	102	98	111	103	104	126	92	100	65	86	116	107	103	98	115	98	105	122	90	54	86	72	98	85	115	-	78	106	97	-	109	108	**97**
A223NE	0.0668	24	44	48	51	54	61	53	42	43	52	50	57	53	53	65	47	51	33	44	60	55	52	50	59	50	54	63	46	28	44	37	50	43	59	-	40	54	50	-	56	55	**49**
A223SE	0.0645	24	44	47	50	54	60	52	42	43	52	50	56	52	53	64	47	51	33	44	59	54	52	50	59	50	53	62	46	27	44	37	50	43	58	-	40	54	49	-	55	55	**49**
A223SW	0.0711	22	39	43	45	48	54	47	37	38	46	45	51	47	47	57	42	45	30	39	53	48	47	44	52	45	48	56	41	25	39	33	44	38	52	-	36	48	44	-	49	49	**44**
A224NE	0.0624	21	38	41	43	46	52	45	36	37	45	43	49	45	46	55	40	44	29	38	51	47	45	43	51	43	46	54	39	24	38	32	43	37	50	-	34	46	43	-	48	47	**42**
A224NW	0.0992	38	69	74	79	84	95	82	65	67	81	78	88	82	83	100	73	79	52	68	92	85	81	78	91	78	83	97	72	43	68	57	78	67	91	-	62	84	77	-	86	85	**77**
A224R1	0.1117	23	42	45	48	51	57	50	40	41	49	48	54	50	50	61	44	48	32	41	56	51	50	47	56	47	51	59	44	26	42	35	47	41	55	-	38	51	47	-	52	52	**47**
A224R2	0.032	8	14	15	16	18	20	17	14	14	17	16	18	17	17	21	15	16	11	14	19	18	17	16	19	16	17	20	15	9	14	12	16	14	19	-	13	17	16	-	18	18	**16**
A224SW	0.0581	13	24	26	27	29	33	28	23	23	28	27	30	28	29	35	25	27	18	24	32	29	28	27	32	27	29	34	25	15	24	20	27	23	31	-	22	29	27	-	30	30	**27**
A225NE	0.0682	16	30	32	34	36	41	35	28	29	35	34	38	35	36	43	31	34	22	30	40	37	35	34	40	34	36	42	31	19	30	25	33	29	39	-	27	36	33	-	37	37	**33**
A225NW	0.1231	43	78	85	90	96	108	94	75	76	92	89	101	93	94	114	83	90	59	78	105	97	93	88	104	89	95	111	82	49	78	65	89	77	104	-	71	96	88	-	98	97	**88**
A225SE	0.0748	18	33	35	37	40	45	39	31	32	38	37	42	39	39	47	35	37	25	32	44	40	39	37	43	37	40	46	34	20	32	27	37	32	43	-	30	40	37	-	41	40	**36**
A226NE	0.068	17	30	33	35	37	41	36	29	29	36	34	39	36	36	44	32	35	23	30	41	37	36	34	40	34	37	43	31	19	30	25	34	30	40	-	27	37	34	-	38	38	**34**
A226NW	0.1354	49	89	96	102	109	122	106	85	86	105	101	114	106	107	129	94	102	67	88	120	109	105	100	118	100	108	126	93	56	88	74	100	87	118	-	81	109	100	-	112	110	**99**
A227NE	0.0287	7	13	14	15	16	18	15	12	12	15	15	16	15	15	19	14	15	10	13	17	16	15	14	17	14	16	18	13	8	13	11	14	12	17	-	12	16	14	-	16	16	**14**
A227NW	0.0646	16	29	31	33	35	39	34	27	28	34	33	37	34	34	42	30	33	22	29	39	35	34	32	38	32	35	41	30	18	29	24	32	28	38	-	26	35	32	-	36	36	**32**
A227SE	0.0679	16	30	33	35	37	41	36	29	29	36	34	39	36	36	44	32	35	23	30	41	37	36	34	40	34	37	43	31	19	30	25	34	29	40	-	27	37	34	-	38	38	**34**
A227SW	0.0984	35	63	69	73	78	87	76	61	62	75	72	82	76	76	93	67	73	48	63	85	78	75	72	85	72	77	90	66	40	63	53	72	62	84	-	58	78	72	-	80	79	**71**
A228NE	0.1045	37	68	74	78	84	94	82	65	67	81	78	88	82	82	100	73	79	52	68	92	84	81	77	91	78	83	97	71	43	68	57	78	67	91	-	62	84	77	-	86	85	**77**
A228NW	0.1369	50	91	98	104	111	125	108	87	88	107	103	117	108	109	132	96	105	69	90	122	112	108	103	121	103	110	129	95	57	90	76	103	89	120	-	82	111	102	-	114	113	**102**
A228R1	0.0632	14	25	27	28	30	34	30	24	24	29	28	32	30	30	36	26	28	19	25	33	30	29	28	33	28	30	35	26	15	25	21	28	24	33	-	22	30	28	-	31	31	**28**
A228R2	0.1043	23	43	46	49	52	59	51	41	42	50	49	55	51	51	62	45	49	32	42	57	53	51	48	57	48	52	60	45	27	43	36	48	42	57	-	39	52	48	-	54	53	**48**
A228SE	0.0654	15	27	30	31	34	38	33	26	27	32	31	35	33	33	40	29	31	21	27	37	34	32	31	36	31	33	39	28	17	27	23	31	27	36	-	25	33	31	-	34	34	**31**
A229N2	0.0307	12	21	23	25	26	29	26	20	21	25	24	28	26	26	31	23	25	16	21	29	26	25	24	29	24	26	30	22	13	21	18	24	21	28	-	19	26	24	-	27	27	**24**
A229NE	0.0591	16	29	32	34	36	40	35	28	29	35	34	38	35	35	43	31	34	22	29	40	36	35	33	39	33	36	42	31	18	29	25	33	29	39	-	27	36	33	-	37	37	**33**
A229NW	0.0601	23	42	45	48	52	58	50	40	41	50	48	54	50	51	61	45	48	32	42	57	52	50	47	56	48	51	59	44	26	42	35	48	41	56	-	38	51	47	-	53	52	**47**
A229R1	0.1224	29	52	57	60	64	72	63	50	51	62	60	67	62	63	76	55	60	40	52	70	64	62	59	70	59	64	74	55	33	52	44	59	51	69	-	47	64	59	-	66	65	**59**
A229R2	0.0799	18	33	35	38	40	45	39	31	32	39	37	42	39	39	48	35	38	25	33	44	40	39	37	44	37	40	46	34	20	33	27	37	32	43	-	30	40	37	-	41	41	**37**
A229SE	0.1047	38	69	74	79	84	95	82	65	67	81	78	88	82	83	100	73	79	52	68	92	85	81	77	91	78	83	97	72	43	68	57	78	67	91	-	62	84	77	-	86	85	**77**
A229SW	0.1401	51	93	101	106	114	128	111	89	90	110	106	119	111	112	135	99	107	70	93	125	115	110	105	124	105	113	132	97	58	93	78	105	91	123	-	84	114	105	-	117	116	**104**
A230NE	0.1102	40	73	79	84	90	101	87	70	71	86	83	94	87	88	107	78	84	55	73	98	90	87	83	97	83	89	103	76	46	73	61	83	72	97	-	66	90	82	-	92	91	**82**
A230NW	0.0787	24	44	47	50	53	60	52	42	42	51	50	56	52	52	63	46	50	33	43	59	54	52	49	58	49	53	62	45	27	43	36	49	43	58	-	40	53	49	-	55	54	**49**
A230R1	0.0373	8	14	15	16	17	19	17	13	14	16	16	18	17	17	20	15	16	11	14	19	17	17	16	19	16	17	20	15	9	14	12	16	14	18	-	13	17	16	-	18	17	**16**
A230R2	0.0266	6	12	13	14	15	16	14	11	12	14	13	15	14	14	17	13	14	9	12	16	15	14	13	16	13	14	17	12	7	12	10	13	12	16	-	11	14	13	-	15	15	**13**
A230R3	0.0632	14	25	27	28	30	34	30	24	24	29	28	32	30	30	36	26	28	19	25	33	30	29	28	33	28	30	35	26	15	25	21	28	24	33	-	22	30	28	-	31	31	**28**
A230R4	0.0984	22	40	44	46	49	55	48	38	39	47	46	52	48	48	59	43	46	30	40	54	50	48	45	54	46	49	57	42	25	40	34	46	39	53	-	37	49	45	-	51	50	**45**
A230WK	0.0128	3	6	6	7	7	8	7	5	6	7	6	7	7	7	8	6	7	4	6	8	7	7	6	8	6	7	8	6	4	6	5	6	6	8	-	5	7	6	-	7	7	**6**
A231N1	0.0597	16	29	32	33	36	40	35	28	28	34	33	38	35	35	43	31	34	22	29	39	36	35	33	39	33	36	41	30	18	29	24	33	29	39	-	27	36	33	-	37	36	**33**
A231NE	0.0603	23	42	46	48	52	58	50	40	41	50	48	54	50	51	61	45	49	32	42	57	52	50	48	56	48	51	60	44	26	42	35	48	41	56	-	38	52	47	-	53	52	**47**
A231NW	0.0466	18	33	35	37	40	45	39	31	32	38	37	42	39	39	47	35	37	25	32	44	40	39	37	43	37	40	46	34	20	32	27	37	32	43	-	30	40	37	-	41	40	**36**
A231R1	0.0242	6	11	12	12	13	15	13	10	10	13	12	14	13	13	16	11	12	8	11	14	13	13	12	14	12	13	15	11	7	11	9	12	11	14	-	10	13	12	-	14	13	**12**
A231R2	0.0334	8	14	15	16	17	19	16	13	13	16	16	18	16	16	20	15	16	10	14	18	17	16	15	18	15	17	19	14	9	14	11	15	13	18	-	12	17	15	-	17	17	**15**
A231R3	0.0319	7	13	14	14	15	17	15	12	12	15	14	16	15	15	18	13	14	9	12	17	15	15	14	17	14	15	18	13	8	12	10	14	12	17	-	11	15	14	-	16	16	**14**
A231R4	0.0319	7	13	14	14	15	17	15	12	12	15	14	16	15	15	18	13	14	9	12	17	15	15	14	17	14	15	18	13	8	12	10	14	12	17	-	11	15	14	-	16	16	**14**
A231R5	0.1171	27	50	54	57	61	69	60	48	49	59	57	64	60	60	73	53	58	38	50	67	62	59	57	67	57	61	71	52	31	50	42	57	49	66	-	45	61	56	-	63	62	**56**
A231R6	0.0912	20	37	40	43	46	51	45	36	36	44	43	48	45	45	54	40	43	28	37	50	46	44	42	50	42	45	53	39	23	37	31	42	37	49	-	34	46	42	-	47	47	**42**
A231SE	0.1067	38	70	76	80	86	96	83	67	68	83	80	90	83	84	102	74	81	53	70	94	86	83	79	93	79	85	99	73	44	70	58	79	69	93	-	63	86	79	-	88	87	**78**
A231SW	0.1371	49	90	97	103	110	124	107	86	87	106	102	116	107	108	131	95	103	68	89	121	111	107	101	120	102	109	127	94	56	89	75	102	88	119	-	82	110	101	-	113	112	**100**
A302NE	0.02	5	10	10	11	12	13	11	9	9	11	11	12	11	12	14	10	11	7	10	13	12	11	11	13	11	12	14	10	6	10	8	11	9	13	-	9	12	11	-	12	12	**11**
A302NW	0.02	5	10	10	11	12	13	11	9	9	11	11	12	11	12	14	10	11	7	10	13	12	11	11	13	11	12	14	10	6	10	8	11	9	13	-	9	12	11	-	12	12	**11**
A302NW1	0.026	10	18	19	20	22	25	21	17	17	21	20	23	21	22	26	19	21	14	18	24	22	21	20	24	20	22	25	19	11	18	15	20	18	24	-	16	22	20	-	22	22	**20**
A302R1	0.063	15	27	29	31	33	37	32	26	26	32	31	35	32	32	39	29	31	20	27	36	33	32	30	36	30	33	38	28	17	27	22	30	26	36	-	24	33	30	-	34	34	**30**
A302SE	0.028	7	13	15	15	16	18	16	13	13	16	15	17	16	16	20	14	15	10	13	18	17	16	15	18	15	16	19	14	8	13	11	15	13	18	-	12	16	15	-	17	17	**15**
A302SW	0.028	7	13	15	15	16	18	16	13	13	16	15	17	16	16	20	14	15	10	13	18	17	16	15	18	15	16	19	14	8	13	11	15	13	18	-	12	16	15	-	17	17	**15**
A302SW1	0.037	14	25	28	29	31	35	30	24	25	30	29	33	30	31	37	27	29	19	25	34	31	30	29	34	29	31	36	27	16	25	21	29	25	34	-	23	31	29	-	32	32	**28**
A303NE1	0.025	7	12	13	14	15	16	14	11	12	14	14	15	14	14	17	13	14	9	12	16	15	14	14	16	14	15	17	12	7	12	10	14	12	16	-	11	15	13	-	15	15	**13**
A303NW1	0.025	7	12	13	14	15	16	14	11	12	14	14	15	14	14	17	13	14	9	12	16	15	14	14	16	14	15	17	12	7	12	10	14	12	16	-	11	15	13	-	15	15	**13**
A303NW2	0.032	12	22	24	25	27	30	26	21	21	26	25	28	26	26	32	23	25	17	22	30	27	26	25	29	25	27	31	23	14	22	18	25	22	29	-	20	27	25	-	28	27	**25**
A303R1	0.102	24	44	47	50	53	60	52	42	42	51	50	56	52	52	63	46	50	33	43	59	54	52	49	58	49	53	62	45	27	43	36	49	43	58	-	40	53	49	-	55	54	**49**
A303R2	0.088	21	38	41	43	46	52	45	36	37	44	43	48	45	45	55	40	43	28	37	51	46	45	42	50	43	46	53	39	23	37	31	42	37	50	-	34	46	42	-	47	47	**42**
A303SE	0.03	8	14	16	16	18	20	17	14	14	17	16	18	17	17	21	15	17	11	14	19	18	17	16	19	16	18	20	15	9	14	12	16	14	19	-	13	18	16	-	18	18	**16**
A303SE1	0.044	12	21	23	24	26	29	25	20	20	25	24	27	25	25	31	22	24	16	21	28	26	25	24	28	24	26	30	22	13	21	18	24	21	28	-	19	26	24	-	26	26	**24**
A303SW	0.03	8	14	16	16	18	20	17	14	14	17	16	18	17	17	21	15	17	11	14	19	18	17	16	19	16	18	20	15	9	14	12	16	14	19	-	13	18	16	-	18	18	**16**
A303SW1	0.044	12	21	23	24	26	29	25	20	20	25	24	27	25	25	31	22	24	16	21	28	26	25	24	28	24	26	30	22	13	21	18	24	21	28	-	19	26	24	-	26	26	**24**
A303SW2	0.056	21	38	42	44	47	53	46	37	37	45	44	49	46	46	56	41	44	29	38	52	47	46	43	51	44	47	54	40	24	38	32	44	38	51	-	35	47	43	-	48	48	**43**

Table B4 - Subcatchments
Yearly Surface Evaporation Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
A303SW3	0.039	15	27	29	31	33	37	32	26	26	32	31	34	32	32	39	28	31	20	27	36	33
A306NE	0.111	40	73	79	83	89	100	87	69	71	86	83	93	87	87	106	77	84	55	72	98	89
A306NW	0.156	56	103	111	118	126	141	122	98	100	121	117	132	122	124	150	109	118	78	102	138	126
A306R2	0.127	30	54	59	62	67	75	65	52	53	64	62	70	65	65	79	57	62	41	54	73	67
A306SE	0.051	13	24	26	28	30	34	29	23	24	29	28	31	29	29	36	26	28	18	24	33	30
A306SW	0.051	13	24	26	28	30	34	29	23	24	29	28	31	29	29	36	26	28	18	24	33	30
A306SW1	0.064	24	44	48	50	54	61	53	42	43	52	50	57	52	53	64	47	51	33	44	59	54
A310NE	0.043	15	28	30	32	35	39	34	27	27	33	32	36	34	34	41	30	32	21	28	38	35
A310NE1	0.028	10	18	20	21	22	25	22	17	18	22	21	23	22	22	27	19	21	14	18	25	23
A310NW	0.054	19	35	38	41	43	49	42	34	34	42	40	46	42	43	52	38	41	27	35	48	44
A310R1	0.044	10	19	20	22	23	26	22	18	18	22	21	24	22	23	27	20	22	14	19	25	23
A310SE	0.034	12	22	24	25	27	31	27	21	22	26	25	29	26	27	32	24	26	17	22	30	27
A310SW	0.054	19	35	38	41	43	49	42	34	34	42	40	46	42	43	52	38	41	27	35	48	44
A311NE	0.12	43	79	85	90	96	108	94	75	76	93	89	101	94	94	114	83	90	59	78	106	97
A311NW	0.067	24	44	48	50	54	61	52	42	43	52	50	57	52	53	64	47	51	33	44	59	54
A311R1	0.107	25	46	49	52	56	63	55	44	45	54	52	59	55	55	67	48	53	35	45	62	56
A311SE	0.119	43	78	84	89	96	108	93	74	76	92	89	100	93	94	114	83	90	59	78	105	96
A311SW	0.067	24	44	48	50	54	61	52	42	43	52	50	57	52	53	64	47	51	33	44	59	54
APOND2	0.019	5	9	10	11	12	13	11	9	9	11	11	12	11	11	14	10	11	7	9	13	12
A104PK	1.72	2,691	7,753	5,555	7,518	7,499	11,040	8,186	4,273	5,079	6,406	7,785	6,756	9,096	7,677	11,658	6,694	6,998	3,373	6,661	10,874	8,073
Total	**28.778**	**10,454**	**21,952**	**20,908**	**23,784**	**24,923**	**30,572**	**25,134**	**17,808**	**18,873**	**23,144**	**23,955**	**25,001**	**26,018**	**24,744**	**32,336**	**21,748**	**23,333**	**14,107**	**20,781**	**29,981**	**25,558**

Node	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A303SW3	32	30	36	30	33	38	28	17	27	22	30	26	36	-	24	33	30	-	34	33	**30**
A306NE	86	82	97	82	88	103	76	45	72	61	82	71	96	-	66	89	82	-	91	90	**81**
A306NW	122	116	137	116	125	145	107	64	102	86	116	101	136	-	93	126	116	-	129	128	**115**
A306R2	64	61	72	61	66	77	57	34	54	45	61	53	72	-	49	66	61	-	68	68	**61**
A306SE	29	28	33	28	30	35	25	15	24	20	28	24	32	-	22	30	28	-	31	30	**27**
A306SW	29	28	33	28	30	35	25	15	24	20	28	24	32	-	22	30	28	-	31	30	**27**
A306SW1	52	50	59	50	53	62	46	28	44	37	50	43	58	-	40	54	50	-	55	55	**49**
A310NE	33	32	38	32	34	40	29	18	28	24	32	28	37	-	26	35	32	-	35	35	**32**
A310NE1	22	21	24	21	22	26	19	11	18	15	21	18	24	-	17	22	21	-	23	23	**20**
A310NW	42	40	47	40	43	50	37	22	35	30	40	35	47	-	32	43	40	-	45	44	**40**
A310R1	22	21	25	21	23	27	20	12	19	16	21	18	25	-	17	23	21	-	24	23	**21**
A310SE	26	25	30	25	27	31	23	14	22	19	25	22	29	-	20	27	25	-	28	28	**25**
A310SW	42	40	47	40	43	50	37	22	35	30	40	35	47	-	32	43	40	-	45	44	**40**
A311NE	93	89	105	89	95	111	82	49	78	66	89	77	104	-	71	96	89	-	99	98	**88**
A311NW	52	50	59	50	53	62	46	27	44	37	50	43	58	-	40	54	50	-	55	55	**49**
A311R1	54	52	61	52	56	65	48	29	45	38	52	45	60	-	41	56	51	-	58	57	**51**
A311SE	93	88	104	88	95	110	81	49	78	65	88	77	103	-	71	96	88	-	98	97	**87**
A311SW	52	50	59	50	53	62	46	27	44	37	50	43	58	-	40	54	50	-	55	55	**49**
APOND2	11	11	13	11	12	13	10	6	9	8	11	9	13	-	9	12	11	-	12	12	**11**
A104PK	8,753	6,257	9,203	5,597	8,778	7,672	6,980	4,484	6,157	4,359	6,452	5,253	7,034		6,740	6,687	8,299		10,594	8,173	**2,691**
Total	**25,595**	**22,284**	**28,129**	**21,662**	**26,027**	**27,758**	**21,793**	**13,357**	**20,284**	**16,197**	**22,506**	**19,163**	**25,837**	**-**	**19,621**	**24,069**	**24,295**	**-**	**28,434**	**25,838**	**18,559**

Table B5 - Subcatchments

Yearly Surface Infiltration Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A102NE	0.1339	170	237	227	242	224	340	304	151	226	213	268	252	340	253	369	247	244	189	208	371	274	278	233	296	237	279	293	234	202	217	166	200	193	244	-	241	252	252	-	329	251	**250**
A103NE	0.1353	121	169	162	173	159	243	217	108	161	152	191	180	242	180	263	176	174	135	148	264	196	198	167	211	169	199	209	167	144	155	118	143	138	174	-	172	180	179	-	235	179	**178**
A103SW	0.0582	65	91	87	93	86	130	116	58	87	82	103	97	130	97	142	95	94	73	80	142	105	106	90	114	91	107	112	90	77	83	63	77	74	94	-	92	97	96	-	126	96	**96**
A104NE	0.1378	139	193	186	198	183	278	248	124	185	174	219	206	278	206	302	202	200	155	170	303	224	227	191	242	194	228	239	191	165	177	135	164	158	199	-	197	206	206	-	269	205	**204**
A104NW	0.0471	100	140	134	143	132	201	179	89	133	126	158	149	201	149	218	146	144	112	122	219	162	164	138	175	140	165	173	138	119	128	98	118	114	144	-	142	149	149	-	194	148	**147**
A104SE	0.0528	53	74	71	76	70	106	95	47	71	67	84	79	106	79	116	77	77	59	65	116	86	87	73	93	74	87	92	73	63	68	52	63	61	76	-	75	79	79	-	103	79	**78**
A104SW	0.0473	46	64	61	65	60	92	82	41	61	57	72	68	92	68	100	67	66	51	56	100	74	75	63	80	64	75	79	63	55	59	45	54	52	66	-	65	68	68	-	89	68	**68**
A105NE	0.0577	65	90	86	92	85	129	115	57	86	81	102	96	129	96	140	94	93	72	79	141	104	106	89	113	90	106	111	89	77	83	63	76	73	93	-	92	96	96	-	125	95	**95**
A105NW	0.1045	90	125	120	128	118	180	160	80	119	112	141	133	179	133	195	130	129	100	110	196	145	147	123	157	125	147	155	124	107	115	87	106	102	129	-	127	133	133	-	174	132	**132**
A105SE	0.0582	65	91	87	93	86	130	116	58	87	82	103	97	130	97	142	95	94	73	80	142	105	106	90	114	91	107	112	90	77	83	63	77	74	94	-	92	97	96	-	126	96	**96**
A105SW	0.1044	70	98	94	100	92	140	125	62	93	88	110	104	140	104	152	102	101	78	86	153	113	115	96	122	98	115	121	97	83	90	68	83	80	101	-	99	104	104	-	136	103	**103**
A106N1	0.0845	63	88	84	90	83	126	113	56	84	79	99	94	126	94	137	92	91	70	77	138	102	103	87	110	88	103	109	87	75	81	61	74	72	91	-	89	94	93	-	122	93	**93**
A106N2	0.0773	52	72	69	74	68	104	93	46	69	65	82	77	104	77	113	75	75	58	63	113	84	85	71	91	72	85	90	72	62	66	51	61	59	75	-	74	77	77	-	101	77	**76**
A106NE	0.0626	58	81	78	83	77	117	104	52	78	73	92	87	117	87	127	85	84	65	71	127	94	95	80	102	81	96	101	81	69	75	57	69	66	84	-	83	87	87	-	113	86	**86**
A106NW	0.0644	53	74	71	75	70	106	95	47	70	66	83	78	106	79	115	77	76	59	65	115	85	86	73	92	74	87	91	73	63	68	52	62	60	76	-	75	79	78	-	102	78	**78**
A106R1	0.0465	158	216	207	213	201	305	272	135	200	197	247	229	307	237	325	232	230	177	190	347	253	245	214	273	221	251	274	214	184	200	154	185	179	224	-	225	235	209	-	311	232	**228**
A106R2	0.1506	528	728	697	727	676	1,033	919	457	681	655	826	768	1,044	786	1,111	772	762	591	643	1,159	852	836	716	918	734	845	908	725	628	671	513	618	600	749	-	748	782	726	-	1,036	776	**768**
A106SE	0.073	46	64	62	66	61	93	83	41	62	58	73	69	93	69	101	67	67	52	57	101	75	76	64	81	65	76	80	64	55	59	45	55	53	67	-	66	69	68	-	90	68	**68**
A106SW	0.0666	52	73	70	74	69	104	93	46	69	65	82	78	104	78	113	76	75	58	64	114	84	85	72	91	73	86	90	72	62	67	51	62	59	75	-	74	78	77	-	101	77	**77**
A108N1	0.052	112	157	150	161	148	226	201	100	150	141	177	167	225	167	245	164	162	126	138	246	182	184	155	196	157	185	194	155	134	144	110	133	128	162	-	160	167	167	-	218	166	**166**
A108NE	0.0393	38	53	51	54	50	76	68	34	51	48	60	57	76	57	83	55	55	43	47	83	62	62	52	67	53	63	66	53	45	49	37	45	43	55	-	54	57	56	-	74	56	**56**
A108NW	0.0287	55	76	73	78	72	109	98	49	73	68	86	81	109	81	119	79	79	61	67	119	88	89	75	95	76	90	94	75	65	70	53	64	62	78	-	77	81	81	-	106	81	**80**
A108R1	0.2228	774	1,064	1,019	1,058	988	1,509	1,343	666	993	960	1,210	1,123	1,526	1,154	1,617	1,133	1,119	867	939	1,699	1,245	1,217	1,048	1,344	1,077	1,235	1,333	1,061	915	982	752	907	879	1,097	-	1,098	1,146	1,051	-	1,520	1,137	**1,123**
A108R2	0.1143	399	549	526	547	510	779	693	344	513	495	624	579	788	595	836	584	576	447	485	876	643	629	541	693	555	637	687	548	473	507	388	468	454	566	-	565	591	545	-	783	586	**580**
A108SE	0.1135	127	177	170	181	167	255	227	113	169	159	200	189	254	189	276	185	183	142	155	277	205	208	175	222	177	209	219	175	151	162	124	150	145	182	-	180	189	188	-	246	188	**187**
A108SW	0.0507	72	100	96	102	95	144	129	64	96	90	113	107	144	107	156	105	103	80	88	157	116	117	99	125	100	118	124	99	85	92	70	85	82	103	-	102	107	106	-	139	106	**106**
A109NE	0.0292	62	87	83	89	82	124	111	55	83	78	98	92	124	92	135	90	89	69	76	135	100	102	85	108	87	102	107	86	74	79	61	73	71	89	-	88	92	92	-	120	92	**91**
A109NW	0.0533	56	78	74	79	73	112	100	50	74	70	88	83	111	83	121	81	80	62	68	121	90	91	77	97	78	91	96	77	66	71	54	66	63	80	-	79	83	82	-	108	82	**82**
A109SE	0.0936	105	146	140	149	138	210	187	93	139	131	165	156	210	156	228	152	151	117	128	229	169	171	144	183	146	172	181	144	125	134	102	124	119	150	-	149	156	155	-	203	155	**154**
A110NE	0.1026	100	139	133	142	131	199	178	89	132	125	157	148	199	148	216	145	143	111	122	217	161	163	137	174	139	163	172	137	118	127	97	117	113	143	-	141	148	147	-	193	147	**146**
A110NW	0.0866	81	113	108	115	106	162	144	72	108	101	127	120	162	120	176	117	116	90	99	176	131	132	111	141	113	133	139	111	96	103	79	95	92	116	-	115	120	120	-	157	119	**119**
A110R1	0.0385	132	180	172	178	167	255	227	112	167	164	205	191	257	197	272	193	191	148	158	289	211	205	178	228	184	209	228	179	154	167	128	154	149	187	-	187	195	175	-	259	193	**190**
A110R10	0.0379	129	176	168	173	163	249	222	110	163	160	201	187	250	193	265	189	187	144	155	283	206	200	174	223	180	205	223	175	150	163	126	151	146	183	-	184	191	170	-	254	189	**186**
A110R2	0.0357	122	167	160	165	155	237	211	104	155	152	191	177	238	183	252	179	177	137	147	268	196	190	165	211	171	194	211	166	143	155	119	143	138	173	-	174	181	163	-	240	179	**177**
A110R3	0.0389	133	182	174	180	169	258	229	114	169	165	208	193	259	199	275	195	193	149	160	292	213	207	180	230	186	212	230	181	155	169	130	156	151	189	-	189	198	177	-	262	195	**192**
A110R4	0.0471	161	221	211	217	205	312	278	137	204	200	251	234	314	241	332	236	234	180	194	353	258	251	218	279	225	256	279	219	188	204	157	189	183	228	-	229	239	214	-	317	236	**233**
A110R5	0.0452	153	210	201	207	195	297	265	131	194	191	240	223	298	230	316	225	224	172	184	337	246	239	208	266	215	244	266	208	179	195	150	180	174	218	-	219	228	203	-	303	225	**222**
A110R6	0.0418	142	195	186	191	180	275	245	121	180	177	222	206	276	213	292	208	207	159	171	312	227	221	192	246	199	226	246	192	166	180	139	166	161	201	-	203	211	188	-	280	208	**205**
A110R7	0.0456	155	212	203	209	197	300	267	132	196	193	242	225	301	232	319	227	225	174	186	340	248	241	210	268	217	246	269	210	181	196	151	181	175	220	-	221	230	205	-	305	227	**224**
A110R8	0.0591	201	275	262	270	255	388	346	171	254	250	314	291	390	301	413	294	292	225	241	441	321	312	272	348	281	319	348	272	234	254	196	235	227	285	-	286	299	266	-	396	294	**290**
A110R9	0.0323	111	152	146	151	141	216	192	95	141	138	173	161	217	166	230	163	161	124	134	244	178	173	150	192	155	177	192	152	130	141	108	130	126	157	-	158	165	149	-	218	163	**161**
A110SE	0.0587	50	70	67	72	66	101	90	45	67	63	79	75	101	75	109	73	73	56	62	110	81	82	69	88	70	83	87	69	60	64	49	59	57	72	-	71	75	75	-	98	74	**74**
A110SW	0.0824	89	124	119	127	117	179	159	79	119	112	140	132	178	133	194	130	128	99	109	195	144	146	123	156	124	146	154	123	106	114	87	105	101	128	-	126	133	132	-	173	132	**131**
A111NW	0.0905	91	127	122	130	120	183	163	81	121	114	144	135	182	136	198	133	131	102	111	199	147	149	125	159	127	150	157	126	108	117	89	108	104	131	-	129	136	135	-	177	135	**134**
A111SE	0.0869	81	113	108	116	107	162	145	72	108	102	128	120	162	121	176	118	117	90	99	177	131	132	111	141	113	133	140	112	96	104	79	96	92	116	-	115	120	120	-	157	120	**119**
A112NE	0.1184	124	172	165	176	163	248	221	110	165	155	195	184	247	184	269	180	178	138	151	270	200	202	170	216	173	203	213	171	147	158	121	146	141	178	-	175	184	183	-	240	183	**182**
A112NW	0.0531	50	69	66	71	65	99	89	44	66	62	78	74	99	74	108	72	71	55	61	108	80	81	68	86	69	81	85	68	59	63	48	58	56	71	-	70	74	73	-	96	73	**73**
A112R3	0.0559	188	258	247	253	239	364	324	161	238	236	295	274	364	284	387	277	276	211	226	415	302	292	256	326	264	300	328	255	219	239	185	221	213	268	-	270	281	248	-	372	276	**273**
A112R4	0.0976	333	457	437	451	424	647	576	285	423	415	521	484	651	500	689	489	485	374	402	732	535	520	452	578	466	531	577	454	390	423	325	391	378	473	-	475	495	444	-	657	490	**483**
A112SE	0.1192	111	155	149	159	146	223	199	99	148	139	175	165	222	165	242	162	160	124	136	243	180	182	153	194	155	183	192	153	132	142	108	131	126	160	-	158	165	165	-	216	164	**164**
A112SW	0.0441	35	48	46	49	45	69	62	31	46	43	54	51	69	51	75	50	50	39	42	75	56	56	47	60	48	57	60	48	41	44	34	41	39	50	-	49	51	51	-	67	51	**51**
A112WK	0.0389	99	138	132	141	130	198	177	88	131	124	155	147	198	147	215	144	142	110	121	215	159	161	136	172	138	162	170	136	117	126	96	116	112	142	-	140	147	146	-	191	146	**145**
A113R1	0.1345	467	642	615	639	596	910	810	402	599	580	730	678	920	697	976	684	676	523	566	1,026	752	734	633	811	651	745	805	641	552	593	454	548	531	662	-	663	692	634	-	918	686	**678**
A113R2	0.0836	286	392	374	386	363	554	493	244	362	356	446	415	557	428	590	419	416	320	344	627	458	445	387	495	399	455	495	389	334	362	279	335	324	405	-	407	424	380	-	563	419	**414**
A114NE	0.0293	24	33	32	34	32	48	43	21	32	30	38	36	48	36	52	35	35	27	29	52	39	39	33	42	34	39	41	33	29	31	23	28	27	35	-	34	36	36	-	47	35	**35**
A114R1	0.0675	227	312	298	305	289	439	392	194	287	285	356	330	440	342	467	334	333	255	273	501	365	353	309	394	319	362	396	307	264	289	223	267	257	324	-	326	339	299	-	450	334	**329**
A114R2	0.0534	184	252	241	249	234	357	317	157	234	228	287	266	359	275	381	269	266	206	222	403	295	287	249	318	256	292	317	251	215	233	179	215	209	260	-	261	272	246	-	361	270	**266**
A114R3	0.0736	251	345	330	340	320	488	434	215	319	313	393	365	491	377	520	369	366	282	303	552	403	392	341	436	352	400	435	342	294	319	245	295	285	357	-	358	374	335	-	496	369	**364**
A114R4	0.1447	491	674	643	662	624	950	847	419	622	613	768	713	954	738	1,011	721	716	551	590	1,079	788	763	666	851	688	782	853	666	573	623	480	576	556	698	-	701	731	650	-	969	721	**711**
A114SE	0.1052	137	191	184	196	181	275	246	122	183	172	216	204	275	204	299	200	198	153	168	300	222	225	189	240	192	226	237	189	163	176	134	162	156	197	-	195	204	203	-	266	203	**202**
A114SW	0.1843	192	268	257	275	253	386	344	171	256	241	303	286	385	286	419	280	277	215	235	420	311	315	265	336	269	316	332	266	229	246	188	227	219	277	-	273	286	285	-	373	284	**283**
A115NE	0.08	87	121	116	123	114	173	155	77	115	108	136	129	173	129	188	126	125	97	106	189	140	141	119	151	121	142	149	119	103	111	84	102	98	124	-	123	129	128	-	168	128	**127**
A115NW	0.0502	47	65	63	67	62	94	84	42	62	59	74	70	94	70	102	68	67	52	57	102	76	77	64	82	65	77	81	65	56	60	46	55	53	67	-	66	70	69	-	91	69	**69**
A115R1	0.0441	152	208	199	205	193	294	262	130	193	188	237	220	297	227	314	222	220	170	183	333	243	237	205	263	212	241	262	207	178	192	148	178	172	215	-	216	225	203	-	298	223	**220**
A115R2	0.0429	147	201	192	198	186	284	253	125	186	182	229	213	286	220	303	215	213	164	177	322	235	228	199	254	205	233	254	199	171	186	143	172	166	208	-	209	218	195	-	289	215	**212**
A115R3	0.0346	118	162	155	160	150	229	204	101	150	147	185	172	231	177	244	174	172	133	142	260	190	184	160	205	165	188	205	161	138	150	115	139	134	168	-	168	176	158	-	233	174	**171**
A115R4	0.0355	120	165	158	162	153	233	208	103	153	150	188	175	234	181	248	177	176	135	145	265	193	187	163	209	169	192	209	164	141	153	118	141	136	171	-	172	179	160	-	238	177	**174**
A115R5	0.05	170	233	222	229	216	329	293	145	215	212	265	246	330	255	349	249	247	191	204	373	272	264	230	294	238	270	294	230	198	215	166	199	192	241	-	242	253	225	-	335	249	**246**
A115R6	0.0405	137	189	180	185	175	266	237	117	174	171	215	200	267	206	283	202	200	154	165	302	220	214	186	238	192	219	239	186	160	174	134	161	156	195	-	196	205	182	-	271	202	**199**
A115SE	0.0218	45	62	60	64	59	90	80	40	60	56	70	66	89	67	97	65	64	50	55	98	72	73	61	78	62	74	77	62	53	57	44	53	51	64	-	63	66	66	-	87	66	**66**
A115SW	0.0392	82	114	110	117	108	164	147	73	109	103	129	122	164	122	178	119	118	91	100	179	132	134	113	143	114	135	141	113	97	105	80	97	93	118	-	116	122	121	-	159	121	**121**
A115W1	0.0351	48	68	65	69	64	97	87	43	64	61	76	72	97	72	105	70	70	54	59	106	78	79	67	85	68	80	84	67	58	62	47	57	55	70	-	69	72	72	-	94	72	**71**
A116E1	0.037	54	75	72	77	71	108	96	48	72	67	85	80	108	80	117	78	77	60	66	117	87	88	74	94	75	88	93	74	64	69	52	64	61	77	-	76	80	80	-	104	79	**79**
A116NE	0.081	88	122	117	125	115	175	157	78	117	110	138	130	175	130	190	127	126	98	107	191	142	143	120	153	122	144	151	121	104	112	85	103	100	126	-	124	130	130	-	170	129	**129**
A116NW	0.0753	76	106	101	108	100	152	136	68	101	95	119	113	152	113	165	110	109	85	93	165	123	124	104	132	106	125	131	105	90	97	74	90	86	109	-	108	113	112	-	147	112	**112**
A116R1	0.1084	380	524	501	523	487	743	662	329	491	471	595	552	752	566	800	556	548	425	463	834	613	601	515	661	528	608	654	522	452	483	369	445	432	539	-	539	563	522	-	745	559	**553**
A116R2	0.1022	363	502	480	504	467	713	635	316	473	450	569	529	721	540	771	530	523	406	443	796	587	579	493	632	504	583	624	500	435	462	352	425	412	516	-	514	537	508	-	710	534	**529**
A116R3	0.0796	274	375	359	371	348	531	473	234	348	340	427	397	536	409	567	401	397	307	330	601	439	427	371	474	382	436	473	374	321	347	267	321	311	388	-	389	406	367	-	538	402	**396**
A116R4	0.059	203	278	266	275	258	394	351	174	258	252	317	294	397	303	421	297	294	227	245	445	326	317	275	352	283	323	350	277	238	257	198	238	230	288	-	288	301	272	-	399	298	**294**
A116R5	0.069	238	327	313	325	304	464	413	205	305	296	373	346	469	356	496	349	345	267	289	523	383	374	323	414	332	380	411	326	281	303	232	279	271	338	-	339	353	322	-	469	350	**346**
A116R6	0.066	224	307	293	302	285	434	387	191	284	279	350	325	436	336	461	329	326	252	269	492	359	348	304	388	314	357	389	304	261	284	219	263	254	318	-	320	333	297	-	442	329	**324**
A116R7	0.062	210	289	275	284	267	407	363	179	266	262	329	305	409	316	433	309	307	236	253	462	337	327	285	365	295	335	365	286	245	267	206	247	238	299	-	301	313	279	-	415	309	**305**
A116SE	0.0791	106	148	142	152	140	213	190	95	141	133	167	158	213	158	231	155	153	119	130	232	172	174	146	185	148	175	183	147	126	136	104	125	121	153	-	151	158	157	-	206	157	**156**
A116SW	0.0762	54	75	72	77	71	108	97	48	72	68	85	80	108	80	117	79	78	60	66	118	87	88	74	94	75	89	93	74	64	69	53	64	61	78	-	77	80	80	-	105	80	**79**
A117NE	0.0839	88	122	117	125	115	176	157	78	117	110	138	130	175	130	191	127	126	98	107	191	142	143	120	153	122	144	151	121	104	112	85	103	100	126	-	124	130	130	-	170	129	**129**
A117NW	0.0821	83	115	111	118	109	166	148	74	110	104	130	123	165	123	180	120	119	92	101	180	134	135	114	144	115	136	143	114	98	106	81	98	94	119	-	117	123	123	-	160	122	**122**
A117R1	0.085	295	406	389	404	377	575	512	254	379	366	462	429	582	441	617	432	427	331	358	648	475	464	400	512	411	471	509	405	349	375	287	346	336	419	-	419	437	401	-	580	434	**428**
A117R2	0.062	212	291	278	286	269	411	366	181	269	264	331	307	413	317	438	311	308	238	255	465	340	330	287	367	296	337	367	288	248	269	207	249	240	301	-	302	315	282	-	417	311	**307**
A117R3	0.094	319	438	418	430	405	618	550	272	404	398	499	463	620	479	657	468	465	358	384	701	511	496	432	553	447	508	554	433	372	405	312	374	361	453	-	456	475	423	-	630	468	**462**
A117R4	0.068	231	317	302	311	293	447	398	197	292	288	361	335	449	347	475	339	336	259	278	507	370	359	313	400	323	368	401	313	269	293	225	271	261	328	-	330	344	306	-	455	339	**334**
A117SE	0.0768	74	104	100	106	98	149	133	66	99	93	117	111	149	111	162	108	107	83	91	163	120	122	102	130	104	122	128	103	89	95	73	88	85	107	-	106	111	110	-	144	110	**110**
A117SW	0.0856	70	98	94	100	92	141	126	63	94	88	111	104	141	105	153	102	101	78	86	153	114	115	97	123	98	115	121	97	84	90	68	83	80	101	-	100	104	104	-	136	104	**103**
A117W1	0.079	65	90	87	93	85	130	116	58	86	81	102	96	130	96	141	94	93	72	79	141	105	106	89	113	90	106	112	89	77	83	63	77	74	93	-	92	96	96	-	126	96	**95**
A117W2	0.087	84	118	113	120	111	169	151	75	112	106	133	125	169	126	183	123	121	94	103	184	136	138	116	147	118	139	146	116	100	108	82	100	96	121	-	120	125	125	-	164	125	**124**
A119NE	0.1464	147	205	197	210	194	295	264	131	196	185	232	219	295	219	321	214	212	165	180	322	238	241	203	257	206	242	254	203	175	188	144	174	168	212	-	209	219	218	-	286	218	**217**
A119NW	0.1135	114	159	153	163	150	229	204	102	152	143	180	170	229	170	249	166	165	128	140	249	185	187	157	200	159	188	197	158	136	146	111	135	130	164	-	162	170	169	-	222	169	**168**
A119R1	0.16	582	802	769	814	753	1,147	1,022	508	763	719	911	850	1,155	860	1,243	843	832	647	707	1,267	936	934	791	1,007	804	938	995	798	694	739	562	679	657	825	-	820	858	831	-	1,128	852	**847**
A119R2	0.228	784	1,075	1,028	1,062	998	1,522	1,355	671	998	974	1,224	1,137	1,534	1,173	1,625	1,149	1,137	879	946	1,720	1,258	1,224	1,061	1,359	1,094	1,249	1,355	1,070	919	994	764	920	890	1,111	-	1,114	1,163	1,050	-	1,542	1,151	**1,135**
A119R3	0.147	508	698	668	692	648	988	879	436	649	631	794	737	998	759	1,057	744	736	569	615	1,115	816	796	688	881	708	810	877	696	598	645	494	596	578	720	-	721	753	685	-	999	746	**737**
A119SE	0.0602	63	88	84	90	83	126	112	56	84	79	99	93	126	94	137	91	91	70	77	137	102	103	86	110	88	103	108	87	75	80	61	74	72	90	-	89	93	93	-	122	93	**93**
A119SW	0.092	89	124	119	127	117	179	160	79	119	112	141	133	178	133	194	130	128	100	109	195	144	146	123	156	124	147	154	123	106	114	87	105	102	128	-	126	133	132	-	173	132	**131**
A121NE	0.062	106	148	142	152	140	213	190	95	142	133	168	158	213	158	231	155	153	119	130	232	172	174	146	186	148	175	184	147	127	136	104	126	121	153	-	151	158	158	-	206	157	**157**
A121NW	0.099	103	144	138	147	136	207	185	92	138	130	163	154	207	154	225	150	149	115	126	226	167	169	142	181	144	170	178	143	123	132	101	122	118	149	-	147	154	153	-	201	153	**152**
A121R1	0.042	145	199	191	198	185	282	251	125	185	180	227	211	285	217	302	213	210	163	176	319	233	227	197	252	202	231	250	199	171	184	141	170	165	206	-	206	215	196	-	285	213	**210**
A121R2	0.072	248	340	325	336	315	481	428	212	315	308	387	359	485	370	513	363	359	277	299	543	397	387	335	429	346	394	428	338	290	314	241	290	281	351	-	352	367	332	-	487	363	**359**
A121R3	0.044	152	209	200	207	194	296	263	130	194	189	238	221	299	227	317	223	220	170	184	334	244	238	206	264	212	242	262	208	179	193	148	178	173	216	-	216	225	205	-	299	223	**220**
A121R4	0.059	205	282	270	280	262	399	355	177	262	255	320	298	403	306	428	300	297	229	248	450	330	322	278	356	286	327	354	281	242	261	200	241	233	291	-	291	304	278	-	403	301	**298**
A121S1	0.154	167	232	223	238	219	334	298	148	222	209	262	248	334	248	362	242	240	186	204	364	269	272	229	291	232	274	287	230	198	213	162	197	190	239	-	237	248	247	-	323	246	**245**
A121SE	0.122	200	279	268	286	264	401	358	178	267	251	315	297	401	298	435	291	288	223	245	437	324	327	275	350	279	329	345	276	238	256	195	236	228	288	-	284	298	296	-	388	296	**295**
A121SW	0.077	83	116	111	119	110	167	149	74	111	104	131	124	167	124	181	121	120	93	102	182	135	136	115	145	116	137	144	115	99	106	81	98	95	120	-	118	124	123	-	162	123	**123**

Table B5 - Subcatchments

Yearly Surface Infiltration Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A122NE	0.1276	143	199	191	204	188	286	255	127	190	179	225	212	286	212	311	208	206	159	175	312	231	233	196	249	199	235	246	197	170	183	139	169	162	205	-	203	212	212	-	277	211	**210**
A122R1	0.0732	260	359	344	361	335	511	455	227	339	322	408	379	516	386	552	380	374	291	318	570	420	414	353	452	361	417	447	358	311	331	252	305	295	369	-	368	385	364	-	508	382	**379**
A122R2	0.2135	759	1,048	1,003	1,053	976	1,489	1,327	661	987	940	1,189	1,105	1,506	1,127	1,610	1,107	1,092	848	926	1,662	1,226	1,209	1,031	1,319	1,053	1,218	1,303	1,044	908	966	735	888	861	1,077	-	1,073	1,123	1,061	-	1,482	1,115	**1,105**
A124NE	0.0469	61	85	82	87	81	123	110	55	82	77	96	91	123	91	133	89	88	68	75	134	99	100	84	107	85	101	106	84	73	78	60	72	70	88	-	87	91	91	-	119	90	**90**
A124NW	0.131	137	191	183	195	180	274	245	122	182	171	216	203	274	204	297	199	197	153	167	299	221	224	188	239	191	225	236	189	163	175	133	161	156	197	-	194	203	203	-	265	202	**201**
A124R1	0.0918	316	433	414	428	402	613	545	270	402	392	493	458	618	472	654	463	458	354	381	693	507	493	427	547	441	503	545	431	370	400	307	370	359	447	-	449	468	423	-	621	463	**457**
A124R2	0.136	470	645	618	640	599	914	814	403	600	584	735	682	923	702	978	689	681	526	569	1,032	755	737	636	815	655	749	811	643	553	597	458	551	535	666	-	667	697	634	-	924	690	**682**
A124SE	0.0469	40	56	54	57	53	81	72	36	54	50	63	60	80	60	87	59	58	45	49	88	65	66	55	70	56	66	69	55	48	51	39	47	46	58	-	57	60	60	-	78	59	**59**
A124SW	0.136	112	155	149	159	147	223	199	99	149	140	176	166	223	166	243	162	161	125	136	244	180	182	153	195	156	183	193	154	133	143	109	132	127	160	-	158	166	165	-	216	165	**164**
A125E1	0.0575	114	158	152	162	150	228	203	101	151	142	179	169	227	169	247	165	164	127	139	248	184	186	156	198	159	187	196	157	135	145	111	134	129	163	-	161	169	168	-	220	168	**167**
A125NE	0.0478	48	67	64	69	63	96	86	43	64	60	76	72	96	72	105	70	69	54	59	105	78	79	66	84	67	79	83	66	57	62	47	57	55	69	-	68	72	71	-	93	71	**71**
A125NW	0.0931	83	116	111	119	110	167	149	74	111	104	131	124	167	124	181	121	120	93	102	182	135	136	115	146	116	137	144	115	99	107	81	98	95	120	-	118	124	123	-	162	123	**123**
A125R1	0.1047	360	494	472	488	458	699	622	308	458	447	562	522	705	539	746	528	522	403	435	790	578	562	487	624	503	573	622	491	422	457	351	422	409	510	-	512	534	482	-	708	528	**521**
A125R2	0.1093	376	515	493	509	478	730	649	322	478	467	587	545	736	562	779	551	545	421	454	825	603	587	509	651	525	599	649	513	441	477	366	441	427	533	-	534	557	504	-	739	552	**544**
A125SE	0.0476	37	52	50	53	49	75	67	33	50	47	59	55	75	55	81	54	54	42	46	81	60	61	51	65	52	61	64	51	44	48	36	44	42	54	-	53	55	55	-	72	55	**55**
A125SW	0.0931	69	97	93	99	91	139	124	62	92	87	109	103	139	103	151	101	100	77	85	152	112	114	95	121	97	114	120	96	83	89	68	82	79	100	-	98	103	103	-	135	103	**102**
A126E1	0.0331	25	34	33	35	33	49	44	22	33	31	39	37	49	37	54	36	36	28	30	54	40	40	34	43	34	41	43	34	29	32	24	29	28	35	-	35	37	37	-	48	36	**36**
A126NE	0.0333	67	93	90	96	88	134	120	60	89	84	106	100	134	100	146	98	97	75	82	146	108	110	92	117	94	110	116	93	80	86	65	79	76	96	-	95	100	99	-	130	99	**99**
A126NW	0.0258	53	74	71	76	70	106	95	47	70	66	83	79	106	79	115	77	76	59	65	116	86	87	73	92	74	87	91	73	63	68	52	62	60	76	-	75	79	78	-	103	78	**78**
A126R1	0.0977	338	464	444	460	430	657	584	290	431	419	528	490	663	505	703	495	489	378	408	741	543	529	457	586	471	538	583	462	397	429	329	396	384	479	-	479	501	455	-	664	496	**490**
A126SE	0.032	48	67	64	68	63	96	85	43	64	60	75	71	96	71	104	69	69	53	58	104	77	78	66	83	67	78	82	66	57	61	47	56	54	69	-	68	71	71	-	93	70	**70**
A126SW	0.0259	41	57	54	58	53	81	73	36	54	51	64	60	81	60	88	59	58	45	50	89	66	66	56	71	57	67	70	56	48	52	40	48	46	58	-	58	60	60	-	79	60	**60**
A126W1	0.0767	66	92	88	94	87	132	118	59	88	82	104	98	132	98	143	96	95	73	80	144	106	108	90	115	92	108	114	91	78	84	64	78	75	95	-	93	98	97	-	128	97	**97**
A129NE	0.1715	179	250	240	256	236	359	320	159	239	224	282	266	358	267	389	261	258	200	219	391	290	293	246	313	250	294	309	247	213	229	175	211	204	257	-	254	266	265	-	347	264	**264**
A129NW	0.0657	66	92	89	94	87	133	118	59	88	83	104	98	132	98	144	96	95	74	81	144	107	108	91	116	92	109	114	91	79	85	64	78	75	95	-	94	98	98	-	128	98	**97**
A129R1	0.123	423	580	555	573	538	821	731	362	538	526	660	613	828	633	877	620	614	474	510	928	679	661	572	733	590	674	731	577	496	537	412	496	480	600	-	601	627	567	-	832	621	**613**
A129R2	0.1272	440	604	578	598	560	855	761	377	562	546	687	638	864	657	915	644	637	492	532	965	706	689	595	763	613	701	759	602	518	558	428	516	500	623	-	624	652	593	-	864	646	**637**
A129SE	0.097	152	212	203	217	200	304	272	135	202	190	239	226	304	226	330	221	219	170	186	332	246	248	209	265	212	250	262	210	181	194	148	179	173	218	-	216	226	225	-	295	224	**224**
A129SW	0.0642	65	90	86	92	85	130	116	58	86	81	102	96	129	96	141	94	93	72	79	141	105	106	89	113	90	106	112	89	77	83	63	76	74	93	-	92	96	96	-	125	95	**95**
A130NE	0.15	140	195	187	199	184	280	250	125	186	175	220	208	280	208	304	203	201	156	171	305	226	229	192	244	195	230	241	193	166	179	136	165	159	201	-	198	208	207	-	271	207	**206**
A130NW	0.047	49	68	66	70	65	98	88	44	65	62	77	73	98	73	107	71	71	55	60	107	79	80	67	86	68	81	85	68	58	63	48	58	56	71	-	70	73	73	-	95	72	**72**
A130R1	0.175	605	830	795	824	771	1,176	1,047	519	773	751	945	878	1,188	904	1,259	886	876	677	732	1,327	972	948	819	1,049	843	964	1,044	828	712	768	589	709	688	858	-	859	897	816	-	1,189	888	**877**
A130SE	0.147	159	222	213	227	209	319	284	142	212	199	250	236	318	237	346	231	229	177	194	347	257	260	219	278	222	261	274	219	189	203	155	188	181	228	-	226	236	236	-	308	235	**234**
A130SW	0.055	51	71	69	73	68	103	92	46	68	64	81	76	103	76	111	75	74	57	63	112	83	84	71	90	72	84	88	71	61	66	50	61	58	74	-	73	76	76	-	99	76	**75**
A132N1	0.029	59	83	80	85	78	119	106	53	79	75	94	88	119	89	129	87	86	66	73	130	96	97	82	104	83	98	103	82	71	76	58	70	68	85	-	84	88	88	-	115	88	**88**
A132NE	0.028	48	67	64	69	63	96	86	43	64	60	76	71	96	71	104	70	69	54	59	105	78	79	66	84	67	79	83	66	57	61	47	57	55	69	-	68	71	71	-	93	71	**71**
A132NW	0.033	26	36	35	37	34	52	46	23	34	32	41	38	52	38	56	38	37	29	32	56	42	42	36	45	36	42	45	36	31	33	25	31	29	37	-	37	38	38	-	50	38	**38**
A132R1	0.088	304	418	400	414	388	592	526	261	388	378	475	441	597	455	633	446	441	341	368	668	489	477	412	528	424	485	525	416	358	386	296	357	346	431	-	432	451	410	-	598	447	**441**
A132R2	0.1119	387	531	508	526	493	752	670	332	494	480	604	561	760	578	805	566	560	433	468	849	621	606	524	671	539	617	667	529	455	491	376	454	440	548	-	549	573	522	-	760	568	**561**
A132R3	0.1145	394	540	516	534	501	764	680	337	501	489	615	571	771	589	816	577	571	441	475	864	632	615	533	682	550	627	680	537	462	499	384	462	447	558	-	560	584	528	-	774	578	**570**
A132R4	0.101	347	476	456	471	442	674	600	297	442	431	542	504	680	519	720	509	504	389	419	762	557	542	470	602	485	553	600	474	407	441	338	407	394	492	-	494	515	465	-	683	510	**503**
A132SE	0.033	53	74	71	75	70	106	95	47	70	66	83	79	106	79	115	77	76	59	65	116	86	87	73	92	74	87	91	73	63	68	52	62	60	76	-	75	79	78	-	103	78	**78**
A132SW	0.048	54	75	72	77	71	108	96	48	72	67	85	80	107	80	117	78	77	60	66	117	87	88	74	94	75	88	93	74	64	69	52	63	61	77	-	76	80	80	-	104	79	**79**
A133NE	0.0433	102	142	136	145	134	204	182	91	136	128	160	151	204	151	221	148	146	114	124	222	164	166	140	178	142	167	176	140	121	130	99	120	116	146	-	144	151	151	-	197	150	**150**
A133NW	0.0948	223	311	298	318	293	447	399	198	297	279	351	331	446	331	484	324	321	249	272	486	360	364	306	389	311	366	384	307	265	285	217	263	253	320	-	316	331	330	-	432	329	**328**
A133SE	0.06	166	231	222	237	218	333	296	147	221	208	261	246	332	246	360	241	238	185	202	361	268	271	228	289	231	273	286	228	197	212	161	195	188	238	-	236	246	246	-	321	245	**244**
A133SW	0.132	364	508	487	521	480	733	652	324	486	457	574	542	730	542	793	530	525	407	445	795	589	596	501	636	508	600	629	503	433	466	355	430	415	523	-	519	542	541	-	707	538	**537**
A133W1	0.0432	102	142	136	145	134	204	182	90	135	127	160	151	203	151	221	148	146	113	124	222	164	166	140	177	142	167	175	140	121	130	99	120	116	146	-	144	151	150	-	197	150	**149**
A133W2	0.06	166	231	222	237	218	333	296	147	221	208	261	246	332	246	360	241	238	185	202	361	268	271	228	289	231	273	286	228	197	212	161	195	188	238	-	236	246	246	-	321	245	**244**
A133W3	0.0616	133	186	178	190	175	267	238	119	177	167	210	198	267	198	290	194	192	149	163	291	215	218	183	233	186	219	230	184	158	170	130	157	152	191	-	189	198	198	-	258	197	**196**
A133W4	0.088	230	320	307	328	302	462	411	205	306	288	362	342	460	342	500	334	331	256	281	501	371	376	316	401	321	378	396	317	273	294	224	271	261	330	-	327	342	341	-	446	339	**338**
A134NE	0.047	137	191	183	196	180	276	245	122	182	171	215	204	274	203	298	199	197	153	167	298	221	224	188	239	191	226	236	189	163	175	133	161	156	196	-	195	203	203	-	265	202	**201**
A134NW	0.126	338	472	453	484	445	680	606	301	451	424	533	503	678	503	736	492	487	378	414	738	547	553	465	591	472	557	584	467	402	433	330	399	385	486	-	481	503	502	-	656	500	**498**
A134SE	0.025	53	74	71	76	70	107	95	47	71	67	84	79	106	79	116	77	77	59	65	116	86	87	73	93	74	87	92	73	63	68	52	63	60	76	-	75	79	79	-	103	78	**78**
A134SW	0.115	300	419	402	429	395	603	537	267	400	376	473	447	602	447	653	437	432	335	367	655	485	491	413	524	419	494	518	414	357	384	293	354	342	431	-	427	446	445	-	582	443	**442**
A135R1	0.023	79	108	104	107	101	154	137	68	101	98	123	115	155	118	164	116	115	89	95	174	127	123	107	137	110	126	137	108	93	100	77	93	90	112	-	112	117	106	-	156	116	**115**
A136NE	0.031	52	73	70	74	68	104	93	46	69	65	82	77	104	77	113	76	75	58	64	114	84	85	72	91	73	85	90	72	62	67	51	61	59	75	-	74	77	77	-	101	77	**77**
A136NE1	0.024	41	57	55	59	54	83	74	37	55	52	65	61	82	61	90	60	59	46	50	90	67	67	57	72	57	68	71	57	49	53	40	49	47	59	-	58	61	61	-	80	61	**61**
A136NW	0.039	33	47	45	48	44	67	60	30	45	42	53	50	67	50	73	49	48	37	41	73	54	55	46	58	47	55	58	46	40	43	33	39	38	48	-	47	50	49	-	65	49	**49**
A136NW1	0.025	43	60	57	61	56	86	77	38	57	54	68	64	86	64	93	62	62	48	52	94	69	70	59	75	60	70	74	59	51	55	42	51	49	62	-	61	64	64	-	83	63	**63**
A136NW2	0.033	28	39	38	40	37	57	51	25	38	35	45	42	57	42	62	41	41	32	35	62	46	46	39	49	39	46	49	39	34	36	28	33	32	41	-	40	42	42	-	55	42	**42**
A136R1	0.034	115	158	151	155	147	223	199	98	146	144	180	168	224	173	238	169	168	130	139	254	185	179	156	200	162	184	200	156	135	147	113	135	131	164	-	165	172	153	-	228	169	**167**
A136SE	0.028	57	80	77	82	76	115	103	51	76	72	90	85	115	85	125	84	83	64	70	125	93	94	79	100	80	94	99	79	68	73	56	68	65	83	-	81	85	85	-	111	85	**85**
A201NE	0.1387	155	216	208	221	204	311	278	138	207	195	244	231	311	231	337	226	223	173	190	339	251	254	213	271	217	255	268	214	185	198	151	183	177	223	-	220	231	230	-	301	229	**228**
A201S1	0.098	84	117	112	120	111	168	150	75	112	105	132	125	168	125	183	122	121	94	103	183	136	137	116	147	117	138	145	116	100	107	82	99	96	121	-	119	125	124	-	163	124	**124**
A201SW	0.133	119	166	159	170	157	238	213	106	159	149	188	177	238	177	259	173	171	133	146	260	192	195	164	208	166	196	205	164	142	152	116	141	135	171	-	169	177	176	-	231	176	**175**
A203NE	0.103	115	161	154	165	152	232	206	103	154	144	182	171	231	171	251	168	166	129	141	252	186	188	158	201	161	190	199	159	137	147	112	136	131	166	-	164	171	171	-	224	170	**170**
A203NW	0.098	121	168	161	172	159	242	216	107	161	151	190	179	241	179	262	175	174	135	147	263	195	197	166	211	168	198	208	166	143	154	118	142	137	173	-	171	179	179	-	234	178	**178**
A203R1	0.116	416	574	550	579	537	818	729	363	544	515	652	607	826	617	887	605	597	464	507	910	672	665	565	723	576	669	713	572	499	530	403	487	471	591	-	587	615	587	-	811	611	**606**
A203R2	0.088	310	428	409	428	398	607	541	269	401	384	485	451	614	461	654	453	447	347	378	680	500	492	420	539	431	496	533	426	369	394	301	363	352	440	-	439	459	429	-	607	456	**451**
A203R3	0.111	384	527	504	522	489	746	664	329	490	476	599	557	754	573	798	562	556	430	464	842	616	601	519	666	535	612	662	525	452	487	373	450	436	544	-	545	569	517	-	754	563	**556**
A204E1	0.1535	155	215	207	220	203	310	276	138	206	194	244	229	309	230	336	225	223	172	189	337	250	253	213	270	216	254	267	213	184	198	151	182	176	222	-	219	230	229	-	300	228	**227**
A204E2	0.1536	120	168	161	171	158	241	215	107	160	151	190	179	241	179	262	175	173	134	147	263	194	197	165	210	168	197	208	166	143	154	117	142	137	173	-	170	179	178	-	233	178	**177**
A204NE	0.096	75	105	101	107	99	151	134	67	100	94	118	112	151	112	163	109	108	84	92	164	122	123	103	131	105	123	130	104	89	96	73	89	86	108	-	107	112	111	-	146	111	**111**
A204NW	0.107	88	122	117	125	116	176	157	78	117	110	138	130	176	131	191	128	126	98	107	192	142	144	121	153	123	144	151	121	104	112	86	104	100	126	-	124	131	130	-	170	130	**129**
A204R1	0.136	470	645	618	640	599	914	814	403	600	584	735	682	923	702	978	689	681	526	569	1,032	755	737	636	815	655	749	811	643	553	597	458	551	535	666	-	667	697	634	-	924	690	**682**
A204R2	0.0665	229	314	300	310	291	444	395	196	291	284	357	332	448	342	474	335	332	256	276	502	367	357	309	396	319	364	395	312	268	290	223	268	260	324	-	325	339	306	-	450	336	**331**
A204R3	0.1353	465	638	610	630	592	903	804	398	592	578	727	675	911	696	964	682	675	521	562	1,021	747	727	630	806	649	741	804	635	546	590	453	546	528	659	-	661	690	623	-	915	683	**674**
A204R4	0.0808	276	379	362	373	351	535	477	236	350	344	431	401	539	414	570	405	402	310	332	606	443	430	374	478	386	440	478	376	323	350	269	324	313	392	-	393	410	368	-	544	405	**400**
A204R5	0.0731	253	347	332	344	322	492	437	217	323	314	395	367	496	378	526	370	366	283	306	555	406	396	342	438	352	403	436	346	297	321	246	296	287	358	-	359	375	341	-	497	371	**366**
A204SE	0.096	93	130	125	133	123	186	167	83	124	117	147	138	186	139	202	135	134	104	114	203	150	152	128	163	130	153	161	128	111	119	91	110	106	134	-	132	138	138	-	181	137	**137**
A205SE	0.109	114	159	152	162	150	228	204	101	152	143	179	169	228	169	247	166	164	127	139	248	184	186	157	199	159	187	196	157	135	146	111	134	130	164	-	161	169	169	-	221	168	**168**
A205SW	0.037	83	115	111	118	109	166	148	74	110	104	130	123	166	123	180	120	119	92	101	181	134	135	114	145	116	136	143	114	98	106	81	98	94	119	-	118	123	123	-	161	122	**122**
A206NE	0.138	149	208	200	213	196	299	267	133	199	187	235	222	299	222	325	217	215	167	182	326	241	244	205	261	208	245	258	206	178	191	146	176	170	214	-	212	222	221	-	290	220	**220**
A206R1	0.078	270	370	354	367	344	524	466	232	344	335	421	392	529	404	561	395	391	302	326	592	434	422	365	468	377	430	466	369	317	343	263	317	307	383	-	383	400	364	-	530	396	**391**
A208NW	0.183	191	266	256	273	252	383	342	170	255	240	301	284	383	284	416	278	275	213	234	417	309	313	263	334	267	314	330	264	227	244	186	226	217	275	-	271	284	283	-	371	282	**281**
A208R1	0.092	318	437	418	433	405	619	550	273	406	395	497	461	625	475	662	466	461	356	385	698	511	498	431	552	443	507	549	435	374	404	310	373	362	451	-	451	471	429	-	625	467	**461**
A208R2	0.11408	394	541	518	536	503	767	683	338	504	490	616	572	775	589	821	578	571	442	477	865	634	618	534	684	550	629	680	539	464	500	384	462	448	559	-	560	584	532	-	775	579	**572**
A208R3	0.11995	412	566	541	559	525	801	713	353	525	512	644	598	807	617	855	605	598	462	498	905	662	644	558	715	576	657	713	563	484	523	402	484	468	585	-	586	612	553	-	811	605	**597**
A208R4	0.06381	219	301	288	297	279	426	379	188	279	273	343	318	429	328	455	322	318	246	265	481	352	343	297	380	306	349	379	299	257	278	214	257	249	311	-	312	325	294	-	432	322	**318**
A208R5	0.04895	168	231	221	228	214	327	291	144	214	209	263	244	329	252	349	247	244	189	203	369	270	263	228	292	235	268	291	230	197	213	164	197	191	239	-	239	250	226	-	331	247	**244**
A208R6	0.03693	127	174	167	172	162	247	219	109	162	158	198	184	248	190	263	186	184	142	153	279	204	198	172	220	177	202	219	173	149	161	124	149	144	180	-	180	188	170	-	250	186	**184**
A208SE	0.135	206	288	276	295	272	414	369	184	275	259	325	307	413	307	449	300	297	230	252	451	334	338	284	360	288	339	356	285	246	264	201	244	235	297	-	293	307	306	-	400	305	**304**
A209NW	0.1408	131	183	176	187	173	263	235	117	175	165	207	195	263	195	285	191	189	147	161	287	212	215	181	229	183	216	227	181	156	168	128	155	149	189	-	186	195	194	-	255	194	**193**
A209R1	0.05338	184	252	241	249	234	356	317	157	234	228	287	266	359	275	380	269	266	206	222	403	295	287	248	318	256	292	317	250	215	233	179	215	208	260	-	261	272	246	-	361	269	**266**
A209SE	0.11198	113	157	151	161	148	226	202	100	150	141	178	167	226	168	245	164	162	126	138	246	182	184	155	197	157	185	195	156	134	144	110	133	128	162	-	160	168	167	-	219	167	**166**
A210NW	0.0605	117	164	157	167	154	235	210	104	156	147	185	174	235	175	255	171	169	131	143	256	190	192	161	205	164	193	202	162	140	150	114	139	134	169	-	166	174	174	-	228	173	**173**
A210SE	0.1357	142	198	190	202	187	284	254	126	189	178	223	211	284	211	308	206	204	158	173	309	229	232	195	247	198	233	245	195	169	181	138	167	161	204	-	201	211	210	-	275	209	**209**
A211R1	0.0326	113	155	148	153	144	219	195	97	144	140	176	163	221	168	234	165	163	126	136	247	181	177	153	195	157	180	195	154	133	143	110	132	128	160	-	160	167	152	-	221	165	**163**
A211R2	0.1526	530	729	698	724	677	1,033	919	456	680	658	829	769	1,044	791	1,107	776	767	594	643	1,164	853	833	718	920	738	846	913	727	626	673	515	621	603	751	-	752	785	719	-	1,041	779	**769**
A211R3	0.08025	290	401	384	406	376	572	509	253	380	359	455	424	576	430	620	421	416	323	353	634	468	465	395	504	402	467	497	399	347	369	281	340	328	412	-	409	429	413	-	564	426	**423**
A213NE	0.1207	126	176	169	180	166	253	226	112	168	158	199	187	252	188	274	183	181	141	154	275	204	206	173	220	176	207	217	174	150	161	123	149	143	181	-	179	187	187	-	244	186	**186**
A214NE	0.1165	109	151	145	155	143	218	194	97	145	136	171	161	217	162	236	158	156	121	133	237	176	178	149	190	152	178	187	150	129	139	106	128	124	156	-	154	162	161	-	211	160	**160**
A214NW	0.119	115	161	154	165	152	231	206	103	154	145	182	171	231	172	251	168	166	129	141	252	187	189	159	201	161	190	199	159	137	148	113	136	131	166	-	164	172	171	-	224	170	**170**
A214SE	0.0937	154	214	206	219	202	308	275	137	205	193	242	228	308	229	334	224	221	172	188	336	249	251	211	268	215	253	265	212	183	197	150	182	175	221	-	218	229	228	-	298	227	**226**
A214SW	0.1075	112	156	150	160	148	225	201	100	150	141	177	167	225	167	244	163	162	125	137	245	181	184	154	196	157	185	194	155	134	144	109	133	128	161	-	159	167	166	-	218	166	**165**
A215NE	0.0554	114	158	152	162	150	228	203	101	151	142	179	169	227	169	247	165	164	127	139	248	184	186	156	198	159	187	196	157	135	145	111	134	129	163	-	161	169	168	-	220	168	**167**
A215NW	0.0554	114	158	152	162	150	228	203	101	151	142	179	169	227	169	247	165	164	127	139	248	184	186	156	198	159	187	196	157	135	145	111	134	129	163	-	161	169	168	-	220	168	**167**
A215SE	0.0271	28	39	38	40	37	57	51	25	38	35	45	42	57	42	62	41	41	32	35	62	46	46	39	49	39	46	49	39	34	36	28	33	32	41	-	40	42	42	-	55	42	**42**
A215SW	0.063	68	95	91	97	90	136	122	61	91	85	107	101	136	101	148	99	98	76	83	149	110	111	94	119	95	112	118	94	81	87	66	80	78	98	-	97	101	101	-	132	101	**100**

Table B5 - Subcatchments

Yearly Surface Infiltration Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
A216E1	0.0308	63	88	85	90	83	127	113	56	84	79	100	94	126	94	137	92	91	71	77	138	102
A216NE	0.0918	92	129	124	132	122	185	165	82	123	116	146	137	185	138	201	134	133	103	113	202	149
A216NW	0.0893	87	121	116	124	114	173	155	77	115	109	136	129	173	129	188	126	125	97	106	189	140
A216R1	0.048	167	229	219	228	213	325	289	143	214	207	261	242	329	249	348	244	241	187	202	366	268
A216R2	0.0407	141	194	186	193	180	275	245	122	181	175	221	205	279	211	295	207	204	158	171	310	227
A216R3	0.0597	203	278	265	273	257	393	350	173	257	252	317	294	394	304	417	297	295	228	244	445	325
A216R4	0.0548	186	255	243	251	236	360	321	159	236	232	291	270	362	279	383	273	271	209	224	409	298
A216SE	0.0888	73	102	97	104	96	146	130	65	97	91	115	108	146	108	158	106	105	81	89	159	118
A216SW	0.0924	72	101	97	103	95	145	129	64	96	91	114	108	145	108	157	105	104	81	88	158	117
A217NE	0.1516	153	213	204	218	201	306	273	136	203	191	241	227	305	227	332	222	220	170	187	333	247
A217NW	0.0784	79	110	106	113	104	158	141	70	105	99	124	117	158	117	172	115	114	88	97	172	128
A217R1	0.0605	210	289	277	287	268	409	364	181	269	261	329	305	414	314	439	308	304	235	255	461	338
A217R2	0.068	235	323	309	320	300	457	407	202	300	292	367	341	462	351	489	344	340	263	284	516	378
A217R3	0.0677	234	321	308	318	298	455	405	201	299	290	366	339	460	350	487	343	339	262	283	514	376
A217R4	0.0502	174	240	230	238	223	340	302	150	224	216	273	253	344	260	364	255	252	195	211	383	281
A217R5	0.0836	284	389	371	383	360	550	490	242	360	354	443	412	552	426	584	416	413	319	341	623	455
A217R6	0.0875	297	407	389	400	377	575	513	253	377	370	464	431	578	446	611	436	432	333	357	653	476
A217R7	0.086	292	400	382	394	371	566	504	249	370	364	456	424	568	438	601	428	425	328	351	641	468
A217R8	0.0631	214	294	280	289	272	415	370	183	272	267	335	311	417	321	441	314	312	240	257	471	343
A217SE	0.1515	119	165	159	169	156	238	212	106	158	149	187	176	238	177	258	173	171	132	145	259	192
A217SW	0.0784	53	73	70	75	69	105	94	47	70	66	83	78	105	78	114	77	76	59	64	115	85
A218NE	0.0513	59	83	79	85	78	119	106	53	79	74	93	88	119	88	129	86	85	66	73	129	96
A218SE	0.0517	46	64	62	66	61	93	83	41	62	58	73	69	93	69	101	67	67	52	57	101	75
A218W3	0.036	51	71	68	73	67	102	91	45	68	64	80	76	102	76	111	74	73	57	62	111	82
A220NE	0.0464	29	41	39	42	39	59	53	26	39	37	46	44	59	44	64	43	42	33	36	64	48
A220NW	0.0577	86	120	115	123	113	172	154	77	115	108	136	128	172	128	187	125	124	96	105	188	139
A220SW	0.1254	112	156	150	160	148	225	201	100	150	141	177	167	225	167	244	163	162	125	137	245	181
A221NE	0.0326	29	41	39	42	38	58	52	26	39	37	46	43	58	43	63	42	42	33	36	64	47
A221SE	0.0561	117	163	157	167	154	235	210	104	156	147	185	174	235	174	255	170	169	131	143	256	189
A222E1	0.0245	51	71	68	73	67	103	92	46	68	64	81	76	102	76	111	74	74	57	63	112	83
A222E2	0.0438	41	57	55	58	54	82	73	36	54	51	64	61	82	61	89	59	59	46	50	89	66
A222E3	0.0327	68	95	91	97	90	137	122	61	91	86	108	101	137	102	149	99	98	76	84	149	110
A227SE	0.0679	127	176	169	181	167	254	226	113	169	159	199	188	253	188	275	184	182	141	155	276	205
A227SW	0.0984	103	143	137	147	135	206	184	92	137	129	162	153	206	153	223	149	148	115	126	224	166
A228NE	0.1045	105	147	141	150	139	211	188	94	140	132	166	156	211	157	229	153	152	117	129	230	170
A228NW	0.1369	133	185	178	189	175	266	237	118	177	166	209	197	266	198	289	193	191	148	162	290	215
A228R1	0.0632	217	298	285	295	277	422	375	186	277	270	339	315	425	325	450	319	315	243	262	477	349
A228R2	0.1043	356	489	467	481	453	691	615	304	452	444	557	517	695	534	736	523	519	400	429	783	572
A228SE	0.0654	129	180	173	185	170	259	231	115	172	162	204	192	259	192	281	188	186	144	158	282	209
A229N2	0.0307	25	35	34	36	33	50	45	22	34	32	40	37	50	37	55	37	36	28	31	55	41
A229NE	0.0591	97	135	130	138	128	194	173	86	129	122	153	144	194	144	211	141	140	108	119	212	157
A229NW	0.0601	49	69	66	70	65	99	88	44	66	62	78	73	99	73	107	72	71	55	60	108	80
A229R1	0.1224	415	570	544	560	528	804	716	354	526	518	649	603	807	624	855	610	606	466	499	913	666
A229R2	0.0799	273	374	358	369	347	529	471	233	347	340	426	396	533	409	564	401	397	306	329	599	438
A229SE	0.1047	105	147	141	150	139	211	189	94	140	132	166	157	211	157	229	153	152	118	129	230	170
A229SW	0.1401	136	189	182	194	179	272	243	121	181	170	214	202	272	202	295	198	196	152	166	297	220
A230NE	0.1102	107	149	143	152	141	214	191	95	142	134	168	159	214	159	232	155	154	119	131	233	173
A230NW	0.0787	112	155	149	159	147	223	200	99	149	140	176	166	223	166	243	162	161	124	136	243	180
A230R1	0.0373	129	177	169	175	164	251	223	111	165	160	201	187	253	193	268	189	187	144	156	283	207
A230R2	0.0266	90	123	117	120	114	173	154	76	113	112	140	130	173	135	184	132	131	101	108	197	144
A230R3	0.0632	217	298	285	295	277	422	375	186	277	270	339	315	425	325	450	319	315	243	262	477	349
A230R4	0.0984	336	461	441	454	428	652	580	287	427	419	525	488	656	504	695	493	489	377	405	738	539
A230WK	0.0128	43	59	56	58	55	83	74	37	54	54	67	63	83	65	89	63	63	48	52	95	69
A231N1	0.0597	100	140	134	143	132	201	179	89	133	126	158	149	200	149	218	146	144	112	123	219	162
A231NE	0.0603	49	69	66	71	65	99	88	44	66	62	78	74	99	74	108	72	71	55	60	108	80
A231NW	0.0466	38	53	51	55	50	77	68	34	51	48	60	57	77	57	83	56	55	43	47	83	62
A231R1	0.0242	82	112	107	109	103	157	140	70	103	102	128	119	158	123	167	120	119	92	98	179	131
A231R2	0.0334	114	157	150	154	145	221	197	97	145	142	178	166	223	171	236	167	166	128	137	251	183
A231R3	0.0319	110	150	144	149	140	213	190	94	140	136	171	159	215	164	227	161	159	123	132	241	176
A231R4	0.0319	110	150	144	149	140	213	190	94	140	136	171	159	215	164	227	161	159	123	132	241	176
A231R5	0.1171	397	545	520	535	505	769	685	339	503	496	621	577	772	597	818	583	580	446	478	873	637
A231R6	0.0912	312	427	408	421	396	604	538	266	395	388	487	452	608	467	644	457	453	350	375	684	500
A231SE	0.1067	107	150	144	153	141	215	192	96	143	135	169	160	215	160	234	156	155	120	131	235	174
A231SW	0.1371	138	192	185	197	182	277	247	123	184	173	218	205	276	205	300	201	199	154	169	301	223
A302NE	0.02	34	48	46	49	45	69	61	31	46	43	54	51	69	51	75	50	49	38	42	75	55
A302NW	0.02	34	48	46	49	45	69	61	31	46	43	54	51	69	51	75	50	49	38	42	75	55
A302NW1	0.026	22	31	30	32	29	45	40	20	30	28	35	33	45	33	48	32	32	25	27	49	36
A302R1	0.063	214	293	280	288	272	414	369	182	270	267	334	310	415	321	440	314	312	240	257	470	343
A302SE	0.028	48	67	64	68	63	96	86	43	64	60	76	71	96	71	104	70	69	54	59	105	78
A302SW	0.028	48	67	64	68	63	96	86	43	64	60	76	71	96	71	104	70	69	54	59	105	78
A302SW1	0.037	32	44	42	45	42	64	57	28	42	40	50	47	64	47	69	46	46	35	39	69	51
A303NE1	0.025	43	60	57	61	56	86	77	38	57	54	68	64	86	64	93	62	62	48	52	94	69
A303NW1	0.025	43	60	57	61	56	86	77	38	57	54	68	64	86	64	93	62	62	48	52	94	69
A303NW2	0.032	27	38	37	39	36	55	49	24	37	34	43	41	55	41	60	40	40	31	34	60	44
A303R1	0.102	346	475	453	466	440	670	597	295	438	432	541	503	673	520	713	508	505	389	416	761	555
A303R2	0.088	299	410	391	402	380	578	515	255	378	373	467	434	580	449	615	439	436	335	359	656	479
A303SE	0.03	51	72	69	73	68	103	92	46	69	65	81	77	103	77	112	75	74	57	63	112	83
A303SE1	0.044	75	105	101	108	99	151	135	67	100	95	119	112	151	112	164	110	109	84	92	165	122
A303SW	0.03	51	72	69	73	68	103	92	46	69	65	81	77	103	77	112	75	74	57	63	112	83
A303SW1	0.044	75	105	101	108	99	151	135	67	100	95	119	112	151	112	164	110	109	84	92	165	122
A303SW2	0.056	48	67	64	69	63	96	86	43	64	60	76	71	96	71	104	70	69	54	59	105	78

Node	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A227SE	207	174	221	177	208	218	175	151	162	123	149	144	182	-	180	188	188	-	246	187	**186**
A227SW	168	141	179	143	169	177	142	122	131	100	121	117	148	-	146	153	152	-	199	152	**151**
A228NE	172	145	184	147	173	182	145	125	135	103	124	120	151	-	149	156	156	-	204	155	**155**
A228NW	217	183	232	185	218	229	183	158	170	129	157	151	191	-	188	197	197	-	257	196	**195**
A228R1	339	294	377	303	346	375	297	255	276	212	255	247	308	-	309	322	291	-	427	319	**315**
A228R2	555	483	618	498	568	617	485	417	452	348	418	404	506	-	508	530	475	-	702	523	**516**
A228SE	211	178	226	180	213	223	178	154	165	126	153	147	186	-	183	192	191	-	251	191	**190**
A229N2	41	35	44	35	41	43	35	30	32	25	30	29	36	-	36	37	37	-	49	37	**37**
A229NE	159	133	169	135	159	167	134	115	124	95	114	110	139	-	138	144	144	-	188	143	**143**
A229NW	81	68	86	69	81	85	68	59	63	48	58	56	71	-	70	73	73	-	96	73	**73**
A229R1	646	563	720	582	662	721	563	484	527	406	487	471	590	-	593	618	550	-	820	610	**601**
A229R2	425	370	473	382	435	473	371	319	346	266	320	310	387	-	389	406	364	-	538	401	**395**
A229SE	172	145	184	147	173	182	145	125	135	103	124	120	151	-	150	157	156	-	205	156	**155**
A229SW	222	187	237	190	223	234	187	162	174	132	160	155	195	-	193	202	201	-	264	201	**200**
A230NE	175	147	187	149	176	184	147	127	137	104	126	122	154	-	151	159	158	-	207	158	**157**
A230NW	182	153	195	156	183	192	154	133	143	109	132	127	160	-	158	166	165	-	216	165	**164**
A230R1	202	175	224	180	206	222	177	152	164	125	151	147	183	-	183	191	174	-	253	189	**187**
A230R2	139	122	155	126	143	156	121	104	114	88	105	101	128	-	128	134	118	-	177	132	**130**
A230R3	339	294	377	303	346	375	297	255	276	212	255	247	308	-	309	322	291	-	427	319	**315**
A230R4	524	456	583	470	535	582	457	393	427	328	395	382	477	-	479	500	448	-	662	494	**487**
A230WK	67	59	75	61	69	75	58	50	55	42	51	49	62	-	62	64	57	-	85	63	**62**
A231N1	164	138	175	140	165	173	138	119	128	98	118	114	144	-	142	149	148	-	194	148	**147**
A231NE	81	68	86	69	81	85	68	59	63	48	58	56	71	-	70	74	73	-	96	73	**73**
A231NW	63	53	67	53	63	66	53	45	49	37	45	44	55	-	54	57	57	-	74	56	**56**
A231R1	126	111	141	114	130	142	110	95	104	80	96	92	116	-	117	122	107	-	161	120	**118**
A231R2	178	155	198	160	182	198	155	133	145	111	134	130	162	-	163	170	152	-	225	168	**165**
A231R3	171	148	190	153	175	189	150	129	139	107	129	125	155	-	156	163	147	-	216	161	**159**
A231R4	171	148	190	153	175	189	150	129	139	107	129	125	155	-	156	163	147	-	216	161	**159**
A231R5	618	539	689	557	633	690	539	463	504	388	466	450	565	-	568	592	526	-	784	583	**575**
A231R6	486	422	540	436	496	540	424	364	395	304	366	354	442	-	444	463	415	-	614	457	**451**
A231SE	176	148	188	150	177	185	148	128	137	105	127	122	154	-	152	160	159	-	208	159	**158**
A231SW	226	190	241	193	227	238	190	164	177	135	163	157	198	-	196	205	205	-	268	204	**203**
A302NE	56	47	60	48	56	59	47	41	44	33	41	39	49	-	49	51	51	-	67	51	**50**
A302NW	56	47	60	48	56	59	47	41	44	33	41	39	49	-	49	51	51	-	67	51	**50**
A302NW1	36	31	39	31	37	38	31	27	29	22	26	25	32	-	32	33	33	-	43	33	**33**
A302R1	332	290	371	300	341	371	290	249	271	209	251	242	304	-	305	318	283	-	422	314	**309**
A302SE	79	66	84	67	79	83	66	57	61	47	57	55	69	-	68	71	71	-	93	71	**71**
A302SW	79	66	84	67	79	83	66	57	61	47	57	55	69	-	68	71	71	-	93	71	**71**
A302SW1	52	44	55	44	52	55	44	38	41	31	37	36	46	-	45	47	47	-	62	47	**47**
A303NE1	70	59	75	60	70	74	59	51	55	42	51	49	62	-	61	64	64	-	83	63	**63**
A303NW1	70	59	75	60	70	74	59	51	55	42	51	49	62	-	61	64	64	-	83	63	**63**
A303NW2	45	38	48	38	45	47	38	33	35	27	32	31	39	-	39	41	41	-	53	41	**40**
A303R1	538	469	600	485	551	601	469	404	439	339	406	392	492	-	494	515	458	-	683	508	**501**
A303R2	464	405	518	419	476	519	405	348	379	292	351	338	425	-	426	445	395	-	589	438	**432**
A303SE	84	71	90	72	85	89	71	61	66	50	61	59	74	-	73	77	76	-	100	76	**76**
A303SE1	123	104	132	105	124	130	104	90	97	74	89	86	108	-	107	112	112	-	146	111	**111**
A303SW	84	71	90	72	85	89	71	61	66	50	61	59	74	-	73	77	76	-	100	76	**76**
A303SW1	123	104	132	105	124	130	104	90	97	74	89	86	108	-	107	112	112	-	146	111	**111**
A303SW2	79	66	84	67	79	83	66	57	61	47	57	55	69	-	68	71	71	-	93	71	**71**

Table B5 - Subcatchments

Yearly Surface Infiltration Volumes (m³)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
A303SW3	0.039	33	47	45	48	44	67	60	30	45	42	53	50	67	50
A306NE	0.111	112	156	150	159	147	224	200	100	149	140	176	166	224	166
A306NW	0.156	157	219	210	224	207	315	281	140	209	197	247	233	314	234
A306R2	0.127	431	591	564	580	548	834	743	368	545	538	674	626	837	648
A306SE	0.051	88	122	117	125	115	175	156	78	116	110	138	130	175	130
A306SW	0.051	88	122	117	125	115	175	156	78	116	110	138	130	175	130
A306SW1	0.064	55	76	73	78	72	110	98	49	73	69	86	82	110	82
A310NE	0.043	43	60	58	62	57	87	77	39	58	54	68	64	87	64
A310NE1	0.028	28	39	38	40	37	56	50	25	38	35	44	42	56	42
A310NW	0.054	54	76	73	78	72	109	97	48	72	68	86	81	109	81
A310R1	0.044	149	205	196	201	190	289	257	127	189	186	233	217	290	224
A310SE	0.034	34	48	46	49	45	69	61	30	46	43	54	51	69	51
A310SW	0.054	54	76	73	78	72	109	97	48	72	68	86	81	109	81
A311NE	0.12	121	168	162	172	159	242	216	108	161	151	190	179	242	180
A311NW	0.067	67	94	90	96	89	135	121	60	90	85	106	100	135	100
A311R1	0.107	363	498	476	489	462	703	626	310	459	453	568	527	706	546
A311SE	0.119	120	167	160	171	158	240	214	107	160	150	189	178	240	178
A311SW	0.067	67	94	90	96	89	135	121	60	90	85	106	100	135	100
APOND2	0.019	31	43	42	44	41	62	56	28	42	39	49	46	62	46
A104PK	1.72	1,938	572	1,114	473	521	950	1,683	990	1,584	1,097	940	1,400	1,672	1,122
Total	**28.778**	**56,869**	**76,422**	**73,745**	**76,492**	**71,390**	**108,956**	**97,932**	**48,763**	**72,803**	**69,601**	**87,052**	**81,849**	**110,150**	**83,133**

Node	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
A303SW3	73	49	48	37	41	73	54	55	46	58	47	55	58	46
A306NE	243	163	161	125	137	244	181	183	154	195	156	184	193	154
A306NW	342	229	226	175	192	343	254	257	216	274	219	258	271	217
A306R2	887	633	629	484	518	948	691	670	584	747	604	686	749	584
A306SE	190	127	126	98	107	191	141	143	120	153	122	144	151	121
A306SW	190	127	126	98	107	191	141	143	120	153	122	144	151	121
A306SW1	119	80	79	61	67	120	89	90	75	96	77	90	95	76
A310NE	94	63	62	48	53	95	70	71	60	76	60	71	75	60
A310NE1	61	41	41	31	34	62	46	46	39	49	39	46	49	39
A310NW	118	79	78	61	66	119	88	89	75	95	76	89	94	75
A310R1	307	219	218	168	179	328	240	232	203	259	209	238	259	202
A310SE	74	50	49	38	42	75	55	56	47	60	48	56	59	47
A310SW	118	79	78	61	66	119	88	89	75	95	76	89	94	75
A311NE	263	176	174	135	148	264	195	198	166	211	169	199	209	167
A311NW	147	98	97	75	82	147	109	110	93	118	94	111	116	93
A311R1	748	533	530	408	437	798	583	564	492	629	509	578	631	492
A311SE	261	174	173	134	147	262	194	196	165	209	167	197	207	165
A311SW	147	98	97	75	82	147	109	110	93	118	94	111	116	93
APOND2	68	45	45	35	38	68	50	51	43	54	44	51	54	43
A104PK	1,649	851	1,115	1,812	814	1,869	1,121	546	1,116	805	1,855	493	1,302	1,281
Total	**117,734**	**81,131**	**80,591**	**63,276**	**67,467**	**122,192**	**89,563**	**87,953**	**75,953**	**96,309**	**78,522**	**89,086**	**96,182**	**76,544**

Node	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A303SW3	40	43	33	39	38	48	-	47	50	49	-	65	49	**49**
A306NE	133	143	109	132	127	161	-	158	166	166	-	217	165	**164**
A306NW	187	201	153	185	179	226	-	223	234	233	-	305	232	**231**
A306R2	503	547	422	506	488	613	-	616	642	571	-	851	633	**624**
A306SE	104	112	85	103	100	126	-	124	130	130	-	170	129	**129**
A306SW	104	112	85	103	100	126	-	124	130	130	-	170	129	**129**
A306SW1	65	70	54	65	62	79	-	78	82	81	-	106	81	**81**
A310NE	52	55	42	51	49	62	-	61	64	64	-	84	64	**64**
A310NE1	34	36	27	33	32	41	-	40	42	42	-	55	42	**41**
A310NW	65	70	53	64	62	78	-	77	81	81	-	105	80	**80**
A310R1	174	190	146	175	169	212	-	213	222	198	-	295	219	**216**
A310SE	41	44	33	40	39	49	-	49	51	51	-	66	51	**50**
A310SW	65	70	53	64	62	78	-	77	81	81	-	105	80	**80**
A311NE	144	154	118	143	138	174	-	171	180	179	-	234	178	**178**
A311NW	80	86	66	80	77	97	-	96	100	100	-	131	100	**99**
A311R1	423	461	355	426	411	516	-	519	541	481	-	717	533	**526**
A311SE	143	153	117	141	136	172	-	170	178	178	-	232	177	**176**
A311SW	80	86	66	80	77	97	-	96	100	100	-	131	100	**99**
APOND2	37	40	30	37	35	45	-	44	46	46	-	60	46	**46**
A104PK	1,816	806	931	768	1,405	1,493	-	1,873	1,957	1,072	-	1,269	887	**1,204**
Total	**66,651**	**70,721**	**54,460**	**65,344**	**63,818**	**79,800**	**-**	**79,923**	**83,542**	**77,742**	**-**	**108,758**	**81,708**	**81,285**

Table B6 - Groundwater

Yearly Sub-Surface Infiltration Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A102NE	0.1339	83	176	174	173	166	158	167	178	179	168	170	166	168	168	155	174	171	187	177	159	166	168	170	159	170	163	159	175	194	176	183	171	179	160	-	179	165	170	-	162	163	**168**
A103NE	0.1353	59	125	124	123	118	112	119	127	127	120	121	118	120	119	110	124	122	133	126	113	118	120	121	113	121	116	113	124	138	125	130	121	127	114	-	127	117	121	-	115	116	**119**
A103SW	0.0582	32	67	67	66	64	61	64	68	69	65	65	64	65	64	59	67	66	72	68	61	64	64	65	61	65	63	61	67	74	67	70	66	69	62	-	69	63	65	-	62	63	**64**
A104NE	0.1378	68	143	142	141	135	129	136	145	146	137	139	135	137	137	126	142	139	153	144	130	135	137	139	130	138	133	129	142	158	143	149	139	146	131	-	146	134	139	-	132	133	**137**
A104NW	0.0471	53	110	110	109	106	102	106	111	111	107	108	106	107	107	100	109	108	115	111	102	106	107	108	102	107	104	102	110	118	110	113	108	112	103	-	111	105	108	-	104	104	**106**
A104SE	0.0528	26	55	54	54	52	49	52	56	56	53	53	52	53	52	48	54	54	59	55	50	52	53	53	50	53	51	50	55	61	55	57	53	56	50	-	56	52	53	-	51	51	**53**
A104SW	0.0473	23	47	47	46	45	43	45	48	48	45	46	45	45	45	42	47	46	51	48	43	45	45	46	43	46	44	43	47	52	47	49	46	48	43	-	48	44	46	-	44	44	**45**
A105NE	0.0577	32	67	66	66	63	60	63	68	68	64	65	63	64	64	59	66	65	71	67	60	63	64	65	60	65	62	60	66	74	67	70	65	68	61	-	68	63	65	-	62	62	**64**
A105NW	0.1045	44	92	92	91	87	83	88	94	94	89	90	87	89	88	81	91	90	99	93	83	87	88	90	84	89	86	83	92	102	92	96	90	94	84	-	94	86	89	-	85	86	**88**
A105SE	0.0582	32	67	67	66	64	61	64	68	68	65	65	64	64	64	59	67	66	72	68	61	64	64	65	61	65	63	61	67	74	67	70	66	69	61	-	69	63	65	-	62	63	**64**
A105SW	0.1044	34	72	72	71	68	65	69	73	73	69	70	68	69	69	63	71	70	77	73	65	68	69	70	65	70	67	65	72	80	72	75	70	73	66	-	74	67	70	-	67	67	**69**
A106N1	0.0845	31	65	64	64	61	58	62	66	66	62	63	61	62	62	57	64	63	69	65	59	61	62	63	59	63	60	59	65	72	65	68	63	66	59	-	66	61	63	-	60	60	**62**
A106N2	0.0773	25	54	53	52	50	48	51	54	54	51	52	50	51	51	47	53	52	57	54	48	50	51	52	48	52	50	48	53	59	53	56	52	54	49	-	54	50	52	-	49	50	**51**
A106NE	0.0626	29	60	60	59	57	54	57	61	61	58	58	57	58	57	53	60	59	64	61	54	57	58	58	54	58	56	54	60	67	60	63	58	61	55	-	61	56	58	-	56	56	**58**
A106NW	0.0644	26	54	54	53	51	49	52	55	55	52	53	51	52	52	48	54	53	58	55	49	51	52	53	49	53	50	49	54	60	54	57	53	55	50	-	55	51	53	-	50	51	**52**
A106R1	0.0465	45	96	95	94	91	87	91	97	97	92	93	91	92	92	85	95	93	101	96	87	91	92	93	87	93	89	87	95	104	95	99	93	97	88	-	97	90	93	-	89	89	**92**
A106R2	0.1506	197	410	409	409	398	386	398	413	414	402	404	400	402	401	382	408	406	426	413	388	398	400	403	387	403	392	389	409	435	410	420	405	416	390	-	413	395	403	-	391	393	**398**
A106SE	0.073	23	48	47	47	45	43	45	48	49	46	46	45	46	45	42	47	46	51	48	43	45	46	46	43	46	44	43	47	53	48	50	46	49	43	-	49	45	46	-	44	44	**46**
A106SW	0.0666	26	54	53	53	51	48	51	55	55	52	52	51	52	51	47	53	52	57	54	49	51	52	52	49	52	50	48	53	60	54	56	52	55	49	-	55	50	52	-	50	50	**51**
A108N1	0.052	60	125	124	123	120	116	120	126	126	121	122	120	121	121	114	124	122	130	125	116	120	121	122	116	122	118	116	124	134	124	128	122	126	117	-	126	119	122	-	118	118	**120**
A108NE	0.0393	19	39	39	39	37	35	37	40	40	38	38	37	38	38	35	39	38	42	40	36	37	38	38	36	38	37	36	39	44	39	41	38	40	36	-	40	37	38	-	36	37	**38**
A108NW	0.0287	27	57	57	56	54	52	55	58	58	55	56	54	55	55	51	57	56	61	58	52	54	55	56	52	56	53	52	57	63	57	60	56	58	53	-	58	54	56	-	53	54	**55**
A108R1	0.2228	267	557	555	553	537	519	538	562	563	543	546	539	543	541	512	553	548	581	561	521	537	541	546	521	545	528	522	555	595	556	572	548	565	524	-	562	533	545	-	527	530	**538**
A108R2	0.1143	143	299	298	297	289	280	289	301	302	292	294	290	292	291	276	297	295	311	301	281	289	291	293	281	293	284	282	298	318	298	306	294	303	282	-	301	287	293	-	284	285	**289**
A108SE	0.1135	62	131	130	129	124	118	124	133	133	126	127	124	126	125	115	130	128	140	132	118	124	125	127	119	127	122	118	130	145	131	137	127	133	119	-	133	123	127	-	121	122	**125**
A108SW	0.0507	35	75	74	73	70	67	71	75	76	71	72	70	70	71	66	74	73	79	75	68	70	71	72	67	72	69	67	74	82	75	78	73	76	68	-	76	70	72	-	69	69	**71**
A109NE	0.0292	33	68	68	68	66	63	66	69	69	66	67	66	66	66	62	68	67	72	69	64	66	66	67	63	67	65	64	68	73	68	70	67	69	64	-	69	65	67	-	64	65	**66**
A109NW	0.0533	27	58	57	56	54	52	55	58	58	55	56	54	55	55	51	57	56	61	58	52	54	55	56	52	56	53	52	57	64	58	60	56	59	52	-	59	54	56	-	53	53	**55**
A109SE	0.0936	51	108	107	106	102	97	103	110	110	104	105	102	104	103	95	107	105	115	109	98	102	104	105	98	105	100	98	107	120	108	113	105	110	99	-	110	101	105	-	100	101	**103**
A110NE	0.1026	49	103	102	101	97	92	98	104	104	98	100	97	98	98	90	102	100	110	103	93	97	98	100	93	99	95	93	102	114	103	107	100	105	94	-	105	96	99	-	95	95	**98**
A110NW	0.0866	40	83	83	82	79	75	79	85	85	80	81	79	80	79	73	82	81	89	84	75	79	80	81	75	81	77	75	83	92	83	87	81	85	76	-	85	78	81	-	77	77	**80**
A110R1	0.0385	40	83	83	82	79	76	80	84	84	81	81	80	81	80	75	82	82	88	84	77	80	80	81	77	81	78	77	83	90	83	86	82	85	77	-	84	79	81	-	78	78	**80**
A110R10	0.0379	37	78	77	77	74	71	74	79	79	75	76	74	75	75	69	77	76	82	78	71	74	75	76	71	75	73	71	77	85	78	81	76	79	72	-	79	73	76	-	72	73	**75**
A110R2	0.0357	37	77	77	76	74	71	74	78	78	75	75	74	75	74	69	77	76	82	78	71	74	74	75	71	75	73	71	77	84	77	80	76	79	72	-	78	73	75	-	72	73	**74**
A110R3	0.0389	40	84	84	83	80	77	81	85	85	81	82	81	81	81	76	83	82	89	85	78	80	81	82	77	82	79	77	84	91	84	87	82	86	78	-	85	80	82	-	79	79	**81**
A110R4	0.0471	49	102	101	101	97	93	98	103	103	99	99	98	99	98	92	101	100	108	103	94	97	98	99	94	99	96	94	101	111	102	105	100	104	95	-	103	97	99	-	95	96	**98**
A110R5	0.0452	44	93	92	91	88	84	88	94	94	89	90	88	89	89	83	92	90	98	94	85	88	89	90	85	90	87	85	92	101	93	96	91	94	85	-	94	88	90	-	86	87	**89**
A110R6	0.0418	41	86	85	84	81	78	82	87	87	83	83	82	83	82	76	85	84	91	87	78	82	82	83	78	83	80	78	85	94	86	89	84	87	79	-	87	81	83	-	80	80	**82**
A110R7	0.0456	45	94	93	92	89	85	89	95	95	90	91	89	90	90	83	93	91	99	94	86	89	90	91	85	91	87	85	93	102	93	97	91	95	86	-	95	88	91	-	87	88	**90**
A110R8	0.0591	58	121	120	119	115	110	116	123	123	117	118	115	117	116	108	120	118	129	122	111	115	116	118	111	118	113	111	121	133	121	126	118	123	112	-	123	114	118	-	113	113	**116**
A110R9	0.0323	35	74	73	73	70	68	71	74	74	71	72	71	71	71	67	73	72	77	74	68	70	71	72	68	72	69	68	73	79	73	76	72	75	69	-	74	70	72	-	69	69	**71**
A110SE	0.0587	25	52	51	51	49	47	49	53	53	50	50	49	50	50	46	51	51	55	52	47	49	50	50	47	50	48	47	52	58	52	54	51	53	47	-	53	49	50	-	48	48	**50**
A110SW	0.0824	44	92	91	90	87	83	87	93	94	88	89	87	88	88	81	91	90	98	93	83	87	88	89	83	89	85	83	91	102	92	96	90	94	84	-	94	86	89	-	85	86	**88**
A111NW	0.0905	45	94	93	92	89	84	89	95	96	90	91	89	90	90	83	93	92	100	95	85	89	90	91	85	91	87	85	93	104	94	98	91	96	86	-	96	88	91	-	87	87	**90**
A111SE	0.0869	40	84	83	82	79	75	79	85	85	80	81	79	80	80	73	83	81	89	84	76	79	80	81	76	81	78	75	83	93	84	87	81	85	76	-	85	78	81	-	77	78	**80**
A112NE	0.1184	61	128	126	125	121	115	121	130	130	122	124	121	122	122	112	126	124	136	129	115	120	122	124	115	123	119	115	127	141	128	133	124	130	116	-	130	120	124	-	118	119	**122**
A112NW	0.0531	24	51	51	50	48	46	49	52	52	49	50	48	49	49	45	51	50	55	51	46	48	49	50	46	49	47	46	51	57	51	53	50	52	47	-	52	48	49	-	47	47	**49**
A112R3	0.0559	52	109	107	107	103	98	103	110	110	104	105	103	104	104	96	107	106	116	109	98	103	104	105	98	105	101	98	108	119	108	113	106	110	99	-	110	102	105	-	100	101	**104**
A112R4	0.0976	101	211	210	209	202	193	202	214	214	204	206	202	204	203	190	209	207	223	213	194	202	203	206	194	205	198	194	210	229	211	219	207	215	196	-	214	200	206	-	197	199	**203**
A112SE	0.1192	55	115	114	113	108	103	109	116	117	110	111	108	110	109	101	113	112	122	116	104	108	110	111	104	111	106	103	114	127	115	120	111	117	104	-	117	107	111	-	106	107	**110**
A112SW	0.0441	17	36	35	35	34	32	34	36	36	34	35	34	34	34	31	35	35	38	36	32	34	34	35	32	34	33	32	35	39	36	37	35	36	32	-	36	33	34	-	33	33	**34**
A112WK	0.0389	56	115	115	115	112	110	112	116	116	113	114	113	113	113	109	115	114	119	116	110	112	113	114	110	113	111	110	115	121	115	117	114	117	110	-	116	112	113	-	111	111	**112**
A113R1	0.1345	161	336	335	334	324	313	325	339	340	328	330	326	328	327	309	334	331	351	339	315	325	327	330	314	329	319	316	335	359	336	346	331	341	317	-	339	322	329	-	318	320	**325**
A113R2	0.0836	86	181	180	179	173	166	173	183	183	175	176	173	175	174	163	179	177	191	182	167	173	174	176	166	176	170	166	180	197	181	187	177	184	168	-	183	172	176	-	169	170	**174**
A114NE	0.0293	12	25	25	24	23	22	24	25	25	24	24	23	24	24	22	25	24	26	25	22	23	24	24	22	24	23	22	25	27	25	26	24	25	23	-	25	23	24	-	23	23	**24**
A114R1	0.0675	62	131	130	129	124	118	124	133	133	126	127	124	126	125	115	130	127	140	132	119	124	125	127	119	127	122	118	130	144	131	136	128	133	120	-	133	123	127	-	121	122	**125**
A114R2	0.0534	58	122	121	120	116	112	117	123	123	118	119	117	118	117	110	121	119	128	123	113	117	117	119	112	118	115	113	121	131	121	125	119	124	113	-	123	116	119	-	114	115	**117**
A114R3	0.0736	76	159	158	157	152	146	152	161	161	154	155	152	154	153	143	158	156	168	161	147	152	153	155	146	155	150	147	158	173	159	165	156	162	148	-	161	151	155	-	149	150	**153**
A114R4	0.1447	141	297	295	292	282	270	283	301	301	286	289	283	286	285	265	294	290	315	300	272	282	285	289	271	288	278	271	295	325	297	308	290	302	273	-	301	280	289	-	276	278	**285**
A114SE	0.1052	68	142	141	140	134	128	135	144	145	136	138	135	136	136	125	141	138	152	143	129	134	136	138	129	137	132	128	141	157	142	148	138	145	130	-	145	133	138	-	131	132	**136**
A114SW	0.1843	94	199	197	195	188	178	189	202	202	190	193	188	190	189	174	196	193	212	200	180	187	190	193	180	192	184	179	197	220	199	207	193	202	181	-	202	186	192	-	183	185	**190**
A115NE	0.08	42	89	88	88	84	80	85	91	91	86	87	84	86	85	79	88	87	95	90	81	84	85	87	81	86	83	81	89	99	89	93	87	91	81	-	91	84	86	-	83	83	**85**
A115NW	0.0502	23	48	48	47	46	43	46	49	49	46	47	46	46	46	42	48	47	52	49	44	46	46	47	44	47	45	44	48	53	48	50	47	49	44	-	49	45	47	-	45	45	**46**
A115R1	0.0441	48	100	100	99	96	92	96	101	102	97	98	97	97	97	91	100	98	106	101	93	96	97	98	93	98	95	93	100	108	100	104	99	102	94	-	102	96	98	-	94	95	**97**
A115R2	0.0429	44	93	92	92	89	85	89	94	94	90	91	89	90	89	84	92	91	98	94	85	89	89	91	85	90	87	85	92	101	93	96	91	94	86	-	94	88	90	-	87	87	**89**
A115R3	0.0346	36	75	74	74	71	69	72	76	76	72	73	72	72	72	67	74	73	79	76	69	72	72	73	69	73	70	69	74	81	75	77	73	76	69	-	76	71	73	-	70	70	**72**
A115R4	0.0355	35	73	72	72	69	66	69	74	74	70	71	69	70	70	65	72	71	77	73	67	69	70	71	67	71	68	66	72	80	73	76	71	74	67	-	74	69	71	-	68	68	**70**
A115R5	0.05	49	103	102	101	97	93	98	104	104	99	100	98	99	98	91	102	100	109	103	94	98	98	100	94	99	96	94	102	112	103	106	100	104	94	-	104	97	100	-	95	96	**98**
A115R6	0.0405	40	83	82	82	79	75	79	84	84	80	81	79	80	80	74	82	81	88	84	76	79	80	81	76	81	78	76	83	91	83	86	81	85	77	-	84	78	81	-	77	78	**80**
A115SE	0.0218	23	49	48	48	46	45	47	49	49	47	47	47	47	47	44	48	48	51	49	45	46	47	47	45	47	46	45	48	52	48	50	48	49	45	-	49	46	47	-	45	46	**47**
A115SW	0.0392	43	89	89	88	86	83	86	90	91	87	87	86	87	86	81	89	88	94	90	83	86	86	87	83	87	84	83	89	96	89	92	88	91	83	-	90	85	87	-	84	85	**86**
A115W1	0.0351	24	50	50	49	47	45	48	51	51	48	49	47	48	48	44	50	49	54	51	45	47	48	49	45	49	47	45	50	55	50	52	49	51	46	-	51	47	49	-	46	47	**48**
A116E1	0.037	27	56	55	55	53	50	53	57	57	54	54	53	53	53	49	55	54	60	56	51	53	53	54	50	54	52	50	55	62	56	58	54	57	51	-	57	52	54	-	52	52	**53**
A116NE	0.081	43	91	90	89	86	81	86	92	92	87	88	86	87	86	80	90	88	97	91	82	85	87	88	82	88	84	82	90	100	91	94	88	92	83	-	92	85	88	-	84	84	**87**
A116NW	0.0753	37	78	78	77	74	70	74	79	80	75	76	74	75	75	69	77	76	84	79	71	74	75	76	71	76	73	71	78	87	78	82	76	80	71	-	80	73	76	-	72	73	**75**
A116R1	0.1084	142	295	295	294	286	278	287	297	298	289	291	288	289	288	275	294	292	306	298	279	286	288	290	279	290	282	280	294	313	295	302	291	299	280	-	297	284	290	-	281	282	**286**
A116R2	0.1022	151	313	313	313	306	298	306	315	316	308	309	308	308	307	296	312	311	322	315	299	306	307	309	298	308	301	300	312	328	312	319	310	317	300	-	314	304	308	-	300	302	**305**
A116R3	0.0796	87	181	180	179	174	167	174	183	184	176	177	174	176	175	164	180	178	191	183	168	174	175	177	168	177	171	168	180	196	181	187	178	184	169	-	183	172	177	-	170	171	**175**
A116R4	0.059	51	134	132	130	128	120	129	135	101	130	131	129	130	129	122	133	131	96	130	123	128	129	131	124	130	124	122	133	127	131	136	120	120	119	-	132	119	127	-	124	127	**124**
A116R5	0.069	62	165	162	160	158	148	158	166	123	160	161	159	160	158	150	163	161	117	160	152	157	159	161	153	159	153	150	163	151	160	162	147	147	147	-	162	146	156	-	153	156	**153**
A116R6	0.066	52	135	133	131	128	119	129	137	103	131	131	129	130	129	120	133	131	97	131	123	128	129	131	123	130	124	121	134	138	132	139	122	121	119	-	134	118	128	-	124	127	**125**
A116R7	0.062	49	127	125	123	121	112	121	128	97	123	123	121	122	121	113	125	123	91	123	115	120	121	123	116	122	117	113	126	130	124	131	114	114	112	-	126	111	120	-	116	119	**117**
A116SE	0.0791	52	110	109	108	104	99	104	111	112	106	107	104	105	105	97	109	107	117	111	100	104	105	107	99	106	102	99	109	121	110	115	107	112	100	-	112	103	107	-	102	102	**105**
A116SW	0.0762	26	56	55	55	53	50	53	56	57	53	54	52	53	53	49	55	54	59	56	50	52	53	54	50	54	52	50	55	62	56	58	54	57	51	-	57	52	54	-	51	52	**53**
A117NE	0.0839	43	91	90	89	85	81	86	92	92	87	88	85	87	86	79	89	88	97	91	82	85	87	88	82	87	84	82	90	100	90	94	88	92	82	-	92	85	88	-	84	84	**86**
A117NW	0.0821	41	85	85	84	81	77	81	87	87	82	83	81	82	81	75	84	83	91	86	77	80	82	83	77	83	79	77	85	94	85	89	83	87	78	-	87	80	83	-	79	79	**82**
A117R1	0.085	80	213	210	205	205	192	205	214	158	207	208	206	207	205	195	210	208	151	206	197	204	205	208	198	206	197	195	211	188	207	204	190	189	191	-	209	190	202	-	198	202	**197**
A117R2	0.062	51	134	132	130	128	119	128	135	102	130	130	128	129	128	120	132	130	96	130	122	127	129	130	123	129	123	121	133	132	130	138	120	120	119	-	132	118	127	-	124	126	**124**
A117R3	0.094	74	193	190	187	183	170	184	195	147	186	187	183	185	184	172	190	187	138	187	175	182	184	187	176	185	177	172	191	197	188	198	173	173	169	-	191	169	182	-	177	180	**178**
A117R4	0.068	54	140	137	135	132	123	133	141	106	135	135	133	134	133	124	137	135	100	135	126	132	133	135	127	134	128	124	138	142	136	143	125	125	122	-	138	122	132	-	128	130	**129**
A117SE	0.0768	37	77	76	75	73	69	73	78	78	74	74	73	74	73	67	76	75	82	77	69	72	74	75	70	74	71	69	76	85	77	80	75	78	70	-	78	72	74	-	71	71	**73**
A117SW	0.0856	34	72	72	71	68	65	69	74	74	69	70	68	69	69	64	72	71	77	73	65	68	69	70	66	70	67	65	72	80	72	76	70	74	66	-	74	68	70	-	67	67	**69**
A117W1	0.079	22	66	66	53	60	58	63	58	45	64	62	63	64	63	59	60	61	41	62	60	63	63	64	58	64	61	59	66	43	64	51	56	56	58	-	66	58	63	-	61	62	**59**
A117W2	0.087	28	86	85	69	78	76	83	75	58	83	80	82	83	82	76	78	80	53	80	78	81	82	84	75	83	79	77	86	55	83	66	73	73	75	-	86	75	82	-	79	81	**76**
A119NE	0.1464	72	152	151	149	144	137	145	154	155	146	147	144	146	145	134	150	148	162	153	138	144	146	148	138	147	141	137	151	168	152	159	148	155	139	-	155	143	147	-	141	141	**145**
A119NW	0.1135	56	118	117	116	111	106	112	120	120	113	114	111	113	112	104	117	115	126	119	107	111	113	114	107	114	110	106	117	131	118	123	115	120	107	-	120	111	114	-	109	110	**113**
A119R1	0.16	206	569	576	481	544	546	570	508	409	575	570	573	573	570	557	554	561	372	553	556	567	568	569	526	569	549	555	576	392	553	454	507	513	541	-	566	532	560	-	555	563	**529**
A119R2	0.228	198	519	511	504	496	464	498	523	391	504	506	498	502	498	470	512	505	370	504	476	494	499	505	479	501	479	470	514	491	504	527	465	464	462	-	511	459	492	-	480	489	**480**
A119R3	0.147	168	351	349	348	338	325	338	354	355	342	344	339	341	340	321	349	345	368	354	327	338	340	344	327	343	332	328	350	377	351	361	345	357	329	-	355	335	343	-	331	333	**339**
A119SE	0.0602	31	65	64	64	61	58	62	66	66	62	63	61	62	62	57	64	63	69	65	59	61	62	63	59	63	60	59	65	72	65	68	63	66	59	-	66	61	63	-	60	60	**62**
A119SW	0.092	44	92	91	90	87	83	87	93	94	88	89	87	88	88	81	91	90	98	93	83	87	88	89	83	89	86	83	92	102	92	96	90	94	84	-	94	86	89	-	85	86	**88**
A121NE	0.062	36	109	108	87	99	96	105	95	74	106	102	105	106	105	97	99	101	67	101	99	104	104	106	95	106	100	98	109	70	105	83	93	92	96	-	109	96	104	-	101	103	**97**
A121NW	0.099	35	105	105	84	96	93	101	92	71	102	99	101	102	101	94	96	98	65	98	96	100	100	103	92	102	97	94	106	68	102	81	90	89	93	-	106	92	100	-	97	99	**93**
A121R1	0.042	38	100	99	98	96	90	97	101	75	98	98	97	97	96	92	99	98	71	97	93	96	97	98	93	97	93	92	99	92	97	99	90	89	90	-	99	89	95	-	93	95	**93**
A121R2	0.072	62	164	161	159	157	146	157	165	124	159	160	157	158	157	148	162	160	117	159	150	156	158	159	151	158	151	149	162	155	159	166	147	146	146	-	162	145	155	-	152	155	**152**
A121R3	0.044	40	105	104	102	101	95	101	106	79	102	103	101	102	101	96	104	103	75	102	97	100	101	102	98	102	97	96	104	96	102	104	94	94	94	-	103	93	100	-	98	99	**97**
A121R4	0.059	55	148	146	143	142	134	143	148	110	144	145	143	144	143	136	146	144	105	143	137	142	143	144	138	143	137	136	147	131	144	142	132	132	133	-	145	132	141	-	138	140	**137**
A121S1	0.154	56	170	169	136	154	149	163	149	115	165	159	162	164	163	151	155	158	104	158	154	161	161	166	149	164	156	151	170	109	164	130	144	144	149	-	170	149	161	-	156	159	**150**
A121SE	0.122	68	205	204	164	186	181	197	179	139	200	191	197	199	197	183	187	190	126	191	187	195	195	200	179	199	189	183	206	132	197	156	175	173	181	-	206	180	195	-	189	193	**182**
A121SW	0.077	28	85	84	68	77	75	82	74	57	82	79	81	82	81	75	77	79	52	79	77	81	81	83	74	82	78	76	85	55	82	65	72	72	75	-	85	75	81	-	78	80	**75**

Table B6 - Groundwater

Yearly Sub-Surface Infiltration Volumes (m^3)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A122NE	0.1276	70	147	146	145	139	132	140	150	150	141	143	139	141	140	129	146	143	157	148	133	139	141	143	133	142	137	133	146	163	147	154	143	150	134	-	150	138	143	-	136	137	141
A122R1	0.0732	108	224	224	224	219	214	219	225	226	221	222	220	221	220	212	223	222	231	226	214	219	220	221	214	221	215	215	224	235	224	228	222	227	215	-	225	217	221	-	215	216	218
A122R2	0.2135	315	653	653	653	638	622	638	658	659	643	646	643	643	642	617	651	649	673	658	624	638	641	645	623	644	628	627	652	685	652	665	648	662	627	-	656	634	644	-	628	630	636
A124NE	0.0469	30	63	63	62	60	57	60	64	64	61	61	60	61	60	56	63	62	68	64	57	60	61	61	57	61	59	57	63	70	63	66	62	65	58	-	64	59	61	-	58	59	61
A124NW	0.131	46	140	139	112	126	123	134	122	94	135	130	133	135	134	124	127	130	86	130	126	132	132	136	122	135	128	124	140	90	135	107	119	118	122	-	140	122	133	-	128	131	124
A124R1	0.0918	100	209	208	207	200	192	201	211	212	203	204	201	203	202	190	207	205	220	211	194	200	202	204	193	204	197	194	208	226	209	216	205	212	195	-	211	199	204	-	196	197	201
A124R2	0.136	123	325	320	316	312	292	313	327	243	316	317	313	315	312	296	321	317	231	315	300	310	313	317	302	314	301	296	322	297	316	320	291	290	291	-	320	289	309	-	302	307	301
A124SE	0.0469	20	42	41	41	39	37	39	42	42	40	40	39	40	40	36	41	40	44	42	38	39	40	40	38	40	38	37	41	46	41	43	40	42	38	-	42	39	40	-	38	39	40
A124SW	0.136	38	114	113	91	103	100	109	100	77	110	106	109	110	109	101	104	106	70	106	103	108	108	111	100	110	104	101	114	73	110	87	97	97	100	-	114	100	108	-	105	107	101
A125E1	0.0575	58	121	121	120	116	111	116	123	123	117	118	116	117	117	109	120	119	128	122	111	116	117	118	111	118	114	111	121	132	121	126	119	123	112	-	123	115	118	-	113	114	117
A125NE	0.0478	24	50	49	49	47	45	47	50	51	48	48	47	48	47	44	49	48	53	50	45	47	48	48	45	48	46	45	49	55	50	52	48	51	45	-	51	47	48	-	46	46	48
A125NW	0.0931	41	86	85	84	81	77	82	87	87	82	83	81	82	82	75	85	84	92	87	78	81	82	83	78	83	80	77	85	95	86	90	84	88	78	-	88	81	83	-	79	80	82
A125R1	0.1047	114	238	237	236	228	220	229	241	241	231	233	229	231	230	216	237	234	251	240	221	228	230	233	221	232	225	221	237	257	238	246	234	242	222	-	241	227	233	-	224	225	230
A125R2	0.1093	119	249	247	246	238	229	239	251	252	241	243	239	241	240	226	247	244	262	251	230	238	240	243	230	242	234	231	248	269	249	257	244	253	232	-	252	237	243	-	234	235	240
A125SE	0.0476	18	38	38	38	36	35	37	39	39	37	37	36	37	37	34	38	37	41	39	35	36	37	37	35	37	36	35	38	43	38	40	37	39	35	-	39	36	37	-	36	36	37
A125SW	0.0931	34	72	71	70	68	64	68	73	73	69	69	67	69	68	63	71	70	76	72	65	67	69	69	65	69	66	64	71	79	72	75	69	73	65	-	73	67	69	-	66	66	68
A126E1	0.0331	12	25	25	25	24	23	24	26	26	24	25	24	24	24	22	25	25	27	26	23	24	24	25	23	25	24	23	25	28	25	27	25	26	23	-	26	24	25	-	24	24	24
A126NE	0.0333	34	72	72	71	69	66	69	73	73	70	70	69	70	70	65	72	71	76	73	67	69	70	70	66	70	68	66	72	78	72	75	71	73	67	-	73	68	70	-	68	68	69
A126NW	0.0258	27	57	57	57	55	53	55	58	58	56	56	55	56	55	52	57	56	60	58	53	55	55	56	53	56	54	53	57	62	57	59	56	58	53	-	58	55	56	-	54	54	55
A126R1	0.0977	112	233	232	231	224	216	225	236	236	227	229	225	227	226	213	232	229	244	235	217	224	226	228	217	228	221	218	232	251	233	240	229	237	219	-	236	223	228	-	220	221	225
A126SE	0.032	24	50	49	49	47	45	47	50	50	48	48	47	47	47	44	49	48	53	50	45	47	47	48	45	48	46	45	49	55	50	52	48	50	45	-	50	46	48	-	46	46	47
A126SW	0.0259	20	42	42	41	40	38	40	43	43	40	41	40	40	40	37	42	41	45	42	38	40	40	41	38	41	39	38	42	46	42	44	41	43	38	-	43	40	41	-	39	39	40
A126W1	0.0767	32	68	67	67	64	61	64	69	69	65	66	64	65	65	60	67	66	72	68	61	64	65	66	61	66	63	61	67	75	68	71	66	69	62	-	69	64	66	-	63	63	65
A129NE	0.1715	88	185	183	182	175	166	176	188	188	177	179	175	177	176	162	183	180	197	186	167	174	177	179	167	179	172	167	184	205	185	193	180	188	168	-	188	173	179	-	171	172	177
A129NW	0.0657	32	68	68	67	65	61	65	69	69	65	66	64	65	65	60	68	66	73	69	62	64	65	66	62	66	63	62	68	76	68	71	66	70	62	-	70	64	66	-	63	63	65
A129R1	0.123	134	280	278	277	268	258	269	283	284	272	274	269	271	271	254	278	275	294	282	259	268	270	273	259	273	264	259	279	302	280	289	275	285	261	-	283	266	273	-	263	264	270
A129R2	0.1272	145	304	302	301	292	282	293	307	307	296	298	293	295	294	278	302	299	318	306	283	292	294	297	283	297	287	283	302	326	303	313	299	308	285	-	307	290	297	-	286	288	293
A129SE	0.097	75	158	156	155	149	142	150	160	160	151	153	149	151	151	139	156	154	168	159	143	149	151	153	143	152	147	143	157	174	158	164	154	161	144	-	160	148	153	-	146	147	151
A129SW	0.0642	32	67	66	66	63	60	63	68	68	64	65	63	64	64	59	66	65	71	67	60	63	64	65	60	65	62	60	66	74	67	70	65	68	61	-	68	63	65	-	62	62	64
A130NE	0.15	47	143	142	114	129	125	137	125	96	138	133	136	138	136	126	130	132	88	133	129	135	135	139	125	138	131	127	143	92	137	109	121	121	125	-	143	125	135	-	131	134	126
A130NW	0.047	17	50	50	40	45	44	48	44	34	49	47	48	48	48	45	46	46	31	47	45	47	48	49	44	49	46	45	50	32	48	38	43	42	44	-	50	44	48	-	46	47	44
A130R1	0.175	158	418	412	406	401	376	402	421	313	407	408	403	405	402	381	413	408	298	406	386	399	403	407	388	404	387	381	414	383	406	412	374	373	374	-	411	372	397	-	388	396	387
A130SE	0.147	54	162	161	130	147	143	156	142	110	157	152	155	157	155	144	148	150	99	151	147	154	154	158	142	157	149	144	162	104	156	124	138	138	142	-	163	142	154	-	149	152	144
A130SW	0.055	17	52	52	42	47	46	50	46	35	51	49	50	51	50	46	48	49	32	49	47	50	50	51	46	51	48	47	52	34	50	40	44	44	46	-	52	46	50	-	48	49	46
A132N1	0.029	21	63	63	50	57	58	62	53	43	61	58	62	62	62	58	57	57	39	58	59	61	60	60	55	61	59	58	64	40	60	47	55	52	57	-	64	57	61	-	60	61	56
A132NE	0.028	16	49	49	39	45	44	47	43	33	48	46	47	48	47	44	45	46	30	46	45	47	47	48	43	48	45	44	49	32	47	38	42	42	43	-	49	43	47	-	45	46	44
A132NW	0.033	9	26	26	21	24	23	25	23	18	26	25	25	25	25	23	24	24	16	25	24	25	25	26	23	26	24	23	26	17	25	20	22	22	23	-	26	23	25	-	24	25	23
A132R1	0.088	79	210	207	204	202	189	202	211	157	204	205	203	204	202	192	208	205	150	204	194	201	203	205	195	203	195	192	208	192	204	207	188	187	188	-	207	187	200	-	195	199	195
A132R2	0.1119	128	267	266	265	257	248	257	270	270	260	262	258	260	259	244	265	263	280	269	249	257	259	262	249	261	253	249	266	287	267	275	263	271	251	-	270	255	261	-	252	253	258
A132R3	0.1145	125	261	259	258	250	240	250	263	264	253	255	251	253	252	236	259	256	274	263	241	250	252	255	241	254	246	242	259	281	260	269	256	265	243	-	264	248	254	-	245	246	251
A132R4	0.101	110	230	229	227	220	212	221	232	233	223	225	221	223	222	209	228	226	242	232	213	220	222	225	213	224	217	213	229	248	230	237	226	234	214	-	233	219	224	-	216	217	221
A132SE	0.033	18	54	54	43	49	48	52	47	37	53	51	52	53	52	48	49	50	33	50	49	52	51	53	47	53	50	48	54	35	52	41	46	46	48	-	54	48	52	-	50	51	48
A132SW	0.048	18	55	54	44	50	48	53	48	37	53	51	52	53	52	49	50	51	34	51	50	52	52	53	48	53	50	49	55	35	53	42	47	46	48	-	55	48	52	-	50	51	49
A133NE	0.0433	56	116	116	115	112	109	113	117	117	114	114	113	113	113	108	115	115	120	117	110	113	113	114	109	114	111	110	116	123	116	119	114	118	110	-	117	112	114	-	110	111	112
A133NW	0.0948	122	254	253	253	246	239	246	256	257	249	250	247	248	248	236	253	251	264	256	240	246	248	250	239	249	242	241	253	269	254	260	251	257	241	-	256	245	249	-	242	243	246
A133SE	0.06	68	184	179	148	173	185	194	148	134	176	169	195	195	180	189	166	165	117	166	189	193	184	174	167	177	178	188	196	114	170	139	160	153	184	-	194	176	188	-	188	192	170
A133SW	0.132	149	405	395	325	380	408	427	325	294	387	371	428	429	397	415	365	363	258	366	416	425	404	384	366	390	391	414	432	251	374	305	353	336	404	-	426	388	413	-	414	422	374
A133W1	0.0432	56	116	115	115	112	109	112	117	117	113	114	113	113	113	108	115	114	120	116	109	112	113	114	109	113	110	110	115	123	116	118	114	117	110	-	116	111	114	-	110	111	112
A133W2	0.06	68	184	179	148	173	185	194	148	134	176	169	195	195	180	189	166	165	117	166	189	193	184	174	167	177	178	188	196	114	170	139	160	153	184	-	194	176	188	-	188	192	170
A133W3	0.0616	71	148	147	146	142	137	142	149	149	144	145	142	143	143	135	146	145	154	149	138	142	143	144	137	144	140	138	147	158	147	152	145	150	138	-	149	141	144	-	139	140	142
A133W4	0.088	92	253	248	203	237	251	264	205	183	243	232	265	266	249	256	228	228	161	229	256	263	251	241	228	244	244	255	268	157	235	191	222	210	249	-	265	243	259	-	256	261	233
A134NE	0.047	57	153	148	123	144	156	163	122	111	146	140	163	164	150	159	138	137	98	138	159	162	154	145	139	147	149	159	164	94	141	115	132	127	154	-	162	146	156	-	158	161	142
A134NW	0.126	136	375	366	301	351	375	393	302	271	358	343	394	395	367	382	338	336	238	339	382	391	373	355	338	361	361	380	398	232	347	282	327	311	371	-	393	359	382	-	381	388	345
A134SE	0.025	19	57	57	45	52	53	56	47	39	55	52	56	57	56	53	51	51	35	52	54	56	55	54	50	55	53	53	58	36	54	43	50	47	52	-	58	52	55	-	54	55	51
A134SW	0.115	120	331	325	266	309	329	345	268	239	317	303	346	347	325	334	299	297	210	300	335	343	328	314	298	319	318	333	351	205	307	250	290	275	326	-	346	318	339	-	334	341	305
A135R1	0.023	20	52	52	51	50	47	50	53	40	51	51	50	51	50	47	52	51	37	51	48	50	50	51	48	51	48	47	52	50	51	53	47	47	47	-	52	46	50	-	48	49	48
A136NE	0.031	18	53	53	43	48	47	51	46	36	52	50	51	52	51	48	49	49	33	50	49	51	51	52	47	52	49	48	53	34	51	41	45	45	47	-	54	47	51	-	49	50	47
A136NE1	0.024	14	42	42	34	38	37	41	37	29	41	39	40	41	41	38	38	39	26	39	38	40	40	41	37	41	39	38	42	27	41	32	36	36	37	-	42	37	40	-	39	40	37
A136NW	0.039	11	34	34	27	31	30	33	30	23	33	32	33	33	33	30	31	32	21	32	31	32	32	33	30	33	31	30	34	22	33	26	29	29	30	-	34	30	32	-	31	32	30
A136NW1	0.025	15	44	44	35	40	39	42	38	30	43	41	42	43	42	39	40	41	27	41	40	42	42	43	38	43	40	39	44	28	42	34	38	37	39	-	44	39	42	-	41	41	39
A136NW2	0.033	10	29	29	23	26	25	28	25	20	28	27	28	28	28	26	26	27	18	27	26	27	27	28	25	28	27	26	29	19	28	22	25	24	25	-	29	25	27	-	27	27	26
A136R1	0.034	27	70	69	68	66	61	66	70	53	67	68	66	67	66	62	69	68	50	68	63	66	67	68	64	67	64	62	69	71	68	72	63	62	61	-	69	61	66	-	64	65	64
A136SE	0.028	21	61	61	48	55	56	60	51	42	59	56	60	60	60	56	55	55	37	56	57	59	58	58	53	59	56	56	62	38	58	46	53	51	55	-	61	55	59	-	58	59	54
A201NE	0.1387	76	160	159	157	151	144	152	163	163	154	155	151	153	153	141	158	156	171	162	145	151	153	155	145	155	149	145	159	177	160	167	156	163	146	-	163	150	155	-	148	149	153
A201S1	0.098	28	86	85	69	78	75	82	75	58	83	80	82	83	82	76	78	80	53	80	78	81	81	84	75	83	79	76	86	55	83	66	73	73	75	-	86	75	81	-	79	80	76
A201SW	0.133	40	121	121	97	110	107	117	106	82	118	113	116	117	116	108	111	113	74	113	110	115	115	118	106	118	111	108	121	78	117	93	103	103	106	-	122	106	115	-	112	114	107
A203NE	0.103	39	117	117	94	106	103	113	103	79	114	110	112	114	112	104	107	109	72	109	106	111	111	115	103	114	108	104	118	76	113	90	100	100	103	-	118	103	111	-	108	110	104
A203NW	0.098	41	123	122	98	112	109	118	108	83	120	115	118	119	118	110	112	114	76	115	112	117	117	120	108	119	113	110	123	79	119	94	105	104	108	-	124	108	117	-	113	116	109
A203R1	0.116	137	380	378	333	370	356	373	363	272	376	377	375	375	373	362	378	376	254	371	363	371	373	374	358	373	360	361	379	278	370	314	336	338	353	-	373	348	367	-	363	369	351
A203R2	0.088	92	249	247	231	242	229	242	250	182	245	245	244	244	243	233	247	245	176	243	235	241	243	245	236	243	234	233	248	203	243	223	223	222	228	-	245	225	239	-	235	239	231
A203R3	0.111	100	265	262	258	254	239	255	267	198	258	259	256	257	255	242	262	259	189	257	245	253	256	258	246	256	246	242	263	243	258	261	237	236	237	-	261	236	252	-	246	251	245
A204E1	0.1535	76	160	158	157	151	143	152	162	162	153	155	151	153	152	140	158	155	170	161	144	151	153	155	144	154	148	144	159	177	160	167	155	163	145	-	162	150	154	-	147	148	153
A204E2	0.1536	59	124	123	122	117	111	118	126	126	119	120	117	119	118	109	123	121	132	125	112	117	119	120	112	120	115	112	123	137	124	130	120	126	113	-	126	116	120	-	115	115	119
A204NE	0.096	25	77	76	61	69	67	74	67	52	74	72	73	74	73	68	70	71	47	71	69	72	73	75	67	74	70	68	77	49	74	59	65	65	67	-	77	67	73	-	70	72	68
A204NW	0.107	30	89	89	72	81	79	86	78	61	87	84	85	86	86	79	82	83	55	83	81	85	85	87	78	87	82	80	90	58	86	68	76	76	78	-	90	78	85	-	82	84	79
A204R1	0.136	123	325	320	316	312	292	313	327	243	316	317	313	315	312	296	321	317	231	315	300	310	313	317	302	314	301	296	322	297	316	320	291	290	291	-	320	289	309	-	302	307	301
A204R2	0.0665	72	151	151	150	145	139	145	153	153	147	148	145	147	146	137	150	148	159	153	140	145	146	148	140	147	143	140	151	163	151	156	149	154	141	-	153	144	148	-	142	143	146
A204R3	0.1353	147	308	306	305	295	284	296	311	312	299	301	296	299	298	279	306	302	324	311	285	295	298	301	285	300	290	285	307	332	308	318	302	313	287	-	312	293	301	-	289	291	297
A204R4	0.0808	83	175	174	173	167	160	167	177	177	169	171	167	169	168	157	173	171	185	176	161	167	168	170	161	170	164	161	174	190	175	181	171	178	162	-	177	166	170	-	163	164	168
A204R5	0.0731	84	175	174	173	168	162	168	176	177	170	171	169	170	169	160	173	172	183	176	163	168	169	171	162	171	165	163	174	188	174	180	172	177	164	-	176	167	171	-	165	166	169
A204SE	0.096	31	95	94	76	86	83	91	83	64	92	89	91	92	91	84	87	88	58	88	86	90	90	93	83	92	87	84	95	61	91	73	81	80	83	-	95	83	90	-	87	89	84
A205SE	0.109	38	116	115	93	105	102	112	102	79	113	108	111	112	111	103	106	108	71	108	105	110	110	113	102	112	107	103	116	75	112	89	99	98	102	-	116	102	110	-	107	109	103
A205SW	0.037	31	89	89	71	82	84	90	74	63	86	82	90	90	88	85	80	81	55	81	86	89	86	85	79	86	84	85	92	56	84	67	79	74	84	-	91	83	88	-	87	88	81
A206NE	0.138	50	152	151	122	138	134	146	133	103	148	142	145	147	146	135	139	141	93	142	138	144	144	149	133	147	140	136	152	98	147	116	129	129	134	-	153	134	145	-	140	143	135
A206R1	0.078	70	187	184	181	179	168	180	188	140	182	182	180	181	179	170	184	182	133	181	172	178	180	182	173	180	173	170	185	170	181	184	167	166	167	-	184	166	177	-	173	177	173
A208NW	0.183	65	195	194	156	177	171	187	170	132	189	182	186	188	186	173	178	181	120	181	176	185	185	190	171	189	179	173	195	125	188	149	166	165	171	-	195	171	185	-	179	183	173
A208R1	0.092	83	220	217	214	211	198	211	221	164	214	215	212	213	211	201	217	215	157	213	203	210	212	214	204	213	204	201	218	201	214	217	197	196	197	-	216	195	209	-	204	208	204
A208R2	0.11408	130	272	271	270	262	253	262	275	276	265	267	263	265	264	249	271	268	285	275	254	262	264	267	253	266	258	254	271	293	272	280	268	277	255	-	275	260	266	-	257	258	263
A208R3	0.11995	131	273	271	270	262	252	262	276	276	265	267	262	265	264	248	271	268	287	275	253	262	264	267	253	266	257	253	272	295	273	282	268	277	255	-	276	260	266	-	256	258	263
A208R4	0.06381	69	145	144	144	139	134	139	147	147	141	142	140	141	140	132	144	142	153	146	135	139	140	142	134	142	137	135	145	157	145	150	143	148	135	-	147	138	142	-	136	137	140
A208R5	0.04895	53	111	111	110	107	103	107	113	113	108	109	107	108	108	101	111	109	117	112	103	107	108	109	103	109	105	103	111	120	111	115	109	113	104	-	113	106	109	-	105	105	107
A208R6	0.03693	40	84	84	83	81	77	81	85	85	82	82	81	82	81	76	83	82	88	85	78	81	81	82	78	82	79	78	84	91	84	87	83	85	78	-	85	80	82	-	79	79	81
A208SE	0.135	70	211	210	169	191	186	203	184	143	206	197	202	205	203	188	192	195	130	196	192	201	201	206	185	205	195	189	212	136	203	161	180	179	186	-	212	186	201	-	195	199	187
A209NW	0.1408	64	136	134	133	128	122	129	137	138	130	131	128	130	129	119	134	132	145	136	122	128	130	131	123	131	126	122	135	150	135	141	132	138	123	-	138	127	131	-	125	126	129
A209R1	0.05338	58	122	121	120	116	112	117	123	123	118	119	117	118	117	110	121	119	128	123	113	116	117	119	112	118	115	113	121	131	121	125	119	123	113	-	123	116	119	-	114	115	117
A209SE	0.11198	55	116	115	114	110	104	111	118	118	112	113	110	111	111	102	115	113	124	117	105	110	111	113	105	113	108	105	116	129	116	121	113	119	106	-	118	109	113	-	107	108	111
A210NW	0.0605	59	124	123	122	118	113	119	126	126	120	121	118	120	119	111	123	121	132	125	114	118	119	121	114	121	116	113	124	136	124	129	121	126	115	-	126	117	121	-	116	116	119
A210SE	0.1357	70	146	145	144	138	131	139	148	149	140	142	138	140	139	128	145	142	156	147	132	138	140	142	132	141	136	132	145	162	146	153	142	149	133	-	149	137	142	-	135	136	140
A211R1	0.0326	37	78	78	77	75	72	75	79	79	76	76	75	76	75	71	77	77	82	79	73	75	75	76	72	76	74	73	78	84	78	80	77	79	73	-	79	74	76	-	73	74	75
A211R2	0.1526	183	381	380	379	368	356	369	385	386	372	374	370	372	371	351	379	376	398	385	357	368	370	374	357	373	362	358	380	408	381	392	376	387	359	-	385	366	374	-	361	363	369
A211R3	0.08025	137	282	282	283	277	272	277	283	284	279	280	280	279	279	270	281	281	288	284	272	277	278	279	272	279	273	274	282	292	281	285	280	285	273	-	282	276	279	-	273	274	275
A213NE	0.1207	62	130	129	128	123	117	124	132	132	125	126	123	125	124	114	129	127	139	131	118	123	125	126	118	126	121	117	129	144	130	136	126	133	118	-	132	122	126	-	120	121	124
A214NE	0.1165	53	112	111	110	106	101	106	114	114	107	109	106	107	107	98	111	109	120	113	101	106	107	109	101	108	104	101	111	124	112	117	109	114	102	-	114	105	108	-	103	104	107
A214NW	0.119	57	119	118	117	112	107	113	121	121	114	115	112	114	114	105	118	116	127	120	108	112	114	115	108	115	111	107	118	132	119	124	116	121	108	-	121	112	115	-	110	111	114
A214SE	0.0937	76	160	158	157	151	144	152	162	162	153	155	151	153	153	141	158	155	170	161	145	151	153	155	145	154	149	144	159	176	160	166	156	163	146	-	162	150	155	-	148	149	153
A214SW	0.1075	55	116	115	114	109	104	110	118	118	111	112	109	111	111	102	115	113	124	117	105	109	111	112	105	112	108	104	115	128	116	121	113	118	106	-	118	109	112	-	107	108	111
A215NE	0.0554	59	123	123	122	118	113	118	125	125	119	120	118	119	119	111	122	121	130	124	114	118	119	120	114	120	116	114	123	133	123	127	121	125	115	-	125	117	120	-	116	116	119
A215NW	0.0554	59	123	123	122	118	113	118	125	125	119	120	118	119	119	111	122	121	130	124	114	118	119	120	114	120	116	114	123	133	123	127	121	125	115	-	125	117	120	-	116	116	119
A215SE	0.0271	14	29	29	29	28	26	28	30	30	28	28	28	28	28	26	29	28	31	29	26	28	28	28	26	28	27	26	29	32	29	31	28	30	27	-	30	27	28	-	27	27	28
A215SW	0.063	23	70	69	56	63	61	67	61	47	68	65	66	67	67	62	63	64	43	65	63	66	66	68	61	67	64	62	70	45	67	53	59	59	61	-	70	61	66	-	64	65	62

Table B6 - Groundwater
Yearly Sub-Surface Infiltration Volumes (m³)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A216E1	0.0308	33	69	68	68	66	63	66	69	69	66	67	66	66	66	62	68	67	72	69	63	66	66	67	63	67	64	63	68	74	68	71	67	70	64	-	69	65	67	-	64	65	**66**
A216NE	0.0918	45	96	95	94	90	86	91	97	97	92	93	90	91	91	84	94	93	102	96	86	90	91	93	86	92	89	86	95	106	95	100	93	97	87	-	97	89	92	-	88	89	**91**
A216NW	0.0893	42	89	89	88	84	80	85	91	91	86	87	84	86	85	78	88	87	95	90	81	84	86	87	81	86	83	81	89	99	89	93	87	91	81	-	91	84	86	-	83	83	**85**
A216R1	0.048	58	120	120	119	116	112	116	121	121	117	118	116	117	117	110	119	118	125	121	112	116	117	118	112	117	114	113	120	128	120	123	118	122	113	-	121	115	118	-	114	114	**116**
A216R2	0.0407	49	102	101	101	98	95	98	103	103	99	100	99	99	99	94	101	100	106	103	95	98	99	100	95	100	97	95	101	109	102	105	100	103	96	-	103	98	100	-	96	97	**98**
A216R3	0.0597	58	122	121	121	116	111	117	124	124	118	119	117	118	117	109	121	119	130	124	112	116	118	119	112	119	114	112	122	134	122	127	120	125	113	-	124	116	119	-	114	115	**117**
A216R4	0.0548	54	112	111	111	107	102	107	114	114	108	109	107	108	108	100	111	110	119	113	103	107	108	109	103	109	105	103	112	123	112	117	110	114	103	-	114	106	109	-	104	105	**108**
A216SE	0.0888	36	75	74	74	71	67	71	76	76	72	73	71	72	72	66	74	73	80	76	68	71	72	73	68	73	70	68	75	83	75	78	73	77	68	-	77	70	73	-	69	70	**72**
A216SW	0.0924	35	75	74	73	70	67	71	76	76	72	72	70	71	71	65	74	73	80	75	67	70	71	72	67	72	69	67	74	83	75	78	72	76	68	-	76	70	72	-	69	69	**71**
A217NE	0.1516	75	158	156	155	149	141	150	160	160	151	153	149	151	150	138	156	153	168	159	142	149	151	153	143	152	146	142	157	174	158	164	153	161	144	-	160	148	152	-	146	146	**151**
A217NW	0.0784	39	82	81	80	77	73	77	83	83	78	79	77	78	78	72	81	79	87	82	74	77	78	79	74	79	76	73	81	90	82	85	79	83	74	-	83	76	79	-	75	76	**78**
A217R1	0.0605	73	151	151	150	146	141	146	153	153	148	148	147	147	147	139	150	149	158	152	142	146	147	148	141	148	144	142	151	162	151	155	149	154	142	-	153	145	148	-	143	144	**146**
A217R2	0.068	78	162	162	161	156	150	156	164	164	158	159	157	158	157	148	161	160	170	164	151	156	157	159	151	159	154	151	162	174	162	167	160	165	152	-	164	155	159	-	153	154	**157**
A217R3	0.0677	77	162	161	160	155	150	156	163	164	157	158	156	157	157	148	161	159	169	163	151	156	157	158	150	158	153	151	161	174	161	166	159	164	152	-	163	154	158	-	152	153	**156**
A217R4	0.0502	60	125	125	125	121	117	121	127	127	122	123	122	122	122	115	125	124	131	126	117	121	122	123	117	123	119	118	125	134	125	129	124	127	118	-	127	120	123	-	119	119	**121**
A217R5	0.0836	82	172	170	169	163	156	163	174	174	165	167	163	165	164	153	170	167	182	173	157	163	165	167	157	166	160	156	170	188	171	178	167	174	158	-	174	162	167	-	159	160	**164**
A217R6	0.0875	85	180	178	177	170	163	171	182	182	173	175	171	173	172	160	178	175	190	181	164	171	172	175	164	174	168	164	178	196	179	186	175	183	165	-	182	169	174	-	167	168	**172**
A217R7	0.086	84	176	175	174	168	160	168	179	179	170	172	168	170	169	157	175	172	187	178	161	168	169	172	161	171	165	161	175	193	176	183	172	179	162	-	179	166	171	-	164	165	**169**
A217R8	0.0631	62	129	128	127	123	117	123	131	131	125	126	123	125	124	115	128	126	137	131	118	123	124	126	118	125	121	118	129	142	129	134	126	132	119	-	131	122	126	-	120	121	**124**
A217SE	0.1515	58	122	121	120	116	110	116	124	124	117	119	115	117	117	107	121	119	131	123	111	115	117	119	111	118	113	110	122	135	122	128	119	125	111	-	125	115	118	-	113	114	**117**
A217SW	0.0784	26	54	54	53	51	49	52	55	55	52	53	51	52	52	48	54	53	58	55	49	51	52	53	49	52	50	49	54	60	54	57	53	55	49	-	55	51	52	-	50	50	**52**
A218NE	0.0513	29	61	61	60	58	55	58	62	62	59	59	58	59	59	54	61	60	65	62	56	58	59	59	55	59	57	55	61	68	61	64	60	63	56	-	62	58	59	-	57	57	**59**
A218SE	0.0517	23	48	47	47	45	43	45	48	49	46	46	45	46	46	42	47	47	51	48	43	45	46	46	43	46	44	43	47	53	48	50	47	49	44	-	49	45	46	-	44	44	**46**
A218W3	0.036	25	53	52	52	50	48	50	54	54	51	51	50	51	50	47	52	51	56	53	48	50	51	51	48	51	49	48	53	58	53	55	51	54	48	-	54	50	51	-	49	49	**51**
A220NE	0.0464	14	30	30	30	29	27	29	31	31	29	29	29	29	29	27	30	30	32	31	27	29	29	29	27	29	28	27	30	34	30	32	29	31	28	-	31	28	29	-	28	28	**29**
A220NW	0.0577	42	89	89	88	84	80	85	91	91	86	87	85	86	85	79	88	87	95	90	81	84	85	87	81	86	83	81	89	99	89	93	87	91	82	-	91	84	87	-	83	83	**85**
A220SW	0.1254	55	116	115	114	109	104	110	117	118	111	112	109	111	110	102	114	113	123	117	105	109	111	112	105	112	107	104	115	128	116	121	112	118	105	-	118	108	112	-	107	107	**111**
A221NE	0.0326	14	30	30	30	28	27	29	31	31	29	29	28	29	29	26	30	29	32	30	27	28	29	29	27	29	28	27	30	33	30	31	29	31	27	-	31	28	29	-	28	28	**29**
A221SE	0.0561	61	128	127	127	123	118	123	129	130	124	125	123	124	124	116	127	126	134	129	119	123	124	125	118	125	121	119	127	138	128	132	126	130	119	-	129	122	125	-	120	121	**123**
A222E1	0.0245	27	56	56	55	54	52	54	56	57	54	55	54	54	54	51	55	55	59	56	52	54	54	55	52	54	53	52	56	60	56	58	55	57	52	-	57	53	55	-	53	53	**54**
A222E2	0.0438	20	42	42	41	40	38	40	43	43	40	41	40	40	40	37	42	41	45	42	38	40	40	41	38	41	39	38	42	47	42	44	41	43	38	-	43	39	41	-	39	39	**40**
A222E3	0.0327	36	75	74	74	71	69	72	75	76	72	73	72	72	72	68	74	73	78	75	69	72	72	73	69	73	70	69	74	80	75	77	73	76	70	-	75	71	73	-	70	71	**72**
A222E4	0.1176	56	118	117	116	111	106	112	119	120	113	114	111	113	112	103	116	115	126	119	106	111	113	114	106	114	109	106	117	130	118	123	114	120	107	-	120	110	114	-	109	109	**112**
A222NE	0.0643	31	64	64	63	61	58	61	65	65	62	62	61	62	61	57	64	63	69	65	58	61	62	62	58	62	60	58	64	71	64	67	63	66	59	-	66	60	62	-	59	60	**62**
A222NW	0.1299	59	125	124	123	118	112	119	127	127	120	121	118	120	119	110	124	122	133	126	113	118	120	121	113	121	116	113	124	138	125	130	121	127	114	-	127	117	121	-	115	116	**119**
A222R1	0.0305	33	69	69	69	67	64	67	70	70	67	68	67	67	67	63	69	68	73	70	64	67	67	68	64	68	65	64	69	75	69	72	68	71	65	-	70	66	68	-	65	66	**67**
A222R2	0.0477	49	103	103	102	98	94	99	104	105	100	101	99	100	99	93	102	101	109	104	95	99	99	101	95	100	97	95	103	112	103	107	101	105	96	-	105	98	101	-	96	97	**99**
A222R3	0.0352	36	76	76	75	73	70	73	77	77	74	74	73	74	73	69	76	75	80	77	70	73	73	74	70	74	72	70	76	83	76	79	75	77	71	-	77	72	74	-	71	72	**73**
A222R4	0.1161	126	264	263	262	253	244	254	267	268	256	258	254	256	255	240	262	259	278	266	245	253	255	258	245	258	249	245	263	285	264	273	259	269	246	-	267	252	258	-	248	250	**255**
A222R5	0.095	98	206	204	203	196	188	197	208	208	199	201	197	199	198	185	204	201	217	207	189	196	198	200	189	200	193	189	205	223	205	213	201	209	191	-	208	195	200	-	192	193	**198**
A222R6	0.1075	111	233	231	230	222	213	223	235	236	225	227	223	225	224	209	231	228	246	235	214	222	224	227	214	226	218	214	231	253	233	241	228	237	216	-	236	221	227	-	217	219	**224**
A222R7	0.0913	94	198	196	195	189	181	189	200	200	191	193	189	191	190	178	196	193	209	199	182	189	190	193	182	192	186	182	197	215	197	205	193	201	183	-	200	187	192	-	185	186	**190**
A222R8	0.1058	109	229	227	226	218	210	219	232	232	222	223	219	221	220	206	227	224	242	231	211	219	221	223	211	223	215	211	228	249	229	237	224	233	212	-	232	217	223	-	214	215	**220**
A222R9	0.1117	122	254	253	252	244	234	244	257	257	247	249	244	246	246	231	252	249	267	256	236	244	246	248	235	248	240	236	253	275	254	262	249	258	237	-	257	242	248	-	239	240	**245**
A222SE	0.0762	39	82	81	81	78	74	78	83	84	79	80	78	79	78	72	81	80	88	83	74	78	79	80	74	79	76	74	82	91	82	86	80	84	75	-	84	77	80	-	76	76	**79**
A222SW	0.1301	62	130	129	128	123	117	124	132	132	125	126	123	125	124	114	129	127	139	131	118	123	125	126	118	126	121	117	129	144	130	136	127	133	119	-	133	122	126	-	120	121	**124**
A223NE	0.0668	32	67	66	66	63	60	64	68	68	64	65	63	64	64	59	66	65	71	67	60	63	64	65	60	65	62	60	66	74	67	70	65	68	61	-	68	63	65	-	62	62	**64**
A223SE	0.0645	28	60	59	58	56	54	57	61	61	57	58	56	57	57	52	59	58	64	60	54	56	57	58	54	58	55	54	59	66	60	62	58	61	54	-	61	56	58	-	55	55	**57**
A223SW	0.0711	50	104	103	103	99	94	99	106	106	100	101	99	100	100	92	103	102	111	105	95	99	100	101	95	101	97	94	104	115	105	109	102	106	95	-	106	98	101	-	97	97	**100**
A224NE	0.0624	37	77	76	76	73	69	73	78	78	74	75	73	74	74	68	76	75	82	78	70	73	74	75	70	74	72	70	77	85	77	80	75	79	70	-	78	72	75	-	71	72	**74**
A224NW	0.0992	42	88	87	86	83	79	83	89	89	84	85	83	84	84	77	87	85	94	88	79	83	84	85	79	85	81	79	87	97	88	92	85	89	80	-	89	82	85	-	81	81	**84**
A224R1	0.1117	128	267	266	264	256	247	257	269	270	260	261	258	259	259	244	265	262	279	269	249	257	258	261	248	261	252	249	266	286	267	275	262	271	250	-	270	255	261	-	252	253	**257**
A224R2	0.032	30	62	62	61	59	56	59	63	63	60	60	59	60	59	55	61	60	66	63	56	59	59	60	56	60	58	56	62	68	62	65	61	63	57	-	63	58	60	-	57	58	**59**
A224SW	0.0581	60	126	125	124	120	115	121	127	128	122	123	121	122	121	113	125	123	133	127	116	120	121	123	116	122	118	116	125	137	126	130	123	128	117	-	128	119	123	-	118	119	**121**
A225NE	0.0682	65	136	135	134	129	123	130	138	138	131	132	129	131	130	121	135	133	145	137	124	129	131	132	124	132	127	124	135	149	136	142	133	139	125	-	138	128	132	-	126	127	**130**
A225NW	0.1231	65	138	136	135	130	124	131	140	140	132	133	130	132	131	121	136	134	147	139	124	130	132	133	124	133	128	124	137	152	138	143	134	140	125	-	140	129	133	-	127	128	**131**
A225SE	0.0748	71	150	148	147	142	135	142	151	152	144	145	142	144	143	133	148	146	159	151	136	142	143	145	136	145	139	136	149	164	149	155	146	152	137	-	152	141	145	-	139	140	**143**
A226NE	0.068	63	132	131	130	125	119	125	134	134	127	128	125	127	126	116	131	128	141	133	120	125	126	128	120	128	123	119	131	145	132	137	129	134	121	-	134	124	128	-	122	123	**126**
A226NW	0.1354	67	141	139	138	133	126	134	143	143	135	136	133	135	134	124	139	137	150	142	127	133	135	136	127	136	131	127	140	156	141	147	137	143	128	-	143	132	136	-	130	131	**134**
A227NE	0.0287	26	56	55	55	53	50	53	56	57	54	54	53	53	53	49	55	54	59	56	51	53	53	54	50	54	52	50	55	61	56	58	54	57	51	-	57	52	54	-	52	52	**53**
A227NW	0.0646	60	126	124	123	119	113	119	127	127	120	122	119	120	120	111	124	122	134	127	114	119	120	122	114	121	117	113	125	138	125	131	122	128	115	-	127	118	122	-	116	117	**120**
A227SE	0.0679	63	132	131	129	125	119	125	134	134	127	128	125	126	126	116	130	128	140	133	120	125	126	128	119	127	123	119	131	145	132	137	128	134	121	-	134	124	128	-	122	123	**126**
A227SW	0.0984	50	106	105	104	100	95	101	108	108	102	103	100	102	101	93	105	103	113	107	96	100	102	103	96	103	99	96	105	117	106	111	103	108	97	-	108	99	103	-	98	99	**101**
A228NE	0.1045	52	109	108	107	103	98	103	110	110	104	105	103	104	104	95	107	106	116	109	98	102	104	105	98	105	101	98	108	120	109	113	106	111	99	-	111	102	105	-	100	101	**104**
A228NW	0.1369	65	137	136	135	129	123	130	139	139	131	133	129	131	131	120	135	133	146	138	124	129	131	133	124	132	127	124	136	152	137	143	133	140	125	-	140	128	133	-	127	127	**131**
A228R1	0.0632	69	144	143	142	138	133	138	145	146	140	141	138	139	139	130	143	141	151	145	133	138	139	141	133	140	136	133	143	155	144	148	141	146	134	-	146	137	140	-	135	136	**139**
A228R2	0.1043	108	226	224	223	215	207	216	228	229	218	220	216	218	217	203	224	221	238	228	208	216	217	220	208	219	212	208	225	245	226	234	221	230	209	-	229	214	220	-	211	212	**217**
A228SE	0.0654	66	138	137	136	131	126	132	140	140	133	135	132	133	133	124	137	135	146	139	127	132	133	134	127	134	129	127	137	150	138	143	135	140	128	-	140	131	134	-	129	130	**133**
A229N2	0.0307	12	26	26	26	25	23	25	26	26	25	25	25	25	25	23	26	25	28	26	24	25	25	25	24	25	24	23	26	29	26	27	25	26	24	-	26	24	25	-	24	24	**25**
A229NE	0.0591	48	101	100	99	95	91	96	102	102	97	98	95	97	96	89	100	98	107	102	91	95	96	98	91	97	94	91	100	111	101	105	98	103	92	-	102	95	98	-	93	94	**96**
A229NW	0.0601	24	51	50	50	48	46	48	52	52	49	49	48	49	48	45	50	50	54	51	46	48	49	49	46	49	47	46	51	56	51	53	49	52	46	-	52	48	49	-	47	47	**49**
A229R1	0.1224	120	251	249	247	239	228	240	254	255	242	244	239	242	241	224	249	245	266	253	230	239	241	244	229	244	235	229	250	275	251	261	245	256	231	-	255	237	244	-	234	235	**241**
A229R2	0.0799	83	173	172	171	165	158	166	175	175	167	169	165	167	167	156	171	169	183	174	159	165	167	169	159	168	162	159	172	188	173	179	169	176	160	-	175	164	168	-	162	163	**166**
A229SE	0.1047	52	109	108	107	103	98	103	110	111	104	105	103	104	104	96	108	106	116	110	98	103	104	106	98	105	101	98	108	120	109	114	106	111	99	-	111	102	105	-	101	101	**104**
A229SW	0.1401	67	140	139	138	132	126	133	142	143	134	136	132	134	134	123	139	137	150	141	127	132	134	136	127	136	130	126	139	155	140	146	136	143	128	-	143	131	136	-	130	130	**134**
A230NE	0.1102	52	110	109	108	104	99	105	112	112	106	107	104	106	105	97	109	107	118	111	100	104	106	107	100	107	102	99	110	122	110	115	107	112	101	-	112	103	107	-	102	103	**105**
A230NW	0.0787	55	116	114	114	109	104	110	117	117	111	112	109	111	110	102	114	113	123	117	105	109	111	112	105	112	107	104	115	128	116	121	113	118	106	-	118	108	112	-	107	108	**111**
A230R1	0.0373	43	89	89	88	86	83	86	90	90	87	87	86	87	86	81	88	88	93	90	83	86	86	87	83	87	84	83	89	96	89	92	88	90	84	-	90	85	87	-	84	84	**86**
A230R2	0.0266	25	52	51	51	49	46	49	52	52	50	50	49	50	49	46	51	50	55	52	47	49	49	50	47	50	48	47	51	57	52	54	50	53	47	-	52	48	50	-	48	48	**49**
A230R3	0.0632	69	144	143	142	138	133	138	145	146	140	141	138	139	139	130	143	141	151	145	133	138	139	141	133	140	136	133	143	155	144	148	141	146	134	-	146	137	140	-	135	136	**139**
A230R4	0.0984	102	213	212	210	203	195	204	215	216	206	208	204	206	205	192	211	208	225	215	196	203	205	208	196	207	200	196	212	231	213	220	209	217	197	-	216	202	207	-	199	200	**205**
A230WK	0.0128	12	25	25	24	23	22	24	25	25	24	24	24	24	24	22	25	24	26	25	23	24	24	24	23	24	23	22	25	27	25	26	24	25	23	-	25	23	24	-	23	23	**24**
A231N1	0.0597	49	104	103	102	98	94	99	105	106	100	101	99	100	99	92	103	101	111	105	94	99	100	101	94	101	97	94	103	115	104	108	101	106	95	-	106	98	101	-	96	97	**100**
A231NE	0.0603	24	51	51	50	48	46	48	52	52	49	49	48	49	48	45	50	50	54	51	46	48	49	50	46	49	47	46	51	56	51	53	50	52	46	-	52	48	49	-	47	47	**49**
A231NW	0.0466	19	39	39	39	37	35	37	40	40	38	38	37	38	38	35	39	38	42	40	36	37	38	38	36	38	37	36	39	44	39	41	38	40	36	-	40	37	38	-	36	37	**38**
A231R1	0.0242	22	47	47	46	44	42	45	48	48	45	46	44	45	45	41	46	46	50	47	43	44	45	46	43	45	44	42	47	52	47	49	46	48	43	-	48	44	46	-	43	44	**45**
A231R2	0.0334	34	72	72	71	69	66	69	73	73	70	70	69	70	70	65	72	71	76	73	67	69	70	70	66	70	68	66	72	79	72	75	71	73	67	-	73	69	70	-	68	68	**69**
A231R3	0.0319	35	73	72	72	70	67	70	73	74	70	71	70	70	70	66	72	71	76	73	67	70	70	71	67	71	68	67	72	78	73	75	71	74	68	-	73	69	71	-	68	69	**70**
A231R4	0.0319	35	73	72	72	70	67	70	73	74	70	71	70	70	70	66	72	71	76	73	67	70	70	71	67	71	68	67	72	78	73	75	71	74	68	-	73	69	71	-	68	69	**70**
A231R5	0.1171	114	240	238	237	228	218	229	243	244	232	234	229	231	231	214	238	235	255	242	220	228	231	234	219	233	225	219	239	263	240	249	235	245	221	-	244	227	234	-	223	225	**230**
A231R6	0.0912	94	197	196	195	188	181	189	200	200	191	193	189	191	190	178	196	193	208	199	182	188	190	192	181	192	185	182	196	214	197	204	193	201	183	-	200	187	192	-	184	186	**190**
A231SE	0.1067	53	111	110	109	105	100	105	113	113	106	108	105	106	106	97	110	108	118	112	100	105	106	108	100	107	103	100	110	123	111	116	108	113	101	-	113	104	107	-	102	103	**106**
A231SW	0.1371	68	143	141	140	135	128	135	145	145	137	138	135	136	136	125	141	139	152	144	129	134	136	138	129	138	132	128	142	158	143	149	139	145	130	-	145	134	138	-	132	132	**136**
A302NE	0.02	12	35	35	28	32	31	34	31	24	34	33	34	34	34	31	32	33	22	33	32	33	33	34	31	34	32	31	35	23	34	27	30	30	31	-	35	31	34	-	32	33	**31**
A302NW	0.02	12	35	35	28	32	31	34	31	24	34	33	34	34	34	31	32	33	22	33	32	33	33	34	31	34	32	31	35	23	34	27	30	30	31	-	35	31	34	-	32	33	**31**
A302NW1	0.026	8	23	23	18	21	20	22	20	15	22	21	22	22	22	20	21	21	14	21	21	22	22	22	20	22	21	20	23	15	22	17	19	19	20	-	23	20	22	-	21	21	**20**
A302R1	0.063	50	129	127	125	123	114	123	130	98	125	125	123	124	123	115	127	125	92	125	117	122	124	125	118	124	119	115	128	132	126	133	116	116	113	-	128	113	122	-	118	121	**119**
A302SE	0.028	16	49	49	39	45	44	47	43	33	48	46	47	48	47	44	45	46	30	46	45	47	47	48	43	48	45	44	49	32	47	38	42	42	43	-	49	43	47	-	45	46	**44**
A302SW	0.028	16	49	49	39	45	44	47	43	33	48	46	47	48	47	44	45	46	30	46	45	47	47	48	43	48	45	44	49	32	47	38	42	42	43	-	49	43	47	-	45	46	**44**
A302SW1	0.037	11	32	32	26	29	29	31	28	22	31	30	31	31	31	29	30	30	20	30	29	31	31	32	28	31	30	29	32	21	31	25	28	27	28	-	32	28	31	-	30	30	**29**
A303NE1	0.025	15	44	44	35	40	39	42	38	30	43	41	42	43	42	39	40	41	27	41	40	42	42	43	38	43	40	39	44	28	42	34	38	37	39	-	44	39	42	-	41	41	**39**
A303NW1	0.025	15	44	44	35	40	39	42	38	30	43	41	42	43	42	39	40	41	27	41	40	42	42	43	38	43	40	39	44	28	42	34	38	37	39	-	44	39	42	-	41	41	**39**
A303NW2	0.032	9	28	28	22	25	25	27	24	19	27	26	27	27	27	25	26	26	17	26	25	27	27	27	25	27	26	25	28	18	27	21	24	24	25	-	28	25	27	-	26	26	**25**
A303R1	0.102	80	210	206	203	198	184	199	211	159	202	203	199	201	199	186	206	203	149	203	190	198	200	203	191	201	192	187	207	213	204	215	188	187	184	-	207	183	197	-	192	196	**193**
A303R2	0.088	69	181	178	175	171	159	172	182	137	174	175	172	173	172	161	178	175	129	175	164	170	173	175	165	173	166	161	179	184	176	186	163	162	158	-	178	158	170	-	165	169	**167**
A303SE	0.03	18	53	53	42	48	47	51	46	36	51	49	51	51	51	47	48	49	32	49	48	50	50	52	46	51	49	47	53	34	51	40	45	45	47	-	53	46	50	-	49	50	**47**
A303SE1	0.044	26	77	77	62	70	68	74	67	52	75	72	74	75	74	69	70	72	48	72	70	74	73	76	68	75	71	69	78	50	74	59	66	65	68	-	78	68	74	-	71	73	**69**
A303SW	0.03	18	53	53	42	48	47	51	46	36	51	49	51	51	51	47	48	49	32	49	48	50	50	52	46	51	49	47	53	34	51	40	45	45	47	-	53	46	50	-	49	50	**47**
A303SW1	0.044	26	77	77	62	70	68	74	67	52	75	72	74	75	74	69	70	72	48	72	70	74	73	76	68	75	71	69	78	50	74	59	66	65	68	-	78	68	74	-	71	73	**69**
A303SW2	0.056	16	49	49	39	44	43	47	43	33	48	46	47	47	47	44	45	45	30	46	44	46	46	48	43	47	45	44	49	32	47	37	42	42	43	-	49	43	47	-	45	46	**43**

Table B6 - Groundwater

Yearly Sub-Surface Infiltration Volumes (m³)

Node	Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
A303SW3	0.039	11	34	34	27	31	30	33	30	23	33	32	33	33	33
A306NE	0.111	38	114	113	91	103	100	109	100	77	111	107	109	110	109
A306NW	0.156	53	160	159	128	145	141	154	140	108	155	150	153	155	153
A306R2	0.127	124	261	259	257	248	237	249	264	264	251	254	248	251	250
A306SE	0.051	30	90	89	72	81	79	86	78	61	87	84	86	87	86
A306SW	0.051	30	90	89	72	81	79	86	78	61	87	84	86	87	86
A306SW1	0.064	19	56	56	45	51	49	54	49	38	54	52	53	54	54
A310NE	0.043	15	44	44	35	40	39	42	39	30	43	41	42	43	42
A310NE1	0.028	10	29	29	23	26	25	28	25	19	28	27	28	28	28
A310NW	0.054	18	55	55	44	50	49	53	49	37	54	52	53	54	53
A310R1	0.044	35	90	89	87	86	79	86	91	69	87	88	86	87	86
A310SE	0.034	12	35	35	28	32	31	34	31	24	34	33	33	34	33
A310SW	0.054	18	55	55	44	50	49	53	49	37	54	52	53	54	53
A311NE	0.12	41	123	122	99	112	108	118	108	83	120	115	118	119	118
A311NW	0.067	23	69	68	55	62	60	66	60	47	67	64	66	66	66
A311R1	0.107	84	220	216	213	208	193	209	222	167	212	213	209	211	209
A311SE	0.119	40	122	121	98	111	107	117	107	83	119	114	117	118	117
A311SW	0.067	23	69	68	55	62	60	66	60	47	67	64	66	66	66
APOND2	0.019	11	32	32	26	29	28	31	28	22	31	30	31	31	31
A104PK	1.72	1,023	302	588	250	275	501	888	523	836	579	497	739	883	592
Total	**28.778**	**20,729**	**45,033**	**44,954**	**42,804**	**42,667**	**41,313**	**43,946**	**44,506**	**42,106**	**43,872**	**43,783**	**43,755**	**44,303**	**43,662**

Node	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
A303SW3	30	31	32	21	32	31	32	32	33	30	33	31	30	34
A306NE	101	104	106	70	106	103	108	108	111	100	110	105	102	114
A306NW	142	146	149	98	149	145	152	152	156	140	155	147	142	160
A306R2	232	258	254	276	263	238	248	250	254	238	253	244	238	259
A306SE	80	82	83	55	83	82	85	85	88	78	87	83	80	90
A306SW	80	82	83	55	83	82	85	85	88	78	87	83	80	90
A306SW1	50	51	52	34	52	51	53	53	55	49	54	51	50	56
A310NE	39	40	41	27	41	40	42	42	43	39	43	41	39	44
A310NE1	26	26	27	18	27	26	27	27	28	25	28	26	26	29
A310NW	49	51	51	34	52	50	52	53	54	49	54	51	49	56
A310R1	80	89	88	64	88	82	85	86	87	82	87	83	81	89
A310SE	31	32	32	21	33	32	33	33	34	31	34	32	31	35
A310SW	49	51	51	34	52	50	52	53	54	49	54	51	49	56
A311NE	109	112	114	76	115	112	117	117	120	108	119	113	110	123
A311NW	61	63	64	42	64	62	65	65	67	60	67	63	61	69
A311R1	195	216	213	157	213	199	207	210	213	200	211	201	196	217
A311SE	108	111	113	75	114	111	116	116	119	107	118	112	109	122
A311SW	61	63	64	42	64	62	65	65	67	60	67	63	61	69
APOND2	29	29	30	20	30	29	30	30	31	28	31	29	29	32
A104PK	871	449	589	956	430	987	592	288	589	425	979	260	688	676
Total	**41,352**	**44,145**	**43,903**	**42,761**	**44,655**	**42,294**	**43,429**	**43,380**	**44,145**	**41,296**	**44,408**	**42,112**	**41,821**	**45,331**

Node	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
A303SW3	22	33	26	29	29	30	-	34	30	32	-	31	32	**30**
A306NE	73	110	87	97	97	100	-	114	100	108	-	105	107	**101**
A306NW	103	154	122	136	136	140	-	161	140	152	-	147	150	**142**
A306R2	285	261	271	255	265	240	-	265	246	253	-	242	244	**250**
A306SE	57	86	68	77	76	79	-	90	79	86	-	83	85	**80**
A306SW	57	86	68	77	76	79	-	90	79	86	-	83	85	**80**
A306SW1	36	54	43	48	47	49	-	56	49	53	-	52	53	**50**
A310NE	28	43	34	38	37	39	-	44	39	42	-	41	41	**39**
A310NE1	19	28	22	24	24	25	-	29	25	27	-	26	27	**25**
A310NW	36	53	42	47	47	49	-	56	49	53	-	51	52	**49**
A310R1	92	88	93	81	81	79	-	89	79	85	-	83	84	**83**
A310SE	22	34	27	30	30	31	-	35	31	33	-	32	33	**31**
A310SW	36	53	42	47	47	49	-	56	49	53	-	51	52	**49**
A311NE	79	119	94	105	105	108	-	124	108	117	-	113	116	**109**
A311NW	44	66	53	58	58	60	-	69	60	65	-	63	65	**61**
A311R1	224	214	226	198	197	193	-	217	192	207	-	201	205	**203**
A311SE	79	118	93	104	104	107	-	123	107	116	-	112	115	**108**
A311SW	44	66	53	58	58	60	-	69	60	65	-	63	65	**61**
APOND2	20	31	24	27	27	28	-	32	28	30	-	29	30	**28**
A104PK	959	426	491	406	742	788		989	1,033	566		670	468	**636**
Total	**45,166**	**44,614**	**44,375**	**42,749**	**44,162**	**41,901**	**-**	**46,159**	**42,697**	**43,942**	**-**	**42,536**	**42,752**	**42,911**

Kevin Murphy

From: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Sent: Monday, June 22, 2020 3:50 PM
To: Kevin Murphy
Cc: Steve Pichette; Zeyad Hassan; Bougadis, John; Zaknoun, Hasnaa
Subject: RE: Information on Smart Covers

Kevin,

Thanks for the Figure showing proposed locations for the smart covers. The proposed locations are acceptable, subject to final locations of the EES system itself.

Regards,

Jeff Shillington, P.Eng.
Senior Project Manager, Development Review, South Branch
Planning, Infrastructure and Economic Development
City of Ottawa
tel: 580-2424 x 16960
email: jeff.shillington@ottawa.ca

From: Kevin Murphy <KMurphy@dsel.ca>
Sent: June 10, 2020 9:27 AM
To: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Cc: Steve Pichette <SPichette@dsel.ca>; Zeyad Hassan <zeyad.hassan@caivan.com>
Subject: RE: Information on Smart Covers

Good morning Jeff,

Please see the attached Figure for the identification of proposed future monitoring locations for the EES system within The Ridge development.
The proposed locations are indicated on the 'Figure 2' from the JFSA LID report.

Based on the text from the MSS it appears that the monitoring systems are to be spread throughout the development as much as possible to capture any differences in soil infiltration throughout the site. In alignment with the MSS, we have selected two (2) EES locations in the upstream portion of the development two (2) at the downstream extent and one midway. Unlike to Minto development, there were no precise details in the MSS of where to locate the monitoring locations within The Ridge development area.

Can you please advise if the locations are acceptable?

Kevin

DSEL
david schaeffer engineering ltd.
phone: (613) 836-0856 ext.563
cell: (613) 324-8361
email: kmurphy@DSEL.ca

From: Matthew Nicolak [mailto:matthew@linkut.ca]
Sent: Friday, May 22, 2020 1:22 PM
To: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Cc: Kevin Murphy <KMurphy@dsel.ca>
Subject: RE: Information on Smart Covers

No problem Jeff.

I'm not sure that we have done anything for Quinn's Pointe Subdivision (unless it is named something different for us). We did install 4 systems this week in Stittsville for J.L. Richards as a capacity analysis downstream of a new sewage pump station. It is for a developer as well. Could that be the one?

Matthew

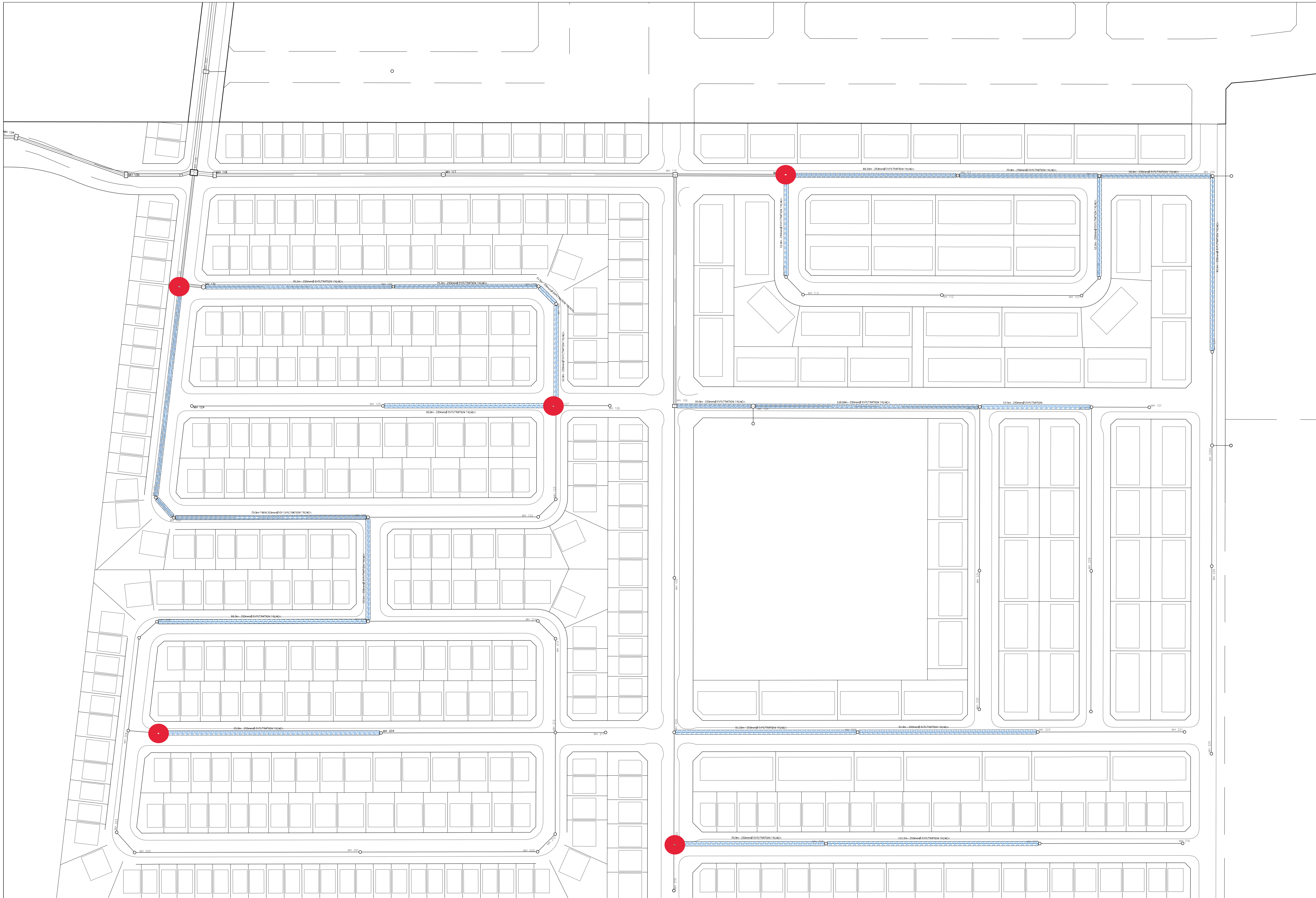
From: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Sent: May 22, 2020 1:00 PM
To: Matthew Nicolak <matthew@linkut.ca>
Cc: Kevin Murphy <kmurphy@dsel.ca>
Subject: RE: Information on Smart Covers

Thanks for the quick response and info Matthew!

Can you advise what you are providing the City of Ottawa on the Quinn's Pointe Subdivision, let me know if you need more information.

The proposed subdivision is just northwest of Quinn's Pointe and we would be looking for the same type of information.

Jeff Shillington, P.Eng.
Senior Project Manager, Development Review, South Branch
Planning, Infrastructure and Economic Development
City of Ottawa
tel: 580-2424 x 16960
email: jeff.shillington@ottawa.ca



LEGEND:

Etobicoke Exfiltration System

Potential EES monitoring Locations

SCALE :

0 40 80 120

J.F. Sabourin & Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
OTTAWA (613) 836-3884
GATINEAU (819) 243-6858

CLIENT :
DAVID SCHAEFFER ENGINEERING LTD.

PROJECT :
THE RIDGE PHASE 1 SUBDIVISION

BY	DATE	DESCRIPTION	BY

EXFILTRATION SYSTEM LOCATIONS

FIGURE 2

DESIGNED:
DRAWN: BL
VERIFIED: JFS
APPROVED: JFS

DRAWING REF.
1800-19\202001 LID Subm3\Design\CAD\Figure 1 & 2.dwg

DATE	PROJECT No.
JAN 2020	1800

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Manning 0.013

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Ottawa

	LOCATION		AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Conc. (min)	2 Year (mm/h)	5 Year (mm/h)	10 Year (mm/h)	100 Year (mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min)	Q/Q full
FUTURE ROAD (DRUMMOND LAND)																																	
	Plug	304	1.20	0.65	2.17	2.17			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	167	600	600	CONC	0.20	10.0	274.6	0.97	0.17	0.61
To Expansion Road, Pipe 304 - 306TEE						2.17				0.00				0.00				0.00	10.17														
			1.00	0.65	1.81	1.81			0.00	0.00			0.00	0.00			0.00	0.00	15.00														
					0.00	1.81	1.45	0.40	1.61	1.61			0.00	0.00			0.00	0.00	15.00														
	Plug	303			0.00	1.81			0.00	1.61			0.00	0.00			0.00	0.00	15.11	61.51	83.20	97.44	142.28	245	750	750	CONC	0.15	10.5	431.2	0.98	0.18	0.57
To Expansion Road, Pipe 303 - 304						1.81				1.61				0.00				0.00	15.29														
			0.99	0.65	1.79	1.79																											
	Plug	302			0.00	1.79			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	137	525	525	CONC	0.20	10.5	192.3	0.89	0.20	0.71
To Expansion Road, Pipe 302 - 303						1.79				0.00				0.00				0.00	10.20														
COMMERCIAL BLOCK - SOUTH																																	
			13.83	0.75	28.84	28.84			0.00	0.00			0.00	0.00			0.00	0.00	13.00														
	CTRL MH 1	133			0.00	28.84			0.00	0.00			0.00	0.00			0.00	0.00	13.00	66.93	90.63	106.17	155.11	1930	1500	1500	CONC	0.20	19.0	3161.3	1.79	0.18	0.61
To Haiku Street, Pipe 133 - 134						28.84				0.00				0.00				0.00	13.18														
Haiku Street																																	
COMMERCIAL BLOCK - SOUTH, Pipe CTRL MH 1 - 133						28.84				0.00				0.00				0.00	13.18														
	133	134	0.58	0.90	1.45	30.29			0.00	0.00			0.00	0.00			0.00	0.00	13.18	66.43	89.95	105.37	153.93	2012	1500	1500	CONC	0.15	77.0	2737.8	1.55	0.83	0.73
	134	135	0.31	0.90	0.78	31.06			0.00	0.00			0.00	0.00			0.00	0.00	14.01	64.22	86.91	101.80	148.69	1995	1500	1500	CONC	0.15	61.0	2737.8	1.55	0.66	0.73
			0.05	0.54	0.08	31.14			0.00	0.00			0.00	0.00			0.00	0.00	14.01														
	135	136	0.18	0.71	0.36	31.49			0.00	0.00			0.00	0.00			0.00	0.00	14.01	64.22	86.91	101.80	148.69	2022	1650	1650	CONC	0.10	37.0	2882.2	1.35	0.46	0.70
To Expansion Road, Pipe 136 - 302						31.49				0.00				0.00				0.00	14.46														
Sturnidae Street																																	
					0.00	0.00	0.03	0.71	0.06	0.06			0.00	0.00			0.00	0.00															
			0.10	0.54	0.15	0.15			0.00	0.06			0.00	0.00			0.00	0.00															
	126	127	0.19	0.71	0.38	0.53			0.00	0.06			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	47	300	300	PVC	0.40	28.5	61.2	0.87	0.55	0.76
To Montology Way, Pipe 127 - 128						0.53				0.06				0.00				0.00	10.55														
			0.23	0.54	0.35	0.35			0.00	0.00			0.00	0.00			0.00	0.00															
	124	125	0.36	0.71	0.71	1.06			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	81	375	375	PVC	0.35	101.0	103.7	0.94	1.79	0.78
			0.21	0.54	0.32	1.37			0.00	0.00			0.00	0.00			0.00	0.00															
	125	127	0.34	0.71	0.67	2.04			0.00	0.00			0.00	0.00			0.00	0.00	11.79	70.55	95.59	112.01	163.68	144	600	600	CONC	0.25	91.5	307.0	1.09	1.40	0.47
To Montology Way, Pipe 127 - 128						2.04				0.00				0.00				0.00	13.20														
Montology Way																																	
Contribution From Travertine Way, Pipe 123 - 127						1.33				0.00				0.00				0.00	12.08														
Contribution From Sturnidae Street, Pipe 125 - 127						2.04				0.00				0.00				0.00	13.20														
Contribution From Sturnidae Street, Pipe 126 - 127						0.53				0.06				0.00				0.00	10.55														
	127	128			0.00	3.90			0.00	0.06			0.00	0.00			0.00	0.00	13.20	66.38	89.87	105.28	153.80	264	750	750	CONC	0.20	54.0	497.9	1.13	0.80	0.53
	128	129			0.00	3.90			0.00	0.06			0.00	0.00			0.00	0.00	14.00	64.24	86.95	101.84	148.75	256	750	750	CONC	0.30	13.5	609.8	1.38	0.16	0.42
			0.25	0.54	0.38	4.27			0.00	0.06			0.00	0.00			0.00	0.00															
	129	130	0.40	0.71	0.79	5.06			0.00	0.06			0.00	0.00			0.00	0.00	14.16	63.83	86.38	101.17	147.76	328	825	825	CONC	0.15	77.0	555.9	1.04	1.23	0.59
			0.18	0.54	0.27	5.33			0.00	0.06			0.00	0.00			0.00	0.00															
	130	131	0.40	0.71	0.79	6.12			0.00	0.06			0.00	0.00			0.00	0.00	15.39	60.86	82.31	96.39	140.74	378	825	825	CONC	0.15	100.5	555.9	1.04	1.61	0.68
	131	132			0.00	6.12			0.00	0.06			0.00	0.00			0.00	0.00	17.00	57.41	77.60	90.85	132.61	356	1200	1200	CONC	0.15	12.0	1510.0	1.34	0.15	0.24
To Travertine Way, Pipe 132 - 136						6.12				0.06				0.00				0.00	17.15														
Rugosa Street																																	
	211	212	0.26	0.54	0.39	0.39			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	30	300	300	PVC	0.35	26.5	57.2	0.81	0.55	0.52
To Appalachian Circle, Pipe 212 - 213						0.39				0.00				0.00				0.00	10.55														
	212	204			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	0.50	97.5	68.4	0.97	1.68	0.00
			0.49	0.54	0.74	0.74			0.00	0.00			0.00	0.00			0.00	0.00															
	204	205	0.50	0.71	0.99	1.72			0.00	0.00			0.00	0.00			0.00	0.00	11.68	70.91	96.09	112.59	164.53	122	525	525	CONC	0.20	112.0	192.3	0.89	2.10	0.64

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM
Checked: ADF
Dwg. Reference: Storm Drainage Plan 84-87

PROJECT: **Ciavan Communities - Brazeau Phase 1**
LOCATION: **City of Ottawa**
File Ref: 18-1030
Date: 27-Jul-20
Sheet No. 1 OF 6

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
	205	206	0.25	0.71	0.49	2.22			0.00	0.00			0.00	0.00			0.00	0.00	13.78	64.80	87.71	102.74	150.07	144	525	525	CONC	0.20	16.0	192.3	0.89	0.30	0.75
To Appalachian Circle, Pipe 206 - 207						2.22				0.00				0.00				0.00	14.08														
Appalachian Circle																																	
	209	210			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	2.40	13.0	149.8	2.12	0.10	0.00
	210	212	0.20	0.71	0.39	0.39			0.00	0.00			0.00	0.00			0.00	0.00	10.10	76.41	103.66	121.51	177.63	30	300	300	PVC	3.80	54.0	188.5	2.67	0.34	0.16
Contribution From Rugosa Street, Pipe 211 - 212						0.39				0.00				0.00				0.00	10.55														
	212	213			0.00	0.79			0.00	0.00			0.00	0.00			0.00	0.00	10.55	74.77	101.40	118.85	173.72	59	375	375	PVC	0.45	49.5	117.6	1.06	0.77	0.50
	213	214	0.12	0.71	0.24	1.02			0.00	0.00			0.00	0.00			0.00	0.00	11.32	72.08	97.70	114.49	167.33	74	375	375	PVC	1.00	13.5	175.3	1.59	0.14	0.42
			0.36	0.54	0.54	1.56			0.00	0.00			0.00	0.00			0.00	0.00															
	214	215	0.44	0.71	0.87	2.43			0.00	0.00			0.00	0.00			0.00	0.00	11.46	71.61	97.06	113.74	166.21	174	375	375	PVC	2.35	90.0	268.8	2.43	0.62	0.65
To Foundation Lane, Pipe 215 - 119						2.43				0.00				0.00				0.00	12.08														
			0.07	0.54	0.11	0.11			0.00	0.00			0.00	0.00			0.00	0.00															
	209	201	0.25	0.71	0.49	0.60			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	46	300	300	PVC	0.55	94.0	71.7	1.01	1.54	0.64
			0.10	0.54	0.15	0.75			0.00	0.00			0.00	0.00			0.00	0.00															
	201	202	0.37	0.71	0.73	1.48			0.00	0.00			0.00	0.00			0.00	0.00	11.54	71.34	96.69	113.30	165.58	106	375	375	PVC	0.90	119.5	166.3	1.51	1.32	0.63
	202	203			0.00	1.48			0.00	0.00			0.00	0.00			0.00	0.00	12.87	67.31	91.15	106.78	156.00	100	450	450	CONC	0.20	14.0	127.5	0.80	0.29	0.78
			0.20	0.54	0.30	1.78			0.00	0.00			0.00	0.00			0.00	0.00															
	203	206	0.20	0.71	0.39	2.17			0.00	0.00			0.00	0.00			0.00	0.00	13.16	66.49	90.02	105.46	154.06	145	450	450	CONC	0.45	54.5	191.3	1.20	0.76	0.76
Contribution From Rugosa Street, Pipe 205 - 206						2.22				0.00				0.00				0.00	14.08														
			0.08	0.54	0.12	4.51			0.00	0.00			0.00	0.00			0.00	0.00															
	206	207	0.14	0.71	0.28	4.79			0.00	0.00			0.00	0.00			0.00	0.00	14.08	64.03	86.65	101.49	148.23	306	600	600	CONC	0.40	49.5	388.3	1.37	0.60	0.79
	207	208			0.00	4.79			0.00	0.00			0.00	0.00			0.00	0.00	14.68	62.53	84.60	99.08	144.69	299	600	600	CONC	1.90	12.5	846.4	2.99	0.07	0.35
			0.12	0.54	0.18	4.97			0.00	0.00			0.00	0.00			0.00	0.00															
	208	215	0.32	0.71	0.63	5.60			0.00	0.00			0.00	0.00			0.00	0.00	14.75	62.36	84.37	98.81	144.30	349	600	600	CONC	1.90	112.0	846.4	2.99	0.62	0.41
To Foundation Lane, Pipe 215 - 119						5.60				0.00				0.00				0.00	15.37														
Foundation Lane																																	
Contribution From Appalachian Circle, Pipe 208 - 215						5.60				0.00				0.00				0.00	15.37														
Contribution From Appalachian Circle, Pipe 214 - 215						2.43				0.00				0.00				0.00	12.08														
	215	119	0.20	0.71	0.39	8.42			0.00	0.00			0.00	0.00			0.00	0.00	15.37	60.90	82.37	96.45	140.84	513	675	675	CONC	1.60	55.0	1063.3	2.97	0.31	0.48
To Travertine Way, Pipe 119 - 120						8.42				0.00				0.00				0.00	15.68														
Travertine Way																																	
			0.15	0.54	0.23	0.23			0.00	0.00			0.00	0.00			0.00	0.00															
	119	122	0.21	0.71	0.41	0.64			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	49	300	300	PVC	0.55	90.0	71.7	1.01	1.48	0.69
			0.13	0.71	0.26	0.90			0.00	0.00			0.00	0.00			0.00	0.00															
	122	123	0.29	0.54	0.44	1.33			0.00	0.00			0.00	0.00			0.00	0.00	11.48	71.56	96.98	113.65	166.09	95	300	300	PVC	1.55	13.0	120.4	1.70	0.13	0.79
	123	127			0.00	1.33			0.00	0.00			0.00	0.00			0.00	0.00	11.61	71.14	96.41	112.98	165.10	95	300	300	PVC	1.60	49.5	122.3	1.73	0.48	0.77
To Montology Way, Pipe 127 - 128						1.33				0.00				0.00				0.00	12.08														
Contribution From Foundation Lane, Pipe 215 - 119						8.42				0.00				0.00				0.00	15.68														
			0.21	0.71	0.41	8.84			0.00	0.00			0.00	0.00			0.00	0.00															
	119	120	0.39	0.54	0.59	9.42			0.00	0.00			0.00	0.00			0.00	0.00	15.68	60.20	81.41	95.33	139.19	567	900	900	CONC	0.20	103.0	809.6	1.27	1.35	0.70
	120	121			0.00	9.42			0.00	0.00			0.00	0.00			0.00	0.00	17.03	57.35	77.52	90.75	132.48	540	900	900	CONC	0.20	14.0	809.6	1.27	0.18	0.67
			0.21	0.54	0.32	9.74			0.00	0.00			0.00	0.00			0.00	0.00															
	121	132	0.52	0.71	1.03	10.77			0.00	0.00			0.00	0.00			0.00	0.00	17.22	56.99	77.02	90.17	131.62	613	900	900	CONC	1.10	114.0	1898.7	2.98	0.64	0.32
Contribution From Montology Way, Pipe 131 - 132						6.12				0.06				0.00				0.00	17.15														
			0.17	0.71	0.34	17.22			0.00	0.06			0.00	0.00			0.00	0.00															
	132	136	0.42	0.54	0.63	17.85			0.00	0.06			0.00	0.00			0.00	0.00	17.85	55.76	75.35	88.20	128.73	1000	1200	1200	CONC	0.20	59.5	1743.6	1.54	0.64	0.57
To Expansion Road, Pipe 136 - 302						17.85				0.06				0.00				0.00	18.50														
Focality Crescent																																	
	107	108			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	0.65	13.0	78.0	1.10	0.20	0.00
			0.28	0.72	0.56	0.56			0.00	0.00			0.00	0.00			0.00	0.00															
	108	110	0.34	0.58	0.55	1.11			0.00	0.00			0.00	0.00			0.00	0.00	10.20	76.06	103.17	120.93	176.78	84	450	450	CONC	0.20	54.0	127.5	0.80	1.12	0.66
To Haiku Street, Pipe 110 - 111						1.11				0.00				0.00				0.00	11.32														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1		
Checked: ADF	LOCATION: City of Ottawa		
Dwg. Reference: Storm Drainage Plan 83-86	File Ref: 18-1030	Date: 27-Jul-20	Sheet No. 2 OF 6

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

Ottawa

Storm sewer design assumptions for Mattamy Halfmoon Bay Phase 8 site

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
	107	112			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	375	375	PVC	0.35	74.0	103.7	0.94	1.31	0.00
			0.04	0.72	0.08	0.08			0.00	0.00			0.00	0.00			0.00	0.00															
			0.15	0.58	0.24	0.32			0.00	0.00			0.00	0.00			0.00	0.00															
			0.22	0.58	0.35	0.68			0.00	0.00			0.00	0.00			0.00	0.00															
	112	113	0.33	0.72	0.66	1.34			0.00	0.00			0.00	0.00			0.00	0.00	11.31	72.11	97.73	114.53	167.38	96	525	525	CONC	0.20	73.5	192.3	0.89	1.38	0.50
	113	114			0.00	1.34			0.00	0.00			0.00	0.00			0.00	0.00	12.69	67.81	91.84	107.60	157.20	91	525	525	CONC	0.20	13.0	192.3	0.89	0.24	0.47
			0.32	0.72	0.64	1.98			0.00	0.00			0.00	0.00			0.00	0.00															
	114	115	0.34	0.58	0.55	2.53			0.00	0.00			0.00	0.00			0.00	0.00	12.94	67.11	90.88	106.47	155.54	170	675	675	CONC	0.40	54.0	531.6	1.49	0.61	0.32
To Haiku Street, Pipe 115 - 116						2.53				0.00				0.00				0.00	13.54														
COMMERCIAL BLOCK - EAST																																	
			2.68	0.75	5.59	5.59			0.00	0.00			0.00	0.00			0.00	0.00	12.50														
	CTRL MH 2	2260			0.00	5.59			0.00	0.00			0.00	0.00			0.00	0.00	12.50	68.38	92.61	108.51	158.53	382	675	675	CONC	0.40	10.0	531.6	1.49	0.11	0.72
To Obsidian Street, Pipe 2260 - 227						5.59				0.00				0.00				0.00	12.61														
Obsidian Street																																	
	225	226	0.27	0.72	0.54	0.54			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	42	300	300	PVC	0.50	99.5	68.4	0.97	1.71	0.61
	226	2260	0.20	0.72	0.40	0.94			0.00	0.00			0.00	0.00			0.00	0.00	11.71	70.79	95.93	112.41	164.27	67	300	300	PVC	1.05	64.0	99.1	1.40	0.76	0.67
From COMMERCIAL BLOCK - EAST- 122, Pipe CTRL MH 2 - 2260						5.59				0.00				0.00				0.00	12.61														
	2260	227			0.00	6.53			0.00	0.00			0.00	0.00			0.00	0.00	12.61	68.05	92.16	107.97	157.75	444	675	675	CONC	1.55	49.5	1046.5	2.92	0.28	0.42
	227	109	0.26	0.72	0.52	7.05			0.00	0.00			0.00	0.00			0.00	0.00	12.89	67.23	91.04	106.66	155.82	474	675	675	CONC	1.60	93.0	1063.3	2.97	0.52	0.45
To Haiku Street, Pipe 109 - 110						7.05				0.00				0.00				0.00	13.42														
Haiku Street																																	
			1.93	0.68	3.65	3.65			0.00	0.00			0.00	0.00			0.00	0.00	11.50														
	CTRL MH 3	109			0.00	3.65			0.00	0.00			0.00	0.00			0.00	0.00	11.50	71.49	96.89	113.54	165.92	261	600	600	CONC	0.40	10.0	388.3	1.37	0.12	0.67
Contribution From Obsidian Street, Pipe 227 - 109						7.05				0.00				0.00				0.00	13.42														
	109	110	0.18	0.72	0.36	11.06			0.00	0.00			0.00	0.00			0.00	0.00	13.42	65.78	89.05	104.31	152.38	727	750	750	CONC	0.70	60.0	931.4	2.11	0.47	0.78
Contribution From Focality Crescent, Pipe 108 - 110						1.11				0.00				0.00				0.00	11.32														
			0.16	0.58	0.26	12.42			0.00	0.00			0.00	0.00			0.00	0.00															
			0.19	0.58	0.31	12.73			0.00	0.00			0.00	0.00			0.00	0.00															
	110	111	0.33	0.72	0.66	13.39			0.00	0.00			0.00	0.00			0.00	0.00	13.89	64.52	87.32	102.28	149.40	864	900	900	CONC	0.40	75.0	1144.9	1.80	0.69	0.75
	111	115	0.18	0.72	0.36	13.75			0.00	0.00			0.00	0.00			0.00	0.00	14.58	62.77	84.92	99.46	145.25	863	975	975	CONC	0.20	91.0	1002.2	1.34	1.13	0.86
Contribution From Focality Crescent, Pipe 114 - 115						2.53				0.00				0.00				0.00	13.54														
					0.00	16.28	0.04	0.72	0.08	0.08			0.00	0.00			0.00	0.00															
			0.15	0.58	0.24	16.52			0.00	0.08			0.00	0.00			0.00	0.00															
			0.16	0.58	0.26	16.78			0.00	0.08			0.00	0.00			0.00	0.00															
	115	116	0.19	0.72	0.38	17.16			0.00	0.08			0.00	0.00			0.00	0.00	15.71	60.13	81.32	95.22	139.03	1038	1050	1050	CONC	0.50	59.0	1930.9	2.23	0.44	0.54
To Inselberg Street, Pipe 116 - 117						17.16				0.08				0.00				0.00	16.16														
PARK BLOCK																																	
	CTRL MH 4	104			0.00	0.00	1.72	0.40	1.91	1.91			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	199	525	525	CONC	0.40	9.5	272.0	1.26	0.13	0.73
To Chillerton Drive, Pipe 104 - 106						0.00				1.91				0.00				0.00	10.13														
Canadensis Lane																																	
			0.01	0.72	0.02	0.02			0.00	0.00			0.00	0.00			0.00	0.00															
			0.03	0.58	0.05	0.07			0.00	0.00			0.00	0.00			0.00	0.00															
			0.04	0.58	0.06	0.13			0.00	0.00			0.00	0.00			0.00	0.00															
			0.16	0.58	0.26	0.39			0.00	0.00			0.00	0.00			0.00	0.00															
	230	231	0.19	0.72	0.38	0.77			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	59	300	300	PVC	2.00	73.5	136.8	1.93	0.63	0.43
			0.12	0.58	0.19	0.96			0.00	0.00			0.00	0.00			0.00	0.00															
			0.21	0.58	0.34	1.30			0.00	0.00			0.00	0.00			0.00	0.00															
	231	103	0.41	0.72	0.82	2.12			0.00	0.00			0.00	0.00			0.00	0.00	10.63	74.46	100.96	118.34	172.97	158	525	525	CONC	2.00	87.0	608.2	2.81	0.52	0.26
To Chillerton Drive, Pipe 103 - 104						2.12				0.00				0.00				0.00	11.15														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
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I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM
Checked: ADF
Dwg. Reference: Storm Drainage Plan 83-86

PROJECT: Ciavan Communities - Brazeau Phase 1
LOCATION: City of Ottawa
File Ref: 18-1030
Date: 27-Jul-20
Sheet No. 3 OF 6

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
Surface Lane																																	
			0.17	0.58	0.27	0.27			0.00	0.00			0.00	0.00			0.00	0.00															
	228	229	0.31	0.72	0.62	0.89			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	69	300	300	PVC	2.00	74.5	136.8	1.93	0.64	0.50
			0.20	0.58	0.32	1.22			0.00	0.00			0.00	0.00			0.00	0.00															
	229	102	0.39	0.72	0.78	2.00			0.00	0.00			0.00	0.00			0.00	0.00	10.64	74.43	100.92	118.29	172.90	149	525	525	CONC	0.85	86.5	396.5	1.83	0.79	0.37
To Chillerton Drive, Pipe 102 - 103						2.00				0.00				0.00				0.00	11.43														
Chillerton Drive																																	
	101	102			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	2.60	30.5	155.9	2.21	0.23	0.00
Contribution From Surface Lane, Pipe 229 - 102						2.00				0.00				0.00				0.00	11.43														
	102	103	0.13	0.72	0.26	2.26			0.00	0.00			0.00	0.00			0.00	0.00	11.43	71.72	97.21	113.91	166.47	162	525	525	CONC	1.55	59.0	535.4	2.47	0.40	0.30
Contribution From Canadensis Lane, Pipe 231 - 103						2.12				0.00				0.00				0.00	11.15														
	103	104	0.19	0.72	0.38	4.76			0.00	0.00			0.00	0.00			0.00	0.00	11.83	70.44	95.44	111.84	163.43	335	750	750	CONC	0.40	120.0	704.1	1.59	1.25	0.48
From PARK BLOCK - 123, Pipe CTRL MH 4 - 104						0.00				1.91				0.00				0.00	10.13														
	104	106	0.26	0.72	0.52	5.28			0.00	1.91			0.00	0.00			0.00	0.00	13.08	66.70	90.32	105.80	154.56	525	1050	1050	CONC	0.15	41.5	1057.6	1.22	0.57	0.50
To Elevation Road, Pipe 106 - 116						5.28				1.91				0.00				0.00	13.65														
Epoch Street																																	
	221	222	0.09	0.72	0.18	0.18			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	14	300	300	PVC	0.50	82.0	68.4	0.97	1.41	0.20
			0.11	0.58	0.18	0.36			0.00	0.00			0.00	0.00			0.00	0.00															
			0.22	0.72	0.44	0.80			0.00	0.00			0.00	0.00			0.00	0.00															
			0.31	0.54	0.47	1.26			0.00	0.00			0.00	0.00			0.00	0.00															
			0.31	0.58	0.50	1.76			0.00	0.00			0.00	0.00			0.00	0.00															
	222	223	0.40	0.72	0.80	2.56			0.00	0.00			0.00	0.00			0.00	0.00	11.41	71.78	97.28	114.00	166.60	184	600	600	CONC	0.15	91.0	237.8	0.84	1.80	0.77
					0.00	2.56	0.07	0.71	0.14	0.14			0.00	0.00			0.00	0.00															
	223	224	0.13	0.72	0.26	2.82			0.00	0.14			0.00	0.00			0.00	0.00	13.22	66.33	89.80	105.20	153.68	200	600	600	CONC	0.20	97.0	274.6	0.97	1.66	0.73
To Elevation Road, Pipe 224 - 105						2.82				0.14				0.00				0.00	14.88														
Eminence Street																																	
			0.09	0.54	0.14	0.14			0.00	0.00			0.00	0.00			0.00	0.00															
			0.11	0.54	0.17	0.30			0.00	0.00			0.00	0.00			0.00	0.00															
	216	217	0.39	0.71	0.77	1.07			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	82	375	375	PVC	0.60	75.5	135.8	1.23	1.02	0.61
			0.25	0.54	0.38	1.45			0.00	0.00			0.00	0.00			0.00	0.00															
			0.32	0.54	0.48	1.93			0.00	0.00			0.00	0.00			0.00	0.00															
	217	218	0.46	0.71	0.91	2.83			0.00	0.00			0.00	0.00			0.00	0.00	11.02	73.09	99.08	116.12	169.72	207	600	600	CONC	0.20	113.0	274.6	0.97	1.94	0.75
					0.00	2.83	0.04	0.71	0.08	0.08			0.00	0.00			0.00	0.00															
	218	220	0.10	0.71	0.20	3.03			0.00	0.08			0.00	0.00			0.00	0.00	12.96	67.04	90.78	106.34	155.36	210	600	600	CONC	0.20	80.5	274.6	0.97	1.38	0.77
To Elevation Road, Pipe 220 - 224						3.03				0.08				0.00				0.00	14.34														
Elevation Road																																	
					0.00	0.00																											
	Plug East	310	1.22	0.65	2.20	2.20			0.00	0.00			0.00	0.00			0.00	0.00	14.71	62.46	84.51	98.97	144.53	138	750	750	CONC	0.20	9.5	497.9	1.13	0.14	0.28
To Elevation Road, Pipe 310 - 311						2.20				0.00				0.00				0.00	14.85														
					0.00	0.00	2.56	0.65	0.00	0.00			0.00	0.00			0.00	0.00	16.00														
			5.09	0.65	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	16.00														
	Plug South	310			9.20	9.20			4.63	4.63			0.00	0.00			0.00	0.00	16.00	59.50	80.46	94.21	137.55	919	1050	1050	CONC	0.15	17.5	1057.6	1.22	0.24	0.87
To Elevation Road, Pipe 310 - 311						9.20				4.63				0.00				0.00	16.24														
	219	220			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	2.65	25.0	157.4	2.23	0.19	0.00
Contribution From Eminence Street, Pipe 218 - 220						3.03				0.08				0.00				0.00	14.34														
					0.00	3.03	0.05	0.71	0.10	0.18			0.00	0.00			0.00	0.00															
			0.06	0.71	0.12	3.15			0.00	0.18			0.00	0.00			0.00	0.00															
	220	224			0.00	3.15	0.12	0.71	0.24	0.41			0.00	0.00			0.00	0.00	14.34	63.36	85.74	100.42	146.66	235	600	600	CONC	1.90	59.0	846.4	2.99	0.33	0.28

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1
Checked: ADF	LOCATION: City of Ottawa
Dwg. Reference: Storm Drainage Plan 83-86	File Ref: 18-1030 · Date: 27-Jul-20 · Sheet No. 4 OF 6

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Ottawa

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
Contribution From Epoch Street, Pipe 223 - 224						2.82				0.14				0.00				0.00	14.88														
					0.00	5.97	0.03	0.58	0.05	0.60			0.00	0.00			0.00	0.00															
			0.06	0.71	0.12	6.09			0.00	0.60			0.00	0.00			0.00	0.00															
			0.11	0.54	0.17	6.26			0.00	0.60			0.00	0.00			0.00	0.00															
	224	105			0.00	6.26	0.16	0.71	0.32	0.92			0.00	0.00			0.00	0.00	14.88	62.05	83.94	98.31	143.56	465	600	600	CONC	1.90	82.0	846.4	2.99	0.46	0.55
	105	106			0.00	6.26	0.35	0.71	0.69	1.61			0.00	0.00			0.00	0.00	15.34	60.98	82.48	96.59	141.04	514	675	675	CONC	1.40	91.0	994.6	2.78	0.55	0.52
Contribution From Chillerton Drive, Pipe 104 - 106						5.28				1.91				0.00				0.00	13.65														
			0.20	0.58	0.32	11.86			0.00	3.52			0.00	0.00			0.00	0.00															
					0.00	11.86	0.21	0.72	0.42	3.94			0.00	0.00			0.00	0.00															
	106	116			0.00	11.86	0.22	0.71	0.43	4.37			0.00	0.00			0.00	0.00	15.88	59.76	80.81	94.62	138.15	1062	1350	1350	CONC	0.20	122.5	2387.0	1.67	1.22	0.45
To Haiku Street, Pipe 116 - 117						11.86				4.37				0.00				0.00	17.11														
Haiku Street																																	
Contribution From Elevation Road, Pipe 106 - 116						11.86				4.37				0.00				0.00	17.11														
Contribution From Haiku Street, Pipe 115 - 116						17.16				0.08				0.00				0.00	16.16														
					0.00	29.02	0.04	0.71	0.08	4.53			0.00	0.00			0.00	0.00															
			0.13	0.54	0.20	29.21			0.00	4.53			0.00	0.00			0.00	0.00															
			0.13	0.54	0.20	29.41			0.00	4.53			0.00	0.00			0.00	0.00															
			0.29	0.54	0.44	29.85			0.00	4.53			0.00	0.00			0.00	0.00															
	116	117	0.31	0.71	0.61	30.46			0.00	4.53			0.00	0.00			0.00	0.00	17.11	57.20	77.31	90.51	132.12	2093	1650	1650	CONC	0.10	122.5	2882.2	1.35	1.51	0.73
			0.15	0.54	0.23	30.68			0.00	4.53			0.00	0.00			0.00	0.00															
			0.16	0.54	0.24	30.92			0.00	4.53			0.00	0.00			0.00	0.00															
	117	118	0.49	0.71	0.97	31.89			0.00	4.53			0.00	0.00			0.00	0.00	18.62	54.36	73.43	85.94	125.43	2066	1650	1650	CONC	0.10	121.0	2882.2	1.35	1.50	0.72
	118	136			0.00	31.89			0.00	4.53			0.00	0.00			0.00	0.00	20.12	51.84	69.99	81.91	119.51	1971	1950	1950	CONC	0.10	11.0	4499.9	1.51	0.12	0.44
To Expansion Road, Pipe 136 - 302						31.89				4.53				0.00				0.00	20.24														
Expansion Road																																	
Contribution From Elevation Road, Plug East - 310						2.20				0.00				0.00				0.00	14.85														
Contribution From Elevation Road, Plug South - 310						9.20				4.63				0.00				0.00	16.24														
					0.00	11.40	0.06	0.54	0.09	4.72			0.00	0.00			0.00	0.00															
			0.09	0.54	0.14	11.54			0.00	4.72			0.00	0.00			0.00	0.00															
			0.16	0.71	0.32	11.85			0.00	4.72			0.00	0.00			0.00	0.00															
	310	311	0.16	0.71	0.32	12.17			0.00	4.72			0.00	0.00			0.00	0.00	16.24	58.99	79.76	93.38	136.34	1094	1200	1200	CONC	0.15	62.5	1510.0	1.34	0.78	0.72
			0.21	0.54	0.32	12.48			0.00	4.72			0.00	0.00			0.00	0.00															
	311	3111TEE	0.25	0.71	0.49	12.98			0.00	4.72			0.00	0.00			0.00	0.00	17.02	57.38	77.56	90.79	132.54	1110	1200	1200	CONC	0.15	72.0	1510.0	1.34	0.90	0.74
	3111TEE	312			0.00	12.98			0.00	4.72			0.00	0.00			0.00	0.00	17.92	55.64	75.18	88.00	128.44	1077	1200	1200	CONC	0.15	76.5	1510.0	1.34	0.95	0.71
	312	313	0.06	0.54	0.09	13.07			0.00	4.72			0.00	0.00			0.00	0.00	18.87	53.92	72.83	85.24	124.39	1048	1200	1200	CONC	0.15	21.5	1510.0	1.34	0.27	0.69
To POND INLET - 120, Pipe 313 - 500						13.07				4.72				0.00				0.00	19.14														
Contribution From Haiku Street, Pipe 118 - 136						31.89				4.53				0.00				0.00	20.24														
Contribution From Travertine Way, Pipe 132 - 136						17.85				0.06				0.00				0.00	18.50														
Contribution From Haiku Street, Pipe 135 - 136						31.49				0.00				0.00				0.00	14.46														
	136	302	0.03	0.54	0.05	81.28			0.00	4.59			0.00	0.00			0.00	0.00	20.24	51.65	69.73	81.60	119.05	4518	2250	2250	CONC	0.10	54.0	6590.6	1.66	0.54	0.69
From FUTURE ROAD (DRUMMOND LAND) - Plug - 302						1.79				0.00				0.00				0.00	10.20														
			0.06	0.54	0.09	83.16			0.00	4.59			0.00	0.00			0.00	0.00															
	302	303	0.16	0.71	0.32	83.48			0.00	4.59			0.00	0.00			0.00	0.00	20.78	50.81	68.58	80.25	117.07	4556	2250	2250	CONC	0.10	59.0	6590.6	1.66	0.59	0.69
From FUTURE ROAD (DRUMMOND LAND) - Plug - 303						1.81				1.61				0.00				0.00	15.29														
			0.09	0.54	0.14	85.42			0.00	6.21			0.00	0.00			0.00	0.00															
	303	304	0.22	0.71	0.43	85.85			0.00	6.21			0.00	0.00			0.00	0.00	21.38	49.92	67.37	78.82	114.99	4704	2250	2250	CONC	0.10	134.5	6590.6	1.66	1.35	0.71
From FUTURE ROAD (DRUMMOND LAND) - Plug - 304						2.17				0.00				0.00				0.00	10.17														
			0.10	0.54	0.15	88.17			0.00	6.21			0.00	0.00			0.00	0.00															
	304	306TEE	0.28	0.71	0.55	88.72			0.00	6.21			0.00	0.00			0.00	0.00	22.73	48.02	64.78	75.78	110.53	4662	2250	2250	CONC	0.10	42.5	6590.6	1.66	0.43	0.71
POND INLET - 120, Pipe 306TEE - 307TEE						88.72				6.21				0.00				0.00	23.16														
POND INLET																																	
Contribution From Expansion Road, Pipe 312 - 313						13.07				4.72				0.00				0.00	19.14														
	313	500			0.00	13.07			0.00	4.72			0.00	0.00			0.00	0.00	19.14	53.46	72.19	84.49	123.30	1039	2250	2250	CONC	0.10	33.5	6590.6	1.66	0.34	0.16
	500	HW501			0.00	13.07			0.00	4.72			0.00	0.00			0.00	0.00	19.48	52.89	71.42	83.58	121.96	1028	2250	2250	CONC	0.10	5.0	6590.6	1.66	0.05	0.16

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1
Checked: ADF	LOCATION: City of Ottawa
Dwg. Reference: Storm Drainage Plan 83-86	File Ref: 18-1030 / Date: 27-Jul-20 / Sheet No. 5 OF 6

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

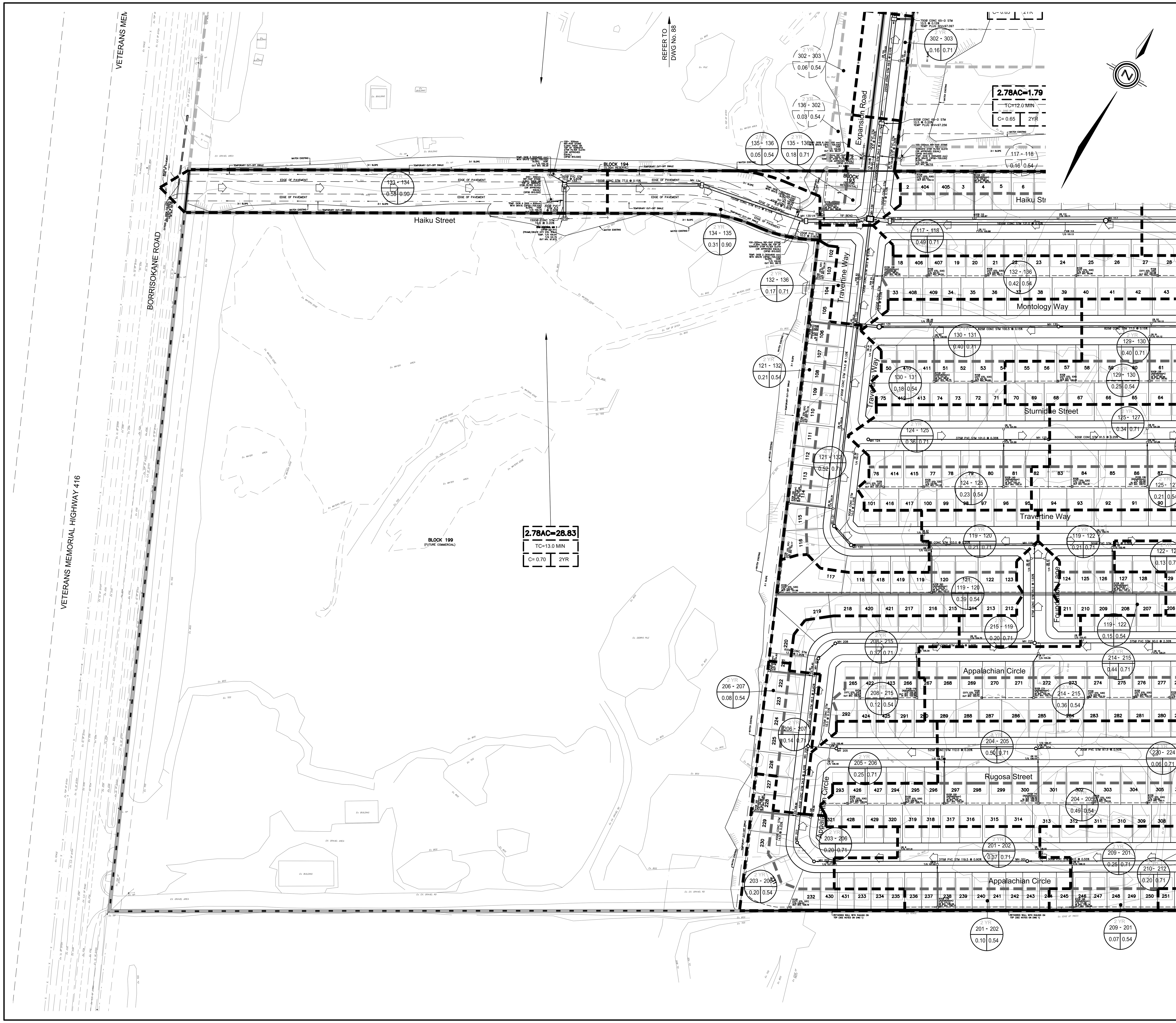
Ottawa

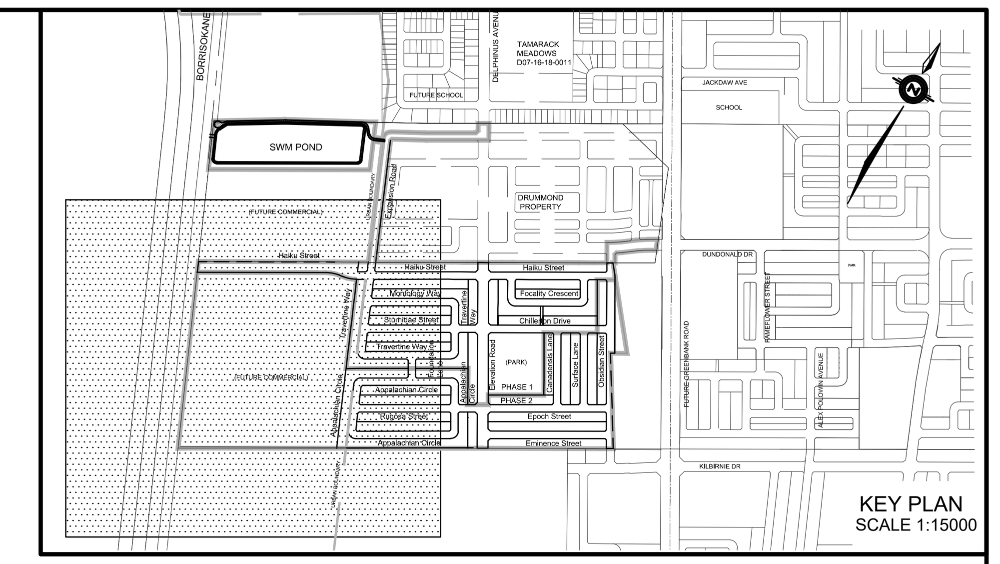
	LOCATION		AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
Contribution From Expansion Road, Pipe 305TEE - 306TEE						88.72				6.21				0.00				0.00	23.16														
	306TEE	307	0.18	0.71	0.36	89.08			0.00	6.21			0.00	0.00			0.00	0.00	23.16	47.45	64.01	74.88	109.20	4624	2250	2250	CONC	0.10	13.0	6590.6	1.66	0.13	0.70
	307	400			0.00	89.08			0.00	6.21			0.00	0.00			0.00	0.00	23.29	47.28	63.78	74.61	108.80	4608	2250	2250	CONC	0.10	23.5	6590.6	1.66	0.24	0.70
ABIC PROPERTY																								210.40									
	400	HW401			0.00	89.08			0.00	6.21			0.00	0.00			0.00	0.00	23.52	46.98	63.36	74.12	108.09	4788	2250	2250	CONC	0.10	15.5	6590.6	1.66	0.16	0.73
POND OUTLET - CONSTANT FLOW RATE 1300 L/S																																	
			0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00						1300									
	HW OUT	1002			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	1300	900	900	CONC	0.60	7.5	1402.3	2.20	0.06	0.93
	1002	1003			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.06	76.59	103.89	121.79	178.04	1300	900	900	CONC	0.60	28.0	1402.3	2.20	0.21	0.93
To BORRISOKANE - 190, Pipe 1003 - 1004						0.00				0.00				0.00				0.00	10.27					1300									
BORRISOKANE ROAD - CONSTANT FLOW RATE 1300 L/S																																	
Contribution From POND OUTLET - 192, Pipe 1002 - 1003						0.00				0.00				0.00				0.00	10.27					1300									
	1003	1004			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.27	75.79	102.80	120.50	176.14	1300	900	900	CONC	0.60	108.5	1402.3	2.20	0.82	0.93
	1004	1005			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	11.09	72.86	98.77	115.76	169.18	1300	975	975	CONC	0.40	106.0	1417.4	1.90	0.93	0.92
	1005	1006			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	12.02	69.83	94.61	110.86	161.99	1300	1200	1200	CONC	0.20	106.0	1743.6	1.54	1.15	0.75
	1006	1007			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	13.17	66.47	89.99	105.42	154.01	1300	1200	1200	CONC	0.20	106.0	1743.6	1.54	1.15	0.75
	1007	1008			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	14.31	63.44	85.85	100.55	146.85	1300	1200	1200	CONC	0.20	88.0	1743.6	1.54	0.95	0.75
	1008	HW1009			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	15.26	61.15	82.72	96.86	141.45	1300	1200	1200	CONC	0.20	14.5	1743.6	1.54	0.16	0.75

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM	PROJECT: **Ciavan Communities - Brazeau Phase 1**			
Checked: ADF	LOCATION: **City of Ottawa**			
Dwg. Reference: Storm Drainage Plan 83-86	File Ref: 18-1030	Date: 27-Jul-20	Sheet No. 6 OF 6	





LEGEND

STORM DRAINAGE BOUNDARY
SUB-DRAINAGE BOUNDARY
STORM DRAINAGE BOUNDARY (OTHER PHASES)
STORM FREQUENCY
UPSTREAM MH TO DOWNSTREAM MH
AREA IN HECTARES
RUNOFF COEFFICIENT
EXTERNAL 2.78AC =
EXTERNAL TIME OF CONCENTRATION
EXTERNAL BLENDED RUNOFF COEFFICIENT
EXTERNAL STORM FREQUENCY
STORM FREQUENCY (OTHER PHASE)
UPSTREAM MH TO DOWNSTREAM MH (OTHER PHASE)
AREA IN HECTARES (OTHER PHASE)
RUNOFF COEFFICIENT (OTHER PHASE)
STREET CATCHBASIN & LEAD
STREET CATCHBASIN WITH CLOSED LID & LEAD
MAINTENANCE HOLE
CURB INLET CATCHBASIN & LEAD
CATCHBASIN/ MAINTENANCE HOLE
INTERCONNECTED CATCH BASIN & LEADS
CAP
OVERLAND FLOW DIRECTION
EXTERNAL OVERLAND FLOW DIRECTION
EMERGENCY OVERLAND FLOW DIRECTION

2YR 43 - 44 0.37 0.51
2.78AC=14.40 TC=14.5 MIN C= 0.70 2YR
303 - 305 7.86 0.75

REFER TO DWG No. 86

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20-07-27	5TH SUBMISSION
5	A.D.F.	20-06-15	4TH SUBMISSION
4	A.D.F.	20-04-24	3RD SUBMISSION
3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

DSEL
david schaeffer engineering ltd
120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

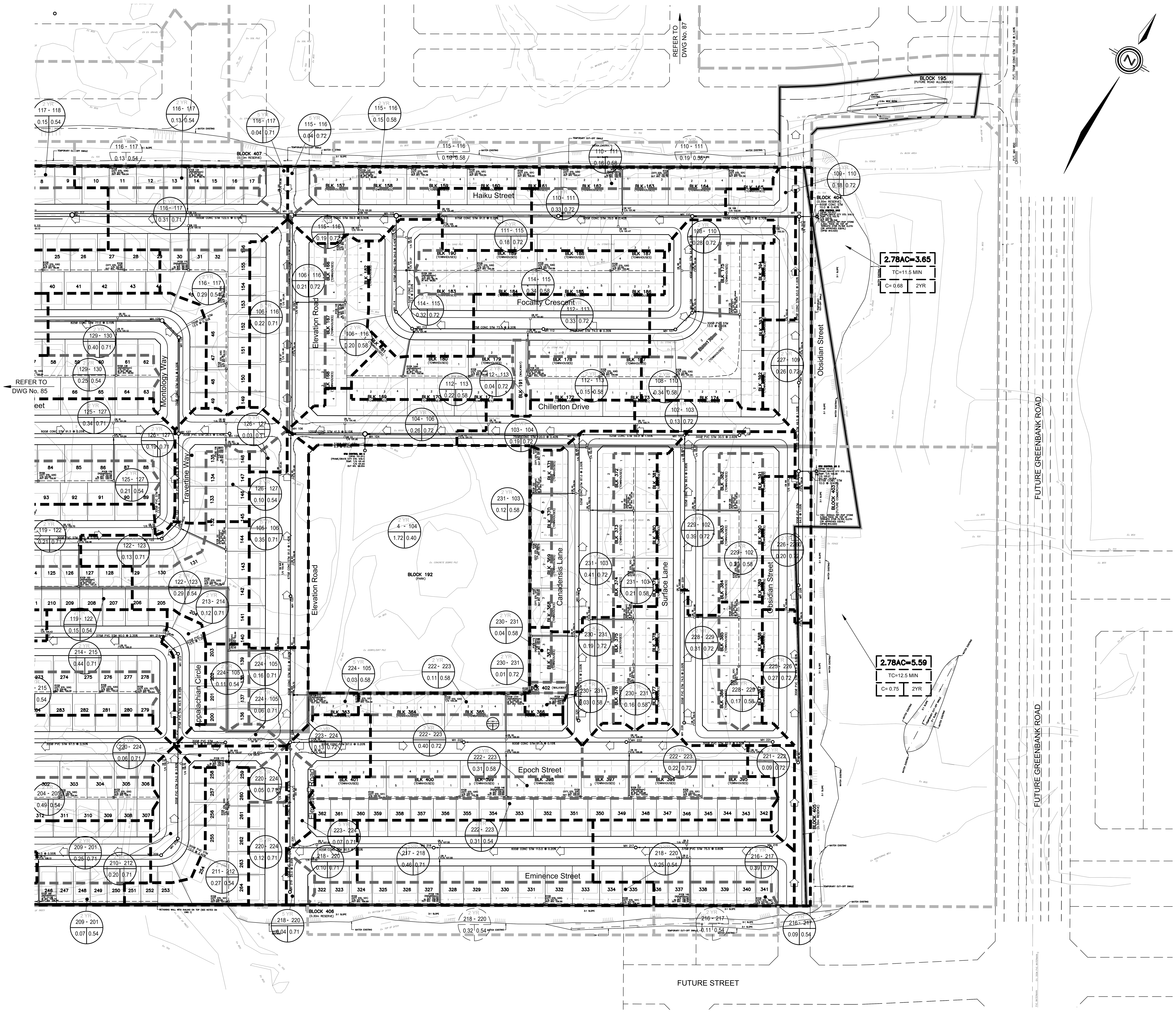
LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 2020-07-27 PROVINCE OF ONTARIO

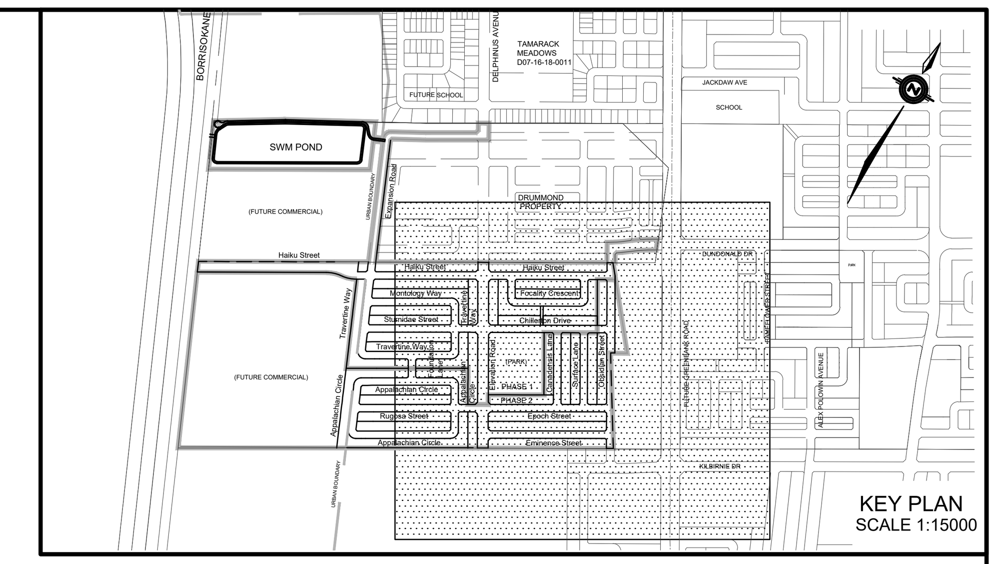
Ottawa CITY OF OTTAWA

STORM DRAINAGE PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.	
SCALE: HORIZ. 1:1000 0 10 20 30 40		SHEET No. 85

CITY PLAN No. 17803
CITY FILE No. D07-16-19-0005





LEGEND

STORM DRAINAGE BOUNDARY SUB-DRAINAGE BOUNDARY STORM DRAINAGE BOUNDARY (OTHER PHASES)	
STORM FREQUENCY	2YR
UPSTREAM MH TO DOWNSTREAM MH	43 - 44
AREA IN HECTARES	0.37
RUNOFF COEFFICIENT	0.51
EXTERNAL 2.78AC =	2.78AC=14.40
EXTERNAL TIME OF CONCENTRATION	TC=14.5 MIN
EXTERNAL BLENDED RUNOFF COEFFICIENT	C= 0.70
EXTERNAL STORM FREQUENCY	2YR
STORM FREQUENCY (OTHER PHASE)	2 YR
UPSTREAM MH TO DOWNSTREAM MH (OTHER PHASE)	303 - 305
AREA IN HECTARES (OTHER PHASE)	7.86
RUNOFF COEFFICIENT (OTHER PHASE)	0.75
STREET CATCHBASIN & LEAD STREET CATCHBASIN WITH CLOSED LID & LEAD MAINTENANCE HOLE	MH202
CURB INLET CATCHBASIN & LEAD CATCHBASIN/ MAINTENANCE HOLE	CBMH201
INTERCONNECTED CATCH BASIN & LEADS	
CAP	
OVERLAND FLOW DIRECTION	
EXTERNAL OVERLAND FLOW DIRECTION	
EMERGENCY OVERLAND FLOW DIRECTION	

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20-07-27	5TH SUBMISSION
5	A.D.F.	20-06-15	4TH SUBMISSION
4	A.D.F.	20-04-24	3RD SUBMISSION
3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

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LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

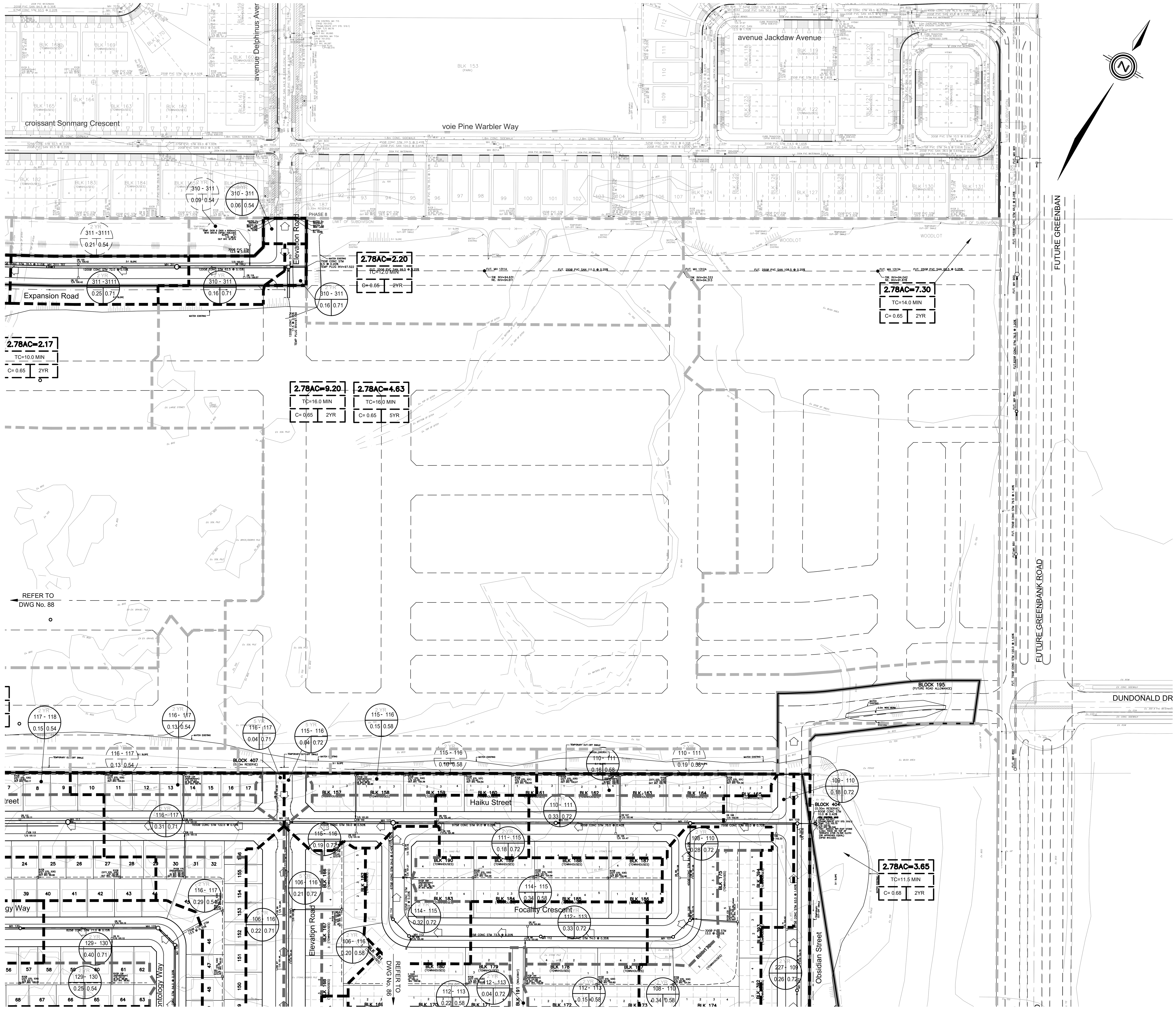
Ottawa CITY OF OTTAWA

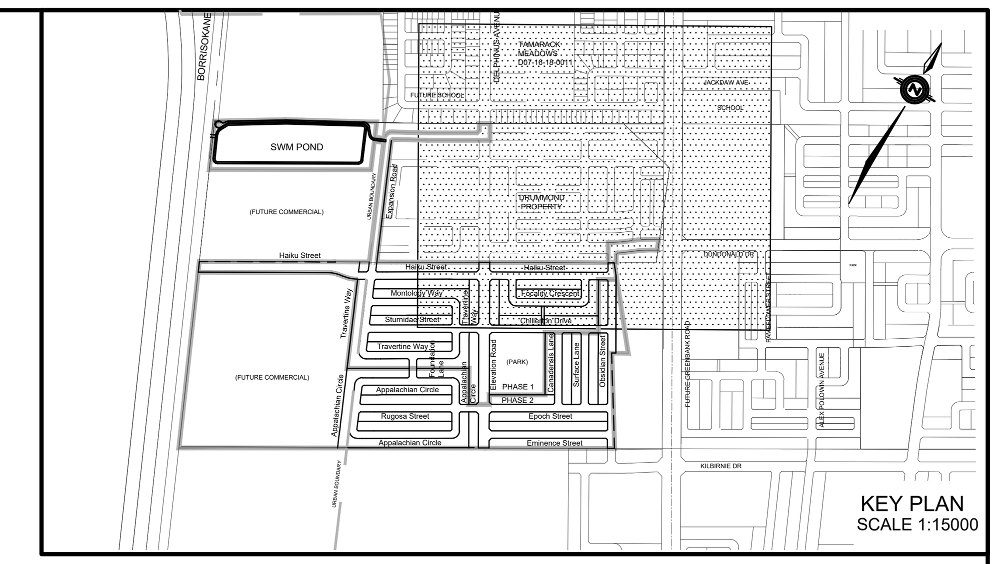
STORM DRAINAGE PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030	
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: HORIZ. 1:1000		SHEET No. 86	

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005





LEGEND

STORM DRAINAGE BOUNDARY	
SUB–DRAINAGE BOUNDARY	
STORM DRAINAGE BOUNDARY (OTHER PHASES)	
STORM FREQUENCY	2Yr
UPSTREAM MH TO DOWNSTREAM MH	43 - 44
AREA IN HECTARES	0.37
RUNOFF COEFFICIENT	0.51
EXTERNAL 2.78AC =	2.78AC=14.40
EXTERNAL TIME OF CONCENTRATION	TC=14.5 MIN
EXTERNAL BLENDED RUNOFF COEFFICIENT	C= 0.70
EXTERNAL STORM FREQUENCY	2YR
STORM FREQUENCY (OTHER PHASE)	2 YR
UPSTREAM MH TO DOWNSTREAM MH (OTHER PHASE)	303 - 305
AREA IN HECTARES (OTHER PHASE)	7.86
RUNOFF COEFFICIENT (OTHER PHASE)	0.75
STREET CATCHBASIN & LEAD	375mmø ST
STREET CATCHBASIN WITH CLOSED LID & LEAD	
MAINTENANCE HOLE	MH202
CURB INLET CATCHBASIN & LEAD	
CATCHBASIN/ MAINTENANCE HOLE	CBMH201
INTERCONNECTED CATCH BASIN & LEADS	
CAP	
OVERLAND FLOW DIRECTION	
EXTERNAL OVERLAND FLOW DIRECTION	
EMERGENCY OVERLAND FLOW DIRECTION	E

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20–07–27	5TH SUBMISSION
5	A.D.F.	20–06–15	4TH SUBMISSION
4	A.D.F.	20–04–24	3RD SUBMISSION
3	A.D.F.	19–12–23	2ND SUBMISSION
2	A.D.F.	19–10–04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18–10–145–00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M–PLAN PROVIDED BY JD BARNES LTD, PROJECT 18–10–145–00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

DSEL
david schaeffer engineering ltd
120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

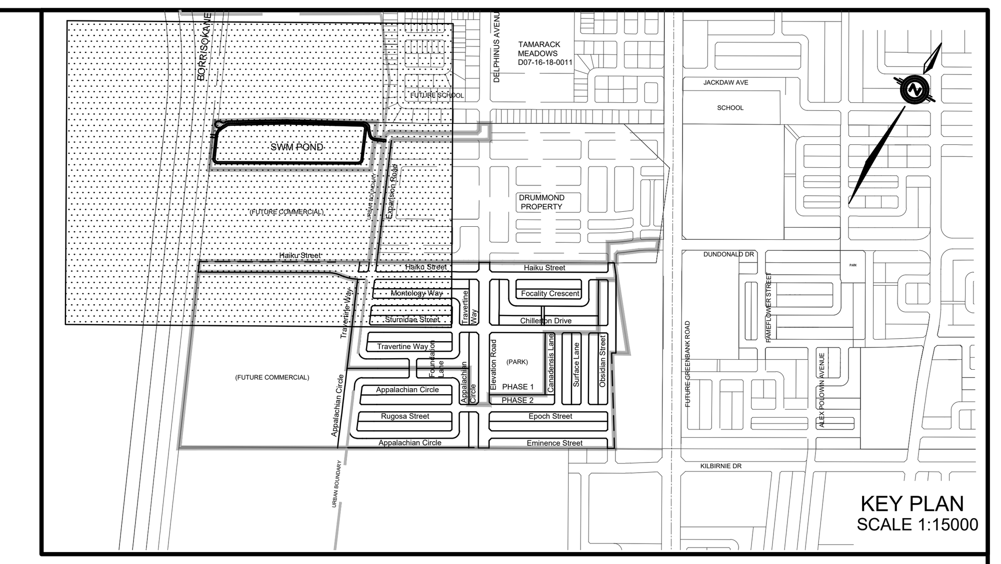
CITY OF OTTAWA

STORM DRAINAGE PLAN

DRAWN BY:	G.G.G.	CHECKED BY:	A.D.F.	PROJECT No. 18–1030
DESIGNED BY:	C.M.K.	CHECKED BY:	A.D.F.	
SCALE: HORIZ. 1:1000				SHEET No. 87

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005



LEGEND

- STORM DRAINAGE BOUNDARY
- SUB-DRAINAGE BOUNDARY
- STORM DRAINAGE BOUNDARY (OTHER PHASES)
- STORM FREQUENCY (2YR)
- UPSTREAM MH TO DOWNSTREAM MH (43 - 44)
- AREA IN HECTARES (0.37)
- RUNOFF COEFFICIENT (0.51)
- EXTERNAL 2.78AC = (2.78AC=14.40)
- EXTERNAL TIME OF CONCENTRATION (TC=14.5 MIN)
- EXTERNAL BLENDED RUNOFF COEFFICIENT (C= 0.70)
- EXTERNAL STORM FREQUENCY (2YR)
- STORM FREQUENCY (OTHER PHASE) (2YR)
- UPSTREAM MH TO DOWNSTREAM MH (OTHER PHASE) (303 - 305)
- AREA IN HECTARES (OTHER PHASE) (7.86)
- RUNOFF COEFFICIENT (OTHER PHASE) (0.75)
- STREET CATCHBASIN & LEAD
- STREET CATCHBASIN WITH CLOSED LID & LEAD
- MAINTENANCE HOLE (MH202)
- CURB INLET CATCHBASIN & LEAD
- CATCHBASIN/ MAINTENANCE HOLE (CBMH201)
- INTERCONNECTED CATCH BASIN & LEADS
- CAP
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- EMERGENCY OVERLAND FLOW DIRECTION

NOT FOR CONSTRUCTION

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2	A.D.F.	19-10-04	1ST SUBMISSION

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LICENSED PROFESSIONAL ENGINEER
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100090626
2020-07-27
PROVINCE OF ONTARIO

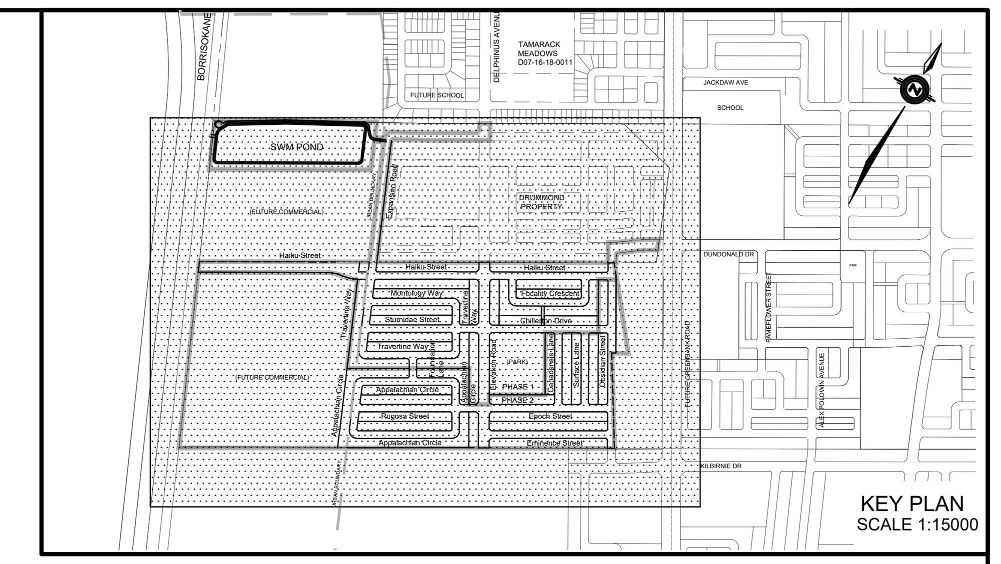
Ottawa CITY OF OTTAWA

STORM DRAINAGE PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No.	18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: HORIZ. 1:1000 (0 10 20 30 40)		SHEET No.	88

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005



LEGEND

EXISTING DRAINAGE BOUNDARY

AREA IN HECTARES
RUNOFF COEFFICIENT
0.28 0.25

EXISTING OVERLAND FLOW DIRECTION

NOT FOR CONSTRUCTION

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3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION

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JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

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A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

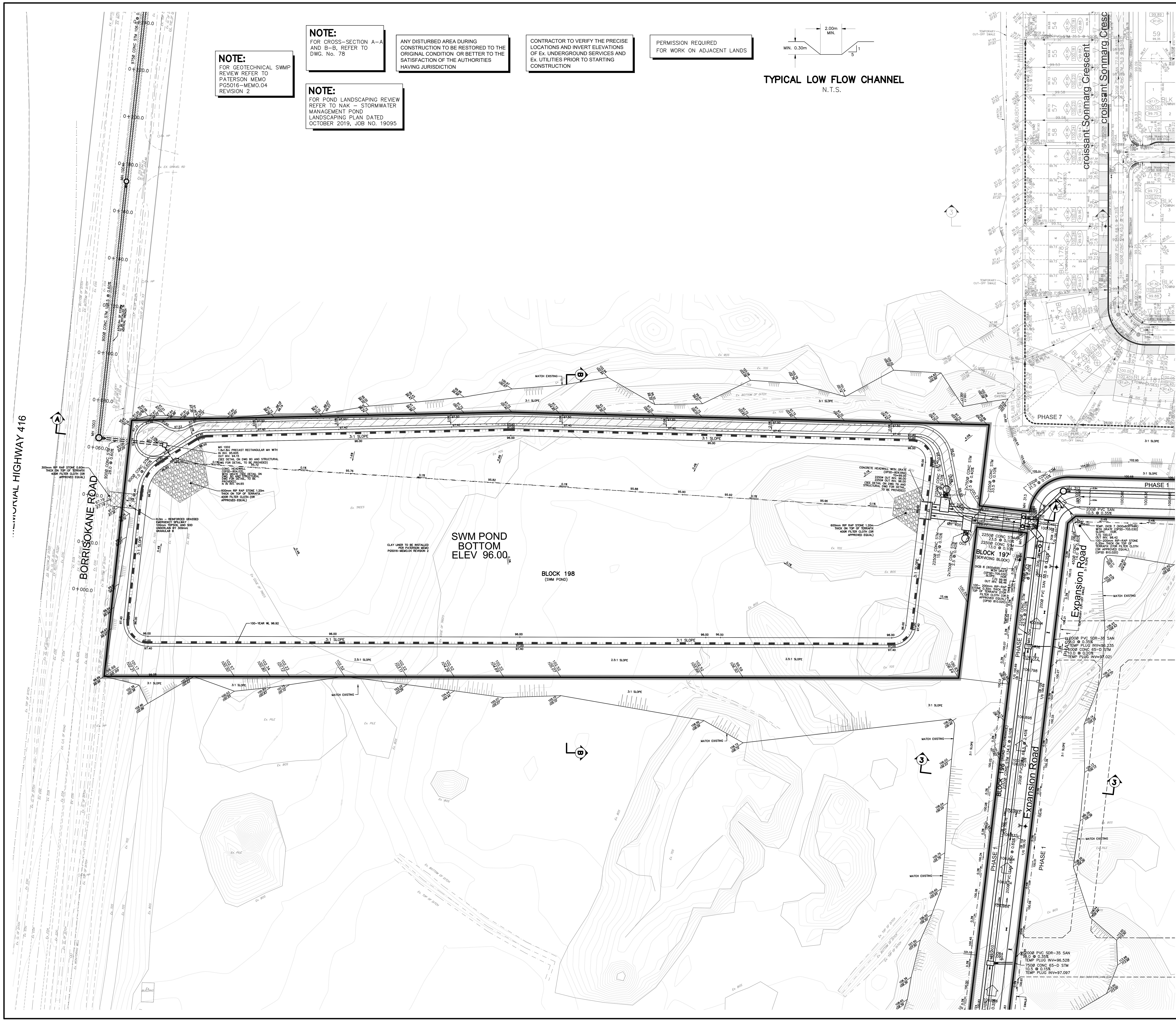
Ottawa CITY OF OTTAWA

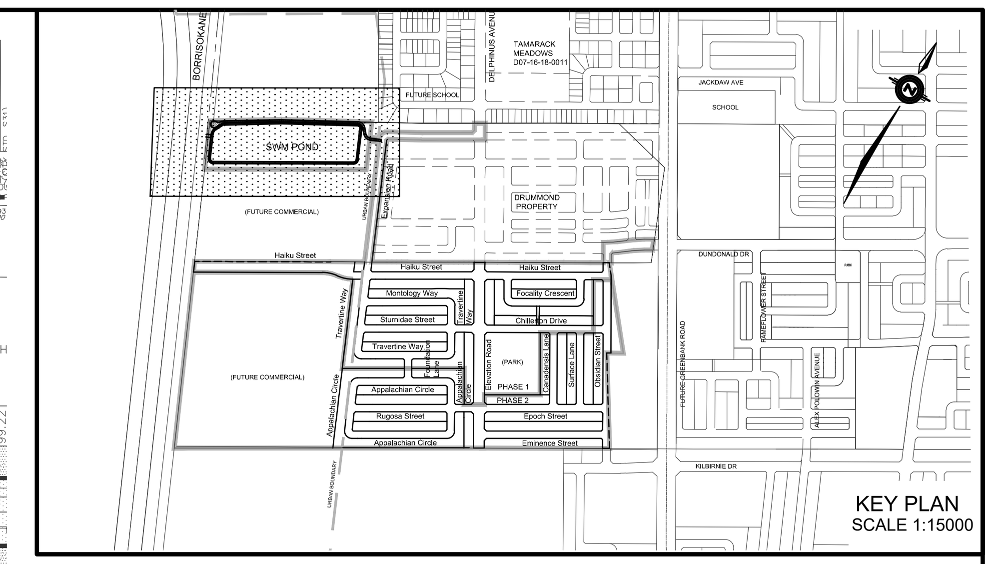
EXTERNAL PRE-DEVELOPMENT STORM DRAINAGE PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.	
SCALE: HORIZ. 1:2000 (0 20 40 60 80)		SHEET No. 89

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005





LEGEND:

- 5.0m ASPHALT ACCESS ROAD (SEE DETAIL ON DWG. 79 - SWM POND DETAILS)
- REINFORCED GRASSED EMERGENCY SPILLWAY 100mm TOPSOIL & SOD UNDERLAIN BY 300mm GRANULAR B
- 98.30 PROPOSED ELEVATION
- PROPOSED ELEVATION / EXISTING ELEVATION
- 291.00 EXISTING CONTOUR ELEVATION
- OVERLAND FLOW DIRECTION
- 3:1 SLOPE UNLESS OTHERWISE INDICATED
- 100 YEAR WATER LEVEL 96.92
- RIP RAP AS SPECIFIED
- PHASE LINE
- RETAINING WALL

NOT FOR CONSTRUCTION

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100090626
2020-07-27
PROVINCE OF ONTARIO

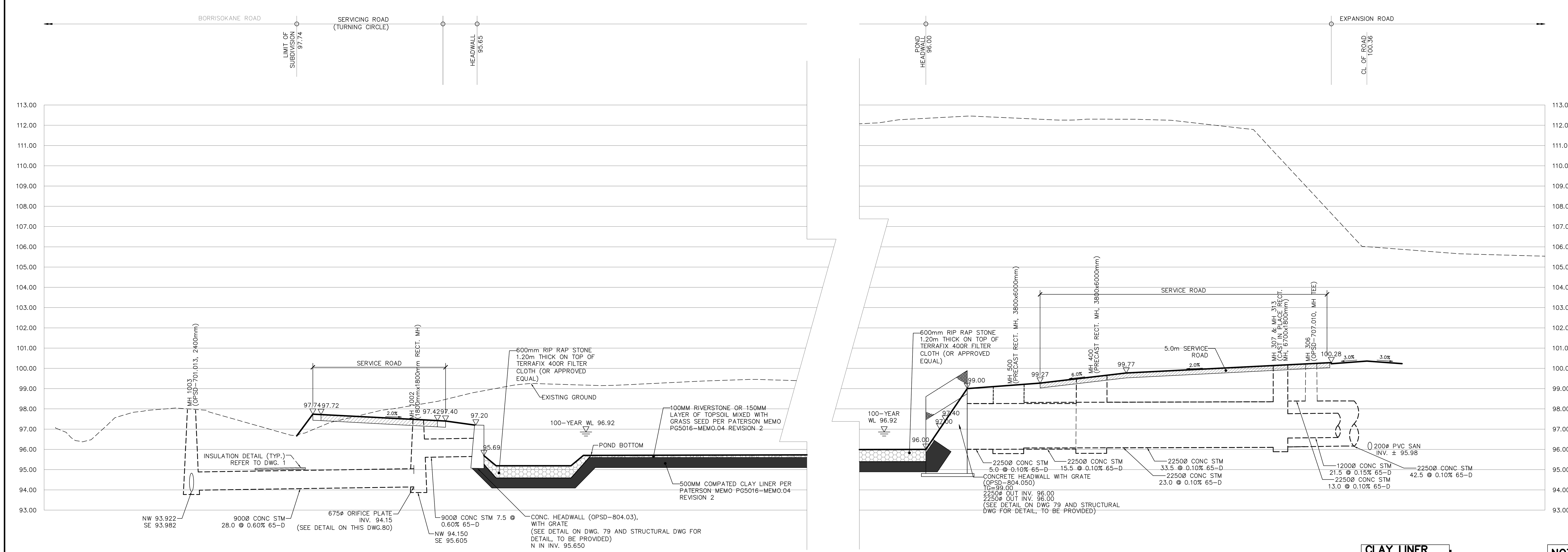
Ottawa CITY OF OTTAWA

SWM POND

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No.	18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: HORIZ. 1:750 (0 10 20 30)		SHEET No.	77

CITY PLAN No. 17803

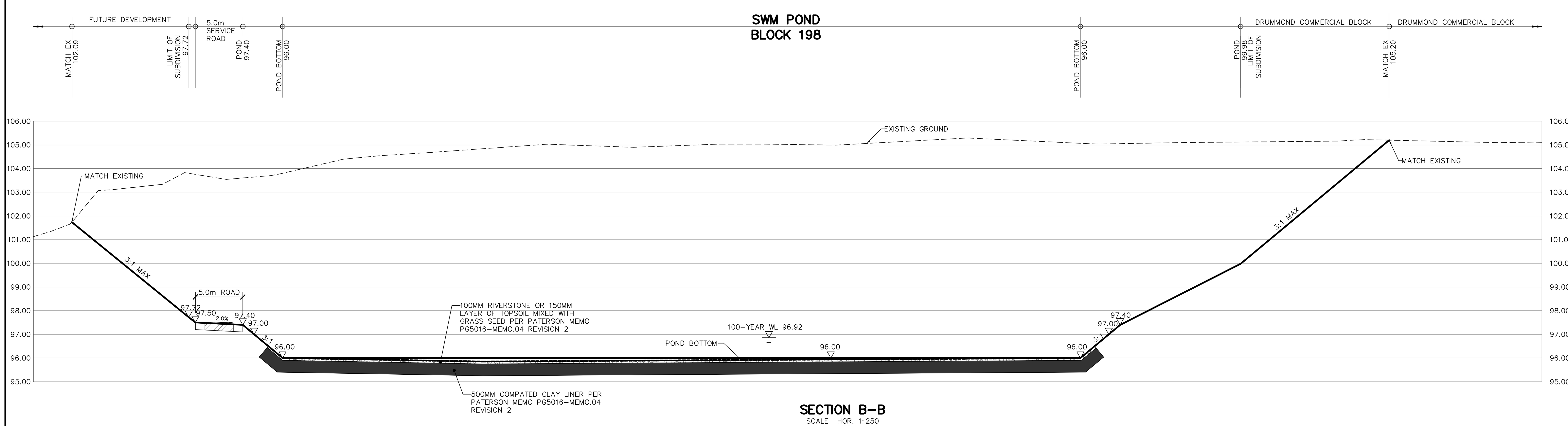
CITY FILE No. D07-16-19-0005



SECTION A–A
SCALE HOR. 1:250
VER. 1:100

CLAY LINER NOTE:
CLAY LINER TO BE INSTALLED PER PATERSON MEMO PG5016–MEMO.04 REVISION 2

NOTE:
FOR GEOTECHNICAL SWMP REVIEW REFER TO PATERSON MEMO PG5016–MEMO.04 REVISION 2



SECTION B–B
SCALE HOR. 1:250
VER. 1:100

NOT FOR CONSTRUCTION

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6	A.D.F.	20–07–27	5TH SUBMISSION
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LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 2020-07-27 PROVINCE OF ONTARIO

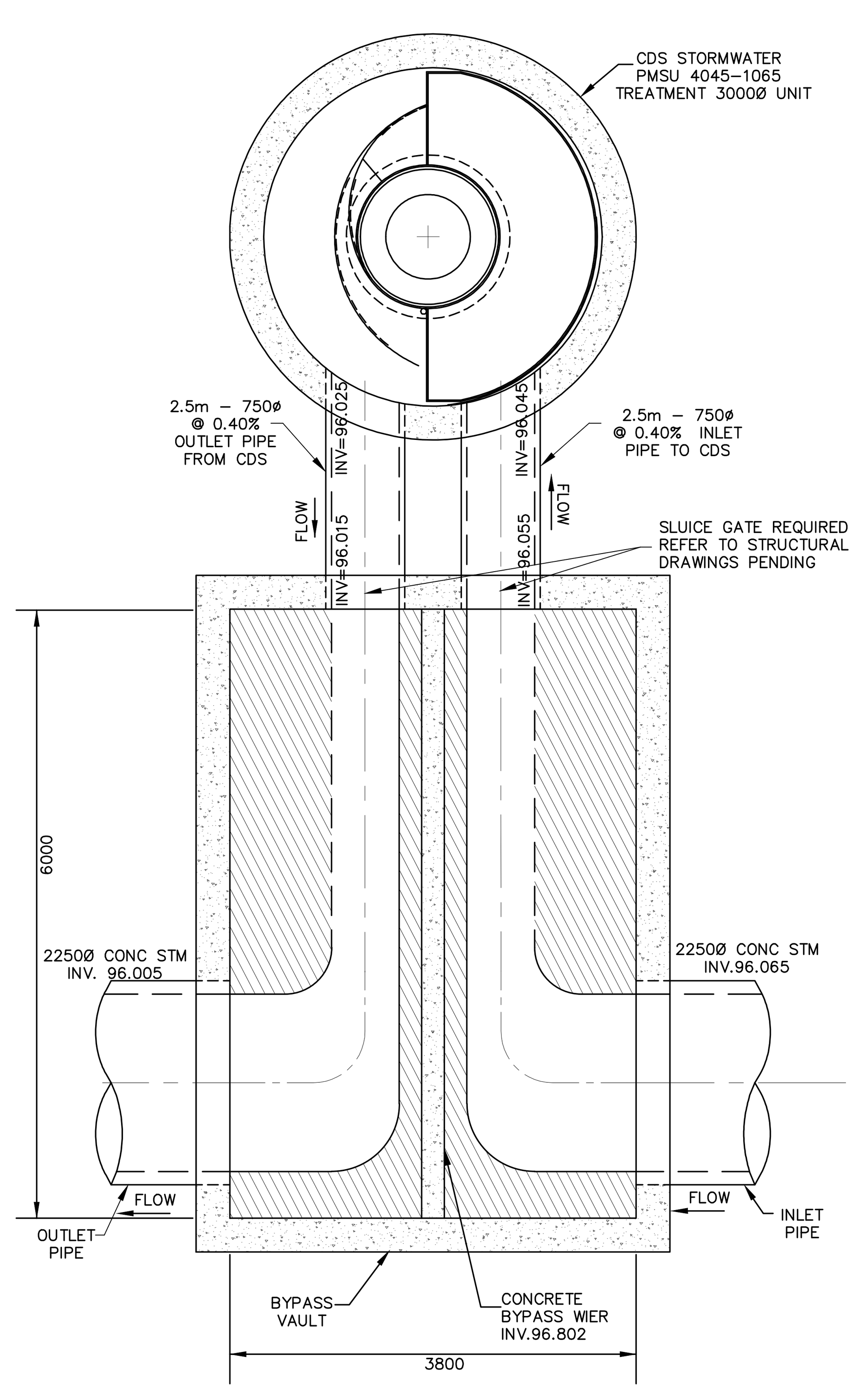
CITY OF OTTAWA

SWM POND SECTIONS

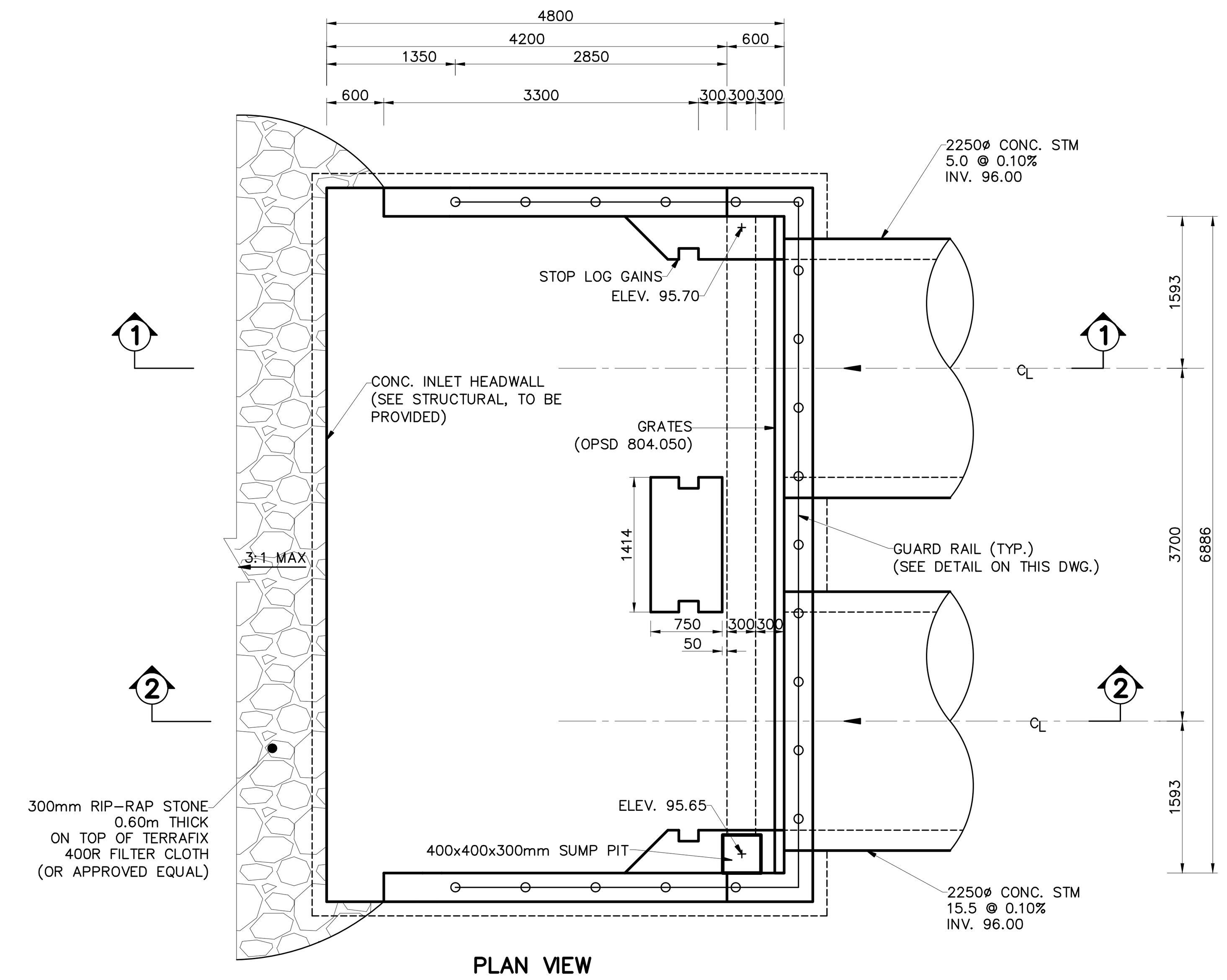
DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030	
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: AS SHOWN		SHEET No. 78	

CITY PLAN No. 17803

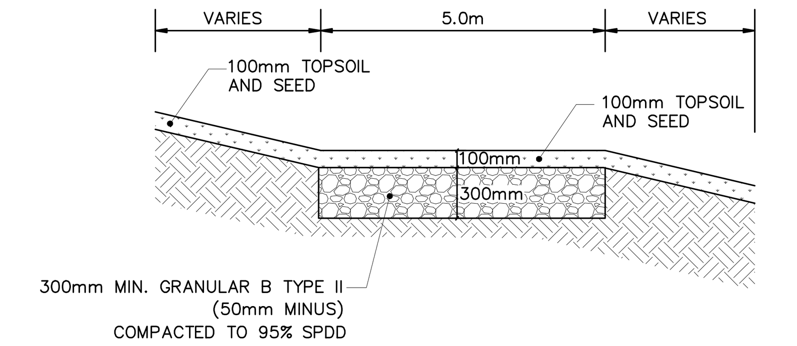
CITY FILE No. D07-16-19-0005



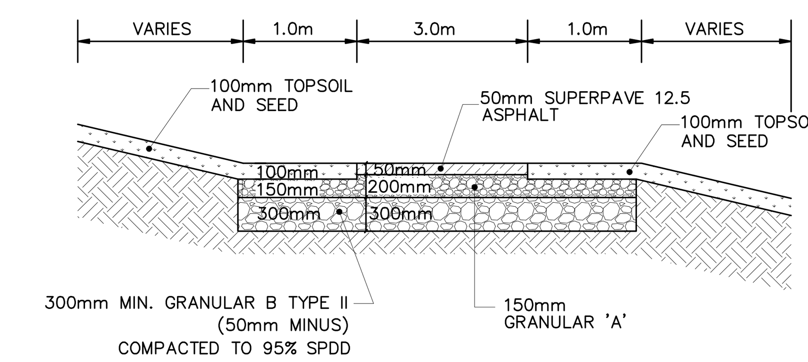
OGS 2 DETAIL
N.T.S



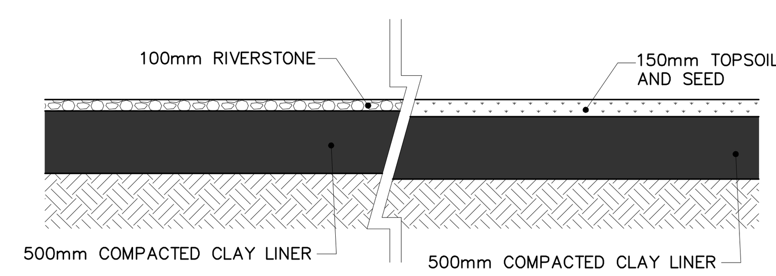
PLAN VIEW
CONC. INLET HEADWALL
(SEE STRUCTURAL DWG., TO BE PROVIDED)
SCALE: N.T.S.



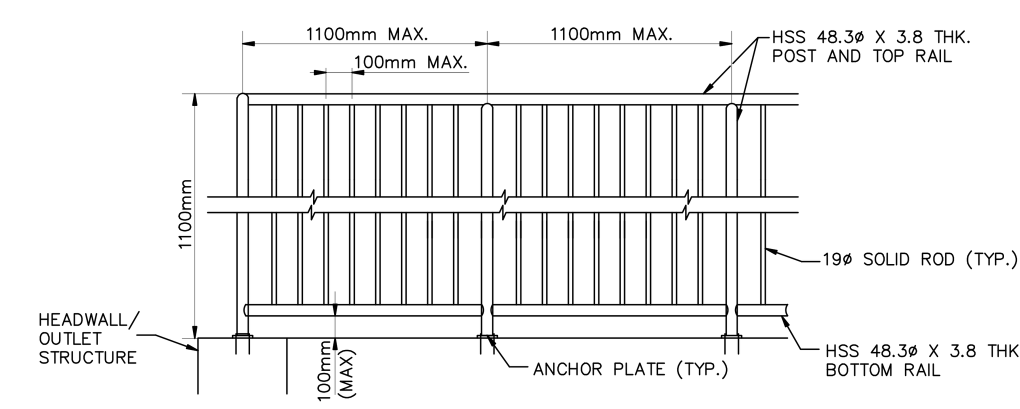
5.0m GRASS REINFORCED SERVICE ROAD
SCALE: N.T.S.



5.0m SERVICE ROAD SECTION
(3.0m ASPHALT PAVEMENT)
SCALE: N.T.S.

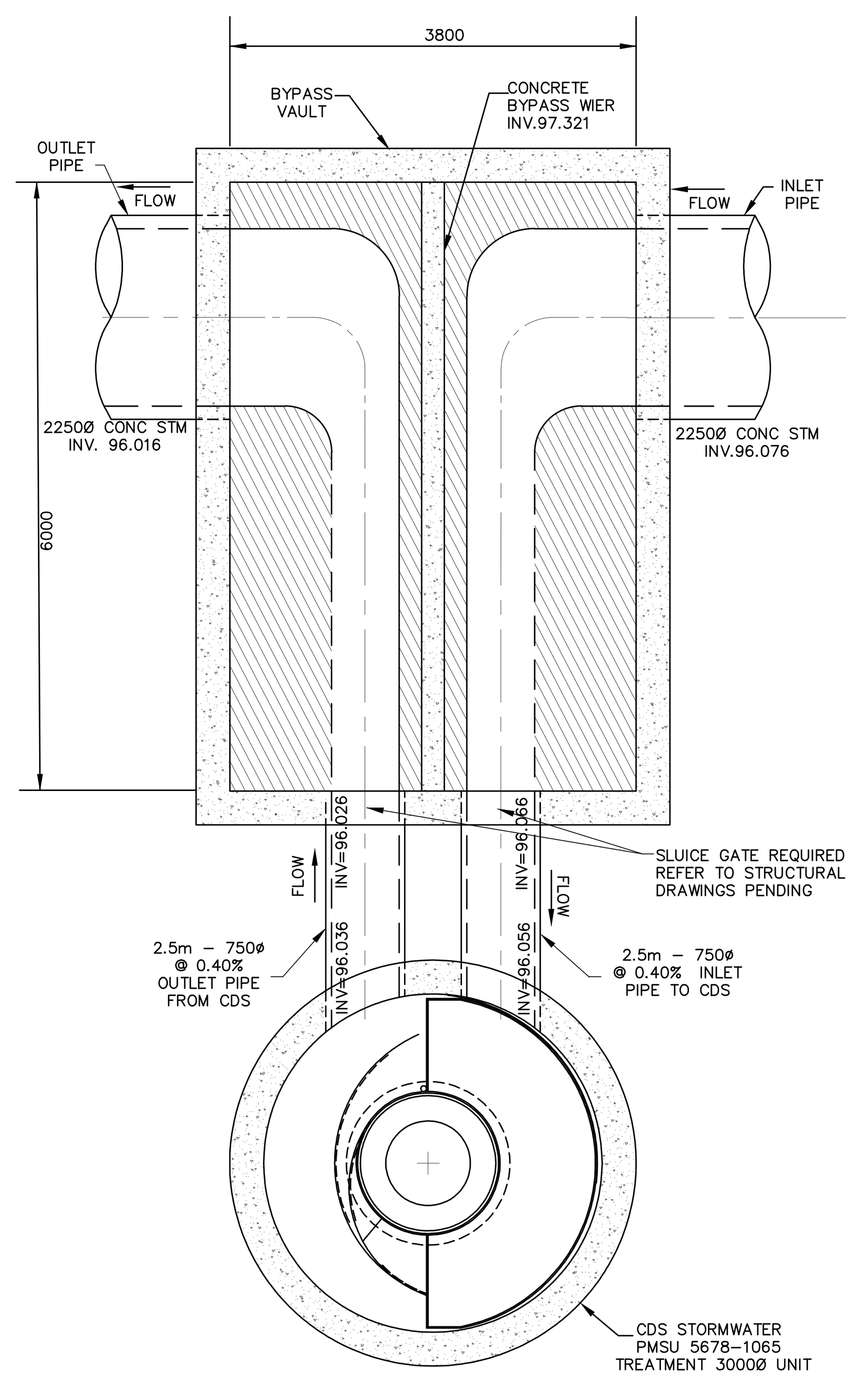


POND CLAY LINER DETAIL
(SEE PATERSON MEMO PG5016-MEMO.04 REVISION 2 FOR DETAILS)
SCALE: N.T.S.

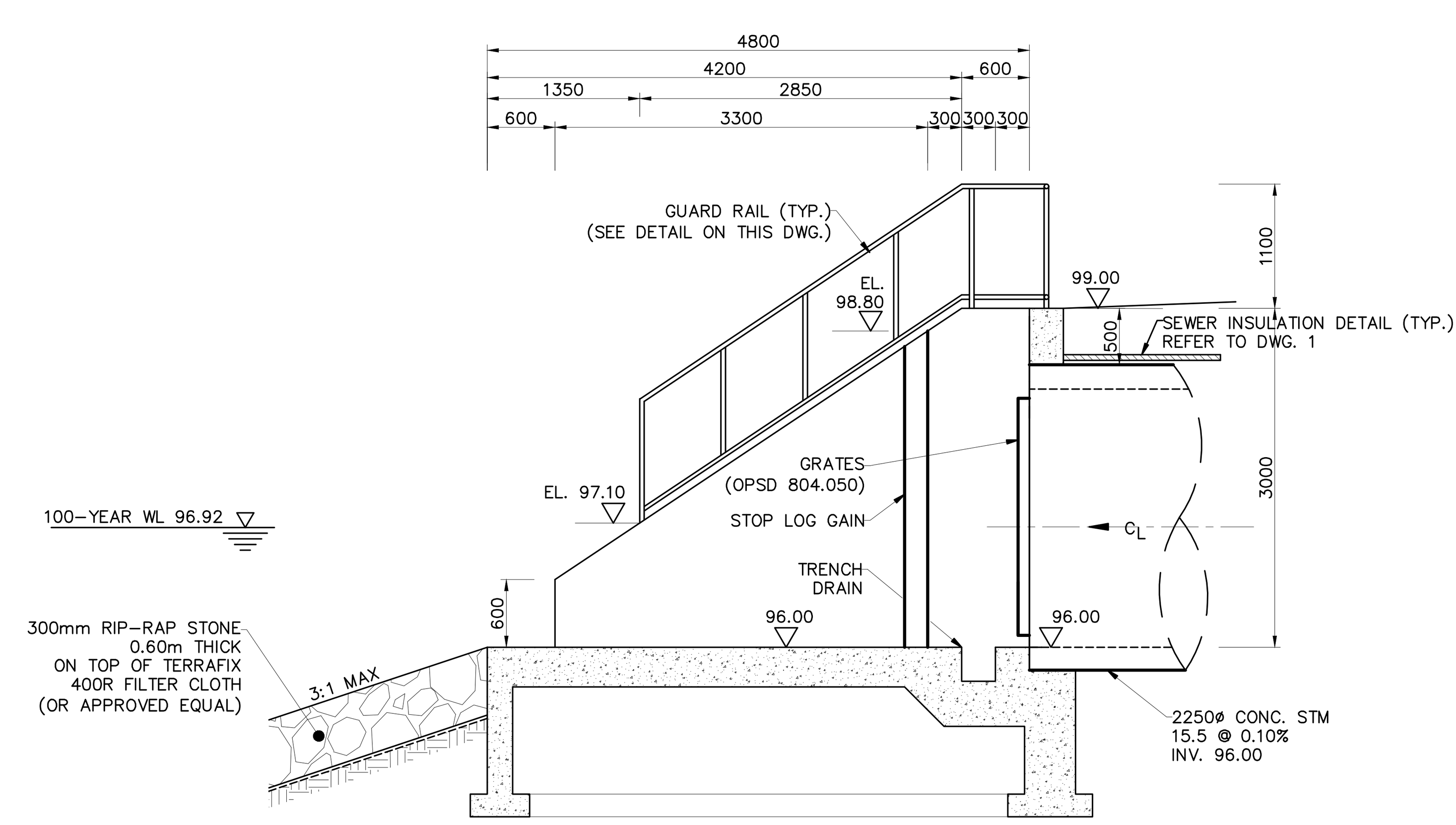


GALVANIZED STEEL RAILING DETAIL
(SEE STRUCTURAL DWG. FOR DETAILS)
SCALE: N.T.S.

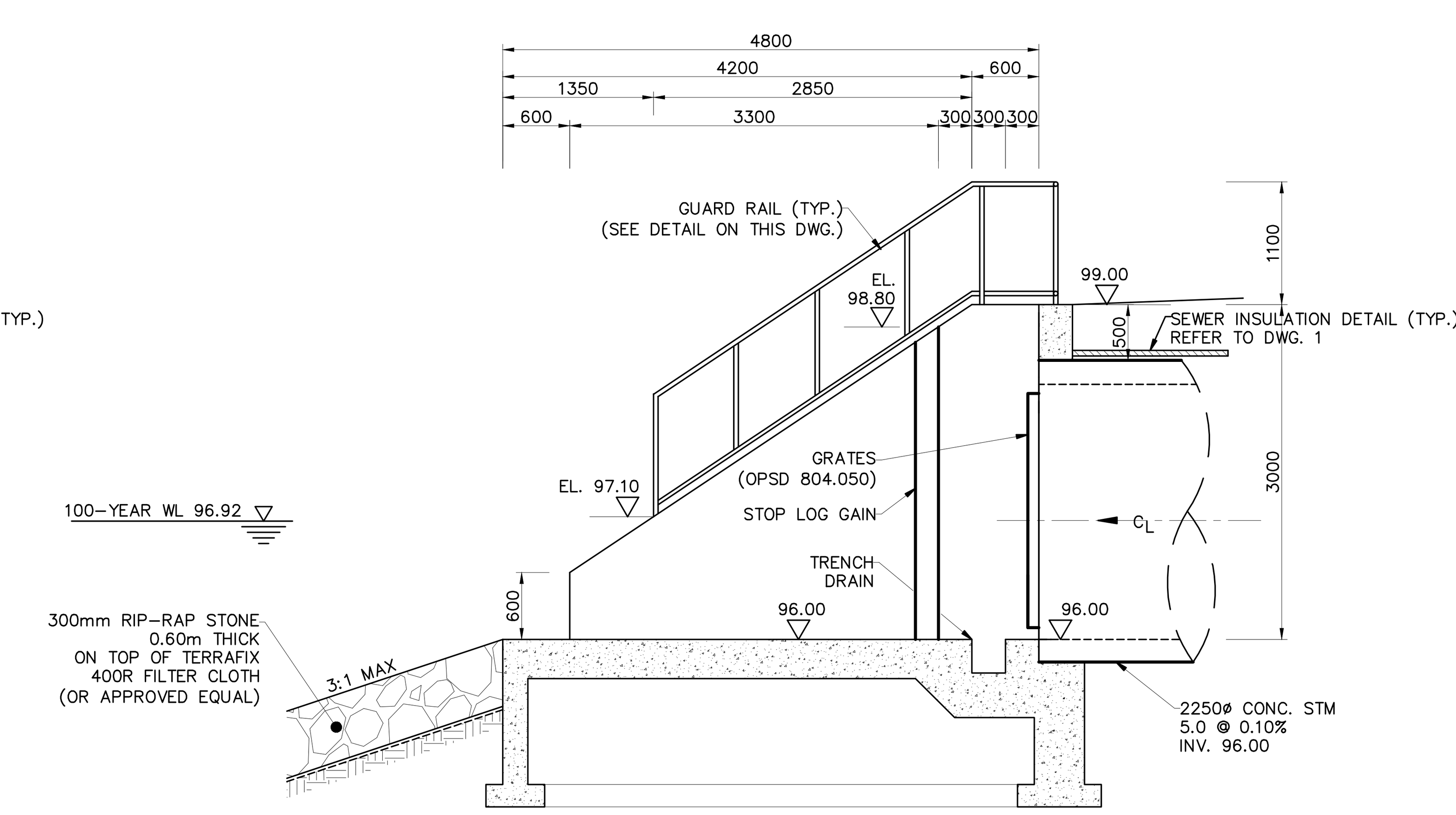
NOTE:
FOR GEOTECHNICAL SWMP REVIEW REFER TO PATERSON MEMO PG5016-MEMO.04 REVISION 2



OGS 1 DETAIL
N.T.S



SECTION 2-2
CONC. INLET HEADWALL
(SEE STRUCTURAL DWG. TO BE PROVIDED)
SCALE: N.T.S.



SECTION 1-1
CONC. INLET HEADWALL
(SEE STRUCTURAL DWG. TO BE PROVIDED)
SCALE: N.T.S.

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
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LICENSED PROFESSIONAL ENGINEER
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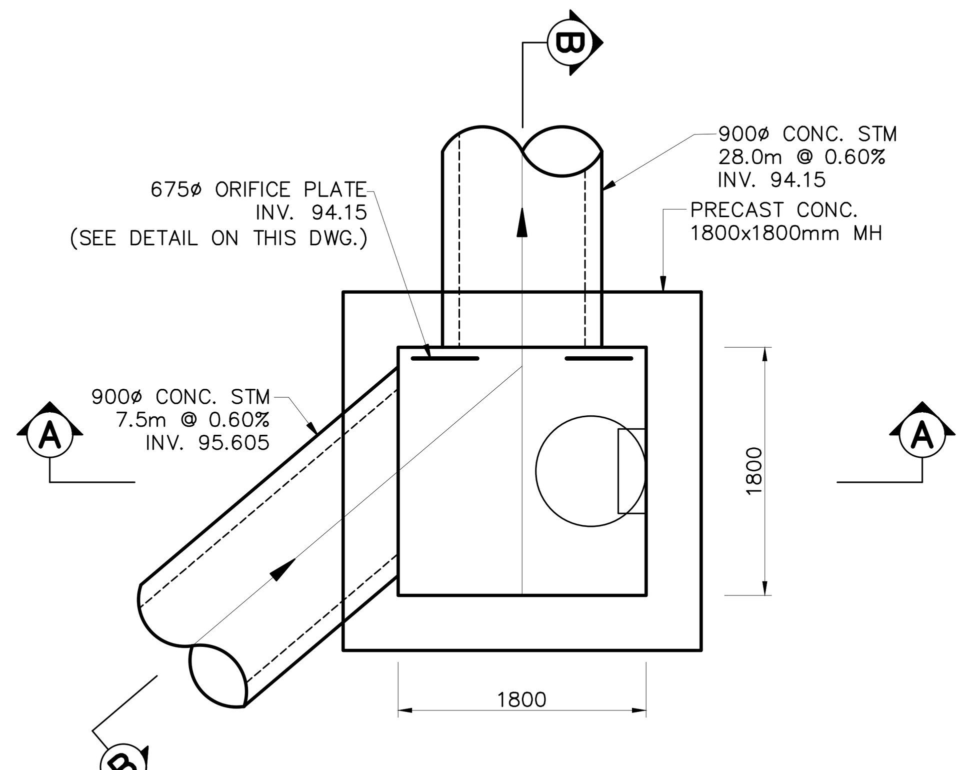
100090628
2020-07-27
PROVINCE OF ONTARIO

CITY OF OTTAWA

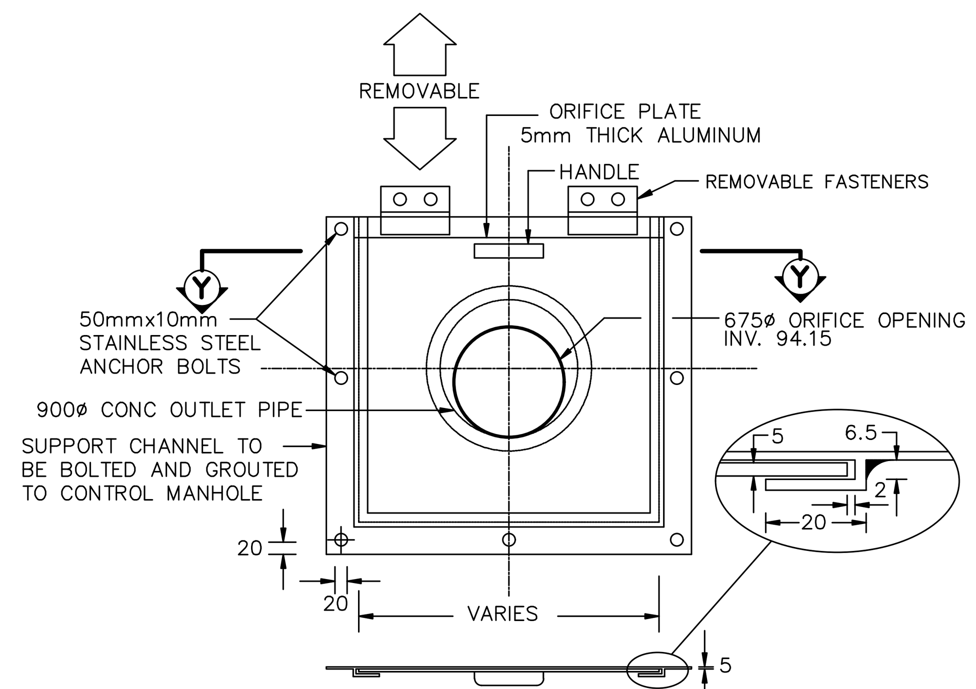
SWM POND DETAILS

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No.	18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: AS SHOWN		SHEET No.	79

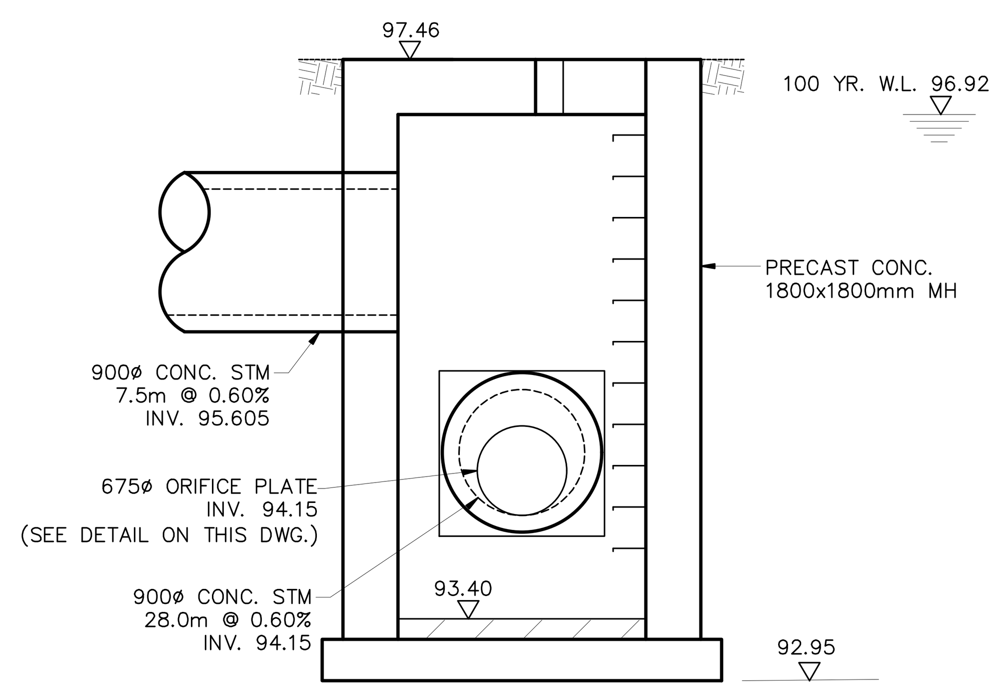
CITY PLAN No. 17803
CITY FILE No. D07-16-19-0005



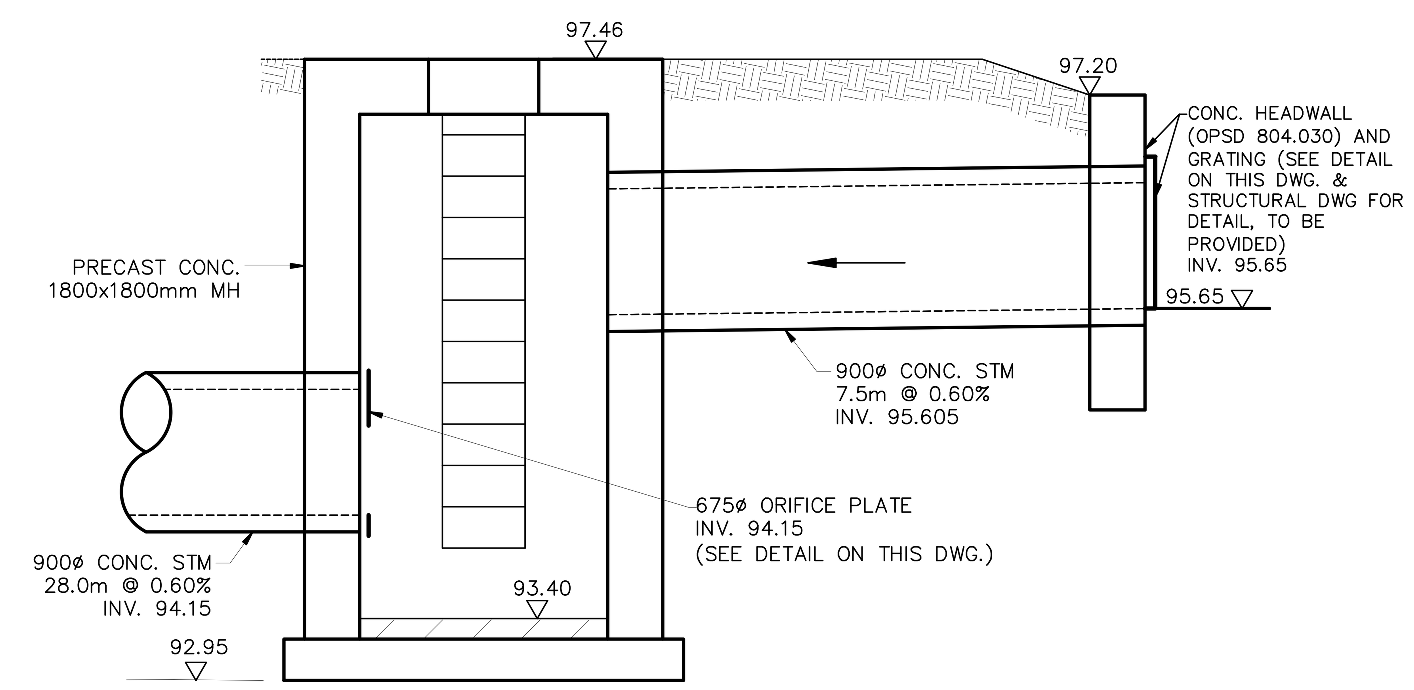
PLAN VIEW
SCALE: N.T.S.



SECTION Y–Y
ORIFICE PLATE DETAIL
SCALE: N.T.S.

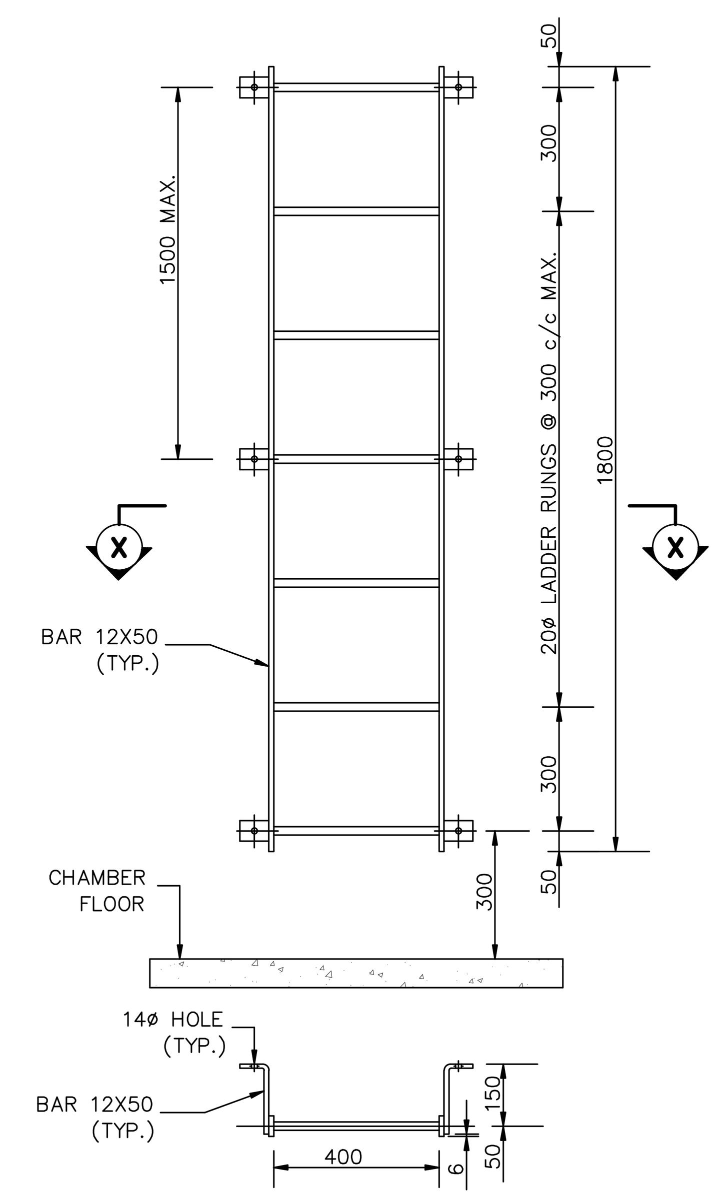


SECTION A–A



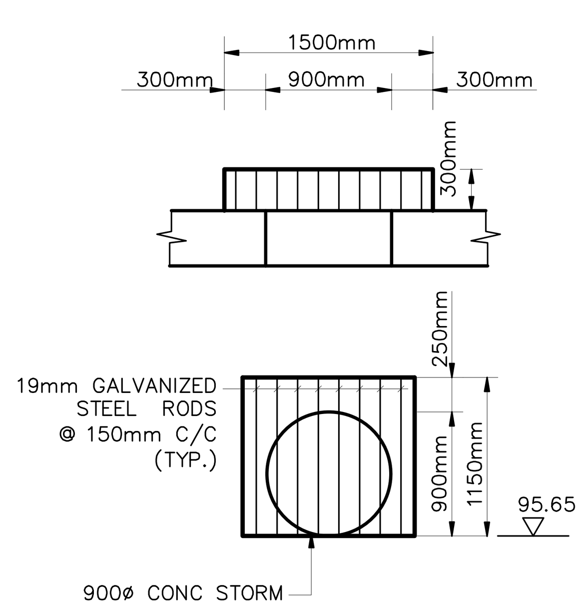
SECTION B–B

OUTLET STRUCTURE DETAIL
(SEE STRUCTURAL DRAWING FOR DETAILS, TO BE PROVIDED)
SCALE N.T.S.



SECTION X–X

ACCESS LADDER DETAIL
(SEE STRUCTURAL DRAWING FOR DETAILS, TO BE PROVIDED)
SCALE: N.T.S.



900ø PIPE GRATE ON HEADWALL
(SEE STRUCTURAL DRAWING FOR DETAILS, TO BE PROVIDED)
SCALE N.T.S.

NOTE:
FOR GEOTECHNICAL SWMP REVIEW REFER TO PATERSON MEMO PG5016-MEMO.04 REVISION 2

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
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LICENSED PROFESSIONAL ENGINEER
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100090626
2020-07-27
PROVINCE OF ONTARIO

CITY OF OTTAWA

SWM POND DETAILS

DRAWN BY: G.G.G.
CHECKED BY: A.D.F.
DESIGNED BY: C.M.K.
CHECKED BY: A.D.F.
SCALE: AS SHOWN
PROJECT No. 18-1030
SHEET No. 80

CITY PLAN No. 17803
CITY FILE No. D07-16-19-0005

ECHELON ENVIRONMENTAL
505 Hood Road Unit 26 Markham ON L3R 5V6
Tel: (905) 948-0000 Fax: (905) 948-0577
E-mail: info@echelonenvironmental.ca

July 29, 2020

David Schaeffer Engineering Ltd.
120 Iber Road, Unit 103
Stittsville, ON
K2S 1E9

Attention: Mr. Steve Merrick, P.Eng.

RE: CDS Oil/Grit Separator for Brazeau Subdivision, Ottawa

Site Specific Data

The proposed CDS design is based on site-specific data provided by David Schaeffer Engineering Ltd. Please note the upstream external areas were not accounted for in terms of sediment loading as it is clean water, however, the additional flow generated from these external areas are accounted for in the sizing of the OGS' as the 22mm and 100-year flows. The following table provides a summary of the hydrologic parameters specific to the application.

Design Parameters	OGS 1	OGS 2
Total Drainage Area (ha):	18.38	16.62
Site Imperviousness:	67%	67%
Particle Size Distribution:	FINE	FINE
Level of Protection Required:	Enhanced (MOE Level 1)	Enhanced (MOE Level 1)
Estimated Peak Flowrate, Q_{100}:	5575 L/s	4585 L/s

Selected CDS Model

The selected CDS model and its standard capacities are summarized in the table below:

	OGS 1	OGS 2
CDS Model:	PMSU5668_10	PMSU5668_10
Sump Capacity (L):	8,896	8,896
Total Holding Capacity (L):	25,960	25,960
Oil Capacity (L):	4,435	4,435

Att: A) CDS TSS Calculations
B) CDS General Cut Sheet Drawings
C) MOE NETE Approval Certificate

Appendix A
CDS TSS Calculations

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name: Brazeau Subdivision
Location: Ottawa, ON
OGS #: 1

Engineer: DSEL
Contact: Steve Merrick, P.Eng.
Report Date: 29-Jul-20

Area	18.380	ha
Weighted C	0.69	
CDS Model	5668	(OFFLINE)

Rainfall Station #	215	
Particle Size Distribution	FINE	
CDS Treatment Capacity	538	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
1.0	10.6%	19.8%	35.0	35.0	6.5	97.0	10.3
1.5	9.9%	29.7%	52.5	52.5	9.8	96.1	9.5
2.0	8.4%	38.1%	70.0	70.0	13.0	95.1	8.0
2.5	7.7%	45.8%	87.5	87.5	16.3	94.2	7.2
3.0	5.9%	51.7%	105.0	105.0	19.5	93.3	5.5
3.5	4.4%	56.1%	122.5	122.5	22.8	92.3	4.0
4.0	4.7%	60.7%	140.0	140.0	26.0	91.4	4.3
4.5	3.3%	64.0%	157.5	157.5	29.3	90.5	3.0
5.0	3.0%	67.1%	175.0	175.0	32.5	89.5	2.7
6.0	5.4%	72.4%	210.0	210.0	39.0	87.7	4.7
7.0	4.4%	76.8%	245.0	245.0	45.5	85.8	3.7
8.0	3.5%	80.3%	280.0	280.0	52.0	83.9	3.0
9.0	2.8%	83.2%	315.0	315.0	58.5	82.1	2.3
10.0	2.2%	85.3%	350.0	350.0	65.0	80.2	1.8
15.0	7.0%	92.3%	525.0	525.0	97.6	70.9	5.0
20.0	4.5%	96.9%	700.0	538.1	100.0	54.0	2.5
25.0	1.4%	98.3%	875.0	538.1	100.0	43.2	0.6
30.0	0.7%	99.0%	1050.0	538.1	100.0	36.0	0.2
35.0	0.5%	99.5%	1225.0	538.1	100.0	30.8	0.1
40.0	0.5%	100.0%	1400.0	538.1	100.0	27.0	0.1
45.0	0.0%	100.0%	1575.0	538.1	100.0	24.0	0.0
50.0	0.0%	100.0%	1750.1	538.1	100.0	21.6	0.0
							87.6

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 81.1%

Predicted Annual Rainfall Treated = 97.5%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name: Brazeau Subdivision　　**Engineer:** DSEL
Location: Ottawa, ON　　**Contact:** Steve Merrick, P.Eng.
OGS #: 2　　**Report Date:** 29-Jul-20

Area 16.620 ha　　**Rainfall Station #** 215
Weighted C 0.69　　**Particle Size Distribution** FINE
CDS Model 5668 (OFFLINE)　　**CDS Treatment Capacity** 538 l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
1.0	10.6%	19.8%	31.6	31.6	5.9	97.2	10.3
1.5	9.9%	29.7%	47.5	47.5	8.8	96.3	9.5
2.0	8.4%	38.1%	63.3	63.3	11.8	95.5	8.0
2.5	7.7%	45.8%	79.1	79.1	14.7	94.6	7.3
3.0	5.9%	51.7%	94.9	94.9	17.6	93.8	5.6
3.5	4.4%	56.1%	110.8	110.8	20.6	93.0	4.0
4.0	4.7%	60.7%	126.6	126.6	23.5	92.1	4.3
4.5	3.3%	64.0%	142.4	142.4	26.5	91.3	3.0
5.0	3.0%	67.1%	158.2	158.2	29.4	90.4	2.7
6.0	5.4%	72.4%	189.9	189.9	35.3	88.7	4.8
7.0	4.4%	76.8%	221.5	221.5	41.2	87.1	3.8
8.0	3.5%	80.3%	253.2	253.2	47.1	85.4	3.0
9.0	2.8%	83.2%	284.8	284.8	52.9	83.7	2.4
10.0	2.2%	85.3%	316.5	316.5	58.8	82.0	1.8
15.0	7.0%	92.3%	474.7	474.7	88.2	73.6	5.1
20.0	4.5%	96.9%	633.0	538.1	100.0	59.7	2.7
25.0	1.4%	98.3%	791.2	538.1	100.0	47.7	0.7
30.0	0.7%	99.0%	949.5	538.1	100.0	39.8	0.3
35.0	0.5%	99.5%	1107.7	538.1	100.0	34.1	0.2
40.0	0.5%	100.0%	1266.0	538.1	100.0	29.8	0.2
45.0	0.0%	100.0%	1424.2	538.1	100.0	26.5	0.0
50.0	0.0%	100.0%	1582.5	538.1	100.0	23.9	0.0
							88.7

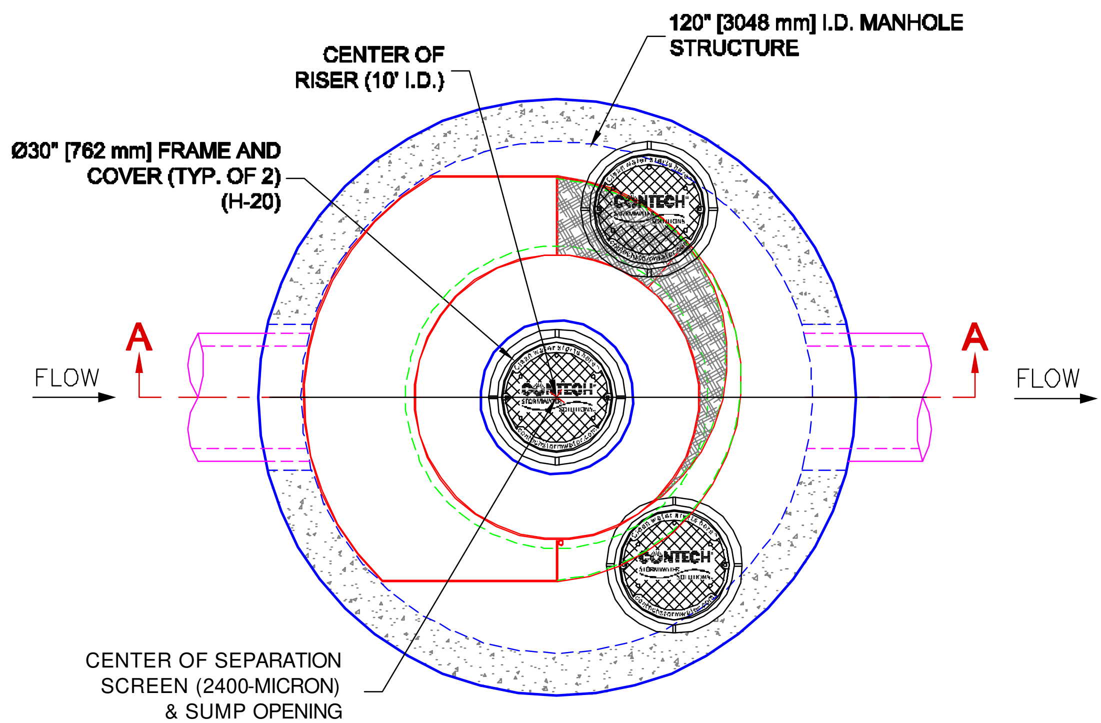
Removal Efficiency Adjustment[2] = 6.5%
Predicted Net Annual Load Removal Efficiency = 82.2%
Predicted Annual Rainfall Treated = 98.0%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

Appendix B

CDS General Cut Sheet Drawings

PLAN VIEW

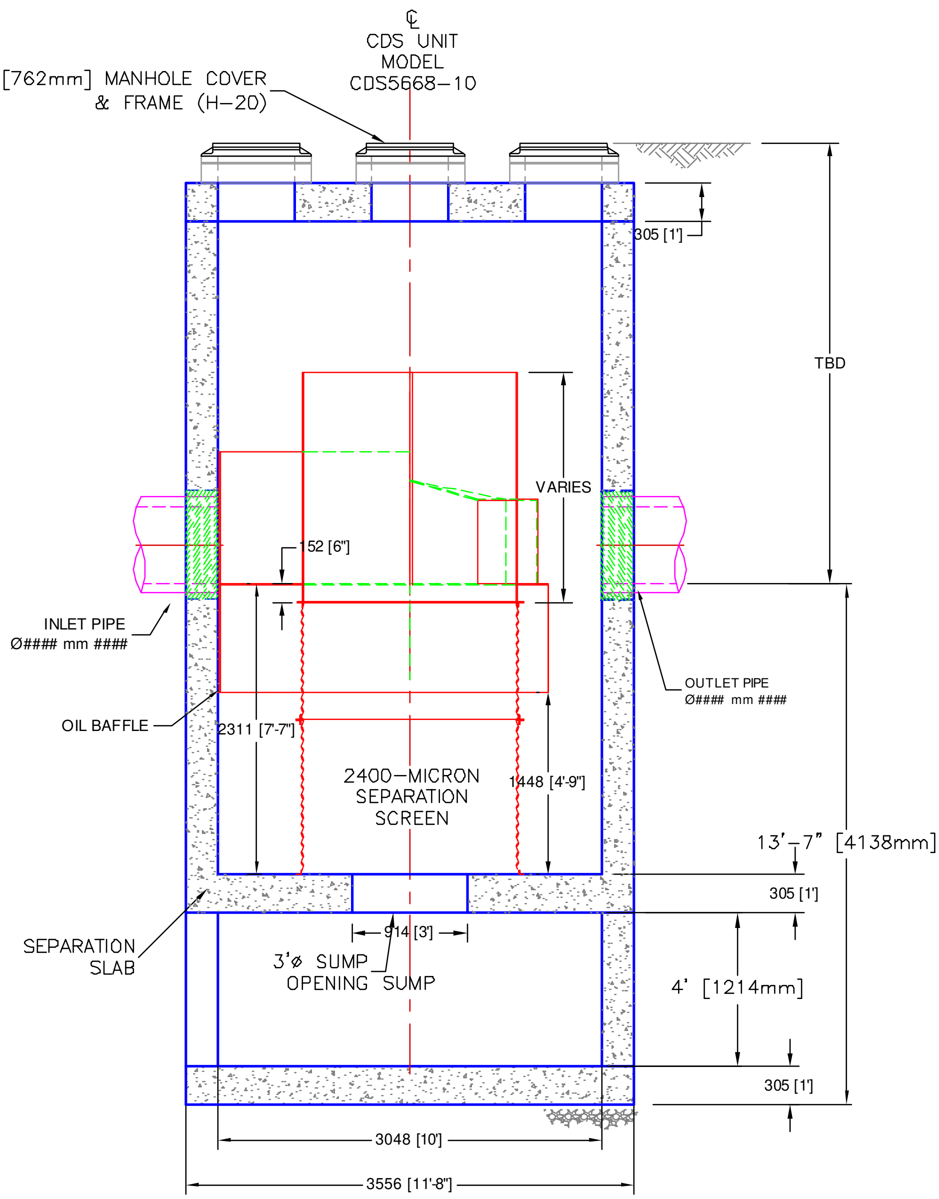


CDS MODEL PMSU56_68_10, 538 L/S TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB#	###/##-##-###	SCALE 1" = 5'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	1
		APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions, Inc. 200 Enterprise Drive, Scarborough, ME, 04074 Ph: 207-885-9830 Fax: 207-885-9825

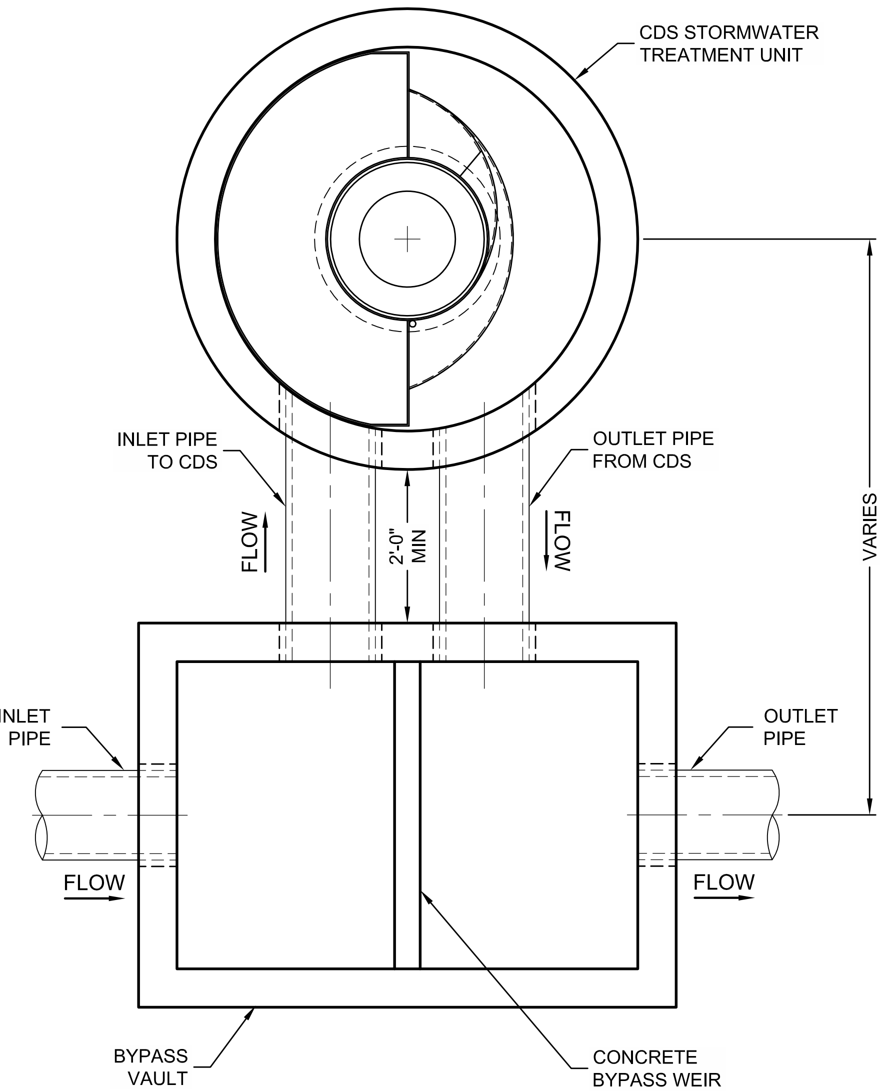
SECTION A-A VIEW



CDS MODEL PMSU56_68_10, 538 L/S TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB#	###/##-##-###	SCALE 1" = 6'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	2
		APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions, Inc. 200 Enterprise Drive, Scarborough, ME, 04074 Ph: 207-885-9830 Fax: 207-885-9825



THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS STORMWATER TREATMENT SYSTEM TYPICAL OFFLINE LAYOUT WITH BYPASS VAULT STRUCTURE

DATE:03/12/13	SCALE: NONE	PROJECT No.: N/A	SEQ. No.: N/A	DRAWN: N/A	CHECKED: N/A

Appendix C
MOE NETE Approval Certificate

TECHNOLOGY ASSESSMENT • TECHNOLOGY ASSESSMENT

CERTIFICATE

OF TECHNOLOGY ASSESSMENT

CDS™ Technologies

*The Ontario Ministry of the Environment has reviewed the solid/liquid separation system developed by **CDS™ Technologies**. Based on the review of the documentation submitted by the company (see the Notable Aspects section and Appendix), and data from pilot-scale testing and full-scale operations conducted by various agencies, the Ministry concludes that the continuous deflection separation (CDS™) system can provide useful removal of solids and floatables as part of a stormwater management system.*

The CDS™ Technologies may be able to provide "basic to advanced" level of protection when used alone, maintained for effective operation, and when appropriately designed for the development area to be serviced. CDS™ units may also be used for pretreatment in combination with other non-proprietary technologies such as man-made wetlands, treatment ponds and infiltration basins.

John Mayes, (A) Director
Standards Development Branch
Ministry of the Environment
(September 2006)

New Environmental Technology Evaluation Program

Promoting the development and application of new environmental technologies

Ontario

TECHNOLOGY ASSESSMENT • TECHNOLOGY ASSESSMENT

Printed on 100% post-consumer recycled paper

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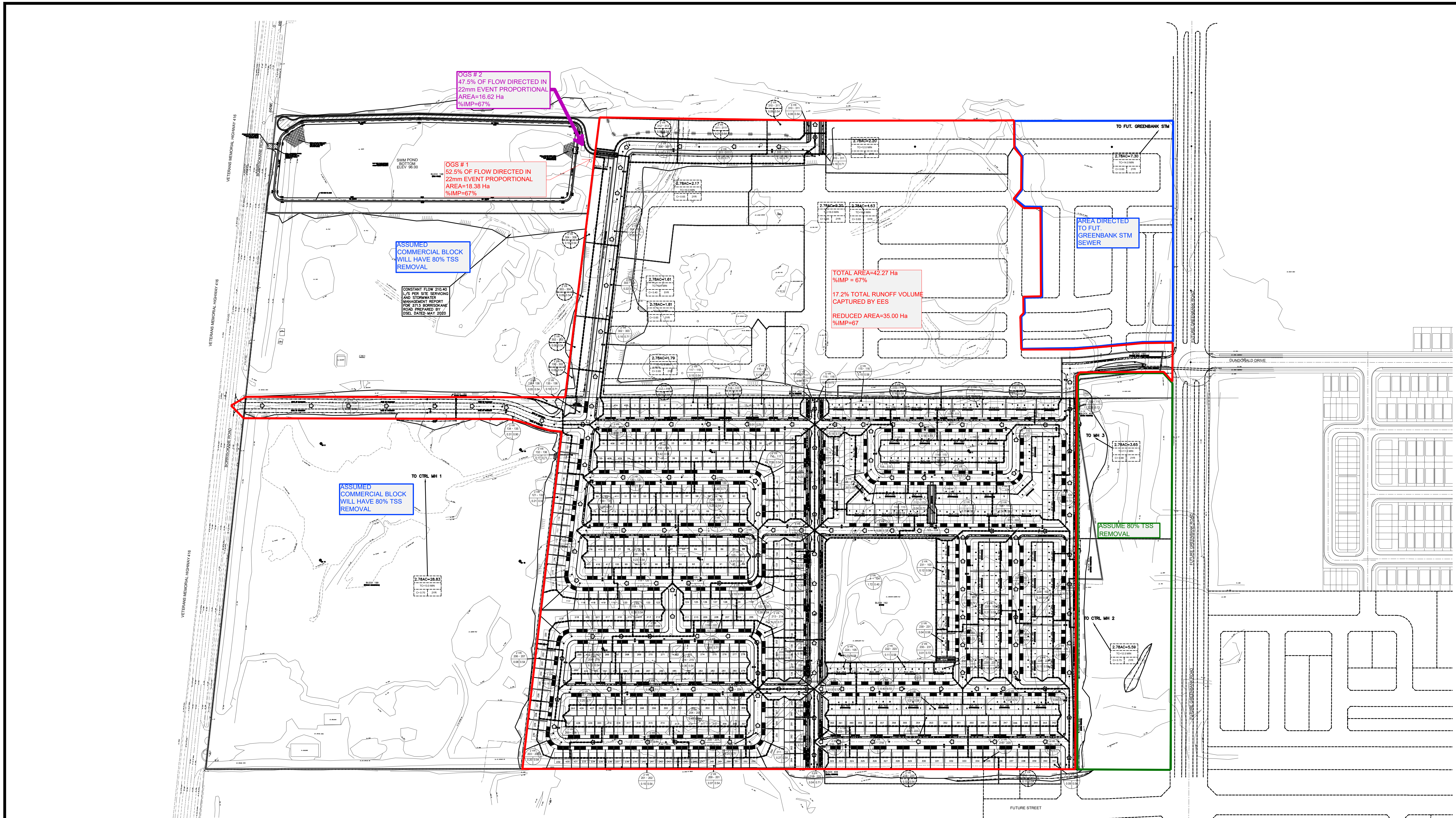

DSEL
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Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

CAIVAN COMMUNITIES - THE RIDGE PHASE 1

CITY OF OTTAWA

OGS DRAINAGE AREA FIGURE

SCALE:	1:4000	PROJECT No.:	18-1030
DATE:	JULY 2020	FIGURE:	1 of 1

5.8 Analysis of EES Results

5.8.1 BSUEA Site Wide Infiltration with EES

A water budget analysis was carried out as part of the Existing Condition Report (Section B6, Appendix B). This analysis revealed that pre-development infiltration across the BSUEA accounted for 40% of the total precipitation based on long-term simulations. Based on the post-development simulation results, the water budget for the overall BSUEA lands is shown in Table 5-8 below and compared in the table with the existing conditions water budget. The use of the EES along the local road network within the BSUEA lands achieves an infiltration of 44% which is greater than under existing conditions, which shows that infiltration within ±10% of existing is achievable. It should be noted that this analysis has excluded the Brazeau and Drummond properties which have been assumed to integrate measures to promote infiltration and preserve pre-infiltration rates along both properties separately from the remaining BSUEA. Further refinements to the high level infiltration concept, including sizing of the EES, can be investigated during detailed design.

Table 5-8: BSUEA EES Water Budget Results

Water Budget Component	Annual Average Depth (mm)	Budget (%)	Existing Condition Budget (%)
Precipitation	844	100%	100%
Evapotranspiration	231	27%	60%
Infiltration	377	44%	40%
Surface Runoff	225	27%	0%

5.8.2 Minto Lands

5.8.2.1 Major System Cascading and Ponding Levels

The simulated elevations along the major overland system nodes are shown in Table 5-9 and Table 5-10. There is no ponding during the 1:5 year event or 1:10 year event for local/collector roads and arterial roads, while the depth of flow along the major system is maintained to or below 350 mm during the 1:100 year event.

Table 5-9: Minto EES Local and Collector Road Major Node Depths

Major System Node	3 hr Chi 1:5 yr Ponding Depth (mm)	24 hr SCS 1:5 yr Ponding Depth (mm)	3 hr Chi 1:100 yr Ponding Depth (mm)	24 hr SCS 1:100 yr Ponding Depth (mm)
S_110-111	10	10	350	210
S_111-112	10	10	250	30
S_150-152	10	10	210	160
S_152-154	10	10	80	70

5.4.3 Stormwater Management Facilities (SWMFs)

The SWMFs, either wet ponds or dry ponds, should be designed in accordance with Section 8 of the OSDG and MOE's publication entitled "SWM Planning and Design Manual, 2003".

The normal water level in the wet ponds should be above the highest elevation of either: (i) the free flowing water level in the downstream storm sewer during the 1:2 year event; or (ii) the elevation of the underlying groundwater table.

For safety reasons, the live storage in dry ponds should be kept to 1.5 m (OSDG) to 2.0 m deep (MOE). A minimum 300 mm freeboard should be provided between the 1:100 year water surface elevation and the overflow elevation.

SWMFs should be integrated into the community through the use of pathways or other linkages.

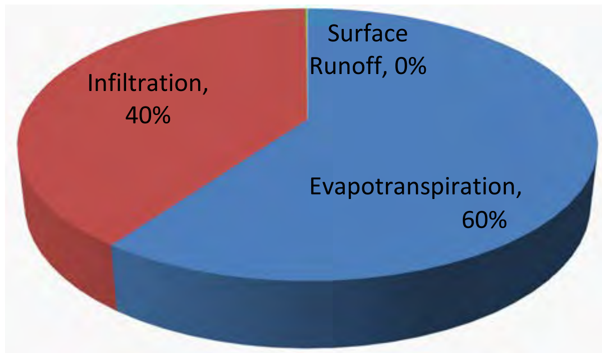
5.4.4 Water Balance

The Hydrogeological Existing Conditions Report (Paterson Group Inc., 2017) recommended that infiltration measures be incorporated into the BSUEA's storm servicing design, as the subject area contributes to groundwater recharge of the esker, which should be preserved. The Paterson Group Inc. (Paterson) Report recommended that:

- Distributed infiltration be achieved to promote recharge of overburden aquifer and preserve the pre-infiltration condition for the three (3) subwatersheds; and,
- Only captured runoff that is relatively free of roadway salts be infiltrated to minimize adverse impacts on the esker.

An analysis (using the PCSWMM software platform) was carried out and is summarized in the Existing Condition Report (Appendix B) to determine the various contributions of the water budget based on long-term simulations. To simulate the infiltration, the analysis utilized measured data compiled as part of Paterson's field program. Infiltration to groundwater recharge zones was simulated based on measured saturated field hydraulic conductivity, which was translated to infiltration rates (refer to Section B6.1.1 of Appendix B). The analysis revealed that overall pre-development infiltration from the subject site (excluding the aggregate extraction areas) accounted for 40% of the overall water budget (Figure 5-2). The City and RVCA have agreed with Paterson's recommendation that pre-development infiltration levels should be maintained and distributed infiltration be achieved across the site, and should not be concentrated at one or two location(s).

Figure 5-2: Existing Water Budget Breakdown



5.5 Storm Servicing Strategy

Based on the storm drainage connections and criteria set out in Sections 5.2 and 5.4 respectively, a stormwater management strategy has been developed. The strategy strives to preserve pre-development infiltration across the BSUEA, which in turn, impacts the individual stormwater management strategies developed for each of the servicing areas depicted in Figure 4-2. Sub-section 5.4 presents the rationale in developing storm servicing strategies, Sub-section 5.5.5 the storm drainage and design methodology, Sub-sections 5.7 5.8, and 5.9 present the analyses carried out for the conventional, EES and infiltration gallery servicing strategies, respectively while Sub-section 5.10.2 summarizes the impact of the strategies on the municipal drains.

5.5.1 EES Infiltration Strategy

5.5.1.1 Background

During the preparation of the Existing Condition Report, it became evident that storm servicing for the BSUEA would need to incorporate measures to recharge the overburden aquifer. As a result of extensive work and consultation with the both the City and RVCA over a nine (9) month period, the preferred infiltration servicing strategy has been identified as the Etobicoke Exfiltration System (EES). During this nine (9) month period, a number of Memoranda were prepared to support the selection process. All documents and work undertaken (Memoranda and Presentation) are described below (Sections 5.5.1.1 to 5.5.1.6) and included in Appendix E.

In September 2016, a Memorandum to the City outlined potential infiltration measures that could be considered for the BSUEA. The Memorandum outlined general considerations related to infiltration and nine (9) specific infiltration measures, which ranged from reduced lot grading to infiltration galleries and bio-retention cells. The advice from the City and RVCA following submission of the Memorandum is that infiltration measures should be spread across the site so as to mimic current infiltration patterns and should not rely on infrastructure on private properties. After further review and discussions, the EES was selected as the preferred measure to preserve the water budget and carried forward for further sizing and analysis.

Table 5-13: Minto EES Pond Parameters and Results

Pond Parameter	Dry Pond 1	Dry Pond 2	Western Spill-over Pond
Water Quality	Not Required	Not Required	Not Required
Simulated Release Rate (m^3/s)	1.7	0.5	0.33
Pond Invert (m)	95	95.6	100
Pond Top of Bank (m)	95.75	96.8	100.7
Active Storage Depth (m)	0.75	1.2	1.1
Freeboard (m)	>0.3	>0.3	>0.3
Outlet Elevation (m)	95	95.6	100
Outlet Diameter (m)	0.675	0.375	0.4
Drawdown Time (hrs)	6	12	6
Surface Area (ha)	1.5	1.7	1.2

5.8.3 Mattamy Lands East and Mattamy Lands West

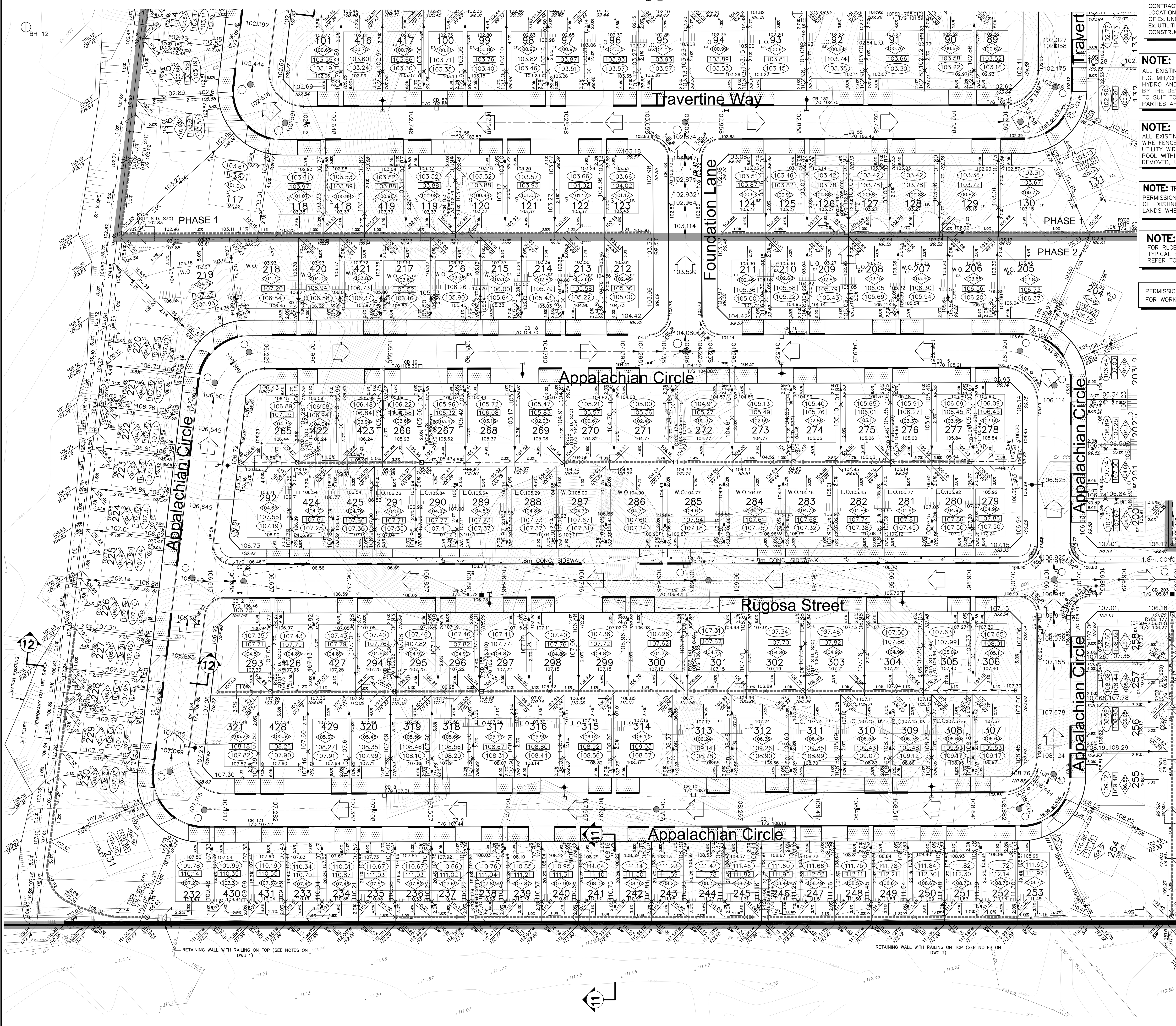
The Mattamy Lands East was modelled at the conceptual level as part of the Half Moon Bay South – Phase 4 Stormwater Management Report (Stantec, 2015) while the minor system of Mattamy Lands West was included in the Draft BSMSSA, Stantec, 2014. Neither of these Reports included an assessment of EES within the storm minor system.

Including the EES within these areas would not alter the stormwater management approach as neither of the Mattamy Lands requires additional water quality control and the MSS designs do not affect major system storage requirements. The use of EES in Mattamy Lands East, however, may improve the downstream HGLs in the Half Moon Bay South subdivision and areas draining to the Todd Pond as exfiltration of clean runoff into the underlying groundwater and esker would be promoted resulting in a reduction in the flow and increase in available capacity in the conventional sewers.

5.8.4 Brazeau and Drummond Aggregate Extraction Areas

The EES has been identified as a suitable strategy on urban development in the BSUEA to achieve distributed infiltration as per the recommendations of Paterson's Existing Conditions Report. Assuming that both aggregate extraction areas are developed as residential, infiltrating clean runoff from local roads can achieve the required infiltration. Alternatively, infiltration galleries could also supplement or replace part of an EES. At detailed design of these properties, the strategy to preserve pre-development infiltration rates will need to be reviewed in consultation with the Geotechnical Engineer once it is known what type of fill material was used to meet the minimum rehabilitation elevations.

APPENDIX E



REFER TO DWG No. 66

NOTE:
FOR CROSS-SECTIONS 11-11 AND 12-12, REFER TO DWG No. 91.

NOTE:
ALL SWALES SHALL BE 0.15m DEEP WITH 3:1 SIDE SLOPES UNLESS OTHERWISE INDICATED

NOTE RE: PERFORATED PIPE
PERFORATED PIPE IS REQUIRED FOR SWALE SLOPE LESS THAN 1.5%. REFER TO CITY STD. S29, S30 FOR REAR YARD TRENCH AND PIPE DETAIL ONLY

NOTE:
A GEOTECHNICAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO IS TO INSPECT ALL SUBGRADE SURFACES FOR FOOTING AND PAVEMENT STRUCTURES PRIOR TO CONSTRUCTION

ANY DISTURBED AREA DURING CONSTRUCTION TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE AUTHORITIES HAVING JURISDICTION

CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION

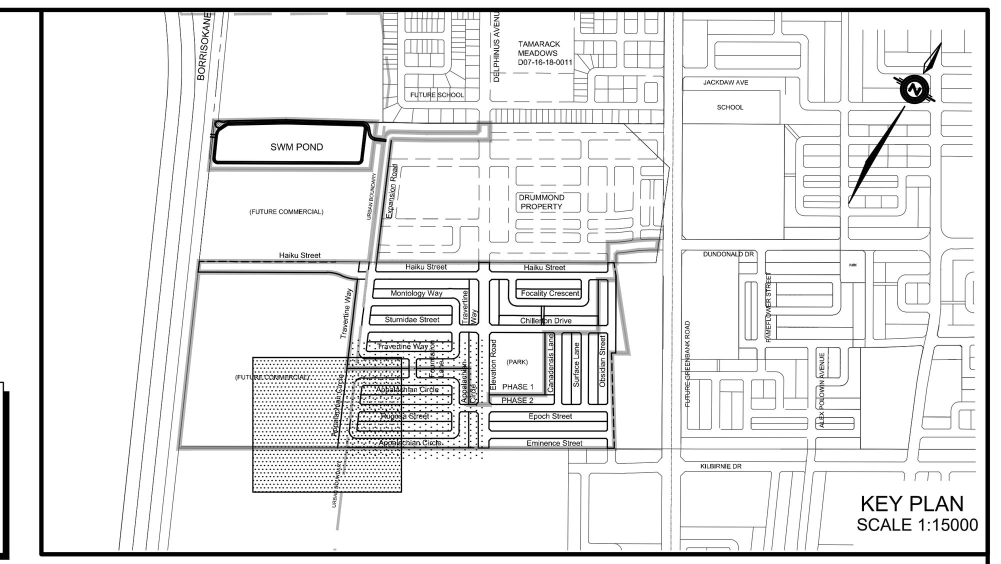
NOTE:
ALL EXISTING ABOVE GROUND FEATURES, E.G. MH/CHAMBER COVERS, PEDESTALS, HYDRO AND LIGHT POLES, ETC. AFFECTED BY THE DEVELOPMENT TO BE ADJUSTED TO SUIT TO THE SATISFACTION OF PARTIES AFFECTED

NOTE:
ALL EXISTING BUILDING, SHED, POST & WIRE FENCE, CHAIN LINK FENCE, TREE, UTILITY WIRE, POLE, CULVERT AND POOL WITHIN LOTS AND BLOCKS TO BE REMOVED, UNLESS OTHERWISE NOTED

NOTE: TREE REMOVAL
PERMISSION REQUIRED FOR REMOVAL OF EXISTING TREES ON EXTERNAL LANDS WHERE APPLICABLE

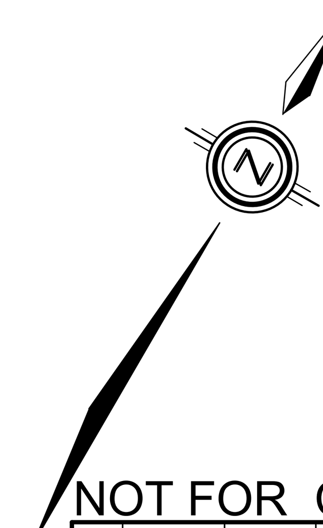
NOTE:
FOR RLCB LAYOUT & TYPICAL EASEMENT DETAIL REFER TO DRAWING No. 3

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS



LEGEND

- PROPOSED ELEVATION — 103.45
- EXISTING ELEVATION — 102.73
- FUTURE ELEVATION — [93.900]
- PROPOSED SWALE GRADE — 1.5%
- HIGH POINT — 102.16
- STREET CATCHBASIN
- STREET CATCHBASIN WITH CLOSED LID
- CATCHBASIN MANHOLE
- TEE CATCHBASIN
- ELBOW CATCHBASIN
- HYDRANT, VALVE & VB
- VALVE & VC
- VALVE & VB
- BUILDING ENVELOPE
- TOP OF FOUNDATION (TOF) — 94.70
- FINISHED FLOOR ELEVATION (FFE) — 95.00
- UNDERSIDE OF FOOTING ELEVATION (USF) — 92.00
- UNITS REQUIRING WATER PRESSURE REDUCING VALVES — PRV
- WALKOUT UNITS — W.O.
- SLAB ON GRADE — SOG
- HYDRO SWITCHGEAR
- HYDRO TRANSFORMER
- STREET LIGHT STANDARD
- TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)
- PREVIOUS PHASES / PHASES NOT PART OF CURRENT GRADING APPROVAL
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- EMERGENCY OVERLAND FLOW DIRECTION
- RETAINING WALL AND ELEVATIONS — T/W=103.10, B/W=102.44
- CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
- NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)
- DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)
- CONSTRUCTION FENCE
- PROPERTY BOUNDARY
- 3:1 TERRACING MAXIMUM SLOPE
- PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m)
- 250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)
- CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)



NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20-07-27	5TH SUBMISSION
5	A.D.F.	20-06-15	4TH SUBMISSION
4	A.D.F.	20-04-24	3RD SUBMISSION
3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

DSEL
david schaeffer engineering ltd
120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

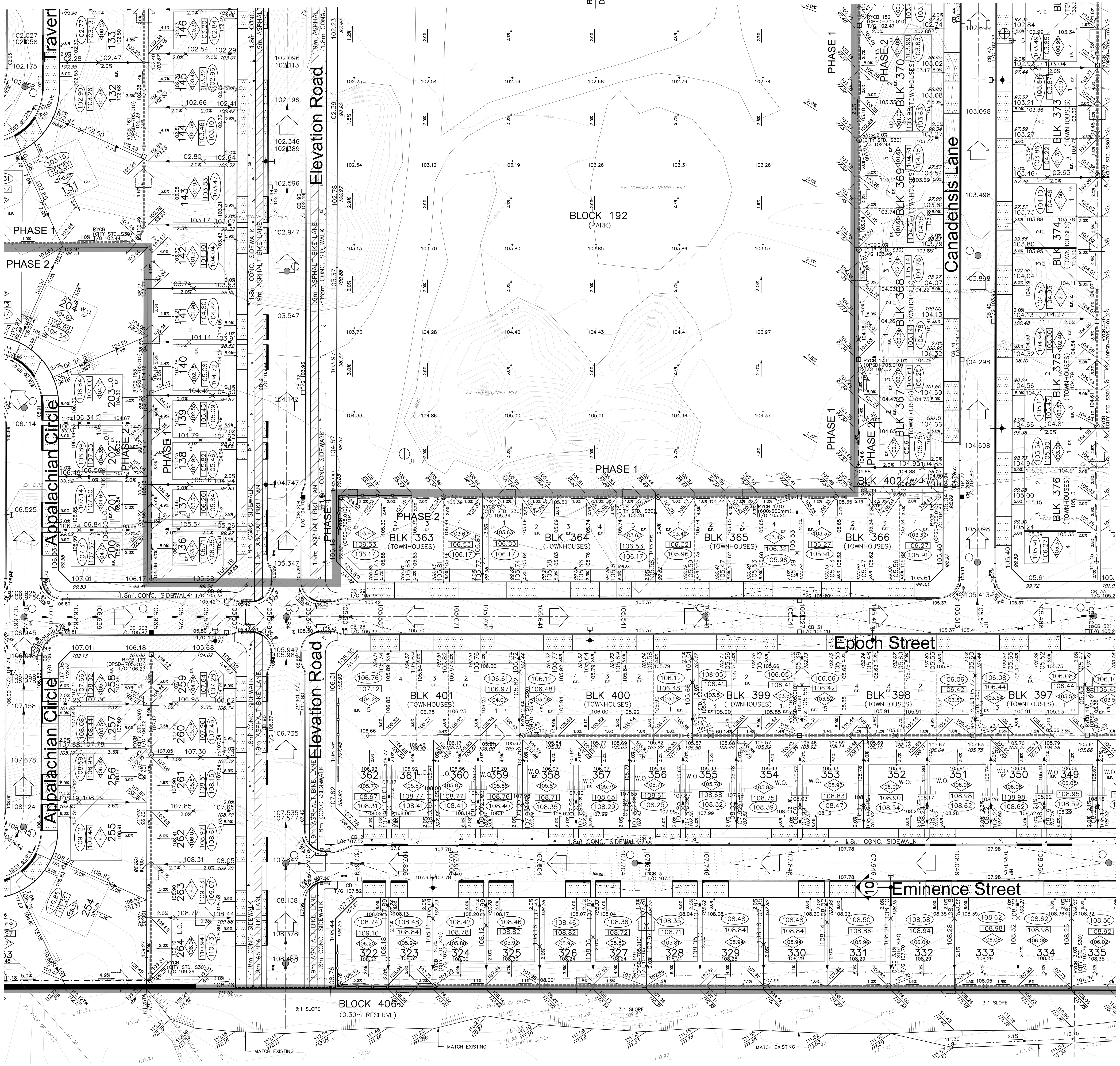
CITY OF OTTAWA

CITY PLAN No. 17803

GRADING PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030	
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: HORIZ. 1:500 (0 10 20)		SHEET No. 65	

CITY FILE No. D07-16-19-0005



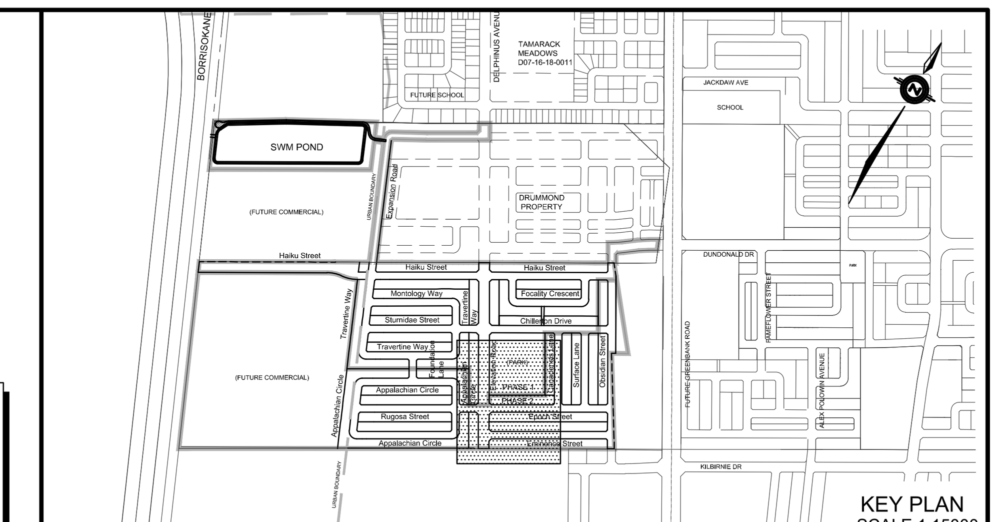
NOTE:
ALL SWALES SHALL BE 0.15m DEEP WITH 3:1 SIDE SLOPES UNLESS OTHERWISE INDICATED

NOTE RE: PERFORATED PIPE
PERFORATED PIPE IS REQUIRED FOR SWALE SLOPE LESS THAN 1.5%. REFER TO CITY STD. S29, S30 FOR REAR YARD TRENCH AND PIPE DETAIL ONLY

NOTE:
A GEOTECHNICAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO IS TO INSPECT ALL SUBGRADE SURFACES FOR FOOTING AND PAVEMENT STRUCTURES PRIOR TO CONSTRUCTION

ANY DISTURBED AREA DURING CONSTRUCTION TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE AUTHORITIES HAVING JURISDICTION

CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION



NOTE:
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NOTE:
ALL EXISTING BUILDING, SHED, POST & WIRE FENCE, CHAIN LINK FENCE, TREE, UTILITY WIRE, POLE, CULVERT AND POOL WITHIN LOTS AND BLOCKS TO BE REMOVED, UNLESS OTHERWISE NOTED

NOTE: TREE REMOVAL
PERMISSION REQUIRED FOR REMOVAL OF EXISTING TREES ON EXTERNAL LANDS WHERE APPLICABLE

NOTE:
FOR RLCB LAYOUT & TYPICAL EASEMENT DETAIL REFER TO DRAWING No. 3

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE:
FOR CROSS-SECTION 10–10, REFER TO DWG No. 90.

LEGEND

- PROPOSED ELEVATION — 103.45
- EXISTING ELEVATION — *102.73*
- FUTURE ELEVATION — [93.900]
- PROPOSED SWALE GRADE — 1.5%
- HIGH POINT — 102.16
- STREET CATCHBASIN
- STREET CATCHBASIN WITH CLOSED LID
- CATCHBASIN MANHOLE
- TEE CATCHBASIN
- ELBOW CATCHBASIN
- HYDRANT, VALVE & VB
- VALVE & VC
- VALVE & VB
- BUILDING ENVELOPE
- TOP OF FOUNDATION (TOF) — 94.70
- FINISHED FLOOR ELEVATION (FFE) — 95.00
- UNDERSIDE OF FOOTING ELEVATION (USF) — 92.00
- UNITS REQUIRING WATER PRESSURE REDUCING VALVES — PRV
- WALKOUT UNITS — W.O.
- SLAB ON GRADE — SOG
- HYDRO SWITCHGEAR
- HYDRO TRANSFORMER
- STREET LIGHT STANDARD — L.S.
- TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)
- PREVIOUS PHASES / PHASES NOT PART OF CURRENT GRADING APPROVAL
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- EMERGENCY OVERLAND FLOW DIRECTION — E
- RETAINING WALL AND ELEVATIONS — T/W=103.10, B/W=102.44
- CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
- NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)
- DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)
- CONSTRUCTION FENCE
- PROPERTY BOUNDARY
- 3:1 TERRACING MAXIMUM SLOPE — 100.20, 99.20
- PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m) — 89.64
- 250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)
- CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20–07–27	5TH SUBMISSION
5	A.D.F.	20–06–15	4TH SUBMISSION
4	A.D.F.	20–04–24	3RD SUBMISSION
3	A.D.F.	19–12–23	2ND SUBMISSION
2	A.D.F.	19–10–04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18–10–145–00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M–PLAN PROVIDED BY JD BARNES LTD, PROJECT 18–10–145–00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

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Stittsville, Ontario, K2S 1E9
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LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

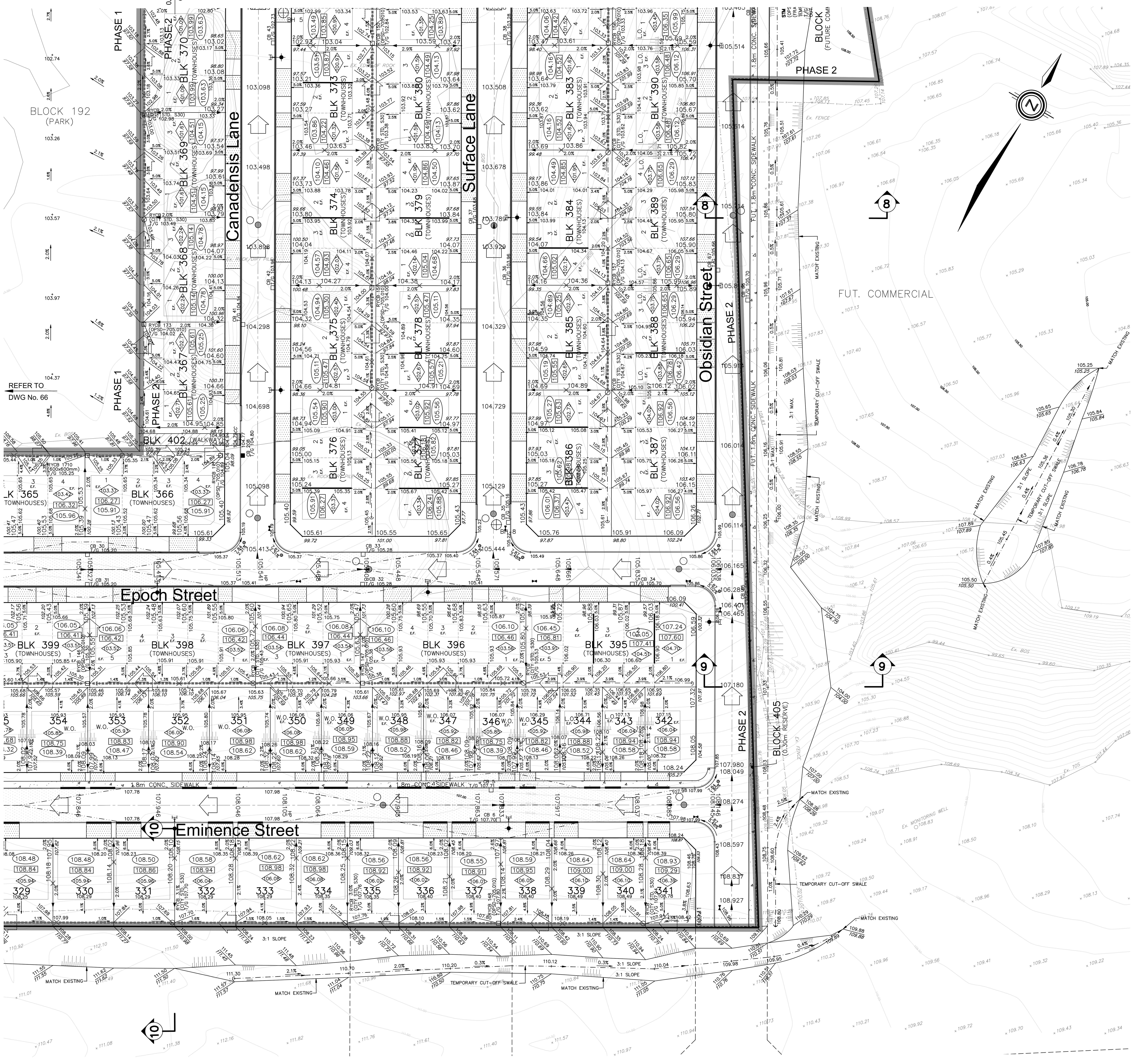
Ottawa CITY OF OTTAWA

GRADING PLAN

DRAWN BY:	G.G.G.	CHECKED BY:	A.D.F.	PROJECT No. 18–1030
DESIGNED BY:	C.M.K.	CHECKED BY:	A.D.F.	
SCALE: HORIZ. 1:500 (0 10 20)				SHEET No. 66

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005



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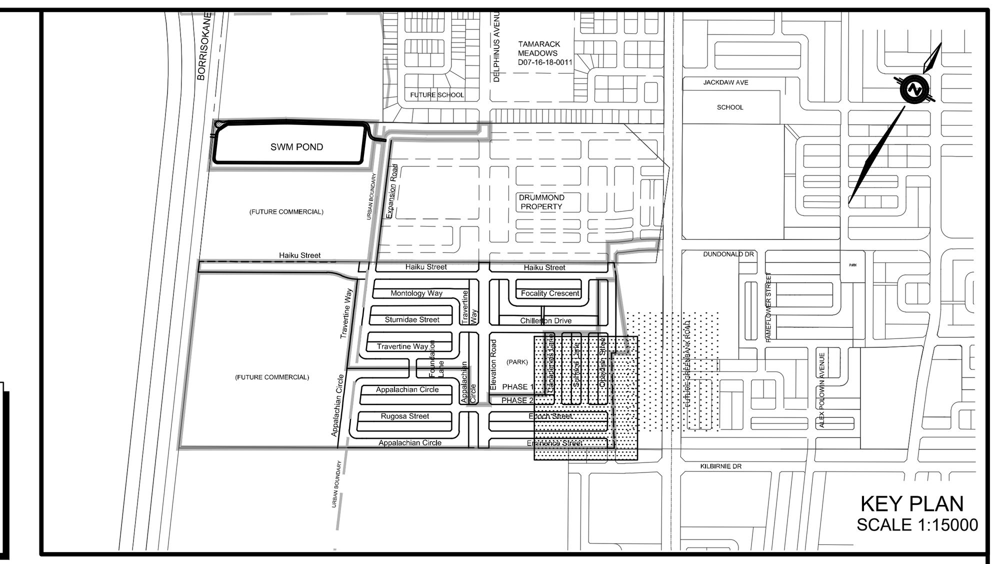
PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE: FOR CROSS–SECTIONS 8–8, 9–9 AND 10–10, REFER TO DWG No. 91.



LEGEND

PROPOSED ELEVATION	103.45
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FUTURE ELEVATION	[93.900]
PROPOSED SWALE GRADE	1.5%
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CATCHBASIN MANHOLE	
TEE CATCHBASIN	
ELBOW CATCHBASIN	
HYDRANT, VALVE & VB	
VALVE & VC	
VALVE & VB	
BUILDING ENVELOPE TOP OF FOUNDATION (TOF)	94.70
FINISHED FLOOR ELEVATION (FFE)	95.00
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WALKOUT UNITS	W.O.
SLAB ON GRADE	SOG
HYDRO SWITCHGEAR	
HYDRO TRANSFORMER	
STREET LIGHT STANDARD	L.S.
TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)	
PREVIOUS PHASES / PHASES NOT PART OF CURRENT GRADING APPROVAL	
OVERLAND FLOW DIRECTION	
EXTERNAL OVERLAND FLOW DIRECTION	
EMERGENCY OVERLAND FLOW DIRECTION	E
RETAINING WALL AND ELEVATIONS	T/W=103.10 B/W=102.44
CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)	
NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)	
DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)	
CONSTRUCTION FENCE	
PROPERTY BOUNDARY	
3:1 TERRACING MAXIMUM SLOPE	100.20 99.20
PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m)	89.64
250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)	
CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)	

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
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TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18–10–145–00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M–PLAN PROVIDED BY JD BARNES LTD, PROJECT 18–10–145–00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
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CAIVAN COMMUNITIES

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LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
PROVINCE OF ONTARIO

Ottawa CITY OF OTTAWA

GRADING PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No.	18–1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: HORIZ. 1:500 (0, 10, 20)		SHEET No.	67

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005

NOTE:
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NOTE:
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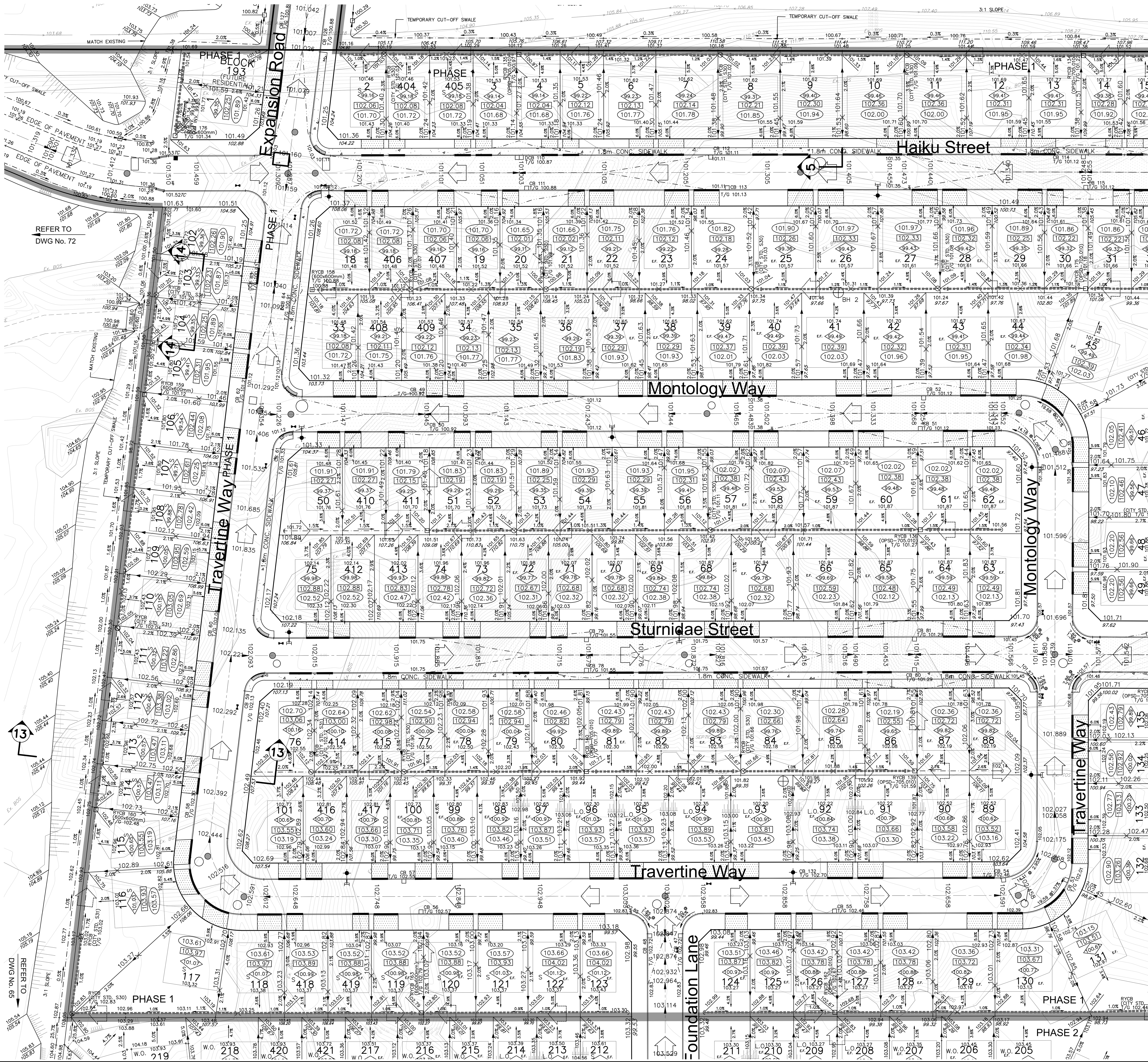
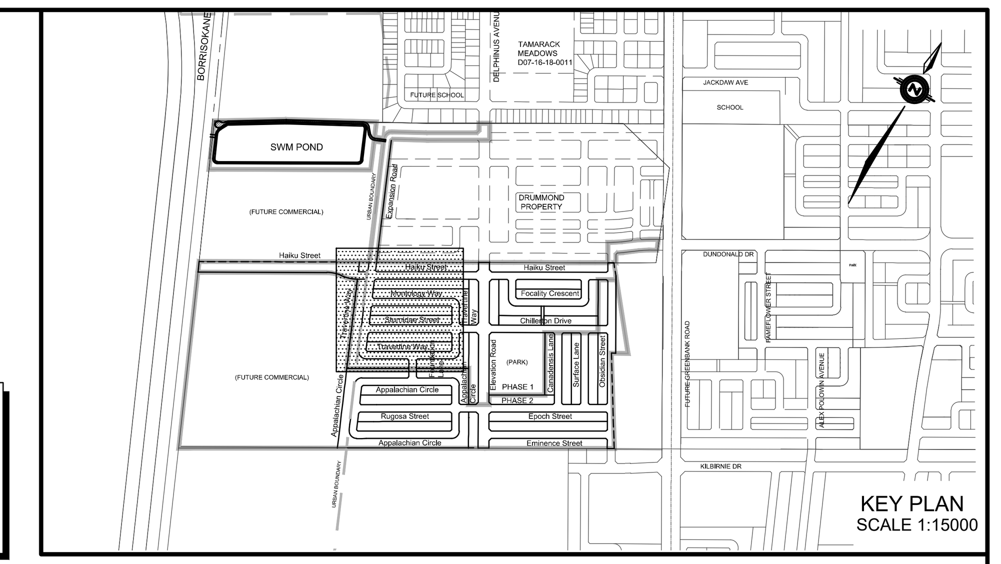
PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE:
FOR CROSS-SECTION 5-5, REFER TO DWG No. 90. FOR CROSS-SECTION 13-13, REFER TO DWG No. 91.





LEGEND

PROPOSED ELEVATION — 103.45
EXISTING ELEVATION — *102.73*
FUTURE ELEVATION — [93.900]
PROPOSED SWALE GRADE — 1.5%
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OVERLAND FLOW DIRECTION
EXTERNAL OVERLAND FLOW DIRECTION
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CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
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NOT FOR CONSTRUCTION

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TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
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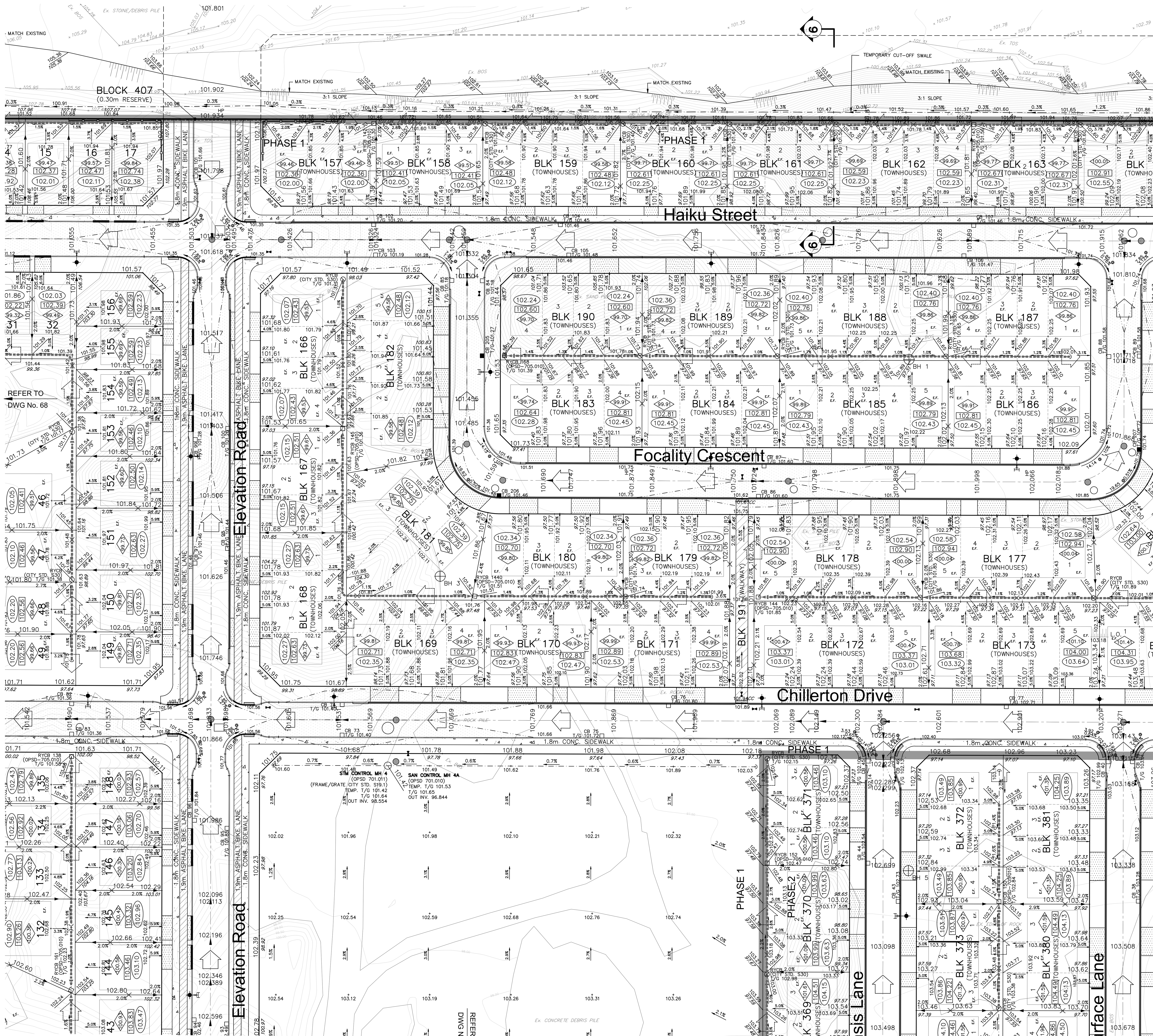
LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

Ottawa CITY OF OTTAWA

GRADING PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030	
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: HORIZ. 1:500 (0, 10, 20)		SHEET No. 68	

CITY PLAN No. 17803
CITY FILE No. D07-16-19-0005



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NOTE:
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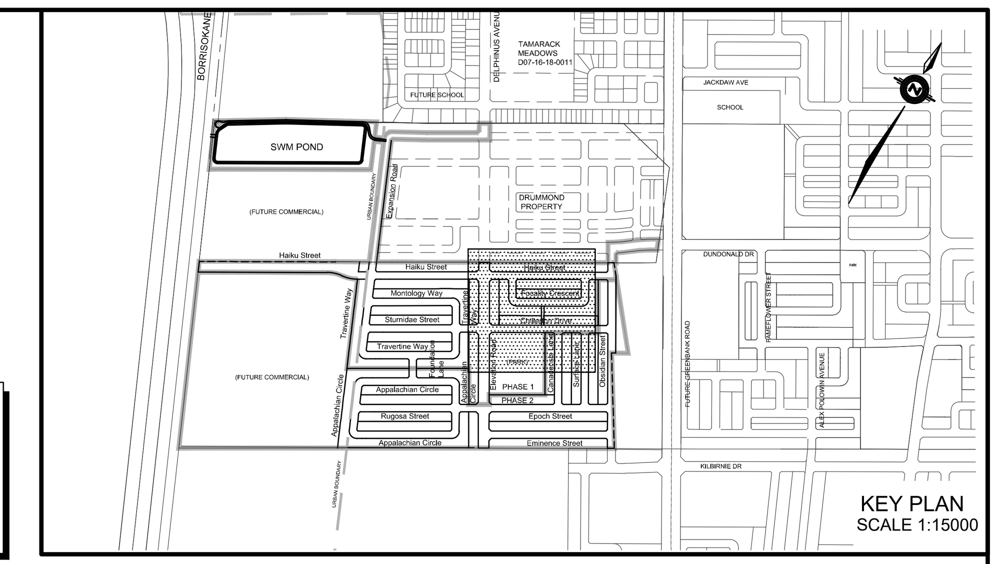

LEGEND

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PROVINCE OF ONTARIO

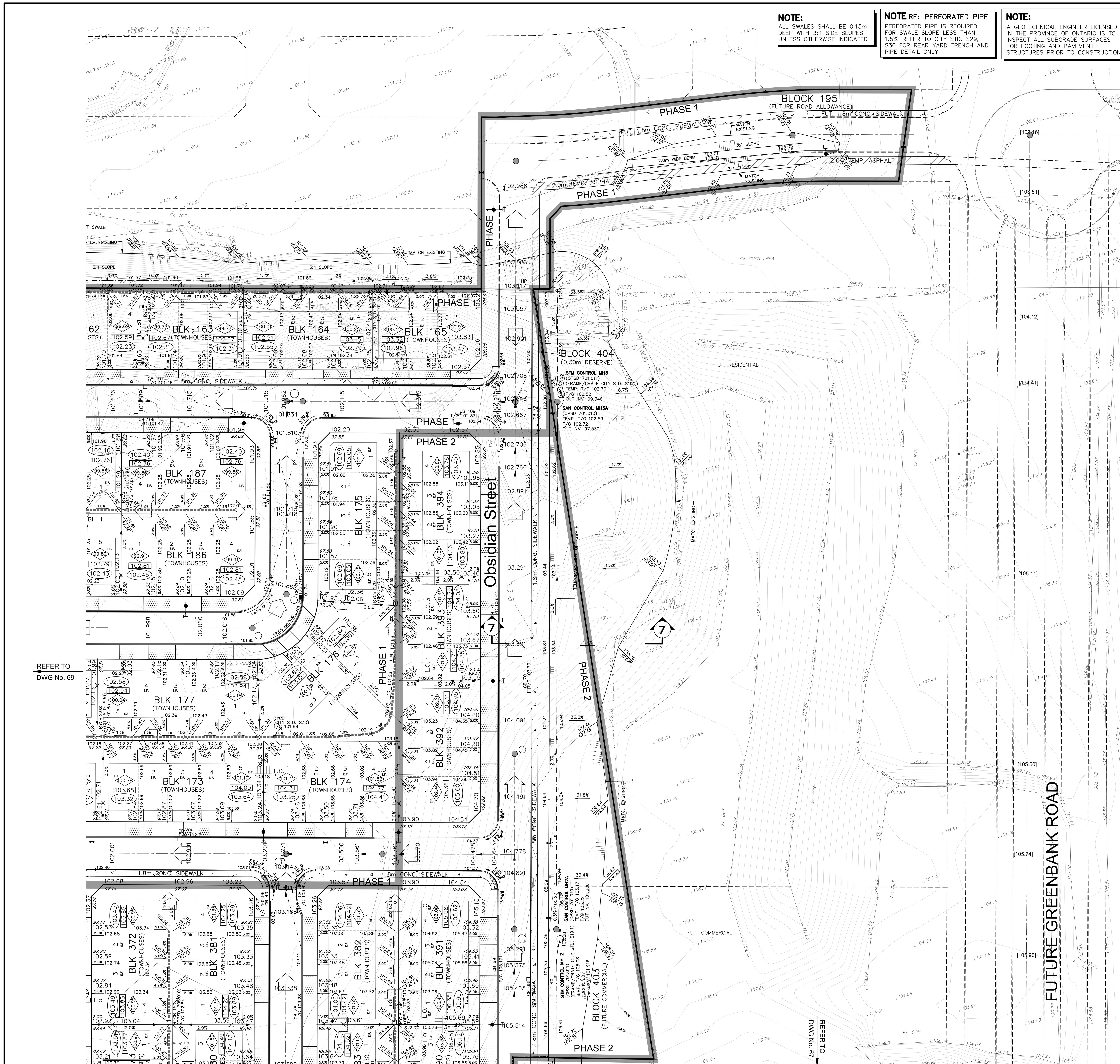
CITY OF OTTAWA

GRADING PLAN

DRAWN BY:	G.G.G.	CHECKED BY:	A.D.F.	PROJECT No. 18-1030
DESIGNED BY:	C.M.K.	CHECKED BY:	A.D.F.	
SCALE: HORIZ. 1:500				SHEET No. 69

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005



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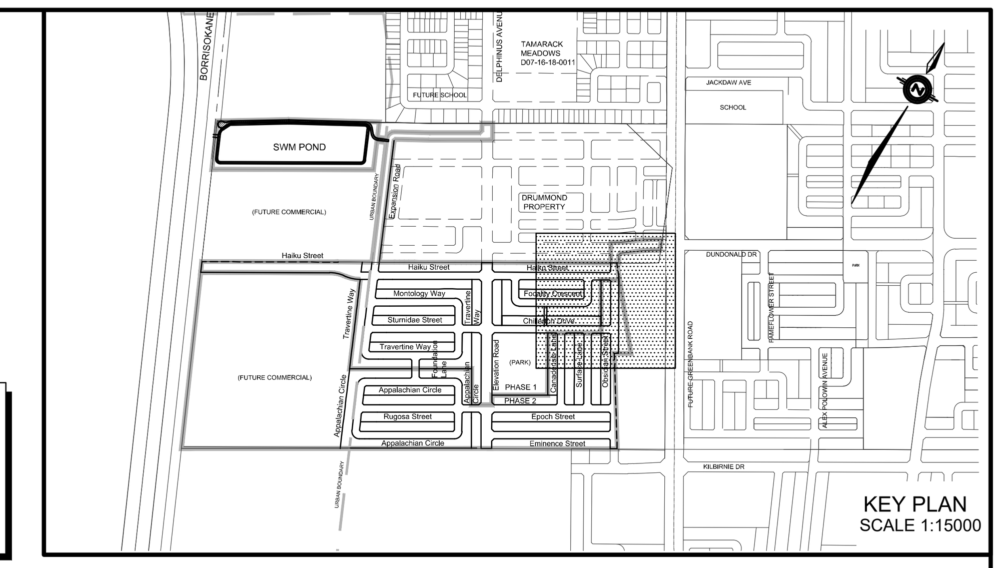
NOTE:
FOR CROSS-SECTION 7-7, REFER TO DWG No. 91.



LEGEND

PROPOSED ELEVATION	103.45
EXISTING ELEVATION	*102.73*
FUTURE ELEVATION	[93.900]
PROPOSED SWALE GRADE	1.5%
HIGH POINT	102.16
STREET CATCHBASIN	
STREET CATCHBASIN WITH CLOSED LID	
CATCHBASIN MANHOLE	
TEE CATCHBASIN	
ELBOW CATCHBASIN	
HYDRANT, VALVE & VB	
VALVE & VC	
VALVE & VB	
BUILDING ENVELOPE TOP OF FOUNDATION (TOF)	94.70
FINISHED FLOOR ELEVATION (FFE)	95.00
UNDERSIDE OF FOOTING ELEVATION (USF)	92.00
UNITS REQUIRING WATER PRESSURE REDUCING VALVES	PRV
WALKOUT UNITS	W.O.
SLAB ON GRADE	SOG
HYDRO SWITCHGEAR	
HYDRO TRANSFORMER	
STREET LIGHT STANDARD	L.S.
TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)	
PREVIOUS PHASES / PHASES NOT PART OF CURRENT GRADING APPROVAL	
OVERLAND FLOW DIRECTION	
EXTERNAL OVERLAND FLOW DIRECTION	
EMERGENCY OVERLAND FLOW DIRECTION	E
RETAINING WALL AND ELEVATIONS	T/W=103.10 B/W=102.44
CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)	
NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)	
DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)	
CONSTRUCTION FENCE	
PROPERTY BOUNDARY	
3:1 TERRACING MAXIMUM SLOPE	100.20 99.20
PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m)	89.64
250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)	
CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)	

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20-07-27	5TH SUBMISSION
5	A.D.F.	20-06-15	4TH SUBMISSION
4	A.D.F.	20-04-24	3RD SUBMISSION
3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

DSEL
david schaeffer engineering ltd
120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

Ottawa CITY OF OTTAWA

GRADING PLAN

DRAWN BY:	G.G.G.	CHECKED BY:	A.D.F.	PROJECT No. 18-1030
DESIGNED BY:	C.M.K.	CHECKED BY:	A.D.F.	
SCALE: HORIZ. 1:500 (0 10 20)				SHEET No. 70

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005

NOTE:
ALL SWALES SHALL BE 0.15m DEEP WITH 3:1 SIDE SLOPES UNLESS OTHERWISE INDICATED

NOTE RE: PERFORATED PIPE
PERFORATED PIPE IS REQUIRED FOR SWALE SLOPE LESS THAN 1.5%. REFER TO CITY STD. S29, S30 FOR REAR YARD TRENCH AND PIPE DETAIL ONLY

NOTE:
A GEOTECHNICAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO IS TO INSPECT ALL SUBGRADE SURFACES FOR FOOTING AND PAVEMENT STRUCTURES PRIOR TO CONSTRUCTION

ANY DISTURBED AREA DURING CONSTRUCTION TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE AUTHORITIES HAVING JURISDICTION

CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION

NOTE:
ALL EXISTING ABOVE GROUND FEATURES, E.G. MH/CHAMBER COVERS, PEDESTALS, HYDRO AND LIGHT POLES, ETC. AFFECTED BY THE DEVELOPMENT TO BE ADJUSTED TO SUIT TO THE SATISFACTION OF PARTIES AFFECTED

NOTE:
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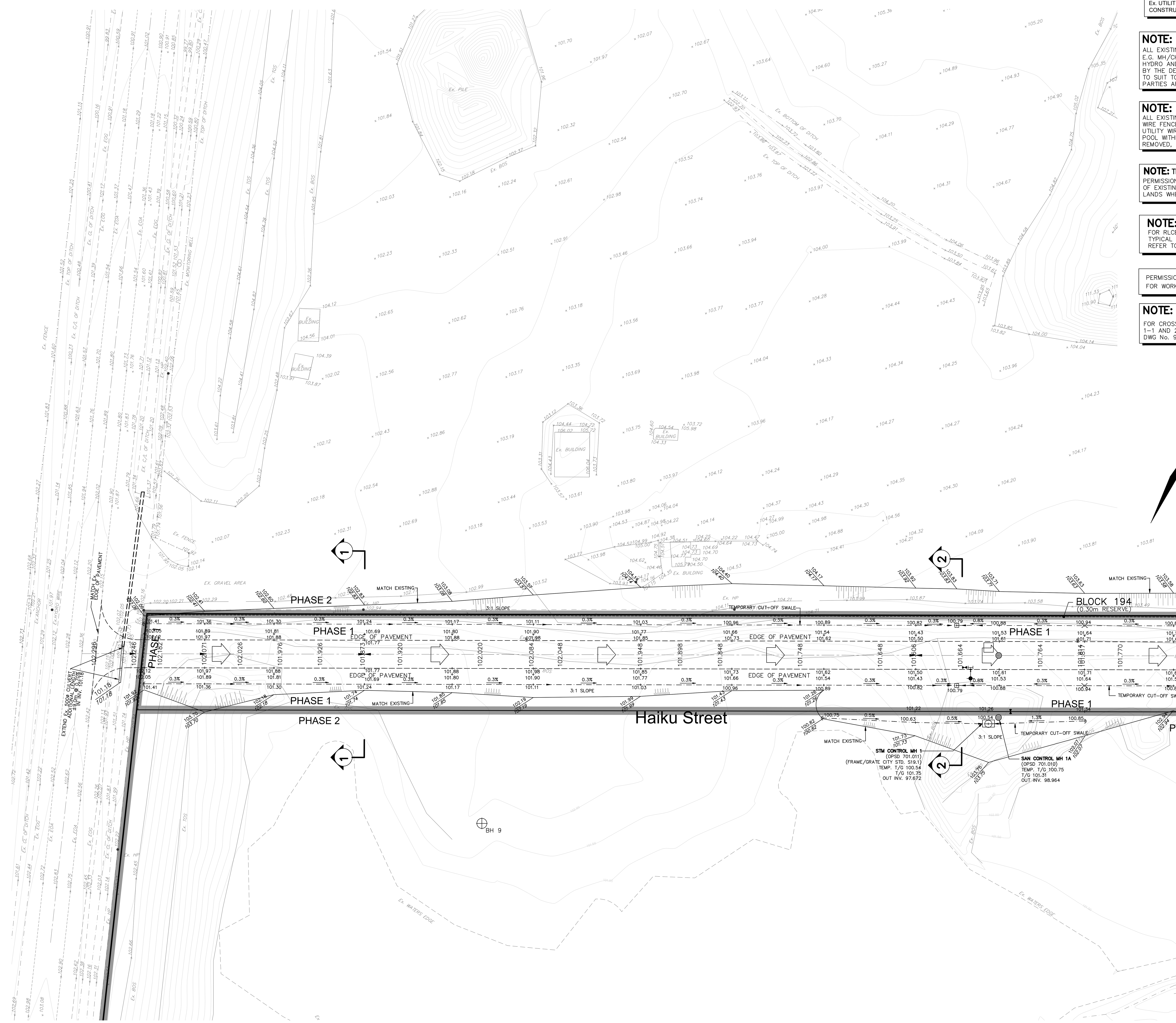
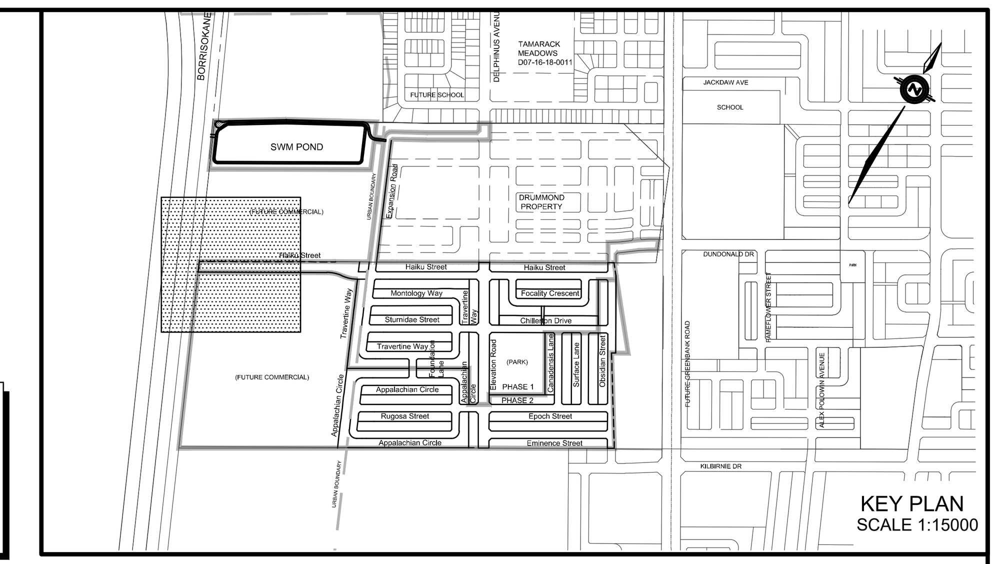
NOTE: TREE REMOVAL
PERMISSION REQUIRED FOR REMOVAL OF EXISTING TREES ON EXTERNAL LANDS WHERE APPLICABLE

NOTE:
FOR RLCB LAYOUT & TYPICAL EASEMENT DETAIL REFER TO DRAWING No. 3

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE:
FOR CROSS-SECTIONS 1-1 AND 2-2, REFER TO DWG No. 90.





LEGEND

PROPOSED ELEVATION	103.45
EXISTING ELEVATION	102.73
FUTURE ELEVATION	[93.900]
PROPOSED SWALE GRADE	1.5%
HIGH POINT	102.16
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STREET CATCHBASIN WITH CLOSED LID	
CATCHBASIN MANHOLE	
TEE CATCHBASIN	
ELBOW CATCHBASIN	
HYDRANT, VALVE & VB	
VALVE & VC	
VALVE & VB	
BUILDING ENVELOPE TOP OF FOUNDATION (TOF)	94.70
FINISHED FLOOR ELEVATION (FFE)	95.00
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WALKOUT UNITS	W.O.
SLAB ON GRADE	SOG
HYDRO SWITCHGEAR	
HYDRO TRANSFORMER	
STREET LIGHT STANDARD	L.S.
TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)	
PREVIOUS PHASES / PHASES NOT PART OF CURRENT GRADING APPROVAL	
OVERLAND FLOW DIRECTION	
EXTERNAL OVERLAND FLOW DIRECTION	
EMERGENCY OVERLAND FLOW DIRECTION	E
RETAINING WALL AND ELEVATIONS	T/W=103.10 B/W=102.44
CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)	
NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)	
DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)	
CONSTRUCTION FENCE	
PROPERTY BOUNDARY	
3:1 TERRACING MAXIMUM SLOPE	100.20 99.20
PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m)	89.64
250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)	
CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)	

NOT FOR CONSTRUCTION

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3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

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LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

Ottawa CITY OF OTTAWA

GRADING PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.	
SCALE: HORIZ. 1:500 (0 10 20)		SHEET No. 71

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005

NOTE:
ALL SWALES SHALL BE 0.15m DEEP WITH 3:1 SIDE SLOPES UNLESS OTHERWISE INDICATED

NOTE RE: PERFORATED PIPE
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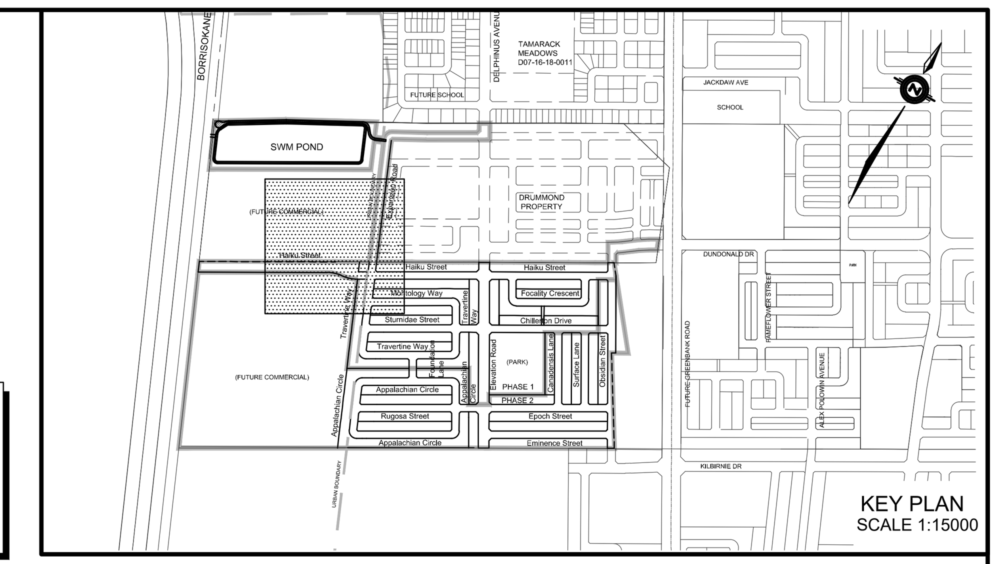
NOTE: TREE REMOVAL
PERMISSION REQUIRED FOR REMOVAL OF EXISTING TREES ON EXTERNAL LANDS WHERE APPLICABLE

NOTE:
FOR RLCB LAYOUT & TYPICAL EASEMENT DETAIL REFER TO DRAWING No. 3

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE:
FOR CROSS-SECTION 2-2, REFER TO DWG No. 90.



LEGEND

PROPOSED ELEVATION — 103.45
EXISTING ELEVATION — *102.73*
FUTURE ELEVATION — [93.900]
PROPOSED SWALE GRADE — 1.5%
HIGH POINT — 102.16
STREET CATCHBASIN
STREET CATCHBASIN WITH CLOSED LID
CATCHBASIN MANHOLE
TEE CATCHBASIN
ELBOW CATCHBASIN
HYDRANT, VALVE & VB
VALVE & VC
VALVE & VB
BUILDING ENVELOPE
TOP OF FOUNDATION (TOF) — 94.70
FINISHED FLOOR ELEVATION (FFE) — 95.00
UNDERSIDE OF FOOTING ELEVATION (USF) — 92.00
UNITS REQUIRING WATER PRESSURE REDUCING VALVES — PRV
WALKOUT UNITS — W.O.
SLAB ON GRADE — SOG
HYDRO SWITCHGEAR
HYDRO TRANSFORMER
STREET LIGHT STANDARD — L.S.
TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)
PREVIOUS PHASES / PHASES NOT PART OF CURRENT GRADING APPROVAL
OVERLAND FLOW DIRECTION
EXTERNAL OVERLAND FLOW DIRECTION
EMERGENCY OVERLAND FLOW DIRECTION — E
RETAINING WALL AND ELEVATIONS — T/W=103.10 B/W=102.44
CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
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DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)
CONSTRUCTION FENCE
PROPERTY BOUNDARY
3:1 TERRACING MAXIMUM SLOPE — 100.20 / 99.20
PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m) — 89.64
250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)
CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
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TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
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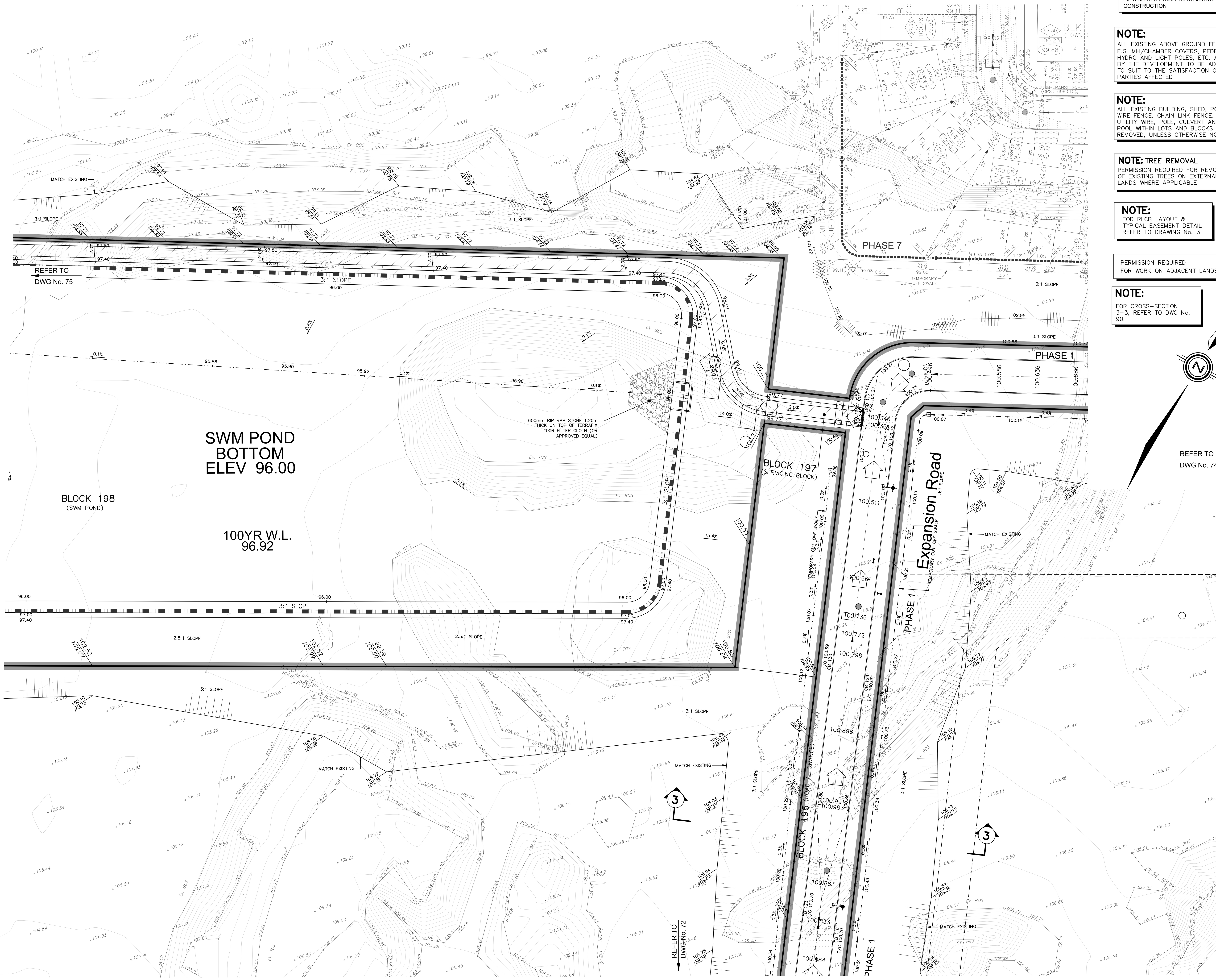
LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 PROVINCE OF ONTARIO 2020-07-27

CITY OF OTTAWA

GRADING PLAN

DRAWN BY: G.G.G. | CHECKED BY: A.D.F. | PROJECT No. 18-1030
DESIGNED BY: C.M.K. | CHECKED BY: A.D.F.
SCALE: HORIZ. 1:500 (0 10 20)
SHEET No. 72

CITY PLAN No. 17803
CITY FILE No. D07-16-19-0005



NOTE: ALL SWALES SHALL BE 0.15m DEEP WITH 3:1 SIDE SLOPES UNLESS OTHERWISE INDICATED

NOTE RE: PERFORATED PIPE PERFORATED PIPE IS REQUIRED FOR SWALE SLOPE LESS THAN 1.5% REFER TO CITY STD. S29, S30 FOR REAR YARD TRENCH AND PIPE DETAIL ONLY

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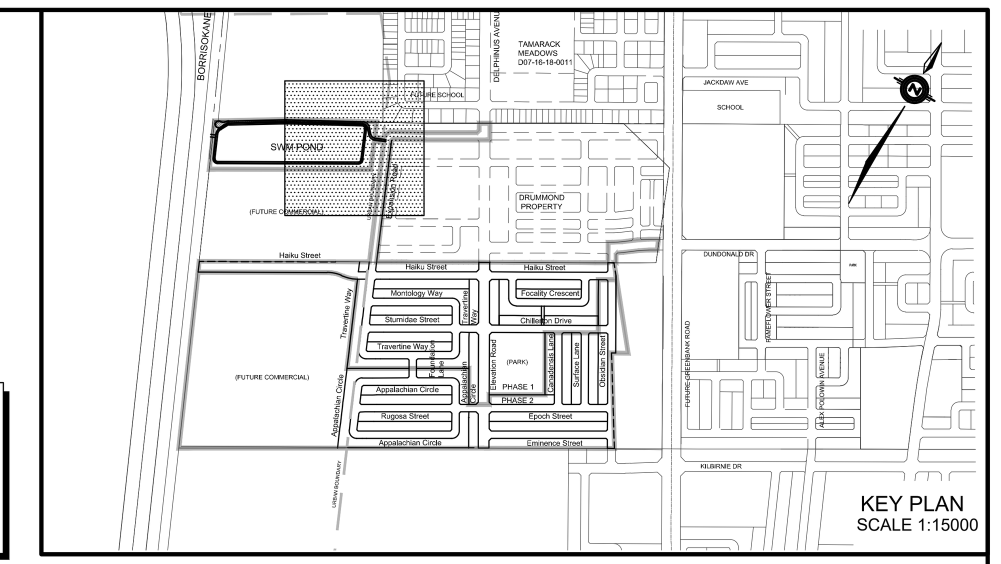
NOTE: TREE REMOVAL PERMISSION REQUIRED FOR REMOVAL OF EXISTING TREES ON EXTERNAL LANDS WHERE APPLICABLE

NOTE: FOR RLCB LAYOUT & TYPICAL EASEMENT DETAIL REFER TO DRAWING No. 3

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE: FOR CROSS-SECTION 3-3, REFER TO DWG No. 90.



LEGEND

- PROPOSED ELEVATION — 103.45
- EXISTING ELEVATION — *102.73*
- FUTURE ELEVATION — [93.900]
- PROPOSED SWALE GRADE — 1.5%
- HIGH POINT — 102.16
- STREET CATCHBASIN
- STREET CATCHBASIN WITH CLOSED LID
- CATCHBASIN MANHOLE
- TEE CATCHBASIN
- ELBOW CATCHBASIN
- HYDRANT, VALVE & VB
- VALVE & VC
- VALVE & VB
- BUILDING ENVELOPE TOP OF FOUNDATION (TOF) — 94.70
- FINISHED FLOOR ELEVATION (FFE) — 95.00
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- UNITS REQUIRING WATER PRESSURE REDUCING VALVES — PRV
- WALKOUT UNITS — W.O.
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- HYDRO TRANSFORMER
- STREET LIGHT STANDARD — L.S.
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- PREVIOUS PHASES / PHASES NOT PART OF CURRENT GRADING APPROVAL
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- EMERGENCY OVERLAND FLOW DIRECTION — E
- RETAINING WALL AND ELEVATIONS — T/W=103.10, B/W=102.44
- CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
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- CONSTRUCTION FENCE
- PROPERTY BOUNDARY
- 3:1 TERRACING MAXIMUM SLOPE — 100.20, 99.20
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- CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)

NOT FOR CONSTRUCTION

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TOPOGRAPHIC INFORMATION
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LICENSED PROFESSIONAL ENGINEER A. D. FOBERT 100090626 2020-07-27 PROVINCE OF ONTARIO

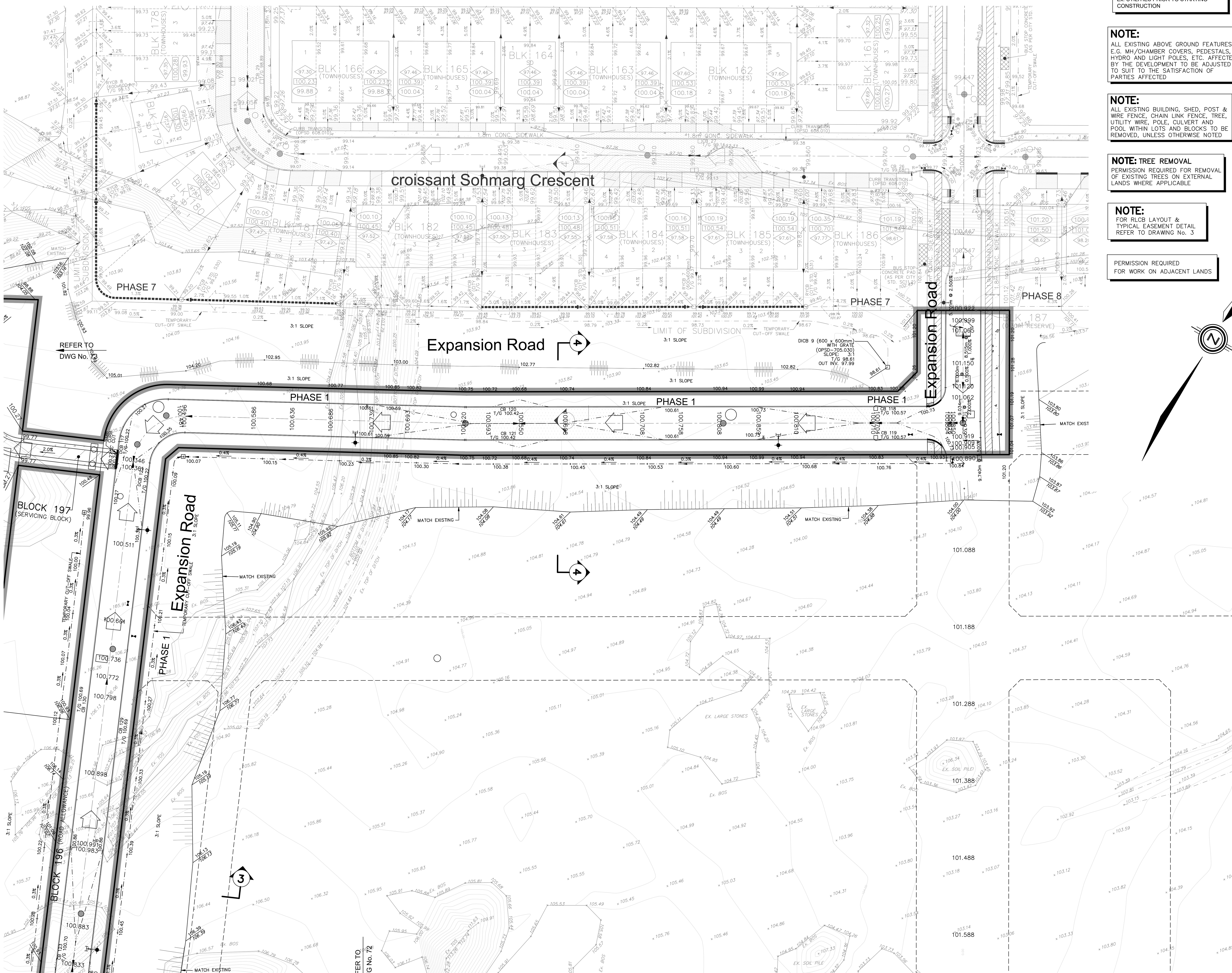
Ottawa CITY OF OTTAWA

GRADING PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030	
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.		
SCALE: HORIZ. 1:500 (0 — 10 — 20)		SHEET No. 73	

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005



NOTE:
FOR CROSS-SECTIONS 3-3 AND 4-4, REFER TO DWG No. 90.

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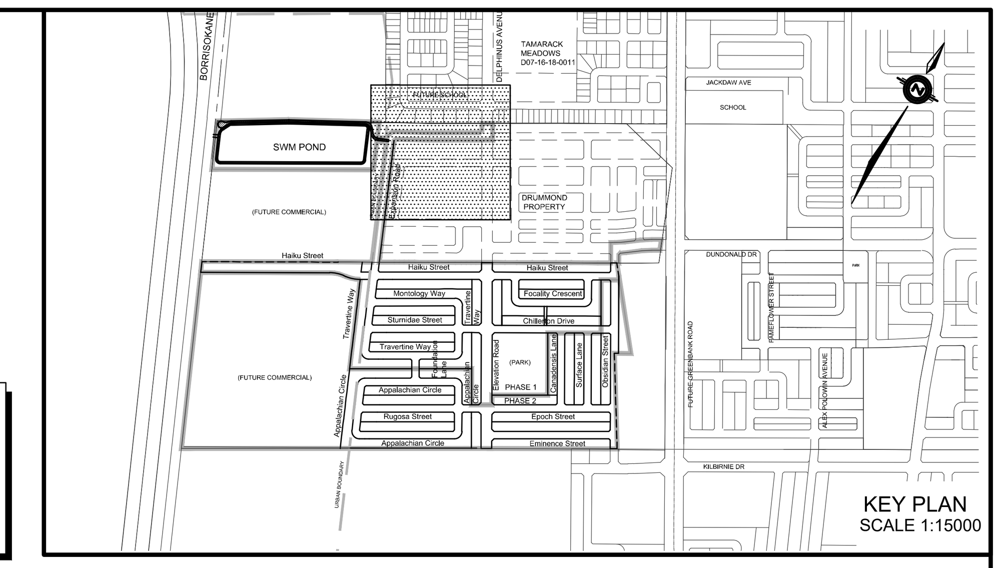
PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS



LEGEND

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- PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m) — 89.64
- 250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)
- CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
6	A.D.F.	20-07-27	5TH SUBMISSION
5	A.D.F.	20-06-15	4TH SUBMISSION
4	A.D.F.	20-04-24	3RD SUBMISSION
3	A.D.F.	19-12-23	2ND SUBMISSION
2	A.D.F.	19-10-04	1ST SUBMISSION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE
PHASE 1

DSEL
david schaeffer engineering ltd
120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

CITY OF OTTAWA

GRADING PLAN

DRAWN BY:	G.G.G.	CHECKED BY:	A.D.F.	PROJECT No. 18-1030
DESIGNED BY:	C.M.K.	CHECKED BY:	A.D.F.	
SCALE: HORIZ. 1:500				SHEET No. 74

CITY PLAN No. 17803
CITY FILE No. D07-16-19-0005

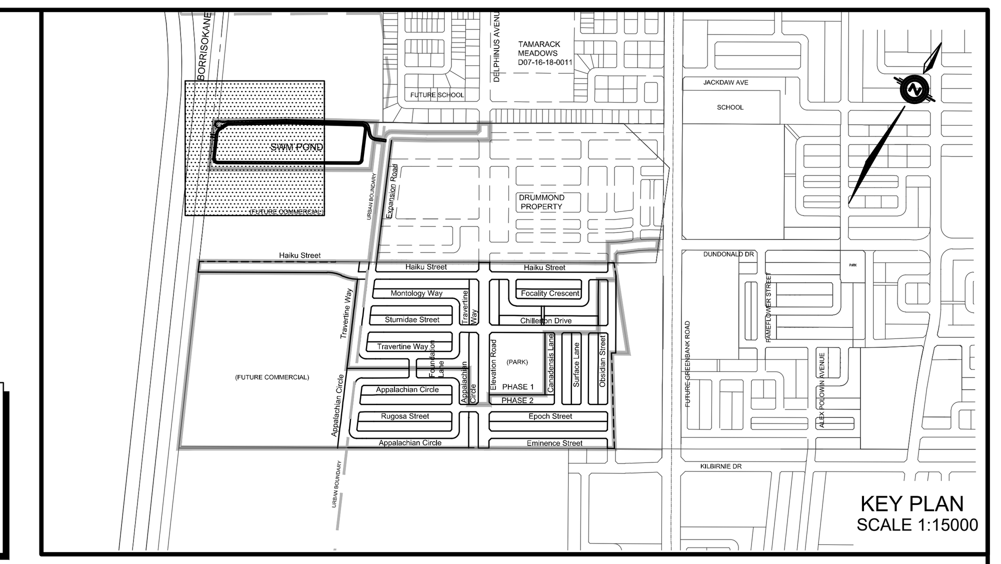
NOTE:
ALL SWALES SHALL BE 0.15m DEEP WITH 3:1 SIDE SLOPES UNLESS OTHERWISE INDICATED

NOTE RE: PERFORATED PIPE
PERFORATED PIPE IS REQUIRED FOR SWALE SLOPE LESS THAN 1.5%. REFER TO CITY STD. S29, S30 FOR REAR YARD TRENCH AND PIPE DETAIL ONLY

NOTE:
A GEOTECHNICAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO IS TO INSPECT ALL SUBGRADE SURFACES FOR FOOTING AND PAVEMENT STRUCTURES PRIOR TO CONSTRUCTION

ANY DISTURBED AREA DURING CONSTRUCTION TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE AUTHORITIES HAVING JURISDICTION

CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION



NOTE:
ALL EXISTING ABOVE GROUND FEATURES, E.G. MH/CHAMBER COVERS, PEDESTALS, HYDRO AND LIGHT POLES, ETC. AFFECTED BY THE DEVELOPMENT TO BE ADJUSTED TO SUIT TO THE SATISFACTION OF PARTIES AFFECTED

NOTE:
ALL EXISTING BUILDING, SHED, POST & WIRE FENCE, CHAIN LINK FENCE, TREE, UTILITY WIRE, POLE, CULVERT AND POOL WITHIN LOTS AND BLOCKS TO BE REMOVED, UNLESS OTHERWISE NOTED

NOTE: TREE REMOVAL
PERMISSION REQUIRED FOR REMOVAL OF EXISTING TREES ON EXTERNAL LANDS WHERE APPLICABLE

NOTE:
FOR RLCB LAYOUT & TYPICAL EASEMENT DETAIL REFER TO DRAWING No. 3

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE:
FOR CROSS-SECTION 3-3, REFER TO DWG No. 90.

LEGEND

PROPOSED ELEVATION	103.45
EXISTING ELEVATION	*102.73*
FUTURE ELEVATION	[93.900]
PROPOSED SWALE GRADE	1.5%
HIGH POINT	102.16
STREET CATCHBASIN	
STREET CATCHBASIN WITH CLOSED LID	
CATCHBASIN MANHOLE	
TEE CATCHBASIN	
ELBOW CATCHBASIN	
HYDRANT, VALVE & VB	
VALVE & VC	
VALVE & VB	
BUILDING ENVELOPE TOP OF FOUNDATION (TOF)	94.70
FINISHED FLOOR ELEVATION (FFE)	95.00
UNDERSIDE OF FOOTING ELEVATION (USF)	92.00
UNITS REQUIRING WATER PRESSURE REDUCING VALVES	PRV
WALKOUT UNITS	W.O.
SLAB ON GRADE	SOG
HYDRO SWITCHGEAR	
HYDRO TRANSFORMER	
STREET LIGHT STANDARD	L.S.
TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)	
PREVIOUS PHASES / PHASES NOT PART OF CURRENT GRADING APPROVAL	
OVERLAND FLOW DIRECTION	
EXTERNAL OVERLAND FLOW DIRECTION	
EMERGENCY OVERLAND FLOW DIRECTION	E
RETAINING WALL AND ELEVATIONS	T/W=103.10 B/W=102.44
CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)	
NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)	
DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)	
CONSTRUCTION FENCE	
PROPERTY BOUNDARY	
3:1 TERRACING MAXIMUM SLOPE	100.20 99.20
PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m)	89.64
250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)	
CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)	

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION
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TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
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CAIVAN COMMUNITIES

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LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

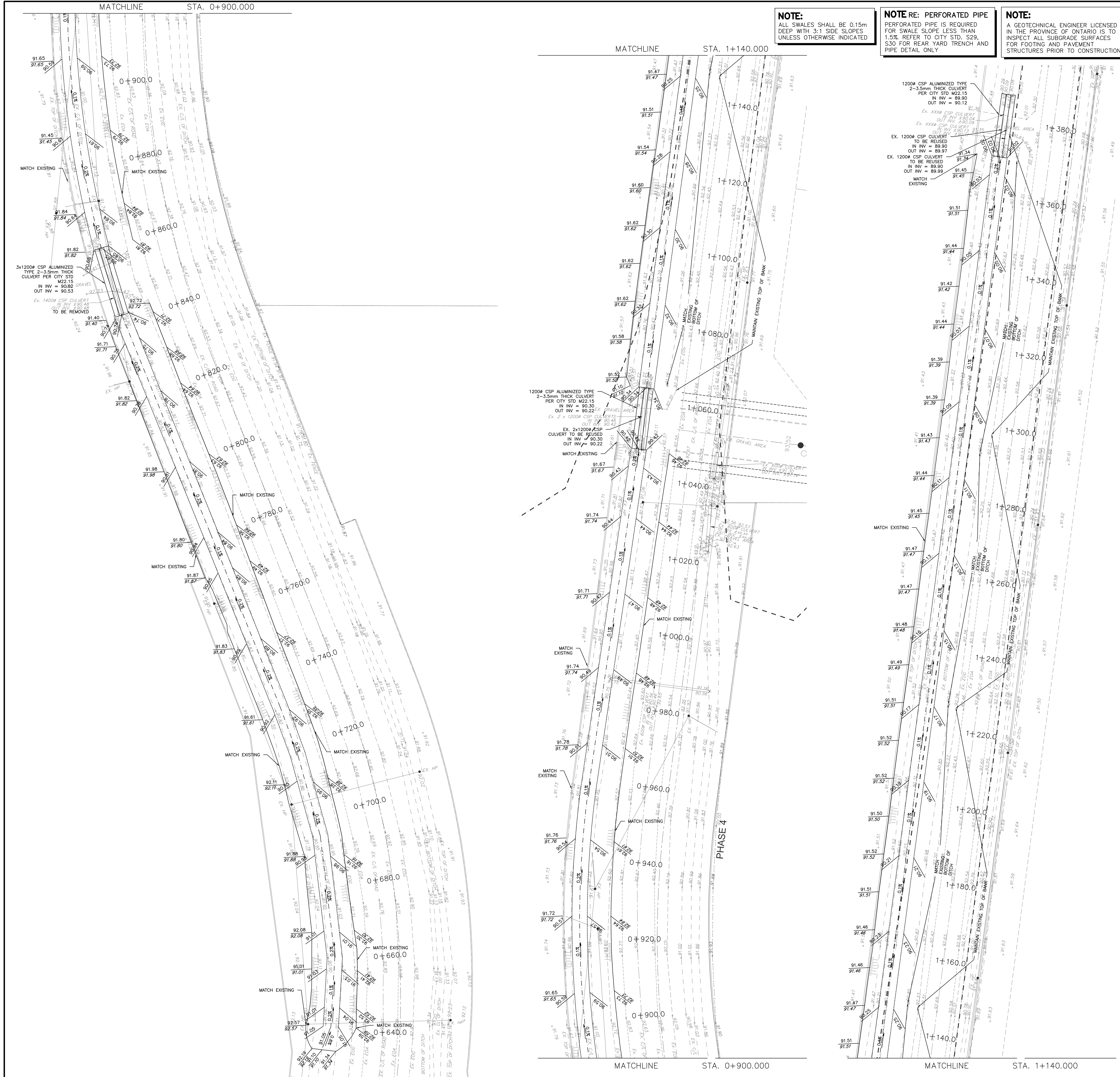
Ottawa CITY OF OTTAWA

GRADING PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.	
SCALE: HORIZ. 1:500 (0 10 20)		SHEET No. 75

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005



NOTE:
ALL SWALES SHALL BE 0.15m DEEP WITH 3:1 SIDE SLOPES UNLESS OTHERWISE INDICATED

NOTE RE: PERFORATED PIPE
PERFORATED PIPE IS REQUIRED FOR SWALE SLOPE LESS THAN 1.5%. REFER TO CITY STD. S29, S30 FOR REAR YARD TRENCH AND PIPE DETAIL ONLY

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NOTE:
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NOTE: TREE REMOVAL
PERMISSION REQUIRED FOR REMOVAL OF EXISTING TREES ON EXTERNAL LANDS WHERE APPLICABLE

NOTE:
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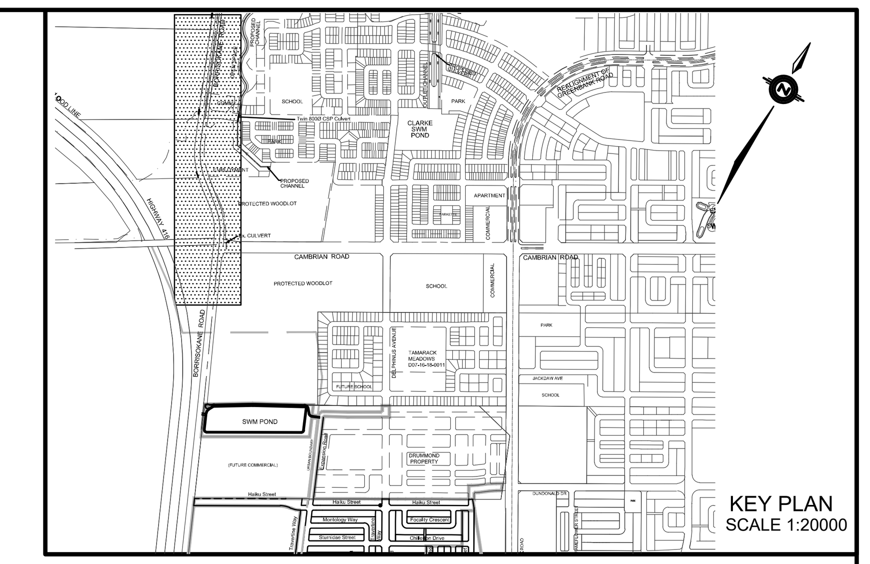
PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE:
FOR CROSS-SECTION 3-3, REFER TO DWG No. 90.



LEGEND

- PROPOSED ELEVATION — 103.45
- EXISTING ELEVATION — 102.73
- FUTURE ELEVATION — [93.900]
- PROPOSED SWALE GRADE — 1.5%
- HIGH POINT — 102.16
- STREET CATCHBASIN
- STREET CATCHBASIN WITH CLOSED LID
- CATCHBASIN MANHOLE
- TEE CATCHBASIN
- ELBOW CATCHBASIN
- HYDRANT, VALVE & VB
- VALVE & VC
- VALVE & VB
- BUILDING ENVELOPE TOP OF FOUNDATION (TOF) — 94.70
- FINISHED FLOOR ELEVATION (FFE) — 95.00
- UNDERSIDE OF FOOTING ELEVATION (USF) — 92.00
- UNITS REQUIRING WATER PRESSURE REDUCING VALVES — PRV
- WALKOUT UNITS — W.O.
- SLAB ON GRADE — SOG
- HYDRO SWITCHGEAR
- HYDRO TRANSFORMER
- STREET LIGHT STANDARD — L.S.
- TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)
- PREVIOUS PHASES / PHASES NOT PART OF CURRENT GRADING APPROVAL
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- EMERGENCY OVERLAND FLOW DIRECTION
- RETAINING WALL AND ELEVATIONS — T/W=103.10, B/W=102.44
- CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
- NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)
- DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)
- CONSTRUCTION FENCE
- PROPERTY BOUNDARY
- 3:1 TERRACING MAXIMUM SLOPE — 100.20, 99.20
- PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m) — 89.64
- 250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)
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TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNES LTD, PROJECT 18-10-145-00, DATED APRIL 6, 2020

BENCH MARK No. 001196403710
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CAIVAN COMMUNITIES

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LICENSED PROFESSIONAL ENGINEER
A. D. FOBERT
100090626
2020-07-27
PROVINCE OF ONTARIO

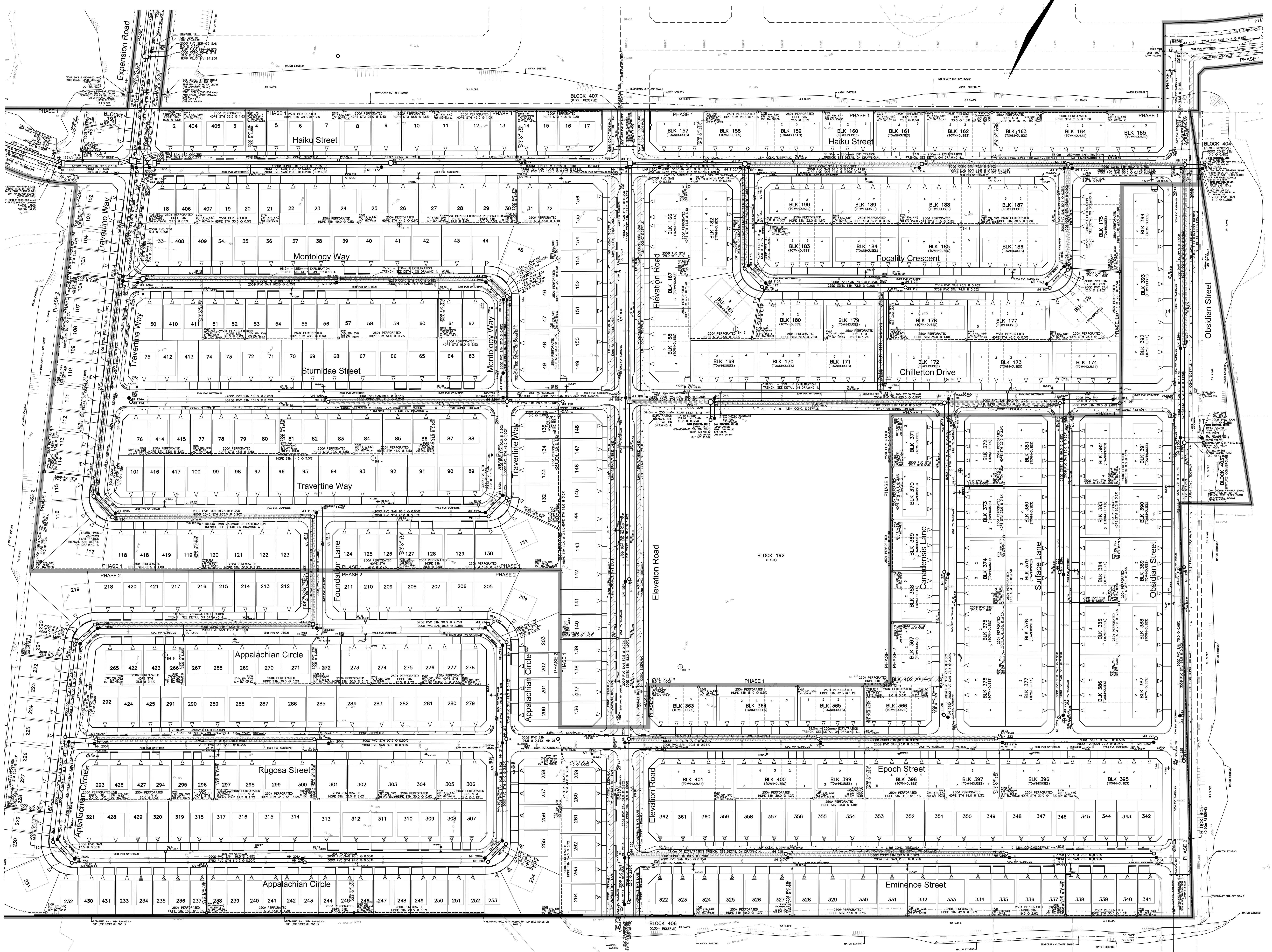
Ottawa CITY OF OTTAWA

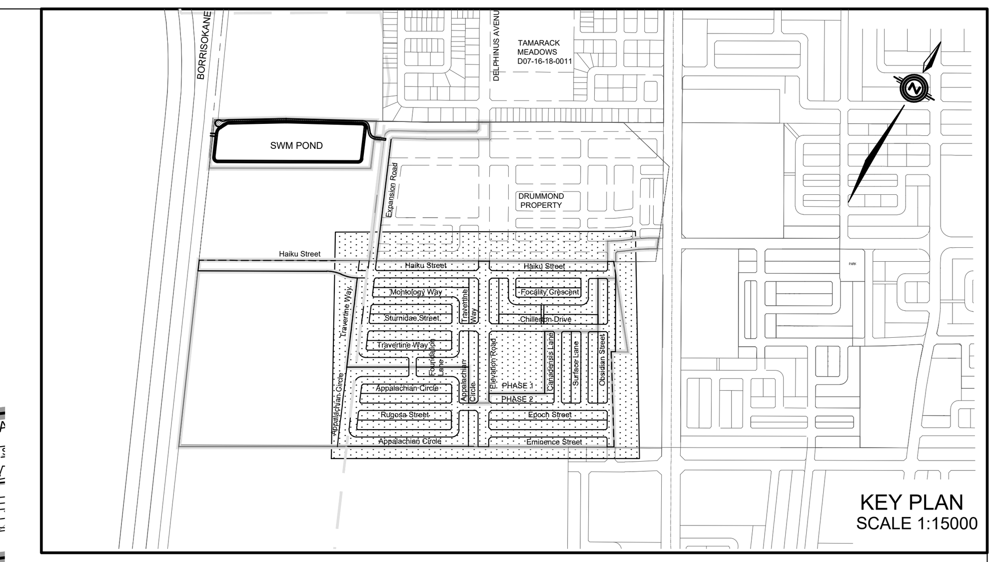
GRADING PLAN

DRAWN BY: G.G.G.	CHECKED BY: A.D.F.	PROJECT No. 18-1030
DESIGNED BY: C.M.K.	CHECKED BY: A.D.F.	
SCALE: HORIZ. 1:500 (0, 10, 20)		SHEET No. 76

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005





LEGEND

- CROSS
- 45° BEND
- LATERAL
- HYDRANT, VALVE & VB
- TEE
- VALVE & VC
- VALVE & VB
- 22.5° BEND
- 11.25° BEND
- REDUCER
- CAP
- SANITARY MAINTENANCE HOLE
- CAP
- STREET CATCHBASIN & LEAD
- STREET CATCHBASIN WITH CLOSED LID & LEAD
- STORM MAINTENANCE HOLE
- CURB INLET CATCH-BASIN & LEAD
- CATCHBASIN/ MAINTENANCE HOLE
- INTERCONNECTED CATCH BASIN & LEADS
- CAP
- TEE CATCHBASIN
- PERFORATED PIPE
- ELBOW CATCHBASIN
- PREVIOUS PHASES
- SINGLE SERVICE LOCATION (ST, SAN & 25mmø PEX TUBING AWWA C-904 WM)
- SINGLE SERVICE LOCATION (ST, SAN & WM)
- SINGLE SERVICE LOCATION (ST, SAN & WM)
- HYDRO SWITCHGEAR
- HYDRO TRANSFORMER
- STREET LIGHT STANDARD
- LOTS EQUIPPED WITH SUMP PUMP (REFER TO DETAIL ON DWG. 3)
- UNITS REQUIRING WATER PRESSURE REDUCING VALVES
- DITCH AND CULVERT
- CONCRETE SIDEWALK
- CURB & DEPRESSED CURB
- ASPHALT SIDEWALK
- CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
- NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)
- DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)
- CONSTRUCTION FENCE
- POST AND RAIL FENCE
- PHASING LIMITS
- PROPERTY BOUNDARY
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- EMERGENCY OVERLAND FLOW DIRECTION
- TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6, SC7, SC7.1, SC7.2, SC7.3)
- EROSION SETBACK
- MEANDER BELT LIMIT
- INFILTRATION TRENCH

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNERS LTD, PROJECT 18-10-145-00, DATED AUGUST 22, 2019

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

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120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

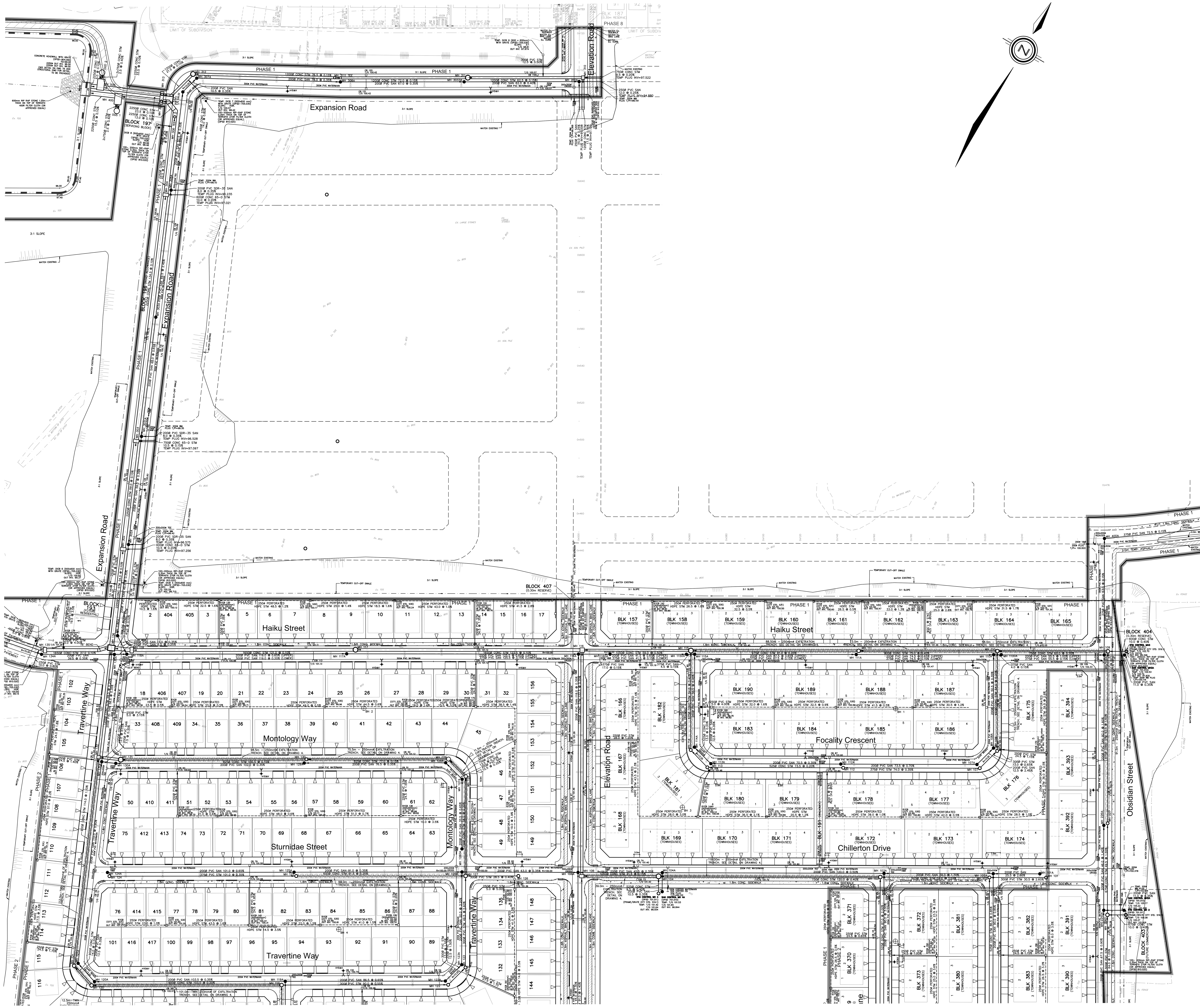
CITY OF OTTAWA

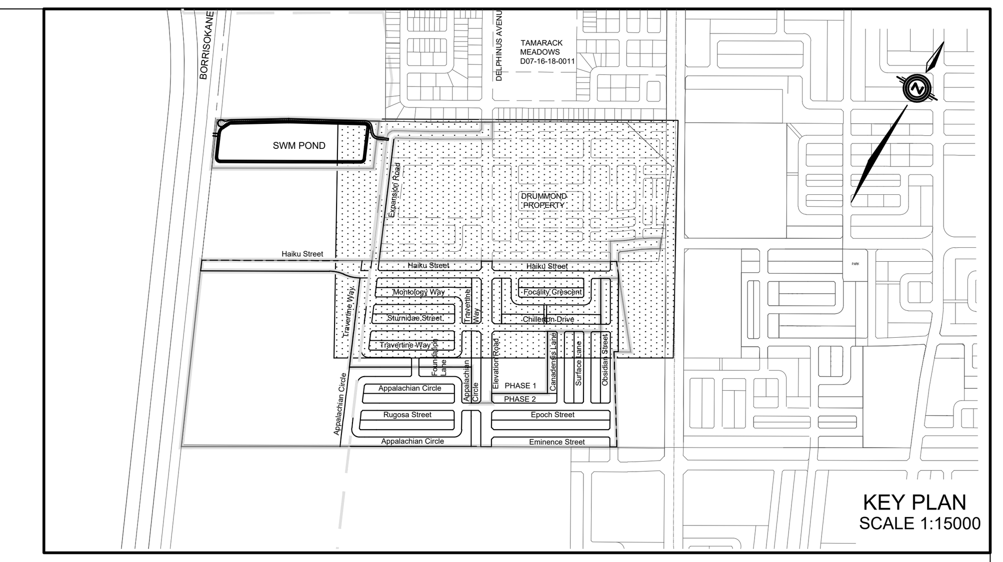
FIGURE 3 - GENERAL PLAN OVERVIEW

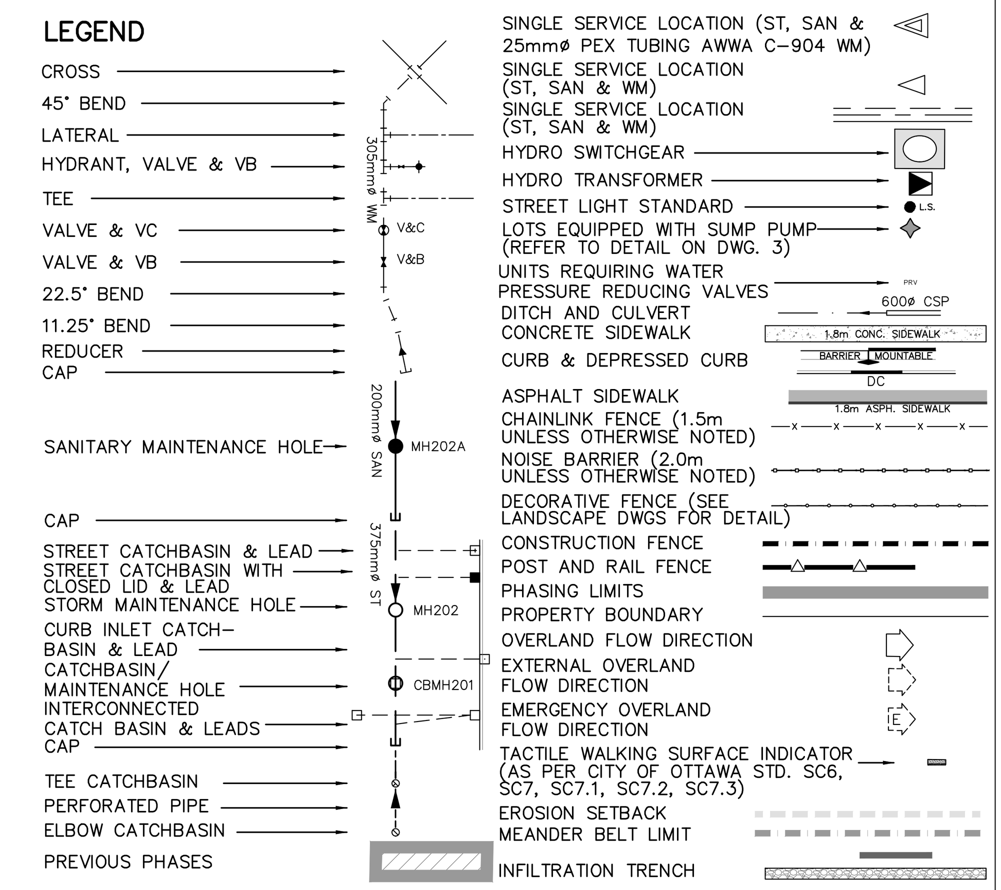
DRAWN BY: XX	CHECKED BY: XX	PROJECT No. 18-1030
DESIGNED BY: XX	CHECKED BY: XX	
SCALE: HORIZ. 1:1000		SHEET No.

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005







NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION

TOPOGRAPHIC INFORMATION
JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
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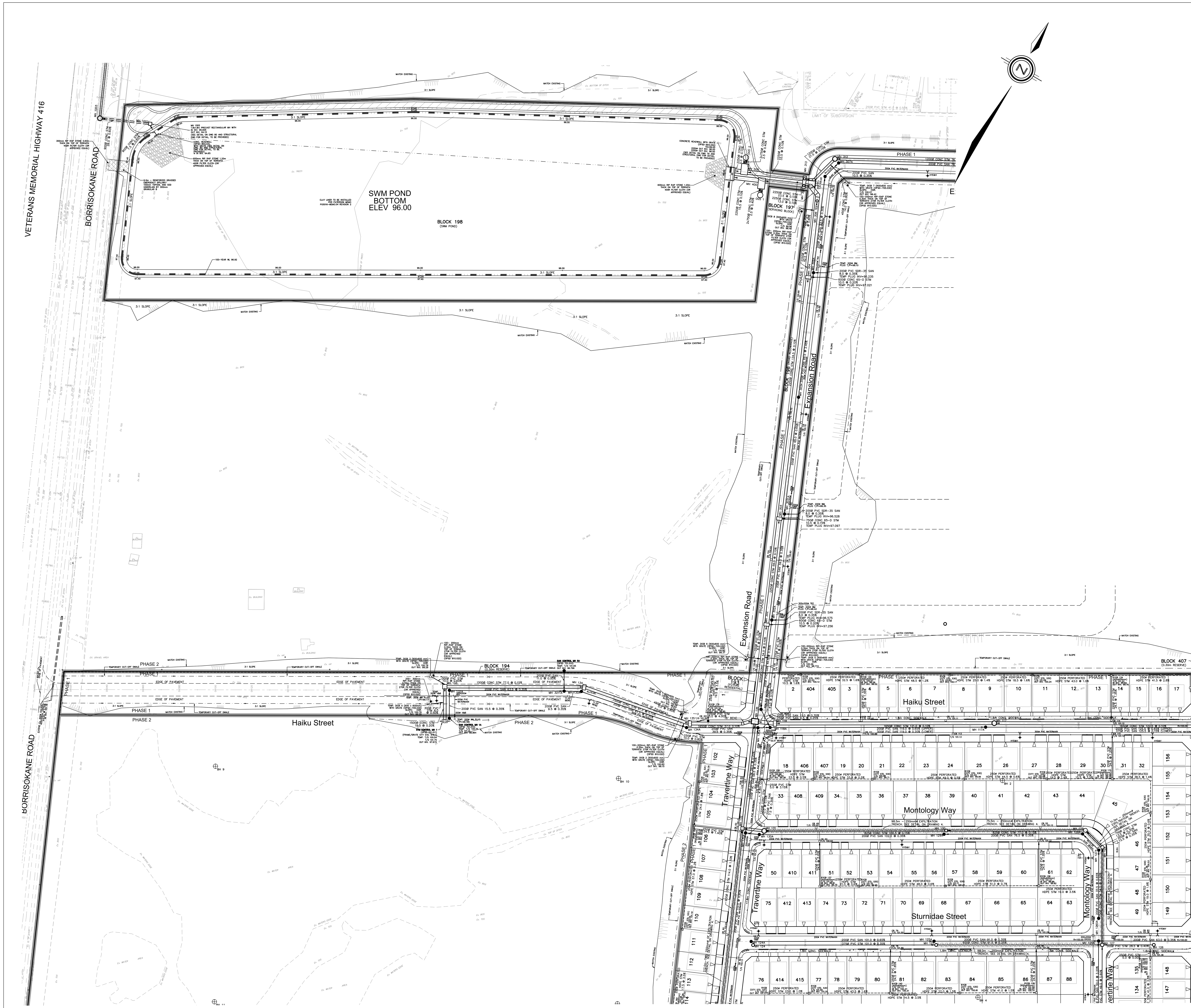
CITY OF OTTAWA

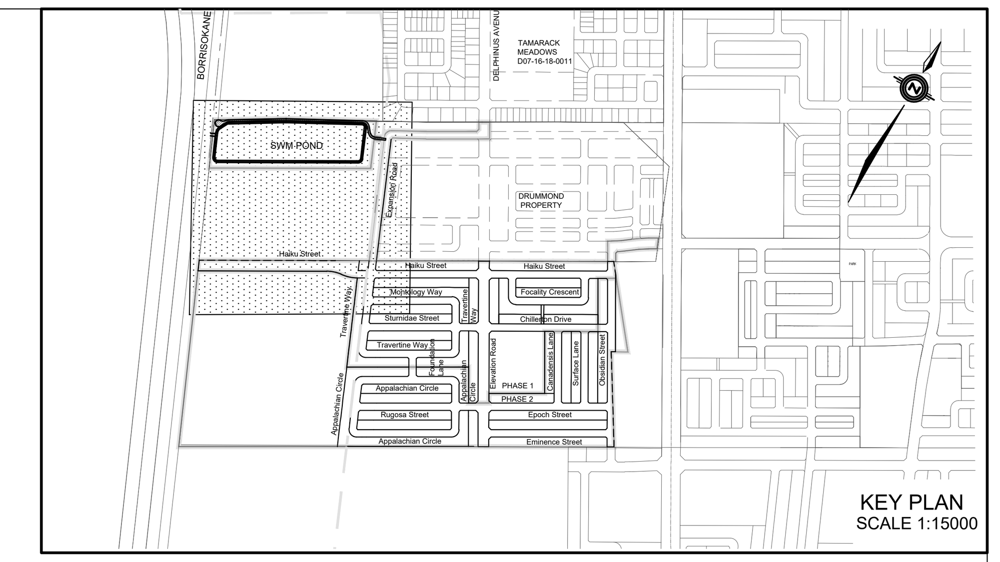
FIGURE 3a - GENERAL PLAN OVERVIEW

DRAWN BY: XX	CHECKED BY: XX	PROJECT No. 18-1030
DESIGNED BY: XX	CHECKED BY: XX	
SCALE: HORIZ. 1:1000 (0 10 20 30 40)		SHEET No.

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005





LEGEND

CROSS
45° BEND
LATERAL
HYDRANT, VALVE & VB
TEE
VALVE & VC
VALVE & VB
22.5° BEND
11.25° BEND
REDUCER
CAP
SANITARY MAINTENANCE HOLE
CAP
STREET CATCHBASIN & LEAD
STREET CATCHBASIN WITH CLOSED LID & LEAD
STORM MAINTENANCE HOLE
CURB INLET CATCH-BASIN & LEAD
CATCHBASIN/ MAINTENANCE HOLE
INTERCONNECTED CATCH BASIN & LEADS
CAP
TEE CATCHBASIN
PERFORATED PIPE
ELBOW CATCHBASIN
PREVIOUS PHASES

SINGLE SERVICE LOCATION (ST, SAN & 25mmø PEX TUBING AWWA C-904 WM)
SINGLE SERVICE LOCATION (ST, SAN & WM)
SINGLE SERVICE LOCATION (ST, SAN & WM)
HYDRO SWITCHGEAR
HYDRO TRANSFORMER
STREET LIGHT STANDARD
LOTS EQUIPPED WITH SUMP PUMP (REFER TO DETAIL ON DWG. 3)
UNITS REQUIRING WATER PRESSURE REDUCING VALVES
DITCH AND CULVERT
CONCRETE SIDEWALK
CURB & DEPRESSED CURB
ASPHALT SIDEWALK
CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)
DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)
CONSTRUCTION FENCE
POST AND RAIL FENCE
PHASING LIMITS
PROPERTY BOUNDARY
OVERLAND FLOW DIRECTION
EXTERNAL OVERLAND FLOW DIRECTION
EMERGENCY OVERLAND FLOW DIRECTION
TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6, SC7, SC7.1, SC7.2, SC7.3)
EROSION SETBACK
MEANDER BELT LIMIT
INFILTRATION TRENCH

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION

TOPOGRAPHIC INFORMATION

JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION

CALCULATED M-PLAN PROVIDED BY JD BARNERS LTD, PROJECT 18-10-145-00, DATED AUGUST 22, 2019

BENCH MARK No. 001196403710

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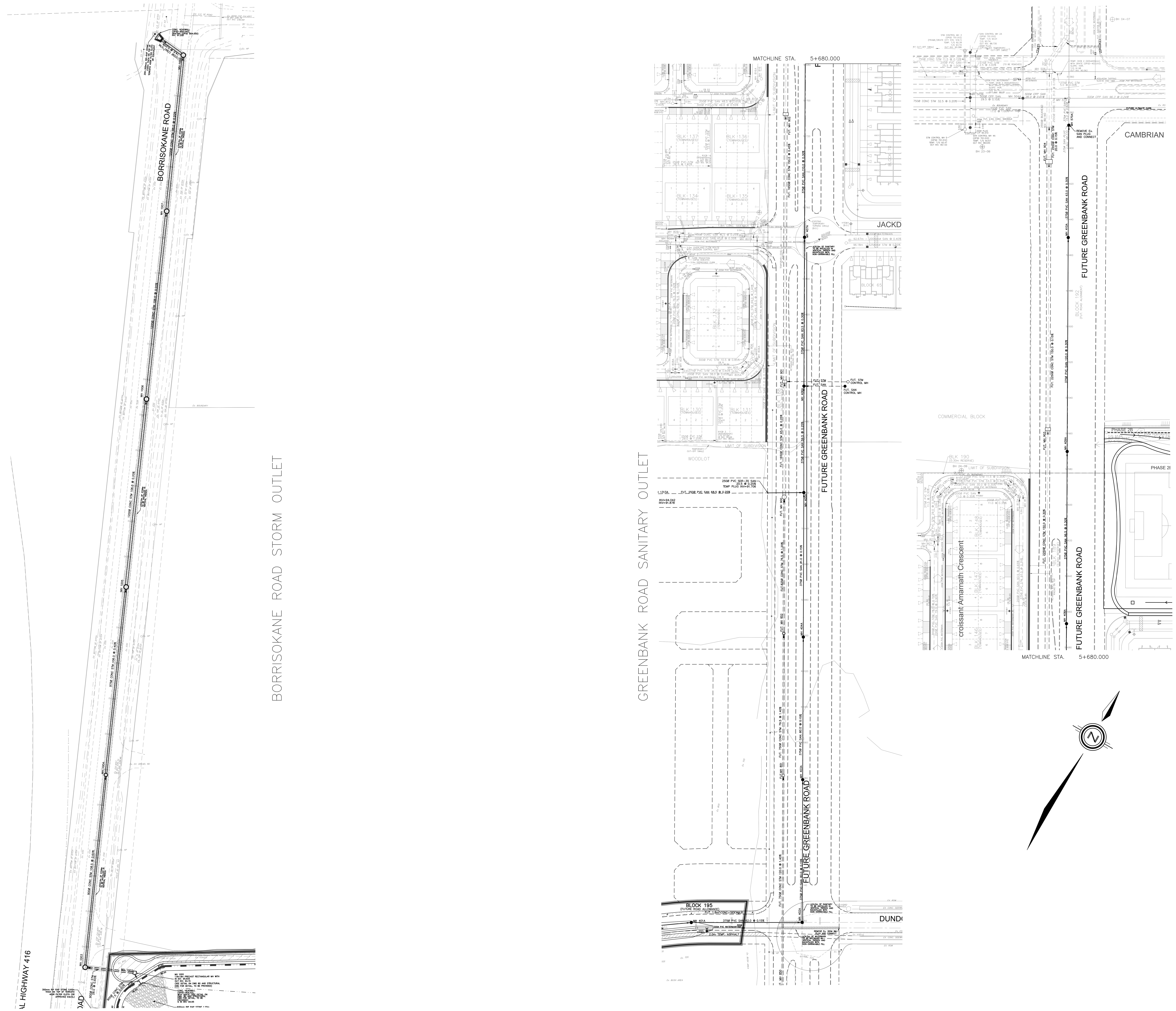
CITY OF OTTAWA

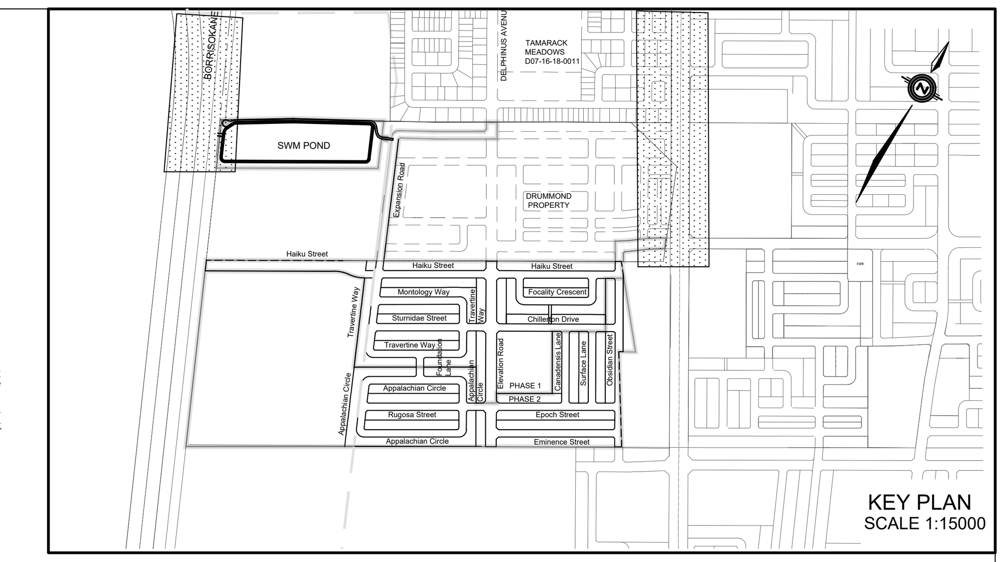
FIGURE 3B - GENERAL PLAN OVERVIEW

DRAWN BY: XX	CHECKED BY: XX	PROJECT No.	18-1030
DESIGNED BY: XX	CHECKED BY: XX	SHEET No.	
SCALE: HORIZ. 1:1000 (0 10 20 30 40)			

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005





LEGEND

CROSS	SINGLE SERVICE LOCATION (ST, SAN & 25mmø PEX TUBING AWWA C-904 WM)
45° BEND	SINGLE SERVICE LOCATION (ST, SAN & WM)
LATERAL	SINGLE SERVICE LOCATION (ST, SAN & WM)
HYDRANT, VALVE & VB	HYDRO SWITCHGEAR
TEE	HYDRO TRANSFORMER
VALVE & VC	STREET LIGHT STANDARD (L.S.)
VALVE & VB	LOTS EQUIPPED WITH SUMP PUMP (REFER TO DETAIL ON DWG. 3)
22.5° BEND	UNITS REQUIRING WATER PRESSURE REDUCING VALVES (PRV)
11.25° BEND	DITCH AND CULVERT (600ø CSP)
REDUCER	CONCRETE SIDEWALK (1.8m CONC. SIDEWALK)
CAP	CURB & DEPRESSED CURB (BARRIER, MOUNTABLE, DC)
SANITARY MAINTENANCE HOLE (200mmø SAN, MH202A)	ASPHALT SIDEWALK (1.8m ASPH. SIDEWALK)
CAP	CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
STREET CATCHBASIN & LEAD	NOISE BARRIER (2.0m UNLESS OTHERWISE NOTED)
STREET CATCHBASIN WITH CLOSED LID & LEAD	DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)
STORM MAINTENANCE HOLE (375mmø ST, MH202)	CONSTRUCTION FENCE
CURB INLET CATCH-BASIN & LEAD	POST AND RAIL FENCE
CATCHBASIN/ MAINTENANCE HOLE (CBMH201)	PHASING LIMITS
INTERCONNECTED CATCH BASIN & LEADS	PROPERTY BOUNDARY
CAP	OVERLAND FLOW DIRECTION
TEE CATCHBASIN	EXTERNAL OVERLAND FLOW DIRECTION
PERFORATED PIPE	EMERGENCY OVERLAND FLOW DIRECTION
ELBOW CATCHBASIN	TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6, SC7, SC7.1, SC7.2, SC7.3)
PREVIOUS PHASES	EROSION SETBACK
	MEANDER BELT LIMIT
	INFILTRATION TRENCH

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JD BARNES LIMITED PROJECT NUMBER 18-10-145-00 SURVEY DATED JULY 26, 2019

LEGAL INFORMATION
CALCULATED M-PLAN PROVIDED BY JD BARNERS LTD, PROJECT 18-10-145-00, DATED AUGUST 22, 2019

BENCH MARK No. 001196403710
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MUNICIPALITY BENCHMARK No. 001196403710 HAVING A PUBLISHED ELEVATION OF 91.724 METERS.

CAIVAN COMMUNITIES

THE RIDGE PHASE 1

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CITY OF OTTAWA

FIGURE 3C - GENERAL PLAN OVERVIEW

DRAWN BY: XX	CHECKED BY: XX	PROJECT No. 18-1030
DESIGNED BY: XX	CHECKED BY: XX	
SCALE: HORIZ. 1:1000 (0 10 20 30 40)		SHEET No.

CITY PLAN No. 17803

CITY FILE No. D07-16-19-0005

E.2 STORMWATER MANAGEMENT REPORT FOR THE RIDGE (BRAZEAU LANDS) BY JFSA (JULY 2020)

Stormwater Management Report for The Ridge (Brazeau) Subdivision

City of Ottawa

July 2020

Prepared for: David Schaeffer Engineering Ltd.

JFSA Ref. No.: 1800-19

Prepared by:

JFSA Water Resources and Environmental Consultants

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Stormwater Management Report for The Ridge (Brazeau) Subdivision

in the City of Ottawa

July 2020

Prepared for :

David Schaeffer Engineering Ltd.

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Stormwater Management Report for The Ridge (Brazeau) Subdivision
in the City of Ottawa

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

Stormwater Management Report for The Ridge (Brazeau) Subdivision
in the City of Ottawa
July 2020

1 INTRODUCTION AND OBJECTIVES

J.F. Sabourin and Associates Inc. (JFSA) were retained by David Schaeffer Engineering Ltd. (DSEL) to prepare a Stormwater Management (SWM) Plan for the Ridge (Brazeau) Subdivision, located within the City of Ottawa. As shown by the image provided on the cover page, the future development is located east of Borrisokane and Highway 416, and south of Cambrian Road. The proposed development will be serviced by a dry SWM pond that will be implemented in the northwest corner of the development and will discharge to the Jock River via an existing ditch on the west side of Borrisokane Road. The proposed development will also be serviced by two oil-and-grit separators that discharge to the SWM pond, that have been sized to ensure 80% Total Suspended Solids (TSS) removal, for more details regarding the OGS units with the development please refer to JFSA's July 2020, Pond Design Brief for the Ridge (Brazeau) Subdivision. As documented in the Barrhaven South Urban Expansion Area Master Servicing Study, by J. L Richards 2018, the development will also have Etobicoke Exfiltration Systems (EES) implemented within this subdivision. These EES will be installed within local roadways of the subdivision, to exfiltrate runoff from the development for the more frequent events. To ensure that the SWM analysis is conservative, these EES's have not been included in this detailed analysis. Please refer to JFSA's "The Ridge (Brazeau) LID Design Report" July 2020 for full details regarding the operations and benefits of the proposed Etobicoke Exfiltration Systems within the site.

The Ridge (Brazeau) development has a total drainage area of 37.03 ha, including a 3.94 ha pond block, a 1.72 ha park block, 2.68 ha of commercial blocks and 28.69 ha of residential development. The proposed development will be treated by the dry pond, along with 21.21 ha of external future commercial development and 13.5 ha of external residential development, for a total drainage area of 71.75 ha. Figure 1 provides an overview of the location of these respective blocks within the subdivision.

The purpose of this report is to evaluate the major and minor system flows of the proposed development with respect to new proposed stormwater management guidelines and to check the adequacy of the proposed pipe sizes to convey the 2-year (5-year on collector and 10-year on arterial roads) and the 100-year storm flows from within the development and from external areas. Background documents that were reviewed in preparing this report include the following:

- *Stormwater Management Planning and Design Manual,* Ministry of the Environment, March 2003.

- *Jock River Flood Risk Mapping (within the City of Ottawa) Hydraulics Report*, PSR Group Ltd. and J.F. Sabourin and Associates Inc., November 2004.
- *Erosion and Sediment Control Guidelines for Urban Construction,* Conservation Halton et al., December 2006.
- *Draft City of Ottawa Stormwater Management Facility Design Guidelines,* IBI Group, April 2012.
- *City of Ottawa Sewer Design Guidelines,* City of Ottawa, October 2012.
- *Technical Bulletin ISDTB-2014-01, Revisions to Ottawa Design Guidelines – Sewer,* City of Ottawa, February 2014.
- *City of Ottawa Technical Bulletin PIEDTB-2016-01*, City of Ottawa, September 2016.
- *City of Ottawa Technical Bulletin ISTB-2018-04*, City of Ottawa, June 2018.
- *Functional Servicing Report for Caivan Communities, Brazeau Lands, 3809 Borrisokane Road*, David Schaeffer Engineering Limited, September 2019.
- *Design Brief for the Stormwater Management Pond for the Ridge (Brazeau) Subdivision,* David Schaeffer Engineering Limited and J.F. Sabourin and Associates Inc., April 2020.

As per the new approach formalized in the September 2016 *City of Ottawa Technical Bulletin PIEDTB-2016-01*, the proposed subdivision has been designed with a 2-year minor system level of service on local roads and 5-year level of service on collector roads (Elevation Road). Where possible with grading and minor system capture limitations, road ponding areas up to 35 cm deep were used to contain the 100-year major system flows.

The SWMHYMO and PCSWMM computer programs were used to model the major and minor systems, to ensure that all the new stormwater management requirements are satisfied. The general SWM design criteria and guidelines that are to be met are described in Section 2.

Figure 1: General Site Location

2 DESIGN CRITERIA AND GUIDELINES

The design criteria and guidelines used for the stormwater management of the subject subdivision are those that were developed in the background documents, as well as those provided in the October 2012 *City of Ottawa Sewer Design Guidelines* and subsequent technical memorandums, and generally accepted stormwater management design guidelines.

The detailed design of the proposed development determined that the 37.03 ha subdivision has an average imperviousness of 54%. The total 71.75 ha drainage area to the dry pond has an average imperviousness of 64%.

A detailed analysis of the proposed dual drainage system was required to confirm that the following general design criteria and guidelines for the minor and major systems would be met.

2.1 Minor System

a) Storm sewers are to be designed to provide a minimum 2-year level of service, plus 5-year inflows on collector roads (Elevation Road) and 10-year inflows on arterial roads.

b) The 100-year hydraulic grade line (HGL) within the development minor systems must be maintained at least 0.3 m below the underside of footing elevation where gravity house connections are installed.

c) For less frequent storms (i.e. larger than 1:2 year or 1:5 year on collector / 1:10 year on arterial roads), the minor system shall, if required, will be limited with the use of inlet control devices to prevent excessive hydraulic surcharges and to maximize the use of surface storage on the road where desired.

d) Catchbasins on the road are to be equipped with City standard type S19 (fish) grates or City standard type S22 side inlets, and grates for catchbasins in rear yards, park and open spaces with pedestrian traffic are to be City standard type S19, S30 and S31.

e) Single catchbasins are to be equipped with 200 mm minimum lead pipes, and double catchbasins are to be equipped with 250 mm minimum lead pipes.

f) Rearyard catchbasins are to be equipped with 250 mm minimum lead pipes. Catchbasins installed on the street, where rearyard catchbasins connect to the main storm sewer through the catchbasin, are to be equipped with 250 mm minimum lead pipes for both single and double catchbasins.

g) Under full flow conditions, the allowable velocity in storm sewers is to be no less than 0.80 m/s and no greater than 3.0 m/s. Where velocities over 3.0 m/s are proposed, provisions shall be made to protect against displacement of sewers by sudden jarring or movement. Velocities greater than 6 m/s are not permitted.

2.2 Major System

a) The major system shall be designed with enough road surface storage to allow the excess runoff of a 100-year storm to be retained within road ponding areas where desired.

b) Inlet control devices should be sized such that they do not create surface ponding on the road during the 2-year design storm on local roads (5-year design storm on collector and 10-year design storm on arterial roads); it should be noted that surface ponding over grates is present during rainfall under any design, as an appropriate depth of water is required for runoff to enter the grate (refer to Tables D-6 of Appendix D).

c) Roof leaders shall be installed to direct the runoff to splash pads and on to grassed areas.

d) For the 100-year storm, the maximum total depth of water (static + dynamic) on all roads shall not exceed 35 cm at the gutter.

e) During the 100-year + 20% stress test, the maximum extent of surface water on streets, rearyards, public space and parking areas shall not touch the building envelope.

f) When catchbasins are installed in rear yards, safe overland flow routes are to be provided to allow the release of excess flows from such areas.

g) The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m^2/s on all roads.

h) The excess major system flows up to the 100-year return period are to be retained on-site in development blocks such as parks, schools, commercial, etc.

i) There must be at least 15 cm of vertical clearance between the spill elevation on the street and the ground elevation at the nearest building envelope that is in the proximity of the flow route or ponding area.

j) There must be at least 30 cm of vertical clearance between the rearyard spill elevation and the ground elevation at the adjacent building envelope.

3 ASSUMPTIONS AND SOURCE OF DATA USED IN THIS STUDY

Sources of information and assumptions made in this study are listed below:

- Stormwater management model: *SWMHYMO (version 5.50), and PCSWMM (version 7.2)*
- Minor system design: *1:2 year, plus 1:5-year inflows on collector roads and 1:10 year on arterial roads. See the Rational Method Calculations in Appendix A.*
- Major system design: *1:100 year*
- Max. 100-yr water depth on roads: *35 cm above the gutter*
- Extent of the major system: *Shall not touch the building envelope during the 100-year + 20% stress test*
- PCSWMM model parameters: *Fo = 76.2 mm/hr, Fc = 13.2 mm/hr, DCAY = 4.14/hr, D.Stor.Imp. = 1.57 mm, D.Stor.Per. = 4.67 mm (as per 2012 City of Ottawa Sewer Design Guidelines) Detailed Area Imperviousness: based on development layout. Lumped Area Imperviousness: based on runoff coefficient (C) where C = 0.7 x imperviousness ratio+ 0.2.*
- Design storms: *2-, 5-, 10- and 100-year 3-hour Chicago and 100-year 24-hour SCS Type II storms as per 2012 City of Ottawa Sewer Design Guidelines; peak averaged over 10 minutes.*
- Historical Events: *July 1st, 1979; August 4th, 1988; and August 8th, 1996 events as per 2012 City of Ottawa Sewer Design Guidelines.*
- Stress Test: *20% increase in the 100-year 3-hour Chicago storm.*
- Street catchbasin covers: *City Standard Type S19 (fish) or City Standard Type S22 (side inlet). Type S19 approach flow-capture curves as per MTO design charts (equivalent to OPSD 400.010). Type S22 approach flow-capture curves as per the 2004 City of Ottawa Guidelines.*
- Rearyard catchbasin covers: *City Standard Type S19, S30 and S31*
- Curb and gutter: *City Standard SC1.3 (mountable) and SC1.1 (barrier). In the absence of flow capture curves for these curbs and gutters, OPSD 600.010 curb and gutters are assumed.*
- Manning's' roughness coeff.: *0.013 for concrete and PVC pipes (free flow).*
- Minor system losses: *Refer to Appendix C for maintenance hole loss coefficients.*
- Underside of footing elevations: *As provided by DSEL.*
- Freeboard in HGL analysis: *0.3 m between the underside of footing elevation and 100-year hydraulic gradeline.*
- Inlet Control Devices: *Refer to Appendix B for Plas-Tech ICD details.*
- Depth of backyard swales: *As per DSEL's Grading Plan*
- Street and pipe dimensions: *As per DSEL's Plan and Profiles*
- Right-of-way characteristics: *As per DSEL's Details of Roads*
- Downstream HGL: *92.5 m based on the top of bank elevation of the ditch that the SWM pond will outlet to.*

4 PROPOSED MINOR AND MAJOR SYSTEM DRAINAGE

The proposed minor and major system drainage routes are shown in plan view in Figures 2 and 3. The residential areas where enough detail was available were modelled in PCSWMM. External or large undetailed future development areas within the subdivision were modelled in SWMHYMO based on the preliminary design information available. The hydrographs generated by SWMHYMO were then read into the PCSWMM model as external hydrographs.

Per the new proposed standards, the minor system has been designed to accommodate a minimum of the 2-year post-development flows from within the site and from external areas, plus 5-year inflows on collector roads (Elevation Road) and 10-year inflows on arterial roads. A Rational Method design was conducted by DSEL (refer to Appendix A) to estimate minor system flows based on the City of Ottawa IDF relationship and selected runoff coefficients.

The minor system release rates from the parklands were set to the 5-year flow based on the rational method, with onsite storage provided up to the 100-year event. The east most commercial lands were limited to the 2-year rational method, with onsite storage provided up to the 100-year event. The ABIC commercial lands were limited to the 2-year pre-development flow per the rational method, and the Brazeau Commercial site limited to maximum flow 1.8m³/s (as per the most recent analysis for the Commercial Brazeau lands), with both sites assumed to have onsite storage provided to the 100-year event. Refer to DSEL's June 2020 Site Plan Report for more details regarding the ABIC site. The collector roads (Elevation Road) were limited to the 5-year rational method as per the City guidelines. The residential lands were limited to 2-year Chicago 3-hour flow + 14% (as calculated by SWMHYMO) to account for additional capture during the 100-year storm as a result of increased head over the catchbasins and lead pipes or inlet control devices, with onsite storage provided to the 100-year event.

For these residential lands under the stress test scenario (100-year Chicago 3-hour +20%) it was assumed that the minor system was set at 107% of 100-year capture, and 100-year + 20% stress test storage set to 145% of 100-year storage. This approach for the residential lands is based on the Abbottsville Crossing was a pilot project. Which looked at the 2-year capture on local road and containment of excess 100-year flows in road ponding areas. Minor system capture during the 100-year + 20% stress test at the detailed design stage for a subdivision or site plan can be evaluated based on the actual design information, e.g. catch basin grate and ICD head-capture relationships, surface storage volumes, simulated water depth, etc. However, there is no set standard or easy rule of thumb for excess capture through catch basin grates, lead pipes and Inlet Control Devices (ICDs) during the 100-year + 20% stress test for undetailed future development areas, where these details don't exist yet. As such, the detailed modelling for the Abbottsville Crossing pilot project has been used as a reference to create a rule of thumb for undetailed areas. As shown in Table D-8 of Appendix D of the September 2018 SWM Report for the Abbottsville Crossing subdivision, minor system capture in the detailed subdivision modelling during the 100-year + 20% storm was 107% greater than the 100-year capture. Similarly, 100-year + 20% surface storage volumes used were 155% greater than those used during the 100-year storm. This was reduced to 145% to be conservative for preliminary modelling of undetailed areas. Refer to Table D-3C in Appendix D for the simulated release rates for the various undetailed lands for the full suite of return periods based on the SWMHYMO modelling.

As noted earlier in this report, where possible with grading limitations, road ponding areas up to 35 cm deep were used to contain the 100-year major system flows in the development. Note that rearyard catchbasins were connected to catchbasins on the road where possible, to allow rearyard runoff access to the storage in road ponding areas at regular intervals. In a design of this type where lots are serviced by gravity house connections, inlet control devices (ICDs) can be used to limit minor system capture at each catchbasin to the appropriate level of service.

Within the development, circular orifice plate type Inlet Control Devices (ICDs) of City standard diameters 83 mm, 94 mm, 102 mm, 108 mm, 127 mm, 152 mm and 178 mm will be used to limit minor system capture to a minimum of the 2-year flow (refer to Appendix B for Plas-Tech ICD details), allowing for sub-surface storage of 0.5 m^3 in single catchbasins, 1.0 m^3 in double catch basins, and 1.9 m^3 in catchbasin manholes. Note that this subsurface catchbasin storage has not been included in the modelling to be conservative.

The street segments within the proposed development have been designed using a 'saw tooth' or 'sagged' road profile. The runoff from within these segments will be conveyed to catchbasins located at the lowest point within the street segment. Flows more than the catchbasin capture rate will be temporarily stored within the 'sagged' street segments and released slowly to the storm sewers, up to the 100-year design storm. When the storage on a specific street segment is surpassed due to blockage or an event greater than the 100-year storm, the excess water will flow towards the next downstream street sag, and eventually to the pond. It should be noted that the major system would outlet during the 100-year + 20% stress test without flooding any of the properties within the subdivision.

If the drainage system's capacity to capture surface flows is exceeded, Figure 4 presents the maximum extent of static surface ponding and volume on the streets based on grading. Additionally, surface storage volumes that may exist in the rear yards have not been considered in this model, and runoff from these areas have been directed straight to the catchbasin that the rear yard swale will discharge to. This has been completed to ensure that the peak flows and ponding volumes calculated in the model are conservative.

The SWMHYMO and PCSWMM analyses, discussed in Sections 4.1 and 4.2, have demonstrated that the proposed drainage system for the subdivision will have sufficient capacity to control the excess flow during a 100-year storm and safely capture and convey the 2-year (plus 5-year on collector roads and 10-year on arterial roads) flow to the pond.

4.1 Major System and SWM Analysis

The PCSWMM and SWMHYMO computer programs were used to model the major and minor system flows within the proposed development and from external areas. As noted above, as the PCSWMM program is most appropriate for use in modelling small urban drainage areas, most undetailed future development areas were instead modelled using SWMHYMO.

The PCSWMM and SWMHYMO models were developed based on the information provided in Figures 2 and 3. Nine (9) simulations were conducted, one for each of the following rainfall events:

i) The 25 mm, 3-hour Chicago storm;
ii) the 2-year, 3-hour Chicago storm;
iii) the 5-year, 3-hour Chicago storm;
iv) the 100-year, 3-hour Chicago storm;
v) the 100-year, 24-hour SCS Type II storm
vi) the July 1st, 1979 historical event;
vii) the August 4th, 1988 historical event;
viii) the August 8th, 1996 historical event; and
ix) the 100-year, 3-hour Chicago storm + 20%.

Note that the purpose of simulating the 100-year, 3-hour Chicago storm with a 20% increase is to stress test the drainage system for potential flooding, as per the October 2012 *City of Ottawa Sewer Design Guidelines*.

The depression storage and infiltration parameters in both the PCSWMM and SWMHYMO models are as per the October 2012 *City of Ottawa Sewer Design Guidelines*. The percent imperviousness of the detailed drainage areas was measured based on the proposed development layout. The proposed development layouts have been established based on zoning requirements and represent the largest allowable footprint on each lot. DSEL have measured the impervious area in each catchment discreetly, and as such, the percent impervious values can be considered to be based on zoning. The percent imperviousness of undetailed (lumped/external) drainage areas were calculated based on the runoff coefficient (C), where C = 0.7 x imperviousness ratio + 0.2. Figure 1 provides an overview of the subcatchments, and Table D-3A and D-3B provide a full summary of all subcatchment parameters modelled in PCSWMM and SWMHYMO respectively.

The approach flow/capture curves applied in the PCSWMM model were based on the values outlined in the City of Ottawa Sewer Design Guidelines (Appendix 7-A.13). These approach flow/capture curves were converted to a depth/capture curve using PCSWMM's diversion node and kinematic wave equations. A depth/capture curve was derived for each of the cross-section profiles and the various slopes. Where required inflows are limited by circular orifice plate type Inlet Control Devices (ICDs) of City standard diameters 83 mm, 94 mm, 102 mm, 108 mm, 127 mm, 152 mm and 178 mm. Note that 200 mm diameter lead pipes were assumed and are required between single catchbasins and the storm sewers, and 250 mm diameter lead pipes were assumed and are required between rearyard catchbasins or single catchbasin manholes and the storm sewers. Double catchbasins and double catchbasin maintenance holes are to be equipped with 250 mm diameter lead pipes. No temporary CBs are required within the development. Refer to Table D-4A in Appendix D for the depth/capture curves applied in the model for catch basins on a constant slope, and Table D-4B for catchbasins at localized depressions with ICD's.

Within the proposed subdivision, the dynamic flow depth on the road (at the gutter) will be minimal during the 100-year Chicago storm, as the 100-year flows are mostly retained within the road ponding areas and do not accumulate as in a typical subdivision design. Furthermore, it was determined that for the 100-year storm at all major system segments, the product of the depth of water (m) at the gutter multiplied by the velocity of flow (m/s) will not exceed the maximum allowable 0.6 m^2/s (refer to Table D-8 of Appendix D, where the calculated maximum was determined to be 0.56 m^2/s). Table D-9 of Appendix D presents the stress test results for dynamic flow depth on the road based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*. As shown in Table D-9, the maximum dynamic flow depth under these conditions is calculated as 0.48 cm, and the product of the depth of water at the gutter multiplied by the velocity of flow is 0.59 m^2/s. Refer below for an assessment of the ponding depth on the road.

Details of the 100-year street maximum water depth and surf elevations are provided in Table D-7 of Appendix D. Based on DSEL's grading the major system has approximately 896 m^3 of storage at these localized low points throughout the development. Depths calculated by the PCSWMM model demonstrates that a total 100-year depth of water (static and dynamic) on the street at these ponding areas will not exceed the maximum depth of 35 cm.

Table D-7 of Appendix D also presents the street storage stress test results based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*. As shown in Table D-7, the maximum depth of water (static + dynamic overflow) at any ponding area under these conditions is calculated as 48 cm. The maximum extent of surface water during the 100-year + 20% stress test will not touch the building envelopes, refer to DSEL drawings number 95-97 for the flood extent of these ponding depths.

An overland flow route is to be provided on Expansion Road in the subdivision to safely convey flows to the pond (Junction C144). This overflow has been set that the crest of the spill elevation and has been represented in the model as a 5m wide open rectangular cross-section. The curb cut and overland flow route are to be constructed as required to convey the 100-year major system flow without exceeding 35 cm during the 100-year storm, and without touching the building envelopes during the 100-year + 20% stress test. Based on the PCSWMM model the overland flow route will have a maximum normal flow depth of 5 cm during the 100-year 3-hour Chicago storm and 6 cm during the 100-year + 20% stress test. Table 1 presents a summary of the major system results simulated in PCSWMM during the 100-year Chicago storm.

Table 1: Summary of Major System Results for the 100-Yea

Catch Basin ID	Flow Depth (cm)	Approach Flow (m^3/s)	Captured Flow (m^3/s)
CB_001	20	0.032	0.021
CB_002	20	0.032	0.019
CB_003	28	0.222	0.099
CB_004	28	0.222	0.045
CB_005	21	0.132	0.044
CB_006	21	0.132	0.071
CB_007	10	0.180	0.038
CB_008	9	0.133	0.034
CB_009	9	0.133	0.034
CB_010	7	0.070	0.020
CB_011	7	0.070	0.020
CB_012	15	0.043	0.031
CB_013	15	0.043	0.018
CB_014	5	0.048	0.014
CB_015	5	0.048	0.014
CB_016	5	0.064	0.016
CB_017	9	0.747	0.195
CB_018	10	0.414	0.036
CB_019	10	0.453	0.034
CB_020	9	0.406	0.033
CB_021	27	0.120	0.033
CB_022	27	0.120	0.033
CB_023	13	0.085	0.021
CB_024	29	0.177	0.073
CB_025	29	0.177	0.046
CB_026	23	0.077	0.019
CB_027	23	0.077	0.024
CB_028	23	0.076	0.032
CB_029	23	0.076	0.019
CB_030	28	0.204	0.051
CB_031	28	0.204	0.073
CB_032	20	0.101	0.070
CB_033	20	0.101	0.019
CB_034	5	0.054	0.011
CB_035	4	0.056	0.012
CB_036	8	0.113	0.026
CB_037	8	0.113	0.026
CB_038	9	0.249	0.035
CB_039	25	0.190	0.098
CB_040	25	0.190	0.064
CB_041	7	0.112	0.023
CB_042	7	0.112	0.023
CB_043	9	0.192	0.030
CB_044	9	0.192	0.030
CB_045	27	0.197	0.089
CB_046	27	0.197	0.065
CB_047	29	0.307	0.090
CB_048	29	0.307	0.090
CB_049	27	0.168	0.045
CB_050	27	0.168	0.072
CB_051	29	0.192	0.073
CB_052	29	0.192	0.046
CB_053	10	0.496	0.033
CB_054	9	0.412	0.029
CB_055	12	0.428	0.042

Table 1: Summary of Major System Results for the 100-Yea

Catch Basin ID	Flow Depth (cm)	Approach Flow (m^3/s)	Captured Flow (m^3/s)
CB_056	9	0.130	0.030
CB_057	9	0.130	0.030
CB_058	10	0.273	0.039
CB_059	8	0.210	0.029
CB_060	8	0.210	0.029
CB_061	6	0.112	0.022
CB_062	6	0.112	0.022
CB_065	3	0.032	0.006
CB_066	6	0.047	0.016
CB_067	6	0.047	0.016
CB_068	6	0.074	0.017
CB_069	6	0.074	0.017
CB_070	6	0.067	0.018
CB_071	6	0.067	0.018
CB_072	6	0.133	0.020
CB_073	35	0.278	0.074
CB_074	35	0.278	0.067
CB_075	13	0.273	0.043
CB_076	13	0.273	0.043
CB_077	8	0.300	0.029
CB_078	28	0.204	0.036
CB_079	28	0.204	0.029
CB_080	35	0.225	0.101
CB_081	35	0.225	0.091
CB_082	29	0.165	0.066
CB_083	29	0.165	0.100
CB_084	34	0.172	0.034
CB_085	34	0.172	0.046
CB_086	21	0.141	0.071
CB_087	21	0.141	0.044
CB_088	31	0.109	0.020
CB_089	31	0.109	0.046
CB_090	4	0.058	0.011
CB_091	6	0.101	0.018
CB_092	6	0.101	0.018
CB_093	8	0.234	0.025
CB_095	9	0.135	0.036
CB_096	9	0.135	0.036
CB_097	6	0.059	0.018
CB_098	6	0.059	0.018
CB_099	27	0.146	0.045
CB_100	27	0.146	0.050
CB_101	3	0.016	0.004
CB_102	31	0.178	0.073
CB_103	31	0.178	0.020
CB_104	9	0.060	0.029
CB_105	9	0.060	0.029
CB_106	30	0.199	0.066
CB_107	30	0.199	0.100
CB_108	8	0.164	0.028
CB_109	6	0.152	0.023
CB_111	29	0.182	0.046
CB_112	9	0.062	0.028
CB_113	9	0.062	0.028
CB_114	26	0.181	0.072

Table 1: Summary of Major System Results for the 100-Yea

Catch Basin ID	Flow Depth (cm)	Approach Flow (m^3/s)	Captured Flow (m^3/s)
CB_115	26	0.181	0.072
CB_116	12	0.071	0.043
CB_118	19	0.059	0.027
CB_119	19	0.059	0.024
CB_120	19	0.112	0.070
CB_121	19	0.112	0.044
CB_123	12	0.071	0.048
CB_124	16	0.050	0.035
CB_125	16	0.050	0.018
CB_126	19	0.069	0.021
CB_127	19	0.069	0.032
CB_128	10	0.180	0.038
CB_129	6	0.045	0.015
CB_130	6	0.045	0.015
CB_131	11	0.402	0.037
CB_201	0	0.012	0.012
CB_203	11	0.103	0.020
CB_204	0	0.014	0.014
CB_205	14	0.146	0.048
CB_206	16	0.090	0.021
CB_207	16	0.086	0.021
CB_208	0	0.018	0.018
DCB_063	28	0.170	0.033
DCB_064	28	0.170	0.051
DCB_110	29	0.182	0.073
DCB_117	5	0.160	0.082
DCB_122	5	0.160	0.042
DICB_1	22	0.052	0.019
DICB_2	22	0.052	0.019
DICB_3	25	0.097	0.025
DICB_4	25	0.097	0.025

4.2 Minor System and Hydraulic Grade line Analysis

The minor system analysis was completed using the PCSWMM program based on the peak flows captured during the rainfall events. Note that the storm sewer design is as provided by DSEL, and a Manning's roughness coefficient of 0.013 was used for concrete and PVC storm sewer pipes. Refer to Appendix C for maintenance hole loss coefficients used in the PCSWMM model.

The minor system performance was analyzed under restrictive downstream conditions. Restrictive downstream conditions for the pond are based on the approximate top of bank elevation of 92.5 m at the existing Borrisokane Road ditch that the storm sewer will outlet too. Table 2 presents the peak minor system outflows obtained with the above-mentioned simulations.

Table 2: Comparison of Minor System Flows to the Pond

Location	**DSEL Rational Method Flow** (m^3/s)	**2-Year PCSWMM/ SWMHYMO Flow** (m^3/s)	**5-Year PCSWMM/ SWMHYMO Flow** (m^3/s)	**100-Year PCSWMM/ SWMHYMO Flow** (m^3/s)
MH 501 to Pond	1.028	2.924	3.966	5.175
MH 401 to Pond	4.787	2.836	4.252	5.737
Total (1)	5.815	5.76	8.218	10.912

(1)The total flow is taken as the direct summation of peak inflows and does not consider the difference in the timing of peaks

Table 2 shows that the total 2-year flows simulated by the PCSWMM/SWMHYMO models are similar to the values calculated by DSEL's Rational Method calculations. Although there is a difference in the individual flows calculated at MH 401 and MH 501 between the Rational method and PCSWMM results. This can be explained by the fact that these two branches will be connected upstream at MH 313 and MH 307 to make full use of the OGS units and minor system infrastructure; this connection has been represented in the PCSWMM modelling but not in the Rational Method calculations.

The PCSWMM/SWMHYMO simulations have determined that for the selected 2-, 5- and 100-year storms, the total minor system flows would be 5.76 m^3/s, 8.218 m^3/s and 10.912 m^3/s, respectively. Note that the values above are simply a summation of peak flows from MH 501 and MH 401 and do not consider the timing of peaks. Although the 100-year flow will surcharge most parts of the minor system, a freeboard of 0.3 m between the 100-year hydraulic grade line and the underside of footings has been provided throughout the proposed development.

The proposed development will provide 80% TSS removal through the use of 2 OGS units, that will treat runoff from high pollutant areas. The total area directed to the OGS units is equal to 60.42 ha, note this does not include the Pond Block or ABIC lands which would not contribute to the OGS. The two OGS units (manufacturer: CDS model: PMSU5668_10) will be implemented within this development downstream of MH 313 and MH 307. Each unit will have a total holding capacity of 25,960 L, a sump capacity of 8,896 L and an oil capacity of 4,435 L. Note that the two units are identical as the flow to each unit will be close to equal for a given event due to the upstream flow connection, and have been sized based on this consideration. Full details of the OGS unit sizing and specifications can be found in JFSA's July 2020 Pond Design Brief for the Ridge (Brazeau) subdivision. Refer to DSEL drawing sheet number 79 for detailed drawings of the proposed OGS units.

A portion of the Ridge development will also be treated for water quality via EES units that will capture and infiltrate runoff from local street roads. For full details regarding the EES units within the development refer to JFSA July 2020 LID Memo for the Ridge (Brazeau) Development. Catchbasins that capture runoff to these EES units will be fitted with Goss traps. It has been assumed that the surrounding future lands will have independent water quality measures on-site, whether that be by way of OGS or EES units or SWM ponds.

Tables C-1A and C-1E of Appendix C summarizes the pipe data and hydraulic simulation results for the 100-year 3-hour Chicago storm, 100-year 24-hour SCS Type II storm and the three historical events. Note that a minimum freeboard of 0.3 m between the hydraulic grade line and the underside of footings has been provided throughout the proposed developments for the 100-year storms, and a minimum freeboard of 0 m has been provided throughout the proposed development for the historical events. Additionally, note that the majority of the flowing full pipe velocities are no less than 0.80 m/s and no greater than 3.0 m/s for all proposed pipes with the exception of 4 locations. Where velocities over 3.0 m/s are proposed, provisions shall be made to protect against displacement of sewers by sudden jarring or movement. Velocities greater than 6 m/s are not permitted.

Table C-1F of Appendix C presents the climate change stress test results for the hydraulic grade line analysis based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*. Under these conditions, no locations within the proposed developments have a USF freeboard less than 0 m.

Table 3 presents the composite hydraulic grade line results for the 100-year 3-hour Chicago and 100-year 24-hour SCS Type II design storms. Note to simplify this analysis, the highest HGL and the lowest USF on a single pipe length are compared, if it is found that the freeboard between these two locations is either less than 0.3m or less than 0.0m this location is flagged yellow or red respectively. This flag then initiates a detailed analysis for this segment, where the HGL is interpolated along the full length of the pipe and then compared with the individual USF along with the distance, to confirm whether there is an HGL issue along that segment.

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
MH_401	POND	96.930	96.730	#N/A	#N/A	#N/A			
MH_501	POND	96.920	96.730	#N/A	#N/A	#N/A			
MH_1002	MH_1003	95.200	94.592	#N/A	#N/A	#N/A			
MH_1003	MH_1004	94.592	93.316	#N/A	#N/A	#N/A			
MH_1004	MH_1005	93.316	92.923	#N/A	#N/A	#N/A			
MH_1005	MH_1006	92.923	92.831	#N/A	#N/A	#N/A			
MH_1006	MH_1007	92.831	92.740	#N/A	#N/A	#N/A			
MH_1007	MH_1008	92.740	92.580	#N/A	#N/A	#N/A			
MH_1008	MH_1009	92.580	92.500	#N/A	#N/A	#N/A			
MH_101	MH_102	100.935	100.197	174-2	101.41	0.475			
MH_102	MH_103	100.197	99.575	172-5	100.47	0.273			
				172-5	100.47	0.822	59.0	6.9	99.648
				173-1	100.78	1.014	59.0	18.1	99.766
				173-2	100.78	0.930	59.0	26.1	99.850
				173-3	101.1	1.174	59.0	33.3	99.926
				173-4	101.1	1.090	59.0	41.3	100.010
				173-5	101.1	1.009	59.0	48.9	100.091
				174-1	101.41	1.241	59.0	56.3	100.169
MH_103	MH_104	99.575	99.245	169-2	99.81	0.235			
				169-2	99.81	0.558	120.0	2.7	99.252
				169-3	99.81	0.538	120.0	10	99.273
				169-4	99.81	0.516	120.0	18	99.295
				170-1	99.93	0.606	120.0	28.6	99.324
				170-2	99.93	0.584	120.0	36.6	99.346
				170-3	99.93	0.563	120.0	44.2	99.367
				171-1	99.99	0.594	120.0	54.9	99.396
				171-2	99.99	0.572	120.0	62.9	99.418
				171-3	99.99	0.552	120.0	70.1	99.438
				171-4	99.99	0.530	120.0	78.1	99.460
				172-1	100.47	0.961	120.0	96.1	99.509
				172-2	100.47	0.939	120.0	104.1	99.531
				172-3	100.47	0.919	120.0	111.3	99.551
				172-4	100.47	0.903	120.0	117	99.567
MH_104	MH_106	99.245	99.115	169-1	99.81	0.565			
MH_105	MH_106	100.002	99.115	148	100.03	0.028			
				148	100.03	0.792	91.0	12.6	99.238
				147	100.16	0.803	91.0	24.8	99.357
				146	100.3	0.844	91.0	35	99.456
				145	100.42	0.855	91.0	46.2	99.565
				144	100.56	0.856	91.0	60.4	99.704
				143	100.93	1.092	91.0	74.2	99.838
				142	101.5	1.518	91.0	88.9	99.982
MH_106	MH_116	99.115	98.880	166-1	99.53	0.415			
MH_107	MH_108	99.460	99.478	176-1	100.1	0.640			
MH_107	MH_112	99.460	99.411	185-1	99.89	0.430			
MH_108	MH_110	99.478	99.456	175-1	100.15	0.672			
MH_109	MH_110	99.691	99.456	164-2	100.01	0.319			
				164-2	100.01	0.549	60.0	1.2	99.461
				164-3	100.25	0.768	60.0	6.7	99.482
				164-4	100.25	0.736	60.0	14.7	99.514
				165-1	100.42	0.865	60.0	25.3	99.555
				165-2	100.93	1.345	60.0	32.9	99.585
				165-3	100.93	1.314	60.0	40.9	99.616
MH_110	MH_111	99.456	99.235	162-1	99.69	0.234			
				188-4	99.86	0.619	75.0	2	99.241
				162-1	99.69	0.436	75.0	6.3	99.254

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (2) (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
				188-3	99.86	0.598	75.0	9.2	99.262
				162-2	99.69	0.413	75.0	14.3	99.277
				188-2	99.86	0.574	75.0	17.2	99.286
				162-3	99.69	0.391	75.0	21.6	99.299
				188-1	99.86	0.552	75.0	24.8	99.308
				162-4	99.69	0.362	75.0	31.6	99.328
				187-4	99.86	0.520	75.0	35.5	99.340
				163-1	99.77	0.417	75.0	40.2	99.353
				187-3	99.86	0.497	75.0	43.5	99.363
				163-2	99.77	0.394	75.0	47.8	99.376
				187-2	99.86	0.476	75.0	50.7	99.384
				163-3	99.77	0.371	75.0	55.8	99.399
				187-1	99.86	0.452	75.0	58.7	99.408
				164-1	100.01	0.579	75.0	66.5	99.431
MH_111	MH_115	99.235	99.046	159-1	99.58	0.345			
MH_112	MH_113	99.411	99.214	183-1	99.74	0.329			
MH_113	MH_114	99.214	99.146	181-1	99.85	0.636			
MH_1	MH_133	98.777	98.629	Est. Fut	99.86	1.083			
MH_114	MH_115	99.146	99.046	182-1	99.58	0.434			
MH_115	MH_116	99.046	98.880	157-1	99.46	0.414			
MH_116	MH_117	98.880	98.727	30	99.32	0.440			
MH_117	MH_118	98.727	98.545	20	99.11	0.383			
				18	99.18	0.628	121.0	4.4	98.552
				2	99.16	0.603	121.0	7.7	98.557
				406	99.18	0.611	121.0	16.1	98.569
				404	99.18	0.604	121.0	20.3	98.576
				407	99.16	0.576	121.0	25.7	98.584
				405	99.18	0.589	121.0	30.5	98.591
				19	99.16	0.558	121.0	37.9	98.602
				3	99.14	0.534	121.0	40.7	98.606
				20	99.11	0.493	121.0	48.1	98.617
				4	99.14	0.518	121.0	51.2	98.622
				21	99.12	0.486	121.0	59.3	98.634
				5	99.22	0.582	121.0	62.1	98.638
				22	99.21	0.557	121.0	71.5	98.653
				6	99.23	0.575	121.0	73.3	98.655
				23	99.22	0.550	121.0	82.9	98.670
				7	99.24	0.563	121.0	87.8	98.677
				24	99.28	0.589	121.0	97.3	98.691
				8	99.31	0.610	121.0	102.8	98.700
				25	99.36	0.645	121.0	113.1	98.715
				9	99.4	0.677	121.0	118.2	98.723
MH_118	MH_136	98.545	98.434	#N/A	#N/A	#N/A			
MH_119	MH_120	100.114	99.688	101	100.65	0.536			
MH_119	MH_122	100.114	99.693	#N/A	#N/A	#N/A			
MH_120	MH_121	99.688	99.310	116	101.03	1.342			
MH_121	MH_132	99.310	98.588	106	99.54	0.230			
				106	99.54	0.906	114.0	7.2	98.634
				107	99.71	0.999	114.0	19.4	98.711
				108	99.88	1.098	114.0	30.6	98.782
				109	100.05	1.204	114.0	40.8	98.846
				110	100.15	1.224	114.0	53.4	98.926
				111	100.32	1.322	114.0	64.8	98.998
				112	100.48	1.404	114.0	77	99.076
				113	100.57	1.423	114.0	88.2	99.147
				114	100.57	1.359	114.0	98.4	99.211

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
				115	100.65	1.373	114.0	108.8	99.277
MH_122	MH_123	99.663	99.517	131	100.61	0.947			
MH_123	MH_127	99.517	99.112	135	99.89	0.373			
MH_124	MH_125	99.469	99.331	72	99.77	0.301			
				82	99.89	0.552	101.0	5.4	99.338
				69	99.84	0.498	101.0	8.4	99.342
				70	99.78	0.424	101.0	18.6	99.356
				81	99.89	0.532	101.0	19.6	99.358
				71	99.78	0.408	101.0	29.7	99.372
				80	99.92	0.547	101.0	31	99.373
				72	99.77	0.384	101.0	39.9	99.386
				79	100.04	0.645	101.0	46.9	99.395
				73	99.82	0.419	101.0	51.1	99.401
				78	100.04	0.635	101.0	54.4	99.405
				74	99.88	0.465	101.0	61.3	99.415
				77	100	0.581	101.0	64.6	99.419
				413	99.93	0.499	101.0	73.4	99.431
				415	100.08	0.646	101.0	75.2	99.434
				412	99.98	0.537	101.0	82.3	99.443
				414	100.1	0.651	101.0	86.4	99.449
				75	99.98	0.521	101.0	94	99.459
				76	100.16	0.695	101.0	98.1	99.465
MH_125	MH_127	99.331	99.112	65	99.58	0.249			
				88	99.82	0.670	91.5	16	99.150
				63	99.59	0.438	91.5	16.6	99.152
				87	99.82	0.637	91.5	29.7	99.183
				64	99.59	0.405	91.5	30.3	99.185
				86	99.65	0.440	91.5	41.1	99.210
				65	99.58	0.363	91.5	43.9	99.217
				85	99.74	0.495	91.5	55.5	99.245
				66	99.69	0.438	91.5	58.6	99.252
				84	99.76	0.477	91.5	71.3	99.283
				67	99.78	0.490	91.5	74.4	99.290
				83	99.89	0.573	91.5	85.7	99.317
				68	99.84	0.515	91.5	88.8	99.325
MH_126	MH_127	100.307	99.112	#N/A	#N/A	#N/A			
MH_127	MH_128	99.112	99.004	47	99.56	0.448			
MH_128	MH_129	99.004	98.958	45	99.49	0.486			
MH_129	MH_130	98.958	98.842	43	99.41	0.452			
MH_130	MH_131	98.842	98.616	33	99.18	0.338			
MH_1302	MH_302	98.440	98.370	Est. Fut	99.36	0.920			
MH_1303	MH_303	98.435	98.291	Est. Fut	99.29	0.855			
MH_1304	MH_304	98.185	98.086	Est. Fut	98.86	0.675			
MH_131	MH_132	98.616	98.588	#N/A	#N/A	#N/A			
MH_1312	MH_310	97.937	97.853	Est. Fut	99.14	1.203			
MH_132	MH_136	98.588	98.434	103	99.33	0.742			
MH_133	MH_134	98.629	98.573	#N/A	#N/A	#N/A			
MH_134	MH_135	98.573	98.511	#N/A	#N/A	#N/A			
MH_135	MH_136	98.511	98.434	#N/A	#N/A	#N/A			
MH_136	MH_302	98.434	98.370	1	99.38	0.946			
MH_201	MH_202	105.434	104.453	321	105.28	-0.154			
				321	105.28	0.757	119.5	8.5	104.523
				430	107.31	2.770	119.5	10.6	104.540
				431	107.37	2.783	119.5	16.3	104.587
				428	105.36	0.725	119.5	22.2	104.635
				233	107.4	2.705	119.5	29.5	104.695

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
				429	105.37	0.658	119.5	31.5	104.712
				234	107.46	2.718	119.5	35.2	104.742
				320	105.45	0.638	119.5	43.7	104.812
				235	107.5	2.655	119.5	47.7	104.845
				319	105.56	0.657	119.5	54.8	104.903
				236	107.62	2.716	119.5	54.9	104.904
				318	105.66	0.673	119.5	65	104.987
				237	107.69	2.685	119.5	67.3	105.005
				238	107.8	2.748	119.5	73	105.052
				317	105.77	0.691	119.5	76.2	105.079
				239	107.87	2.709	119.5	86.2	105.161
				316	105.9	0.721	119.5	88.4	105.179
				240	107.99	2.783	119.5	91.9	105.207
				315	106.02	0.748	119.5	99.8	105.272
				241	108.06	2.744	119.5	105.1	105.316
				242	108.16	2.797	119.5	110.8	105.363
				314	106.13	0.741	119.5	114	105.389
MH_202	MH_203	104.453	104.385	230	105.39	0.937			
MH_203	MH_206	104.385	103.787	225	104.9	0.515			
MH_204	MH_205	103.979	103.873	285	104.64	0.661			
MH_205	MH_206	103.873	103.787	#N/A	#N/A	#N/A			
MH_206	MH_207	103.787	103.339	221	104.52	0.733			
MH_207	MH_208	103.339	103.021	219	104.39	1.051			
MH_208	MH_215	103.021	101.393	212	102.46	-0.561			
				271	102.46	0.938	112.0	8.9	101.522
				212	102.46	0.882	112.0	12.7	101.578
				270	102.67	0.941	112.0	23.1	101.729
				213	102.68	0.927	112.0	24.8	101.753
				214	102.89	0.988	112.0	35	101.902
				269	102.93	1.015	112.0	35.9	101.915
				215	103.1	1.035	112.0	46.2	102.065
				268	103.18	1.099	112.0	47.3	102.081
				216	103.36	1.118	112.0	58.4	102.242
				267	103.42	1.162	112.0	59.5	102.258
				217	103.62	1.212	112.0	69.8	102.408
				266	103.68	1.259	112.0	70.7	102.421
				423	103.94	1.371	112.0	80.9	102.569
				421	103.83	1.245	112.0	82	102.585
				422	104.04	1.310	112.0	92	102.730
				420	104.04	1.294	112.0	93.1	102.746
				265	104.35	1.450	112.0	103.7	102.900
				218	104.3	1.372	112.0	105.6	102.928
MH_209	MH_201	105.833	105.434	313	106.24	0.407			
MH_209	MH_210	105.833	105.596	254	108.31	2.477			
MH_210	MH_212	105.596	103.579	258	105.12	-0.476			
				258	105.12	0.955	54.0	15.7	104.165
				257	105.54	0.938	54.0	27.4	104.602
				256	106.05	1.025	54.0	38.7	105.025
				255	106.58	1.178	54.0	48.8	105.402
MH_211	MH_212	104.040	103.579	#N/A	#N/A	#N/A			
MH_212	MH_204	103.579	103.979	284	104.71	1.131			
MH_212	MH_213	103.579	103.233	203	104.1	0.521			
MH_213	MH_214	103.233	103.053	204	104.02	0.787			
MH_214	MH_215	103.053	101.393	272	102.37	-0.683			
				272	102.37	0.841	90.0	7.4	101.529
				211	102.46	0.776	90.0	15.8	101.684

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
				273	102.59	0.799	90.0	21.6	101.791
				210	102.68	0.771	90.0	28	101.909
				274	102.86	0.788	90.0	36.8	102.072
				209	102.89	0.792	90.0	38.2	102.098
				275	103.11	0.828	90.0	48.2	102.282
				208	103.15	0.846	90.0	49.4	102.304
				276	103.37	0.863	90.0	60.4	102.507
				207	103.4	0.834	90.0	63.6	102.566
				277	103.55	0.905	90.0	67.9	102.645
				206	103.66	0.884	90.0	75	102.776
				278	103.55	0.613	90.0	83.7	102.937
				205	103.83	0.860	90.0	85.5	102.970
MH_215	MH_119	101.393	100.114	#N/A	#N/A	#N/A			
MH_216	MH_217	105.511	105.093	346	105.85	0.339			
MH_217	MH_218	105.093	104.927	356	105.71	0.617			
MH_218	MH_220	104.927	104.166	357	105.75	0.823			
MH_219	MH_220	105.649	104.166	#N/A	#N/A	#N/A			
MH_220	MH_224	103.894	102.523	259	104.74	0.846			
MH_221	MH_222	103.088	102.811	396-1	103.56	0.472			
MH_222	MH_223	102.811	102.698	366-1	103.37	0.559			
MH_2	MH_2260	102.506	102.126	Est. Fut	103.49	0.984			
MH_223	MH_224	102.698	102.523	365-1	103.42	0.722			
MH_224	MH_105	102.025	100.067	141	101.9	-0.125			
				141	101.9	1.561	82.0	11.4	100.339
				140	102.18	1.502	82.0	25.6	100.678
				139	102.55	1.602	82.0	36.9	100.948
				138	102.92	1.728	82.0	47.1	101.192
				137	103.3	1.843	82.0	58.2	101.457
				136	103.81	2.029	82.0	71.8	101.781
MH_225	MH_226	103.572	103.053	388-3	103.75	0.178			
				389-2	103.75	0.667	99.5	5.8	103.083
				389-1	103.75	0.610	82.0	13.8	103.140
				388-3	103.75	0.543	82.0	24.4	103.207
				388-2	103.88	0.624	82.0	32.1	103.256
				388-1	103.88	0.573	82.0	40.1	103.307
				387-4	104.02	0.646	82.0	50.7	103.374
				387-3	104.02	0.595	82.0	58.7	103.425
				387-2	104.02	0.550	82.0	65.9	103.470
				387-1	104.02	0.499	82.0	73.9	103.521
MH_2260	MH_227	102.126	101.119	392-1	102.46	0.334			
MH_226	MH_2260	103.053	102.126	391-3	103.08	0.027			
				391-3	103.08	0.921	64.0	2.3	102.159
				391-2	103.45	1.185	64.0	9.6	102.265
				391-1	103.45	1.069	64.0	17.6	102.381
				390-3	103.58	1.046	64.0	28.2	102.534
				390-2	103.58	0.930	64.0	36.2	102.650
				390-1	103.58	0.820	64.0	43.8	102.760
				389-4	103.75	0.835	64.0	54.5	102.915
				389-3	103.75	0.719	64.0	62.5	103.031
MH_227	MH_109	101.119	99.691	394-3	100.86	-0.259			
				394-4	100.86	0.874	93.0	19.2	99.986
				394-3	100.86	0.751	93.0	27.2	100.109
				394-2	101.26	1.039	93.0	34.5	100.221
				394-1	101.26	0.916	93.0	42.5	100.344
				393-3	101.49	0.968	93.0	54.1	100.522
				393-2	101.81	1.172	93.0	61.7	100.638

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
				393-1	101.81	1.049	93.0	69.7	100.761
				392-4	102.21	1.269	93.0	81.4	100.941
				392-3	102.21	1.146	93.0	89.4	101.064
MH_228	MH_229	102.612	101.073	384-3	102.12	-0.492			
				384-3	102.12	0.997	74.5	2.4	101.123
				379-2	102.14	0.997	74.5	3.4	101.143
				384-4	102.12	0.832	74.5	10.4	101.288
				379-1	102.14	0.832	74.5	11.4	101.308
				385-1	102.35	0.843	74.5	21	101.507
				378-3	102.57	1.043	74.5	22	101.527
				385-2	102.65	0.986	74.5	28.6	101.664
				378-2	102.67	0.983	74.5	29.7	101.687
				385-3	102.65	0.821	74.5	36.6	101.829
				378-1	102.67	0.818	74.5	37.7	101.852
				386-1	102.73	0.680	74.5	47.3	102.050
				377-4	103.02	0.949	74.5	48.3	102.071
				386-2	103.08	0.865	74.5	55.3	102.215
				377-3	103.28	1.044	74.5	56.3	102.236
				377-2	103.34	0.955	74.5	63.5	102.385
				377-1	103.34	0.790	74.5	71.5	102.550
MH_229	MH_102	101.073	100.197	381-1	101.35	0.277			
				382-1	101.52	1.184	86.5	13.7	100.336
				381-4	101.35	1.004	86.5	14.7	100.346
				382-2	101.52	1.103	86.5	21.7	100.417
				381-3	101.35	0.923	86.5	22.7	100.427
				382-3	101.52	1.030	86.5	28.9	100.490
				381-2	101.35	0.849	86.5	30	100.501
				382-4	101.52	0.949	86.5	36.9	100.571
				381-1	101.35	0.768	86.5	38	100.582
				383-1	101.62	0.941	86.5	47.6	100.679
				380-3	101.59	0.901	86.5	48.6	100.689
				383-2	101.62	0.860	86.5	55.6	100.760
				380-2	101.59	0.820	86.5	56.6	100.770
				383-3	101.62	0.783	86.5	63.2	100.837
				380-1	101.59	0.743	86.5	64.2	100.847
				384-1	101.95	1.006	86.5	73.8	100.944
				379-4	101.96	1.004	86.5	74.9	100.956
				384-2	101.95	0.925	86.5	81.8	101.025
				379-3	101.96	0.923	86.5	82.9	101.037
MH_230	MH_231	102.557	100.982	374-3	102.03	-0.527			
				374-3	102.03	0.994	73.5	2.5	101.036
				368-3	102.24	1.151	73.5	5	101.089
				374-4	102.03	0.823	73.5	10.5	101.207
				368-2	102.24	0.979	73.5	13	101.261
				368-1	102.24	0.817	73.5	20.6	101.423
				375-1	102.4	0.964	73.5	21.2	101.436
				375-2	102.57	0.971	73.5	28.8	101.599
				367-3	102.71	1.057	73.5	31.3	101.653
				375-3	102.57	0.799	73.5	36.8	101.771
				367-2	102.71	0.886	73.5	39.3	101.824
				367-1	102.71	0.723	73.5	46.9	101.987
				376-1	103	1.002	73.5	47.4	101.998
				376-2	103	0.831	73.5	55.4	102.169
				376-3	103.37	1.044	73.5	62.7	102.326
				376-4	103.37	0.873	73.5	70.7	102.497
MH_231	MH_103	100.982	99.575	371-1	100.56	-0.422			

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
				371-3	100.56	0.775	87.0	13	99.785
				372-1	100.95	1.150	87.0	13.9	99.800
				371-2	100.56	0.645	87.0	21	99.915
				372-2	100.95	1.021	87.0	21.9	99.929
				371-1	100.56	0.522	87.0	28.6	100.038
				372-3	100.95	0.903	87.0	29.2	100.047
				372-4	100.95	0.773	87.0	37.2	100.177
				370-3	101.09	0.879	87.0	39.3	100.211
				370-2	101.09	0.750	87.0	47.3	100.340
				373-1	100.97	0.622	87.0	47.8	100.348
				370-1	101.09	0.627	87.0	54.9	100.463
				373-2	101.32	0.843	87.0	55.8	100.477
				373-3	101.32	0.720	87.0	63.4	100.600
				369-3	101.61	0.976	87.0	65.5	100.634
				369-2	101.61	0.846	87.0	73.5	100.764
				374-1	101.56	0.787	87.0	74.1	100.773
				369-1	101.61	0.722	87.0	81.2	100.888
				374-2	101.56	0.657	87.0	82.1	100.903
MH_302	MH_303	98.370	98.291	#N/A	#N/A	#N/A			
MH_303	MH_304	98.291	98.086	#N/A	#N/A	#N/A			
MH_304	MH_306TEE	98.086	97.813	#N/A	#N/A	#N/A			
MH_306TEE	MH_307	97.813	97.550	#N/A	#N/A	#N/A			
MH_313	MH_307	97.449	97.550	#N/A	#N/A	#N/A			
MH_307	MH_400	97.550	97.537	#N/A	#N/A	#N/A			
MH_309	MH_310	97.979	97.853	#N/A	#N/A	#N/A			
MH_310	MH_311	97.853	97.779	#N/A	#N/A	#N/A			
MH_3	MH_109	99.716	99.691	#N/A	#N/A	#N/A			
MH_3111TEE	MH_312	97.671	97.526	#N/A	#N/A	#N/A			
MH_311	MH_3111TEE	97.779	97.671	#N/A	#N/A	#N/A			
MH_312	MH_313	97.526	97.449	#N/A	#N/A	#N/A			
MH_313	MH_500	97.449	97.416	#N/A	#N/A	#N/A			
MH_400	OGS_1	97.537	97.517	#N/A	#N/A	#N/A			
OGS_1	OGS_1-Out	97.517	97.265	#N/A	#N/A	#N/A			
OGS_1-Out	MH_401	97.265	96.930	#N/A	#N/A	#N/A			
MH_4	MH_104	99.324	99.245	#N/A	#N/A	#N/A			
MH_500	OGS_2	97.416	97.406	#N/A	#N/A	#N/A			
OGS_2	OGS_2-Out	97.406	97.174	#N/A	#N/A	#N/A			
OGS_2-Out	MH_501	97.174	96.920	#N/A	#N/A	#N/A			

[(2)] Conservative estimate of freeboard based on U/S HGL and lowest USF connected to pipe. Actual HGL / freeboard at all connecting lots interpolated where conservative estimate does not meet freeboard requirements.

[(3)] Future USF elevations estimated as 1.8 m below the upstream top of manhole elevations.

(green)	Interpolated HGL elevation
(yellow)	Freebaord Less than 0.3m
(red)	Freebaord Less than 0.0m

5 EROSION AND SEDIMENT CONTROL DURING AND AFTER CONSTRUCTION

Silt and erosion control strategies shall be implemented during construction activities to minimize the transfer of silt off-site. The following measures should be implemented:

i) Silt control fences shall be installed as required to prevent the movement of silt off-site during rainfall events.

ii) Construction of a mud mat shall be installed at the site entrance to promote self-cleaning of truck tires when leaving the site.

iii) All catch basins shall be equipped with a crushed stone filter to prevent the capture of silt in the storm sewer system.

iv) Regular cleaning of the adjacent roads shall be undertaken during the construction activities.

v) Regular inspection and maintenance of the silt control measures shall be undertaken until the site has been stabilized.

vi) The erosion and sediment control devices shall be removed after the site has been stabilized.

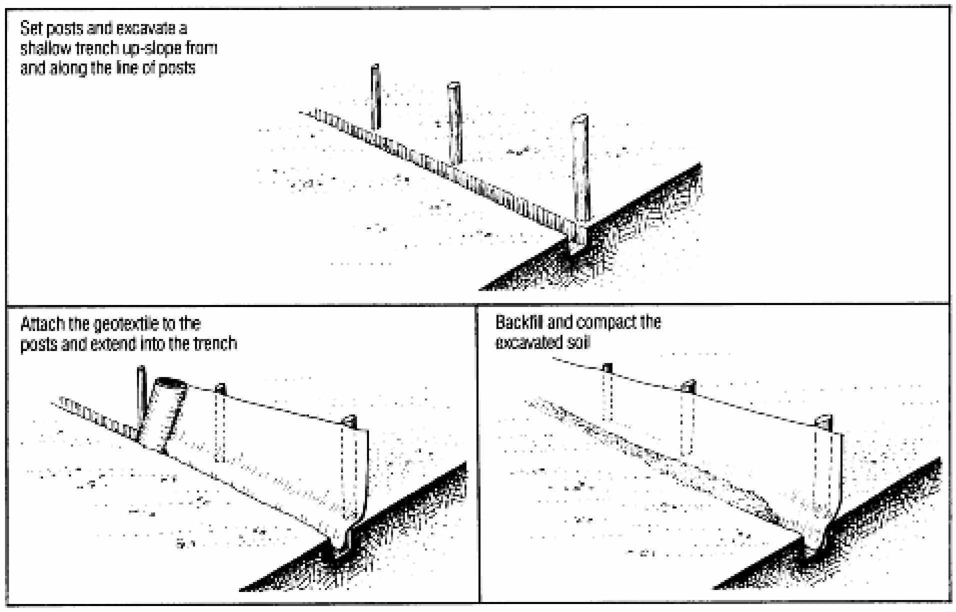

Figure 5: Typical installation of silt fences

Figure 6: Catchbasin with geotextile to protect storm sewer pipes from sediment contamination

6 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The Ridge (Brazeau) development is in the City of Ottawa, east of Borrisokane and Highway 416, and south of Cambrian Road. The development has a total drainage area of 37.03 ha, which will be treated by two oil-and-grit separators for quality control, which then discharges to a dry SWM pond. The dry SWM pond discharges to the Jock River through an existing ditch running north, parallel to Borrisokane Road. The development will also have Etobicoke Exfiltration Systems (EES) implemented within this subdivision. These EES will be installed within local roadways of the subdivision, to exfiltrate runoff from the development for the more frequent events.

Per the City of Ottawa design guidelines, the minor system has been designed to accommodate a minimum of the 2-year post-development flows from within the site and from external areas (plus 5-year flows on collector and 10-year flows on arterial roads). The combined SWMHYMO / PCSWMM model analyses have determined that the minor system will surcharge in most parts of the system. However, with the use of Inlet Control Devices, a minimum freeboard of 0.3 m is provided between the 100-year hydraulic grade line and the underside of footings throughout the subdivision.

The PCSWMM/SWMHYMO simulations have determined that for the selected 2-, 5- and 100-year storms, the total minor system flows would be 5.76 m^3/s, 8.218 m^3/s and 10.912 m^3/s, respectively.

Within the subdivision, the peak water depths do not exceed the maximum allowable 35 cm depth at the gutter for the simulated 100-year storm (Table D-7 of Appendix D). Furthermore, it was determined that for the 100-year event, the product of the velocity and depth of flow does not exceed the maximum allowable 0.60 m^2/s. Also as required, the maximum extent of surface water during the 100-year + 20% stress test will not touch the building envelopes.

Table C-1A- C1F of Appendix C summarizes the hydraulic grade line analysis for the various storm. Note that the full pipe velocities are generally no less than 0.80 m/s and no greater than 3.0 m/s for the proposed pipes. Where velocities over 3.0 m/s are proposed, provisions shall be made to protect against displacement of sewers by sudden jarring or movement.

Stress test results for the major and minor drainage systems based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*, are summarized in Section 4.

Recommendations for silt and erosion control strategies to be implemented during construction are presented in Section 6.

In conclusion, the proposed design satisfies all selected design guidelines and requirements.

Legend

ICD Type

- 83mm Circular Orifice Plate
- 94mm Circular Orifice Plate
- 102mm Circular Orifice Plate
- 108mm Circular Orifice Plate
- 127mm Circular Orifice Plate
- 152mm Circular Orifice Plate
- 178mm Circular Orifice Plate
- No ICD

Conduits

- Minor System

Junctions

- Maintenance Hole
- Site Plan

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DSEL
david schaeffer engineering ltd

SCALE : 1:3500

0 50 100 150 200 m

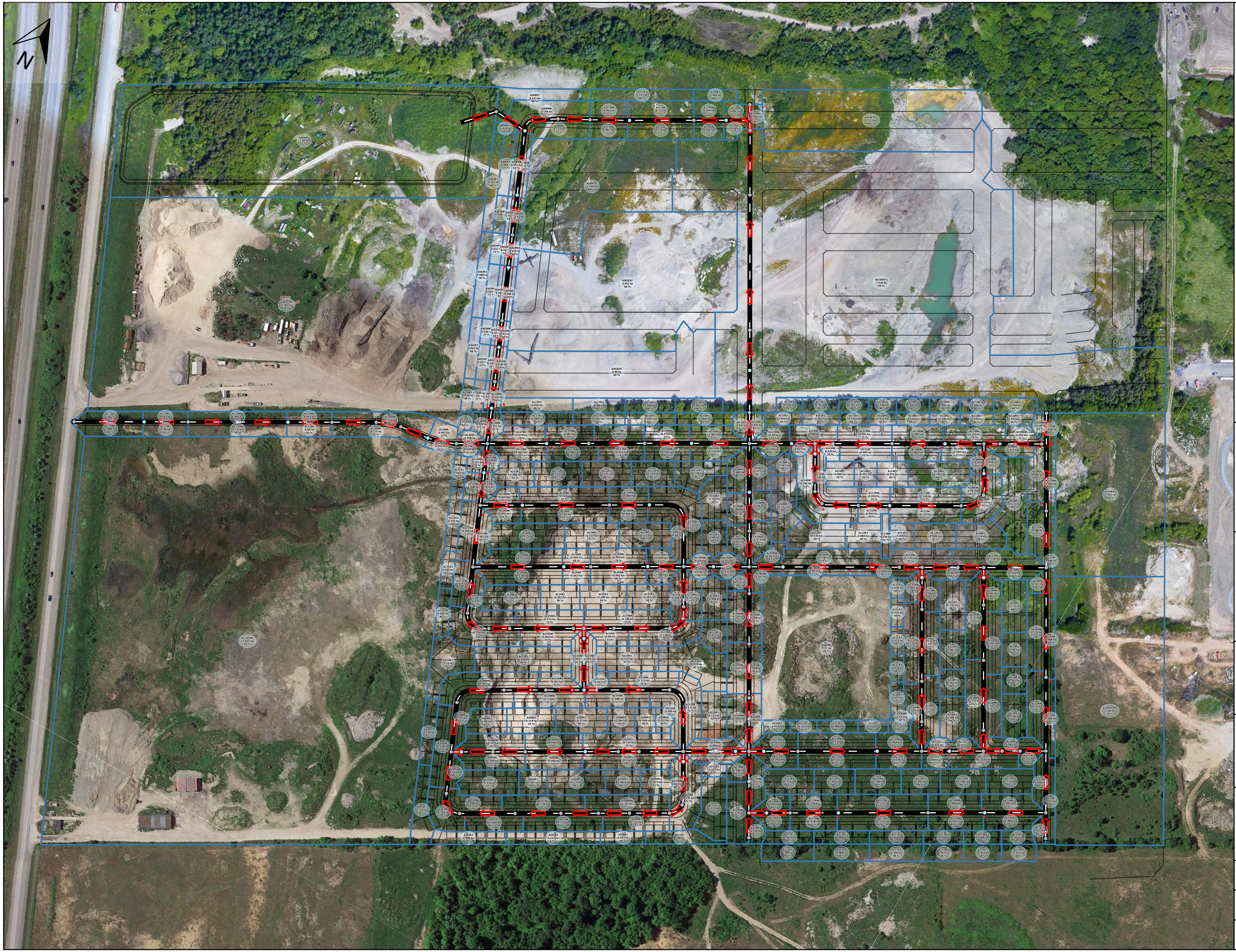
PROJECT :

The Ridge Phase 1

TITLE :

Figure 2: Minor System Overview

PROJECT	1800-19
DRAWN:	JB
DATE:	JUNE 2020



Legend

- Subcatchments
- Junctions
  - Major System
  - Low Point
- Major System
- Catch Basins
- Site Plan

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DSEL
david schaeffer engineering ltd

SCALE : 1:3,500

0 50 100 150 200 m

PROJECT :

Brazeau Phase 1

TITLE :

Figure 3: Major System Overview

PROJECT	1800-19
DRAWN:	JB
DATE:	APRIL 2020

Legend

Maximum Available Storage
- Volume at Low Points (m^3)
- Max Depth at Low Points(m)

— Site Plan

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david schaeffer engineering ltd

SCALE : 1:3500

0 50 100 150 200 m

PROJECT :

Brazeau Phase 1

TITLE :

Figure 4: Major System Storage

PROJECT	1800-19
DRAWN:	JB
DATE:	APRIL 2020

APPENDIX

A

Rational Method Design Sheets
(as per DSEL)

JFSA Water Resources and Environmental Consultants

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min)	Q/Q full
FUTURE ROAD (DRUMMOND LAND)																																	
	Plug	304	1.20	0.65	2.17	2.17			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	167	600	600	CONC	0.20	10.0	274.6	0.97	0.17	0.61
To Expansion Road, Pipe 304 - 306TEE						2.17				0.00				0.00				0.00	10.17														
			1.00	0.65	1.81	1.81			0.00	0.00			0.00	0.00			0.00	0.00	15.00														
					0.00	1.81	1.45	0.40	1.61	1.61			0.00	0.00			0.00	0.00	15.00														
	Plug	303			0.00	1.81			0.00	1.61			0.00	0.00			0.00	0.00	15.11	61.51	83.20	97.44	142.28	245	750	750	CONC	0.15	10.5	431.2	0.98	0.18	0.57
To Expansion Road, Pipe 303 - 304						1.81				1.61				0.00				0.00	15.29														
			0.99	0.65	1.79	1.79																											
	Plug	302			0.00	1.79			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	137	525	525	CONC	0.20	10.5	192.3	0.89	0.20	0.71
To Expansion Road, Pipe 302 - 303						1.79				0.00				0.00				0.00	10.20														
COMMERCIAL BLOCK - SOUTH																																	
			13.83	0.75	28.84	28.84			0.00	0.00			0.00	0.00			0.00	0.00	13.00														
	CTRL MH 1	133			0.00	28.84			0.00	0.00			0.00	0.00			0.00	0.00	13.00	66.93	90.63	106.17	155.11	1930	1500	1500	CONC	0.20	19.0	3161.3	1.79	0.18	0.61
To Haiku Street, Pipe 133 - 134						28.84				0.00				0.00				0.00	13.18														
Haiku Street																																	
COMMERCIAL BLOCK - SOUTH, Pipe CTRL MH 1 - 133						28.84				0.00				0.00				0.00	13.18														
From ABIC Property			7.39	0.30																				210.40									
	133	134	0.58	0.90	1.45	30.29			0.00	0.00			0.00	0.00			0.00	0.00	13.18	66.43	89.95	105.37	153.93	2222	1500	1500	CONC	0.15	77.0	2737.8	1.55	0.83	0.81
	134	135	0.31	0.90	0.78	31.06			0.00	0.00			0.00	0.00			0.00	0.00	14.01	64.22	86.91	101.80	148.69	2205	1500	1500	CONC	0.15	61.0	2737.8	1.55	0.66	0.81
			0.05	0.54	0.08	31.14			0.00	0.00			0.00	0.00			0.00	0.00	14.01														
	135	136	0.18	0.71	0.36	31.49			0.00	0.00			0.00	0.00			0.00	0.00	14.01	64.22	86.91	101.80	148.69	2233	1650	1650	CONC	0.10	37.0	2882.2	1.35	0.46	0.77
To Expansion Road, Pipe 136 - 302						31.49				0.00				0.00				0.00	14.46														
Sturnidae Street																																	
					0.00	0.00	0.03	0.71	0.06	0.06			0.00	0.00			0.00	0.00															
			0.10	0.54	0.15	0.15			0.00	0.06			0.00	0.00			0.00	0.00															
	126	127	0.19	0.71	0.38	0.53			0.00	0.06			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	47	300	300	PVC	0.40	28.5	61.2	0.87	0.55	0.76
To Montology Way, Pipe 127 - 128						0.53				0.06				0.00				0.00	10.55														
			0.23	0.54	0.35	0.35			0.00	0.00			0.00	0.00			0.00	0.00															
	124	125	0.36	0.71	0.71	1.06			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	81	375	375	PVC	0.35	101.0	103.7	0.94	1.79	0.78
			0.21	0.54	0.32	1.37			0.00	0.00			0.00	0.00			0.00	0.00															
	125	127	0.34	0.71	0.67	2.04			0.00	0.00			0.00	0.00			0.00	0.00	11.79	70.55	95.59	112.01	163.68	144	600	600	CONC	0.25	91.5	307.0	1.09	1.40	0.47
To Montology Way, Pipe 127 - 128						2.04				0.00				0.00				0.00	13.20														
Montology Way																																	
Contribution From Travertine Way, Pipe 123 - 127						1.33				0.00				0.00				0.00	12.08														
Contribution From Sturnidae Street, Pipe 125 - 127						2.04				0.00				0.00				0.00	13.20														
Contribution From Sturnidae Street, Pipe 126 - 127						0.53				0.06				0.00				0.00	10.55														
	127	128			0.00	3.90			0.00	0.06			0.00	0.00			0.00	0.00	13.20	66.38	89.87	105.28	153.80	264	675	675	CONC	0.20	54.0	375.9	1.05	0.86	0.70
	128	129			0.00	3.90			0.00	0.06			0.00	0.00			0.00	0.00	14.05	64.10	86.74	101.60	148.40	255	675	675	CONC	0.30	13.5	460.4	1.29	0.17	0.55
			0.25	0.54	0.38	4.27			0.00	0.06			0.00	0.00			0.00	0.00															
	129	130	0.40	0.71	0.79	5.06			0.00	0.06			0.00	0.00			0.00	0.00	14.23	63.65	86.14	100.88	147.35	327	750	750	CONC	0.15	77.0	431.2	0.98	1.31	0.76
			0.18	0.54	0.27	5.33			0.00	0.06			0.00	0.00			0.00	0.00															
	130	131	0.40	0.71	0.79	6.12			0.00	0.06			0.00	0.00			0.00	0.00	15.54	60.51	81.84	95.83	139.93	375	750	750	CONC	0.15	100.5	431.2	0.98	1.72	0.87
	131	132			0.00	6.12			0.00	0.06			0.00	0.00			0.00	0.00	17.26	56.90	76.90	90.03	131.41	353	1200	1200	CONC	0.15	12.0	1510.0	1.34	0.15	0.23
To Travertine Way, Pipe 132 - 136						6.12				0.06				0.00				0.00	17.41														
Rugosa Street																																	
	211	212	0.26	0.54	0.39	0.39			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	30	300	300	PVC	0.35	26.5	57.2	0.81	0.55	0.52
To Appalachian Circle, Pipe 212 - 213						0.39				0.00				0.00				0.00	10.55														
	212	204			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	0.50	92.5	68.4	0.97	1.59	0.00
			0.49	0.54	0.74	0.74			0.00	0.00			0.00	0.00			0.00	0.00															
	204	205	0.50	0.71	0.99	1.72			0.00	0.00			0.00	0.00			0.00	0.00	11.59	71.18	96.47	113.04	165.19	123	525	525	CONC	0.20	118.0	192.3	0.89	2.21	0.64

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1		
Checked: ADF	LOCATION: City of Ottawa		
Dwg. Reference: Storm Drainage Plan 84-87	File Ref: 18-1030	Date: 15-Jun-20	Sheet No. 1 OF 6

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
	205	206	0.25	0.71	0.49	2.22			0.00	0.00			0.00	0.00			0.00	0.00	13.81	64.73	87.62	102.63	149.91	143	525	525	CONC	0.20	16.0	192.3	0.89	0.30	0.75
To Appalachian Circle, Pipe 206 - 207						2.22				0.00				0.00				0.00	14.11														
Appalachian Circle																																	
	209	210			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	2.40	13.0	149.8	2.12	0.10	0.00
	210	212	0.20	0.71	0.39	0.39			0.00	0.00			0.00	0.00			0.00	0.00	10.10	76.41	103.66	121.51	177.63	30	300	300	PVC	3.80	54.0	188.5	2.67	0.34	0.16
Contribution From Rugosa Street, Pipe 211 - 212						0.39				0.00				0.00				0.00	10.55														
	212	213			0.00	0.79			0.00	0.00			0.00	0.00			0.00	0.00	10.55	74.77	101.40	118.85	173.72	59	375	375	PVC	0.45	49.5	117.6	1.06	0.77	0.50
	213	214	0.12	0.71	0.24	1.02			0.00	0.00			0.00	0.00			0.00	0.00	11.32	72.08	97.70	114.49	167.33	74	375	375	PVC	1.00	13.5	175.3	1.59	0.14	0.42
			0.36	0.54	0.54	1.56			0.00	0.00			0.00	0.00			0.00	0.00															
	214	215	0.44	0.71	0.87	2.43			0.00	0.00			0.00	0.00			0.00	0.00	11.46	71.61	97.06	113.74	166.21	174	375	375	PVC	2.35	90.0	268.8	2.43	0.62	0.65
To Foundation Lane, Pipe 215 - 119						2.43				0.00				0.00				0.00	12.08														
			0.07	0.54	0.11	0.11			0.00	0.00			0.00	0.00			0.00	0.00															
	209	201	0.25	0.71	0.49	0.60			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	46	300	300	PVC	0.55	94.0	71.7	1.01	1.54	0.64
			0.10	0.54	0.15	0.75			0.00	0.00			0.00	0.00			0.00	0.00															
	201	202	0.37	0.71	0.73	1.48			0.00	0.00			0.00	0.00			0.00	0.00	11.54	71.34	96.69	113.30	165.58	106	375	375	PVC	0.90	119.5	166.3	1.51	1.32	0.63
	202	203			0.00	1.48			0.00	0.00			0.00	0.00			0.00	0.00	12.87	67.31	91.15	106.78	156.00	100	450	450	CONC	0.20	14.0	127.5	0.80	0.29	0.78
			0.20	0.54	0.30	1.78			0.00	0.00			0.00	0.00			0.00	0.00															
	203	206	0.20	0.71	0.39	2.17			0.00	0.00			0.00	0.00			0.00	0.00	13.16	66.49	90.02	105.46	154.06	145	450	450	CONC	0.45	54.5	191.3	1.20	0.76	0.76
Contribution From Rugosa Street, Pipe 205 - 206						2.22				0.00				0.00				0.00	14.11														
			0.08	0.54	0.12	4.51			0.00	0.00			0.00	0.00			0.00	0.00															
	206	207	0.14	0.71	0.28	4.79			0.00	0.00			0.00	0.00			0.00	0.00	14.11	63.96	86.56	101.38	148.07	306	600	600	CONC	0.40	49.5	388.3	1.37	0.60	0.79
	207	208			0.00	4.79			0.00	0.00			0.00	0.00			0.00	0.00	14.71	62.47	84.51	98.98	144.54	299	600	600	CONC	1.90	12.5	846.4	2.99	0.07	0.35
			0.12	0.54	0.18	4.97			0.00	0.00			0.00	0.00			0.00	0.00															
	208	215	0.32	0.71	0.63	5.60			0.00	0.00			0.00	0.00			0.00	0.00	14.78	62.30	84.28	98.70	144.15	349	600	600	CONC	1.90	112.0	846.4	2.99	0.62	0.41
To Foundation Lane, Pipe 215 - 119						5.60				0.00				0.00				0.00	15.40														
Foundation Lane																																	
Contribution From Appalachian Circle, Pipe 208 - 215						5.60				0.00				0.00				0.00	15.40														
Contribution From Appalachian Circle, Pipe 214 - 215						2.43				0.00				0.00				0.00	12.08														
	215	119	0.20	0.71	0.39	8.42			0.00	0.00			0.00	0.00			0.00	0.00	15.40	60.84	82.28	96.35	140.69	512	675	675	CONC	1.60	55.0	1063.3	2.97	0.31	0.48
To Travertine Way, Pipe 119 - 120						8.42				0.00				0.00				0.00	15.71														
Travertine Way																																	
			0.15	0.54	0.23	0.23			0.00	0.00			0.00	0.00			0.00	0.00															
	119	122	0.21	0.71	0.41	0.64			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	49	300	300	PVC	0.55	90.0	71.7	1.01	1.48	0.69
			0.13	0.71	0.26	0.90			0.00	0.00			0.00	0.00			0.00	0.00															
	122	123	0.29	0.54	0.44	1.33			0.00	0.00			0.00	0.00			0.00	0.00	11.48	71.56	96.98	113.65	166.09	95	300	300	PVC	1.55	13.0	120.4	1.70	0.13	0.79
	123	127			0.00	1.33			0.00	0.00			0.00	0.00			0.00	0.00	11.61	71.14	96.41	112.98	165.10	95	300	300	PVC	1.60	49.5	122.3	1.73	0.48	0.77
To Montology Way, Pipe 127 - 128						1.33				0.00				0.00				0.00	12.08														
Contribution From Foundation Lane, Pipe 215 - 119						8.42				0.00				0.00				0.00	15.71														
			0.21	0.71	0.41	8.84			0.00	0.00			0.00	0.00			0.00	0.00															
	119	120	0.39	0.54	0.59	9.42			0.00	0.00			0.00	0.00			0.00	0.00	15.71	60.14	81.33	95.23	139.05	567	900	900	CONC	0.20	103.0	809.6	1.27	1.35	0.70
	120	121			0.00	9.42			0.00	0.00			0.00	0.00			0.00	0.00	17.06	57.30	77.45	90.67	132.35	540	900	900	CONC	0.20	14.0	809.6	1.27	0.18	0.67
			0.21	0.54	0.32	9.74			0.00	0.00			0.00	0.00			0.00	0.00															
	121	132	0.52	0.71	1.03	10.77			0.00	0.00			0.00	0.00			0.00	0.00	17.24	56.94	76.95	90.08	131.50	613	900	900	CONC	1.10	114.0	1898.7	2.98	0.64	0.32
Contribution From Montology Way, Pipe 131 - 132						6.12				0.06				0.00				0.00	17.41														
			0.17	0.71	0.34	17.22			0.00	0.06			0.00	0.00			0.00	0.00															
	132	136	0.42	0.54	0.63	17.85			0.00	0.06			0.00	0.00			0.00	0.00	17.88	55.71	75.28	88.12	128.62	999	1200	1200	CONC	0.20	59.5	1743.6	1.54	0.64	0.57
To Expansion Road, Pipe 136 - 302						17.85				0.06				0.00				0.00	18.52														
Focality Crescent																																	
	107	108			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	0.65	13.0	78.0	1.10	0.20	0.00
			0.28	0.72	0.56	0.56			0.00	0.00			0.00	0.00			0.00	0.00															
	108	110	0.34	0.58	0.55	1.11			0.00	0.00			0.00	0.00			0.00	0.00	10.20	76.06	103.17	120.93	176.78	84	450	450	CONC	0.20	54.0	127.5	0.80	1.12	0.66
To Haiku Street, Pipe 110 - 111						1.11				0.00				0.00				0.00	11.32														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1	
Checked: ADF	LOCATION: City of Ottawa	
Dwg. Reference: Storm Drainage Plan 83-86	File Ref: 18-1030	Date: 15-Jun-20	Sheet No. 2 OF 6

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

Ottawa

Design Data for HMB ph 8 storm outlet point (MH 3)

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
	107	112			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	0.35	74.0	57.2	0.81	1.52	0.00
			0.04	0.72	0.08	0.08			0.00	0.00			0.00	0.00			0.00	0.00															
			0.15	0.58	0.24	0.32			0.00	0.00			0.00	0.00			0.00	0.00															
			0.22	0.58	0.35	0.68			0.00	0.00			0.00	0.00			0.00	0.00															
	112	113	0.33	0.72	0.66	1.34			0.00	0.00			0.00	0.00			0.00	0.00	11.52	71.41	96.78	113.41	165.73	95	450	450	CONC	0.20	73.5	127.5	0.80	1.53	0.75
	113	114			0.00	1.34			0.00	0.00			0.00	0.00			0.00	0.00	13.05	66.78	90.43	105.94	154.76	89	450	450	CONC	0.20	13.0	127.5	0.80	0.27	0.70
			0.32	0.72	0.64	1.98			0.00	0.00			0.00	0.00			0.00	0.00															
	114	115	0.34	0.58	0.55	2.53			0.00	0.00			0.00	0.00			0.00	0.00	13.32	66.03	89.40	104.73	152.98	167	675	675	CONC	0.40	54.0	531.6	1.49	0.61	0.31
To Haiku Street, Pipe 115 - 116						2.53				0.00				0.00				0.00	13.93														
COMMERCIAL BLOCK - EAST																																	
			2.68	0.75	5.59	5.59			0.00	0.00			0.00	0.00			0.00	0.00	12.50														
	CTRL MH 2	2260			0.00	5.59			0.00	0.00			0.00	0.00			0.00	0.00	12.50	68.38	92.61	108.51	158.53	382	675	675	CONC	0.40	10.0	531.6	1.49	0.11	0.72
To Obsidian Street, Pipe 2260 - 227						5.59				0.00				0.00				0.00	12.61														
Obsidian Street																																	
	225	226	0.27	0.72	0.54	0.54			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	42	300	300	PVC	0.50	99.5	68.4	0.97	1.71	0.61
	226	2260	0.20	0.72	0.40	0.94			0.00	0.00			0.00	0.00			0.00	0.00	11.71	70.79	95.93	112.41	164.27	67	300	300	PVC	1.05	64.0	99.1	1.40	0.76	0.67
From COMMERCIAL BLOCK - EAST- 122, Pipe CTRL MH 2 - 2260						5.59				0.00				0.00				0.00	12.61														
	2260	227			0.00	6.53			0.00	0.00			0.00	0.00			0.00	0.00	12.61	68.05	92.16	107.97	157.75	444	675	675	CONC	1.55	49.5	1046.5	2.92	0.28	0.42
	227	109	0.26	0.72	0.52	7.05			0.00	0.00			0.00	0.00			0.00	0.00	12.89	67.23	91.04	106.66	155.82	474	675	675	CONC	1.60	93.0	1063.3	2.97	0.52	0.45
To Haiku Street, Pipe 109 - 110						7.05				0.00				0.00				0.00	13.42														
Haiku Street																																	
			1.93	0.68	3.65	3.65			0.00	0.00			0.00	0.00			0.00	0.00	11.50														
	CTRL MH 3	109			0.00	3.65			0.00	0.00			0.00	0.00			0.00	0.00	11.50	71.49	96.89	113.54	165.92	261	600	600	CONC	0.40	10.0	388.3	1.37	0.12	0.67
Contribution From Obsidian Street, Pipe 227 - 109						7.05				0.00				0.00				0.00	13.42														
	109	110	0.18	0.72	0.36	11.06			0.00	0.00			0.00	0.00			0.00	0.00	13.42	65.78	89.05	104.31	152.38	727	750	750	CONC	0.70	60.0	931.4	2.11	0.47	0.78
Contribution From Focality Crescent, Pipe 108 - 110						1.11				0.00				0.00				0.00	11.32														
			0.16	0.58	0.26	12.42			0.00	0.00			0.00	0.00			0.00	0.00															
			0.19	0.58	0.31	12.73			0.00	0.00			0.00	0.00			0.00	0.00															
	110	111	0.33	0.72	0.66	13.39			0.00	0.00			0.00	0.00			0.00	0.00	13.89	64.52	87.32	102.28	149.40	864	900	900	CONC	0.40	75.0	1144.9	1.80	0.69	0.75
	111	115	0.18	0.72	0.36	13.75			0.00	0.00			0.00	0.00			0.00	0.00	14.58	62.77	84.92	99.46	145.25	863	975	975	CONC	0.20	91.0	1002.2	1.34	1.13	0.86
Contribution From Focality Crescent, Pipe 114 - 115						2.53				0.00				0.00				0.00	13.93														
					0.00	16.28	0.04	0.72	0.08	0.08			0.00	0.00			0.00	0.00															
			0.15	0.58	0.24	16.52			0.00	0.08			0.00	0.00			0.00	0.00															
			0.16	0.58	0.26	16.78			0.00	0.08			0.00	0.00			0.00	0.00															
	115	116	0.19	0.72	0.38	17.16			0.00	0.08			0.00	0.00			0.00	0.00	15.71	60.13	81.32	95.22	139.03	1038	1050	1050	CONC	0.50	59.0	1930.9	2.23	0.44	0.54
To Inselberg Street, Pipe 116 - 117						17.16				0.08				0.00				0.00	16.16														
PARK BLOCK																																	
	CTRL MH 4	104			0.00	0.00	1.72	0.40	1.91	1.91			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	199	525	525	CONC	0.40	9.5	272.0	1.26	0.13	0.73
To Chillerton Drive, Pipe 104 - 106						0.00				1.91				0.00				0.00	10.13														
Canadensis Lane																																	
			0.01	0.72	0.02	0.02			0.00	0.00			0.00	0.00			0.00	0.00															
			0.03	0.58	0.05	0.07			0.00	0.00			0.00	0.00			0.00	0.00															
			0.04	0.58	0.06	0.13			0.00	0.00			0.00	0.00			0.00	0.00															
			0.16	0.58	0.26	0.39			0.00	0.00			0.00	0.00			0.00	0.00															
	230	231	0.19	0.72	0.38	0.77			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	59	300	300	PVC	2.00	73.5	136.8	1.93	0.63	0.43
			0.12	0.58	0.19	0.96			0.00	0.00			0.00	0.00			0.00	0.00															
			0.21	0.58	0.34	1.30			0.00	0.00			0.00	0.00			0.00	0.00															
	231	103	0.41	0.72	0.82	2.12			0.00	0.00			0.00	0.00			0.00	0.00	10.63	74.46	100.96	118.34	172.97	158	525	525	CONC	2.00	87.0	608.2	2.81	0.52	0.26
To Chillerton Drive, Pipe 103 - 104						2.12				0.00				0.00				0.00	11.15														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM
Checked: ADF
Dwg. Reference: Storm Drainage Plan 83-86

PROJECT: **Ciavan Communities - Brazeau Phase 1**
LOCATION: **City of Ottawa**
File Ref: 18-1030 | Date: 15-Jun-20 | Sheet No. 3 OF 6

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Ottawa

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

LOCATION			AREA (Ha)																FLOW						SEWER DATA									
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
Surface Lane																																	
			0.17	0.58	0.27	0.27			0.00	0.00			0.00	0.00			0.00	0.00															
	228	229	0.31	0.72	0.62	0.89			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	69	300	300	PVC	2.00	74.5	136.8	1.93	0.64	0.50
			0.20	0.58	0.32	1.22			0.00	0.00			0.00	0.00			0.00	0.00															
	229	102	0.39	0.72	0.78	2.00			0.00	0.00			0.00	0.00			0.00	0.00	10.64	74.43	100.92	118.29	172.90	149	525	525	CONC	0.85	86.5	396.5	1.83	0.79	0.37
To Chillerton Drive, Pipe 102 - 103						2.00				0.00				0.00				0.00	11.43														
Chillerton Drive																																	
	101	102			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	2.60	30.5	155.9	2.21	0.23	0.00
Contribution From Surface Lane, Pipe 229 - 102						2.00				0.00				0.00				0.00	11.43														
	102	103	0.13	0.72	0.26	2.26			0.00	0.00			0.00	0.00			0.00	0.00	11.43	71.72	97.21	113.91	166.47	162	525	525	CONC	1.55	59.0	535.4	2.47	0.40	0.30
Contribution From Canadensis Lane, Pipe 231 - 103						2.12				0.00				0.00				0.00	11.15														
	103	104	0.19	0.72	0.38	4.76			0.00	0.00			0.00	0.00			0.00	0.00	11.83	70.44	95.44	111.84	163.43	335	750	750	CONC	0.40	120.0	704.1	1.59	1.25	0.48
From PARK BLOCK - 123, Pipe CTRL MH 4 - 104						0.00				1.91				0.00				0.00	10.13														
	104	106	0.26	0.72	0.52	5.28			0.00	1.91			0.00	0.00			0.00	0.00	13.08	66.70	90.32	105.80	154.56	525	1050	1050	CONC	0.15	41.5	1057.6	1.22	0.57	0.50
To Elevation Road, Pipe 106 - 116						5.28				1.91				0.00				0.00	13.65														
Epoch Street																																	
	221	222	0.09	0.72	0.18	0.18			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	14	300	300	PVC	0.50	77.5	68.4	0.97	1.34	0.20
			0.11	0.58	0.18	0.36			0.00	0.00			0.00	0.00			0.00	0.00															
			0.22	0.72	0.44	0.80			0.00	0.00			0.00	0.00			0.00	0.00															
			0.31	0.54	0.47	1.26			0.00	0.00			0.00	0.00			0.00	0.00															
			0.31	0.58	0.50	1.76			0.00	0.00			0.00	0.00			0.00	0.00															
	222	223	0.40	0.72	0.80	2.56			0.00	0.00			0.00	0.00			0.00	0.00	11.34	72.03	97.63	114.41	167.21	185	600	600	CONC	0.15	95.5	237.8	0.84	1.89	0.78
					0.00	2.56	0.07	0.71	0.14	0.14			0.00	0.00			0.00	0.00															
	223	224	0.13	0.72	0.26	2.82			0.00	0.14			0.00	0.00			0.00	0.00	13.23	66.29	89.76	105.15	153.60	200	600	600	CONC	0.20	97.0	274.6	0.97	1.66	0.73
To Elevation Road, Pipe 224 - 105						2.82				0.14				0.00				0.00	14.89														
Eminence Street																																	
			0.09	0.54	0.14	0.14			0.00	0.00			0.00	0.00			0.00	0.00															
			0.11	0.54	0.17	0.30			0.00	0.00			0.00	0.00			0.00	0.00															
	216	217	0.39	0.71	0.77	1.07			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	82	375	375	PVC	0.60	75.5	135.8	1.23	1.02	0.61
			0.25	0.54	0.38	1.45			0.00	0.00			0.00	0.00			0.00	0.00															
			0.32	0.54	0.48	1.93			0.00	0.00			0.00	0.00			0.00	0.00															
	217	218	0.46	0.71	0.91	2.83			0.00	0.00			0.00	0.00			0.00	0.00	11.02	73.09	99.08	116.12	169.72	207	600	600	CONC	0.20	113.0	274.6	0.97	1.94	0.75
					0.00	2.83	0.04	0.71	0.08	0.08			0.00	0.00			0.00	0.00															
	218	220	0.10	0.71	0.20	3.03			0.00	0.08			0.00	0.00			0.00	0.00	12.96	67.04	90.78	106.34	155.36	210	600	600	CONC	0.20	80.5	274.6	0.97	1.38	0.77
To Elevation Road, Pipe 220 - 224						3.03				0.08				0.00				0.00	14.34														
Elevation Road																																	
					0.00	0.00																											
	Plug East	310	1.22	0.65	2.20	2.20			0.00	0.00			0.00	0.00			0.00	0.00	14.71	62.46	84.51	98.97	144.53	138	750	750	CONC	0.20	9.5	497.9	1.13	0.14	0.28
To Elevation Road, Pipe 310 - 311						2.20				0.00				0.00				0.00	14.85														
					0.00	0.00	2.56	0.65	0.00	0.00			0.00	0.00			0.00	0.00	16.00														
			5.09	0.65	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	16.00														
	Plug South	310			9.20	9.20			4.63	4.63			0.00	0.00			0.00	0.00	16.00	59.50	80.46	94.21	137.55	919	1050	1050	CONC	0.15	17.5	1057.6	1.22	0.24	0.87
To Elevation Road, Pipe 310 - 311						9.20				4.63				0.00				0.00	16.24														
	219	220			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	2.65	25.0	157.4	2.23	0.19	0.00
Contribution From Eminence Street, Pipe 218 - 220						3.03				0.08				0.00				0.00	14.34														
					0.00	3.03	0.05	0.71	0.10	0.18			0.00	0.00			0.00	0.00															
			0.06	0.71	0.12	3.15			0.00	0.18			0.00	0.00			0.00	0.00															
	220	224			0.00	3.15	0.12	0.71	0.24	0.41			0.00	0.00			0.00	0.00	14.34	63.36	85.74	100.42	146.66	235	600	600	CONC	1.90	59.0	846.4	2.99	0.33	0.28

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1		
Checked: ADF	LOCATION: City of Ottawa		
Dwg. Reference: Storm Drainage Plan 83-86	File Ref: 18-1030	Date: 15-Jun-20	Sheet No. 4 OF 6

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Manning 0.013

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW Time of Conc.	Intensity 2 Year	Intensity 5 Year	Intensity 10 Year	Intensity 100 Year	Peak Flow	SEWER DATA DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF FLOW	RATIO
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	(min)	Q/Q full
Contribution From Epoch Street, Pipe 223 - 224						2.82				0.14				0.00				0.00	14.89														
					0.00	5.97	0.03	0.58	0.05	0.60			0.00	0.00			0.00	0.00															
			0.06	0.71	0.12	6.09			0.00	0.60			0.00	0.00			0.00	0.00															
			0.11	0.54	0.17	6.26			0.00	0.60			0.00	0.00			0.00	0.00															
	224	105			0.00	6.26	0.16	0.71	0.32	0.92			0.00	0.00			0.00	0.00	14.89	62.02	83.91	98.26	143.50	465	600	600	CONC	1.90	82.0	846.4	2.99	0.46	0.55
	105	106			0.00	6.26	0.35	0.71	0.69	1.61			0.00	0.00			0.00	0.00	15.35	60.96	82.45	96.55	140.98	514	675	675	CONC	1.40	91.0	994.6	2.78	0.55	0.52
Contribution From Chillerton Drive, Pipe 104 - 106						5.28				1.91				0.00				0.00	13.65														
			0.20	0.58	0.32	11.86			0.00	3.52			0.00	0.00			0.00	0.00															
					0.00	11.86	0.21	0.72	0.42	3.94			0.00	0.00			0.00	0.00															
	106	116			0.00	11.86	0.22	0.71	0.43	4.37			0.00	0.00			0.00	0.00	15.89	59.73	80.77	94.58	138.09	1062	1350	1350	CONC	0.20	122.5	2387.0	1.67	1.22	0.44
To Haiku Street, Pipe 116 - 117						11.86				4.37				0.00				0.00	17.12														
Haiku Street																																	
Contribution From Elevation Road, Pipe 106 - 116						11.86				4.37				0.00				0.00	17.12														
Contribution From Haiku Street, Pipe 115 - 116						17.16				0.08				0.00				0.00	16.16														
					0.00	29.02	0.04	0.71	0.08	4.53			0.00	0.00			0.00	0.00															
			0.13	0.54	0.20	29.21			0.00	4.53			0.00	0.00			0.00	0.00															
			0.13	0.54	0.20	29.41			0.00	4.53			0.00	0.00			0.00	0.00															
			0.29	0.54	0.44	29.85			0.00	4.53			0.00	0.00			0.00	0.00															
	116	117	0.31	0.71	0.61	30.46			0.00	4.53			0.00	0.00			0.00	0.00	17.12	57.18	77.28	90.47	132.07	2092	1650	1650	CONC	0.10	122.5	2882.2	1.35	1.51	0.73
			0.15	0.54	0.23	30.68			0.00	4.53			0.00	0.00			0.00	0.00															
			0.16	0.54	0.24	30.92			0.00	4.53			0.00	0.00			0.00	0.00															
	117	118	0.49	0.71	0.97	31.89			0.00	4.53			0.00	0.00			0.00	0.00	18.63	54.34	73.40	85.91	125.38	2066	1650	1650	CONC	0.10	121.0	2882.2	1.35	1.50	0.72
	118	136			0.00	31.89			0.00	4.53			0.00	0.00			0.00	0.00	20.13	51.82	69.97	81.88	119.46	1970	1950	1950	CONC	0.10	11.0	4499.9	1.51	0.12	0.44
To Expansion Road, Pipe 136 - 302						31.89				4.53				0.00				0.00	20.25														
Expansion Road																																	
Contribution From Elevation Road, Plug East - 310						2.20				0.00				0.00				0.00	14.85														
Contribution From Elevation Road, Plug South - 310						9.20				4.63				0.00				0.00	16.24														
					0.00	11.40	0.06	0.54	0.09	4.72			0.00	0.00			0.00	0.00															
			0.09	0.54	0.14	11.54			0.00	4.72			0.00	0.00			0.00	0.00															
			0.16	0.71	0.32	11.85			0.00	4.72			0.00	0.00			0.00	0.00															
	310	311	0.16	0.71	0.32	12.17			0.00	4.72			0.00	0.00			0.00	0.00	16.24	58.99	79.76	93.38	136.34	1094	1200	1200	CONC	0.15	62.5	1510.0	1.34	0.78	0.72
			0.21	0.54	0.32	12.48			0.00	4.72			0.00	0.00			0.00	0.00															
	311	3111TEE	0.25	0.71	0.49	12.98			0.00	4.72			0.00	0.00			0.00	0.00	17.02	57.38	77.56	90.79	132.54	1110	1200	1200	CONC	0.15	72.0	1510.0	1.34	0.90	0.74
	3111TEE	312			0.00	12.98			0.00	4.72			0.00	0.00			0.00	0.00	17.92	55.64	75.18	88.00	128.44	1077	1200	1200	CONC	0.15	76.5	1510.0	1.34	0.95	0.71
	312	313	0.06	0.54	0.09	13.07			0.00	4.72			0.00	0.00			0.00	0.00	18.87	53.92	72.83	85.24	124.39	1048	1200	1200	CONC	0.15	21.5	1510.0	1.34	0.27	0.69
To POND INLET - 120, Pipe 313 - 500						13.07				4.72				0.00				0.00	19.14														
Contribution From Haiku Street, Pipe 118 - 136						31.89				4.53				0.00				0.00	20.25														
Contribution From Travertine Way, Pipe 132 - 136						17.85				0.06				0.00				0.00	18.52														
Contribution From Haiku Street, Pipe 135 - 136						31.49				0.00				0.00				0.00	14.46														
	136	302	0.03	0.54	0.05	81.28			0.00	4.59			0.00	0.00			0.00	0.00	20.25	51.63	69.70	81.57	119.01	4727	2250	2250	CONC	0.10	54.0	6590.6	1.66	0.54	0.72
From FUTURE ROAD (DRUMMOND LAND) - Plug - 302						1.79				0.00				0.00				0.00	10.20														
			0.06	0.54	0.09	83.16			0.00	4.59			0.00	0.00			0.00	0.00															
	302	303	0.16	0.71	0.32	83.48			0.00	4.59			0.00	0.00			0.00	0.00	20.79	50.79	68.55	80.22	117.03	4765	2250	2250	CONC	0.10	59.0	6590.6	1.66	0.59	0.72
From FUTURE ROAD (DRUMMOND LAND) - Plug - 303						1.81				1.61				0.00				0.00	15.29														
			0.09	0.54	0.14	85.42			0.00	6.21			0.00	0.00			0.00	0.00															
	303	304	0.22	0.71	0.43	85.85			0.00	6.21			0.00	0.00			0.00	0.00	21.39	49.90	67.35	78.80	114.95	4912	2250	2250	CONC	0.10	134.5	6590.6	1.66	1.35	0.75
From FUTURE ROAD (DRUMMOND LAND) - Plug - 304						2.17				0.00				0.00				0.00	10.17														
			0.10	0.54	0.15	88.17			0.00	6.21			0.00	0.00			0.00	0.00															
	304	306TEE	0.28	0.71	0.55	88.72			0.00	6.21			0.00	0.00			0.00	0.00	22.74	48.00	64.76	75.76	110.49	4871	2250	2250	CONC	0.10	42.5	6590.6	1.66	0.43	0.74
POND INLET - 120, Pipe 306TEE - 307TEE						88.72				6.21				0.00				0.00	23.17														
POND INLET																																	
Contribution From Expansion Road, Pipe 312 - 313						13.07				4.72				0.00				0.00	19.14														
	313	500			0.00	13.07			0.00	4.72			0.00	0.00			0.00	0.00	19.14	53.46	72.19	84.49	123.30	1039	2250	2250	CONC	0.10	33.5	6590.6	1.66	0.34	0.16
	500	HW501			0.00	13.07			0.00	4.72			0.00	0.00			0.00	0.00	19.48	52.89	71.42	83.58	121.96	1028	2250	2250	CONC	0.10	5.0	6590.6	1.66	0.05	0.16

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1		
Checked: ADF	LOCATION: City of Ottawa		
Dwg. Reference: Storm Drainage Plan 83-86	File Ref: 18-1030	Date: 15-Jun-20	Sheet No. 5 OF 6

1030_Stm_SLM.xlsx

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

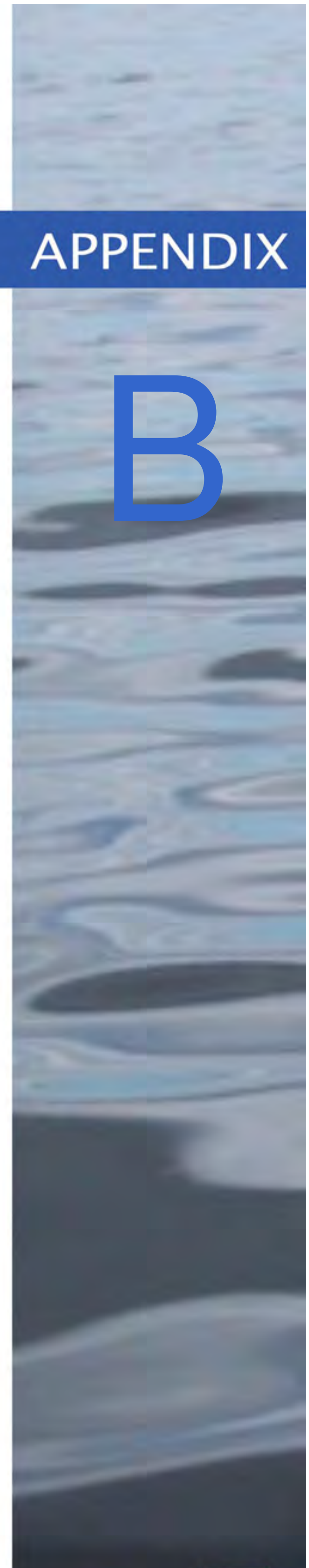
Ottawa

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of Conc.	Intensity 2 Year	Intensity 5 Year	Intensity 10 Year	Intensity 100 Year	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF FLOW	RATIO
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	(min)	Q/Q full
Contribution From Expansion Road, Pipe 305TEE - 306TEE						88.72				6.21				0.00				0.00	23.17														
	306TEE	307	0.18	0.71	0.36	89.08			0.00	6.21			0.00	0.00			0.00	0.00	23.17	47.44	63.99	74.85	109.17	4833	2250	2250	CONC	0.10	13.0	6590.6	1.66	0.13	0.73
	307	400			0.00	89.08			0.00	6.21			0.00	0.00			0.00	0.00	23.30	47.27	63.76	74.58	108.77	4817	2250	2250	CONC	0.10	23.5	6590.6	1.66	0.24	0.73
	400	HW401			0.00	89.08			0.00	6.21			0.00	0.00			0.00	0.00	23.53	46.96	63.34	74.09	108.05	4787	2250	2250	CONC	0.10	15.5	6590.6	1.66	0.16	0.73
POND OUTLET - CONSTANT FLOW RATE 1300 L/S																																	
			0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00						1300									
	HW OUT	1002			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	1300	900	900	CONC	0.60	7.5	1402.3	2.20	0.06	0.93
	1002	1003			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.06	76.59	103.89	121.79	178.04	1300	900	900	CONC	0.60	28.0	1402.3	2.20	0.21	0.93
To BORRISOKANE - 190, Pipe 1003 - 1004						0.00				0.00				0.00				0.00	10.27					1300									
BORRISOKANE ROAD - CONSTANT FLOW RATE 1300 L/S																																	
Contribution From POND OUTLET - 192, Pipe 1002 - 1003						0.00				0.00				0.00				0.00	10.27					1300									
	1003	1004			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.27	75.79	102.80	120.50	176.14	1300	900	900	CONC	0.60	108.5	1402.3	2.20	0.82	0.93
	1004	1005			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	11.09	72.86	98.77	115.76	169.18	1300	975	975	CONC	0.40	106.0	1417.4	1.90	0.93	0.92
	1005	1006			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	12.02	69.83	94.61	110.86	161.99	1300	1200	1200	CONC	0.20	106.0	1743.6	1.54	1.15	0.75
	1006	1007			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	13.17	66.47	89.99	105.42	154.01	1300	1200	1200	CONC	0.20	106.0	1743.6	1.54	1.15	0.75
	1007	1008			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	14.31	63.44	85.85	100.55	146.85	1300	1200	1200	CONC	0.20	88.0	1743.6	1.54	0.95	0.75
	1008	HW1009			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	15.26	61.15	82.72	96.86	141.45	1300	1200	1200	CONC	0.20	14.5	1743.6	1.54	0.16	0.75

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: SLM	PROJECT: Ciavan Communities - Brazeau Phase 1		
Checked: ADF	LOCATION: City of Ottawa		
Dwg. Reference: Storm Drainage Plan 83-86	File Ref: 18-1030	Date: 15-Jun-20	Sheet No. 6 OF 6



APPENDIX B

Inlet Control Devices

SWMHYMO Input and Summary Files

PCSWMM Input Files

JFSA Water Resources and Environmental Consultants

Products – StormTech Orifice Plate

Our StormTech Orifice Plate uses a calibrated orifice to control the outflow at a specific rate at a specific head in the catch basin. This is our simplest and most economical Inlet Control Device (ICD), and can be sometimes used by municipalities as a starting point for storm water management until more information is gathered. As with all our products, it can be swapped out with another StormTech ICD once more is known about the system.

Orifice Plate units can have any shape or size of orifice customized to meet your needs. Standard designs include Round, Diamond, Keyhole and Diamond Keyhole shaped orifices. Keyholes help create a torsional flow pattern through the orifice that can help unblock some debris.

Orifice plate ICD's do not form water traps to prevent odours and are also prone to blockage by floatables like leaves, twigs, bottles and cans, especially during higher rainfall periods. Monitoring of these types of installs is recommended and sometimes leads to recommendations to upgrade to water trap devices, such as Odour Traps and Sumps, to prevent blockage and odours. But in locations where they work properly they are an economical alternative solution.

Primary Function(s): Flow Control for Medium to High Flow Rates (15 to 100 l/s | 237 to 1585 GPM).

Other Functions(s): None.

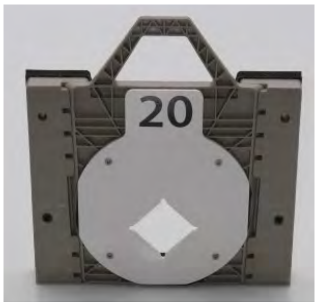
Outflow Pipe Diameter: 150 mm to 300 mm | 6 inch to 12 inch. Special orders can be made for larger sizes.

Catch Basin Types: All – with or without sumps.
Rectangular or Round Catch Basins (Round requires built-in adapter that can be provided).
Standard Round is 600 mm, but larger sizes available (900 mm, 1200 mm, 1600 mm …etc.).
Fits through even small Catch Basin openings (300 mm x 450 mm).

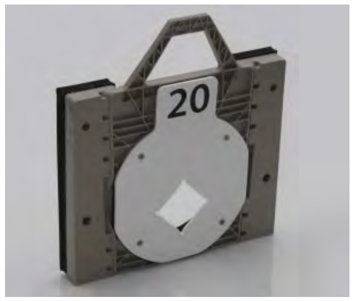
Specifications:
Orifice Plate: HDPE Thermoplastic with UV resistant additives.
Handle Plate (common): HDPE Thermoplastic.
Handle Plate (common): HDPE Thermoplastic.
Mounting Plate (common): HDPE Thermoplastic.
Hardware (common): Stainless Steel Wedge Bolts with Nut and Washer (4).
Welds: None.
Inner Ring Seal: Rubber Bulb Seal EPDM. Held in place and reusable. No need to replace.
Wall Seal: 3/8 or 5/8 inch Neoprene closed cell sponge gasket attached to Mounting Plate.
Identifier: 50 mm high numeric's on top of unit. Peel and stick. Note: Not visible from street surface.
Special Tools: None required.
Weight: Removable Unit: 0.5 kg / 1 lb. Maximum Total Assembly: 2.3 kg / 5 lb.

Products – StormTech Orifice Plate (continued)

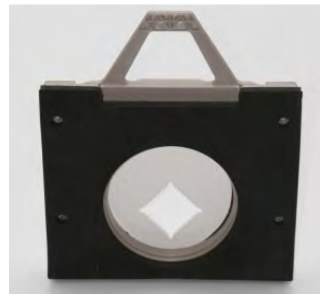
Orifice Plate – Square Adapter (with Diamond Orifice pictured)



Front

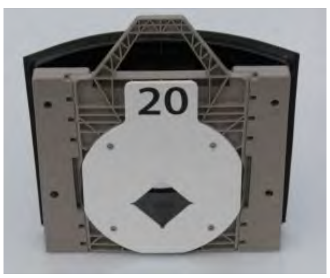


Left Angle

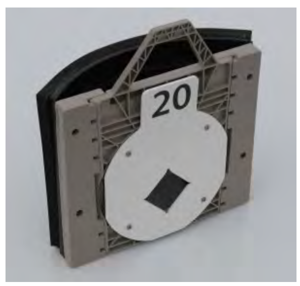


Back – View from Wall

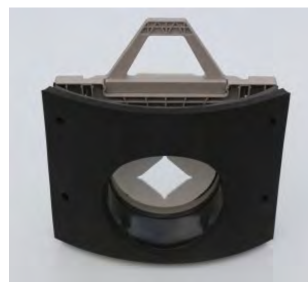
Orifice Plate – Round Adapter



Front



Left Angle



Back – View from Wall

Installation:

1. If necessary, cut protruding out-flowing pipe back flush to Catch Basin wall.
2. Use Mounting Plate as template to mark four hole pattern on Catch Basin wall.
3. Install four Stainless Steel Wedge Bolts (provided) perpendicular to Mounting Plate.
4. Install Mounting Plate and hand secure with four washers and nuts (provided).
5. Torque nuts to 40 N-▪m or 30 lbf▪ft. Do not over-tighten.
6. Snap unit into place by pushing Handle Plate into dove-tail slot of Mounting Plate.
7. Record Unit Identifier along with Catch Basin Location according to municipal requirements.
8. Note – Unit Identifier with this model is NOT easily seen from street level.

Table B-1: Plas-Tech StormTech Orifice Plate Inlet Control Device (ICD) Capacities [1]

ICD Diameter (mm)	Capture (L/s)							
	CB (1.38 m lead pipe invert depth)				CBMH (1.74 m lead pipe invert depth)			
Water Depth:	*0 cm*	*Average*	*30 cm*	*35 cm*	*0 cm*	*Average*	*30 cm*	*35 cm*
Head:	*1.28 m*	*1.4 m*	*1.58 m*	*1.63 m*	*1.64 m*	*1.76 m*	*1.94 m*	*1.99 m*
83	17.6	18.4	19.6	19.9	19.9	20.7	21.7	22.0
94	22.6	23.6	25.1	25.5	25.6	26.5	27.8	28.2
102	26.6	27.8	29.6	30.0	30.1	31.2	32.8	33.2
108	29.8	31.2	33.2	33.7	33.8	35.0	36.7	37.2
127	41.3	43.2	45.8	46.6	46.7	48.4	50.8	51.5
152	59.1	61.8	65.7	66.7	66.9	69.3	72.8	73.7
178	81.1	84.8	90.1	91.5	91.8	95.0	99.8	101.1

[1] For circular orifices plate type with diameters as specified by City of Ottawa standards.

```
20    Metric units / ID numbers OFF
*#***************************************************************************************************
*#  SWMHYMO  / INPUT DATA FILE
*#***************************************************************************************************
*#  Project Name: [Brazeau Lands]    Project Number: [1800]
*#  Date         : 16-September-2019
*#  Modeller     : [JB]
*#  Updated      : [JB -  Feb 2020]
*#               : [JB -  June 2020]
*#  Company      : JFSAinc.
*#  License #    :  2549237

*#***************************************************************************************************
*# Model developed to simulate runoff from catchments that are greater than 0.5 ha
*#***************************************************************************************************
*#  Updated      : 22 April 2020 to reflect development boundary changes and on-site controls - JB JFSA
*%  25 mm Storm based on 2-Year, 3-Hour Chicago Storm
START                    TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[001]
                        ["25MMC3H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|------------------------------------------------------------|
READ STORM               STORM_FILENAME=["STORM.001"]
*%-----------------|------------------------------------------------------------|
*SAVE ALL HYDS            ON=[1]
*%-----------------|------------------------------------------------------------|
*# Park Lands
CALIB STANDHYD           NHYD=["A104PK"], DT=[1](min), AREA=[1.720](ha), XIMP=[0.19], TIMP=[0.29], DWF=[0](cms),
                         LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr), DCAY=[4.14](/hr), F=[0.00](mm),
                         Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[135](m), MNP=[0.25], SCP=[0](min),
                         Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[107](m), MNI=[0.013], SCI=[0](min),
                         RAINFALL=[ ,  ,  -1](mm/hr)
*%-----------------|------------------------------------------------------------|
*# Minor system flow limited to 5-Year Rational (0.199m3/s)
*# On-site storage provided up to the 100 year event.
ROUTE RESERVOIR          NHYDout=["A104PKmi"], NHYDin=["A104PK"], RDT=[1](min),
                              TABLE of ( OUTFLOW-STORAGE ) values
                                        (cms)  - (ha-m)
                                      [  0.0   ,  0.0 ]
                                      [  0.199,   0.001]
                                      [  0.199,   0.0075]
                                      [   -1   ,  -1   ]  (maximum one hundred pairs of points)
                                      NHYDovf=["A104PKMa"],
*%-----------------|------------------------------------------------------------|
SAVE HYD                 NHYD=["A104PKmi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                         HYD_COMMENT=["A104PK-minor"]
SAVE HYD                 NHYD=["A104PKMa"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                         HYD_COMMENT=["A104PK-Major"]
*%-----------------|------------------------------------------------------------|
*# Residential Lands
CALIB STANDHYD           NHYD=["A109RES"], DT=[1](min), AREA=[1.64](ha), XIMP=[.59], TIMP=[.69], DWF=[0](cms),
                         LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr), DCAY=[4.14](/hr), F=[0.00](mm),
                         Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m), MNP=[0.25], SCP=[0](min),
                         Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[104](m), MNI=[0.013], SCI=[0](min),
                         RAINFALL=[ ,  ,  -1](mm/hr)
*%-----------------|------------------------------------------------------------|
```

```
*# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
*# On-site storage provided up to the 100 year event.
*# 100-year + 20% stress test capture set at 107% of 100-year capture,
*# and 100-year + 20% stress test storage set to 145% of 100-year storage
ROUTE RESERVOIR     NHYDout=["A109RESmi"], NHYDin=["A109RES"], RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                  [  0.0  ,  0.0 ]
                                  [  0.230,  0.001]
                                  [  0.230,  0.026]
                                  [  0.246,  0.044]
                                  [   -1  ,  -1  ]  (maximum one hundred pairs of points)
                                  NHYDovf=["A109RESMa"],
*%-----------------|-----------------------------------------------------------|
SAVE HYD            NHYD=["A109RESmi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["A109RES-minor"]
SAVE HYD            NHYD=["A109RESMa"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["A109RES-Major"]
*%-----------------|-----------------------------------------------------------|
*# Commercial Block
CALIB STANDHYD      NHYD=["A2260COM"], DT=[1](min), AREA=[2.68](ha), XIMP=[.69],
TIMP=[.79], DWF=[0](cms),
                    LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr),
                    DCAY=[4.14](/hr), F=[0.00](mm),
                    Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m),
                    MNP=[0.25], SCP=[0](min),
                    Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[133](m),
                    MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  -1](mm/hr)
*%-----------------|-----------------------------------------------------------|
*# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
*# On-site storage provided up to the 100 year event.
ROUTE RESERVOIR     NHYDout=["A2260COMmi"], NHYDin=["A2260COM"], RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                  [  0.0  ,  0.0 ]
                                  [  0.382,  .001]
                                  [  0.382,  .0445]
                                  [   -1  ,  -1  ]  (maximum one hundred pairs of points)
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*%-----------------|-----------------------------------------------------------|
SAVE HYD            NHYD=["A2260COMmi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["A2260COM-minor"]
SAVE HYD            NHYD=["A2260COMMa"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["A2260COM-Major"]
*%-----------------|-----------------------------------------------------------|
*# Residential Block
CALIB STANDHYD      NHYD=["A303EXT"], DT=[1](min), AREA=[2.451](ha), XIMP=[.59],
TIMP=[.69], DWF=[0](cms),
                    LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr),
                    DCAY=[4.14](/hr), F=[0.00](mm),
                    Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m),
                    MNP=[0.25], SCP=[0](min),
                    Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[127](m),
                    MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  -1](mm/hr)
*%-----------------|-----------------------------------------------------------|
*# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
*# On-site storage provided up to the 100 year event.
*# 100-year + 20% stress test capture set at 107% of 100-year capture,
*# and 100-year + 20% stress test storage set to 145% of 100-year storage
ROUTE RESERVOIR     NHYDout=["A303EXTmi"], NHYDin=["A303EXT"], RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                  [  0.0  ,  0.0 ]
                                  [  0.336,  .001]
                                  [  0.336,  .038]
```

```
                                  [  0.360,  .055]
                                  [   -1   ,  -1  ]  (maximum one hundred pairs of points)
                                  NHYDovf=["A303EXTMa"],
*%-----------------|-----------------------------------------------------------|
SAVE HYD                NHYD=["A303EXTmi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                        HYD_COMMENT=["A301EXT-minor"]
SAVE HYD                NHYD=["A303EXTMa"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                        HYD_COMMENT=["A301EXT-Major"]
*%-----------------|-----------------------------------------------------------|
*# Residential Block
CALIB STANDHYD          NHYD=["A302EXT"], DT=[1](min), AREA=[0.99](ha), XIMP=[.59],
TIMP=[.69], DWF=[0](cms),
                        LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr),
                        DCAY=[4.14](/hr), F=[0.00](mm),
                        Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m),
                        MNP=[0.25], SCP=[0](min),
                        Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[81](m),
                        MNI=[0.013], SCI=[0](min),
                        RAINFALL=[ ,  ,  -1](mm/hr)
*%-----------------|-----------------------------------------------------------|
*# Minor system limited to 2-Year Chicago 3hr +14% (0.146 m³/s)
*# On-site storage provided up to the 100 year event.
*# 100-year + 20% stress test capture set at 107% of 100-year capture,
*# and 100-year + 20% stress test storage set to 145% of 100-year storage
ROUTE RESERVOIR         NHYDout=["A302EXTmi"], NHYDin=["A302EXT"], RDT=[1](min),
                            TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms)  -  (ha-m)
                                  [  0.0   ,  0.0 ]
                                  [  0.146,  .001]
                                  [  0.146,  .015]
                                  [  0.156,  .021]
                                  [   -1   ,  -1  ]  (maximum one hundred pairs of points)
                                  NHYDovf=["A302EXTMa"],
*%-----------------|-----------------------------------------------------------|
SAVE HYD                NHYD=["A302EXTmi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                        HYD_COMMENT=["A302EXT-minor"]
SAVE HYD                NHYD=["A302EXTMa"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                        HYD_COMMENT=["A302EXT-Major"]
*%-----------------|-----------------------------------------------------------|
*# Residential Block
CALIB STANDHYD          NHYD=["A304EXT"], DT=[1](min), AREA=[1.199](ha), XIMP=[.59],
TIMP=[.69], DWF=[0](cms),
                        LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr),
                        DCAY=[4.14](/hr), F=[0.00](mm),
                        Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m),
                        MNP=[0.25], SCP=[0](min),
                        Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[89](m),
                        MNI=[0.013], SCI=[0](min),
                        RAINFALL=[ ,  ,  -1](mm/hr)
*%-----------------|-----------------------------------------------------------|
*# Minor system limited to 2-Year Chicago 3hr +14% (0.173 m³/s)
*# On-site storage provided up to the 100 year event.
*# 100-year + 20% stress test capture set at 107% of 100-year capture,
*# and 100-year + 20% stress test storage set to 145% of 100-year storage
ROUTE RESERVOIR         NHYDout=["A304EXTmi"], NHYDin=["A304EXT"], RDT=[1](min),
                            TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms)  -  (ha-m)
                                  [  0.0   ,  0.0 ]
                                  [  0.173,  .001]
                                  [  0.173,  .0180]
                                  [  0.185,  .0261]
                                  [   -1   ,  -1  ]  (maximum one hundred pairs of points)
                                  NHYDovf=["A304EXTMa"],
*%-----------------|-----------------------------------------------------------|
SAVE HYD                NHYD=["A304EXTmi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                        HYD_COMMENT=["A304EXT-minor"]
SAVE HYD                NHYD=["A304EXTMa"],  # OF PCYCLES=[-1],  ICASEsh=[1]
```

```
                          HYD_COMMENT=["A304EXT-Major"]
*%-----------------|-------------------------------------------------------------|
*# Residential Block
CALIB STANDHYD            NHYD=["A310EXT1"], DT=[1](min), AREA=[1.223](ha), XIMP=[.59],
TIMP=[.69], DWF=[0](cms),
                          LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr),
                          DCAY=[4.14](/hr), F=[0.00](mm),
                          Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m),
                          MNP=[0.25], SCP=[0](min),
                          Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[90](m),
                          MNI=[0.013], SCI=[0](min),
                          RAINFALL=[ ,   ,   -1](mm/hr)
*%-----------------|-------------------------------------------------------------|
*# Minor system limited to 2-Year Chicago 3hr +14% (0.177 m³/s)
*# On-site storage provided up to the 100 year event.
*# 100-year + 20% stress test capture set at 107% of 100-year capture,
*# and 100-year + 20% stress test storage set to 145% of 100-year storage
ROUTE RESERVOIR           NHYDout=["A310EXT1mi"], NHYDin=["A310EXT1"], RDT=[1](min),
                                TABLE of ( OUTFLOW-STORAGE ) values
                                           (cms)  -  (ha-m)
                                        [   0.0   ,   0.0 ]
                                        [   0.177,   .001]
                                        [   0.177,   .019]
                                        [   0.189,   .028]
                                        [    -1   ,   -1   ]  (maximum one hundred pairs of points)
                                        NHYDovf=["A310EXT1Ma"],
*%-----------------|-------------------------------------------------------------|
SAVE HYD                  NHYD=["A310EXT1mi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                          HYD_COMMENT=["A310EXT1-minor"]
SAVE HYD                  NHYD=["A310EXT1Ma"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                          HYD_COMMENT=["A310EXT1-Major"]
*%-----------------|-------------------------------------------------------------|
*# Residential Block
CALIB STANDHYD            NHYD=["A310EXT2"], DT=[1](min), AREA=[7.636](ha), XIMP=[.59],
TIMP=[.69], DWF=[0](cms),
                          LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr),
                          DCAY=[4.14](/hr), F=[0.00](mm),
                          Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m),
                          MNP=[0.25], SCP=[0](min),
                          Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[226](m),
                          MNI=[0.013], SCI=[0](min),
                          RAINFALL=[ ,   ,   -1](mm/hr)
*%-----------------|-------------------------------------------------------------|
*# Minor system limited to 2-Year Chicago 3hr +14% (0.877 m³/s)
*# On-site storage provided up to the 100 year event.
*# 100-year + 20% stress test capture set at 107% of 100-year capture,
*# and 100-year + 20% stress test storage set to 145% of 100-year storage
ROUTE RESERVOIR           NHYDout=["A310EXT2mi"], NHYDin=["A310EXT2"], RDT=[1](min),
                                TABLE of ( OUTFLOW-STORAGE ) values
                                           (cms)  -  (ha-m)
                                        [   0.0   ,   0.0 ]
                                        [   0.877,   .001]
                                        [   0.877,   .133]
                                        [   0.939,   .192]
                                        [    -1   ,   -1   ]  (maximum one hundred pairs of points)
                                        NHYDovf=["A310EXT2Ma"],
*%-----------------|-------------------------------------------------------------|
SAVE HYD                  NHYD=["A310EXT2mi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                          HYD_COMMENT=["A310EXT2-minor"]
SAVE HYD                  NHYD=["A310EXT2Ma"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                          HYD_COMMENT=["A310EXT2-Major"]
*%-----------------|-------------------------------------------------------------|
*# Brazeau Commercial Block
CALIB STANDHYD            NHYD=["A133COM"], DT=[1](min), AREA=[13.831](ha), XIMP=[.69],
TIMP=[.79], DWF=[0](cms),
                          LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr),
                          DCAY=[4.14](/hr), F=[0.00](mm),
```

```
                          Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m),
                          MNP=[0.25], SCP=[0](min),
                          Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[303](m),
                          MNI=[0.013], SCI=[0](min),
                          RAINFALL=[ ,  ,  -1](mm/hr)
*%-----------------|------------------------------------------------------------|
*# Site controlled to (1.8 m³/s)
*# On-site storage provided up to the 100 year event + 20%.
ROUTE RESERVOIR     NHYDout=["A133COMmi"], NHYDin=["A133COM"], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [  0.0   ,  0.0 ]
                                 [  1.8,   .001]
                                 [  1.8,   .35]
                                 [   -1   ,  -1   ]  (maximum one hundred pairs of points)
                                 NHYDovf=["A133COMMa"],
*%-----------------|------------------------------------------------------------|
SAVE HYD            NHYD=["A133COMmi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["A133COM-minor"]
SAVE HYD            NHYD=["A133COMMa"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["A133COM-Major"]
*%-----------------|------------------------------------------------------------|
*# ABIC Commercial Block
CALIB STANDHYD      NHYD=["A303COM"], DT=[1](min), AREA=[7.381](ha), XIMP=[.69],
TIMP=[.79], DWF=[0](cms),
                    LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr),
                    DCAY=[4.14](/hr), F=[0.00](mm),
                    Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m),
                    MNP=[0.25], SCP=[0](min),
                    Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[222](m),
                    MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  -1](mm/hr)
*%-----------------|------------------------------------------------------------|
*# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 m³/s)
* SWM control reduced from 253 L/s to 210.4 L/s
* On-site storage provided up to the 100 Year + 20%
ROUTE RESERVOIR     NHYDout=["A303COMmi"], NHYDin=["A303COM"], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [  0.0   ,  0.0 ]
                                 [  0.2104,   .001]
                                 [  0.2104,   .385]
                                 [   -1   ,  -1   ]  (maximum one hundred pairs of points)
                                 NHYDovf=["A303COMMa"],
*%-----------------|------------------------------------------------------------|
SAVE HYD            NHYD=["A303COMmi"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["A303COM-minor"]
SAVE HYD            NHYD=["A303COMMa"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["A303COM-Major"]
*%-----------------|------------------------------------------------------------|
*# SWM Pond Block
* Imperviousness increased to 93% based on impermeable clay liner in the pond up to the
100-Year water level
CALIB STANDHYD      NHYD=["APOND1"], DT=[1](min), AREA=[3.94](ha), XIMP=[.93],
TIMP=[.93], DWF=[0](cms),
                    LOSS=[1] Horton Equ: Fo=[76.2](mm/hr), Fc=[13.2](mm/hr),
                    DCAY=[4.14](/hr), F=[0.00](mm),
                    Pervious   areas: IAper=[4.67](mm), SLPP=[2.0](%), LGP=[40](m),
                    MNP=[0.25], SCP=[0](min),
                    Impervious areas: IAimp=[1.57](mm), SLPI=[0.5](%), LGI=[162](m),
                    MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  -1](mm/hr)
*%-----------------|------------------------------------------------------------|
*SAVE HYD            NHYD=["APOND1"],  # OF PCYCLES=[-1],  ICASEsh=[1]
*                    HYD_COMMENT=["APOND1"]
*%-----------------|------------------------------------------------------------|
*Add Major and minor flows from A303COM directly to Pond
```

```
ADD HYD             NHYDsum=["PND-A303"], NHYDs to add=["A303COMMa"+"A303COMMi"+"APOND1"]
*%-----------------|-----------------------------------------------------------|
SAVE HYD            NHYD=["PND-A303"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["PND-A303"]
*%-----------------|-----------------------------------------------------------|
*#############################################################################
*# STORMS
*#############################################################################
*%  25 mm Storm based on 2-Year, 3-Hour Chicago Storm
*%START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[001]
*%                     ["25MMC3H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  2-Year, 3-Hour Chicago Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
*%                   ["002YC3H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  5-Year, 3-Hour Chicago Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
*%                   ["005YC3H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  10-Year, 3-Hour Chicago Storm
*START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
*%                   ["010YC3H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  25-Year, 3-Hour Chicago Storm
*START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
*%                   ["025YC3H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  50-Year, 3-Hour Chicago Storm
*START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
*%                   ["050YC3H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  100-Year, 3-Hour Chicago Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[099]
*%                   ["100YC3H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  2-Year, 24-Hour SCS Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[102]
*%                   ["SC24002x.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  5-Year, 24-Hour SCS Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[105]
*%                   ["SC24005x.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  10-Year, 24-Hour SCS Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[110]
*%                   ["SC24010x.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  25-Year, 24-Hour SCS Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[125]
*%                   ["SC24025x.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  50-Year, 24-Hour SCS Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[150]
*%                   ["SC24050x.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  100-Year, 24-Hour SCS Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[199]
*%                   ["SC24100x.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  July 1st, 1979 Storm - Ottawa International Airport
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[979]
*%                   ["19790701.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  August 4th, 1988 Storm - Ottawa International Airport
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[988]
*%                   ["19880804.stm"] <--storm filename, one per line for NSTORM time
```

```
*%-----------------|-----------------------------------------------------------|
*%  August 8th, 1996 Storm - Ottawa International Airport
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[996]
*%                   ["19960808.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  100-Year, 24-Hour SCS Storm + 20%
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[998]
*%                   ["SC24100x+.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
*%  100-Year, 3-Hour Chicago Storm + 20%
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[999]
*%                   ["100YC3H+.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
FINISH
```

```
 ==========================================================================================

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO         222     000    11   5555   =========
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O          2    0   0   11   5
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O          2    0   0   11   5      Ver 5.500
     S    W W    M   M   H   H     Y     M   M   O   O        222    0   0   11   555    FEB  2015
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2      0   0   11     5    =========
                                                              2      0   0   11     5    # 2549237
       StormWater Management HYdrologic Model                  222     000    11   555    =========

 ******************************************************************************************
 **************************************  SWMHYMO Ver 5.500  *******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                OTTHYMO-83 and OTTHYMO-89.                   ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.Com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: JFSAinc.                                   ++++++++++++
 ++++++++++++++++++              Ottawa                SERIAL#:2549237        ++++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++          ************
 ******************           Maximum value for ID numbers  :     11          ************
 ******************           Max. number of rainfall points: 105408          ************
 ******************           Max. number of flow points    : 105408          ************
 ******************************************************************************************


 ********************************   S U M M A R Y   O U T P U T   ************************
 ******************************************************************************************
 *                 RUN DATE: 2020-06-17     TIME: 11:43:37     RUN COUNTER: 003114         *
 ******************************************************************************************
 * Input   file: C:\OneDrive\OneDrive - J.F. Sabourin and Associates Inc\PROJ\20200615-Development*
 *               \BRAZ_v04.dat                                                             *
 * Output  file: C:\OneDrive\OneDrive - J.F. Sabourin and Associates Inc\PROJ\20200615-Development*
 *               \BRAZ_v04.out                                                             *
 * Summary file: C:\OneDrive\OneDrive - J.F. Sabourin and Associates Inc\PROJ\20200615-Development*
 *               \BRAZ_v04.sum                                                             *
 * User comments:                                                                          *
 * 1:______________________________________________________________________________________*
 * 2:______________________________________________________________________________________*
 * 3:______________________________________________________________________________________*
 ******************************************************************************************


#******************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#******************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#******************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#******************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
 RUN#:COMMAND#
R0001:C00001------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 0001 ]
R0001:C00002------------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = 25 MM BASED ON CHICAGO STORM 2 Year, 3 Hours
      [SDT=10.00:SDUR=   3.00:PTOT=  25.00]
# Park Lands
R0001:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72     .050 No_date    1:00    5.88 .235      .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0001:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .050 No_date    1:00    5.88  n/a      .000
                out <=    1.0 01:A104PKmi       1.72     .050 No_date    1:01    5.88  n/a      .000
           overflow <=    1.0 03:A104PKMa        .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2502E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72     .050 No_date    1:01    5.88  n/a      .000
      fname :A104PKmi.0001
      remark:A104PK-minor
R0001:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A104PKMa        .00     .000 No_date    0:00     .00  n/a      .000
      fname :A104PKMa.0001
      remark:A104PK-Major
# Residential Lands
R0001:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64     .149 No_date    1:00   15.13 .605      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0001:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .149 No_date    1:00   15.13  n/a      .000
                out <=    1.0 01:A109RESmi      1.64     .148 No_date    1:01   15.13  n/a      .000
           overflow <=    1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.6444E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi      1.64     .148 No_date    1:01   15.13  n/a      .000
      fname :A109RESmi.0001
      remark:A109RES-minor
R0001:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A109RESMa.0001
      remark:A109RES-Major
# Commercial Block
R0001:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM       2.68     .273 No_date    1:01   17.42 .697      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0001:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68     .273 No_date    1:01   17.42  n/a      .000
                out <=    1.0 01:A2260COMmi     2.68     .271 No_date    1:01   17.42  n/a      .000
           overflow <=    1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.7151E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi     2.68     .271 No_date    1:01   17.42  n/a      .000
      fname :A2260COMmi.0001
      remark:A2260COM-minor
R0001:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A2260COMMa.0001
      remark:A2260COM-Major
# Residential Block
R0001:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT        2.45     .216 No_date    1:01   15.13 .605      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0001:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .216 No_date    1:01   15.13  n/a      .000
                out <=    1.0 01:A303EXTmi      2.45     .216 No_date    1:01   15.13  n/a      .000
           overflow <=    1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.6437E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi      2.45     .216 No_date    1:01   15.13  n/a      .000
      fname :A303EXTmi.0001
      remark:A301EXT-minor
R0001:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303EXTMa.0001
      remark:A301EXT-Major
# Residential Block
R0001:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT         .99     .094 No_date    1:00   15.13 .605      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0001:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .094 No_date    1:00   15.13  n/a      .000
                out <=    1.0 01:A302EXTmi       .99     .092 No_date    1:01   15.13  n/a      .000
           overflow <=    1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.6311E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99     .092 No_date    1:01   15.13  n/a      .000
      fname :A302EXTmi.0001
      remark:A302EXT-minor
R0001:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A302EXTMa.0001
      remark:A302EXT-Major
# Residential Block
R0001:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .111 No_date    1:00   15.13 .605      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0001:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .111 No_date    1:00   15.13  n/a      .000
                out <=    1.0 01:A304EXTmi      1.20     .109 No_date    1:01   15.13  n/a      .000
           overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.6346E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .109 No_date    1:01   15.13  n/a      .000
      fname :A304EXTmi.0001
      remark:A304EXT-minor
R0001:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A304EXTMa.0001
      remark:A304EXT-Major
# Residential Block
R0001:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .113 No_date    1:00   15.13 .605      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0001:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .113 No_date    1:00   15.13  n/a      .000
                out <=    1.0 01:A310EXT1mi     1.22     .112 No_date    1:01   15.13  n/a      .000
           overflow <=    1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.6322E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22     .112 No_date    1:01   15.13  n/a      .000
      fname :A310EXT1mi.0001
      remark:A310EXT1-minor
R0001:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT1Ma.0001
      remark:A310EXT1-Major
# Residential Block
R0001:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64     .596 No_date    1:02   15.13 .605      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0001:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64     .596 No_date    1:02   15.13  n/a      .000
                out <=    1.0 01:A310EXT2mi     7.64     .595 No_date    1:02   15.13  n/a      .000
           overflow <=    1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.6813E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64     .595 No_date    1:02   15.13  n/a      .000
      fname :A310EXT2mi.0001
      remark:A310EXT2-minor
R0001:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT2Ma.0001
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0001:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM       13.83    1.175 No_date    1:03   17.42 .697      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0001:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83    1.175 No_date    1:03   17.42  n/a      .000
                out <=    1.0 01:A133COMmi     13.83    1.174 No_date    1:03   17.42  n/a      .000
           overflow <=    1.0 03:A133COMMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.6537E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi     13.83    1.174 No_date    1:03   17.42  n/a      .000
      fname :A133COMmi.0001
      remark:A133COM-minor
R0001:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A133COMMa.0001
      remark:A133COM-Major
# ABIC Commercial Block
R0001:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM        7.38     .678 No_date    1:02   17.42 .697      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0001:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38     .678 No_date    1:02   17.42  n/a      .000
                out <=    1.0 01:A303COMmi      7.38     .210 No_date    0:53   17.42  n/a      .000
           overflow <=    1.0 03:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.4274E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0001:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi      7.38     .210 No_date    0:53   17.42  n/a      .000
      fname :A303COMmi.0001
      remark:A303COM-minor
R0001:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303COMMa.0001
      remark:A303COM-Major
# SWM Pond Block
R0001:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94     .511 No_date    1:01   21.84 .874      .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0001:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
                     +    1.0 02:A303COMmi      7.38     .210 No_date    0:53   17.42  n/a      .000
                     +    1.0 02:APOND1         3.94     .511 No_date    1:01   21.84  n/a      .000
                  SUM=    1.0 01:PND-A303      11.32     .722 No_date    1:01   18.96  n/a      .000
R0001:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32     .722 No_date    1:01   18.96  n/a      .000
      fname :PND-A303.0001
      remark:PND-A303
################################################################################
# STORMS
################################################################################
  ** END OF RUN :    1

******************************************************************************************





 RUN#:COMMAND#
R0002:C00001------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 0002 ]
#******************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#******************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#******************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#******************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0002:C00002------------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
```

```
      Comment  = CHICAGO STORM 2 Year, 3 Hours
      [SDT=10.00:SDUR=   3.00:PTOT=  31.86]
# Park Lands
R0002:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72     .066 No_date    1:00    9.82 .308     .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0002:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .066 No_date    1:00    9.82  n/a     .000
                out <=    1.0 01:A104PKmi       1.72     .065 No_date    1:01    9.82  n/a     .000
           overflow <=    1.0 03:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.3291E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72     .065 No_date    1:01    9.82  n/a     .000
      fname :A104PKmi.0002
      remark:A104PK-minor
R0002:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
      fname :A104PKMa.0002
      remark:A104PK-Major
# Residential Lands
R0002:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64     .203 No_date    1:01   20.58 .646     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0002:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .203 No_date    1:01   20.58  n/a     .000
                out <=    1.0 01:A109RESmi      1.64     .201 No_date    1:01   20.58  n/a     .000
           overflow <=    1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.8791E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi      1.64     .201 No_date    1:01   20.58  n/a     .000
      fname :A109RESmi.0002
      remark:A109RES-minor
R0002:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A109RESMa.0002
      remark:A109RES-Major
# Commercial Block
R0002:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM       2.68     .372 No_date    1:01   23.35 .733     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0002:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68     .372 No_date    1:01   23.35  n/a     .000
                out <=    1.0 01:A2260COMmi     2.68     .371 No_date    1:01   23.35  n/a     .000
           overflow <=    1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.9731E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi     2.68     .371 No_date    1:01   23.35  n/a     .000
      fname :A2260COMmi.0002
      remark:A2260COM-minor
R0002:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A2260COMMa.0002
      remark:A2260COM-Major
# Residential Block
R0002:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT        2.45     .295 No_date    1:01   20.58 .646     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0002:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .295 No_date    1:01   20.58  n/a     .000
                out <=    1.0 01:A303EXTmi      2.45     .294 No_date    1:01   20.58  n/a     .000
           overflow <=    1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.8769E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi      2.45     .294 No_date    1:01   20.58  n/a     .000
      fname :A303EXTmi.0002
      remark:A301EXT-minor
R0002:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A303EXTMa.0002
      remark:A301EXT-Major
# Residential Block
R0002:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT         .99     .128 No_date    1:00   20.58 .646     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0002:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .128 No_date    1:00   20.58  n/a     .000
                out <=    1.0 01:A302EXTmi       .99     .125 No_date    1:01   20.58  n/a     .000
           overflow <=    1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.8553E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99     .125 No_date    1:01   20.58  n/a     .000
      fname :A302EXTmi.0002
      remark:A302EXT-minor
R0002:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A302EXTMa.0002
      remark:A302EXT-Major
# Residential Block
R0002:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .152 No_date    1:00   20.58 .646     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0002:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .152 No_date    1:00   20.58  n/a     .000
                out <=    1.0 01:A304EXTmi      1.20     .150 No_date    1:01   20.58  n/a     .000
           overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.8667E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .150 No_date    1:01   20.58  n/a     .000
      fname :A304EXTmi.0002
      remark:A304EXT-minor
R0002:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A304EXTMa.0002
      remark:A304EXT-Major
# Residential Block
R0002:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .155 No_date    1:00   20.58 .646     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0002:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .155 No_date    1:00   20.58  n/a     .000
                out <=    1.0 01:A310EXT1mi     1.22     .153 No_date    1:01   20.58  n/a     .000
           overflow <=    1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.8638E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22     .153 No_date    1:01   20.58  n/a     .000
      fname :A310EXT1mi.0002
      remark:A310EXT1-minor
R0002:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A310EXT1Ma.0002
      remark:A310EXT1-Major
# Residential Block
R0002:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64     .820 No_date    1:02   20.58 .646     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0002:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64     .820 No_date    1:02   20.58  n/a     .000
                out <=    1.0 01:A310EXT2mi     7.64     .818 No_date    1:02   20.58  n/a     .000
           overflow <=    1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.9375E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64     .818 No_date    1:02   20.58  n/a     .000
      fname :A310EXT2mi.0002
      remark:A310EXT2-minor
R0002:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A310EXT2Ma.0002
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0002:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM       13.83    1.607 No_date    1:03   23.35 .733     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0002:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83    1.607 No_date    1:03   23.35  n/a     .000
                out <=    1.0 01:A133COMmi     13.83    1.606 No_date    1:03   23.35  n/a     .000
           overflow <=    1.0 03:A133COMMa      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.8943E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi     13.83    1.606 No_date    1:03   23.35  n/a     .000
      fname :A133COMmi.0002
      remark:A133COM-minor
R0002:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A133COMMa.0002
      remark:A133COM-Major
# ABIC Commercial Block
R0002:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM        7.38     .921 No_date    1:02   23.35 .733     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0002:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38     .921 No_date    1:02   23.35  n/a     .000
                out <=    1.0 01:A303COMmi      7.38     .210 No_date    0:51   23.35  n/a     .000
           overflow <=    1.0 03:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.7252E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0002:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi      7.38     .210 No_date    0:51   23.35  n/a     .000
      fname :A303COMmi.0002
      remark:A303COM-minor
R0002:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A303COMMa.0002
      remark:A303COM-Major
# SWM Pond Block
R0002:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94     .670 No_date    1:01   28.42 .892     .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0002:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
                   +      1.0 02:A303COMmi      7.38     .210 No_date    0:51   23.35  n/a     .000
                   +      1.0 02:APOND1         3.94     .670 No_date    1:01   28.42  n/a     .000
                SUM=      1.0 01:PND-A303      11.32     .880 No_date    1:01   25.11  n/a     .000
R0002:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32     .880 No_date    1:01   25.11  n/a     .000
      fname :PND-A303.0002
      remark:PND-A303
################################################################################
# STORMS
################################################################################
  ** END OF RUN :    4

***************************************************************************************************





 RUN#:COMMAND#
R0005:C00001---------------------------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  = 0005 ]
#**************************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#**************************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#**************************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#**************************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0005:C00002---------------------------------------------------------------------------------------
      READ STORM
       Filename = STORM.001
       Comment  = CHICAGO STORM  5 Year, 3 Hours
       [SDT=10.00:SDUR=   3.00:PTOT=  42.51]
# Park Lands
R0005:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72     .101 No_date    1:00   16.88 .397     .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0005:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .101 No_date    1:00   16.88  n/a     .000
                out <=    1.0 01:A104PKmi       1.72     .099 No_date    1:01   16.88  n/a     .000
           overflow <=    1.0 03:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.4990E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72     .099 No_date    1:01   16.88  n/a     .000
      fname :A104PKmi.0005
      remark:A104PK-minor
R0005:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
      fname :A104PKMa.0005
      remark:A104PK-Major
# Residential Lands
R0005:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64     .306 No_date    1:00   29.71 .699     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0005:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .306 No_date    1:00   29.71  n/a     .000
                out <=    1.0 01:A109RESmi      1.64     .230 No_date    0:57   29.71  n/a     .000
           overflow <=    1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.3270E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi      1.64     .230 No_date    0:57   29.71  n/a     .000
      fname :A109RESmi.0005
      remark:A109RES-minor
R0005:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A109RESMa.0005
      remark:A109RES-Major
# Commercial Block
R0005:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM       2.68     .547 No_date    1:01   33.03 .777     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0005:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68     .547 No_date    1:01   33.03  n/a     .000
                out <=    1.0 01:A2260COMmi     2.68     .382 No_date    0:56   33.03  n/a     .000
           overflow <=    1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.7134E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi     2.68     .382 No_date    0:56   33.03  n/a     .000
      fname :A2260COMmi.0005
      remark:A2260COM-minor
R0005:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A2260COMMa.0005
      remark:A2260COM-Major
# Residential Block
R0005:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT        2.45     .448 No_date    1:01   29.71 .699     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
```

```
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0005:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .448 No_date    1:01   29.71  n/a      .000
                out <=    1.0 01:A303EXTmi      2.45     .336 No_date    0:57   29.71  n/a      .000
           overflow <=    1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.4642E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi      2.45     .336 No_date    0:57   29.71  n/a      .000
      fname :A303EXTmi.0005
      remark:A301EXT-minor
R0005:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303EXTMa.0005
      remark:A301EXT-Major
# Residential Block
R0005:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT         .99     .192 No_date    1:00   29.71 .699      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0005:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .192 No_date    1:00   29.71  n/a      .000
                out <=    1.0 01:A302EXTmi       .99     .146 No_date    0:57   29.71  n/a      .000
           overflow <=    1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2277E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99     .146 No_date    0:57   29.71  n/a      .000
      fname :A302EXTmi.0005
      remark:A302EXT-minor
R0005:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A302EXTMa.0005
      remark:A302EXT-Major
# Residential Block
R0005:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .231 No_date    1:00   29.71 .699      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0005:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .231 No_date    1:00   29.71  n/a      .000
                out <=    1.0 01:A304EXTmi      1.20     .173 No_date    0:57   29.71  n/a      .000
           overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2688E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .173 No_date    0:57   29.71  n/a      .000
      fname :A304EXTmi.0005
      remark:A304EXT-minor
R0005:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A304EXTMa.0005
      remark:A304EXT-Major
# Residential Block
R0005:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .235 No_date    1:00   29.71 .699      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0005:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .235 No_date    1:00   29.71  n/a      .000
                out <=    1.0 01:A310EXT1mi     1.22     .177 No_date    0:57   29.71  n/a      .000
           overflow <=    1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2690E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22     .177 No_date    0:57   29.71  n/a      .000
      fname :A310EXT1mi.0005
      remark:A310EXT1-minor
R0005:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT1Ma.0005
      remark:A310EXT1-Major
# Residential Block
R0005:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64    1.255 No_date    1:02   29.71 .699      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0005:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64    1.255 No_date    1:02   29.71  n/a      .000
                out <=    1.0 01:A310EXT2mi     7.64     .877 No_date    0:57   29.71  n/a      .000
           overflow <=    1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1749E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64     .877 No_date    0:57   29.71  n/a      .000
      fname :A310EXT2mi.0005
      remark:A310EXT2-minor
R0005:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT2Ma.0005
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0005:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM       13.83    2.426 No_date    1:03   33.03 .777      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0005:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83    2.426 No_date    1:03   33.03  n/a      .000
                out <=    1.0 01:A133COMmi     13.83    1.800 No_date    0:58   33.03  n/a      .000
           overflow <=    1.0 03:A133COMMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2746E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi     13.83    1.800 No_date    0:58   33.03  n/a      .000
      fname :A133COMmi.0005
      remark:A133COM-minor
R0005:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A133COMMa.0005
      remark:A133COM-Major
# ABIC Commercial Block
R0005:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM        7.38    1.386 No_date    1:02   33.03 .777      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0005:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38    1.386 No_date    1:02   33.03  n/a      .000
                out <=    1.0 01:A303COMmi      7.38     .210 No_date    0:46   33.03  n/a      .000
           overflow <=    1.0 03:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1276E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0005:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi      7.38     .210 No_date    0:46   33.03  n/a      .000
      fname :A303COMmi.0005
      remark:A303COM-minor
R0005:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303COMMa.0005
      remark:A303COM-Major
# SWM Pond Block
R0005:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94     .952 No_date    1:00   38.72 .911      .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0005:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
                    +     1.0 02:A303COMmi      7.38     .210 No_date    0:46   33.03  n/a      .000
                    +     1.0 02:APOND1         3.94     .952 No_date    1:00   38.72  n/a      .000
                 SUM=     1.0 01:PND-A303      11.32    1.162 No_date    1:00   35.01  n/a      .000
R0005:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32    1.162 No_date    1:00   35.01  n/a      .000
      fname :PND-A303.0005
      remark:PND-A303
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   98

*******************************************************************************************



 RUN#:COMMAND#
R0099:C00001------------------------------------------------------------------------------------
    START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 0099 ]
#*******************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#*******************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#*******************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#*******************************************************************************************
#  Updated     : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0099:C00002------------------------------------------------------------------------------------
    READ STORM
      Filename = STORM.001
      Comment  = CHICAGO STORM   100 Year, 3 Hours
      [SDT=10.00:SDUR=   3.00:PTOT=  71.66]
# Park Lands
R0099:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72     .274 No_date    1:11   40.08 .559      .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0099:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .274 No_date    1:11   40.08  n/a      .000
                out <=    1.0 01:A104PKmi       1.72     .199 No_date    0:59   40.08  n/a      .000
           overflow <=    1.0 03:A104PKMa        .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.7111E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72     .199 No_date    0:59   40.08  n/a      .000
      fname :A104PKmi.0099
      remark:A104PK-minor
R0099:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A104PKMa        .00     .000 No_date    0:00     .00  n/a      .000
      fname :A104PKMa.0099
      remark:A104PK-Major
# Residential Lands
R0099:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64     .621 No_date    1:00   56.40 .787      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0099:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .621 No_date    1:00   56.40  n/a      .000
                out <=    1.0 01:A109RESmi      1.64     .230 No_date    0:53   56.40  n/a      .000
           overflow <=    1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2516E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi      1.64     .230 No_date    0:53   56.40  n/a      .000
      fname :A109RESmi.0099
      remark:A109RES-minor
R0099:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A109RESMa.0099
      remark:A109RES-Major
# Commercial Block
R0099:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM       2.68    1.076 No_date    1:00   60.59 .846      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0099:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68    1.076 No_date    1:00   60.59  n/a      .000
                out <=    1.0 01:A2260COMmi     2.68     .382 No_date    0:53   60.59  n/a      .000
           overflow <=    1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.4450E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi     2.68     .382 No_date    0:53   60.59  n/a      .000
      fname :A2260COMmi.0099
      remark:A2260COM-minor
R0099:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A2260COMMa.0099
      remark:A2260COM-Major
# Residential Block
R0099:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT        2.45     .913 No_date    1:00   56.40 .787      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0099:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .913 No_date    1:00   56.40  n/a      .000
                out <=    1.0 01:A303EXTmi      2.45     .336 No_date    0:53   56.40  n/a      .000
           overflow <=    1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.3775E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi      2.45     .336 No_date    0:53   56.40  n/a      .000
      fname :A303EXTmi.0099
      remark:A301EXT-minor
R0099:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303EXTMa.0099
      remark:A301EXT-Major
# Residential Block
R0099:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT         .99     .388 No_date    1:00   56.40 .787      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0099:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .388 No_date    1:00   56.40  n/a      .000
                out <=    1.0 01:A302EXTmi       .99     .146 No_date    0:53   56.40  n/a      .000
           overflow <=    1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1494E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99     .146 No_date    0:53   56.40  n/a      .000
      fname :A302EXTmi.0099
      remark:A302EXT-minor
R0099:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A302EXTMa.0099
      remark:A302EXT-Major
# Residential Block
R0099:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .460 No_date    1:00   56.40 .787      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0099:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .460 No_date    1:00   56.40  n/a      .000
                out <=    1.0 01:A304EXTmi      1.20     .173 No_date    0:53   56.40  n/a      .000
           overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1798E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .173 No_date    0:53   56.40  n/a      .000
      fname :A304EXTmi.0099
      remark:A304EXT-minor
R0099:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A304EXTMa.0099
      remark:A304EXT-Major
# Residential Block
R0099:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .469 No_date    1:00   56.40 .787      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
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# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0099:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A310EXT1      1.22      .469 No_date    1:00   56.40  n/a      .000
                 out <=    1.0 01:A310EXT1mi    1.22      .177 No_date    0:53   56.40  n/a      .000
            overflow <=    1.0 03:A310EXT1Ma     .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.1825E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A310EXT1mi    1.22      .177 No_date    0:53   56.40  n/a      .000
       fname :A310EXT1mi.0099
       remark:A310EXT1-minor
R0099:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma     .00      .000 No_date    0:00     .00  n/a      .000
       fname :A310EXT1Ma.0099
       remark:A310EXT1-Major
# Residential Block
R0099:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A310EXT2      7.64     2.641 No_date    1:01   56.40 .787      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0099:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A310EXT2      7.64     2.641 No_date    1:01   56.40  n/a      .000
                 out <=    1.0 01:A310EXT2mi    7.64      .877 No_date    0:53   56.40  n/a      .000
            overflow <=    1.0 03:A310EXT2Ma     .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.1328E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A310EXT2mi    7.64      .877 No_date    0:53   56.40  n/a      .000
       fname :A310EXT2mi.0099
       remark:A310EXT2-minor
R0099:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma     .00      .000 No_date    0:00     .00  n/a      .000
       fname :A310EXT2Ma.0099
       remark:A310EXT2-Major
# Brazeau Commercial Block
R0099:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A133COM      13.83     4.865 No_date    1:02   60.59 .846      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0099:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A133COM      13.83     4.865 No_date    1:02   60.59  n/a      .000
                 out <=    1.0 01:A133COMmi    13.83     1.800 No_date    0:54   60.65  n/a      .000
            overflow <=    1.0 03:A133COMMa      .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.2285E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A133COMmi    13.83     1.800 No_date    0:54   60.65  n/a      .000
       fname :A133COMmi.0099
       remark:A133COM-minor
R0099:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa      .00      .000 No_date    0:00     .00  n/a      .000
       fname :A133COMMa.0099
       remark:A133COM-Major
# ABIC Commercial Block
R0099:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A303COM       7.38     2.761 No_date    1:01   60.59 .846      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0099:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A303COM       7.38     2.761 No_date    1:01   60.59  n/a      .000
                 out <=    1.0 01:A303COMmi     7.38      .210 No_date    0:40   60.59  n/a      .000
            overflow <=    1.0 03:A303COMMa      .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.2945E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0099:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A303COMmi     7.38      .210 No_date    0:40   60.59  n/a      .000
       fname :A303COMmi.0099
       remark:A303COM-minor
R0099:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa      .00      .000 No_date    0:00     .00  n/a      .000
       fname :A303COMMa.0099
       remark:A303COM-Major
# SWM Pond Block
R0099:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:APOND1        3.94     1.760 No_date    1:00   67.27 .939      .000
       [XIMP=.93:TIMP=.93]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0099:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ADD HYD               1.0 02:A303COMMa      .00      .000 No_date    0:00     .00  n/a      .000
                      +    1.0 01:A303COMmi     7.38      .210 No_date    0:40   60.59  n/a      .000
                      +    1.0 02:APOND1        3.94     1.760 No_date    1:00   67.27  n/a      .000
                   SUM=    1.0 01:PND-A303     11.32     1.971 No_date    1:00   62.92  n/a      .000
R0099:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:PND-A303     11.32     1.971 No_date    1:00   62.92  n/a      .000
       fname :PND-A303.0099
       remark:PND-A303
##########################################################################################
# STORMS
##########################################################################################
  ** END OF RUN : 101

*************************************************************************************************






 RUN#:COMMAND#
R0102:C00001----------------------------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2   (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  = 0102 ]
#************************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#************************************************************************************************
# Project Name: [Brazeau Lands]    Project Number: [1800]
# Date        : 16-September-2019
# Modeller    : [JB]
# Updated     : [JB -  Feb 2020]
#             : [JB -  June 2020]
# Company     : JFSAinc.
# License #   : 2549237
#************************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#************************************************************************************************
# Updated    : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0102:C00002----------------------------------------------------------------------------------------
     READ STORM
       Filename = STORM.001
       Comment  = 2 years SCS Type 2 Storm 24 Hours step 10 min, City of Ottawa
       [SDT=10.00:SDUR= 24.00:PTOT=  48.46]
# Park Lands
R0102:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A104PK        1.72      .064 No_date   12:01   16.80 .347      .000
       [XIMP=.19:TIMP=.29]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0102:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A104PK        1.72      .064 No_date   12:01   16.80  n/a      .000
                 out <=    1.0 01:A104PKmi      1.72      .063 No_date   12:01   16.80  n/a      .000
            overflow <=    1.0 03:A104PKMa       .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.3193E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A104PKmi      1.72      .063 No_date   12:01   16.80  n/a      .000
       fname :A104PKmi.0102
       remark:A104PK-minor
R0102:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A104PKMa       .00      .000 No_date    0:00     .00  n/a      .000
       fname :A104PKMa.0102
       remark:A104PK-Major
# Residential Lands
R0102:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A109RES       1.64      .185 No_date   12:00   32.22 .665      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0102:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A109RES       1.64      .185 No_date   12:00   32.22  n/a      .000
                 out <=    1.0 01:A109RESmi     1.64      .184 No_date   12:01   32.22  n/a      .000
            overflow <=    1.0 03:A109RESMa      .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.8013E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A109RESmi     1.64      .184 No_date   12:01   32.22  n/a      .000
       fname :A109RESmi.0102
       remark:A109RES-minor
R0102:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa      .00      .000 No_date    0:00     .00  n/a      .000
       fname :A109RESMa.0102
       remark:A109RES-Major
# Commercial Block
R0102:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A2260COM      2.68      .327 No_date   12:01   36.10 .745      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0102:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A2260COM      2.68      .327 No_date   12:01   36.10  n/a      .000
                 out <=    1.0 01:A2260COMmi    2.68      .327 No_date   12:01   36.10  n/a      .000
            overflow <=    1.0 03:A2260COMMa     .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.8572E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A2260COMmi    2.68      .327 No_date   12:01   36.10  n/a      .000
       fname :A2260COMmi.0102
       remark:A2260COM-minor
R0102:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A2260COMMa     .00      .000 No_date    0:00     .00  n/a      .000
       fname :A2260COMMa.0102
       remark:A2260COM-Major
# Residential Block
R0102:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A303EXT       2.45      .270 No_date   12:00   32.22 .665      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0102:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A303EXT       2.45      .270 No_date   12:00   32.22  n/a      .000
                 out <=    1.0 01:A303EXTmi     2.45      .269 No_date   12:01   32.22  n/a      .000
            overflow <=    1.0 03:A303EXTMa      .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.8024E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A303EXTmi     2.45      .269 No_date   12:01   32.22  n/a      .000
       fname :A303EXTmi.0102
       remark:A301EXT-minor
R0102:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa      .00      .000 No_date    0:00     .00  n/a      .000
       fname :A303EXTMa.0102
       remark:A301EXT-Major
# Residential Block
R0102:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A302EXT        .99      .116 No_date   12:00   32.22 .665      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0102:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A302EXT        .99      .116 No_date   12:00   32.22  n/a      .000
                 out <=    1.0 01:A302EXTmi      .99      .114 No_date   12:01   32.22  n/a      .000
            overflow <=    1.0 03:A302EXTMa      .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.7801E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A302EXTmi      .99      .114 No_date   12:01   32.22  n/a      .000
       fname :A302EXTmi.0102
       remark:A302EXT-minor
R0102:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa      .00      .000 No_date    0:00     .00  n/a      .000
       fname :A302EXTMa.0102
       remark:A302EXT-Major
# Residential Block
R0102:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A304EXT       1.20      .137 No_date   12:00   32.22 .665      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0102:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A304EXT       1.20      .137 No_date   12:00   32.22  n/a      .000
                 out <=    1.0 01:A304EXTmi     1.20      .136 No_date   12:01   32.22  n/a      .000
            overflow <=    1.0 03:A304EXTMa      .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.7846E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A304EXTmi     1.20      .136 No_date   12:01   32.22  n/a      .000
       fname :A304EXTmi.0102
       remark:A304EXT-minor
R0102:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa      .00      .000 No_date    0:00     .00  n/a      .000
       fname :A304EXTMa.0102
       remark:A304EXT-Major
# Residential Block
R0102:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A310EXT1      1.22      .140 No_date   12:00   32.22 .665      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0102:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A310EXT1      1.22      .140 No_date   12:00   32.22  n/a      .000
                 out <=    1.0 01:A310EXT1mi    1.22      .138 No_date   12:01   32.22  n/a      .000
            overflow <=    1.0 03:A310EXT1Ma     .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.7819E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A310EXT1mi    1.22      .138 No_date   12:01   32.22  n/a      .000
       fname :A310EXT1mi.0102
       remark:A310EXT1-minor
R0102:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma     .00      .000 No_date    0:00     .00  n/a      .000
       fname :A310EXT1Ma.0102
       remark:A310EXT1-Major
# Residential Block
R0102:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A310EXT2      7.64      .767 No_date   12:02   32.22 .665      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0102:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A310EXT2      7.64      .767 No_date   12:02   32.22  n/a      .000
 *               out <=    1.0 01:A310EXT2mi    7.64      .767 No_date   12:02   32.22  n/a      .000
            overflow <=    1.0 03:A310EXT2Ma     .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.8765E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A310EXT2mi    7.64      .767 No_date   12:02   32.22  n/a      .000
       fname :A310EXT2mi.0102
       remark:A310EXT2-minor
R0102:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma     .00      .000 No_date    0:00     .00  n/a      .000
       fname :A310EXT2Ma.0102
       remark:A310EXT2-Major
# Brazeau Commercial Block
R0102:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A133COM      13.83     1.464 No_date   12:03   36.10 .745      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0102:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A133COM      13.83     1.464 No_date   12:03   36.10  n/a      .000
 *               out <=    1.0 01:A133COMmi    13.83     1.465 No_date   12:03   36.10  n/a      .000
            overflow <=    1.0 03:A133COMMa      .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.8166E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A133COMmi    13.83     1.465 No_date   12:03   36.10  n/a      .000
       fname :A133COMmi.0102
       remark:A133COM-minor
R0102:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa      .00      .000 No_date    0:00     .00  n/a      .000
       fname :A133COMMa.0102
       remark:A133COM-Major
# ABIC Commercial Block
R0102:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     CALIB STANDHYD        1.0 01:A303COM       7.38      .834 No_date   12:01   36.10 .745      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0102:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     ROUTE RESERVOIR ->    1.0 02:A303COM       7.38      .834 No_date   12:01   36.10  n/a      .000
                 out <=    1.0 01:A303COMmi     7.38      .210 No_date   11:44   36.10  n/a      .000
            overflow <=    1.0 03:A303COMMa      .00      .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.6680E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0102:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
     SAVE HYD              1.0 01:A303COMmi     7.38      .210 No_date   11:44   36.10  n/a      .000
       fname :A303COMmi.0102
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       remark:A303COM-minor
R0102:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa       .00      .000 No_date    0:00      .00  n/a      .000
       fname :A303COMMa.0102
       remark:A303COM-Major
# SWM Pond Block
R0102:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94      .548 No_date   12:00   44.12 .910      .000
       [XIMP=.93:TIMP=.93]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0102:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa       .00      .000 No_date    0:00      .00  n/a      .000
                     +    1.0 02:A303COMmi      7.38      .210 No_date   11:44   36.10  n/a      .000
                     +    1.0 02:APOND1         3.94      .548 No_date   12:00   44.12  n/a      .000
                  SUM=    1.0 01:PND-A303      11.32      .758 No_date   12:00   38.89  n/a      .000
R0102:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32      .758 No_date   12:00   38.89  n/a      .000
       fname :PND-A303.0102
       remark:PND-A303
################################################################################
# STORMS
################################################################################
  ** END OF RUN :  104

*****************************************************************************************

 RUN#:COMMAND#
R0105:C00001-----------------------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  = 0105 ]
#****************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#****************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#****************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#****************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0105:C00002-----------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = 5 years SCS Type 2 Storm 24 Hours step 10 min, City of Ottawa
       [SDT=10.00:SDUR=  24.00:PTOT=  64.11]
# Park Lands
R0105:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72      .113 No_date   12:01   25.03 .390      .000
       [XIMP=.19:TIMP=.29]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0105:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72      .113 No_date   12:01   25.03  n/a      .000
                out <=    1.0 01:A104PKmi       1.72      .112 No_date   12:02   25.03  n/a      .000
           overflow <=    1.0 03:A104PKMa        .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.5637E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72      .112 No_date   12:02   25.03  n/a      .000
       fname :A104PKmi.0105
       remark:A104PK-minor
R0105:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A104PKMa        .00      .000 No_date    0:00      .00  n/a      .000
       fname :A104PKMa.0105
       remark:A104PK-Major
# Residential Lands
R0105:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64      .270 No_date   12:00   44.30 .691      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0105:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64      .270 No_date   12:00   44.30  n/a      .000
                out <=    1.0 01:A109RESmi      1.64      .230 No_date   11:57   44.30  n/a      .000
           overflow <=    1.0 03:A109RESMa       .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.2087E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi      1.64      .230 No_date   11:57   44.30  n/a      .000
       fname :A109RESmi.0105
       remark:A109RES-minor
R0105:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa       .00      .000 No_date    0:00      .00  n/a      .000
       fname :A109RESMa.0105
       remark:A109RES-Major
# Commercial Block
R0105:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM       2.68      .468 No_date   12:00   49.15 .767      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0105:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68      .468 No_date   12:00   49.15  n/a      .000
                out <=    1.0 01:A2260COMmi     2.68      .382 No_date   11:56   49.15  n/a      .000
           overflow <=    1.0 03:A2260COMMa      .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.3739E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi     2.68      .382 No_date   11:56   49.15  n/a      .000
       fname :A2260COMmi.0105
       remark:A2260COM-minor
R0105:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A2260COMMa      .00      .000 No_date    0:00      .00  n/a      .000
       fname :A2260COMMa.0105
       remark:A2260COM-Major
# Residential Block
R0105:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT        2.45      .393 No_date   12:00   44.30 .691      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0105:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45      .393 No_date   12:00   44.30  n/a      .000
                out <=    1.0 01:A303EXTmi      2.45      .336 No_date   11:57   44.30  n/a      .000
           overflow <=    1.0 03:A303EXTMa       .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.2562E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi      2.45      .336 No_date   11:57   44.30  n/a      .000
       fname :A303EXTmi.0105
       remark:A301EXT-minor
R0105:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa       .00      .000 No_date    0:00      .00  n/a      .000
       fname :A303EXTMa.0105
       remark:A301EXT-Major
# Residential Block
R0105:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT         .99      .166 No_date   12:00   44.30 .691      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0105:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99      .166 No_date   12:00   44.30  n/a      .000
                out <=    1.0 01:A302EXTmi       .99      .146 No_date   11:58   44.30  n/a      .000
           overflow <=    1.0 03:A302EXTMa       .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.1416E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99      .146 No_date   11:58   44.30  n/a      .000
       fname :A302EXTmi.0105
       remark:A302EXT-minor
R0105:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00      .000 No_date    0:00      .00  n/a      .000
       fname :A302EXTMa.0105
       remark:A302EXT-Major
# Residential Block
R0105:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20      .201 No_date   12:00   44.30 .691      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0105:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20      .201 No_date   12:00   44.30  n/a      .000
                out <=    1.0 01:A304EXTmi      1.20      .173 No_date   11:57   44.30  n/a      .000
           overflow <=    1.0 03:A304EXTMa       .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.1636E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20      .173 No_date   11:57   44.30  n/a      .000
       fname :A304EXTmi.0105
       remark:A304EXT-minor
R0105:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00      .000 No_date    0:00      .00  n/a      .000
       fname :A304EXTMa.0105
       remark:A304EXT-Major
# Residential Block
R0105:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22      .204 No_date   12:00   44.30 .691      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0105:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22      .204 No_date   12:00   44.30  n/a      .000
                out <=    1.0 01:A310EXT1mi     1.22      .177 No_date   11:57   44.30  n/a      .000
           overflow <=    1.0 03:A310EXT1Ma      .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.1623E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22      .177 No_date   11:57   44.30  n/a      .000
       fname :A310EXT1mi.0105
       remark:A310EXT1-minor
R0105:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00      .000 No_date    0:00      .00  n/a      .000
       fname :A310EXT1Ma.0105
       remark:A310EXT1-Major
# Residential Block
R0105:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64     1.136 No_date   12:01   44.30 .691      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0105:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64     1.136 No_date   12:01   44.30  n/a      .000
                out <=    1.0 01:A310EXT2mi     7.64      .877 No_date   11:56   44.30  n/a      .000
           overflow <=    1.0 03:A310EXT2Ma      .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.1178E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64      .877 No_date   11:56   44.30  n/a      .000
       fname :A310EXT2mi.0105
       remark:A310EXT2-minor
R0105:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00      .000 No_date    0:00      .00  n/a      .000
       fname :A310EXT2Ma.0105
       remark:A310EXT2-Major
# Brazeau Commercial Block
R0105:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM       13.83     2.115 No_date   12:02   49.15 .767      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0105:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83     2.115 No_date   12:02   49.15  n/a      .000
                out <=    1.0 01:A133COMmi     13.83     1.800 No_date   11:58   49.15  n/a      .000
           overflow <=    1.0 03:A133COMMa       .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.1195E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi     13.83     1.800 No_date   11:58   49.15  n/a      .000
       fname :A133COMmi.0105
       remark:A133COM-minor
R0105:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa       .00      .000 No_date    0:00      .00  n/a      .000
       fname :A133COMMa.0105
       remark:A133COM-Major
# ABIC Commercial Block
R0105:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM        7.38     1.191 No_date   12:01   49.15 .767      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0105:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38     1.191 No_date   12:01   49.15  n/a      .000
                out <=    1.0 01:A303COMmi      7.38      .210 No_date   11:40   49.15  n/a      .000
           overflow <=    1.0 03:A303COMMa       .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.1145E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0105:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi      7.38      .210 No_date   11:40   49.15  n/a      .000
       fname :A303COMmi.0105
       remark:A303COM-minor
R0105:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa       .00      .000 No_date    0:00      .00  n/a      .000
       fname :A303COMMa.0105
       remark:A303COM-Major
# SWM Pond Block
R0105:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94      .749 No_date   12:00   59.19 .923      .000
       [XIMP=.93:TIMP=.93]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0105:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa       .00      .000 No_date    0:00      .00  n/a      .000
                     +    1.0 02:A303COMmi      7.38      .210 No_date   11:40   49.15  n/a      .000
                     +    1.0 02:APOND1         3.94      .749 No_date   12:00   59.19  n/a      .000
                  SUM=    1.0 01:PND-A303      11.32      .960 No_date   12:00   52.64  n/a      .000
R0105:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32      .960 No_date   12:00   52.64  n/a      .000
       fname :PND-A303.0105
       remark:PND-A303
################################################################################
# STORMS
################################################################################
  ** END OF RUN :  109

*****************************************************************************************

 RUN#:COMMAND#
R0110:C00001-----------------------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  = 0110 ]
#****************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#****************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#****************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#****************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0110:C00002-----------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = 10 years SCS Type 2 Storm 24 Hours step 10 min, City of Ottawa
       [SDT=10.00:SDUR=  24.00:PTOT=  74.35]
# Park Lands
R0110:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72      .152 No_date   12:01   30.79 .414      .000
       [XIMP=.19:TIMP=.29]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0110:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72      .152 No_date   12:01   30.79  n/a      .000
                out <=    1.0 01:A104PKmi       1.72      .150 No_date   12:02   30.79  n/a      .000
           overflow <=    1.0 03:A104PKMa        .00      .000 No_date    0:00      .00  n/a      .000
      {MxStoUsed=.7578E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72      .150 No_date   12:02   30.79  n/a      .000
       fname :A104PKmi.0110
       remark:A104PK-minor
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R0110:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A104PKMa        .00     .000 No_date    0:00     .00  n/a      .000
       fname :A104PKMa.0110
       remark:A104PK-Major
# Residential Lands
R0110:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A109RES        1.64     .329 No_date   12:00   52.35 .704      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0110:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .329 No_date   12:00   52.35  n/a      .000
                 out <=    1.0 01:A109RESmi      1.64     .230 No_date   11:54   52.35  n/a      .000
            overflow <=    1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.4939E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A109RESmi      1.64     .230 No_date   11:54   52.35  n/a      .000
       fname :A109RESmi.0110
       remark:A109RES-minor
R0110:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
       fname :A109RESMa.0110
       remark:A109RES-Major
# Commercial Block
R0110:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A2260COM       2.68     .559 No_date   12:00   57.76 .777      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0110:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68     .559 No_date   12:00   57.76  n/a      .000
                 out <=    1.0 01:A2260COMmi     2.68     .382 No_date   11:54   57.76  n/a      .000
            overflow <=    1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.8753E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A2260COMmi     2.68     .382 No_date   11:54   57.76  n/a      .000
       fname :A2260COMmi.0110
       remark:A2260COM-minor
R0110:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
       fname :A2260COMMa.0110
       remark:A2260COM-Major
# Residential Block
R0110:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A303EXT        2.45     .475 No_date   12:00   52.35 .704      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0110:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .475 No_date   12:00   52.35  n/a      .000
                 out <=    1.0 01:A303EXTmi      2.45     .336 No_date   11:54   52.35  n/a      .000
            overflow <=    1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.6900E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A303EXTmi      2.45     .336 No_date   11:54   52.35  n/a      .000
       fname :A303EXTmi.0110
       remark:A301EXT-minor
R0110:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
       fname :A303EXTMa.0110
       remark:A301EXT-Major
# Residential Block
R0110:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A302EXT         .99     .201 No_date   12:00   52.35 .704      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0110:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .201 No_date   12:00   52.35  n/a      .000
                 out <=    1.0 01:A302EXTmi       .99     .146 No_date   11:54   52.35  n/a      .000
            overflow <=    1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.3029E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A302EXTmi       .99     .146 No_date   11:54   52.35  n/a      .000
       fname :A302EXTmi.0110
       remark:A302EXT-minor
R0110:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
       fname :A302EXTMa.0110
       remark:A302EXT-Major
# Residential Block
R0110:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A304EXT        1.20     .242 No_date   12:00   52.35 .704      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0110:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .242 No_date   12:00   52.35  n/a      .000
                 out <=    1.0 01:A304EXTmi      1.20     .173 No_date   11:54   52.35  n/a      .000
            overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.3666E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A304EXTmi      1.20     .173 No_date   11:54   52.35  n/a      .000
       fname :A304EXTmi.0110
       remark:A304EXT-minor
R0110:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
       fname :A304EXTMa.0110
       remark:A304EXT-Major
# Residential Block
R0110:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A310EXT1       1.22     .247 No_date   12:00   52.35 .704      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0110:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .247 No_date   12:00   52.35  n/a      .000
                 out <=    1.0 01:A310EXT1mi     1.22     .177 No_date   11:54   52.35  n/a      .000
            overflow <=    1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.3678E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A310EXT1mi     1.22     .177 No_date   11:54   52.35  n/a      .000
       fname :A310EXT1mi.0110
       remark:A310EXT1-minor
R0110:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
       fname :A310EXT1Ma.0110
       remark:A310EXT1-Major
# Residential Block
R0110:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A310EXT2       7.64    1.387 No_date   12:01   52.35 .704      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0110:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64    1.387 No_date   12:01   52.35  n/a      .000
                 out <=    1.0 01:A310EXT2mi     7.64     .877 No_date   11:53   52.35  n/a      .000
            overflow <=    1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.2820E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A310EXT2mi     7.64     .877 No_date   11:53   52.35  n/a      .000
       fname :A310EXT2mi.0110
       remark:A310EXT2-minor
R0110:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
       fname :A310EXT2Ma.0110
       remark:A310EXT2-Major
# Brazeau Commercial Block
R0110:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A133COM       13.83    2.549 No_date   12:01   57.76 .777      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0110:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83    2.549 No_date   12:01   57.76  n/a      .000
                 out <=    1.0 01:A133COMmi     13.83    1.800 No_date   11:55   57.76  n/a      .000
            overflow <=    1.0 03:A133COMMa       .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.3752E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A133COMmi     13.83    1.800 No_date   11:55   57.76  n/a      .000
       fname :A133COMmi.0110
       remark:A133COM-minor
R0110:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A133COMMa       .00     .000 No_date    0:00     .00  n/a      .000
       fname :A133COMMa.0110
       remark:A133COM-Major
# ABIC Commercial Block
R0110:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A303COM        7.38    1.434 No_date   12:01   57.76 .777      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0110:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38    1.434 No_date   12:01   57.76  n/a      .000
                 out <=    1.0 01:A303COMmi      7.38     .210 No_date   11:37   57.76  n/a      .000
            overflow <=    1.0 03:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.1471E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0110:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A303COMmi      7.38     .210 No_date   11:37   57.76  n/a      .000
       fname :A303COMmi.0110
       remark:A303COM-minor
R0110:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
       fname :A303COMMa.0110
       remark:A303COM-Major
# SWM Pond Block
R0110:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:APOND1         3.94     .892 No_date   12:00   69.02 .928      .000
       [XIMP=.93:TIMP=.93]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0110:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              1.0 02:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
                  +      1.0 02:A303COMmi      7.38     .210 No_date   11:37   57.76  n/a      .000
                  +      1.0 02:APOND1         3.94     .892 No_date   12:00   69.02  n/a      .000
               SUM=      1.0 01:PND-A303      11.32    1.102 No_date   12:00   61.68  n/a      .000
R0110:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:PND-A303      11.32    1.102 No_date   12:00   61.68  n/a      .000
       fname :PND-A303.0110
       remark:PND-A303
################################################################################
# STORMS
################################################################################
  ** END OF RUN :  124

******************************************************************************************





 RUN#:COMMAND#
R0125:C00001------------------------------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  = 0125 ]
#*****************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#*****************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#*****************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#*****************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0125:C00002------------------------------------------------------------------------------------------
      READ STORM
       Filename = STORM.001
       Comment  = 25 years SCS Type 2 Storm 24 Hours step 10 min, City of Ottawa
       [SDT=10.00:SDUR=  24.00:PTOT=  86.89]
# Park Lands
R0125:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A104PK         1.72     .205 No_date   12:01   38.05 .438      .000
       [XIMP=.19:TIMP=.29]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0125:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .205 No_date   12:01   38.05  n/a      .000
                 out <=    1.0 01:A104PKmi       1.72     .199 No_date   12:01   38.05  n/a      .000
            overflow <=    1.0 03:A104PKMa        .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.1048E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A104PKmi       1.72     .199 No_date   12:01   38.05  n/a      .000
       fname :A104PKmi.0125
       remark:A104PK-minor
R0125:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A104PKMa        .00     .000 No_date    0:00     .00  n/a      .000
       fname :A104PKMa.0125
       remark:A104PK-Major
# Residential Lands
R0125:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A109RES        1.64     .393 No_date   12:00   62.28 .717      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0125:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .393 No_date   12:00   62.28  n/a      .000
                 out <=    1.0 01:A109RESmi      1.64     .230 No_date   11:52   62.28  n/a      .000
            overflow <=    1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.9171E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A109RESmi      1.64     .230 No_date   11:52   62.28  n/a      .000
       fname :A109RESmi.0125
       remark:A109RES-minor
R0125:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
       fname :A109RESMa.0125
       remark:A109RES-Major
# Commercial Block
R0125:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A2260COM       2.68     .665 No_date   12:00   68.25 .785      .000
       [XIMP=.69:TIMP=.79]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0125:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68     .665 No_date   12:00   68.25  n/a      .000
                 out <=    1.0 01:A2260COMmi     2.68     .382 No_date   11:51   68.25  n/a      .000
            overflow <=    1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.1612E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A2260COMmi     2.68     .382 No_date   11:51   68.25  n/a      .000
       fname :A2260COMmi.0125
       remark:A2260COM-minor
R0125:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
       fname :A2260COMMa.0125
       remark:A2260COM-Major
# Residential Block
R0125:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A303EXT        2.45     .578 No_date   12:00   62.28 .717      .000
       [XIMP=.59:TIMP=.69]
       [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
       [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0125:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .578 No_date   12:00   62.28  n/a      .000
                 out <=    1.0 01:A303EXTmi      2.45     .336 No_date   11:52   62.28  n/a      .000
            overflow <=    1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      {MxStoUsed=.1384E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A303EXTmi      2.45     .336 No_date   11:52   62.28  n/a      .000
       fname :A303EXTmi.0125
       remark:A301EXT-minor
R0125:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
       fname :A303EXTMa.0125
       remark:A301EXT-Major
# Residential Block
R0125:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
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    CALIB STANDHYD        1.0 01:A302EXT         .99     .243 No_date   12:00   62.28 .717     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0125:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .243 No_date   12:00   62.28  n/a     .000
                out <=    1.0 01:A302EXTmi       .99     .146 No_date   11:52   62.28  n/a     .000
           overflow <=    1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.5652E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99     .146 No_date   11:52   62.28  n/a     .000
      fname :A302EXTmi.0125
      remark:A302EXT-minor
R0125:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A302EXTMa.0125
      remark:A302EXT-Major
# Residential Block
R0125:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .293 No_date   12:00   62.28 .717     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0125:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .293 No_date   12:00   62.28  n/a     .000
                out <=    1.0 01:A304EXTmi      1.20     .173 No_date   11:52   62.28  n/a     .000
           overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.6896E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .173 No_date   11:52   62.28  n/a     .000
      fname :A304EXTmi.0125
      remark:A304EXT-minor
R0125:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A304EXTMa.0125
      remark:A304EXT-Major
# Residential Block
R0125:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .299 No_date   12:00   62.28 .717     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0125:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .299 No_date   12:00   62.28  n/a     .000
                out <=    1.0 01:A310EXT1mi     1.22     .177 No_date   11:52   62.28  n/a     .000
           overflow <=    1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.6961E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22     .177 No_date   11:52   62.28  n/a     .000
      fname :A310EXT1mi.0125
      remark:A310EXT1-minor
R0125:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A310EXT1Ma.0125
      remark:A310EXT1-Major
# Residential Block
R0125:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64    1.668 No_date   12:01   62.28 .717     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0125:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64    1.668 No_date   12:01   62.28  n/a     .000
                out <=    1.0 01:A310EXT2mi     7.64     .877 No_date   11:50   62.29  n/a     .000
           overflow <=    1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.5224E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64     .877 No_date   11:50   62.29  n/a     .000
      fname :A310EXT2mi.0125
      remark:A310EXT2-minor
R0125:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A310EXT2Ma.0125
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0125:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM       13.83    3.077 No_date   12:01   68.25 .785     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0125:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83    3.077 No_date   12:01   68.25  n/a     .000
                out <=    1.0 01:A133COMmi     13.83    1.800 No_date   11:52   68.25  n/a     .000
           overflow <=    1.0 03:A133COMMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.7864E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi     13.83    1.800 No_date   11:52   68.25  n/a     .000
      fname :A133COMmi.0125
      remark:A133COM-minor
R0125:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A133COMMa.0125
      remark:A133COM-Major
# ABIC Commercial Block
R0125:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM        7.38    1.727 No_date   12:01   68.25 .785     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0125:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38    1.727 No_date   12:01   68.25  n/a     .000
                out <=    1.0 01:A303COMmi      7.38     .210 No_date   11:36   68.25  n/a     .000
           overflow <=    1.0 03:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1884E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0125:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi      7.38     .210 No_date   11:36   68.25  n/a     .000
      fname :A303COMmi.0125
      remark:A303COM-minor
R0125:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A303COMMa.0125
      remark:A303COM-Major
# SWM Pond Block
R0125:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94    1.057 No_date   12:00   81.08 .933     .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0125:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
                   +      1.0 02:A303COMmi      7.38     .210 No_date   11:36   68.25  n/a     .000
                   +      1.0 02:APOND1         3.94    1.057 No_date   12:00   81.08  n/a     .000
                SUM=      1.0 01:PND-A303      11.32    1.267 No_date   12:00   72.71  n/a     .000
R0125:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32    1.267 No_date   12:00   72.71  n/a     .000
      fname :PND-A303.0125
      remark:PND-A303
##############################################################################
# STORMS
##############################################################################
  ** END OF RUN :  149

*******************************************************************************************





 RUN#:COMMAND#
R0150:C00001---------------------------------------------------------------------------------
     START
      [TZERO =     .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 0150 ]
#******************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#******************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    : 2549237
#******************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#******************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0150:C00002---------------------------------------------------------------------------------
     READ STORM
       Filename = STORM.001
       Comment  = 50 years SCS Type 2 Storm 24 Hours step 10 min, City of Ottawa
       [SDT=10.00:SDUR= 24.00:PTOT= 96.53]
# Park Lands
R0150:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72     .244 No_date   12:01   43.67 .452     .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0150:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .244 No_date   12:01   43.67  n/a     .000
                out <=    1.0 01:A104PKmi       1.72     .199 No_date   11:58   43.67  n/a     .000
           overflow <=    1.0 03:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.3082E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72     .199 No_date   11:58   43.67  n/a     .000
      fname :A104PKmi.0150
      remark:A104PK-minor
R0150:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
      fname :A104PKMa.0150
      remark:A104PK-Major
# Residential Lands
R0150:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64     .447 No_date   12:00   69.78 .723     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0150:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .447 No_date   12:00   69.78  n/a     .000
                out <=    1.0 01:A109RESmi      1.64     .230 No_date   11:49   69.78  n/a     .000
           overflow <=    1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1335E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi      1.64     .230 No_date   11:49   69.78  n/a     .000
      fname :A109RESmi.0150
      remark:A109RES-minor
R0150:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A109RESMa.0150
      remark:A109RES-Major
# Commercial Block
R0150:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM       2.68     .757 No_date   12:00   76.28 .790     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0150:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68     .757 No_date   12:00   76.28  n/a     .000
                out <=    1.0 01:A2260COMmi     2.68     .382 No_date   11:48   76.28  n/a     .000
           overflow <=    1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.2297E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi     2.68     .382 No_date   11:48   76.28  n/a     .000
      fname :A2260COMmi.0150
      remark:A2260COM-minor
R0150:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A2260COMMa.0150
      remark:A2260COM-Major
# Residential Block
R0150:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT        2.45     .653 No_date   12:00   69.78 .723     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0150:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .653 No_date   12:00   69.78  n/a     .000
                out <=    1.0 01:A303EXTmi      2.45     .336 No_date   11:49   69.78  n/a     .000
           overflow <=    1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1938E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi      2.45     .336 No_date   11:49   69.78  n/a     .000
      fname :A303EXTmi.0150
      remark:A301EXT-minor
R0150:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A303EXTMa.0150
      remark:A301EXT-Major
# Residential Block
R0150:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT         .99     .273 No_date   12:00   69.78 .723     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0150:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .273 No_date   12:00   69.78  n/a     .000
                out <=    1.0 01:A302EXTmi       .99     .146 No_date   11:50   69.78  n/a     .000
           overflow <=    1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.7865E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99     .146 No_date   11:50   69.78  n/a     .000
      fname :A302EXTmi.0150
      remark:A302EXT-minor
R0150:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A302EXTMa.0150
      remark:A302EXT-Major
# Residential Block
R0150:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .329 No_date   12:00   69.78 .723     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0150:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .329 No_date   12:00   69.78  n/a     .000
                out <=    1.0 01:A304EXTmi      1.20     .173 No_date   11:49   69.78  n/a     .000
           overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.9649E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .173 No_date   11:49   69.78  n/a     .000
      fname :A304EXTmi.0150
      remark:A304EXT-minor
R0150:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A304EXTMa.0150
      remark:A304EXT-Major
# Residential Block
R0150:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .336 No_date   12:00   69.78 .723     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0150:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .336 No_date   12:00   69.78  n/a     .000
                out <=    1.0 01:A310EXT1mi     1.22     .177 No_date   11:49   69.78  n/a     .000
           overflow <=    1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.9756E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22     .177 No_date   11:49   69.78  n/a     .000
      fname :A310EXT1mi.0150
      remark:A310EXT1-minor
R0150:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A310EXT1Ma.0150
      remark:A310EXT1-Major
# Residential Block
R0150:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64    1.906 No_date   12:01   69.78 .723     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
```

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      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0150:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64    1.906 No_date   12:01   69.78  n/a      .000
                 out <=    1.0 01:A310EXT2mi     7.64     .877 No_date   11:48   69.83  n/a      .000
            overflow <=    1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.7489E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64     .877 No_date   11:48   69.83  n/a      .000
      fname :A310EXT2mi.0150
      remark:A310EXT2-minor
R0150:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT2Ma.0150
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0150:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM       13.83    3.468 No_date   12:01   76.28 .790      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0150:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83    3.468 No_date   12:01   76.28  n/a      .000
                 out <=    1.0 01:A133COMmi     13.83    1.800 No_date   11:50   76.28  n/a      .000
            overflow <=    1.0 03:A133COMMa      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1142E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi     13.83    1.800 No_date   11:50   76.28  n/a      .000
      fname :A133COMmi.0150
      remark:A133COM-minor
R0150:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A133COMMa.0150
      remark:A133COM-Major
# ABIC Commercial Block
R0150:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM        7.38    1.941 No_date   12:01   76.28 .790      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0150:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38    1.941 No_date   12:01   76.28  n/a      .000
                 out <=    1.0 01:A303COMmi      7.38     .210 No_date   11:35   76.28  n/a      .000
            overflow <=    1.0 03:A303COMMa      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2201E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0150:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi      7.38     .210 No_date   11:35   76.28  n/a      .000
      fname :A303COMmi.0150
      remark:A303COM-minor
R0150:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303COMMa.0150
      remark:A303COM-Major
# SWM Pond Block
R0150:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94    1.185 No_date   12:00   90.37 .936      .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0150:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa      .00     .000 No_date    0:00     .00  n/a      .000
                     +     1.0 02:A303COMmi      7.38     .210 No_date   11:35   76.28  n/a      .000
                     +     1.0 02:APOND1         3.94    1.185 No_date   12:00   90.37  n/a      .000
                  SUM=     1.0 01:PND-A303      11.32    1.396 No_date   12:00   81.18  n/a      .000
R0150:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32    1.396 No_date   12:00   81.18  n/a      .000
      fname :PND-A303.0150
      remark:PND-A303
#################################################################################
# STORMS
#################################################################################
  ** END OF RUN :  198

***************************************************************************************************






 RUN#:COMMAND#
R0199:C00001--------------------------------------------------------------------------------------
    START
      [TZERO =    .00 hrs on      0]
      [METOUT=   2   (1=imperial, 2=metric output)]
      [NSTORM=    1 ]
      [NRUN  = 0199 ]
#**************************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#**************************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#**************************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#**************************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0199:C00002--------------------------------------------------------------------------------------
    READ STORM
      Filename = STORM.001
      Comment  = 100 years SCS Type 2 Storm 24 Hours step 10 min, City of Ottawa
      [SDT=10.00:SDUR= 24.00:PTOT= 106.73]
# Park Lands
R0199:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72     .286 No_date   12:01   49.56 .464      .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0199:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .286 No_date   12:01   49.56  n/a      .000
                 out <=    1.0 01:A104PKmi       1.72     .199 No_date   11:56   49.56  n/a      .000
            overflow <=    1.0 03:A104PKMa        .00     .018 No_date   12:16   49.56  n/a      .000
     {MxStoUsed=.7469E-02  m3, TotOvfVol=.1097E-03  m3, N-Ovf=    1, TotDurOvf=    0.hrs}
R0199:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72     .199 No_date   11:56   49.56  n/a      .000
      fname :A104PKmi.0199
      remark:A104PK-minor
R0199:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKMa        .00     .018 No_date   12:16   49.56  n/a      .000
      fname :A104PKMa.0199
      remark:A104PK-Major
# Residential Lands
R0199:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64     .500 No_date   12:00   77.73 .728      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0199:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .500 No_date   12:00   77.73  n/a      .000
                 out <=    1.0 01:A109RESmi      1.64     .230 No_date   11:47   77.73  n/a      .000
            overflow <=    1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1806E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0199:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi      1.64     .230 No_date   11:47   77.73  n/a      .000
      fname :A109RESmi.0199
      remark:A109RES-minor
R0199:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A109RESMa.0199
      remark:A109RES-Major
# Commercial Block
R0199:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM       2.68     .844 No_date   12:00   84.92 .796      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0199:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68     .844 No_date   12:00   84.92  n/a      .000
                 out <=    1.0 01:A2260COMmi     2.68     .382 No_date   11:46   84.92  n/a      .000
            overflow <=    1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.3093E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0199:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi     2.68     .382 No_date   11:46   84.92  n/a      .000
      fname :A2260COMmi.0199
      remark:A2260COM-minor
R0199:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A2260COMMa.0199
      remark:A2260COM-Major
# Residential Block
R0199:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT        2.45     .739 No_date   12:00   77.73 .728      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0199:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .739 No_date   12:00   77.73  n/a      .000
                 out <=    1.0 01:A303EXTmi      2.45     .336 No_date   11:47   77.73  n/a      .000
            overflow <=    1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2706E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0199:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi      2.45     .336 No_date   11:47   77.73  n/a      .000
      fname :A303EXTmi.0199
      remark:A301EXT-minor
R0199:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303EXTMa.0199
      remark:A301EXT-Major
# Residential Block
R0199:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT         .99     .309 No_date   12:00   77.73 .728      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0199:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .309 No_date   12:00   77.73  n/a      .000
                 out <=    1.0 01:A302EXTmi       .99     .146 No_date   11:47   77.73  n/a      .000
            overflow <=    1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1065E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0199:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99     .146 No_date   11:47   77.73  n/a      .000
      fname :A302EXTmi.0199
      remark:A302EXT-minor
R0199:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A302EXTMa.0199
      remark:A302EXT-Major
# Residential Block
R0199:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .372 No_date   12:00   77.73 .728      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0199:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .372 No_date   12:00   77.73  n/a      .000
                 out <=    1.0 01:A304EXTmi      1.20     .173 No_date   11:47   77.73  n/a      .000
            overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1333E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0199:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .173 No_date   11:47   77.73  n/a      .000
      fname :A304EXTmi.0199
      remark:A304EXT-minor
R0199:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A304EXTMa.0199
      remark:A304EXT-Major
# Residential Block
R0199:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .375 No_date   12:00   77.73 .728      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0199:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .375 No_date   12:00   77.73  n/a      .000
                 out <=    1.0 01:A310EXT1mi     1.22     .177 No_date   11:47   77.73  n/a      .000
            overflow <=    1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1317E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0199:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22     .177 No_date   11:47   77.73  n/a      .000
      fname :A310EXT1mi.0199
      remark:A310EXT1-minor
R0199:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT1Ma.0199
      remark:A310EXT1-Major
# Residential Block
R0199:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64    2.137 No_date   12:01   77.73 .728      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0199:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64    2.137 No_date   12:01   77.73  n/a      .000
                 out <=    1.0 01:A310EXT2mi     7.64     .877 No_date   11:47   77.73  n/a      .000
            overflow <=    1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.9914E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0199:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64     .877 No_date   11:47   77.73  n/a      .000
      fname :A310EXT2mi.0199
      remark:A310EXT2-minor
R0199:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT2Ma.0199
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0199:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM       13.83    3.947 No_date   12:01   84.92 .796      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0199:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83    3.947 No_date   12:01   84.92  n/a      .000
                 out <=    1.0 01:A133COMmi     13.83    1.800 No_date   11:48   85.02  n/a      .000
            overflow <=    1.0 03:A133COMMa      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1573E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0199:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi     13.83    1.800 No_date   11:48   85.02  n/a      .000
      fname :A133COMmi.0199
      remark:A133COM-minor
R0199:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A133COMMa.0199
      remark:A133COM-Major
# ABIC Commercial Block
R0199:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM        7.38    2.189 No_date   12:01   84.92 .796      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0199:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38    2.189 No_date   12:01   84.92  n/a      .000
                 out <=    1.0 01:A303COMmi      7.38     .210 No_date   11:34   84.92  n/a      .000
            overflow <=    1.0 03:A303COMMa      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2546E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0199:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi      7.38     .210 No_date   11:34   84.92  n/a      .000
      fname :A303COMmi.0199
      remark:A303COM-minor
R0199:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303COMMa.0199
      remark:A303COM-Major
# SWM Pond Block
R0199:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94    1.322 No_date   12:00  100.22 .939      .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0199:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa      .00     .000 No_date    0:00     .00  n/a      .000
                     +     1.0 02:A303COMmi      7.38     .210 No_date   11:34   84.92  n/a      .000
                     +     1.0 02:APOND1         3.94    1.322 No_date   12:00  100.22  n/a      .000
                  SUM=     1.0 01:PND-A303      11.32    1.532 No_date   12:00   90.24  n/a      .000
R0199:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32    1.532 No_date   12:00   90.24  n/a      .000
      fname :PND-A303.0199
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      remark:PND-A303
################################################################################
# STORMS
################################################################################
  ** END OF RUN :  978

*********************************************************************************************






 RUN#:COMMAND#
R0979:C00001-----------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 0979 ]
#********************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#********************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#********************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#********************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0979:C00002-----------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = July 1st, 1979 Storm (3H) - Ottawa International Airport step 5 min
      [SDT= 5.00:SDUR=   3.00:PTOT=  83.99]
# Park Lands
R0979:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72     .265 No_date    1:41   53.15 .633     .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0979:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .265 No_date    1:41   53.15  n/a     .000
                 out <=   1.0 01:A104PKmi       1.72     .199 No_date    1:29   53.15  n/a     .000
            overflow <=   1.0 03:A104PKMa        .00     .014 No_date    1:56   53.15  n/a     .000
     {MxStoUsed=.7489E-02  m3, TotOvfVol=.1741E-03  m3, N-Ovf=    1, TotDurOvf=    0.hrs}
R0979:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72     .199 No_date    1:29   53.15  n/a     .000
      fname :A104PKmi.0979
      remark:A104PK-minor
R0979:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKMa        .00     .014 No_date    1:56   53.15  n/a     .000
      fname :A104PKMa.0979
      remark:A104PK-Major
# Residential Lands
R0979:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64     .400 No_date    1:31   69.37 .826     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0979:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .400 No_date    1:31   69.37  n/a     .000
                 out <=   1.0 01:A109RESmi      1.64     .230 No_date    1:20   69.37  n/a     .000
            overflow <=   1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1681E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0979:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi      1.64     .230 No_date    1:20   69.37  n/a     .000
      fname :A109RESmi.0979
      remark:A109RES-minor
R0979:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A109RESMa.0979
      remark:A109RES-Major
# Commercial Block
R0979:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM       2.68     .680 No_date    1:31   73.42 .874     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0979:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68     .680 No_date    1:31   73.42  n/a     .000
                 out <=   1.0 01:A2260COMmi     2.68     .382 No_date    1:20   73.42  n/a     .000
            overflow <=   1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.2907E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0979:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi     2.68     .382 No_date    1:20   73.42  n/a     .000
      fname :A2260COMmi.0979
      remark:A2260COM-minor
R0979:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A2260COMMa.0979
      remark:A2260COM-Major
# Residential Block
R0979:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT        2.45     .594 No_date    1:31   69.37 .826     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0979:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .594 No_date    1:31   69.37  n/a     .000
                 out <=   1.0 01:A303EXTmi      2.45     .336 No_date    1:20   69.37  n/a     .000
            overflow <=   1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.2581E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0979:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi      2.45     .336 No_date    1:20   69.37  n/a     .000
      fname :A303EXTmi.0979
      remark:A301EXT-minor
R0979:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A303EXTMa.0979
      remark:A301EXT-Major
# Residential Block
R0979:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT         .99     .246 No_date    1:30   69.37 .826     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0979:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .246 No_date    1:30   69.37  n/a     .000
                 out <=   1.0 01:A302EXTmi       .99     .146 No_date    1:21   69.37  n/a     .000
            overflow <=   1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.9712E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0979:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99     .146 No_date    1:21   69.37  n/a     .000
      fname :A302EXTmi.0979
      remark:A302EXT-minor
R0979:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A302EXTMa.0979
      remark:A302EXT-Major
# Residential Block
R0979:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .297 No_date    1:30   69.37 .826     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0979:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .297 No_date    1:30   69.37  n/a     .000
                 out <=   1.0 01:A304EXTmi      1.20     .173 No_date    1:20   69.37  n/a     .000
            overflow <=   1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1208E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0979:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .173 No_date    1:20   69.37  n/a     .000
      fname :A304EXTmi.0979
      remark:A304EXT-minor
R0979:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A304EXTMa.0979
      remark:A304EXT-Major
# Residential Block
R0979:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .303 No_date    1:30   69.37 .826     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0979:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .303 No_date    1:30   69.37  n/a     .000
                 out <=   1.0 01:A310EXT1mi     1.22     .177 No_date    1:20   69.37  n/a     .000
            overflow <=   1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1221E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0979:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22     .177 No_date    1:20   69.37  n/a     .000
      fname :A310EXT1mi.0979
      remark:A310EXT1-minor
R0979:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A310EXT1Ma.0979
      remark:A310EXT1-Major
# Residential Block
R0979:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64    1.752 No_date    1:32   69.37 .826     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0979:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64    1.752 No_date    1:32   69.37  n/a     .000
                 out <=   1.0 01:A310EXT2mi     7.64     .877 No_date    1:18   69.44  n/a     .000
            overflow <=   1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1041E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0979:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64     .877 No_date    1:18   69.44  n/a     .000
      fname :A310EXT2mi.0979
      remark:A310EXT2-minor
R0979:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A310EXT2Ma.0979
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0979:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM       13.83    3.265 No_date    1:33   73.42 .874     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0979:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83    3.265 No_date    1:33   73.42  n/a     .000
                 out <=   1.0 01:A133COMmi     13.83    1.800 No_date    1:20   73.49  n/a     .000
            overflow <=   1.0 03:A133COMMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1620E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0979:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi     13.83    1.800 No_date    1:20   73.49  n/a     .000
      fname :A133COMmi.0979
      remark:A133COM-minor
R0979:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A133COMMa.0979
      remark:A133COM-Major
# ABIC Commercial Block
R0979:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM        7.38    1.799 No_date    1:32   73.42 .874     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0979:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38    1.799 No_date    1:32   73.42  n/a     .000
                 out <=   1.0 01:A303COMmi      7.38     .210 No_date    0:35   73.42  n/a     .000
            overflow <=   1.0 03:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.3847E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0979:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi      7.38     .210 No_date    0:35   73.42  n/a     .000
      fname :A303COMmi.0979
      remark:A303COM-minor
R0979:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A303COMMa.0979
      remark:A303COM-Major
# SWM Pond Block
R0979:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94    1.070 No_date    1:30   79.61 .948     .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0979:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
                     +    1.0 02:A303COMmi      7.38     .210 No_date    0:35   73.42  n/a     .000
                     +    1.0 02:APOND1         3.94    1.070 No_date    1:30   79.61  n/a     .000
                  SUM=    1.0 01:PND-A303      11.32    1.281 No_date    1:30   75.57  n/a     .000
R0979:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32    1.281 No_date    1:30   75.57  n/a     .000
      fname :PND-A303.0979
      remark:PND-A303
################################################################################
# STORMS
################################################################################
  ** END OF RUN :  987

*********************************************************************************************






 RUN#:COMMAND#
R0988:C00001-----------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 0988 ]
#********************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#********************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#********************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#********************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0988:C00002-----------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = August 4th, 1988 Storm (5H+) - Ottawa International Airport step 5
      [SDT= 5.00:SDUR=   5.58:PTOT=  80.59]
# Park Lands
R0988:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72     .268 No_date    2:01   48.69 .604     .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0988:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .268 No_date    2:01   48.69  n/a     .000
                 out <=   1.0 01:A104PKmi       1.72     .199 No_date    1:58   48.69  n/a     .000
            overflow <=   1.0 03:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.3154E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0988:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.72     .199 No_date    1:58   48.69  n/a     .000
      fname :A104PKmi.0988
      remark:A104PK-minor
R0988:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
      fname :A104PKMa.0988
      remark:A104PK-Major
# Residential Lands
R0988:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64     .478 No_date    2:00   65.22 .809     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0988:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .478 No_date    2:00   65.22  n/a     .000
                 out <=   1.0 01:A109RESmi      1.64     .230 No_date    1:30   65.22  n/a     .000
            overflow <=   1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1088E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
```

```
R0988:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A109RESmi      1.64     .230 No_date    1:30   65.22  n/a     .000
      fname :A109RESmi.0988
      remark:A109RES-minor
R0988:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A109RESMa.0988
      remark:A109RES-Major
# Commercial Block
R0988:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A2260COM       2.68     .814 No_date    2:00   69.51 .862     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0988:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A2260COM       2.68     .814 No_date    2:00   69.51  n/a     .000
                out <=   1.0 01:A2260COMmi     2.68     .382 No_date    1:30   69.51  n/a     .000
           overflow <=   1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1873E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0988:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A2260COMmi     2.68     .382 No_date    1:30   69.51  n/a     .000
      fname :A2260COMmi.0988
      remark:A2260COM-minor
R0988:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A2260COMMa.0988
      remark:A2260COM-Major
# Residential Block
R0988:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A303EXT        2.45     .699 No_date    2:00   65.22 .809     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0988:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A303EXT        2.45     .699 No_date    2:00   65.22  n/a     .000
                out <=   1.0 01:A303EXTmi      2.45     .336 No_date    1:30   65.22  n/a     .000
           overflow <=   1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1621E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0988:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A303EXTmi      2.45     .336 No_date    1:30   65.22  n/a     .000
      fname :A303EXTmi.0988
      remark:A301EXT-minor
R0988:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A303EXTMa.0988
      remark:A301EXT-Major
# Residential Block
R0988:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A302EXT         .99     .306 No_date    2:00   65.22 .809     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0988:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A302EXT         .99     .306 No_date    2:00   65.22  n/a     .000
                out <=   1.0 01:A302EXTmi       .99     .146 No_date    1:30   65.22  n/a     .000
           overflow <=   1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.6453E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0988:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A302EXTmi       .99     .146 No_date    1:30   65.22  n/a     .000
      fname :A302EXTmi.0988
      remark:A302EXT-minor
R0988:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A302EXTMa.0988
      remark:A302EXT-Major
# Residential Block
R0988:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A304EXT        1.20     .365 No_date    2:00   65.22 .809     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0988:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A304EXT        1.20     .365 No_date    2:00   65.22  n/a     .000
                out <=   1.0 01:A304EXTmi      1.20     .173 No_date    1:30   65.22  n/a     .000
           overflow <=   1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.7686E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0988:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A304EXTmi      1.20     .173 No_date    1:30   65.22  n/a     .000
      fname :A304EXTmi.0988
      remark:A304EXT-minor
R0988:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A304EXTMa.0988
      remark:A304EXT-Major
# Residential Block
R0988:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A310EXT1       1.22     .371 No_date    2:00   65.22 .809     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0988:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A310EXT1       1.22     .371 No_date    2:00   65.22  n/a     .000
                out <=   1.0 01:A310EXT1mi     1.22     .177 No_date    1:30   65.22  n/a     .000
           overflow <=   1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.7761E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0988:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A310EXT1mi     1.22     .177 No_date    1:30   65.22  n/a     .000
      fname :A310EXT1mi.0988
      remark:A310EXT1-minor
R0988:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A310EXT1Ma.0988
      remark:A310EXT1-Major
# Residential Block
R0988:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A310EXT2       7.64    1.976 No_date    2:01   65.22 .809     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0988:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A310EXT2       7.64    1.976 No_date    2:01   65.22  n/a     .000
                out <=   1.0 01:A310EXT2mi     7.64     .877 No_date    1:30   65.22  n/a     .000
           overflow <=   1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.6864E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0988:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A310EXT2mi     7.64     .877 No_date    1:30   65.22  n/a     .000
      fname :A310EXT2mi.0988
      remark:A310EXT2-minor
R0988:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A310EXT2Ma.0988
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0988:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A133COM       13.83    3.594 No_date    2:02   69.51 .862     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0988:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A133COM       13.83    3.594 No_date    2:02   69.51  n/a     .000
                out <=   1.0 01:A133COMmi     13.83    1.800 No_date    1:31   69.65  n/a     .000
           overflow <=   1.0 03:A133COMMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.9722E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0988:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A133COMmi     13.83    1.800 No_date    1:31   69.65  n/a     .000
      fname :A133COMmi.0988
      remark:A133COM-minor
R0988:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A133COMMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A133COMMa.0988
      remark:A133COM-Major
# ABIC Commercial Block
R0988:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A303COM        7.38    2.055 No_date    2:01   69.51 .862     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0988:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A303COM        7.38    2.055 No_date    2:01   69.51  n/a     .000
                out <=   1.0 01:A303COMmi      7.38     .210 No_date    0:29   69.51  n/a     .000
           overflow <=   1.0 03:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.3026E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0988:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A303COMmi      7.38     .210 No_date    0:29   69.51  n/a     .000
      fname :A303COMmi.0988
      remark:A303COM-minor
R0988:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A303COMMa.0988
      remark:A303COM-Major
# SWM Pond Block
R0988:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:APOND1         3.94    1.284 No_date    2:01   76.12 .945     .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0988:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              1.0 02:A303COMMa       .00     .000 No_date    0:00     .00  n/a     .000
                   +     1.0 02:A303COMmi      7.38     .210 No_date    0:29   69.51  n/a     .000
                   +     1.0 02:APOND1         3.94    1.284 No_date    2:01   76.12  n/a     .000
               SUM=      1.0 01:PND-A303      11.32    1.494 No_date    2:01   71.81  n/a     .000
R0988:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:PND-A303      11.32    1.494 No_date    2:01   71.81  n/a     .000
      fname :PND-A303.0988
      remark:PND-A303
################################################################################
# STORMS
################################################################################
  ** END OF RUN :  995

*****************************************************************************************************

 RUN#:COMMAND#
R0996:C00001-----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 0996 ]
#****************************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#****************************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#****************************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#****************************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0996:C00002-----------------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = August 8th, 1996 Storm (5H+) - Ottawa International Airport step 5
      [SDT= 5.00:SDUR=   5.75:PTOT=  73.90]
# Park Lands
R0996:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A104PK         1.72     .139 No_date    1:30   44.00 .595     .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0996:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A104PK         1.72     .139 No_date    1:30   44.00  n/a     .000
                out <=   1.0 01:A104PKmi       1.72     .138 No_date    1:31   44.00  n/a     .000
           overflow <=   1.0 03:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.6951E-03  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A104PKmi       1.72     .138 No_date    1:31   44.00  n/a     .000
      fname :A104PKmi.0996
      remark:A104PK-minor
R0996:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A104PKMa        .00     .000 No_date    0:00     .00  n/a     .000
      fname :A104PKMa.0996
      remark:A104PK-Major
# Residential Lands
R0996:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A109RES        1.64     .350 No_date    1:27   59.39 .804     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0996:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A109RES        1.64     .350 No_date    1:27   59.39  n/a     .000
                out <=   1.0 01:A109RESmi      1.64     .230 No_date    1:23   59.39  n/a     .000
           overflow <=   1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.6925E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A109RESmi      1.64     .230 No_date    1:23   59.39  n/a     .000
      fname :A109RESmi.0996
      remark:A109RES-minor
R0996:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A109RESMa.0996
      remark:A109RES-Major
# Commercial Block
R0996:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A2260COM       2.68     .619 No_date    1:27   63.20 .855     .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0996:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A2260COM       2.68     .619 No_date    1:27   63.20  n/a     .000
                out <=   1.0 01:A2260COMmi     2.68     .382 No_date    1:23   63.20  n/a     .000
           overflow <=   1.0 03:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1302E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A2260COMmi     2.68     .382 No_date    1:23   63.20  n/a     .000
      fname :A2260COMmi.0996
      remark:A2260COM-minor
R0996:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A2260COMMa      .00     .000 No_date    0:00     .00  n/a     .000
      fname :A2260COMMa.0996
      remark:A2260COM-Major
# Residential Block
R0996:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A303EXT        2.45     .515 No_date    1:30   59.39 .804     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0996:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A303EXT        2.45     .515 No_date    1:30   59.39  n/a     .000
                out <=   1.0 01:A303EXTmi      2.45     .336 No_date    1:23   59.39  n/a     .000
           overflow <=   1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.1007E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A303EXTmi      2.45     .336 No_date    1:23   59.39  n/a     .000
      fname :A303EXTmi.0996
      remark:A301EXT-minor
R0996:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
      fname :A303EXTMa.0996
      remark:A301EXT-Major
# Residential Block
R0996:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD       1.0 01:A302EXT         .99     .218 No_date    1:27   59.39 .804     .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0996:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->   1.0 02:A302EXT         .99     .218 No_date    1:27   59.39  n/a     .000
                out <=   1.0 01:A302EXTmi       .99     .146 No_date    1:24   59.39  n/a     .000
           overflow <=   1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
     {MxStoUsed=.4362E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD             1.0 01:A302EXTmi       .99     .146 No_date    1:24   59.39  n/a     .000
      fname :A302EXTmi.0996
      remark:A302EXT-minor
R0996:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD             1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a     .000
```

```
       fname :A302EXTMa.0996
       remark:A302EXT-Major
# Residential Block
R0996:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .263 No_date    1:27   59.39 .804      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0996:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .263 No_date    1:27   59.39  n/a      .000
                out <=    1.0 01:A304EXTmi      1.20     .173 No_date    1:23   59.39  n/a      .000
           overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.5290E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .173 No_date    1:23   59.39  n/a      .000
      fname :A304EXTmi.0996
      remark:A304EXT-minor
R0996:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A304EXTMa.0996
      remark:A304EXT-Major
# Residential Block
R0996:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .268 No_date    1:27   59.39 .804      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0996:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .268 No_date    1:27   59.39  n/a      .000
                out <=    1.0 01:A310EXT1mi     1.22     .177 No_date    1:23   59.39  n/a      .000
           overflow <=    1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.5332E-02  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22     .177 No_date    1:23   59.39  n/a      .000
      fname :A310EXT1mi.0996
      remark:A310EXT1-minor
R0996:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT1Ma.0996
      remark:A310EXT1-Major
# Residential Block
R0996:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64    1.517 No_date    1:30   59.39 .804      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0996:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64    1.517 No_date    1:30   59.39  n/a      .000
                out <=    1.0 01:A310EXT2mi     7.64     .877 No_date    1:23   59.43  n/a      .000
           overflow <=    1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.3742E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64     .877 No_date    1:23   59.43  n/a      .000
      fname :A310EXT2mi.0996
      remark:A310EXT2-minor
R0996:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT2Ma.0996
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0996:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM       13.83    2.899 No_date    1:30   63.20 .855      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0996:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM       13.83    2.899 No_date    1:30   63.20  n/a      .000
                out <=    1.0 01:A133COMmi     13.83    1.800 No_date    1:24   63.28  n/a      .000
           overflow <=    1.0 03:A133COMMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.6004E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi     13.83    1.800 No_date    1:24   63.28  n/a      .000
      fname :A133COMmi.0996
      remark:A133COM-minor
R0996:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A133COMMa.0996
      remark:A133COM-Major
# ABIC Commercial Block
R0996:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM        7.38    1.624 No_date    1:30   63.20 .855      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0996:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM        7.38    1.624 No_date    1:30   63.20  n/a      .000
                out <=    1.0 01:A303COMmi      7.38     .210 No_date    0:19   63.20  n/a      .000
           overflow <=    1.0 03:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2101E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0996:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi      7.38     .210 No_date    0:19   63.20  n/a      .000
      fname :A303COMmi.0996
      remark:A303COM-minor
R0996:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303COMMa.0996
      remark:A303COM-Major
# SWM Pond Block
R0996:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1         3.94    1.032 No_date    1:28   69.63 .942      .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0996:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa       .00     .000 No_date    0:00     .00  n/a      .000
                     +    1.0 02:A303COMmi      7.38     .210 No_date    0:19   63.20  n/a      .000
                     +    1.0 02:APOND1         3.94    1.032 No_date    1:28   69.63  n/a      .000
                  SUM=    1.0 01:PND-A303      11.32    1.243 No_date    1:28   65.44  n/a      .000
R0996:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303      11.32    1.243 No_date    1:28   65.44  n/a      .000
      fname :PND-A303.0996
      remark:PND-A303
##############################################################################
# STORMS
##############################################################################
  ** END OF RUN :  997

*****************************************************************************************************





 RUN#:COMMAND#
R0998:C00001-----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 0998 ]
#****************************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#****************************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date         : 16-September-2019
#  Modeller     : [JB]
#  Updated      : [JB -  Feb 2020]
#               : [JB -  June 2020]
#  Company      : JFSAinc.
#  License #    :  2549237
#****************************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#****************************************************************************************************
#  Updated      : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0998:C00002-----------------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = 100 years SCS Type 2 Storm 24 Hours step 10 min, City of Ottawa   +
      [SDT=10.00:SDUR=  24.00:PTOT= 128.08]
# Park Lands
R0998:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK         1.72     .381 No_date   12:01   61.71 .482      .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0998:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK         1.72     .381 No_date   12:01   61.71  n/a      .000
                out <=    1.0 01:A104PKmi       1.54     .199 No_date   11:53   61.71  n/a      .000
           overflow <=    1.0 03:A104PKMa        .18     .179 No_date   12:02   61.71  n/a      .000
     {MxStoUsed=.7479E-02  m3, TotOvfVol=.1130E-01  m3, N-Ovf=    2, TotDurOvf=    0.hrs}
R0998:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi       1.54     .199 No_date   11:53   61.71  n/a      .000
      fname :A104PKmi.0998
      remark:A104PK-minor
R0998:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKMa        .18     .179 No_date   12:02   61.71  n/a      .000
      fname :A104PKMa.0998
      remark:A104PK-Major
# Residential Lands
R0998:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES        1.64     .617 No_date   12:00   94.74 .740      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0998:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES        1.64     .617 No_date   12:00   94.74  n/a      .000
                out <=    1.0 01:A109RESmi      1.64     .233 No_date   12:08   94.74  n/a      .000
           overflow <=    1.0 03:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2937E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0998:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi      1.64     .233 No_date   12:08   94.74  n/a      .000
      fname :A109RESmi.0998
      remark:A109RES-minor
R0998:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A109RESMa.0998
      remark:A109RES-Major
# Commercial Block
R0998:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM       2.68    1.036 No_date   12:00  103.07 .805      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0998:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM       2.68    1.036 No_date   12:00  103.07  n/a      .000
                out <=    1.0 01:A2260COMmi     2.63     .382 No_date   11:44  103.07  n/a      .000
           overflow <=    1.0 03:A2260COMMa      .05     .444 No_date   12:03  103.07  n/a      .000
     {MxStoUsed=.4443E-01  m3, TotOvfVol=.5122E-02  m3, N-Ovf=    2, TotDurOvf=    0.hrs}
R0998:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi     2.63     .382 No_date   11:44  103.07  n/a      .000
      fname :A2260COMmi.0998
      remark:A2260COM-minor
R0998:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMMa      .05     .444 No_date   12:03  103.07  n/a      .000
      fname :A2260COMMa.0998
      remark:A2260COM-Major
# Residential Block
R0998:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT        2.45     .913 No_date   12:00   94.74 .740      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0998:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT        2.45     .913 No_date   12:00   94.74  n/a      .000
                out <=    1.0 01:A303EXTmi      2.45     .344 No_date   12:08   94.74  n/a      .000
           overflow <=    1.0 03:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.4398E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0998:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi      2.45     .344 No_date   12:08   94.74  n/a      .000
      fname :A303EXTmi.0998
      remark:A301EXT-minor
R0998:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303EXTMa.0998
      remark:A301EXT-Major
# Residential Block
R0998:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT         .99     .377 No_date   12:00   94.74 .740      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0998:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT         .99     .377 No_date   12:00   94.74  n/a      .000
                out <=    1.0 01:A302EXTmi       .99     .149 No_date   12:07   94.74  n/a      .000
           overflow <=    1.0 03:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1699E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0998:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi       .99     .149 No_date   12:07   94.74  n/a      .000
      fname :A302EXTmi.0998
      remark:A302EXT-minor
R0998:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A302EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A302EXTMa.0998
      remark:A302EXT-Major
# Residential Block
R0998:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT        1.20     .455 No_date   12:00   94.74 .740      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0998:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT        1.20     .455 No_date   12:00   94.74  n/a      .000
                out <=    1.0 01:A304EXTmi      1.20     .177 No_date   12:07   94.74  n/a      .000
           overflow <=    1.0 03:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2086E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0998:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi      1.20     .177 No_date   12:07   94.74  n/a      .000
      fname :A304EXTmi.0998
      remark:A304EXT-minor
R0998:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A304EXTMa       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A304EXTMa.0998
      remark:A304EXT-Major
# Residential Block
R0998:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1       1.22     .464 No_date   12:00   94.74 .740      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0998:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1       1.22     .464 No_date   12:00   94.74  n/a      .000
                out <=    1.0 01:A310EXT1mi     1.22     .180 No_date   12:07   94.74  n/a      .000
           overflow <=    1.0 03:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2121E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0998:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi     1.22     .180 No_date   12:07   94.74  n/a      .000
      fname :A310EXT1mi.0998
      remark:A310EXT1-minor
R0998:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT1Ma.0998
      remark:A310EXT1-Major
# Residential Block
R0998:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2       7.64    2.660 No_date   12:00   94.74 .740      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0998:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2       7.64    2.660 No_date   12:00   94.74  n/a      .000
                out <=    1.0 01:A310EXT2mi     7.64     .899 No_date   12:13   94.84  n/a      .000
           overflow <=    1.0 03:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.1539E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0998:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi     7.64     .899 No_date   12:13   94.84  n/a      .000
      fname :A310EXT2mi.0998
      remark:A310EXT2-minor
R0998:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT2Ma      .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT2Ma.0998
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0998:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
```

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    CALIB STANDHYD        1.0 01:A133COM        13.83    4.879 No_date   12:01  103.07 .805      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0998:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM        13.83    4.879 No_date   12:01  103.07  n/a      .000
                 out <=   1.0 01:A133COMmi      13.83    1.800 No_date   11:45  103.10  n/a      .000
            overflow <=   1.0 03:A133COMMa        .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2556E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0998:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi      13.83    1.800 No_date   11:45  103.10  n/a      .000
      fname :A133COMmi.0998
      remark:A133COM-minor
R0998:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa        .00     .000 No_date    0:00     .00  n/a      .000
      fname :A133COMMa.0998
      remark:A133COM-Major
# ABIC Commercial Block
R0998:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM         7.38    2.719 No_date   12:00  103.07 .805      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0998:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM         7.38    2.719 No_date   12:00  103.07  n/a      .000
                 out <=   1.0 01:A303COMmi       7.38     .210 No_date   11:32  103.07  n/a      .000
            overflow <=   1.0 03:A303COMMa        .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.3274E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0998:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi       7.38     .210 No_date   11:32  103.07  n/a      .000
      fname :A303COMmi.0998
      remark:A303COM-minor
R0998:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa        .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303COMMa.0998
      remark:A303COM-Major
# SWM Pond Block
R0998:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1          3.94    1.602 No_date   12:00  120.77 .943      .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0998:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa        .00     .000 No_date    0:00     .00  n/a      .000
                    +     1.0 02:A303COMmi       7.38     .210 No_date   11:32  103.07  n/a      .000
                    +     1.0 02:APOND1          3.94    1.602 No_date   12:00  120.77  n/a      .000
                 SUM=     1.0 01:PND-A303       11.32    1.813 No_date   12:00  109.23  n/a      .000
R0998:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303       11.32    1.813 No_date   12:00  109.23  n/a      .000
      fname :PND-A303.0998
      remark:PND-A303
################################################################################
# STORMS
################################################################################
  ** END OF RUN :  998

*********************************************************************************************





 RUN#:COMMAND#
R0999:C00001---------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 0999 ]
#*********************************************************************************************
#  SWMHYMO  / INPUT DATA FILE
#*********************************************************************************************
#  Project Name: [Brazeau Lands]    Project Number: [1800]
#  Date       : 16-September-2019
#  Modeller   : [JB]
#  Updated    : [JB -  Feb 2020]
#             : [JB -  June 2020]
#  Company    : JFSAinc.
#  License #  :  2549237
#*********************************************************************************************
# Model developed to simulate runoff from catchments that are greater than 0.5 ha
#*********************************************************************************************
#  Updated    : 22 April 2020 to reflect development boundary changes and onsite controls - JB JFSA
R0999:C00002---------------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = CHICAGO STORM   100 Year, 3 Hours  +20% Stress Test
      [SDT=10.00:SDUR=   3.00:PTOT=  86.00]
# Park Lands
R0999:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A104PK          1.72     .382 No_date    1:10   52.48 .610      .000
      [XIMP=.19:TIMP=.29]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP= 135.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 107.:MNI=.013:SCI=   .0]
# Minor system flow limited to 5-Year Rational (0.199m3/s)
# On-site storage provided up to the 100 year event.
R0999:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A104PK          1.72     .382 No_date    1:10   52.48  n/a      .000
                 out <=   1.0 01:A104PKmi        1.46     .199 No_date    0:56   52.48  n/a      .000
            overflow <=   1.0 03:A104PKMa         .26     .182 No_date    1:10   52.48  n/a      .000
     {MxStoUsed=.7482E-02  m3, TotOvfVol=.1373E-01  m3, N-Ovf=    2, TotDurOvf=    0.hrs}
R0999:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKmi        1.46     .199 No_date    0:56   52.48  n/a      .000
      fname :A104PKmi.0999
      remark:A104PK-minor
R0999:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A104PKMa         .26     .182 No_date    1:10   52.48  n/a      .000
      fname :A104PKMa.0999
      remark:A104PK-Major
# Residential Lands
R0999:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A109RES         1.64     .787 No_date    1:00   70.04 .814      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 104.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.230m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0999:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A109RES         1.64     .787 No_date    1:00   70.04  n/a      .000
                 out <=   1.0 01:A109RESmi       1.64     .241 No_date    1:14   70.04  n/a      .000
            overflow <=   1.0 03:A109RESMa        .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.3793E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0999:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A109RESmi       1.64     .241 No_date    1:14   70.04  n/a      .000
      fname :A109RESmi.0999
      remark:A109RES-minor
R0999:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A109RESMa        .00     .000 No_date    0:00     .00  n/a      .000
      fname :A109RESMa.0999
      remark:A109RES-Major
# Commercial Block
R0999:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A2260COM        2.68    1.341 No_date    1:00   74.46 .866      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 133.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Yr Rational Method (0.382 m3/s)
# On-site storage provided up to the 100 year event.
R0999:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A2260COM        2.68    1.341 No_date    1:00   74.46  n/a      .000
                 out <=   1.0 01:A2260COMmi      2.39     .382 No_date    0:52   74.46  n/a      .000
            overflow <=   1.0 03:A2260COMMa       .29     .743 No_date    1:03   74.46  n/a      .000
     {MxStoUsed=.4442E-01  m3, TotOvfVol=.2193E-01  m3, N-Ovf=    2, TotDurOvf=    0.hrs}
R0999:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMmi      2.39     .382 No_date    0:52   74.46  n/a      .000
      fname :A2260COMmi.0999
      remark:A2260COM-minor
R0999:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A2260COMMa       .29     .743 No_date    1:03   74.46  n/a      .000
      fname :A2260COMMa.0999
      remark:A2260COM-Major
# Residential Block
R0999:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303EXT         2.45    1.136 No_date    1:00   70.04 .814      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 127.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.336 m3/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0999:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303EXT         2.45    1.136 No_date    1:00   70.04  n/a      .000
                 out <=   1.0 01:A303EXTmi       2.44     .360 No_date    1:12   70.04  n/a      .000
            overflow <=   1.0 03:A303EXTMa        .02     .131 No_date    1:12   70.04  n/a      .000
     {MxStoUsed=.5495E-01  m3, TotOvfVol=.1107E-02  m3, N-Ovf=    2, TotDurOvf=    0.hrs}
R0999:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTmi       2.44     .360 No_date    1:12   70.04  n/a      .000
      fname :A303EXTmi.0999
      remark:A301EXT-minor
R0999:C00018------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303EXTMa        .02     .131 No_date    1:12   70.04  n/a      .000
      fname :A303EXTMa.0999
      remark:A301EXT-Major
# Residential Block
R0999:C00019------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A302EXT          .99     .481 No_date    1:00   70.04 .814      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  81.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.146 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0999:C00020------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A302EXT          .99     .481 No_date    1:00   70.04  n/a      .000
                 out <=   1.0 01:A302EXTmi        .97     .156 No_date    1:09   70.04  n/a      .000
            overflow <=   1.0 03:A302EXTMa        .02     .066 No_date    1:09   70.04  n/a      .000
     {MxStoUsed=.2100E-01  m3, TotOvfVol=.1154E-02  m3, N-Ovf=    1, TotDurOvf=    0.hrs}
R0999:C00021------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTmi        .97     .156 No_date    1:09   70.04  n/a      .000
      fname :A302EXTmi.0999
      remark:A302EXT-minor
R0999:C00022------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A302EXTMa        .02     .066 No_date    1:09   70.04  n/a      .000
      fname :A302EXTMa.0999
      remark:A302EXT-Major
# Residential Block
R0999:C00023------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A304EXT         1.20     .580 No_date    1:00   70.04 .814      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  89.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.173 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0999:C00024------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A304EXT         1.20     .580 No_date    1:00   70.04  n/a      .000
                 out <=   1.0 01:A304EXTmi       1.18     .185 No_date    1:10   70.04  n/a      .000
            overflow <=   1.0 03:A304EXTMa        .02     .074 No_date    1:10   70.04  n/a      .000
     {MxStoUsed=.2604E-01  m3, TotOvfVol=.1078E-02  m3, N-Ovf=    1, TotDurOvf=    0.hrs}
R0999:C00025------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTmi       1.18     .185 No_date    1:10   70.04  n/a      .000
      fname :A304EXTmi.0999
      remark:A304EXT-minor
R0999:C00026------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A304EXTMa        .02     .074 No_date    1:10   70.04  n/a      .000
      fname :A304EXTMa.0999
      remark:A304EXT-Major
# Residential Block
R0999:C00027------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT1        1.22     .591 No_date    1:00   70.04 .814      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=  90.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.177 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0999:C00028------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT1        1.22     .591 No_date    1:00   70.04  n/a      .000
                 out <=   1.0 01:A310EXT1mi      1.22     .189 No_date    1:13   70.04  n/a      .000
            overflow <=   1.0 03:A310EXT1Ma       .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.2767E-01  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0999:C00029------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT1mi      1.22     .189 No_date    1:13   70.04  n/a      .000
      fname :A310EXT1mi.0999
      remark:A310EXT1-minor
R0999:C00030------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A310EXT1Ma       .00     .000 No_date    0:00     .00  n/a      .000
      fname :A310EXT1Ma.0999
      remark:A310EXT1-Major
# Residential Block
R0999:C00031------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A310EXT2        7.64    3.298 No_date    1:01   70.04 .814      .000
      [XIMP=.59:TIMP=.69]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 226.:MNI=.013:SCI=   .0]
# Minor system limited to 2-Year Chicago 3hr +14% (0.877 mÂ³/s)
# On-site storage provided up to the 100 year event.
# 100-year + 20% stress test capture set at 107% of 100-year capture,
# and 100-year + 20% stress test storage set to 145% of 100-year storage
R0999:C00032------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A310EXT2        7.64    3.298 No_date    1:01   70.04  n/a      .000
                 out <=   1.0 01:A310EXT2mi      7.60     .939 No_date    1:16   70.06  n/a      .000
            overflow <=   1.0 03:A310EXT2Ma       .03     .282 No_date    1:16   70.04  n/a      .000
     {MxStoUsed=.1920E+00  m3, TotOvfVol=.2431E-02  m3, N-Ovf=    2, TotDurOvf=    0.hrs}
R0999:C00033------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2mi      7.60     .939 No_date    1:16   70.06  n/a      .000
      fname :A310EXT2mi.0999
      remark:A310EXT2-minor
R0999:C00034------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A310EXT2Ma       .03     .282 No_date    1:16   70.04  n/a      .000
      fname :A310EXT2Ma.0999
      remark:A310EXT2-Major
# Brazeau Commercial Block
R0999:C00035------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A133COM        13.83    6.103 No_date    1:01   74.46 .866      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 303.:MNI=.013:SCI=   .0]
# Site controlled to (1.8 mÂ³/s)
# On-site storage provided up to the 100 year event + 20%.
R0999:C00036------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A133COM        13.83    6.103 No_date    1:01   74.46  n/a      .000
                 out <=   1.0 01:A133COMmi      13.83    1.800 No_date    0:53   74.57  n/a      .000
            overflow <=   1.0 03:A133COMMa        .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.3462E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0999:C00037------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A133COMmi      13.83    1.800 No_date    0:53   74.57  n/a      .000
      fname :A133COMmi.0999
      remark:A133COM-minor
R0999:C00038------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A133COMMa        .00     .000 No_date    0:00     .00  n/a      .000
      fname :A133COMMa.0999
      remark:A133COM-Major
# ABIC Commercial Block
R0999:C00039------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:A303COM         7.38    3.455 No_date    1:01   74.46 .866      .000
      [XIMP=.69:TIMP=.79]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 222.:MNI=.013:SCI=   .0]
# Site controlled to the pre-development 2-Year rational method peak flow (0.2104 mÂ³/s)
R0999:C00040------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ROUTE RESERVOIR ->    1.0 02:A303COM         7.38    3.455 No_date    1:01   74.46  n/a      .000
                 out <=   1.0 01:A303COMmi       7.38     .210 No_date    0:35   74.46  n/a      .000
            overflow <=   1.0 03:A303COMMa        .00     .000 No_date    0:00     .00  n/a      .000
     {MxStoUsed=.3821E+00  m3, TotOvfVol=.0000E+00  m3, N-Ovf=    0, TotDurOvf=    0.hrs}
R0999:C00041------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:A303COMmi       7.38     .210 No_date    0:35   74.46  n/a      .000
      fname :A303COMmi.0999
      remark:A303COM-minor
R0999:C00042------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  SAVE HYD              1.0 01:A303COMMa        .00     .000 No_date    0:00     .00  n/a      .000
      fname :A303COMMa.0999
      remark:A303COM-Major
# SWM Pond Block
R0999:C00043------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CALIB STANDHYD        1.0 01:APOND1          3.94    2.143 No_date    1:00   81.41 .947      .000
      [XIMP=.93:TIMP=.93]
      [Horton parameters: Fo= 76.20:Fc= 13.20:DCAY=4.14:  F= .00]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 162.:MNI=.013:SCI=   .0]
R0999:C00044------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD               1.0 02:A303COMMa        .00     .000 No_date    0:00     .00  n/a      .000
                    +     1.0 02:A303COMmi       7.38     .210 No_date    0:35   74.46  n/a      .000
                    +     1.0 02:APOND1          3.94    2.143 No_date    1:00   81.41  n/a      .000
                 SUM=     1.0 01:PND-A303       11.32    2.353 No_date    1:00   76.87  n/a      .000
R0999:C00045------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    SAVE HYD              1.0 01:PND-A303       11.32    2.353 No_date    1:00   76.87  n/a      .000
      fname :PND-A303.0999
      remark:PND-A303
################################################################################
# STORMS
################################################################################
R0999:C00002---------------------------------------------------------------------------------------
    FINISH
---------------------------------------------------------------------------------------------------
***************************************************************************************************
      WARNINGS / ERRORS / NOTES
      -------------------------
R0001:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0001:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0001:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0001:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0001:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
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R0001:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0001:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0001:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0001:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0001:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0002:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0005:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0099:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0099:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0099:C00014  SAVE HYD
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R0099:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0099:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0099:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0099:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0099:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0099:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0099:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00032  ROUTE RESERVOIR
*** WARNING: Inflow peak was not reduced! Check OUTFLOW/STORAGE table or reduce DT.
R0102:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00036  ROUTE RESERVOIR
*** WARNING: Inflow peak was not reduced! Check OUTFLOW/STORAGE table or reduce DT.
R0102:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0102:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0105:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0110:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0110:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0110:C00014  SAVE HYD
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R0110:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0110:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0110:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0110:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0110:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0110:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0110:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0125:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0150:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0150:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0150:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0150:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0150:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0150:C00026  SAVE HYD
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R0150:C00030  SAVE HYD
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R0150:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0150:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0150:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0199:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0199:C00014  SAVE HYD
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R0199:C00018  SAVE HYD
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R0199:C00022  SAVE HYD
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R0199:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0199:C00042  SAVE HYD
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*** WARNING: This hydrograph is dry.
R0979:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0979:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0979:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0979:C00026  SAVE HYD
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R0979:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0979:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0979:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0979:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00034  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0988:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0996:C00006  SAVE HYD
*** WARNING: This hydrograph is dry.
R0996:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0996:C00014  SAVE HYD
*** WARNING: This hydrograph is dry.
R0996:C00018  SAVE HYD
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R0996:C00022  SAVE HYD
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R0996:C00038  SAVE HYD
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R0996:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0998:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0998:C00018  SAVE HYD
*** WARNING: This hydrograph is dry.
R0998:C00022  SAVE HYD
*** WARNING: This hydrograph is dry.
R0998:C00026  SAVE HYD
*** WARNING: This hydrograph is dry.
R0998:C00030  SAVE HYD
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R0998:C00034  SAVE HYD
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R0998:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0998:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
R0999:C00010  SAVE HYD
*** WARNING: This hydrograph is dry.
R0999:C00030  SAVE HYD
*** WARNING: This hydrograph is dry.
R0999:C00038  SAVE HYD
*** WARNING: This hydrograph is dry.
R0999:C00042  SAVE HYD
*** WARNING: This hydrograph is dry.
   Simulation ended on 2020-06-17     at 11:43:46
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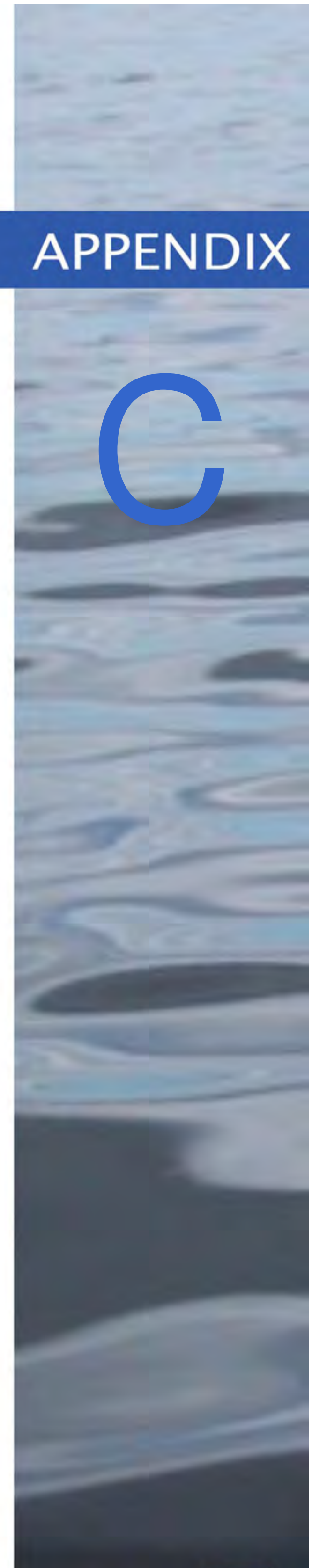

APPENDIX C

PCSWMM Model Schematic

Manhole Loss Coefficient Nomograph and Table

Pipe Data and Hydraulic Simulation Results

JFSA Water Resources and Environmental Consultants

MANHOLE LOSS COEFFICIENT NOMOGRAPH AND TABLE

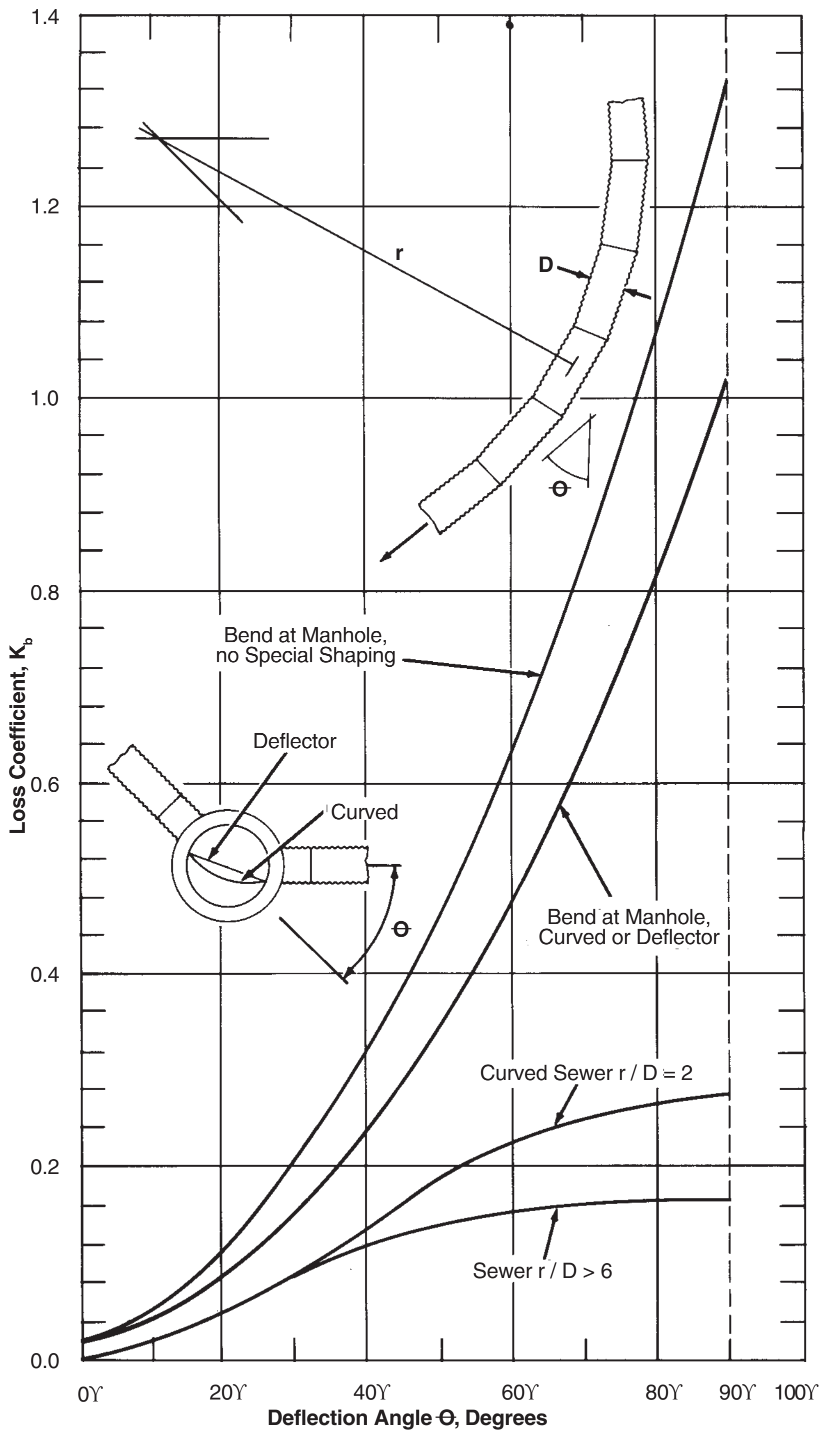

Figure 4.13 Sewer bend loss coefficient[16]

Angle	Exit Loss
0	0.02
5	0.035
10	0.055
15	0.08
20	0.11
25	0.16
30	0.21
35	0.26
40	0.32
45	0.39
50	0.47
55	0.54
60	0.635
65	0.73
70	0.84
75	0.95
80	1.07
85	1.19
90	1.33

Legend

Conduits

- Minor System

Junctions

- Maintenance Hole
- Site Plan

J.F. Sabourin and Associates Inc.
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(613) 836-3884
www.jfsa.com

DSEL
david schaeffer engineering ltd

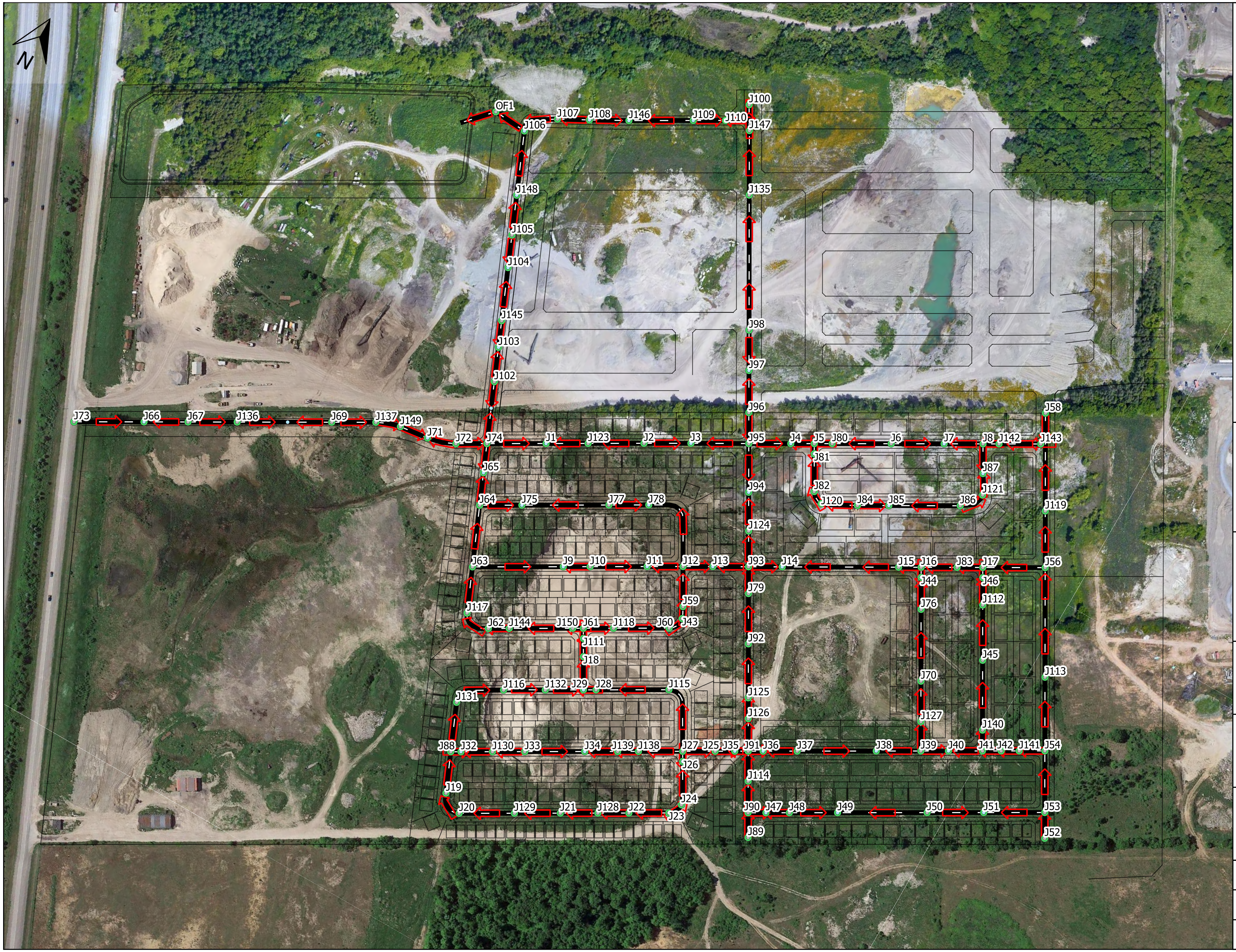
SCALE : 1:3500

0 50 100 150 200 m

PROJECT : Brazeau Phase 1

TITLE : Figure C1: Minor System Overview

PROJECT	1800-19
DRAWN:	JB
DATE:	APRIL 2020



Legend

Conduits

Major System

Junctions

Major-System

Site Plan

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david schaeffer engineering ltd

SCALE : 1:3500

0 50 100 150 200 m

PROJECT :

Brazeau Phase 1

TITLE :

Figure C2: Major System Overview

PROJECT	1800-19
DRAWN:	JB
DATE:	APRIL 2020

Table C-1A: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_401	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	5.31	0.4	-1.320	01:17	96.930	96.730	#N/A	#N/A	#N/A			
MH_501	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	4.52	0.3	-1.330	01:18	96.920	96.730	#N/A	#N/A	#N/A			
MH_1002	MH_1003	94.150	93.982	900	28.0	0.6	0.013	98.370	98.040	2.204	1.40	1.27	0.9	0.150	02:13	95.200	94.592	#N/A	#N/A	#N/A			
MH_1003	MH_1004	93.922	93.271	900	108.5	0.6	0.013	98.040	96.170	3.188	17.21	1.27	0.1	-0.230	02:14	94.592	93.316	#N/A	#N/A	#N/A			
MH_1004	MH_1005	92.586	92.162	975	106.0	0.4	0.013	96.170	95.150	1.898	1.42	1.27	0.9	-0.245	02:14	93.316	92.923	#N/A	#N/A	#N/A			
MH_1005	MH_1006	91.933	91.721	1200	106.0	0.2	0.013	95.150	94.970	1.542	1.74	1.27	0.7	-0.210	02:15	92.923	92.831	#N/A	#N/A	#N/A			
MH_1006	MH_1007	91.701	91.489	1200	106.0	0.2	0.013	94.970	94.270	1.542	1.74	1.27	0.7	-0.070	02:16	92.831	92.740	#N/A	#N/A	#N/A			
MH_1007	MH_1008	91.470	91.230	1200	88.0	0.3	0.013	94.270	93.460	1.801	2.04	1.56	0.8	0.070	00:00	92.740	92.580	#N/A	#N/A	#N/A			
MH_1008	MH_1009	91.230	91.200	1200	14.5	0.2	0.013	93.460	#N/A	1.568	1.77	1.58	0.9	0.150	00:01	92.580	92.500	#N/A	#N/A	#N/A			
MH_101	MH_102	100.935	100.142	300	30.5	2.6	0.013	103.750	103.240	2.206	0.16	0.00	0.0	-0.300	00:00	100.935	100.197	174-2	101.41	0.475			
MH_102	MH_103	99.917	99.002	525	59.0	1.6	0.013	103.240	102.350	2.474	0.54	0.29	0.5	-0.245	01:11	100.197	99.575	172-5	100.47	0.273			
																		172-5	100.47	0.822	59.0	6.9	99.648
																		173-1	100.78	1.014	59.0	18.1	99.766
																		173-2	100.78	0.930	59.0	26.1	99.850
																		173-3	101.1	1.174	59.0	33.3	99.926
																		173-4	101.1	1.090	59.0	41.3	100.010
																		173-5	101.1	1.009	59.0	48.9	100.091
																		174-1	101.41	1.241	59.0	56.3	100.169
MH_103	MH_104	98.755	98.516	750	120.0	0.4	0.013	102.350	101.590	1.594	0.70	0.63	0.9	0.070	01:10	99.575	99.245	169-2	99.81	0.235			
																		169-2	99.81	0.558	120.0	2.7	99.252
																		169-3	99.81	0.538	120.0	10	99.273
																		169-4	99.81	0.516	120.0	18	99.295
																		170-1	99.93	0.606	120.0	28.6	99.324
																		170-2	99.93	0.584	120.0	36.6	99.346
																		170-3	99.93	0.563	120.0	44.2	99.367
																		171-1	99.99	0.594	120.0	54.9	99.396
																		171-2	99.99	0.572	120.0	62.9	99.418
																		171-3	99.99	0.552	120.0	70.1	99.438
																		171-4	99.99	0.530	120.0	78.1	99.460
																		172-1	100.47	0.961	120.0	96.1	99.509
																		172-2	100.47	0.939	120.0	104.1	99.531
																		172-3	100.47	0.919	120.0	111.3	99.551
																		172-4	100.47	0.903	120.0	117	99.567
MH_104	MH_106	97.975	97.913	1050	41.5	0.1	0.013	101.590	101.840	1.217	1.05	0.97	0.9	0.220	01:11	99.245	99.115	169-1	99.81	0.565			
MH_105	MH_106	99.562	97.913	675	91.0	1.4	0.013	103.170	101.840	4.109	16.64	0.76	0.0	-0.235	01:11	100.002	99.115	148	100.03	0.028			
																		148	100.03	0.792	91.0	12.6	99.238
																		147	100.16	0.803	91.0	24.8	99.357
																		146	100.3	0.844	91.0	35	99.456
																		145	100.42	0.855	91.0	46.2	99.565
																		144	100.56	0.856	91.0	60.4	99.704
																		143	100.93	1.092	91.0	74.2	99.838
																		142	101.5	1.518	91.0	88.9	99.982
MH_106	MH_116	97.605	97.360	1350	122.5	0.2	0.013	101.840	101.580	1.668	2.39	1.80	0.8	0.160	01:13	99.115	98.880	166-1	99.53	0.415			
MH_107	MH_108	99.165	99.080	300	74.0	0.4	0.013	101.895	101.880	0.809	0.06	0.03	0.5	-0.005	01:12	99.460	99.478	176-1	100.1	0.640			
MH_107	MH_112	99.165	98.906	300	74.0	0.4	0.013	101.895	101.695	0.809	0.06	0.03	0.5	-0.005	01:12	99.460	99.411	185-1	99.89	0.430			
MH_108	MH_110	98.908	98.800	450	54.0	0.2	0.013	101.880	101.980	0.802	0.13	0.09	0.7	0.120	01:10	99.478	99.456	175-1	100.15	0.672			
MH_109	MH_110	99.151	98.800	750	60.0	0.7	0.013	102.650	101.980	2.108	0.93	0.79	0.8	-0.210	01:10	99.691	99.456	164-2	100.01	0.319			
																		164-2	100.01	0.549	60.0	1.2	99.461
																		164-3	100.25	0.768	60.0	6.7	99.482
																		164-4	100.25	0.736	60.0	14.7	99.514
																		165-1	100.42	0.865	60.0	25.3	99.555
																		165-2	100.93	1.345	60.0	32.9	99.585
																		165-3	100.93	1.314	60.0	40.9	99.616
MH_110	MH_111	98.346	98.046	900	75.0	0.4	0.013	101.980	101.770	1.800	1.14	1.02	0.9	0.210	01:09	99.456	99.235	162-1	99.69	0.234			
																		188-4	99.86	0.619	75.0	2	99.241
																		162-1	99.69	0.436	75.0	6.3	99.254
																		188-3	99.86	0.598	75.0	9.2	99.262

Table C-1A: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		162-2	99.69	0.413	75.0	14.3	99.277
																		188-2	99.86	0.574	75.0	17.2	99.286
																		162-3	99.69	0.391	75.0	21.6	99.299
																		188-1	99.86	0.552	75.0	24.8	99.308
																		162-4	99.69	0.362	75.0	31.6	99.328
																		187-4	99.86	0.520	75.0	35.5	99.340
																		163-1	99.77	0.417	75.0	40.2	99.353
																		187-3	99.86	0.497	75.0	43.5	99.363
																		163-2	99.77	0.394	75.0	47.8	99.376
																		187-2	99.86	0.476	75.0	50.7	99.384
																		163-3	99.77	0.371	75.0	55.8	99.399
																		187-1	99.86	0.452	75.0	58.7	99.408
																		164-1	100.01	0.579	75.0	66.5	99.431
MH_111	MH_115	97.925	97.743	975	91.0	0.2	0.013	101.770	101.450	1.342	1.00	1.02	1.0	0.335	01:14	99.235	99.046	159-1	99.58	0.345			
MH_112	MH_113	98.756	98.609	450	73.5	0.2	0.013	101.695	101.525	0.802	0.13	0.14	1.1	0.205	01:13	99.411	99.214	183-1	99.74	0.329			
MH_113	MH_114	98.549	98.523	450	13.0	0.2	0.013	101.525	101.520	0.802	0.13	0.16	1.3	0.215	01:13	99.214	99.146	181-1	99.85	0.636			
MH_1	MH_133	97.607	97.569	1500	19.0	0.2	0.013	101.660	101.660	1.789	3.16	1.80	0.6	-0.330	01:25	98.777	98.629	Est. Fut	99.86	1.083			
MH_114	MH_115	98.296	97.743	675	54.0	0.4	0.013	101.520	101.450	1.486	0.53	0.29	0.5	0.175	01:13	99.146	99.046	182-1	99.58	0.434			
MH_115	MH_116	97.656	97.360	1050	59.0	0.5	0.013	101.450	101.580	2.230	1.93	1.40	0.7	0.340	01:14	99.046	98.880	157-1	99.46	0.414			
MH_116	MH_117	97.060	96.937	1650	122.5	0.1	0.013	101.580	101.370	1.348	2.88	3.33	1.2	0.170	01:13	98.880	98.727	30	99.32	0.440			
MH_117	MH_118	96.917	96.796	1650	121.0	0.1	0.013	101.370	101.290	1.348	2.88	3.50	1.2	0.160	01:13	98.727	98.545	20	99.11	0.383			
																		18	99.18	0.628	121.0	4.4	98.552
																		2	99.16	0.603	121.0	7.7	98.557
																		406	99.18	0.611	121.0	16.1	98.569
																		404	99.18	0.604	121.0	20.3	98.576
																		407	99.16	0.576	121.0	25.7	98.584
																		405	99.18	0.589	121.0	30.5	98.591
																		19	99.16	0.558	121.0	37.9	98.602
																		3	99.14	0.534	121.0	40.7	98.606
																		20	99.11	0.493	121.0	48.1	98.617
																		4	99.14	0.518	121.0	51.2	98.622
																		21	99.12	0.486	121.0	59.3	98.634
																		5	99.22	0.582	121.0	62.1	98.638
																		22	99.21	0.557	121.0	71.5	98.653
																		6	99.23	0.575	121.0	73.3	98.655
																		23	99.22	0.550	121.0	82.9	98.670
																		7	99.24	0.563	121.0	87.8	98.677
																		24	99.28	0.589	121.0	97.3	98.691
																		8	99.31	0.610	121.0	102.8	98.700
																		25	99.36	0.645	121.0	113.1	98.715
																		9	99.4	0.677	121.0	118.2	98.723
MH_118	MH_136	96.645	96.634	1950	11.0	0.1	0.013	101.290	101.190	1.507	4.50	3.48	0.8	-0.050	01:14	98.545	98.434	#N/A	#N/A	#N/A			
MH_119	MH_120	99.144	98.938	900	103.0	0.2	0.013	103.010	102.570	1.273	0.81	1.06	1.3	0.070	01:12	100.114	99.688	101	100.65	0.536			
MH_119	MH_122	99.144	99.693	900	103.0	0.2	0.013	103.010	102.490	1.840	9.94	1.06	0.1	0.070	01:12	100.114	99.693	#N/A	#N/A	#N/A			
MH_120	MH_121	98.878	98.850	900	14.0	0.2	0.013	102.570	102.480	1.273	0.81	1.12	1.4	-0.090	01:12	99.688	99.310	116	101.03	1.342			
MH_121	MH_132	98.790	97.536	900	114.0	1.1	0.013	102.480	101.320	2.985	1.90	1.21	0.6	-0.380	01:12	99.310	98.588	106	99.54	0.230			
																		106	99.54	0.906	114.0	7.2	98.634
																		107	99.71	0.999	114.0	19.4	98.711
																		108	99.88	1.098	114.0	30.6	98.782
																		109	100.05	1.204	114.0	40.8	98.846
																		110	100.15	1.224	114.0	53.4	98.926
																		111	100.32	1.322	114.0	64.8	98.998
																		112	100.48	1.404	114.0	77	99.076
																		113	100.57	1.423	114.0	88.2	99.147
																		114	100.57	1.359	114.0	98.4	99.211
																		115	100.65	1.373	114.0	108.8	99.277
MH_122	MH_123	99.663	99.461	300	13.0	1.6	0.013	102.490	102.270	1.705	0.12	0.00	0.0	-0.300	00:00	99.663	99.517	131	100.61	0.947			

Table C-1A: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_123	MH_127	99.407	98.615	300	49.5	1.6	0.013	102.270	101.675	1.730	0.12	0.03	0.3	-0.190	01:11	99.517	99.112	135	99.89	0.373			
MH_124	MH_125	99.069	98.715	375	101.0	0.4	0.013	102.060	101.870	1.421	2.66	0.07	0.0	0.025	01:23	99.469	99.331	72	99.77	0.301			
																		82	99.89	0.552	101.0	5.4	99.338
																		69	99.84	0.498	101.0	8.4	99.342
																		70	99.78	0.424	101.0	18.6	99.356
																		81	99.89	0.532	101.0	19.6	99.358
																		71	99.78	0.408	101.0	29.7	99.372
																		80	99.92	0.547	101.0	31	99.373
																		72	99.77	0.384	101.0	39.9	99.386
																		79	100.04	0.645	101.0	46.9	99.395
																		73	99.82	0.419	101.0	51.1	99.401
																		78	100.04	0.635	101.0	54.4	99.405
																		74	99.88	0.465	101.0	61.3	99.415
																		77	100	0.581	101.0	64.6	99.419
																		413	99.93	0.499	101.0	73.4	99.431
																		415	100.08	0.646	101.0	75.2	99.434
																		412	99.98	0.537	101.0	82.3	99.443
																		414	100.1	0.651	101.0	86.4	99.449
																		75	99.98	0.521	101.0	94	99.459
																		76	100.16	0.695	101.0	98.1	99.465
MH_125	MH_127	98.481	98.615	600	91.5	0.3	0.013	101.870	101.675	1.618	5.82	0.27	0.0	0.250	01:29	99.331	99.112	65	99.58	0.249			
																		88	99.82	0.670	91.5	16	99.150
																		63	99.59	0.438	91.5	16.6	99.152
																		87	99.82	0.637	91.5	29.7	99.183
																		64	99.59	0.405	91.5	30.3	99.185
																		86	99.65	0.440	91.5	41.1	99.210
																		65	99.58	0.363	91.5	43.9	99.217
																		85	99.74	0.495	91.5	55.5	99.245
																		66	99.69	0.438	91.5	58.6	99.252
																		84	99.76	0.477	91.5	71.3	99.283
																		67	99.78	0.490	91.5	74.4	99.290
																		83	99.89	0.573	91.5	85.7	99.317
																		68	99.84	0.515	91.5	88.8	99.325
MH_126	MH_127	98.697	98.615	300	28.5	0.4	0.013	101.500	101.675	0.865	0.06	0.17	2.7	1.310	01:19	100.307	99.112	#N/A	#N/A	#N/A			
MH_127	MH_128	98.102	97.994	750	54.0	0.2	0.013	101.675	101.395	1.654	7.44	0.45	0.1	0.260	01:14	99.112	99.004	47	99.56	0.448			
MH_128	MH_129	97.964	97.923	750	13.5	0.3	0.013	101.395	101.315	1.389	0.61	0.45	0.7	0.290	01:14	99.004	98.958	45	99.49	0.486			
MH_129	MH_130	97.848	97.732	825	77.0	0.2	0.013	101.315	101.420	1.496	6.17	0.57	0.1	0.285	01:14	98.958	98.842	43	99.41	0.452			
MH_130	MH_131	97.732	97.581	825	100.5	0.2	0.013	101.420	101.200	1.040	0.56	0.69	1.2	0.285	01:31	98.842	98.616	33	99.18	0.338			
MH_1302	MH_302	97.470	96.430	600	98.5	0.2	0.013	101.160	101.140	0.971	0.27	0.15	0.5	0.370	00:57	98.440	98.370	Est. Fut	99.36	0.920			
MH_1303	MH_303	97.245	96.351	750	109.0	0.2	0.013	101.090	101.080	0.976	0.43	0.34	0.8	0.440	01:45	98.435	98.291	Est. Fut	99.29	0.855			
MH_1304	MH_304	97.175	96.196	600	87.0	0.2	0.013	100.660	100.730	0.971	0.27	0.18	0.6	0.410	00:56	98.185	98.086	Est. Fut	98.86	0.675			
MH_131	MH_132	97.206	97.536	1200	12.0	0.2	0.013	101.200	101.320	1.335	1.51	0.69	0.5	0.210	01:31	98.616	98.588	#N/A	#N/A	#N/A			
MH_1312	MH_310	97.627	97.113	750	62.0	0.2	0.013	100.940	100.940	1.127	0.50	0.18	0.4	-0.440	00:54	97.937	97.853	Est. Fut	99.14	1.203			
MH_132	MH_136	97.128	96.634	1200	59.5	0.2	0.013	101.320	101.190	1.542	1.74	2.00	1.1	0.260	01:12	98.588	98.434	103	99.33	0.742			
MH_133	MH_134	97.509	97.393	1500	77.0	0.2	0.013	101.660	101.550	2.126	19.14	1.87	0.1	-0.380	01:24	98.629	98.573	#N/A	#N/A	#N/A			
MH_134	MH_135	97.363	97.271	1500	61.0	0.2	0.013	101.550	101.440	1.554	2.75	1.93	0.7	-0.290	01:25	98.573	98.511	#N/A	#N/A	#N/A			
MH_135	MH_136	97.121	96.634	1650	37.0	0.1	0.013	101.440	101.190	1.348	2.88	1.95	0.7	-0.260	01:24	98.511	98.434	#N/A	#N/A	#N/A			
MH_136	MH_302	96.484	96.430	2250	54.0	0.1	0.013	101.190	101.140	1.658	6.59	7.32	1.1	-0.300	01:14	98.434	98.370	1	99.38	0.946			
MH_201	MH_202	105.214	104.138	375	119.5	0.9	0.013	108.120	107.180	1.506	0.17	0.11	0.6	-0.155	01:10	105.434	104.453	321	105.28	-0.154			
																		321	105.28	0.757	119.5	8.5	104.523
																		430	107.31	2.770	119.5	10.6	104.540
																		431	107.37	2.783	119.5	16.3	104.587
																		428	105.36	0.725	119.5	22.2	104.635
																		233	107.4	2.705	119.5	29.5	104.695
																		429	105.37	0.658	119.5	31.5	104.712
																		234	107.46	2.718	119.5	35.2	104.742
																		320	105.45	0.638	119.5	43.7	104.812

Table C-1A: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		235	107.5	2.655	119.5	47.7	104.845
																		319	105.56	0.657	119.5	54.8	104.903
																		236	107.62	2.716	119.5	54.9	104.904
																		318	105.66	0.673	119.5	65	104.987
																		237	107.69	2.685	119.5	67.3	105.005
																		238	107.8	2.748	119.5	73	105.052
																		317	105.77	0.691	119.5	76.2	105.079
																		239	107.87	2.709	119.5	86.2	105.161
																		316	105.9	0.721	119.5	88.4	105.179
																		240	107.99	2.783	119.5	91.9	105.207
																		315	106.02	0.748	119.5	99.8	105.272
																		241	108.06	2.744	119.5	105.1	105.316
																		242	108.16	2.797	119.5	110.8	105.363
																		314	106.13	0.741	119.5	114	105.389
MH_202	MH_203	104.063	104.035	450	14.0	0.2	0.013	107.180	107.090	0.802	0.13	0.14	1.1	-0.060	01:10	104.453	104.385	230	105.39	0.937			
MH_203	MH_206	103.975	103.730	450	54.5	0.5	0.013	107.090	106.720	1.203	0.19	0.22	1.1	-0.040	01:11	104.385	103.787	225	104.9	0.515			
MH_204	MH_205	103.579	103.343	525	118.0	0.2	0.013	106.620	106.610	0.888	0.19	0.15	0.8	-0.125	01:15	103.979	103.873	285	104.64	0.661			
MH_205	MH_206	103.313	103.730	525	16.0	0.2	0.013	106.610	106.720	0.888	0.19	0.21	1.1	0.035	01:15	103.873	103.787	#N/A	#N/A	#N/A			
MH_206	MH_207	103.197	102.999	600	49.5	0.4	0.013	106.720	106.460	1.373	0.39	0.44	1.1	-0.010	01:11	103.787	103.339	221	104.52	0.733			
MH_207	MH_208	102.969	102.731	600	12.5	1.9	0.013	106.460	106.320	2.997	0.85	0.44	0.5	-0.230	01:11	103.339	103.021	219	104.39	1.051			
MH_208	MH_215	102.671	100.543	600	112.0	1.9	0.013	106.320	104.150	2.993	0.85	0.51	0.6	-0.250	01:12	103.021	101.393	212	102.46	-0.561			
																		271	102.46	0.938	112.0	8.9	101.522
																		212	102.46	0.882	112.0	12.7	101.578
																		270	102.67	0.941	112.0	23.1	101.729
																		213	102.68	0.927	112.0	24.8	101.753
																		214	102.89	0.988	112.0	35	101.902
																		269	102.93	1.015	112.0	35.9	101.915
																		215	103.1	1.035	112.0	46.2	102.065
																		268	103.18	1.099	112.0	47.3	102.081
																		216	103.36	1.118	112.0	58.4	102.242
																		267	103.42	1.162	112.0	59.5	102.258
																		217	103.62	1.212	112.0	69.8	102.408
																		266	103.68	1.259	112.0	70.7	102.421
																		423	103.94	1.371	112.0	80.9	102.569
																		421	103.83	1.245	112.0	82	102.585
																		422	104.04	1.310	112.0	92	102.730
																		420	104.04	1.294	112.0	93.1	102.746
																		265	104.35	1.450	112.0	103.7	102.900
																		218	104.3	1.372	112.0	105.6	102.928
MH_209	MH_201	105.833	105.316	300	94.0	0.6	0.013	108.630	108.120	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.434	313	106.24	0.407			
MH_209	MH_210	105.833	105.518	300	94.0	0.6	0.013	108.630	108.320	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.596	254	108.31	2.477			
MH_210	MH_212	105.486	103.434	300	54.0	3.8	0.013	108.320	107.010	2.668	0.19	0.05	0.3	-0.190	01:11	105.596	103.579	258	105.12	-0.476			
																		258	105.12	0.955	54.0	15.7	104.165
																		257	105.54	0.938	54.0	27.4	104.602
																		256	106.05	1.025	54.0	38.7	105.025
																		255	106.58	1.178	54.0	48.8	105.402
MH_211	MH_212	103.900	103.434	300	26.5	0.4	0.013	106.090	107.010	0.810	0.06	0.02	0.3	-0.160	01:10	104.040	103.579	#N/A	#N/A	#N/A			
MH_212	MH_204	103.359	103.804	375	49.5	0.5	0.013	107.010	106.620	1.066	0.12	0.07	0.6	-0.155	01:12	103.579	103.979	284	104.71	1.131			
MH_212	MH_213	103.359	103.136	375	49.5	0.5	0.013	107.010	106.020	1.066	0.12	0.07	0.6	-0.155	01:12	103.579	103.233	203	104.1	0.521			
MH_213	MH_214	103.053	102.918	375	13.5	1.0	0.013	106.020	105.800	1.587	0.18	0.07	0.4	-0.195	01:12	103.233	103.053	204	104.02	0.787			
MH_214	MH_215	102.883	100.543	375	90.0	2.4	0.013	105.800	104.150	2.434	0.27	0.11	0.4	-0.205	01:10	103.053	101.393	272	102.37	-0.683			
																		272	102.37	0.841	90.0	7.4	101.529
																		211	102.46	0.776	90.0	15.8	101.684
																		273	102.59	0.799	90.0	21.6	101.791
																		210	102.68	0.771	90.0	28	101.909
																		274	102.86	0.788	90.0	36.8	102.072
																		209	102.89	0.792	90.0	38.2	102.098

Table C-1A: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL		
																					Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
																		275	103.11	0.828	90.0	48.2	102.282
																		208	103.15	0.846	90.0	49.4	102.304
																		276	103.37	0.863	90.0	60.4	102.507
																		207	103.4	0.834	90.0	63.6	102.566
																		277	103.55	0.905	90.0	67.9	102.645
																		206	103.66	0.884	90.0	75	102.776
																		278	103.55	0.613	90.0	83.7	102.937
																		205	103.83	0.860	90.0	85.5	102.970
MH_215	MH_119	100.303	99.423	675	55.0	1.6	0.013	104.150	103.010	2.971	1.06	0.99	0.9	0.415	01:11	101.393	100.114	#N/A	#N/A	#N/A			
MH_216	MH_217	105.251	104.798	375	75.5	0.6	0.013	108.100	107.980	1.230	0.14	0.12	0.8	-0.115	01:14	105.511	105.093	346	105.85	0.339			
MH_217	MH_218	104.573	104.347	600	113.0	0.2	0.013	107.980	107.690	0.971	0.27	0.26	0.9	-0.080	01:18	105.093	104.927	356	105.71	0.617			
MH_218	MH_220	104.327	104.166	600	80.5	0.2	0.013	107.690	107.790	0.971	0.27	0.30	1.1	0.000	01:20	104.927	104.166	357	105.75	0.823			
MH_219	MH_220	105.649	104.166	300	25.0	2.7	0.013	108.450	107.790	2.228	0.16	0.00	0.0	-0.300	00:00	105.649	104.166	#N/A	#N/A	#N/A			
MH_220	MH_224	103.644	102.523	600	59.0	1.9	0.013	107.790	105.620	2.993	0.85	0.30	0.4	-0.350	01:20	103.894	102.523	259	104.74	0.846			
MH_221	MH_222	103.008	102.620	300	77.5	0.5	0.013	105.960	105.420	0.968	0.07	0.01	0.2	-0.220	01:10	103.088	102.811	396-1	103.56	0.472			
MH_222	MH_223	102.311	102.168	600	95.5	0.2	0.013	105.420	105.450	0.841	0.24	0.22	0.9	-0.100	01:11	102.811	102.698	366-1	103.37	0.559			
MH_2	MH_2260	101.916	101.876	675	10.0	0.4	0.013	105.290	105.290	1.486	0.53	0.38	0.7	-0.085	00:53	102.506	102.126	Est. Fut	103.49	0.984			
MH_223	MH_224	102.148	102.523	600	97.0	0.2	0.013	105.450	105.620	0.971	0.27	0.27	1.0	-0.050	01:13	102.698	102.523	365-1	103.42	0.722			
MH_224	MH_105	101.625	100.067	600	82.0	1.9	0.013	105.620	103.170	2.993	0.85	0.66	0.8	-0.200	01:11	102.025	100.067	141	101.9	-0.125			
																		141	101.9	1.561	82.0	11.4	100.339
																		140	102.18	1.502	82.0	25.6	100.678
																		139	102.55	1.602	82.0	36.9	100.948
																		138	102.92	1.728	82.0	47.1	101.192
																		137	103.3	1.843	82.0	58.2	101.457
																		136	103.81	2.029	82.0	71.8	101.781
MH_225	MH_226	103.412	102.914	300	99.5	0.5	0.013	106.390	105.720	0.968	0.07	0.04	0.5	-0.140	01:10	103.572	103.053	388-3	103.75	0.178			
																		389-2	103.75	0.667	99.5	5.8	103.083
																		389-1	103.75	0.610	82.0	13.8	103.140
																		388-3	103.75	0.543	82.0	24.4	103.207
																		388-2	103.88	0.624	82.0	32.1	103.256
																		388-1	103.88	0.573	82.0	40.1	103.307
																		387-4	104.02	0.646	82.0	50.7	103.374
																		387-3	104.02	0.595	82.0	58.7	103.425
																		387-2	104.02	0.550	82.0	65.9	103.470
																		387-1	104.02	0.499	82.0	73.9	103.521
MH_2260	MH_227	101.816	101.049	675	49.5	1.6	0.013	105.290	104.230	2.925	1.05	0.45	0.4	-0.365	01:10	102.126	101.119	392-1	102.46	0.334			
MH_226	MH_2260	102.863	101.876	300	64.0	1.1	0.013	105.720	105.290	1.402	0.10	0.07	0.7	-0.110	01:10	103.053	102.126	391-3	103.08	0.027			
																		391-3	103.08	0.921	64.0	2.3	102.159
																		391-2	103.45	1.185	64.0	9.6	102.265
																		391-1	103.45	1.069	64.0	17.6	102.381
																		390-3	103.58	1.046	64.0	28.2	102.534
																		390-2	103.58	0.930	64.0	36.2	102.650
																		390-1	103.58	0.820	64.0	43.8	102.760
																		389-4	103.75	0.835	64.0	54.5	102.915
																		389-3	103.75	0.719	64.0	62.5	103.031
MH_227	MH_109	100.759	99.306	675	93.0	1.6	0.013	104.230	102.650	2.971	1.06	0.51	0.5	-0.315	01:10	101.119	99.691	394-3	100.86	-0.259			
																		394-4	100.86	0.874	93.0	19.2	99.986
																		394-3	100.86	0.751	93.0	27.2	100.109
																		394-2	101.26	1.039	93.0	34.5	100.221
																		394-1	101.26	0.916	93.0	42.5	100.344
																		393-3	101.49	0.968	93.0	54.1	100.522
																		393-2	101.81	1.172	93.0	61.7	100.638
																		393-1	101.81	1.049	93.0	69.7	100.761
																		392-4	102.21	1.269	93.0	81.4	100.941
																		392-3	102.21	1.146	93.0	89.4	101.064
MH_228	MH_229	102.472	100.982	300	74.5	2.0	0.013	105.270	103.790	1.935	0.14	0.07	0.5	-0.160	01:10	102.612	101.073	384-3	102.12	-0.492			
																		384-3	102.12	0.997	74.5	2.4	101.123

Table C-1A: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		379-2	102.14	0.997	74.5	3.4	101.143
																		384-4	102.12	0.832	74.5	10.4	101.288
																		379-1	102.14	0.832	74.5	11.4	101.308
																		385-1	102.35	0.843	74.5	21	101.507
																		378-3	102.57	1.043	74.5	22	101.527
																		385-2	102.65	0.986	74.5	28.6	101.664
																		378-2	102.67	0.983	74.5	29.7	101.687
																		385-3	102.65	0.821	74.5	36.6	101.829
																		378-1	102.67	0.818	74.5	37.7	101.852
																		386-1	102.73	0.680	74.5	47.3	102.050
																		377-4	103.02	0.949	74.5	48.3	102.071
																		386-2	103.08	0.865	74.5	55.3	102.215
																		377-3	103.28	1.044	74.5	56.3	102.236
																		377-2	103.34	0.955	74.5	63.5	102.385
																		377-1	103.34	0.790	74.5	71.5	102.550
MH_229	MH_102	100.723	100.142	525	86.5	0.9	0.013	103.790	103.240	1.832	0.40	0.26	0.7	-0.175	01:10	101.073	100.197	381-1	101.35	0.277			
																		382-1	101.52	1.184	86.5	13.7	100.336
																		381-4	101.35	1.004	86.5	14.7	100.346
																		382-2	101.52	1.103	86.5	21.7	100.417
																		381-3	101.35	0.923	86.5	22.7	100.427
																		382-3	101.52	1.030	86.5	28.9	100.490
																		381-2	101.35	0.849	86.5	30	100.501
																		382-4	101.52	0.949	86.5	36.9	100.571
																		381-1	101.35	0.768	86.5	38	100.582
																		383-1	101.62	0.941	86.5	47.6	100.679
																		380-3	101.59	0.901	86.5	48.6	100.689
																		383-2	101.62	0.860	86.5	55.6	100.760
																		380-2	101.59	0.820	86.5	56.6	100.770
																		383-3	101.62	0.783	86.5	63.2	100.837
																		380-1	101.59	0.743	86.5	64.2	100.847
																		384-1	101.95	1.006	86.5	73.8	100.944
																		379-4	101.96	1.004	86.5	74.9	100.956
																		384-2	101.95	0.925	86.5	81.8	101.025
																		379-3	101.96	0.923	86.5	82.9	101.037
MH_230	MH_231	102.417	100.947	300	73.5	2.0	0.013	105.220	103.750	1.935	0.14	0.06	0.4	-0.160	01:12	102.557	100.982	374-3	102.03	-0.527			
																		374-3	102.03	0.994	73.5	2.5	101.036
																		368-3	102.24	1.151	73.5	5	101.089
																		374-4	102.03	0.823	73.5	10.5	101.207
																		368-2	102.24	0.979	73.5	13	101.261
																		368-1	102.24	0.817	73.5	20.6	101.423
																		375-1	102.4	0.964	73.5	21.2	101.436
																		375-2	102.57	0.971	73.5	28.8	101.599
																		367-3	102.71	1.057	73.5	31.3	101.653
																		375-3	102.57	0.799	73.5	36.8	101.771
																		367-2	102.71	0.886	73.5	39.3	101.824
																		367-1	102.71	0.723	73.5	46.9	101.987
																		376-1	103	1.002	73.5	47.4	101.998
																		376-2	103	0.831	73.5	55.4	102.169
																		376-3	103.37	1.044	73.5	62.7	102.326
																		376-4	103.37	0.873	73.5	70.7	102.497
MH_231	MH_103	100.722	99.002	525	87.0	2.0	0.013	103.750	102.350	2.810	0.61	0.27	0.4	-0.265	01:11	100.982	99.575	371-1	100.56	-0.422			
																		371-3	100.56	0.775	87.0	13	99.785
																		372-1	100.95	1.150	87.0	13.9	99.800
																		371-2	100.56	0.645	87.0	21	99.915
																		372-2	100.95	1.021	87.0	21.9	99.929
																		371-1	100.56	0.522	87.0	28.6	100.038
																		372-3	100.95	0.903	87.0	29.2	100.047

Table C-1A: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		372-4	100.95	0.773	87.0	37.2	100.177
																		370-3	101.09	0.879	87.0	39.3	100.211
																		370-2	101.09	0.750	87.0	47.3	100.340
																		373-1	100.97	0.622	87.0	47.8	100.348
																		370-1	101.09	0.627	87.0	54.9	100.463
																		373-2	101.32	0.843	87.0	55.8	100.477
																		373-3	101.32	0.720	87.0	63.4	100.600
																		369-3	101.61	0.976	87.0	65.5	100.634
																		369-2	101.61	0.846	87.0	73.5	100.764
																		374-1	101.56	0.787	87.0	74.1	100.773
																		369-1	101.61	0.722	87.0	81.2	100.888
																		374-2	101.56	0.657	87.0	82.1	100.903
MH_302	MH_303	96.410	96.351	2250	59.0	0.1	0.013	101.140	101.080	1.658	6.59	7.52	1.1	-0.290	1:15	98.370	98.291	#N/A	#N/A	#N/A			
MH_303	MH_304	96.331	96.196	2250	134.5	0.1	0.013	101.080	100.730	1.658	6.59	7.96	1.2	-0.290	01:15	98.291	98.086	#N/A	#N/A	#N/A			
MH_304	MH_306TEE	96.176	96.133	2250	42.5	0.1	0.013	100.730	100.350	1.666	6.62	8.15	1.2	-0.340	01:15	98.086	97.813	#N/A	#N/A	#N/A			
MH_306TEE	MH_307	96.133	96.120	2250	13.0	0.1	0.013	100.350	100.350	2.128	28.73	8.29	0.3	-0.570	01:15	97.813	97.550	#N/A	#N/A	#N/A			
MH_313	MH_307	96.099	96.120	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.45	0.7	-0.900	01:16	97.449	97.550	#N/A	#N/A	#N/A			
MH_307	MH_400	96.100	96.076	2250	22.7	0.1	0.013	100.350	100.350	1.707	6.79	5.33	0.8	-0.800	01:17	97.550	97.537	#N/A	#N/A	#N/A			
MH_309	MH_310	97.139	97.113	1200	17.5	0.1	0.013	100.990	100.940	1.331	1.50	0.88	0.6	-0.360	01:31	97.979	97.853	#N/A	#N/A	#N/A			
MH_310	MH_311	97.053	96.959	1200	62.5	0.2	0.013	100.940	100.830	1.335	1.51	1.13	0.7	-0.400	01:28	97.853	97.779	#N/A	#N/A	#N/A			
MH_3	MH_109	99.346	99.306	600	10.0	0.4	0.013	102.650	102.650	1.373	0.39	0.23	0.6	-0.230	00:53	99.716	99.691	#N/A	#N/A	#N/A			
MH_3111TEE	MH_312	96.831	96.716	1200	76.5	0.2	0.013	100.640	100.450	1.335	1.51	1.24	0.8	-0.360	01:21	97.671	97.526	#N/A	#N/A	#N/A			
MH_311	MH_3111TEE	96.939	96.831	1200	72.0	0.2	0.013	100.830	100.640	1.335	1.51	1.22	0.8	-0.360	01:19	97.779	97.671	#N/A	#N/A	#N/A			
MH_312	MH_313	96.656	96.624	1200	21.5	0.1	0.013	100.450	100.350	1.331	1.50	1.25	0.8	-0.330	01:21	97.526	97.449	#N/A	#N/A	#N/A			
MH_313	MH_500	96.099	96.065	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.45	0.7	-0.900	01:16	97.449	97.416	#N/A	#N/A	#N/A			
MH_400	OGS_1	96.067	96.057	750	4.9	0.2	0.013	100.350	100.500	1.133	0.50	1.00	2.0	0.720	00:59	97.537	97.517	#N/A	#N/A	#N/A			
OGS_1	OGS_1-Out	96.037	96.027	750	4.9	0.2	0.013	100.500	100.350	1.138	0.50	1.00	2.0	0.730	00:59	97.517	97.265	#N/A	#N/A	#N/A			
OGS_1-Out	MH_401	96.015	96.000	2250	14.7	0.1	0.013	100.350	100.350	1.674	6.66	6.35	1.0	-1.000	01:17	97.265	96.930	#N/A	#N/A	#N/A			
MH_4	MH_104	98.554	98.516	525	9.5	0.4	0.013	101.580	101.590	1.256	0.27	0.20	0.7	0.245	01:28	99.324	99.245	#N/A	#N/A	#N/A			
MH_500	OGS_2	96.056	96.046	750	5.0	0.2	0.013	100.350	100.428	1.127	0.50	0.97	1.9	0.610	01:44	97.416	97.406	#N/A	#N/A	#N/A			
OGS_2	OGS_2-Out	96.026	96.016	750	5.1	0.2	0.013	100.428	100.350	1.118	0.49	0.97	2.0	0.630	01:44	97.406	97.174	#N/A	#N/A	#N/A			
OGS_2-Out	MH_501	96.004	96.000	2250	4.2	0.1	0.013	100.350	100.350	1.624	6.46	5.39	0.8	-1.080	01:16	97.174	96.920	#N/A	#N/A	#N/A			

[2] Conservative estimate of freeboard based on U/S HGL and lowest USF connected to pipe. Actual HGL / freeboard at all connecting lots interpolated where conservative estimate does not meet freeboard requirements.

[3] Future USF elevations estimated as 1.8 m below the upstream top of manhole elevations.

Legend colour	Meaning
Green	Interpolated HGL elevation
Yellow	Freebaord Less than 0.3m
Red	Freebaord Less than 0.0m

Table C-1B: Pipe Data and Hydraulic Simulation Results for the 100-Year, 24-Hour SCS Type II Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_401	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	5.25	0.4	-1.320	12:04	96.930	96.730	#N/A	#N/A	#N/A			
MH_501	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	4.54	0.3	-1.370	12:04	96.880	96.730	#N/A	#N/A	#N/A			
MH_1002	MH_1003	94.150	93.982	900	28.0	0.6	0.013	98.370	98.040	2.204	1.40	1.26	0.9	0.140	12:54	95.190	94.592	#N/A	#N/A	#N/A			
MH_1003	MH_1004	93.922	93.271	900	108.5	0.6	0.013	98.040	96.170	3.188	17.21	1.26	0.1	-0.230	12:55	94.592	93.306	#N/A	#N/A	#N/A			
MH_1004	MH_1005	92.586	92.162	975	106.0	0.4	0.013	96.170	95.150	1.898	1.42	1.26	0.9	-0.255	12:55	93.306	92.913	#N/A	#N/A	#N/A			
MH_1005	MH_1006	91.933	91.721	1200	106.0	0.2	0.013	95.150	94.970	1.542	1.74	1.26	0.7	-0.220	12:56	92.913	92.831	#N/A	#N/A	#N/A			
MH_1006	MH_1007	91.701	91.489	1200	106.0	0.2	0.013	94.970	94.270	1.542	1.74	1.26	0.7	-0.070	12:57	92.831	92.730	#N/A	#N/A	#N/A			
MH_1007	MH_1008	91.470	91.230	1200	88.0	0.3	0.013	94.270	93.460	1.801	2.04	1.56	0.8	0.060	00:00	92.730	92.580	#N/A	#N/A	#N/A			
MH_1008	MH_1009	91.230	91.200	1200	14.5	0.2	0.013	93.460	#N/A	1.568	1.77	1.58	0.9	0.150	00:01	92.580	92.500	#N/A	#N/A	#N/A			
MH_101	MH_102	100.935	100.142	300	30.5	2.6	0.013	103.750	103.240	2.206	0.16	0.00	0.0	-0.300	00:00	100.935	100.187	174-2	101.41	0.475			
MH_102	MH_103	99.917	99.002	525	59.0	1.6	0.013	103.240	102.350	2.474	0.54	0.27	0.5	-0.255	12:00	100.187	99.455	172-5	100.47	0.283			
																		172-5	100.47	0.929	59.0	6.9	99.541
																		173-1	100.78	1.100	59.0	18.1	99.680
																		173-2	100.78	1.001	59.0	26.1	99.779
																		173-3	101.1	1.232	59.0	33.3	99.868
																		173-4	101.1	1.133	59.0	41.3	99.967
																		173-5	101.1	1.038	59.0	48.9	100.062
																		174-1	101.41	1.256	59.0	56.3	100.154
MH_103	MH_104	98.755	98.516	750	120.0	0.4	0.013	102.350	101.590	1.594	0.70	0.58	0.8	-0.050	12:04	99.455	99.185	169-2	99.81	0.355			
																		169-2	99.81	0.619	120.0	2.7	99.191
																		169-3	99.81	0.603	120.0	10	99.208
																		169-4	99.81	0.585	120.0	18	99.226
																		170-1	99.93	0.681	120.0	28.6	99.249
																		170-2	99.93	0.663	120.0	36.6	99.267
																		170-3	99.93	0.646	120.0	44.2	99.284
																		171-1	99.99	0.681	120.0	54.9	99.309
																		171-2	99.99	0.663	120.0	62.9	99.327
																		171-3	99.99	0.647	120.0	70.1	99.343
																		171-4	99.99	0.629	120.0	78.1	99.361
																		172-1	100.47	1.069	120.0	96.1	99.401
																		172-2	100.47	1.051	120.0	104.1	99.419
																		172-3	100.47	1.035	120.0	111.3	99.435
																		172-4	100.47	1.022	120.0	117	99.448
MH_104	MH_106	97.975	97.913	1050	41.5	0.1	0.013	101.590	101.840	1.217	1.05	0.92	0.9	0.160	11:58	99.185	99.065	169-1	99.81	0.625			
MH_105	MH_106	99.562	97.913	675	91.0	1.4	0.013	103.170	101.840	4.109	16.64	0.74	0.0	-0.245	11:59	99.992	99.065	148	100.03	0.038			
																		148	100.03	0.837	91.0	12.6	99.193
																		147	100.16	0.842	91.0	24.8	99.318
																		146	100.3	0.878	91.0	35	99.422
																		145	100.42	0.884	91.0	46.2	99.536
																		144	100.56	0.880	91.0	60.4	99.680
																		143	100.93	1.109	91.0	74.2	99.821
																		142	101.5	1.529	91.0	88.9	99.971
MH_106	MH_116	97.605	97.360	1350	122.5	0.2	0.013	101.840	101.580	1.668	2.39	1.74	0.7	0.110	12:01	99.065	98.830	166-1	99.53	0.465			
MH_107	MH_108	99.165	99.080	300	74.0	0.4	0.013	101.895	101.880	0.809	0.06	0.03	0.5	-0.055	12:03	99.410	99.418	176-1	100.1	0.690			
MH_107	MH_112	99.165	98.906	300	74.0	0.4	0.013	101.895	101.695	0.809	0.06	0.03	0.5	-0.055	12:03	99.410	99.361	185-1	99.89	0.480			
MH_108	MH_110	98.908	98.800	450	54.0	0.2	0.013	101.880	101.980	0.802	0.13	0.09	0.7	0.060	11:57	99.418	99.386	175-1	100.15	0.732			
MH_109	MH_110	99.151	98.800	750	60.0	0.7	0.013	102.650	101.980	2.108	0.93	0.77	0.8	-0.220	12:00	99.681	99.386	164-2	100.01	0.329			
																		164-2	100.01	0.618	60.0	1.2	99.392
																		164-3	100.25	0.831	60.0	6.7	99.419
																		164-4	100.25	0.792	60.0	14.7	99.458
																		165-1	100.42	0.910	60.0	25.3	99.510
																		165-2	100.93	1.382	60.0	32.9	99.548
																		165-3	100.93	1.343	60.0	40.9	99.587
MH_110	MH_111	98.346	98.046	900	75.0	0.4	0.013	101.980	101.770	1.800	1.14	0.99	0.9	0.140	11:56	99.386	99.175	162-1	99.69	0.304			
																		188-4	99.86	0.679	75.0	2	99.181
																		162-1	99.69	0.497	75.0	6.3	99.193
																		188-3	99.86	0.659	75.0	9.2	99.201

Table C-1B: Pipe Data and Hydraulic Simulation Results for the 100-Year, 24-Hour SCS Type II Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		162-2	99.69	0.475	75.0	14.3	99.215
																		188-2	99.86	0.637	75.0	17.2	99.223
																		162-3	99.69	0.454	75.0	21.6	99.236
																		188-1	99.86	0.615	75.0	24.8	99.245
																		162-4	99.69	0.426	75.0	31.6	99.264
																		187-4	99.86	0.585	75.0	35.5	99.275
																		163-1	99.77	0.482	75.0	40.2	99.288
																		187-3	99.86	0.563	75.0	43.5	99.297
																		163-2	99.77	0.461	75.0	47.8	99.309
																		187-2	99.86	0.542	75.0	50.7	99.318
																		163-3	99.77	0.438	75.0	55.8	99.332
																		187-1	99.86	0.520	75.0	58.7	99.340
																		164-1	100.01	0.648	75.0	66.5	99.362
MH_111	MH_115	97.925	97.743	975	91.0	0.2	0.013	101.770	101.450	1.342	1.00	1.00	1.0	0.275	12:02	99.175	98.986	159-1	99.58	0.405			
MH_112	MH_113	98.756	98.609	450	73.5	0.2	0.013	101.695	101.525	0.802	0.13	0.14	1.1	0.155	12:03	99.361	99.154	183-1	99.74	0.379			
MH_113	MH_114	98.549	98.523	450	13.0	0.2	0.013	101.525	101.520	0.802	0.13	0.16	1.3	0.155	12:03	99.154	99.096	181-1	99.85	0.696			
MH_1	MH_133	97.607	97.569	1500	19.0	0.2	0.013	101.660	101.660	1.789	3.16	1.80	0.6	-0.350	12:09	98.757	98.599	Est. Fut	99.86	1.103			
MH_114	MH_115	98.296	97.743	675	54.0	0.4	0.013	101.520	101.450	1.486	0.53	0.29	0.5	0.125	12:02	99.096	98.986	182-1	99.58	0.484			
MH_115	MH_116	97.656	97.360	1050	59.0	0.5	0.013	101.450	101.580	2.230	1.93	1.38	0.7	0.280	12:02	98.986	98.830	157-1	99.46	0.474			
MH_116	MH_117	97.060	96.937	1650	122.5	0.1	0.013	101.580	101.370	1.348	2.88	3.25	1.1	0.120	12:02	98.830	98.677	30	99.32	0.490			
MH_117	MH_118	96.917	96.796	1650	121.0	0.1	0.013	101.370	101.290	1.348	2.88	3.41	1.2	0.110	12:02	98.677	98.505	20	99.11	0.433			
																		18	99.18	0.669	121.0	4.4	98.511
																		2	99.16	0.644	121.0	7.7	98.516
																		406	99.18	0.652	121.0	16.1	98.528
																		404	99.18	0.646	121.0	20.3	98.534
																		407	99.16	0.618	121.0	25.7	98.542
																		405	99.18	0.632	121.0	30.5	98.548
																		19	99.16	0.601	121.0	37.9	98.559
																		3	99.14	0.577	121.0	40.7	98.563
																		20	99.11	0.537	121.0	48.1	98.573
																		4	99.14	0.562	121.0	51.2	98.578
																		21	99.12	0.531	121.0	59.3	98.589
																		5	99.22	0.627	121.0	62.1	98.593
																		22	99.21	0.603	121.0	71.5	98.607
																		6	99.23	0.621	121.0	73.3	98.609
																		23	99.22	0.597	121.0	82.9	98.623
																		7	99.24	0.610	121.0	87.8	98.630
																		24	99.28	0.637	121.0	97.3	98.643
																		8	99.31	0.659	121.0	102.8	98.651
																		25	99.36	0.694	121.0	113.1	98.666
																		9	99.4	0.727	121.0	118.2	98.673
MH_118	MH_136	96.645	96.634	1950	11.0	0.1	0.013	101.290	101.190	1.507	4.50	3.41	0.8	-0.090	12:02	98.505	98.394	#N/A	#N/A	#N/A			
MH_119	MH_120	99.144	98.938	900	103.0	0.2	0.013	103.010	102.570	1.273	0.81	1.02	1.3	0.030	12:01	100.074	99.668	101	100.65	0.576			
MH_119	MH_122	99.144	99.693	900	103.0	0.2	0.013	103.010	102.490	1.840	9.94	1.02	0.1	0.030	12:01	100.074	99.693	#N/A	#N/A	#N/A			
MH_120	MH_121	98.878	98.850	900	14.0	0.2	0.013	102.570	102.480	1.273	0.81	1.07	1.3	-0.110	12:01	99.668	99.300	116	101.03	1.362			
MH_121	MH_132	98.790	97.536	900	114.0	1.1	0.013	102.480	101.320	2.985	1.90	1.16	0.6	-0.390	12:01	99.300	98.538	106	99.54	0.240			
																		106	99.54	0.954	114.0	7.2	98.586
																		107	99.71	1.042	114.0	19.4	98.668
																		108	99.88	1.137	114.0	30.6	98.743
																		109	100.05	1.239	114.0	40.8	98.811
																		110	100.15	1.255	114.0	53.4	98.895
																		111	100.32	1.349	114.0	64.8	98.971
																		112	100.48	1.427	114.0	77	99.053
																		113	100.57	1.442	114.0	88.2	99.128
																		114	100.57	1.374	114.0	98.4	99.196
																		115	100.65	1.385	114.0	108.8	99.265
MH_122	MH_123	99.663	99.461	300	13.0	1.6	0.013	102.490	102.270	1.705	0.12	0.00	0.0	-0.300	00:00	99.663	99.507	131	100.61	0.947			

Table C-1B: Pipe Data and Hydraulic Simulation Results for the 100-Year, 24-Hour SCS Type II Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_123	MH_127	99.407	98.615	300	49.5	1.6	0.013	102.270	101.675	1.730	0.12	0.03	0.2	-0.200	12:00	99.507	99.062	135	99.89	0.383			
MH_124	MH_125	99.069	98.715	375	101.0	0.4	0.013	102.060	101.870	1.421	2.66	0.07	0.0	-0.065	12:08	99.379	99.261	72	99.77	0.391			
																		82	99.89	0.623	101.0	5.4	99.267
																		69	99.84	0.569	101.0	8.4	99.271
																		70	99.78	0.497	101.0	18.6	99.283
																		81	99.89	0.606	101.0	19.6	99.284
																		71	99.78	0.484	101.0	29.7	99.296
																		80	99.92	0.623	101.0	31	99.297
																		72	99.77	0.462	101.0	39.9	99.308
																		79	100.04	0.724	101.0	46.9	99.316
																		73	99.82	0.499	101.0	51.1	99.321
																		78	100.04	0.715	101.0	54.4	99.325
																		74	99.88	0.547	101.0	61.3	99.333
																		77	100	0.664	101.0	64.6	99.336
																		413	99.93	0.583	101.0	73.4	99.347
																		415	100.08	0.731	101.0	75.2	99.349
																		412	99.98	0.623	101.0	82.3	99.357
																		414	100.1	0.738	101.0	86.4	99.362
																		75	99.98	0.609	101.0	94	99.371
																		76	100.16	0.784	101.0	98.1	99.376
MH_125	MH_127	98.481	98.615	600	91.5	0.3	0.013	101.870	101.675	1.618	5.82	0.27	0.0	0.180	12:12	99.261	99.062	65	99.58	0.319			
																		88	99.82	0.723	91.5	16	99.097
																		63	99.59	0.492	91.5	16.6	99.098
																		87	99.82	0.693	91.5	29.7	99.127
																		64	99.59	0.462	91.5	30.3	99.128
																		86	99.65	0.499	91.5	41.1	99.151
																		65	99.58	0.423	91.5	43.9	99.157
																		85	99.74	0.557	91.5	55.5	99.183
																		66	99.69	0.501	91.5	58.6	99.189
																		84	99.76	0.543	91.5	71.3	99.217
																		67	99.78	0.556	91.5	74.4	99.224
																		83	99.89	0.642	91.5	85.7	99.248
																		68	99.84	0.585	91.5	88.8	99.255
MH_126	MH_127	98.697	98.615	300	28.5	0.4	0.013	101.500	101.675	0.865	0.06	0.16	2.6	1.200	12:03	100.197	99.062	#N/A	#N/A	#N/A			
MH_127	MH_128	98.102	97.994	750	54.0	0.2	0.013	101.675	101.395	1.654	7.44	0.44	0.1	0.210	12:11	99.062	98.954	47	99.56	0.498			
MH_128	MH_129	97.964	97.923	750	13.5	0.3	0.013	101.395	101.315	1.389	0.61	0.45	0.7	0.240	12:11	98.954	98.908	45	99.49	0.536			
MH_129	MH_130	97.848	97.732	825	77.0	0.2	0.013	101.315	101.420	1.496	6.17	0.56	0.1	0.235	12:11	98.908	98.792	43	99.41	0.502			
MH_130	MH_131	97.732	97.581	825	100.5	0.2	0.013	101.420	101.200	1.040	0.56	0.68	1.2	0.235	12:12	98.792	98.566	33	99.18	0.388			
MH_1302	MH_302	97.470	96.430	600	98.5	0.2	0.013	101.160	101.140	0.971	0.27	0.16	0.6	0.330	12:26	98.400	98.330	Est. Fut	99.36	0.960			
MH_1303	MH_303	97.245	96.351	750	109.0	0.2	0.013	101.090	101.080	0.976	0.43	0.35	0.8	0.400	12:26	98.395	98.251	Est. Fut	99.29	0.895			
MH_1304	MH_304	97.175	96.196	600	87.0	0.2	0.013	100.660	100.730	0.971	0.27	0.19	0.7	0.360	11:48	98.135	98.036	Est. Fut	98.86	0.725			
MH_131	MH_132	97.206	97.536	1200	12.0	0.2	0.013	101.200	101.320	1.335	1.51	0.69	0.5	0.160	12:12	98.566	98.538	#N/A	#N/A	#N/A			
MH_1312	MH_310	97.627	97.113	750	62.0	0.2	0.013	100.940	100.940	1.127	0.50	0.18	0.4	-0.440	12:10	97.937	97.843	Est. Fut	99.14	1.203			
MH_132	MH_136	97.128	96.634	1200	59.5	0.2	0.013	101.320	101.190	1.542	1.74	1.95	1.1	0.210	12:01	98.538	98.394	103	99.33	0.792			
MH_133	MH_134	97.509	97.393	1500	77.0	0.2	0.013	101.660	101.550	2.126	19.14	1.87	0.1	-0.410	12:09	98.599	98.533	#N/A	#N/A	#N/A			
MH_134	MH_135	97.363	97.271	1500	61.0	0.2	0.013	101.550	101.440	1.554	2.75	1.95	0.7	-0.330	12:10	98.533	98.481	#N/A	#N/A	#N/A			
MH_135	MH_136	97.121	96.634	1650	37.0	0.1	0.013	101.440	101.190	1.348	2.88	1.97	0.7	-0.290	12:09	98.481	98.394	#N/A	#N/A	#N/A			
MH_136	MH_302	96.484	96.430	2250	54.0	0.1	0.013	101.190	101.140	1.658	6.59	7.25	1.1	-0.340	12:03	98.394	98.330	1	99.38	0.986			
MH_201	MH_202	105.214	104.138	375	119.5	0.9	0.013	108.120	107.180	1.506	0.17	0.09	0.5	-0.175	12:00	105.414	104.403	321	105.28	-0.134			
																		321	105.28	0.805	119.5	8.5	104.475
																		430	107.31	2.817	119.5	10.6	104.493
																		431	107.37	2.829	119.5	16.3	104.541
																		428	105.36	0.769	119.5	22.2	104.591
																		233	107.4	2.747	119.5	29.5	104.653
																		429	105.37	0.701	119.5	31.5	104.669
																		234	107.46	2.759	119.5	35.2	104.701
																		320	105.45	0.677	119.5	43.7	104.773

Table C-1B: Pipe Data and Hydraulic Simulation Results for the 100-Year, 24-Hour SCS Type II Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		235	107.5	2.693	119.5	47.7	104.807
																		319	105.56	0.693	119.5	54.8	104.867
																		236	107.62	2.753	119.5	54.9	104.867
																		318	105.66	0.707	119.5	65	104.953
																		237	107.69	2.718	119.5	67.3	104.972
																		238	107.8	2.779	119.5	73	105.021
																		317	105.77	0.722	119.5	76.2	105.048
																		239	107.87	2.738	119.5	86.2	105.132
																		316	105.9	0.749	119.5	88.4	105.151
																		240	107.99	2.810	119.5	91.9	105.180
																		315	106.02	0.773	119.5	99.8	105.247
																		241	108.06	2.768	119.5	105.1	105.292
																		242	108.16	2.820	119.5	110.8	105.340
																		314	106.13	0.763	119.5	114	105.367
MH_202	MH_203	104.063	104.035	450	14.0	0.2	0.013	107.180	107.090	0.802	0.13	0.12	1.0	-0.110	12:00	104.403	104.335	230	105.39	0.987			
MH_203	MH_206	103.975	103.730	450	54.5	0.5	0.013	107.090	106.720	1.203	0.19	0.19	1.0	-0.090	12:00	104.335	103.747	225	104.9	0.565			
MH_204	MH_205	103.579	103.343	525	118.0	0.2	0.013	106.620	106.610	0.888	0.19	0.14	0.7	-0.155	12:05	103.949	103.843	285	104.64	0.691			
MH_205	MH_206	103.313	103.730	525	16.0	0.2	0.013	106.610	106.720	0.888	0.19	0.21	1.1	0.005	12:04	103.843	103.747	#N/A	#N/A	#N/A			
MH_206	MH_207	103.197	102.999	600	49.5	0.4	0.013	106.720	106.460	1.373	0.39	0.42	1.1	-0.050	12:01	103.747	103.319	221	104.52	0.773			
MH_207	MH_208	102.969	102.731	600	12.5	1.9	0.013	106.460	106.320	2.997	0.85	0.42	0.5	-0.250	12:01	103.319	102.991	219	104.39	1.071			
MH_208	MH_215	102.671	100.543	600	112.0	1.9	0.013	106.320	104.150	2.993	0.85	0.48	0.6	-0.280	12:01	102.991	101.233	212	102.46	-0.531			
																		271	102.46	1.087	112.0	8.9	101.373
																		212	102.46	1.028	112.0	12.7	101.432
																		270	102.67	1.074	112.0	23.1	101.596
																		213	102.68	1.058	112.0	24.8	101.622
																		214	102.89	1.108	112.0	35	101.782
																		269	102.93	1.133	112.0	35.9	101.797
																		215	103.1	1.142	112.0	46.2	101.958
																		268	103.18	1.205	112.0	47.3	101.975
																		216	103.36	1.210	112.0	58.4	102.150
																		267	103.42	1.253	112.0	59.5	102.167
																		217	103.62	1.291	112.0	69.8	102.329
																		266	103.68	1.337	112.0	70.7	102.343
																		423	103.94	1.437	112.0	80.9	102.503
																		421	103.83	1.310	112.0	82	102.520
																		422	104.04	1.363	112.0	92	102.677
																		420	104.04	1.346	112.0	93.1	102.694
																		265	104.35	1.489	112.0	103.7	102.861
																		218	104.3	1.409	112.0	105.6	102.891
MH_209	MH_201	105.833	105.316	300	94.0	0.6	0.013	108.630	108.120	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.414	313	106.24	0.407			
MH_209	MH_210	105.833	105.518	300	94.0	0.6	0.013	108.630	108.320	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.586	254	108.31	2.477			
MH_210	MH_212	105.486	103.434	300	54.0	3.8	0.013	108.320	107.010	2.668	0.19	0.05	0.3	-0.200	12:00	105.586	103.579	258	105.12	-0.466			
																		258	105.12	0.957	54.0	15.7	104.163
																		257	105.54	0.943	54.0	27.4	104.597
																		256	106.05	1.033	54.0	38.7	105.017
																		255	106.58	1.187	54.0	48.8	105.393
MH_211	MH_212	103.900	103.434	300	26.5	0.4	0.013	106.090	107.010	0.810	0.06	0.02	0.3	-0.160	12:00	104.040	103.579	#N/A	#N/A	#N/A			
MH_212	MH_204	103.359	103.804	375	49.5	0.5	0.013	107.010	106.620	1.066	0.12	0.07	0.6	-0.155	12:01	103.579	103.949	284	104.71	1.131			
MH_212	MH_213	103.359	103.136	375	49.5	0.5	0.013	107.010	106.020	1.066	0.12	0.07	0.6	-0.155	12:01	103.579	103.233	203	104.1	0.521			
MH_213	MH_214	103.053	102.918	375	13.5	1.0	0.013	106.020	105.800	1.587	0.18	0.07	0.4	-0.195	12:01	103.233	103.053	204	104.02	0.787			
MH_214	MH_215	102.883	100.543	375	90.0	2.4	0.013	105.800	104.150	2.434	0.27	0.11	0.4	-0.205	12:00	103.053	101.233	272	102.37	-0.683			
																		272	102.37	0.987	90.0	7.4	101.383
																		211	102.46	0.907	90.0	15.8	101.553
																		273	102.59	0.920	90.0	21.6	101.670
																		210	102.68	0.881	90.0	28	101.799
																		274	102.86	0.883	90.0	36.8	101.977
																		209	102.89	0.885	90.0	38.2	102.005

Table C-1B: Pipe Data and Hydraulic Simulation Results for the 100-Year, 24-Hour SCS Type II Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		275	103.11	0.902	90.0	48.2	102.208
																		208	103.15	0.918	90.0	49.4	102.232
																		276	103.37	0.916	90.0	60.4	102.454
																		207	103.4	0.881	90.0	63.6	102.519
																		277	103.55	0.944	90.0	67.9	102.606
																		206	103.66	0.910	90.0	75	102.750
																		278	103.55	0.624	90.0	83.7	102.926
																		205	103.83	0.868	90.0	85.5	102.962
MH_215	MH_119	100.303	99.423	675	55.0	1.6	0.013	104.150	103.010	2.971	1.06	0.96	0.9	0.255	12:00	101.233	100.074	#N/A	#N/A	#N/A			
MH_216	MH_217	105.251	104.798	375	75.5	0.6	0.013	108.100	107.980	1.230	0.14	0.11	0.8	-0.115	12:01	105.511	105.083	346	105.85	0.339			
MH_217	MH_218	104.573	104.347	600	113.0	0.2	0.013	107.980	107.690	0.971	0.27	0.26	1.0	-0.090	12:10	105.083	104.917	356	105.71	0.627			
MH_218	MH_220	104.327	104.166	600	80.5	0.2	0.013	107.690	107.790	0.971	0.27	0.30	1.1	-0.010	12:05	104.917	104.166	357	105.75	0.833			
MH_219	MH_220	105.649	104.166	300	25.0	2.7	0.013	108.450	107.790	2.228	0.16	0.00	0.0	-0.300	00:00	105.649	104.166	#N/A	#N/A	#N/A			
MH_220	MH_224	103.644	102.523	600	59.0	1.9	0.013	107.790	105.620	2.993	0.85	0.30	0.4	-0.350	12:00	103.894	102.523	259	104.74	0.846			
MH_221	MH_222	103.008	102.620	300	77.5	0.5	0.013	105.960	105.420	0.968	0.07	0.01	0.1	-0.230	12:00	103.078	102.811	396-1	103.56	0.482			
MH_222	MH_223	102.311	102.168	600	95.5	0.2	0.013	105.420	105.450	0.841	0.24	0.22	0.9	-0.100	12:01	102.811	102.698	366-1	103.37	0.559			
MH_2	MH_2260	101.916	101.876	675	10.0	0.4	0.013	105.290	105.290	1.486	0.53	0.38	0.7	-0.085	11:46	102.506	102.126	Est. Fut	103.49	0.984			
MH_223	MH_224	102.148	102.523	600	97.0	0.2	0.013	105.450	105.620	0.971	0.27	0.27	1.0	-0.050	12:02	102.698	102.523	365-1	103.42	0.722			
MH_224	MH_105	101.625	100.067	600	82.0	1.9	0.013	105.620	103.170	2.993	0.85	0.65	0.8	-0.200	12:00	102.025	100.067	141	101.9	-0.125			
																		141	101.9	1.561	82.0	11.4	100.339
																		140	102.18	1.502	82.0	25.6	100.678
																		139	102.55	1.602	82.0	36.9	100.948
																		138	102.92	1.728	82.0	47.1	101.192
																		137	103.3	1.843	82.0	58.2	101.457
																		136	103.81	2.029	82.0	71.8	101.781
MH_225	MH_226	103.412	102.914	300	99.5	0.5	0.013	106.390	105.720	0.968	0.07	0.03	0.5	-0.150	12:00	103.562	103.033	388-3	103.75	0.188			
																		389-2	103.75	0.686	99.5	5.8	103.064
																		389-1	103.75	0.628	82.0	13.8	103.122
																		388-3	103.75	0.560	82.0	24.4	103.190
																		388-2	103.88	0.640	82.0	32.1	103.240
																		388-1	103.88	0.588	82.0	40.1	103.292
																		387-4	104.02	0.660	82.0	50.7	103.360
																		387-3	104.02	0.608	82.0	58.7	103.412
																		387-2	104.02	0.562	82.0	65.9	103.458
																		387-1	104.02	0.510	82.0	73.9	103.510
MH_2260	MH_227	101.816	101.049	675	49.5	1.6	0.013	105.290	104.230	2.925	1.05	0.45	0.4	-0.365	12:00	102.126	101.109	392-1	102.46	0.334			
MH_226	MH_2260	102.863	101.876	300	64.0	1.1	0.013	105.720	105.290	1.402	0.10	0.06	0.6	-0.130	12:00	103.033	102.126	391-3	103.08	0.047			
																		391-3	103.08	0.921	64.0	2.3	102.159
																		391-2	103.45	1.188	64.0	9.6	102.262
																		391-1	103.45	1.075	64.0	17.6	102.375
																		390-3	103.58	1.054	64.0	28.2	102.526
																		390-2	103.58	0.941	64.0	36.2	102.639
																		390-1	103.58	0.833	64.0	43.8	102.747
																		389-4	103.75	0.852	64.0	54.5	102.898
																		389-3	103.75	0.738	64.0	62.5	103.012
MH_227	MH_109	100.759	99.306	675	93.0	1.6	0.013	104.230	102.650	2.971	1.06	0.50	0.5	-0.325	11:59	101.109	99.681	394-3	100.86	-0.249			
																		394-4	100.86	0.884	93.0	19.2	99.976
																		394-3	100.86	0.761	93.0	27.2	100.099
																		394-2	101.26	1.049	93.0	34.5	100.211
																		394-1	101.26	0.926	93.0	42.5	100.334
																		393-3	101.49	0.978	93.0	54.1	100.512
																		393-2	101.81	1.182	93.0	61.7	100.628
																		393-1	101.81	1.059	93.0	69.7	100.751
																		392-4	102.21	1.279	93.0	81.4	100.931
																		392-3	102.21	1.156	93.0	89.4	101.054
MH_228	MH_229	102.472	100.982	300	74.5	2.0	0.013	105.270	103.790	1.935	0.14	0.06	0.4	-0.160	12:00	102.612	101.063	384-3	102.12	-0.492			
																		384-3	102.12	1.007	74.5	2.4	101.113

Table C-1B: Pipe Data and Hydraulic Simulation Results for the 100-Year, 24-Hour SCS Type II Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		379-2	102.14	1.006	74.5	3.4	101.134
																		384-4	102.12	0.841	74.5	10.4	101.279
																		379-1	102.14	0.840	74.5	11.4	101.300
																		385-1	102.35	0.850	74.5	21	101.500
																		378-3	102.57	1.050	74.5	22	101.520
																		385-2	102.65	0.992	74.5	28.6	101.658
																		378-2	102.67	0.989	74.5	29.7	101.681
																		385-3	102.65	0.826	74.5	36.6	101.824
																		378-1	102.67	0.823	74.5	37.7	101.847
																		386-1	102.73	0.684	74.5	47.3	102.046
																		377-4	103.02	0.953	74.5	48.3	102.067
																		386-2	103.08	0.867	74.5	55.3	102.213
																		377-3	103.28	1.046	74.5	56.3	102.234
																		377-2	103.34	0.957	74.5	63.5	102.383
																		377-1	103.34	0.790	74.5	71.5	102.550
MH_229	MH_102	100.723	100.142	525	86.5	0.9	0.013	103.790	103.240	1.832	0.40	0.25	0.6	-0.185	12:00	101.063	100.187	381-1	101.35	0.287			
																		382-1	101.52	1.194	86.5	13.7	100.326
																		381-4	101.35	1.014	86.5	14.7	100.336
																		382-2	101.52	1.113	86.5	21.7	100.407
																		381-3	101.35	0.933	86.5	22.7	100.417
																		382-3	101.52	1.040	86.5	28.9	100.480
																		381-2	101.35	0.859	86.5	30	100.491
																		382-4	101.52	0.959	86.5	36.9	100.561
																		381-1	101.35	0.778	86.5	38	100.572
																		383-1	101.62	0.951	86.5	47.6	100.669
																		380-3	101.59	0.911	86.5	48.6	100.679
																		383-2	101.62	0.870	86.5	55.6	100.750
																		380-2	101.59	0.830	86.5	56.6	100.760
																		383-3	101.62	0.793	86.5	63.2	100.827
																		380-1	101.59	0.753	86.5	64.2	100.837
																		384-1	101.95	1.016	86.5	73.8	100.934
																		379-4	101.96	1.014	86.5	74.9	100.946
																		384-2	101.95	0.935	86.5	81.8	101.015
																		379-3	101.96	0.933	86.5	82.9	101.027
MH_230	MH_231	102.417	100.947	300	73.5	2.0	0.013	105.220	103.750	1.935	0.14	0.05	0.4	-0.170	12:01	102.547	100.972	374-3	102.03	-0.517			
																		374-3	102.03	1.004	73.5	2.5	101.026
																		368-3	102.24	1.161	73.5	5	101.079
																		374-4	102.03	0.833	73.5	10.5	101.197
																		368-2	102.24	0.989	73.5	13	101.251
																		368-1	102.24	0.827	73.5	20.6	101.413
																		375-1	102.4	0.974	73.5	21.2	101.426
																		375-2	102.57	0.981	73.5	28.8	101.589
																		367-3	102.71	1.067	73.5	31.3	101.643
																		375-3	102.57	0.809	73.5	36.8	101.761
																		367-2	102.71	0.896	73.5	39.3	101.814
																		367-1	102.71	0.733	73.5	46.9	101.977
																		376-1	103	1.012	73.5	47.4	101.988
																		376-2	103	0.841	73.5	55.4	102.159
																		376-3	103.37	1.054	73.5	62.7	102.316
																		376-4	103.37	0.883	73.5	70.7	102.487
MH_231	MH_103	100.722	99.002	525	87.0	2.0	0.013	103.750	102.350	2.810	0.61	0.26	0.4	-0.275	11:59	100.972	99.455	371-1	100.56	-0.412			
																		371-3	100.56	0.878	87.0	13	99.682
																		372-1	100.95	1.253	87.0	13.9	99.697
																		371-2	100.56	0.739	87.0	21	99.821
																		372-2	100.95	1.113	87.0	21.9	99.837
																		371-1	100.56	0.606	87.0	28.6	99.954
																		372-3	100.95	0.986	87.0	29.2	99.964

Table C-1B: Pipe Data and Hydraulic Simulation Results for the 100-Year, 24-Hour SCS Type II Storm

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		372-4	100.95	0.846	87.0	37.2	100.104
																		370-3	101.09	0.950	87.0	39.3	100.140
																		370-2	101.09	0.810	87.0	47.3	100.280
																		373-1	100.97	0.682	87.0	47.8	100.288
																		370-1	101.09	0.678	87.0	54.9	100.412
																		373-2	101.32	0.892	87.0	55.8	100.428
																		373-3	101.32	0.760	87.0	63.4	100.560
																		369-3	101.61	1.013	87.0	65.5	100.597
																		369-2	101.61	0.873	87.0	73.5	100.737
																		374-1	101.56	0.813	87.0	74.1	100.747
																		369-1	101.61	0.739	87.0	81.2	100.871
																		374-2	101.56	0.673	87.0	82.1	100.887
MH_302	MH_303	96.410	96.351	2250	59.0	0.1	0.013	101.140	101.080	1.658	6.59	7.46	1.1	-0.330	12:03	98.330	98.251	#N/A	#N/A	#N/A			
MH_303	MH_304	96.331	96.196	2250	134.5	0.1	0.013	101.080	100.730	1.658	6.59	7.92	1.2	-0.330	12:02	98.251	98.036	#N/A	#N/A	#N/A			
MH_304	MH_306TEE	96.176	96.133	2250	42.5	0.1	0.013	100.730	100.350	1.666	6.62	8.09	1.2	-0.390	12:03	98.036	97.763	#N/A	#N/A	#N/A			
MH_306TEE	MH_307	96.133	96.120	2250	13.0	0.1	0.013	100.350	100.350	2.128	28.73	8.24	0.3	-0.620	12:03	97.763	97.490	#N/A	#N/A	#N/A			
MH_313	MH_307	96.099	96.120	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.39	0.7	-0.970	12:03	97.379	97.490	#N/A	#N/A	#N/A			
MH_307	MH_400	96.100	96.076	2250	22.7	0.1	0.013	100.350	100.350	1.707	6.79	5.25	0.8	-0.860	12:03	97.490	97.447	#N/A	#N/A	#N/A			
MH_309	MH_310	97.139	97.113	1200	17.5	0.1	0.013	100.990	100.940	1.331	1.50	0.88	0.6	-0.370	12:12	97.969	97.843	#N/A	#N/A	#N/A			
MH_310	MH_311	97.053	96.959	1200	62.5	0.2	0.013	100.940	100.830	1.335	1.51	1.13	0.8	-0.410	12:09	97.843	97.759	#N/A	#N/A	#N/A			
MH_3	MH_109	99.346	99.306	600	10.0	0.4	0.013	102.650	102.650	1.373	0.39	0.23	0.6	-0.230	12:03	99.716	99.681	#N/A	#N/A	#N/A			
MH_3111TEE	MH_312	96.831	96.716	1200	76.5	0.2	0.013	100.640	100.450	1.335	1.51	1.24	0.8	-0.380	12:02	97.651	97.476	#N/A	#N/A	#N/A			
MH_311	MH_3111TEE	96.939	96.831	1200	72.0	0.2	0.013	100.830	100.640	1.335	1.51	1.22	0.8	-0.380	12:03	97.759	97.651	#N/A	#N/A	#N/A			
MH_312	MH_313	96.656	96.624	1200	21.5	0.1	0.013	100.450	100.350	1.331	1.50	1.25	0.8	-0.380	12:06	97.476	97.379	#N/A	#N/A	#N/A			
MH_313	MH_500	96.099	96.065	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.39	0.7	-0.970	12:03	97.379	97.326	#N/A	#N/A	#N/A			
MH_400	OGS_1	96.067	96.057	750	4.9	0.2	0.013	100.350	100.500	1.133	0.50	1.00	2.0	0.630	11:46	97.447	97.427	#N/A	#N/A	#N/A			
OGS_1	OGS_1-Out	96.037	96.027	750	4.9	0.2	0.013	100.500	100.350	1.138	0.50	1.00	2.0	0.640	11:46	97.427	97.215	#N/A	#N/A	#N/A			
OGS_1-Out	MH_401	96.015	96.000	2250	14.7	0.1	0.013	100.350	100.350	1.674	6.66	6.30	0.9	-1.050	12:03	97.215	96.930	#N/A	#N/A	#N/A			
MH_4	MH_104	98.554	98.516	525	9.5	0.4	0.013	101.580	101.590	1.256	0.27	0.20	0.7	0.175	12:11	99.254	99.185	#N/A	#N/A	#N/A			
MH_500	OGS_2	96.056	96.046	750	5.0	0.2	0.013	100.350	100.428	1.127	0.50	0.98	2.0	0.520	12:29	97.326	97.306	#N/A	#N/A	#N/A			
OGS_2	OGS_2-Out	96.026	96.016	750	5.1	0.2	0.013	100.428	100.350	1.118	0.49	0.98	2.0	0.530	12:29	97.306	97.134	#N/A	#N/A	#N/A			
OGS_2-Out	MH_501	96.004	96.000	2250	4.2	0.1	0.013	100.350	100.350	1.624	6.46	5.37	0.8	-1.120	12:03	97.134	96.880	#N/A	#N/A	#N/A			

[2] Conservative estimate of freeboard based on U/S HGL and lowest USF connected to pipe. Actual HGL / freeboard at all connecting lots interpolated where conservative estimate does not meet freeboard requirements.

[3] Future USF elevations estimated as 1.8 m below the upstream top of manhole elevations.

Legend colour	Meaning
Green	Interpolated HGL elevation
Yellow	Freebaord Less than 0.3m
Red	Freebaord Less than 0.0m

Table C-1C: Pipe Data and Hydraulic Simulation Results for the July 1st, 1979 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_401	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	5.15	0.3	-1.060	01:34	97.190	96.730	#N/A	#N/A	#N/A			
MH_501	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	4.55	0.3	-1.060	01:47	97.190	96.730	#N/A	#N/A	#N/A			
MH_1002	MH_1003	94.150	93.982	900	28.0	0.6	0.013	98.370	98.040	2.204	1.40	1.35	1.0	0.210	02:29	95.260	94.632	#N/A	#N/A	#N/A			
MH_1003	MH_1004	93.922	93.271	900	108.5	0.6	0.013	98.040	96.170	3.188	17.21	1.35	0.1	-0.190	02:29	94.632	93.366	#N/A	#N/A	#N/A			
MH_1004	MH_1005	92.586	92.162	975	106.0	0.4	0.013	96.170	95.150	1.898	1.42	1.35	1.0	-0.195	02:30	93.366	92.993	#N/A	#N/A	#N/A			
MH_1005	MH_1006	91.933	91.721	1200	106.0	0.2	0.013	95.150	94.970	1.542	1.74	1.35	0.8	-0.140	02:31	92.993	92.891	#N/A	#N/A	#N/A			
MH_1006	MH_1007	91.701	91.489	1200	106.0	0.2	0.013	94.970	94.270	1.542	1.74	1.35	0.8	-0.010	02:32	92.891	92.760	#N/A	#N/A	#N/A			
MH_1007	MH_1008	91.470	91.230	1200	88.0	0.3	0.013	94.270	93.460	1.801	2.04	1.56	0.8	0.090	00:00	92.760	92.590	#N/A	#N/A	#N/A			
MH_1008	MH_1009	91.230	91.200	1200	14.5	0.2	0.013	93.460	#N/A	1.568	1.77	1.58	0.9	0.160	00:01	92.590	92.500	#N/A	#N/A	#N/A			
MH_101	MH_102	100.935	100.142	300	30.5	2.6	0.013	103.750	103.240	2.206	0.16	0.00	0.0	-0.300	00:00	100.935	100.177	174-2	101.41	0.475			
MH_102	MH_103	99.917	99.002	525	59.0	1.6	0.013	103.240	102.350	2.474	0.54	0.26	0.5	-0.265	01:31	100.177	99.295	172-5	100.47	0.293			
																		172-5	100.47	1.072	59.0	6.9	99.398
																		173-1	100.78	1.214	59.0	18.1	99.566
																		173-2	100.78	1.095	59.0	26.1	99.685
																		173-3	101.1	1.307	59.0	33.3	99.793
																		173-4	101.1	1.188	59.0	41.3	99.912
																		173-5	101.1	1.074	59.0	48.9	100.026
																		174-1	101.41	1.273	59.0	56.3	100.137
MH_103	MH_104	98.755	98.516	750	120.0	0.4	0.013	102.350	101.590	1.594	0.70	0.54	0.8	-0.210	01:31	99.295	99.095	169-2	99.81	0.515			
																		169-2	99.81	0.711	120.0	2.7	99.100
																		169-3	99.81	0.698	120.0	10	99.112
																		169-4	99.81	0.685	120.0	18	99.125
																		170-1	99.93	0.787	120.0	28.6	99.143
																		170-2	99.93	0.774	120.0	36.6	99.156
																		170-3	99.93	0.761	120.0	44.2	99.169
																		171-1	99.99	0.804	120.0	54.9	99.187
																		171-2	99.99	0.790	120.0	62.9	99.200
																		171-3	99.99	0.778	120.0	70.1	99.212
																		171-4	99.99	0.765	120.0	78.1	99.225
																		172-1	100.47	1.215	120.0	96.1	99.255
																		172-2	100.47	1.202	120.0	104.1	99.269
																		172-3	100.47	1.190	120.0	111.3	99.281
																		172-4	100.47	1.180	120.0	117	99.290
MH_104	MH_106	97.975	97.913	1050	41.5	0.1	0.013	101.590	101.840	1.217	1.05	0.88	0.8	0.070	01:31	99.095	98.995	169-1	99.81	0.715			
MH_105	MH_106	99.562	97.913	675	91.0	1.4	0.013	103.170	101.840	4.109	16.64	0.71	0.0	-0.255	01:31	99.982	98.995	148	100.03	0.048			
																		148	100.03	0.898	91.0	12.6	99.132
																		147	100.16	0.896	91.0	24.8	99.264
																		146	100.3	0.925	91.0	35	99.375
																		145	100.42	0.924	91.0	46.2	99.496
																		144	100.56	0.910	91.0	60.4	99.650
																		143	100.93	1.130	91.0	74.2	99.800
																		142	101.5	1.541	91.0	88.9	99.959
MH_106	MH_116	97.605	97.360	1350	122.5	0.2	0.013	101.840	101.580	1.668	2.39	1.68	0.7	0.040	01:32	98.995	98.780	166-1	99.53	0.535			
MH_107	MH_108	99.165	99.080	300	74.0	0.4	0.013	101.895	101.880	0.809	0.06	0.02	0.4	-0.155	01:36	99.310	99.338	176-1	100.1	0.790			
MH_107	MH_112	99.165	98.906	300	74.0	0.4	0.013	101.895	101.695	0.809	0.06	0.02	0.4	-0.155	01:36	99.310	99.271	185-1	99.89	0.580			
MH_108	MH_110	98.908	98.800	450	54.0	0.2	0.013	101.880	101.980	0.802	0.13	0.09	0.7	-0.020	01:47	99.338	99.306	175-1	100.15	0.812			
MH_109	MH_110	99.151	98.800	750	60.0	0.7	0.013	102.650	101.980	2.108	0.93	0.75	0.8	-0.240	01:30	99.661	99.306	164-2	100.01	0.349			
																		164-2	100.01	0.697	60.0	1.2	99.313
																		164-3	100.25	0.904	60.0	6.7	99.346
																		164-4	100.25	0.857	60.0	14.7	99.393
																		165-1	100.42	0.964	60.0	25.3	99.456
																		165-2	100.93	1.429	60.0	32.9	99.501
																		165-3	100.93	1.382	60.0	40.9	99.548
MH_110	MH_111	98.346	98.046	900	75.0	0.4	0.013	101.980	101.770	1.800	1.14	0.98	0.9	0.060	01:27	99.306	99.095	162-1	99.69	0.384			
																		188-4	99.86	0.759	75.0	2	99.101
																		162-1	99.69	0.577	75.0	6.3	99.113
																		188-3	99.86	0.739	75.0	9.2	99.121

Table C-1C: Pipe Data and Hydraulic Simulation Results for the July 1st, 1979 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		162-2	99.69	0.555	75.0	14.3	99.135
																		188-2	99.86	0.717	75.0	17.2	99.143
																		162-3	99.69	0.534	75.0	21.6	99.156
																		188-1	99.86	0.695	75.0	24.8	99.165
																		162-4	99.69	0.506	75.0	31.6	99.184
																		187-4	99.86	0.665	75.0	35.5	99.195
																		163-1	99.77	0.562	75.0	40.2	99.208
																		187-3	99.86	0.643	75.0	43.5	99.217
																		163-2	99.77	0.541	75.0	47.8	99.229
																		187-2	99.86	0.622	75.0	50.7	99.238
																		163-3	99.77	0.518	75.0	55.8	99.252
																		187-1	99.86	0.600	75.0	58.7	99.260
																		164-1	100.01	0.728	75.0	66.5	99.282
MH_111	MH_115	97.925	97.743	975	91.0	0.2	0.013	101.770	101.450	1.342	1.00	0.98	1.0	0.195	01:30	99.095	98.926	159-1	99.58	0.485			
MH_112	MH_113	98.756	98.609	450	73.5	0.2	0.013	101.695	101.525	0.802	0.13	0.14	1.1	0.065	01:36	99.271	99.084	183-1	99.74	0.469			
MH_113	MH_114	98.549	98.523	450	13.0	0.2	0.013	101.525	101.520	0.802	0.13	0.16	1.2	0.085	01:36	99.084	99.026	181-1	99.85	0.766			
MH_1	MH_133	97.607	97.569	1500	19.0	0.2	0.013	101.660	101.660	1.789	3.16	1.80	0.6	-0.360	01:47	98.747	98.589	Est. Fut	99.86	1.113			
MH_114	MH_115	98.296	97.743	675	54.0	0.4	0.013	101.520	101.450	1.486	0.53	0.28	0.5	0.055	01:46	99.026	98.926	182-1	99.58	0.554			
MH_115	MH_116	97.656	97.360	1050	59.0	0.5	0.013	101.450	101.580	2.230	1.93	1.33	0.7	0.220	01:35	98.926	98.780	157-1	99.46	0.534			
MH_116	MH_117	97.060	96.937	1650	122.5	0.1	0.013	101.580	101.370	1.348	2.88	3.13	1.1	0.070	01:34	98.780	98.637	30	99.32	0.540			
MH_117	MH_118	96.917	96.796	1650	121.0	0.1	0.013	101.370	101.290	1.348	2.88	3.26	1.1	0.070	01:34	98.637	98.475	20	99.11	0.473			
																		18	99.18	0.699	121.0	4.4	98.481
																		2	99.16	0.675	121.0	7.7	98.485
																		406	99.18	0.683	121.0	16.1	98.497
																		404	99.18	0.678	121.0	20.3	98.502
																		407	99.16	0.651	121.0	25.7	98.509
																		405	99.18	0.664	121.0	30.5	98.516
																		19	99.16	0.634	121.0	37.9	98.526
																		3	99.14	0.611	121.0	40.7	98.529
																		20	99.11	0.571	121.0	48.1	98.539
																		4	99.14	0.596	121.0	51.2	98.544
																		21	99.12	0.566	121.0	59.3	98.554
																		5	99.22	0.662	121.0	62.1	98.558
																		22	99.21	0.639	121.0	71.5	98.571
																		6	99.23	0.657	121.0	73.3	98.573
																		23	99.22	0.634	121.0	82.9	98.586
																		7	99.24	0.647	121.0	87.8	98.593
																		24	99.28	0.675	121.0	97.3	98.605
																		8	99.31	0.697	121.0	102.8	98.613
																		25	99.36	0.734	121.0	113.1	98.626
																		9	99.4	0.767	121.0	118.2	98.633
MH_118	MH_136	96.645	96.634	1950	11.0	0.1	0.013	101.290	101.190	1.507	4.50	3.26	0.7	-0.120	01:37	98.475	98.374	#N/A	#N/A	#N/A			
MH_119	MH_120	99.144	98.938	900	103.0	0.2	0.013	103.010	102.570	1.273	0.81	0.95	1.2	-0.040	01:33	100.004	99.628	101	100.65	0.646			
MH_119	MH_122	99.144	99.693	900	103.0	0.2	0.013	103.010	102.490	1.840	9.94	0.95	0.1	-0.040	01:33	100.004	99.693	#N/A	#N/A	#N/A			
MH_120	MH_121	98.878	98.850	900	14.0	0.2	0.013	102.570	102.480	1.273	0.81	1.00	1.2	-0.150	01:33	99.628	99.270	116	101.03	1.402			
MH_121	MH_132	98.790	97.536	900	114.0	1.1	0.013	102.480	101.320	2.985	1.90	1.07	0.6	-0.420	01:33	99.270	98.508	106	99.54	0.270			
																		106	99.54	0.984	114.0	7.2	98.556
																		107	99.71	1.072	114.0	19.4	98.638
																		108	99.88	1.167	114.0	30.6	98.713
																		109	100.05	1.269	114.0	40.8	98.781
																		110	100.15	1.285	114.0	53.4	98.865
																		111	100.32	1.379	114.0	64.8	98.941
																		112	100.48	1.457	114.0	77	99.023
																		113	100.57	1.472	114.0	88.2	99.098
																		114	100.57	1.404	114.0	98.4	99.166
																		115	100.65	1.415	114.0	108.8	99.235
MH_122	MH_123	99.663	99.461	300	13.0	1.6	0.013	102.490	102.270	1.705	0.12	0.00	0.0	-0.300	00:00	99.663	99.497	131	100.61	0.947			

Table C-1C: Pipe Data and Hydraulic Simulation Results for the July 1st, 1979 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_123	MH_127	99.407	98.615	300	49.5	1.6	0.013	102.270	101.675	1.730	0.12	0.02	0.2	-0.210	01:33	99.497	99.002	135	99.89	0.393			
MH_124	MH_125	99.069	98.715	375	101.0	0.4	0.013	102.060	101.870	1.421	2.66	0.07	0.0	-0.115	01:42	99.329	99.201	72	99.77	0.441			
																		82	99.89	0.682	101.0	5.4	99.208
																		69	99.84	0.628	101.0	8.4	99.212
																		70	99.78	0.555	101.0	18.6	99.225
																		81	99.89	0.664	101.0	19.6	99.226
																		71	99.78	0.541	101.0	29.7	99.239
																		80	99.92	0.680	101.0	31	99.240
																		72	99.77	0.518	101.0	39.9	99.252
																		79	100.04	0.780	101.0	46.9	99.260
																		73	99.82	0.554	101.0	51.1	99.266
																		78	100.04	0.770	101.0	54.4	99.270
																		74	99.88	0.601	101.0	61.3	99.279
																		77	100	0.717	101.0	64.6	99.283
																		413	99.93	0.636	101.0	73.4	99.294
																		415	100.08	0.784	101.0	75.2	99.296
																		412	99.98	0.675	101.0	82.3	99.305
																		414	100.1	0.790	101.0	86.4	99.310
																		75	99.98	0.660	101.0	94	99.320
																		76	100.16	0.835	101.0	98.1	99.325
MH_125	MH_127	98.481	98.615	600	91.5	0.3	0.013	101.870	101.675	1.618	5.82	0.28	0.0	0.120	01:43	99.201	99.002	65	99.58	0.379			
																		88	99.82	0.783	91.5	16	99.037
																		63	99.59	0.552	91.5	16.6	99.038
																		87	99.82	0.753	91.5	29.7	99.067
																		64	99.59	0.522	91.5	30.3	99.068
																		86	99.65	0.559	91.5	41.1	99.091
																		65	99.58	0.483	91.5	43.9	99.097
																		85	99.74	0.617	91.5	55.5	99.123
																		66	99.69	0.561	91.5	58.6	99.129
																		84	99.76	0.603	91.5	71.3	99.157
																		67	99.78	0.616	91.5	74.4	99.164
																		83	99.89	0.702	91.5	85.7	99.188
																		68	99.84	0.645	91.5	88.8	99.195
MH_126	MH_127	98.697	98.615	300	28.5	0.4	0.013	101.500	101.675	0.865	0.06	0.16	2.5	1.050	01:36	100.047	99.002	#N/A	#N/A	#N/A			
MH_127	MH_128	98.102	97.994	750	54.0	0.2	0.013	101.675	101.395	1.654	7.44	0.42	0.1	0.150	01:39	99.002	98.894	47	99.56	0.558			
MH_128	MH_129	97.964	97.923	750	13.5	0.3	0.013	101.395	101.315	1.389	0.61	0.42	0.7	0.180	01:39	98.894	98.858	45	99.49	0.596			
MH_129	MH_130	97.848	97.732	825	77.0	0.2	0.013	101.315	101.420	1.496	6.17	0.54	0.1	0.185	01:39	98.858	98.752	43	99.41	0.552			
MH_130	MH_131	97.732	97.581	825	100.5	0.2	0.013	101.420	101.200	1.040	0.56	0.66	1.2	0.195	01:39	98.752	98.536	33	99.18	0.428			
MH_1302	MH_302	97.470	96.430	600	98.5	0.2	0.013	101.160	101.140	0.971	0.27	0.16	0.6	0.320	02:07	98.390	98.310	Est. Fut	99.36	0.970			
MH_1303	MH_303	97.245	96.351	750	109.0	0.2	0.013	101.090	101.080	0.976	0.43	0.35	0.8	0.380	02:07	98.375	98.241	Est. Fut	99.29	0.915			
MH_1304	MH_304	97.175	96.196	600	87.0	0.2	0.013	100.660	100.730	0.971	0.27	0.18	0.6	0.360	02:09	98.135	98.036	Est. Fut	98.86	0.725			
MH_131	MH_132	97.206	97.536	1200	12.0	0.2	0.013	101.200	101.320	1.335	1.51	0.66	0.4	0.130	01:39	98.536	98.508	#N/A	#N/A	#N/A			
MH_1312	MH_310	97.627	97.113	750	62.0	0.2	0.013	100.940	100.940	1.127	0.50	0.18	0.4	-0.440	01:50	97.937	97.853	Est. Fut	99.14	1.203			
MH_132	MH_136	97.128	96.634	1200	59.5	0.2	0.013	101.320	101.190	1.542	1.74	1.84	1.1	0.180	01:32	98.508	98.374	103	99.33	0.822			
MH_133	MH_134	97.509	97.393	1500	77.0	0.2	0.013	101.660	101.550	2.126	19.14	1.87	0.1	-0.420	01:46	98.589	98.523	#N/A	#N/A	#N/A			
MH_134	MH_135	97.363	97.271	1500	61.0	0.2	0.013	101.550	101.440	1.554	2.75	1.93	0.7	-0.340	01:46	98.523	98.461	#N/A	#N/A	#N/A			
MH_135	MH_136	97.121	96.634	1650	37.0	0.1	0.013	101.440	101.190	1.348	2.88	1.94	0.7	-0.310	01:45	98.461	98.374	#N/A	#N/A	#N/A			
MH_136	MH_302	96.484	96.430	2250	54.0	0.1	0.013	101.190	101.140	1.658	6.59	7.01	1.1	-0.360	01:37	98.374	98.310	1	99.38	1.006			
MH_201	MH_202	105.214	104.138	375	119.5	0.9	0.013	108.120	107.180	1.506	0.17	0.08	0.5	-0.195	01:30	105.394	104.373	321	105.28	-0.114			
																		321	105.28	0.834	119.5	8.5	104.446
																		430	107.31	2.846	119.5	10.6	104.464
																		431	107.37	2.858	119.5	16.3	104.512
																		428	105.36	0.797	119.5	22.2	104.563
																		233	107.4	2.775	119.5	29.5	104.625
																		429	105.37	0.728	119.5	31.5	104.642
																		234	107.46	2.786	119.5	35.2	104.674
																		320	105.45	0.704	119.5	43.7	104.746

Table C-1C: Pipe Data and Hydraulic Simulation Results for the July 1st, 1979 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S (1) (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (2) (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		235	107.5	2.719	119.5	47.7	104.781
																		319	105.56	0.719	119.5	54.8	104.841
																		236	107.62	2.778	119.5	54.9	104.842
																		318	105.66	0.732	119.5	65	104.928
																		237	107.69	2.742	119.5	67.3	104.948
																		238	107.8	2.803	119.5	73	104.997
																		317	105.77	0.746	119.5	76.2	105.024
																		239	107.87	2.761	119.5	86.2	105.109
																		316	105.9	0.772	119.5	88.4	105.128
																		240	107.99	2.832	119.5	91.9	105.158
																		315	106.02	0.794	119.5	99.8	105.226
																		241	108.06	2.789	119.5	105.1	105.271
																		242	108.16	2.840	119.5	110.8	105.320
																		314	106.13	0.783	119.5	114	105.347
MH_202	MH_203	104.063	104.035	450	14.0	0.2	0.013	107.180	107.090	0.802	0.13	0.11	0.9	-0.140	01:30	104.373	104.295	230	105.39	1.017			
MH_203	MH_206	103.975	103.730	450	54.5	0.5	0.013	107.090	106.720	1.203	0.19	0.17	0.9	-0.130	01:31	104.295	103.730	225	104.9	0.605			
MH_204	MH_205	103.579	103.343	525	118.0	0.2	0.013	106.620	106.610	0.888	0.19	0.14	0.7	-0.175	01:37	103.929	103.823	285	104.64	0.711			
MH_205	MH_206	103.313	103.730	525	16.0	0.2	0.013	106.610	106.720	0.888	0.19	0.20	1.1	-0.015	01:36	103.823	103.730	#N/A	#N/A	#N/A			
MH_206	MH_207	103.197	102.999	600	49.5	0.4	0.013	106.720	106.460	1.373	0.39	0.39	1.0	-0.090	01:31	103.707	103.309	221	104.52	0.813			
MH_207	MH_208	102.969	102.731	600	12.5	1.9	0.013	106.460	106.320	2.997	0.85	0.39	0.5	-0.260	01:31	103.309	102.981	219	104.39	1.081			
MH_208	MH_215	102.671	100.543	600	112.0	1.9	0.013	106.320	104.150	2.993	0.85	0.44	0.5	-0.290	01:32	102.981	101.133	212	102.46	-0.521			
																		271	102.46	1.180	112.0	8.9	101.280
																		212	102.46	1.117	112.0	12.7	101.343
																		270	102.67	1.156	112.0	23.1	101.514
																		213	102.68	1.138	112.0	24.8	101.542
																		214	102.89	1.180	112.0	35	101.711
																		269	102.93	1.205	112.0	35.9	101.725
																		215	103.1	1.205	112.0	46.2	101.895
																		268	103.18	1.267	112.0	47.3	101.913
																		216	103.36	1.263	112.0	58.4	102.097
																		267	103.42	1.305	112.0	59.5	102.115
																		217	103.62	1.335	112.0	69.8	102.285
																		266	103.68	1.380	112.0	70.7	102.300
																		423	103.94	1.472	112.0	80.9	102.468
																		421	103.83	1.344	112.0	82	102.486
																		422	104.04	1.389	112.0	92	102.651
																		420	104.04	1.371	112.0	93.1	102.669
																		265	104.35	1.506	112.0	103.7	102.844
																		218	104.3	1.425	112.0	105.6	102.875
MH_209	MH_201	105.833	105.316	300	94.0	0.6	0.013	108.630	108.120	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.394	313	106.24	0.407			
MH_209	MH_210	105.833	105.518	300	94.0	0.6	0.013	108.630	108.320	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.586	254	108.31	2.477			
MH_210	MH_212	105.486	103.434	300	54.0	3.8	0.013	108.320	107.010	2.668	0.19	0.05	0.3	-0.200	01:30	105.586	103.569	258	105.12	-0.466			
																		258	105.12	0.965	54.0	15.7	104.155
																		257	105.54	0.948	54.0	27.4	104.592
																		256	106.05	1.035	54.0	38.7	105.015
																		255	106.58	1.188	54.0	48.8	105.392
MH_211	MH_212	103.900	103.434	300	26.5	0.4	0.013	106.090	107.010	0.810	0.06	0.02	0.3	-0.160	01:30	104.040	103.569	#N/A	#N/A	#N/A			
MH_212	MH_204	103.359	103.804	375	49.5	0.5	0.013	107.010	106.620	1.066	0.12	0.07	0.6	-0.165	01:31	103.569	103.929	284	104.71	1.141			
MH_212	MH_213	103.359	103.136	375	49.5	0.5	0.013	107.010	106.020	1.066	0.12	0.07	0.6	-0.165	01:31	103.569	103.233	203	104.1	0.531			
MH_213	MH_214	103.053	102.918	375	13.5	1.0	0.013	106.020	105.800	1.587	0.18	0.07	0.4	-0.195	01:31	103.233	103.053	204	104.02	0.787			
MH_214	MH_215	102.883	100.543	375	90.0	2.4	0.013	105.800	104.150	2.434	0.27	0.10	0.4	-0.205	01:30	103.053	101.133	272	102.37	-0.683			
																		272	102.37	1.079	90.0	7.4	101.291
																		211	102.46	0.990	90.0	15.8	101.470
																		273	102.59	0.996	90.0	21.6	101.594
																		210	102.68	0.950	90.0	28	101.730
																		274	102.86	0.942	90.0	36.8	101.918
																		209	102.89	0.942	90.0	38.2	101.948

Table C-1C: Pipe Data and Hydraulic Simulation Results for the July 1st, 1979 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S (1) (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (2) (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		275	103.11	0.949	90.0	48.2	102.161
																		208	103.15	0.963	90.0	49.4	102.187
																		276	103.37	0.948	90.0	60.4	102.422
																		207	103.4	0.910	90.0	63.6	102.490
																		277	103.55	0.968	90.0	67.9	102.582
																		206	103.66	0.927	90.0	75	102.733
																		278	103.55	0.631	90.0	83.7	102.919
																		205	103.83	0.873	90.0	85.5	102.957
MH_215	MH_119	100.303	99.423	675	55.0	1.6	0.013	104.150	103.010	2.971	1.06	0.91	0.9	0.155	01:32	101.133	100.004	#N/A	#N/A	#N/A			
MH_216	MH_217	105.251	104.798	375	75.5	0.6	0.013	108.100	107.980	1.230	0.14	0.11	0.8	-0.115	01:40	105.511	105.073	346	105.85	0.339			
MH_217	MH_218	104.573	104.347	600	113.0	0.2	0.013	107.980	107.690	0.971	0.27	0.26	0.9	-0.100	01:43	105.073	104.907	356	105.71	0.637			
MH_218	MH_220	104.327	104.166	600	80.5	0.2	0.013	107.690	107.790	0.971	0.27	0.29	1.1	-0.020	01:31	104.907	104.166	357	105.75	0.843			
MH_219	MH_220	105.649	104.166	300	25.0	2.7	0.013	108.450	107.790	2.228	0.16	0.00	0.0	-0.300	00:00	105.649	104.166	#N/A	#N/A	#N/A			
MH_220	MH_224	103.644	102.523	600	59.0	1.9	0.013	107.790	105.620	2.993	0.85	0.29	0.3	-0.360	01:31	103.884	102.523	259	104.74	0.856			
MH_221	MH_222	103.008	102.620	300	77.5	0.5	0.013	105.960	105.420	0.968	0.07	0.01	0.1	-0.240	01:30	103.068	102.801	396-1	103.56	0.492			
MH_222	MH_223	102.311	102.168	600	95.5	0.2	0.013	105.420	105.450	0.841	0.24	0.22	0.9	-0.110	01:40	102.801	102.698	366-1	103.37	0.569			
MH_2	MH_2260	101.916	101.876	675	10.0	0.4	0.013	105.290	105.290	1.486	0.53	0.38	0.7	-0.085	01:20	102.506	102.116	Est. Fut	103.49	0.984			
MH_223	MH_224	102.148	102.523	600	97.0	0.2	0.013	105.450	105.620	0.971	0.27	0.27	1.0	-0.050	01:41	102.698	102.523	365-1	103.42	0.722			
MH_224	MH_105	101.625	100.067	600	82.0	1.9	0.013	105.620	103.170	2.993	0.85	0.64	0.8	-0.210	01:31	102.015	100.067	141	101.9	-0.115			
																		141	101.9	1.562	82.0	11.4	100.338
																		140	102.18	1.505	82.0	25.6	100.675
																		139	102.55	1.606	82.0	36.9	100.944
																		138	102.92	1.734	82.0	47.1	101.186
																		137	103.3	1.850	82.0	58.2	101.450
																		136	103.81	2.037	82.0	71.8	101.773
MH_225	MH_226	103.412	102.914	300	99.5	0.5	0.013	106.390	105.720	0.968	0.07	0.03	0.4	-0.170	01:30	103.542	103.023	388-3	103.75	0.208			
																		389-2	103.75	0.697	99.5	5.8	103.053
																		389-1	103.75	0.640	82.0	13.8	103.110
																		388-3	103.75	0.573	82.0	24.4	103.177
																		388-2	103.88	0.654	82.0	32.1	103.226
																		388-1	103.88	0.603	82.0	40.1	103.277
																		387-4	104.02	0.676	82.0	50.7	103.344
																		387-3	104.02	0.625	82.0	58.7	103.395
																		387-2	104.02	0.580	82.0	65.9	103.440
																		387-1	104.02	0.529	82.0	73.9	103.491
MH_2260	MH_227	101.816	101.049	675	49.5	1.6	0.013	105.290	104.230	2.925	1.05	0.44	0.4	-0.375	01:30	102.116	101.099	392-1	102.46	0.344			
MH_226	MH_2260	102.863	101.876	300	64.0	1.1	0.013	105.720	105.290	1.402	0.10	0.05	0.5	-0.140	01:30	103.023	102.116	391-3	103.08	0.057			
																		391-3	103.08	0.931	64.0	2.3	102.149
																		391-2	103.45	1.198	64.0	9.6	102.252
																		391-1	103.45	1.085	64.0	17.6	102.365
																		390-3	103.58	1.064	64.0	28.2	102.516
																		390-2	103.58	0.951	64.0	36.2	102.629
																		390-1	103.58	0.843	64.0	43.8	102.737
																		389-4	103.75	0.862	64.0	54.5	102.888
																		389-3	103.75	0.748	64.0	62.5	103.002
MH_227	MH_109	100.759	99.306	675	93.0	1.6	0.013	104.230	102.650	2.971	1.06	0.48	0.5	-0.335	01:30	101.099	99.661	394-3	100.86	-0.239			
																		394-4	100.86	0.902	93.0	19.2	99.958
																		394-3	100.86	0.778	93.0	27.2	100.082
																		394-2	101.26	1.066	93.0	34.5	100.194
																		394-1	101.26	0.942	93.0	42.5	100.318
																		393-3	101.49	0.992	93.0	54.1	100.498
																		393-2	101.81	1.195	93.0	61.7	100.615
																		393-1	101.81	1.071	93.0	69.7	100.739
																		392-4	102.21	1.290	93.0	81.4	100.920
																		392-3	102.21	1.167	93.0	89.4	101.043
MH_228	MH_229	102.472	100.982	300	74.5	2.0	0.013	105.270	103.790	1.935	0.14	0.05	0.4	-0.170	01:30	102.602	101.053	384-3	102.12	-0.482			
																		384-3	102.12	1.017	74.5	2.4	101.103

Table C-1C: Pipe Data and Hydraulic Simulation Results for the July 1st, 1979 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
																		379-2	102.14	1.016	74.5	3.4	101.124
																		384-4	102.12	0.851	74.5	10.4	101.269
																		379-1	102.14	0.850	74.5	11.4	101.290
																		385-1	102.35	0.860	74.5	21	101.490
																		378-3	102.57	1.060	74.5	22	101.510
																		385-2	102.65	1.002	74.5	28.6	101.648
																		378-2	102.67	0.999	74.5	29.7	101.671
																		385-3	102.65	0.836	74.5	36.6	101.814
																		378-1	102.67	0.833	74.5	37.7	101.837
																		386-1	102.73	0.694	74.5	47.3	102.036
																		377-4	103.02	0.963	74.5	48.3	102.057
																		386-2	103.08	0.877	74.5	55.3	102.203
																		377-3	103.28	1.056	74.5	56.3	102.224
																		377-2	103.34	0.967	74.5	63.5	102.373
																		377-1	103.34	0.800	74.5	71.5	102.540
MH_229	MH_102	100.723	100.142	525	86.5	0.9	0.013	103.790	103.240	1.832	0.40	0.24	0.6	-0.195	01:30	101.053	100.177	381-1	101.35	0.297			
																		382-1	101.52	1.204	86.5	13.7	100.316
																		381-4	101.35	1.024	86.5	14.7	100.326
																		382-2	101.52	1.123	86.5	21.7	100.397
																		381-3	101.35	0.943	86.5	22.7	100.407
																		382-3	101.52	1.050	86.5	28.9	100.470
																		381-2	101.35	0.869	86.5	30	100.481
																		382-4	101.52	0.969	86.5	36.9	100.551
																		381-1	101.35	0.788	86.5	38	100.562
																		383-1	101.62	0.961	86.5	47.6	100.659
																		380-3	101.59	0.921	86.5	48.6	100.669
																		383-2	101.62	0.880	86.5	55.6	100.740
																		380-2	101.59	0.840	86.5	56.6	100.750
																		383-3	101.62	0.803	86.5	63.2	100.817
																		380-1	101.59	0.763	86.5	64.2	100.827
																		384-1	101.95	1.026	86.5	73.8	100.924
																		379-4	101.96	1.024	86.5	74.9	100.936
																		384-2	101.95	0.945	86.5	81.8	101.005
																		379-3	101.96	0.943	86.5	82.9	101.017
MH_230	MH_231	102.417	100.947	300	73.5	2.0	0.013	105.220	103.750	1.935	0.14	0.04	0.3	-0.190	01:30	102.527	100.962	374-3	102.03	-0.497			
																		374-3	102.03	1.015	73.5	2.5	101.015
																		368-3	102.24	1.172	73.5	5	101.068
																		374-4	102.03	0.844	73.5	10.5	101.186
																		368-2	102.24	1.001	73.5	13	101.239
																		368-1	102.24	0.839	73.5	20.6	101.401
																		375-1	102.4	0.987	73.5	21.2	101.413
																		375-2	102.57	0.995	73.5	28.8	101.575
																		367-3	102.71	1.082	73.5	31.3	101.628
																		375-3	102.57	0.824	73.5	36.8	101.746
																		367-2	102.71	0.911	73.5	39.3	101.799
																		367-1	102.71	0.749	73.5	46.9	101.961
																		376-1	103	1.029	73.5	47.4	101.971
																		376-2	103	0.858	73.5	55.4	102.142
																		376-3	103.37	1.073	73.5	62.7	102.297
																		376-4	103.37	0.903	73.5	70.7	102.467
MH_231	MH_103	100.722	99.002	525	87.0	2.0	0.013	103.750	102.350	2.810	0.61	0.24	0.4	-0.285	01:30	100.962	99.295	371-1	100.56	-0.402			
																		371-3	100.56	1.016	87.0	13	99.544
																		372-1	100.95	1.389	87.0	13.9	99.561
																		371-2	100.56	0.863	87.0	21	99.697
																		372-2	100.95	1.235	87.0	21.9	99.715
																		371-1	100.56	0.717	87.0	28.6	99.843
																		372-3	100.95	1.096	87.0	29.2	99.854

Table C-1C: Pipe Data and Hydraulic Simulation Results for the July 1st, 1979 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL		
																					Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
																		372-4	100.95	0.942	87.0	37.2	100.008
																		370-3	101.09	1.042	87.0	39.3	100.048
																		370-2	101.09	0.889	87.0	47.3	100.201
																		373-1	100.97	0.759	87.0	47.8	100.211
																		370-1	101.09	0.743	87.0	54.9	100.347
																		373-2	101.32	0.956	87.0	55.8	100.364
																		373-3	101.32	0.810	87.0	63.4	100.510
																		369-3	101.61	1.060	87.0	65.5	100.550
																		369-2	101.61	0.907	87.0	73.5	100.703
																		374-1	101.56	0.845	87.0	74.1	100.715
																		369-1	101.61	0.759	87.0	81.2	100.851
																		374-2	101.56	0.692	87.0	82.1	100.868
MH_302	MH_303	96.410	96.351	2250	59.0	0.1	0.013	101.140	101.080	1.658	6.59	7.20	1.1	-0.350	01:36	98.310	98.241	#N/A	#N/A	#N/A			
MH_303	MH_304	96.331	96.196	2250	134.5	0.1	0.013	101.080	100.730	1.658	6.59	7.63	1.2	-0.340	01:38	98.241	98.036	#N/A	#N/A	#N/A			
MH_304	MH_306TEE	96.176	96.133	2250	42.5	0.1	0.013	100.730	100.350	1.666	6.62	7.84	1.2	-0.390	01:37	98.036	97.783	#N/A	#N/A	#N/A			
MH_306TEE	MH_307	96.133	96.120	2250	13.0	0.1	0.013	100.350	100.350	2.128	28.73	7.99	0.3	-0.600	01:39	97.783	97.540	#N/A	#N/A	#N/A			
MH_313	MH_307	96.099	96.120	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.31	0.6	-0.920	01:38	97.429	97.540	#N/A	#N/A	#N/A			
MH_307	MH_400	96.100	96.076	2250	22.7	0.1	0.013	100.350	100.350	1.707	6.79	5.13	0.8	-0.810	01:37	97.540	97.517	#N/A	#N/A	#N/A			
MH_309	MH_310	97.139	97.113	1200	17.5	0.1	0.013	100.990	100.940	1.331	1.50	0.88	0.6	-0.370	01:49	97.969	97.853	#N/A	#N/A	#N/A			
MH_310	MH_311	97.053	96.959	1200	62.5	0.2	0.013	100.940	100.830	1.335	1.51	1.12	0.7	-0.400	01:42	97.853	97.769	#N/A	#N/A	#N/A			
MH_3	MH_109	99.346	99.306	600	10.0	0.4	0.013	102.650	102.650	1.373	0.39	0.23	0.6	-0.250	01:44	99.696	99.661	#N/A	#N/A	#N/A			
MH_3111TEE	MH_312	96.831	96.716	1200	76.5	0.2	0.013	100.640	100.450	1.335	1.51	1.24	0.8	-0.370	01:38	97.661	97.516	#N/A	#N/A	#N/A			
MH_311	MH_3111TEE	96.939	96.831	1200	72.0	0.2	0.013	100.830	100.640	1.335	1.51	1.22	0.8	-0.370	01:40	97.769	97.661	#N/A	#N/A	#N/A			
MH_312	MH_313	96.656	96.624	1200	21.5	0.1	0.013	100.450	100.350	1.331	1.50	1.25	0.8	-0.340	01:38	97.516	97.429	#N/A	#N/A	#N/A			
MH_313	MH_500	96.099	96.065	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.31	0.6	-0.920	01:38	97.429	97.396	#N/A	#N/A	#N/A			
MH_400	OGS_1	96.067	96.057	750	4.9	0.2	0.013	100.350	100.500	1.133	0.50	0.99	2.0	0.700	01:10	97.517	97.507	#N/A	#N/A	#N/A			
OGS_1	OGS_1-Out	96.037	96.027	750	4.9	0.2	0.013	100.500	100.350	1.138	0.50	0.99	2.0	0.720	01:10	97.507	97.275	#N/A	#N/A	#N/A			
OGS_1-Out	MH_401	96.015	96.000	2250	14.7	0.1	0.013	100.350	100.350	1.674	6.66	6.10	0.9	-0.990	01:40	97.275	97.190	#N/A	#N/A	#N/A			
MH_4	MH_104	98.554	98.516	525	9.5	0.4	0.013	101.580	101.590	1.256	0.27	0.20	0.7	0.095	01:49	99.174	99.095	#N/A	#N/A	#N/A			
MH_500	OGS_2	96.056	96.046	750	5.0	0.2	0.013	100.350	100.428	1.127	0.50	0.96	1.9	0.590	01:53	97.396	97.376	#N/A	#N/A	#N/A			
OGS_2	OGS_2-Out	96.026	96.016	750	5.1	0.2	0.013	100.428	100.350	1.118	0.49	0.96	1.9	0.600	01:53	97.376	97.194	#N/A	#N/A	#N/A			
OGS_2-Out	MH_501	96.004	96.000	2250	4.2	0.1	0.013	100.350	100.350	1.624	6.46	5.21	0.8	-1.060	01:38	97.194	97.190	#N/A	#N/A	#N/A			

[2] Conservative estimate of freeboard based on U/S HGL and lowest USF connected to pipe. Actual HGL / freeboard at all connecting lots interpolated where conservative estimate does not meet freeboard requirements.

[3] Future USF elevations estimated as 1.8 m below the upstream top of manhole elevations.

(green)	Interpolated HGL elevation
(yellow)	Freebaord Less than 0.3m
(red)	Freebaord Less than 0.0m

Table C-1D: Pipe Data and Hydraulic Simulation Results for the August 4th, 1988 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
MH_401	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	5.05	0.3	-1.270	02:03	96.980	96.730	#N/A	#N/A	#N/A			
MH_501	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	4.37	0.3	-1.270	02:03	96.980	96.730	#N/A	#N/A	#N/A			
MH_1002	MH_1003	94.150	93.982	900	28.0	0.6	0.013	98.370	98.040	2.204	1.40	1.29	0.9	0.170	02:32	95.220	94.602	#N/A	#N/A	#N/A			
MH_1003	MH_1004	93.922	93.271	900	108.5	0.6	0.013	98.040	96.170	3.188	17.21	1.29	0.1	-0.220	02:33	94.602	93.326	#N/A	#N/A	#N/A			
MH_1004	MH_1005	92.586	92.162	975	106.0	0.4	0.013	96.170	95.150	1.898	1.42	1.29	0.9	-0.235	02:33	93.326	92.943	#N/A	#N/A	#N/A			
MH_1005	MH_1006	91.933	91.721	1200	106.0	0.2	0.013	95.150	94.970	1.542	1.74	1.29	0.7	-0.190	02:34	92.943	92.841	#N/A	#N/A	#N/A			
MH_1006	MH_1007	91.701	91.489	1200	106.0	0.2	0.013	94.970	94.270	1.542	1.74	1.29	0.7	-0.060	02:35	92.841	92.740	#N/A	#N/A	#N/A			
MH_1007	MH_1008	91.470	91.230	1200	88.0	0.3	0.013	94.270	93.460	1.801	2.04	1.56	0.8	0.070	00:00	92.740	92.580	#N/A	#N/A	#N/A			
MH_1008	MH_1009	91.230	91.200	1200	14.5	0.2	0.013	93.460	#N/A	1.568	1.77	1.58	0.9	0.150	00:01	92.580	92.500	#N/A	#N/A	#N/A			
MH_101	MH_102	100.935	100.142	300	30.5	2.6	0.013	103.750	103.240	2.206	0.16	0.00	0.0	-0.300	00:00	100.935	100.177	174-2	101.41	0.475			
MH_102	MH_103	99.917	99.002	525	59.0	1.6	0.013	103.240	102.350	2.474	0.54	0.27	0.5	-0.265	02:01	100.177	99.285	172-5	100.47	0.293			
																		172-5	100.47	1.081	59.0	6.9	99.389
																		173-1	100.78	1.221	59.0	18.1	99.559
																		173-2	100.78	1.100	59.0	26.1	99.680
																		173-3	101.1	1.312	59.0	33.3	99.788
																		173-4	101.1	1.191	59.0	41.3	99.909
																		173-5	101.1	1.076	59.0	48.9	100.024
																		174-1	101.41	1.274	59.0	56.3	100.136
MH_103	MH_104	98.755	98.516	750	120.0	0.4	0.013	102.350	101.590	1.594	0.70	0.57	0.8	-0.220	02:01	99.285	99.065	169-2	99.81	0.525			
																		169-2	99.81	0.740	120.0	2.7	99.070
																		169-3	99.81	0.727	120.0	10	99.083
																		169-4	99.81	0.712	120.0	18	99.098
																		170-1	99.93	0.813	120.0	28.6	99.117
																		170-2	99.93	0.798	120.0	36.6	99.132
																		170-3	99.93	0.784	120.0	44.2	99.146
																		171-1	99.99	0.824	120.0	54.9	99.166
																		171-2	99.99	0.810	120.0	62.9	99.180
																		171-3	99.99	0.796	120.0	70.1	99.194
																		171-4	99.99	0.782	120.0	78.1	99.208
																		172-1	100.47	1.229	120.0	96.1	99.241
																		172-2	100.47	1.214	120.0	104.1	99.256
																		172-3	100.47	1.201	120.0	111.3	99.269
																		172-4	100.47	1.191	120.0	117	99.280
MH_104	MH_106	97.975	97.913	1050	41.5	0.1	0.013	101.590	101.840	1.217	1.05	0.90	0.9	0.040	02:02	99.065	98.965	169-1	99.81	0.745			
MH_105	MH_106	99.562	97.913	675	91.0	1.4	0.013	103.170	101.840	4.109	16.64	0.72	0.0	-0.245	02:00	99.992	98.965	148	100.03	0.038			
																		148	100.03	0.923	91.0	12.6	99.107
																		147	100.16	0.915	91.0	24.8	99.245
																		146	100.3	0.940	91.0	35	99.360
																		145	100.42	0.934	91.0	46.2	99.486
																		144	100.56	0.913	91.0	60.4	99.647
																		143	100.93	1.128	91.0	74.2	99.802
																		142	101.5	1.532	91.0	88.9	99.968
MH_106	MH_116	97.605	97.360	1350	122.5	0.2	0.013	101.840	101.580	1.668	2.39	1.69	0.7	0.010	02:02	98.965	98.770	166-1	99.53	0.565			
MH_107	MH_108	99.165	99.080	300	74.0	0.4	0.013	101.895	101.880	0.809	0.06	0.02	0.3	-0.185	02:04	99.280	99.318	176-1	100.1	0.820			
MH_107	MH_112	99.165	98.906	300	74.0	0.4	0.013	101.895	101.695	0.809	0.06	0.02	0.3	-0.185	02:04	99.280	99.191	185-1	99.89	0.610			
MH_108	MH_110	98.908	98.800	450	54.0	0.2	0.013	101.880	101.980	0.802	0.13	0.09	0.7	-0.040	02:00	99.318	99.286	175-1	100.15	0.832			
MH_109	MH_110	99.151	98.800	750	60.0	0.7	0.013	102.650	101.980	2.108	0.93	0.77	0.8	-0.230	02:00	99.671	99.286	164-2	100.01	0.339			
																		164-2	100.01	0.716	60.0	1.2	99.294
																		164-3	100.25	0.921	60.0	6.7	99.329
																		164-4	100.25	0.870	60.0	14.7	99.380
																		165-1	100.42	0.972	60.0	25.3	99.448
																		165-2	100.93	1.433	60.0	32.9	99.497
																		165-3	100.93	1.382	60.0	40.9	99.548
MH_110	MH_111	98.346	98.046	900	75.0	0.4	0.013	101.980	101.770	1.800	1.14	0.99	0.9	0.040	01:59	99.286	99.075	162-1	99.69	0.404			
																		188-4	99.86	0.779	75.0	2	99.081
																		162-1	99.69	0.597	75.0	6.3	99.093
																		188-3	99.86	0.759	75.0	9.2	99.101

Table C-1D: Pipe Data and Hydraulic Simulation Results for the August 4th, 1988 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		162-2	99.69	0.575	75.0	14.3	99.115
																		188-2	99.86	0.737	75.0	17.2	99.123
																		162-3	99.69	0.554	75.0	21.6	99.136
																		188-1	99.86	0.715	75.0	24.8	99.145
																		162-4	99.69	0.526	75.0	31.6	99.164
																		187-4	99.86	0.685	75.0	35.5	99.175
																		163-1	99.77	0.582	75.0	40.2	99.188
																		187-3	99.86	0.663	75.0	43.5	99.197
																		163-2	99.77	0.561	75.0	47.8	99.209
																		187-2	99.86	0.642	75.0	50.7	99.218
																		163-3	99.77	0.538	75.0	55.8	99.232
																		187-1	99.86	0.620	75.0	58.7	99.240
																		164-1	100.01	0.748	75.0	66.5	99.262
MH_111	MH_115	97.925	97.743	975	91.0	0.2	0.013	101.770	101.450	1.342	1.00	0.99	1.0	0.175	02:01	99.075	98.906	159-1	99.58	0.505			
MH_112	MH_113	98.756	98.609	450	73.5	0.2	0.013	101.695	101.525	0.802	0.13	0.13	1.1	-0.015	02:05	99.191	99.044	183-1	99.74	0.549			
MH_113	MH_114	98.549	98.523	450	13.0	0.2	0.013	101.525	101.520	0.802	0.13	0.16	1.2	0.045	02:06	99.044	98.996	181-1	99.85	0.806			
MH_1	MH_133	97.607	97.569	1500	19.0	0.2	0.013	101.660	101.660	1.789	3.16	1.80	0.6	-0.360	02:09	98.747	98.579	Est. Fut	99.86	1.113			
MH_114	MH_115	98.296	97.743	675	54.0	0.4	0.013	101.520	101.450	1.486	0.53	0.28	0.5	0.025	02:05	98.996	98.906	182-1	99.58	0.584			
MH_115	MH_116	97.656	97.360	1050	59.0	0.5	0.013	101.450	101.580	2.230	1.93	1.33	0.7	0.200	02:01	98.906	98.770	157-1	99.46	0.554			
MH_116	MH_117	97.060	96.937	1650	122.5	0.1	0.013	101.580	101.370	1.348	2.88	3.12	1.1	0.060	02:02	98.770	98.617	30	99.32	0.550			
MH_117	MH_118	96.917	96.796	1650	121.0	0.1	0.013	101.370	101.290	1.348	2.88	3.26	1.1	0.050	02:02	98.617	98.455	20	99.11	0.493			
																		18	99.18	0.719	121.0	4.4	98.461
																		2	99.16	0.695	121.0	7.7	98.465
																		406	99.18	0.703	121.0	16.1	98.477
																		404	99.18	0.698	121.0	20.3	98.482
																		407	99.16	0.671	121.0	25.7	98.489
																		405	99.18	0.684	121.0	30.5	98.496
																		19	99.16	0.654	121.0	37.9	98.506
																		3	99.14	0.631	121.0	40.7	98.509
																		20	99.11	0.591	121.0	48.1	98.519
																		4	99.14	0.616	121.0	51.2	98.524
																		21	99.12	0.586	121.0	59.3	98.534
																		5	99.22	0.682	121.0	62.1	98.538
																		22	99.21	0.659	121.0	71.5	98.551
																		6	99.23	0.677	121.0	73.3	98.553
																		23	99.22	0.654	121.0	82.9	98.566
																		7	99.24	0.667	121.0	87.8	98.573
																		24	99.28	0.695	121.0	97.3	98.585
																		8	99.31	0.717	121.0	102.8	98.593
																		25	99.36	0.754	121.0	113.1	98.606
																		9	99.4	0.787	121.0	118.2	98.613
MH_118	MH_136	96.645	96.634	1950	11.0	0.1	0.013	101.290	101.190	1.507	4.50	3.25	0.7	-0.140	02:02	98.455	98.364	#N/A	#N/A	#N/A			
MH_119	MH_120	99.144	98.938	900	103.0	0.2	0.013	103.010	102.570	1.273	0.81	0.99	1.2	-0.010	02:02	100.034	99.638	101	100.65	0.616			
MH_119	MH_122	99.144	99.693	900	103.0	0.2	0.013	103.010	102.490	1.840	9.94	0.99	0.1	-0.010	02:02	100.034	99.693	#N/A	#N/A	#N/A			
MH_120	MH_121	98.878	98.850	900	14.0	0.2	0.013	102.570	102.480	1.273	0.81	1.03	1.3	-0.140	02:02	99.638	99.280	116	101.03	1.392			
MH_121	MH_132	98.790	97.536	900	114.0	1.1	0.013	102.480	101.320	2.985	1.90	1.10	0.6	-0.410	02:02	99.280	98.498	106	99.54	0.260			
																		106	99.54	0.993	114.0	7.2	98.547
																		107	99.71	1.079	114.0	19.4	98.631
																		108	99.88	1.172	114.0	30.6	98.708
																		109	100.05	1.272	114.0	40.8	98.778
																		110	100.15	1.286	114.0	53.4	98.864
																		111	100.32	1.377	114.0	64.8	98.943
																		112	100.48	1.454	114.0	77	99.026
																		113	100.57	1.467	114.0	88.2	99.103
																		114	100.57	1.397	114.0	98.4	99.173
																		115	100.65	1.406	114.0	108.8	99.244
MH_122	MH_123	99.663	99.461	300	13.0	1.6	0.013	102.490	102.270	1.705	0.12	0.00	0.0	-0.300	00:00	99.663	99.497	131	100.61	0.947			

Table C-1D: Pipe Data and Hydraulic Simulation Results for the August 4th, 1988 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_123	MH_127	99.407	98.615	300	49.5	1.6	0.013	102.270	101.675	1.730	0.12	0.02	0.2	-0.210	02:02	99.497	98.992	135	99.89	0.393			
MH_124	MH_125	99.069	98.715	375	101.0	0.4	0.013	102.060	101.870	1.421	2.66	0.07	0.0	-0.125	02:06	99.319	99.191	72	99.77	0.451			
																		82	99.89	0.692	101.0	5.4	99.198
																		69	99.84	0.638	101.0	8.4	99.202
																		70	99.78	0.565	101.0	18.6	99.215
																		81	99.89	0.674	101.0	19.6	99.216
																		71	99.78	0.551	101.0	29.7	99.229
																		80	99.92	0.690	101.0	31	99.230
																		72	99.77	0.528	101.0	39.9	99.242
																		79	100.04	0.790	101.0	46.9	99.250
																		73	99.82	0.564	101.0	51.1	99.256
																		78	100.04	0.780	101.0	54.4	99.260
																		74	99.88	0.611	101.0	61.3	99.269
																		77	100	0.727	101.0	64.6	99.273
																		413	99.93	0.646	101.0	73.4	99.284
																		415	100.08	0.794	101.0	75.2	99.286
																		412	99.98	0.685	101.0	82.3	99.295
																		414	100.1	0.800	101.0	86.4	99.300
																		75	99.98	0.670	101.0	94	99.310
																		76	100.16	0.845	101.0	98.1	99.315
MH_125	MH_127	98.481	98.615	600	91.5	0.3	0.013	101.870	101.675	1.618	5.82	0.28	0.0	0.110	02:08	99.191	98.992	65	99.58	0.389			
																		88	99.82	0.793	91.5	16	99.027
																		63	99.59	0.562	91.5	16.6	99.028
																		87	99.82	0.763	91.5	29.7	99.057
																		64	99.59	0.532	91.5	30.3	99.058
																		86	99.65	0.569	91.5	41.1	99.081
																		65	99.58	0.493	91.5	43.9	99.087
																		85	99.74	0.627	91.5	55.5	99.113
																		66	99.69	0.571	91.5	58.6	99.119
																		84	99.76	0.613	91.5	71.3	99.147
																		67	99.78	0.626	91.5	74.4	99.154
																		83	99.89	0.712	91.5	85.7	99.178
																		68	99.84	0.655	91.5	88.8	99.185
MH_126	MH_127	98.697	98.615	300	28.5	0.4	0.013	101.500	101.675	0.865	0.06	0.16	2.6	1.070	02:02	100.067	98.992	#N/A	#N/A	#N/A			
MH_127	MH_128	98.102	97.994	750	54.0	0.2	0.013	101.675	101.395	1.654	7.44	0.43	0.1	0.140	02:04	98.992	98.894	47	99.56	0.568			
MH_128	MH_129	97.964	97.923	750	13.5	0.3	0.013	101.395	101.315	1.389	0.61	0.43	0.7	0.180	02:04	98.894	98.848	45	99.49	0.596			
MH_129	MH_130	97.848	97.732	825	77.0	0.2	0.013	101.315	101.420	1.496	6.17	0.54	0.1	0.175	02:04	98.848	98.732	43	99.41	0.562			
MH_130	MH_131	97.732	97.581	825	100.5	0.2	0.013	101.420	101.200	1.040	0.56	0.66	1.2	0.175	02:04	98.732	98.516	33	99.18	0.448			
MH_1302	MH_302	97.470	96.430	600	98.5	0.2	0.013	101.160	101.140	0.971	0.27	0.15	0.6	0.300	01:30	98.370	98.300	Est. Fut	99.36	0.990			
MH_1303	MH_303	97.245	96.351	750	109.0	0.2	0.013	101.090	101.080	0.976	0.43	0.36	0.8	0.370	02:18	98.365	98.221	Est. Fut	99.29	0.925			
MH_1304	MH_304	97.175	96.196	600	87.0	0.2	0.013	100.660	100.730	0.971	0.27	0.19	0.7	0.340	01:30	98.115	98.026	Est. Fut	98.86	0.745			
MH_131	MH_132	97.206	97.536	1200	12.0	0.2	0.013	101.200	101.320	1.335	1.51	0.66	0.4	0.110	02:04	98.516	98.498	#N/A	#N/A	#N/A			
MH_1312	MH_310	97.627	97.113	750	62.0	0.2	0.013	100.940	100.940	1.127	0.50	0.18	0.4	-0.440	02:07	97.937	97.843	Est. Fut	99.14	1.203			
MH_132	MH_136	97.128	96.634	1200	59.5	0.2	0.013	101.320	101.190	1.542	1.74	1.87	1.1	0.170	02:02	98.498	98.364	103	99.33	0.832			
MH_133	MH_134	97.509	97.393	1500	77.0	0.2	0.013	101.660	101.550	2.126	19.14	1.88	0.1	-0.430	02:09	98.579	98.513	#N/A	#N/A	#N/A			
MH_134	MH_135	97.363	97.271	1500	61.0	0.2	0.013	101.550	101.440	1.554	2.75	1.95	0.7	-0.350	02:09	98.513	98.451	#N/A	#N/A	#N/A			
MH_135	MH_136	97.121	96.634	1650	37.0	0.1	0.013	101.440	101.190	1.348	2.88	1.97	0.7	-0.320	02:09	98.451	98.364	#N/A	#N/A	#N/A			
MH_136	MH_302	96.484	96.430	2250	54.0	0.1	0.013	101.190	101.140	1.658	6.59	6.99	1.1	-0.370	02:03	98.364	98.300	1	99.38	1.016			
MH_201	MH_202	105.214	104.138	375	119.5	0.9	0.013	108.120	107.180	1.506	0.17	0.10	0.6	-0.175	02:00	105.414	104.413	321	105.28	-0.134			
																		321	105.28	0.796	119.5	8.5	104.484
																		430	107.31	2.808	119.5	10.6	104.502
																		431	107.37	2.820	119.5	16.3	104.550
																		428	105.36	0.761	119.5	22.2	104.599
																		233	107.4	2.740	119.5	29.5	104.660
																		429	105.37	0.693	119.5	31.5	104.677
																		234	107.46	2.752	119.5	35.2	104.708
																		320	105.45	0.671	119.5	43.7	104.779

Table C-1D: Pipe Data and Hydraulic Simulation Results for the August 4th, 1988 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		235	107.5	2.687	119.5	47.7	104.813
																		319	105.56	0.688	119.5	54.8	104.872
																		236	107.62	2.747	119.5	54.9	104.873
																		318	105.66	0.703	119.5	65	104.957
																		237	107.69	2.713	119.5	67.3	104.977
																		238	107.8	2.776	119.5	73	105.024
																		317	105.77	0.719	119.5	76.2	105.051
																		239	107.87	2.735	119.5	86.2	105.135
																		316	105.9	0.747	119.5	88.4	105.153
																		240	107.99	2.807	119.5	91.9	105.183
																		315	106.02	0.771	119.5	99.8	105.249
																		241	108.06	2.767	119.5	105.1	105.293
																		242	108.16	2.819	119.5	110.8	105.341
																		314	106.13	0.762	119.5	114	105.368
MH_202	MH_203	104.063	104.035	450	14.0	0.2	0.013	107.180	107.090	0.802	0.13	0.13	1.0	-0.100	02:00	104.413	104.345	230	105.39	0.977			
MH_203	MH_206	103.975	103.730	450	54.5	0.5	0.013	107.090	106.720	1.203	0.19	0.20	1.0	-0.080	02:01	104.345	103.737	225	104.9	0.555			
MH_204	MH_205	103.579	103.343	525	118.0	0.2	0.013	106.620	106.610	0.888	0.19	0.14	0.7	-0.165	02:05	103.939	103.833	285	104.64	0.701			
MH_205	MH_206	103.313	103.730	525	16.0	0.2	0.013	106.610	106.720	0.888	0.19	0.21	1.1	-0.005	02:04	103.833	103.737	#N/A	#N/A	#N/A			
MH_206	MH_207	103.197	102.999	600	49.5	0.4	0.013	106.720	106.460	1.373	0.39	0.41	1.1	-0.060	02:01	103.737	103.319	221	104.52	0.783			
MH_207	MH_208	102.969	102.731	600	12.5	1.9	0.013	106.460	106.320	2.997	0.85	0.41	0.5	-0.250	02:01	103.319	102.991	219	104.39	1.071			
MH_208	MH_215	102.671	100.543	600	112.0	1.9	0.013	106.320	104.150	2.993	0.85	0.47	0.6	-0.280	02:01	102.991	101.193	212	102.46	-0.531			
																		271	102.46	1.124	112.0	8.9	101.336
																		212	102.46	1.063	112.0	12.7	101.397
																		270	102.67	1.106	112.0	23.1	101.564
																		213	102.68	1.089	112.0	24.8	101.591
																		214	102.89	1.135	112.0	35	101.755
																		269	102.93	1.161	112.0	35.9	101.769
																		215	103.1	1.165	112.0	46.2	101.935
																		268	103.18	1.228	112.0	47.3	101.952
																		216	103.36	1.229	112.0	58.4	102.131
																		267	103.42	1.272	112.0	59.5	102.148
																		217	103.62	1.306	112.0	69.8	102.314
																		266	103.68	1.352	112.0	70.7	102.328
																		423	103.94	1.448	112.0	80.9	102.492
																		421	103.83	1.321	112.0	82	102.509
																		422	104.04	1.370	112.0	92	102.670
																		420	104.04	1.352	112.0	93.1	102.688
																		265	104.35	1.492	112.0	103.7	102.858
																		218	104.3	1.412	112.0	105.6	102.888
MH_209	MH_201	105.833	105.316	300	94.0	0.6	0.013	108.630	108.120	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.414	313	106.24	0.407			
MH_209	MH_210	105.833	105.518	300	94.0	0.6	0.013	108.630	108.320	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.586	254	108.31	2.477			
MH_210	MH_212	105.486	103.434	300	54.0	3.8	0.013	108.320	107.010	2.668	0.19	0.05	0.3	-0.200	02:00	105.586	103.569	258	105.12	-0.466			
																		258	105.12	0.965	54.0	15.7	104.155
																		257	105.54	0.948	54.0	27.4	104.592
																		256	106.05	1.035	54.0	38.7	105.015
																		255	106.58	1.188	54.0	48.8	105.392
MH_211	MH_212	103.900	103.434	300	26.5	0.4	0.013	106.090	107.010	0.810	0.06	0.02	0.3	-0.160	02:00	104.040	103.569	#N/A	#N/A	#N/A			
MH_212	MH_204	103.359	103.804	375	49.5	0.5	0.013	107.010	106.620	1.066	0.12	0.07	0.6	-0.165	02:01	103.569	103.939	284	104.71	1.141			
MH_212	MH_213	103.359	103.136	375	49.5	0.5	0.013	107.010	106.020	1.066	0.12	0.07	0.6	-0.165	02:01	103.569	103.233	203	104.1	0.531			
MH_213	MH_214	103.053	102.918	375	13.5	1.0	0.013	106.020	105.800	1.587	0.18	0.07	0.4	-0.195	02:01	103.233	103.053	204	104.02	0.787			
MH_214	MH_215	102.883	100.543	375	90.0	2.4	0.013	105.800	104.150	2.434	0.27	0.11	0.4	-0.205	02:00	103.053	101.193	272	102.37	-0.683			
																		272	102.37	1.024	90.0	7.4	101.346
																		211	102.46	0.940	90.0	15.8	101.520
																		273	102.59	0.951	90.0	21.6	101.639
																		210	102.68	0.908	90.0	28	101.772
																		274	102.86	0.906	90.0	36.8	101.954
																		209	102.89	0.908	90.0	38.2	101.982

Table C-1D: Pipe Data and Hydraulic Simulation Results for the August 4th, 1988 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		275	103.11	0.921	90.0	48.2	102.189
																		208	103.15	0.936	90.0	49.4	102.214
																		276	103.37	0.929	90.0	60.4	102.441
																		207	103.4	0.893	90.0	63.6	102.507
																		277	103.55	0.954	90.0	67.9	102.596
																		206	103.66	0.917	90.0	75	102.743
																		278	103.55	0.627	90.0	83.7	102.923
																		205	103.83	0.870	90.0	85.5	102.960
MH_215	MH_119	100.303	99.423	675	55.0	1.6	0.013	104.150	103.010	2.971	1.06	0.95	0.9	0.215	02:01	101.193	100.034	#N/A	#N/A	#N/A			
MH_216	MH_217	105.251	104.798	375	75.5	0.6	0.013	108.100	107.980	1.230	0.14	0.11	0.8	-0.115	02:02	105.511	105.073	346	105.85	0.339			
MH_217	MH_218	104.573	104.347	600	113.0	0.2	0.013	107.980	107.690	0.971	0.27	0.26	0.9	-0.100	02:05	105.073	104.907	356	105.71	0.637			
MH_218	MH_220	104.327	104.166	600	80.5	0.2	0.013	107.690	107.790	0.971	0.27	0.29	1.1	-0.020	02:03	104.907	104.166	357	105.75	0.843			
MH_219	MH_220	105.649	104.166	300	25.0	2.7	0.013	108.450	107.790	2.228	0.16	0.00	0.0	-0.300	00:00	105.649	104.166	#N/A	#N/A	#N/A			
MH_220	MH_224	103.644	102.523	600	59.0	1.9	0.013	107.790	105.620	2.993	0.85	0.29	0.3	-0.360	02:00	103.884	102.523	259	104.74	0.856			
MH_221	MH_222	103.008	102.620	300	77.5	0.5	0.013	105.960	105.420	0.968	0.07	0.01	0.1	-0.230	02:00	103.078	102.801	396-1	103.56	0.482			
MH_222	MH_223	102.311	102.168	600	95.5	0.2	0.013	105.420	105.450	0.841	0.24	0.22	0.9	-0.110	02:01	102.801	102.688	366-1	103.37	0.569			
MH_2	MH_2260	101.916	101.876	675	10.0	0.4	0.013	105.290	105.290	1.486	0.53	0.38	0.7	-0.085	01:49	102.506	102.126	Est. Fut	103.49	0.984			
MH_223	MH_224	102.148	102.523	600	97.0	0.2	0.013	105.450	105.620	0.971	0.27	0.26	1.0	-0.060	02:03	102.688	102.523	365-1	103.42	0.732			
MH_224	MH_105	101.625	100.067	600	82.0	1.9	0.013	105.620	103.170	2.993	0.85	0.64	0.8	-0.210	02:01	102.015	100.067	141	101.9	-0.115			
																		141	101.9	1.562	82.0	11.4	100.338
																		140	102.18	1.505	82.0	25.6	100.675
																		139	102.55	1.606	82.0	36.9	100.944
																		138	102.92	1.734	82.0	47.1	101.186
																		137	103.3	1.850	82.0	58.2	101.450
																		136	103.81	2.037	82.0	71.8	101.773
MH_225	MH_226	103.412	102.914	300	99.5	0.5	0.013	106.390	105.720	0.968	0.07	0.03	0.5	-0.150	02:00	103.562	103.043	388-3	103.75	0.188			
																		389-2	103.75	0.677	99.5	5.8	103.073
																		389-1	103.75	0.620	82.0	13.8	103.130
																		388-3	103.75	0.553	82.0	24.4	103.197
																		388-2	103.88	0.634	82.0	32.1	103.246
																		388-1	103.88	0.583	82.0	40.1	103.297
																		387-4	104.02	0.656	82.0	50.7	103.364
																		387-3	104.02	0.605	82.0	58.7	103.415
																		387-2	104.02	0.560	82.0	65.9	103.460
																		387-1	104.02	0.509	82.0	73.9	103.511
MH_2260	MH_227	101.816	101.049	675	49.5	1.6	0.013	105.290	104.230	2.925	1.05	0.45	0.4	-0.365	02:01	102.126	101.109	392-1	102.46	0.334			
MH_226	MH_2260	102.863	101.876	300	64.0	1.1	0.013	105.720	105.290	1.402	0.10	0.06	0.6	-0.120	02:00	103.043	102.126	391-3	103.08	0.037			
																		391-3	103.08	0.921	64.0	2.3	102.159
																		391-2	103.45	1.186	64.0	9.6	102.264
																		391-1	103.45	1.072	64.0	17.6	102.378
																		390-3	103.58	1.050	64.0	28.2	102.530
																		390-2	103.58	0.935	64.0	36.2	102.645
																		390-1	103.58	0.826	64.0	43.8	102.754
																		389-4	103.75	0.843	64.0	54.5	102.907
																		389-3	103.75	0.728	64.0	62.5	103.022
MH_227	MH_109	100.759	99.306	675	93.0	1.6	0.013	104.230	102.650	2.971	1.06	0.50	0.5	-0.325	02:00	101.109	99.671	394-3	100.86	-0.249			
																		394-4	100.86	0.892	93.0	19.2	99.968
																		394-3	100.86	0.768	93.0	27.2	100.092
																		394-2	101.26	1.056	93.0	34.5	100.204
																		394-1	101.26	0.932	93.0	42.5	100.328
																		393-3	101.49	0.982	93.0	54.1	100.508
																		393-2	101.81	1.185	93.0	61.7	100.625
																		393-1	101.81	1.061	93.0	69.7	100.749
																		392-4	102.21	1.280	93.0	81.4	100.930
																		392-3	102.21	1.157	93.0	89.4	101.053
MH_228	MH_229	102.472	100.982	300	74.5	2.0	0.013	105.270	103.790	1.935	0.14	0.06	0.4	-0.160	02:00	102.612	101.063	384-3	102.12	-0.492			
																		384-3	102.12	1.007	74.5	2.4	101.113

Table C-1D: Pipe Data and Hydraulic Simulation Results for the August 4th, 1988 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		379-2	102.14	1.006	74.5	3.4	101.134
																		384-4	102.12	0.841	74.5	10.4	101.279
																		379-1	102.14	0.840	74.5	11.4	101.300
																		385-1	102.35	0.850	74.5	21	101.500
																		378-3	102.57	1.050	74.5	22	101.520
																		385-2	102.65	0.992	74.5	28.6	101.658
																		378-2	102.67	0.989	74.5	29.7	101.681
																		385-3	102.65	0.826	74.5	36.6	101.824
																		378-1	102.67	0.823	74.5	37.7	101.847
																		386-1	102.73	0.684	74.5	47.3	102.046
																		377-4	103.02	0.953	74.5	48.3	102.067
																		386-2	103.08	0.867	74.5	55.3	102.213
																		377-3	103.28	1.046	74.5	56.3	102.234
																		377-2	103.34	0.957	74.5	63.5	102.383
																		377-1	103.34	0.790	74.5	71.5	102.550
MH_229	MH_102	100.723	100.142	525	86.5	0.9	0.013	103.790	103.240	1.832	0.40	0.25	0.6	-0.185	02:01	101.063	100.177	381-1	101.35	0.287			
																		382-1	101.52	1.203	86.5	13.7	100.317
																		381-4	101.35	1.022	86.5	14.7	100.328
																		382-2	101.52	1.121	86.5	21.7	100.399
																		381-3	101.35	0.940	86.5	22.7	100.410
																		382-3	101.52	1.047	86.5	28.9	100.473
																		381-2	101.35	0.866	86.5	30	100.484
																		382-4	101.52	0.965	86.5	36.9	100.555
																		381-1	101.35	0.784	86.5	38	100.566
																		383-1	101.62	0.955	86.5	47.6	100.665
																		380-3	101.59	0.915	86.5	48.6	100.675
																		383-2	101.62	0.874	86.5	55.6	100.746
																		380-2	101.59	0.833	86.5	56.6	100.757
																		383-3	101.62	0.796	86.5	63.2	100.824
																		380-1	101.59	0.755	86.5	64.2	100.835
																		384-1	101.95	1.017	86.5	73.8	100.933
																		379-4	101.96	1.016	86.5	74.9	100.944
																		384-2	101.95	0.935	86.5	81.8	101.015
																		379-3	101.96	0.934	86.5	82.9	101.026
MH_230	MH_231	102.417	100.947	300	73.5	2.0	0.013	105.220	103.750	1.935	0.14	0.05	0.4	-0.180	02:00	102.537	100.972	374-3	102.03	-0.507			
																		374-3	102.03	1.005	73.5	2.5	101.025
																		368-3	102.24	1.162	73.5	5	101.078
																		374-4	102.03	0.834	73.5	10.5	101.196
																		368-2	102.24	0.991	73.5	13	101.249
																		368-1	102.24	0.829	73.5	20.6	101.411
																		375-1	102.4	0.977	73.5	21.2	101.423
																		375-2	102.57	0.985	73.5	28.8	101.585
																		367-3	102.71	1.072	73.5	31.3	101.638
																		375-3	102.57	0.814	73.5	36.8	101.756
																		367-2	102.71	0.901	73.5	39.3	101.809
																		367-1	102.71	0.739	73.5	46.9	101.971
																		376-1	103	1.019	73.5	47.4	101.981
																		376-2	103	0.848	73.5	55.4	102.152
																		376-3	103.37	1.063	73.5	62.7	102.307
																		376-4	103.37	0.893	73.5	70.7	102.477
MH_231	MH_103	100.722	99.002	525	87.0	2.0	0.013	103.750	102.350	2.810	0.61	0.26	0.4	-0.275	02:00	100.972	99.285	371-1	100.56	-0.412			
																		371-3	100.56	1.023	87.0	13	99.537
																		372-1	100.95	1.395	87.0	13.9	99.555
																		371-2	100.56	0.868	87.0	21	99.692
																		372-2	100.95	1.240	87.0	21.9	99.710
																		371-1	100.56	0.720	87.0	28.6	99.840
																		372-3	100.95	1.099	87.0	29.2	99.851

Table C-1D: Pipe Data and Hydraulic Simulation Results for the August 4th, 1988 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		372-4	100.95	0.944	87.0	37.2	100.006
																		370-3	101.09	1.043	87.0	39.3	100.047
																		370-2	101.09	0.888	87.0	47.3	100.202
																		373-1	100.97	0.758	87.0	47.8	100.212
																		370-1	101.09	0.740	87.0	54.9	100.350
																		373-2	101.32	0.953	87.0	55.8	100.367
																		373-3	101.32	0.806	87.0	63.4	100.514
																		369-3	101.61	1.055	87.0	65.5	100.555
																		369-2	101.61	0.900	87.0	73.5	100.710
																		374-1	101.56	0.838	87.0	74.1	100.722
																		369-1	101.61	0.750	87.0	81.2	100.860
																		374-2	101.56	0.683	87.0	82.1	100.877
MH_302	MH_303	96.410	96.351	2250	59.0	0.1	0.013	101.140	101.080	1.658	6.59	7.18	1.1	-0.360	02:04	98.300	98.221	#N/A	#N/A	#N/A			
MH_303	MH_304	96.331	96.196	2250	134.5	0.1	0.013	101.080	100.730	1.658	6.59	7.56	1.1	-0.360	02:04	98.221	98.026	#N/A	#N/A	#N/A			
MH_304	MH_306TEE	96.176	96.133	2250	42.5	0.1	0.013	100.730	100.350	1.666	6.62	7.77	1.2	-0.400	02:04	98.026	97.763	#N/A	#N/A	#N/A			
MH_306TEE	MH_307	96.133	96.120	2250	13.0	0.1	0.013	100.350	100.350	2.128	28.73	7.84	0.3	-0.620	02:04	97.763	97.510	#N/A	#N/A	#N/A			
MH_313	MH_307	96.099	96.120	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.24	0.6	-0.940	02:03	97.409	97.510	#N/A	#N/A	#N/A			
MH_307	MH_400	96.100	96.076	2250	22.7	0.1	0.013	100.350	100.350	1.707	6.79	5.02	0.7	-0.840	02:04	97.510	97.477	#N/A	#N/A	#N/A			
MH_309	MH_310	97.139	97.113	1200	17.5	0.1	0.013	100.990	100.940	1.331	1.50	0.88	0.6	-0.370	02:08	97.969	97.843	#N/A	#N/A	#N/A			
MH_310	MH_311	97.053	96.959	1200	62.5	0.2	0.013	100.940	100.830	1.335	1.51	1.13	0.8	-0.410	02:06	97.843	97.769	#N/A	#N/A	#N/A			
MH_3	MH_109	99.346	99.306	600	10.0	0.4	0.013	102.650	102.650	1.373	0.39	0.23	0.6	-0.240	02:04	99.706	99.671	#N/A	#N/A	#N/A			
MH_3111TEE	MH_312	96.831	96.716	1200	76.5	0.2	0.013	100.640	100.450	1.335	1.51	1.23	0.8	-0.370	02:05	97.661	97.496	#N/A	#N/A	#N/A			
MH_311	MH_3111TEE	96.939	96.831	1200	72.0	0.2	0.013	100.830	100.640	1.335	1.51	1.21	0.8	-0.370	02:02	97.769	97.661	#N/A	#N/A	#N/A			
MH_312	MH_313	96.656	96.624	1200	21.5	0.1	0.013	100.450	100.350	1.331	1.50	1.23	0.8	-0.360	02:05	97.496	97.409	#N/A	#N/A	#N/A			
MH_313	MH_500	96.099	96.065	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.24	0.6	-0.940	02:03	97.409	97.396	#N/A	#N/A	#N/A			
MH_400	OGS_1	96.067	96.057	750	4.9	0.2	0.013	100.350	100.500	1.133	0.50	1.00	2.0	0.660	01:31	97.477	97.477	#N/A	#N/A	#N/A			
OGS_1	OGS_1-Out	96.037	96.027	750	4.9	0.2	0.013	100.500	100.350	1.138	0.50	1.00	2.0	0.690	01:31	97.477	97.225	#N/A	#N/A	#N/A			
OGS_1-Out	MH_401	96.015	96.000	2250	14.7	0.1	0.013	100.350	100.350	1.674	6.66	6.03	0.9	-1.040	02:03	97.225	96.980	#N/A	#N/A	#N/A			
MH_4	MH_104	98.554	98.516	525	9.5	0.4	0.013	101.580	101.590	1.256	0.27	0.20	0.7	0.065	02:09	99.144	99.065	#N/A	#N/A	#N/A			
MH_500	OGS_2	96.056	96.046	750	5.0	0.2	0.013	100.350	100.428	1.127	0.50	0.96	1.9	0.590	02:14	97.396	97.376	#N/A	#N/A	#N/A			
OGS_2	OGS_2-Out	96.026	96.016	750	5.1	0.2	0.013	100.428	100.350	1.118	0.49	0.96	1.9	0.600	02:14	97.376	97.144	#N/A	#N/A	#N/A			
OGS_2-Out	MH_501	96.004	96.000	2250	4.2	0.1	0.013	100.350	100.350	1.624	6.46	5.16	0.8	-1.110	02:03	97.144	96.980	#N/A	#N/A	#N/A			

(2) Conservative estimate of freeboard based on U/S HGL and lowest USF connected to pipe. Actual HGL / freeboard at all connecting lots interpolated where conservative estimate does not meet freeboard requirements.

(3) Future USF elevations estimated as 1.8 m below the upstream top of manhole elevations.

Legend colour	Meaning
Green	Interpolated HGL elevation
Yellow	Freebaord Less than 0.3m
Red	Freebaord Less than 0.0m

Table C-1E: Pipe Data and Hydraulic Simulation Results for the August 8th, 1996 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_401	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	4.72	0.3	-1.370	01:32	96.880	96.730	#N/A	#N/A	#N/A			
MH_501	POND	96.000	99.800	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	4.00	0.3	-1.420	01:34	96.830	96.730	#N/A	#N/A	#N/A			
MH_1002	MH_1003	94.150	93.982	900	28.0	0.6	0.013	98.370	98.040	2.204	1.40	1.24	0.9	0.130	03:47	95.180	94.582	#N/A	#N/A	#N/A			
MH_1003	MH_1004	93.922	93.271	900	108.5	0.6	0.013	98.040	96.170	3.188	17.21	1.24	0.1	-0.240	03:48	94.582	93.306	#N/A	#N/A	#N/A			
MH_1004	MH_1005	92.586	92.162	975	106.0	0.4	0.013	96.170	95.150	1.898	1.42	1.24	0.9	-0.255	03:48	93.306	92.903	#N/A	#N/A	#N/A			
MH_1005	MH_1006	91.933	91.721	1200	106.0	0.2	0.013	95.150	94.970	1.542	1.74	1.24	0.7	-0.230	03:49	92.903	92.821	#N/A	#N/A	#N/A			
MH_1006	MH_1007	91.701	91.489	1200	106.0	0.2	0.013	94.970	94.270	1.542	1.74	1.24	0.7	-0.080	03:50	92.821	92.720	#N/A	#N/A	#N/A			
MH_1007	MH_1008	91.470	91.230	1200	88.0	0.3	0.013	94.270	93.460	1.801	2.04	1.56	0.8	0.050	00:00	92.720	92.580	#N/A	#N/A	#N/A			
MH_1008	MH_1009	91.230	91.200	1200	14.5	0.2	0.013	93.460	#N/A	1.568	1.77	1.58	0.9	0.150	00:01	92.580	92.500	#N/A	#N/A	#N/A			
MH_101	MH_102	100.935	100.142	300	30.5	2.6	0.013	103.750	103.240	2.206	0.16	0.00	0.0	-0.300	00:00	100.935	100.167	174-2	101.41	0.475			
MH_102	MH_103	99.917	99.002	525	59.0	1.6	0.013	103.240	102.350	2.474	0.54	0.24	0.4	-0.275	01:28	100.167	99.225	172-5	100.47	0.303			
																		172-5	100.47	1.135	59.0	6.9	99.335
																		173-1	100.78	1.266	59.0	18.1	99.514
																		173-2	100.78	1.138	59.0	26.1	99.642
																		173-3	101.1	1.343	59.0	33.3	99.757
																		173-4	101.1	1.216	59.0	41.3	99.884
																		173-5	101.1	1.094	59.0	48.9	100.006
																		174-1	101.41	1.286	59.0	56.3	100.124
MH_103	MH_104	98.755	98.516	750	120.0	0.4	0.013	102.350	101.590	1.594	0.70	0.50	0.7	-0.280	01:30	99.225	98.825	169-2	99.81	0.585			
																		169-2	99.81	0.976	120.0	2.7	98.834
																		169-3	99.81	0.952	120.0	10	98.858
																		169-4	99.81	0.925	120.0	18	98.885
																		170-1	99.93	1.010	120.0	28.6	98.920
																		170-2	99.93	0.983	120.0	36.6	98.947
																		170-3	99.93	0.958	120.0	44.2	98.972
																		171-1	99.99	0.982	120.0	54.9	99.008
																		171-2	99.99	0.955	120.0	62.9	99.035
																		171-3	99.99	0.931	120.0	70.1	99.059
																		171-4	99.99	0.905	120.0	78.1	99.085
																		172-1	100.47	1.325	120.0	96.1	99.145
																		172-2	100.47	1.298	120.0	104.1	99.172
																		172-3	100.47	1.274	120.0	111.3	99.196
																		172-4	100.47	1.255	120.0	117	99.215
MH_104	MH_106	97.975	97.913	1050	41.5	0.1	0.013	101.590	101.840	1.217	1.05	0.74	0.7	-0.200	01:26	98.825	98.725	169-1	99.81	0.985			
MH_105	MH_106	99.562	97.913	675	91.0	1.4	0.013	103.170	101.840	4.109	16.64	0.67	0.0	-0.265	01:30	99.972	98.725	148	100.03	0.058			
																		148	100.03	1.132	91.0	12.6	98.898
																		147	100.16	1.095	91.0	24.8	99.065
																		146	100.3	1.095	91.0	35	99.205
																		145	100.42	1.062	91.0	46.2	99.358
																		144	100.56	1.007	91.0	60.4	99.553
																		143	100.93	1.188	91.0	74.2	99.742
																		142	101.5	1.557	91.0	88.9	99.943
MH_106	MH_116	97.605	97.360	1350	122.5	0.2	0.013	101.840	101.580	1.668	2.39	1.48	0.6	-0.230	01:30	98.725	98.570	166-1	99.53	0.805			
MH_107	MH_108	99.165	99.080	300	74.0	0.4	0.013	101.895	101.880	0.809	0.06	0.00	0.0	-0.265	01:31	99.200	99.208	176-1	100.1	0.900			
MH_107	MH_112	99.165	98.906	300	74.0	0.4	0.013	101.895	101.695	0.809	0.06	0.00	0.0	-0.265	01:31	99.200	99.101	185-1	99.89	0.690			
MH_108	MH_110	98.908	98.800	450	54.0	0.2	0.013	101.880	101.980	0.802	0.13	0.08	0.6	-0.150	01:31	99.208	99.006	175-1	100.15	0.942			
MH_109	MH_110	99.151	98.800	750	60.0	0.7	0.013	102.650	101.980	2.108	0.93	0.73	0.8	-0.250	01:27	99.651	99.006	164-2	100.01	0.359			
																		164-2	100.01	0.991	60.0	1.2	99.019
																		164-3	100.25	1.172	60.0	6.7	99.078
																		164-4	100.25	1.086	60.0	14.7	99.164
																		165-1	100.42	1.142	60.0	25.3	99.278
																		165-2	100.93	1.570	60.0	32.9	99.360
																		165-3	100.93	1.484	60.0	40.9	99.446
MH_110	MH_111	98.346	98.046	900	75.0	0.4	0.013	101.980	101.770	1.800	1.14	0.97	0.8	-0.240	01:27	99.006	98.845	162-1	99.69	0.684			
																		188-4	99.86	1.011	75.0	2	98.849
																		162-1	99.69	0.831	75.0	6.3	98.859
																		188-3	99.86	0.995	75.0	9.2	98.865

Table C-1E: Pipe Data and Hydraulic Simulation Results for the August 8th, 1996 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
																		162-2	99.69	0.814	75.0	14.3	98.876
																		188-2	99.86	0.978	75.0	17.2	98.882
																		162-3	99.69	0.799	75.0	21.6	98.891
																		188-1	99.86	0.962	75.0	24.8	98.898
																		162-4	99.69	0.777	75.0	31.6	98.913
																		187-4	99.86	0.939	75.0	35.5	98.921
																		163-1	99.77	0.839	75.0	40.2	98.931
																		187-3	99.86	0.922	75.0	43.5	98.938
																		163-2	99.77	0.822	75.0	47.8	98.948
																		187-2	99.86	0.906	75.0	50.7	98.954
																		163-3	99.77	0.805	75.0	55.8	98.965
																		187-1	99.86	0.889	75.0	58.7	98.971
																		164-1	100.01	1.022	75.0	66.5	98.988
MH_111	MH_115	97.925	97.743	975	91.0	0.2	0.013	101.770	101.450	1.342	1.00	0.98	1.0	-0.055	01:27	98.845	98.706	159-1	99.58	0.735			
MH_112	MH_113	98.756	98.609	450	73.5	0.2	0.013	101.695	101.525	0.802	0.13	0.11	0.9	-0.105	01:31	99.101	98.874	183-1	99.74	0.639			
MH_113	MH_114	98.549	98.523	450	13.0	0.2	0.013	101.525	101.520	0.802	0.13	0.14	1.1	-0.125	01:33	98.874	98.786	181-1	99.85	0.976			
MH_1	MH_133	97.607	97.569	1500	19.0	0.2	0.013	101.660	101.660	1.789	3.16	1.80	0.6	-0.390	01:48	98.717	98.519	Est. Fut	99.86	1.143			
MH_114	MH_115	98.296	97.743	675	54.0	0.4	0.013	101.520	101.450	1.486	0.53	0.26	0.5	-0.185	01:27	98.786	98.706	182-1	99.58	0.794			
MH_115	MH_116	97.656	97.360	1050	59.0	0.5	0.013	101.450	101.580	2.230	1.93	1.30	0.7	0.000	01:35	98.706	98.570	157-1	99.46	0.754			
MH_116	MH_117	97.060	96.937	1650	122.5	0.1	0.013	101.580	101.370	1.348	2.88	2.85	1.0	-0.140	01:32	98.570	98.467	30	99.32	0.750			
MH_117	MH_118	96.917	96.796	1650	121.0	0.1	0.013	101.370	101.290	1.348	2.88	2.98	1.0	-0.100	01:34	98.467	98.345	20	99.11	0.643			
																		18	99.18	0.831	121.0	4.4	98.349
																		2	99.16	0.807	121.0	7.7	98.353
																		406	99.18	0.819	121.0	16.1	98.361
																		404	99.18	0.815	121.0	20.3	98.365
																		407	99.16	0.789	121.0	25.7	98.371
																		405	99.18	0.804	121.0	30.5	98.376
																		19	99.16	0.777	121.0	37.9	98.383
																		3	99.14	0.754	121.0	40.7	98.386
																		20	99.11	0.717	121.0	48.1	98.393
																		4	99.14	0.743	121.0	51.2	98.397
																		21	99.12	0.715	121.0	59.3	98.405
																		5	99.22	0.812	121.0	62.1	98.408
																		22	99.21	0.793	121.0	71.5	98.417
																		6	99.23	0.811	121.0	73.3	98.419
																		23	99.22	0.791	121.0	82.9	98.429
																		7	99.24	0.806	121.0	87.8	98.434
																		24	99.28	0.837	121.0	97.3	98.443
																		8	99.31	0.861	121.0	102.8	98.449
																		25	99.36	0.901	121.0	113.1	98.459
																		9	99.4	0.936	121.0	118.2	98.464
MH_118	MH_136	96.645	96.634	1950	11.0	0.1	0.013	101.290	101.190	1.507	4.50	2.98	0.7	-0.250	01:34	98.345	98.254	#N/A	#N/A	#N/A			
MH_119	MH_120	99.144	98.938	900	103.0	0.2	0.013	103.010	102.570	1.273	0.81	0.88	1.1	-0.100	01:27	99.944	99.588	101	100.65	0.706			
MH_119	MH_122	99.144	99.693	900	103.0	0.2	0.013	103.010	102.490	1.840	9.94	0.88	0.1	-0.100	01:27	99.944	99.693	#N/A	#N/A	#N/A			
MH_120	MH_121	98.878	98.850	900	14.0	0.2	0.013	102.570	102.480	1.273	0.81	0.92	1.1	-0.190	01:28	99.588	99.250	116	101.03	1.442			
MH_121	MH_132	98.790	97.536	900	114.0	1.1	0.013	102.480	101.320	2.985	1.90	0.99	0.5	-0.440	01:28	99.250	98.358	106	99.54	0.290			
																		106	99.54	1.126	114.0	7.2	98.414
																		107	99.71	1.200	114.0	19.4	98.510
																		108	99.88	1.283	114.0	30.6	98.597
																		109	100.05	1.373	114.0	40.8	98.677
																		110	100.15	1.374	114.0	53.4	98.776
																		111	100.32	1.455	114.0	64.8	98.865
																		112	100.48	1.520	114.0	77	98.960
																		113	100.57	1.522	114.0	88.2	99.048
																		114	100.57	1.442	114.0	98.4	99.128
																		115	100.65	1.441	114.0	108.8	99.209
MH_122	MH_123	99.663	99.461	300	13.0	1.6	0.013	102.490	102.270	1.705	0.12	0.00	0.0	-0.300	00:00	99.663	99.487	131	100.61	0.947			

Table C-1E: Pipe Data and Hydraulic Simulation Results for the August 8th, 1996 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S (1) (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (2) (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
MH_123	MH_127	99.407	98.615	300	49.5	1.6	0.013	102.270	101.675	1.730	0.12	0.02	0.1	-0.220	01:26	99.487	98.642	135	99.89	0.403			
MH_124	MH_125	99.069	98.715	375	101.0	0.4	0.013	102.060	101.870	1.421	2.66	0.07	0.0	-0.155	01:35	99.289	98.921	72	99.77	0.481			
																		82	99.89	0.949	101.0	5.4	98.941
																		69	99.84	0.888	101.0	8.4	98.952
																		70	99.78	0.791	101.0	18.6	98.989
																		81	99.89	0.898	101.0	19.6	98.992
																		71	99.78	0.751	101.0	29.7	99.029
																		80	99.92	0.886	101.0	31	99.034
																		72	99.77	0.704	101.0	39.9	99.066
																		79	100.04	0.948	101.0	46.9	99.092
																		73	99.82	0.713	101.0	51.1	99.107
																		78	100.04	0.921	101.0	54.4	99.119
																		74	99.88	0.736	101.0	61.3	99.144
																		77	100	0.844	101.0	64.6	99.156
																		413	99.93	0.742	101.0	73.4	99.188
																		415	100.08	0.885	101.0	75.2	99.195
																		412	99.98	0.759	101.0	82.3	99.221
																		414	100.1	0.864	101.0	86.4	99.236
																		75	99.98	0.717	101.0	94	99.263
																		76	100.16	0.882	101.0	98.1	99.278
MH_125	MH_127	98.481	98.615	600	91.5	0.3	0.013	101.870	101.675	1.618	5.82	0.22	0.0	-0.160	01:25	98.921	98.642	65	99.58	0.659			
																		88	99.82	1.129	91.5	16	98.691
																		63	99.59	0.897	91.5	16.6	98.693
																		87	99.82	1.087	91.5	29.7	98.733
																		64	99.59	0.856	91.5	30.3	98.734
																		86	99.65	0.883	91.5	41.1	98.767
																		65	99.58	0.804	91.5	43.9	98.776
																		85	99.74	0.929	91.5	55.5	98.811
																		66	99.69	0.869	91.5	58.6	98.821
																		84	99.76	0.901	91.5	71.3	98.859
																		67	99.78	0.911	91.5	74.4	98.869
																		83	99.89	0.987	91.5	85.7	98.903
																		68	99.84	0.927	91.5	88.8	98.913
MH_126	MH_127	98.697	98.615	300	28.5	0.4	0.013	101.500	101.675	0.865	0.06	0.14	2.3	0.690	01:25	99.687	98.642	#N/A	#N/A	#N/A			
MH_127	MH_128	98.102	97.994	750	54.0	0.2	0.013	101.675	101.395	1.654	7.44	0.38	0.1	-0.210	01:25	98.642	98.574	47	99.56	0.918			
MH_128	MH_129	97.964	97.923	750	13.5	0.3	0.013	101.395	101.315	1.389	0.61	0.37	0.6	-0.140	01:26	98.574	98.548	45	99.49	0.916			
MH_129	MH_130	97.848	97.732	825	77.0	0.2	0.013	101.315	101.420	1.496	6.17	0.48	0.1	-0.125	01:26	98.548	98.502	43	99.41	0.862			
MH_130	MH_131	97.732	97.581	825	100.5	0.2	0.013	101.420	101.200	1.040	0.56	0.56	1.0	-0.055	01:27	98.502	98.376	33	99.18	0.678			
MH_1302	MH_302	97.470	96.430	600	98.5	0.2	0.013	101.160	101.140	0.971	0.27	0.16	0.6	0.200	01:42	98.270	98.200	Est. Fut	99.36	1.090			
MH_1303	MH_303	97.245	96.351	750	109.0	0.2	0.013	101.090	101.080	0.976	0.43	0.35	0.8	0.270	01:44	98.265	98.131	Est. Fut	99.29	1.025			
MH_1304	MH_304	97.175	96.196	600	87.0	0.2	0.013	100.660	100.730	0.971	0.27	0.18	0.6	0.260	01:25	98.035	97.946	Est. Fut	98.86	0.825			
MH_131	MH_132	97.206	97.536	1200	12.0	0.2	0.013	101.200	101.320	1.335	1.51	0.54	0.4	-0.030	01:31	98.376	98.358	#N/A	#N/A	#N/A			
MH_1312	MH_310	97.627	97.113	750	62.0	0.2	0.013	100.940	100.940	1.127	0.50	0.18	0.4	-0.440	01:36	97.937	97.843	Est. Fut	99.14	1.203			
MH_132	MH_136	97.128	96.634	1200	59.5	0.2	0.013	101.320	101.190	1.542	1.74	1.62	0.9	0.030	01:31	98.358	98.254	103	99.33	0.972			
MH_133	MH_134	97.509	97.393	1500	77.0	0.2	0.013	101.660	101.550	2.126	19.14	1.87	0.1	-0.490	01:37	98.519	98.433	#N/A	#N/A	#N/A			
MH_134	MH_135	97.363	97.271	1500	61.0	0.2	0.013	101.550	101.440	1.554	2.75	1.91	0.7	-0.430	01:36	98.433	98.361	#N/A	#N/A	#N/A			
MH_135	MH_136	97.121	96.634	1650	37.0	0.1	0.013	101.440	101.190	1.348	2.88	1.93	0.7	-0.410	01:36	98.361	98.254	#N/A	#N/A	#N/A			
MH_136	MH_302	96.484	96.430	2250	54.0	0.1	0.013	101.190	101.140	1.658	6.59	6.45	1.0	-0.480	01:32	98.254	98.200	1	99.38	1.126			
MH_201	MH_202	105.214	104.138	375	119.5	0.9	0.013	108.120	107.180	1.506	0.17	0.08	0.5	-0.195	01:26	105.394	104.363	321	105.28	-0.114			
																		321	105.28	0.844	119.5	8.5	104.436
																		430	107.31	2.856	119.5	10.6	104.454
																		431	107.37	2.866	119.5	16.3	104.504
																		428	105.36	0.805	119.5	22.2	104.555
																		233	107.4	2.782	119.5	29.5	104.618
																		429	105.37	0.735	119.5	31.5	104.635
																		234	107.46	2.793	119.5	35.2	104.667
																		320	105.45	0.710	119.5	43.7	104.740

Table C-1E: Pipe Data and Hydraulic Simulation Results for the August 8th, 1996 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		235	107.5	2.725	119.5	47.7	104.775
																		319	105.56	0.724	119.5	54.8	104.836
																		236	107.62	2.783	119.5	54.9	104.837
																		318	105.66	0.736	119.5	65	104.924
																		237	107.69	2.746	119.5	67.3	104.944
																		238	107.8	2.807	119.5	73	104.993
																		317	105.77	0.750	119.5	76.2	105.020
																		239	107.87	2.763	119.5	86.2	105.107
																		316	105.9	0.774	119.5	88.4	105.126
																		240	107.99	2.834	119.5	91.9	105.156
																		315	106.02	0.796	119.5	99.8	105.224
																		241	108.06	2.790	119.5	105.1	105.270
																		242	108.16	2.841	119.5	110.8	105.319
																		314	106.13	0.783	119.5	114	105.347
MH_202	MH_203	104.063	104.035	450	14.0	0.2	0.013	107.180	107.090	0.802	0.13	0.10	0.8	-0.150	01:26	104.363	104.285	230	105.39	1.027			
MH_203	MH_206	103.975	103.730	450	54.5	0.5	0.013	107.090	106.720	1.203	0.19	0.16	0.8	-0.140	01:27	104.285	103.730	225	104.9	0.615			
MH_204	MH_205	103.579	103.343	525	118.0	0.2	0.013	106.620	106.610	0.888	0.19	0.14	0.7	-0.185	01:34	103.919	103.803	285	104.64	0.721			
MH_205	MH_206	103.313	103.730	525	16.0	0.2	0.013	106.610	106.720	0.888	0.19	0.20	1.0	-0.035	01:34	103.803	103.730	#N/A	#N/A	#N/A			
MH_206	MH_207	103.197	102.999	600	49.5	0.4	0.013	106.720	106.460	1.373	0.39	0.37	0.9	-0.110	01:30	103.687	103.299	221	104.52	0.833			
MH_207	MH_208	102.969	102.731	600	12.5	1.9	0.013	106.460	106.320	2.997	0.85	0.37	0.4	-0.270	01:30	103.299	102.981	219	104.39	1.091			
MH_208	MH_215	102.671	100.543	600	112.0	1.9	0.013	106.320	104.150	2.993	0.85	0.41	0.5	-0.290	01:30	102.981	101.023	212	102.46	-0.521			
																		271	102.46	1.281	112.0	8.9	101.179
																		212	102.46	1.215	112.0	12.7	101.245
																		270	102.67	1.243	112.0	23.1	101.427
																		213	102.68	1.223	112.0	24.8	101.457
																		214	102.89	1.255	112.0	35	101.635
																		269	102.93	1.279	112.0	35.9	101.651
																		215	103.1	1.269	112.0	46.2	101.831
																		268	103.18	1.330	112.0	47.3	101.850
																		216	103.36	1.316	112.0	58.4	102.044
																		267	103.42	1.357	112.0	59.5	102.063
																		217	103.62	1.377	112.0	69.8	102.243
																		266	103.68	1.421	112.0	70.7	102.259
																		423	103.94	1.503	112.0	80.9	102.437
																		421	103.83	1.373	112.0	82	102.457
																		422	104.04	1.409	112.0	92	102.631
																		420	104.04	1.389	112.0	93.1	102.651
																		265	104.35	1.514	112.0	103.7	102.836
																		218	104.3	1.431	112.0	105.6	102.869
MH_209	MH_201	105.833	105.316	300	94.0	0.6	0.013	108.630	108.120	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.394	313	106.24	0.407			
MH_209	MH_210	105.833	105.518	300	94.0	0.6	0.013	108.630	108.320	1.015	0.07	0.00	0.0	-0.300	00:00	105.833	105.586	254	108.31	2.477			
MH_210	MH_212	105.486	103.434	300	54.0	3.8	0.013	108.320	107.010	2.668	0.19	0.05	0.3	-0.200	01:25	105.586	103.569	258	105.12	-0.466			
																		258	105.12	0.965	54.0	15.7	104.155
																		257	105.54	0.948	54.0	27.4	104.592
																		256	106.05	1.035	54.0	38.7	105.015
																		255	106.58	1.188	54.0	48.8	105.392
MH_211	MH_212	103.900	103.434	300	26.5	0.4	0.013	106.090	107.010	0.810	0.06	0.02	0.3	-0.160	01:30	104.040	103.569	#N/A	#N/A	#N/A			
MH_212	MH_204	103.359	103.804	375	49.5	0.5	0.013	107.010	106.620	1.066	0.12	0.07	0.6	-0.165	01:26	103.569	103.919	284	104.71	1.141			
MH_212	MH_213	103.359	103.136	375	49.5	0.5	0.013	107.010	106.020	1.066	0.12	0.07	0.6	-0.165	01:26	103.569	103.233	203	104.1	0.531			
MH_213	MH_214	103.053	102.918	375	13.5	1.0	0.013	106.020	105.800	1.587	0.18	0.07	0.4	-0.195	01:26	103.233	103.043	204	104.02	0.787			
MH_214	MH_215	102.883	100.543	375	90.0	2.4	0.013	105.800	104.150	2.434	0.27	0.10	0.4	-0.215	01:26	103.043	101.023	272	102.37	-0.673			
																		272	102.37	1.181	90.0	7.4	101.189
																		211	102.46	1.082	90.0	15.8	101.378
																		273	102.59	1.082	90.0	21.6	101.508
																		210	102.68	1.029	90.0	28	101.651
																		274	102.86	1.011	90.0	36.8	101.849
																		209	102.89	1.010	90.0	38.2	101.880

Table C-1E: Pipe Data and Hydraulic Simulation Results for the August 8th, 1996 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S (1) (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (2) (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		275	103.11	1.005	90.0	48.2	102.105
																		208	103.15	1.018	90.0	49.4	102.132
																		276	103.37	0.991	90.0	60.4	102.379
																		207	103.4	0.950	90.0	63.6	102.450
																		277	103.55	1.003	90.0	67.9	102.547
																		206	103.66	0.954	90.0	75	102.706
																		278	103.55	0.648	90.0	83.7	102.902
																		205	103.83	0.888	90.0	85.5	102.942
MH_215	MH_119	100.303	99.423	675	55.0	1.6	0.013	104.150	103.010	2.971	1.06	0.85	0.8	0.045	01:26	101.023	99.944	#N/A	#N/A	#N/A			
MH_216	MH_217	105.251	104.798	375	75.5	0.6	0.013	108.100	107.980	1.230	0.14	0.11	0.8	-0.115	01:30	105.511	105.053	346	105.85	0.339			
MH_217	MH_218	104.573	104.347	600	113.0	0.2	0.013	107.980	107.690	0.971	0.27	0.25	0.9	-0.120	01:32	105.053	104.887	356	105.71	0.657			
MH_218	MH_220	104.327	104.166	600	80.5	0.2	0.013	107.690	107.790	0.971	0.27	0.28	1.0	-0.040	01:30	104.887	104.166	357	105.75	0.863			
MH_219	MH_220	105.649	104.166	300	25.0	2.7	0.013	108.450	107.790	2.228	0.16	0.00	0.0	-0.300	00:00	105.649	104.166	#N/A	#N/A	#N/A			
MH_220	MH_224	103.644	102.523	600	59.0	1.9	0.013	107.790	105.620	2.993	0.85	0.28	0.3	-0.360	01:30	103.884	102.523	259	104.74	0.856			
MH_221	MH_222	103.008	102.620	300	77.5	0.5	0.013	105.960	105.420	0.968	0.07	0.01	0.1	-0.240	01:25	103.068	102.781	396-1	103.56	0.492			
MH_222	MH_223	102.311	102.168	600	95.5	0.2	0.013	105.420	105.450	0.841	0.24	0.21	0.9	-0.130	01:34	102.781	102.678	366-1	103.37	0.589			
MH_2	MH_2260	101.916	101.876	675	10.0	0.4	0.013	105.290	105.290	1.486	0.53	0.38	0.7	-0.085	03:03	102.506	102.116	Est. Fut	103.49	0.984			
MH_223	MH_224	102.148	102.523	600	97.0	0.2	0.013	105.450	105.620	0.971	0.27	0.26	0.9	-0.070	01:32	102.678	102.523	365-1	103.42	0.742			
MH_224	MH_105	101.625	100.067	600	82.0	1.9	0.013	105.620	103.170	2.993	0.85	0.61	0.7	-0.220	01:30	102.005	100.067	141	101.9	-0.105			
																		141	101.9	1.564	82.0	11.4	100.336
																		140	102.18	1.508	82.0	25.6	100.672
																		139	102.55	1.611	82.0	36.9	100.939
																		138	102.92	1.740	82.0	47.1	101.180
																		137	103.3	1.857	82.0	58.2	101.443
																		136	103.81	2.046	82.0	71.8	101.764
MH_225	MH_226	103.412	102.914	300	99.5	0.5	0.013	106.390	105.720	0.968	0.07	0.02	0.4	-0.180	01:27	103.532	103.003	388-3	103.75	0.218			
																		389-2	103.75	0.716	99.5	5.8	103.034
																		389-1	103.75	0.658	82.0	13.8	103.092
																		388-3	103.75	0.590	82.0	24.4	103.160
																		388-2	103.88	0.670	82.0	32.1	103.210
																		388-1	103.88	0.618	82.0	40.1	103.262
																		387-4	104.02	0.690	82.0	50.7	103.330
																		387-3	104.02	0.638	82.0	58.7	103.382
																		387-2	104.02	0.592	82.0	65.9	103.428
																		387-1	104.02	0.540	82.0	73.9	103.480
MH_2260	MH_227	101.816	101.049	675	49.5	1.6	0.013	105.290	104.230	2.925	1.05	0.43	0.4	-0.375	01:26	102.116	101.099	392-1	102.46	0.344			
MH_226	MH_2260	102.863	101.876	300	64.0	1.1	0.013	105.720	105.290	1.402	0.10	0.05	0.5	-0.160	01:26	103.003	102.116	391-3	103.08	0.077			
																		391-3	103.08	0.932	64.0	2.3	102.148
																		391-2	103.45	1.201	64.0	9.6	102.249
																		391-1	103.45	1.090	64.0	17.6	102.360
																		390-3	103.58	1.073	64.0	28.2	102.507
																		390-2	103.58	0.962	64.0	36.2	102.618
																		390-1	103.58	0.857	64.0	43.8	102.723
																		389-4	103.75	0.879	64.0	54.5	102.871
																		389-3	103.75	0.768	64.0	62.5	102.982
MH_227	MH_109	100.759	99.306	675	93.0	1.6	0.013	104.230	102.650	2.971	1.06	0.47	0.4	-0.335	01:26	101.099	99.651	394-3	100.86	-0.239			
																		394-4	100.86	0.910	93.0	19.2	99.950
																		394-3	100.86	0.785	93.0	27.2	100.075
																		394-2	101.26	1.072	93.0	34.5	100.188
																		394-1	101.26	0.947	93.0	42.5	100.313
																		393-3	101.49	0.997	93.0	54.1	100.493
																		393-2	101.81	1.198	93.0	61.7	100.612
																		393-1	101.81	1.074	93.0	69.7	100.736
																		392-4	102.21	1.292	93.0	81.4	100.918
																		392-3	102.21	1.167	93.0	89.4	101.043
MH_228	MH_229	102.472	100.982	300	74.5	2.0	0.013	105.270	103.790	1.935	0.14	0.05	0.3	-0.180	01:26	102.592	101.043	384-3	102.12	-0.472			
																		384-3	102.12	1.027	74.5	2.4	101.093

Table C-1E: Pipe Data and Hydraulic Simulation Results for the August 8th, 1996 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S (1) (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (2) (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		379-2	102.14	1.026	74.5	3.4	101.114
																		384-4	102.12	0.861	74.5	10.4	101.259
																		379-1	102.14	0.860	74.5	11.4	101.280
																		385-1	102.35	0.870	74.5	21	101.480
																		378-3	102.57	1.070	74.5	22	101.500
																		385-2	102.65	1.012	74.5	28.6	101.638
																		378-2	102.67	1.009	74.5	29.7	101.661
																		385-3	102.65	0.846	74.5	36.6	101.804
																		378-1	102.67	0.843	74.5	37.7	101.827
																		386-1	102.73	0.704	74.5	47.3	102.026
																		377-4	103.02	0.973	74.5	48.3	102.047
																		386-2	103.08	0.887	74.5	55.3	102.193
																		377-3	103.28	1.066	74.5	56.3	102.214
																		377-2	103.34	0.977	74.5	63.5	102.363
																		377-1	103.34	0.810	74.5	71.5	102.530
MH_229	MH_102	100.723	100.142	525	86.5	0.9	0.013	103.790	103.240	1.832	0.40	0.23	0.6	-0.205	01:30	101.043	100.167	381-1	101.35	0.307			
																		382-1	101.52	1.214	86.5	13.7	100.306
																		381-4	101.35	1.034	86.5	14.7	100.316
																		382-2	101.52	1.133	86.5	21.7	100.387
																		381-3	101.35	0.953	86.5	22.7	100.397
																		382-3	101.52	1.060	86.5	28.9	100.460
																		381-2	101.35	0.879	86.5	30	100.471
																		382-4	101.52	0.979	86.5	36.9	100.541
																		381-1	101.35	0.798	86.5	38	100.552
																		383-1	101.62	0.971	86.5	47.6	100.649
																		380-3	101.59	0.931	86.5	48.6	100.659
																		383-2	101.62	0.890	86.5	55.6	100.730
																		380-2	101.59	0.850	86.5	56.6	100.740
																		383-3	101.62	0.813	86.5	63.2	100.807
																		380-1	101.59	0.773	86.5	64.2	100.817
																		384-1	101.95	1.036	86.5	73.8	100.914
																		379-4	101.96	1.034	86.5	74.9	100.926
																		384-2	101.95	0.955	86.5	81.8	100.995
																		379-3	101.96	0.953	86.5	82.9	101.007
MH_230	MH_231	102.417	100.947	300	73.5	2.0	0.013	105.220	103.750	1.935	0.14	0.04	0.3	-0.190	01:26	102.527	100.962	374-3	102.03	-0.497			
																		374-3	102.03	1.015	73.5	2.5	101.015
																		368-3	102.24	1.172	73.5	5	101.068
																		374-4	102.03	0.844	73.5	10.5	101.186
																		368-2	102.24	1.001	73.5	13	101.239
																		368-1	102.24	0.839	73.5	20.6	101.401
																		375-1	102.4	0.987	73.5	21.2	101.413
																		375-2	102.57	0.995	73.5	28.8	101.575
																		367-3	102.71	1.082	73.5	31.3	101.628
																		375-3	102.57	0.824	73.5	36.8	101.746
																		367-2	102.71	0.911	73.5	39.3	101.799
																		367-1	102.71	0.749	73.5	46.9	101.961
																		376-1	103	1.029	73.5	47.4	101.971
																		376-2	103	0.858	73.5	55.4	102.142
																		376-3	103.37	1.073	73.5	62.7	102.297
																		376-4	103.37	0.903	73.5	70.7	102.467
MH_231	MH_103	100.722	99.002	525	87.0	2.0	0.013	103.750	102.350	2.810	0.61	0.23	0.4	-0.285	01:26	100.962	99.225	371-1	100.56	-0.402			
																		371-3	100.56	1.075	87.0	13	99.485
																		372-1	100.95	1.447	87.0	13.9	99.503
																		371-2	100.56	0.916	87.0	21	99.644
																		372-2	100.95	1.288	87.0	21.9	99.662
																		371-1	100.56	0.764	87.0	28.6	99.796
																		372-3	100.95	1.142	87.0	29.2	99.808

Table C-1E: Pipe Data and Hydraulic Simulation Results for the August 8th, 1996 Historical Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [(2)] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		372-4	100.95	0.982	87.0	37.2	99.968
																		370-3	101.09	1.080	87.0	39.3	100.010
																		370-2	101.09	0.921	87.0	47.3	100.169
																		373-1	100.97	0.791	87.0	47.8	100.179
																		370-1	101.09	0.769	87.0	54.9	100.321
																		373-2	101.32	0.981	87.0	55.8	100.339
																		373-3	101.32	0.829	87.0	63.4	100.491
																		369-3	101.61	1.077	87.0	65.5	100.533
																		369-2	101.61	0.918	87.0	73.5	100.692
																		374-1	101.56	0.856	87.0	74.1	100.704
																		369-1	101.61	0.764	87.0	81.2	100.846
																		374-2	101.56	0.696	87.0	82.1	100.864
MH_302	MH_303	96.410	96.351	2250	59.0	0.1	0.013	101.140	101.080	1.658	6.59	6.61	1.0	-0.460	01:32	98.200	98.131	#N/A	#N/A	#N/A			
MH_303	MH_304	96.331	96.196	2250	134.5	0.1	0.013	101.080	100.730	1.658	6.59	6.98	1.1	-0.450	01:33	98.131	97.946	#N/A	#N/A	#N/A			
MH_304	MH_306TEE	96.176	96.133	2250	42.5	0.1	0.013	100.730	100.350	1.666	6.62	7.16	1.1	-0.480	01:33	97.946	97.693	#N/A	#N/A	#N/A			
MH_306TEE	MH_307	96.133	96.120	2250	13.0	0.1	0.013	100.350	100.350	2.128	28.73	7.23	0.3	-0.690	01:32	97.693	97.470	#N/A	#N/A	#N/A			
MH_313	MH_307	96.099	96.120	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	3.89	0.6	-0.970	01:34	97.379	97.470	#N/A	#N/A	#N/A			
MH_307	MH_400	96.100	96.076	2250	22.7	0.1	0.013	100.350	100.350	1.707	6.79	4.65	0.7	-0.880	01:32	97.470	97.447	#N/A	#N/A	#N/A			
MH_309	MH_310	97.139	97.113	1200	17.5	0.1	0.013	100.990	100.940	1.331	1.50	0.88	0.6	-0.370	01:35	97.969	97.843	#N/A	#N/A	#N/A			
MH_310	MH_311	97.053	96.959	1200	62.5	0.2	0.013	100.940	100.830	1.335	1.51	1.12	0.7	-0.410	01:32	97.843	97.749	#N/A	#N/A	#N/A			
MH_3	MH_109	99.346	99.306	600	10.0	0.4	0.013	102.650	102.650	1.373	0.39	0.23	0.6	-0.260	01:32	99.686	99.651	#N/A	#N/A	#N/A			
MH_3111TEE	MH_312	96.831	96.716	1200	76.5	0.2	0.013	100.640	100.450	1.335	1.51	1.21	0.8	-0.390	01:31	97.641	97.466	#N/A	#N/A	#N/A			
MH_311	MH_3111TEE	96.939	96.831	1200	72.0	0.2	0.013	100.830	100.640	1.335	1.51	1.21	0.8	-0.390	01:31	97.749	97.641	#N/A	#N/A	#N/A			
MH_312	MH_313	96.656	96.624	1200	21.5	0.1	0.013	100.450	100.350	1.331	1.50	1.21	0.8	-0.390	01:31	97.466	97.379	#N/A	#N/A	#N/A			
MH_313	MH_500	96.099	96.065	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	3.89	0.6	-0.970	01:34	97.379	97.346	#N/A	#N/A	#N/A			
MH_400	OGS_1	96.067	96.057	750	4.9	0.2	0.013	100.350	100.500	1.133	0.50	1.00	2.0	0.630	03:03	97.447	97.417	#N/A	#N/A	#N/A			
OGS_1	OGS_1-Out	96.037	96.027	750	4.9	0.2	0.013	100.500	100.350	1.138	0.50	1.00	2.0	0.630	03:03	97.417	97.135	#N/A	#N/A	#N/A			
OGS_1-Out	MH_401	96.015	96.000	2250	14.7	0.1	0.013	100.350	100.350	1.674	6.66	5.32	0.8	-1.130	01:32	97.135	96.880	#N/A	#N/A	#N/A			
MH_4	MH_104	98.554	98.516	525	9.5	0.4	0.013	101.580	101.590	1.256	0.27	0.14	0.5	-0.155	01:31	98.924	98.825	#N/A	#N/A	#N/A			
MH_500	OGS_2	96.056	96.046	750	5.0	0.2	0.013	100.350	100.428	1.127	0.50	0.98	2.0	0.540	03:25	97.346	97.326	#N/A	#N/A	#N/A			
OGS_2	OGS_2-Out	96.026	96.016	750	5.1	0.2	0.013	100.428	100.350	1.118	0.49	0.98	2.0	0.550	03:25	97.326	97.094	#N/A	#N/A	#N/A			
OGS_2-Out	MH_501	96.004	96.000	2250	4.2	0.1	0.013	100.350	100.350	1.624	6.46	4.73	0.7	-1.160	01:32	97.094	96.830	#N/A	#N/A	#N/A			

(2) Conservative estimate of freeboard based on U/S HGL and lowest USF connected to pipe. Actual HGL / freeboard at all connecting lots interpolated where conservative estimate does not meet freeboard requirements.

(3) Future USF elevations estimated as 1.8 m below the upstream top of manhole elevations.

Legend	
(green)	Interpolated HGL elevation
(yellow)	Freebaord Less than 0.3m
(red)	Freebaord Less than 0.0m

Table C-1F: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm + 20%

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_401	POND	96.000	95.950	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	5.74	0.4	-1.070	01:13	97.180	96.730	#N/A	#N/A	#N/A			
MH_501	POND	96.000	95.950	2250	10.0	0.5	0.013	100.350	#N/A	3.706	14.74	5.04	0.3	-1.070	01:13	97.180	96.730	#N/A	#N/A	#N/A			
MH_1002	MH_1003	94.150	93.982	900	28.0	0.6	0.013	98.370	98.040	2.204	1.40	1.35	1.0	0.210	02:18	95.260	94.632	#N/A	#N/A	#N/A			
MH_1003	MH_1004	93.922	93.271	900	108.5	0.6	0.013	98.040	96.170	2.204	1.40	1.35	1.0	-0.190	02:19	94.632	93.366	#N/A	#N/A	#N/A			
MH_1004	MH_1005	92.586	92.162	975	106.0	0.4	0.013	96.170	95.150	1.898	1.42	1.35	1.0	-0.195	02:20	93.366	92.993	#N/A	#N/A	#N/A			
MH_1005	MH_1006	91.933	91.721	1200	106.0	0.2	0.013	95.150	94.970	1.542	1.74	1.35	0.8	-0.140	02:22	92.993	92.891	#N/A	#N/A	#N/A			
MH_1006	MH_1007	91.701	91.489	1200	106.0	0.2	0.013	94.970	94.270	1.542	1.74	1.35	0.8	-0.010	02:22	92.891	92.760	#N/A	#N/A	#N/A			
MH_1007	MH_1008	91.470	91.230	1200	88.0	0.3	0.013	94.270	93.460	1.801	2.04	1.56	0.8	0.090	00:00	92.760	92.590	#N/A	#N/A	#N/A			
MH_1008	MH_1009	91.230	91.200	1200	14.5	0.2	0.013	93.460	#N/A	1.568	1.77	1.58	0.9	0.160	00:01	92.590	92.500	#N/A	#N/A	#N/A			
MH_101	MH_102	100.935	99.988	300	30.5	2.6	0.013	103.750	103.240	2.206	0.16	0.00	0.0	-0.300	00:00	100.935	100.327	174-2	101.41	0.475			
MH_102	MH_103	99.917	98.982	525	59.0	1.6	0.013	103.240	102.350	2.474	0.54	0.31	0.6	-0.115	01:10	100.327	100.075	172-5	100.47	0.143			
																		172-5	100.47	0.366	59.0	6.9	100.104
																		173-1	100.78	0.628	59.0	18.1	100.152
																		173-2	100.78	0.594	59.0	26.1	100.186
																		173-3	101.1	0.883	59.0	33.3	100.217
																		173-4	101.1	0.849	59.0	41.3	100.251
																		173-5	101.1	0.816	59.0	48.9	100.284
																		174-1	101.41	1.095	59.0	56.3	100.315
MH_103	MH_104	98.755	98.516	750	120.0	0.4	0.013	102.350	101.590	1.594	0.70	0.72	1.0	0.570	01:10	100.075	99.585	169-2	99.81	-0.265			
																		169-2	99.81	0.214	120.0	2.7	99.596
																		169-3	99.81	0.184	120.0	10	99.626
																		169-4	99.81	0.152	120.0	18	99.659
																		170-1	99.93	0.228	120.0	28.6	99.702
																		170-2	99.93	0.196	120.0	36.6	99.734
																		170-3	99.93	0.165	120.0	44.2	99.765
																		171-1	99.99	0.181	120.0	54.9	99.809
																		171-2	99.99	0.148	120.0	62.9	99.842
																		171-3	99.99	0.119	120.0	70.1	99.871
																		171-4	99.99	0.086	120.0	78.1	99.904
																		172-1	100.47	0.493	120.0	96.1	99.977
																		172-2	100.47	0.460	120.0	104.1	100.010
																		172-3	100.47	0.431	120.0	111.3	100.039
																		172-4	100.47	0.407	120.0	117	100.063
MH_104	MH_106	97.975	98.288	1050	41.5	0.1	0.013	101.590	101.840	1.217	1.05	1.06	1.0	0.560	01:10	99.585	99.425	169-1	99.81	0.225			
MH_105	MH_106	99.562	98.288	675	91.0	1.4	0.013	103.170	101.840	2.779	0.99	0.79	0.8	-0.135	01:10	100.102	99.425	148	100.03	-0.072			
																		148	100.03	0.511	91.0	12.6	99.519
																		147	100.16	0.550	91.0	24.8	99.610
																		146	100.3	0.615	91.0	35	99.685
																		145	100.42	0.651	91.0	46.2	99.769
																		144	100.56	0.686	91.0	60.4	99.874
																		143	100.93	0.953	91.0	74.2	99.977
																		142	101.5	1.414	91.0	88.9	100.086
MH_106	MH_116	97.605	97.361	1350	122.5	0.2	0.013	101.840	101.580	1.668	2.39	2.01	0.8	0.470	01:11	99.425	99.120	166-1	99.53	0.105			
MH_107	MH_108	99.165	99.080	300	74.0	0.4	0.013	101.895	101.880	0.809	0.06	0.04	0.7	0.365	01:09	99.830	100.018	176-1	100.1	0.270			
MH_107	MH_112	99.165	98.906	300	74.0	0.4	0.013	101.895	101.695	0.809	0.06	0.04	0.7	0.365	01:09	99.830	99.731	185-1	99.89	0.060			
MH_108	MH_110	98.908	98.731	450	54.0	0.2	0.013	101.880	101.980	0.802	0.13	0.09	0.7	0.660	01:07	100.018	99.836	175-1	100.15	0.132			
MH_109	MH_110	99.151	98.731	750	60.0	0.7	0.013	102.650	101.980	2.108	0.93	0.90	1.0	0.330	01:06	100.231	99.836	164-2	100.01	-0.221			
																		164-2	100.01	0.166	60.0	1.2	99.844
																		164-3	100.25	0.370	60.0	6.7	99.880
																		164-4	100.25	0.317	60.0	14.7	99.933
																		165-1	100.42	0.417	60.0	25.3	100.003
																		165-2	100.93	0.877	60.0	32.9	100.053
																		165-3	100.93	0.825	60.0	40.9	100.105
MH_110	MH_111	98.346	98.046	900	75.0	0.4	0.013	101.980	101.770	1.800	1.14	1.15	1.0	0.590	01:06	99.836	99.565	162-1	99.69	-0.146			
																		188-4	99.86	0.288	75.0	2	99.572
																		162-1	99.69	0.102	75.0	6.3	99.588
																		188-3	99.86	0.262	75.0	9.2	99.598

Table C-1F: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm + 20%

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
																		162-2	99.69	0.073	75.0	14.3	99.617
																		188-2	99.86	0.233	75.0	17.2	99.627
																		162-3	99.69	0.047	75.0	21.6	99.643
																		188-1	99.86	0.205	75.0	24.8	99.655
																		162-4	99.69	0.011	75.0	31.6	99.679
																		187-4	99.86	0.167	75.0	35.5	99.693
																		163-1	99.77	0.060	75.0	40.2	99.710
																		187-3	99.86	0.138	75.0	43.5	99.722
																		163-2	99.77	0.032	75.0	47.8	99.738
																		187-2	99.86	0.112	75.0	50.7	99.748
																		163-3	99.77	0.003	75.0	55.8	99.767
																		187-1	99.86	0.083	75.0	58.7	99.777
																		164-1	100.01	0.205	75.0	66.5	99.805
MH_111	MH_115	97.925	98.080	975	91.0	0.2	0.013	101.770	101.450	1.342	1.00	1.19	1.2	0.665	01:11	99.565	99.316	159-1	99.58	0.015			
MH_112	MH_113	98.756	98.609	450	73.5	0.2	0.013	101.695	101.525	0.802	0.13	0.15	1.2	0.525	01:11	99.731	99.504	183-1	99.74	0.009			
MH_113	MH_114	98.549	98.523	450	13.0	0.2	0.013	101.525	101.520	0.802	0.13	0.18	1.4	0.505	01:11	99.504	99.436	181-1	99.85	0.346			
MH_1	MH_133	97.607	97.569	1500	19.0	0.2	0.013	101.660	101.660	1.789	3.16	1.80	0.6	-0.250	01:27	98.857	98.739	Est. Fut	99.86	1.003			
MH_114	MH_115	98.296	98.080	675	54.0	0.4	0.013	101.520	101.450	1.486	0.53	0.31	0.6	0.465	01:10	99.436	99.316	182-1	99.58	0.144			
MH_115	MH_116	97.656	97.361	1050	59.0	0.5	0.013	101.450	101.580	2.230	1.93	1.58	0.8	0.610	01:11	99.316	99.120	157-1	99.46	0.144			
MH_116	MH_117	97.060	96.937	1650	122.5	0.1	0.013	101.580	101.370	1.348	2.88	3.74	1.3	0.410	01:11	99.120	98.917	30	99.32	0.200			
MH_117	MH_118	96.917	96.796	1650	121.0	0.1	0.013	101.370	101.290	1.348	2.88	3.94	1.4	0.350	01:12	98.917	98.695	20	99.11	0.193			
																		18	99.18	0.477	121.0	4.4	98.703
																		2	99.16	0.451	121.0	7.7	98.709
																		406	99.18	0.455	121.0	16.1	98.725
																		404	99.18	0.448	121.0	20.3	98.732
																		407	99.16	0.418	121.0	25.7	98.742
																		405	99.18	0.429	121.0	30.5	98.751
																		19	99.16	0.395	121.0	37.9	98.765
																		3	99.14	0.370	121.0	40.7	98.770
																		20	99.11	0.327	121.0	48.1	98.783
																		4	99.14	0.351	121.0	51.2	98.789
																		21	99.12	0.316	121.0	59.3	98.804
																		5	99.22	0.411	121.0	62.1	98.809
																		22	99.21	0.384	121.0	71.5	98.826
																		6	99.23	0.401	121.0	73.3	98.829
																		23	99.22	0.373	121.0	82.9	98.847
																		7	99.24	0.384	121.0	87.8	98.856
																		24	99.28	0.406	121.0	97.3	98.874
																		8	99.31	0.426	121.0	102.8	98.884
																		25	99.36	0.457	121.0	113.1	98.903
																		9	99.4	0.488	121.0	118.2	98.912
MH_118	MH_136	96.645	97.084	1950	11.0	0.1	0.013	101.290	101.190	1.507	4.50	3.94	0.9	0.100	01:12	98.695	98.564	#N/A	#N/A	#N/A			
MH_119	MH_120	100.183	98.938	300	89.0	0.6	0.013	103.010	102.570	1.015	0.07	0.00	0.0	-0.289	01:11	100.194	99.738	101	100.65	0.456			
MH_119	MH_122	100.183	99.693	300	89.0	0.6	0.013	103.010	102.490	1.015	0.07	0.00	0.0	-0.289	01:11	100.194	99.693	#N/A	#N/A	#N/A			
MH_120	MH_121	98.878	98.850	900	14.0	0.2	0.013	102.570	102.480	1.273	0.81	1.21	1.5	-0.040	01:11	99.738	99.370	116	101.03	1.292			
MH_121	MH_132	98.790	97.188	900	114.0	1.1	0.013	102.480	101.320	2.985	1.90	1.31	0.7	-0.320	01:12	99.370	98.748	106	99.54	0.170			
																		106	99.54	0.753	114.0	7.2	98.787
																		107	99.71	0.856	114.0	19.4	98.854
																		108	99.88	0.965	114.0	30.6	98.915
																		109	100.05	1.079	114.0	40.8	98.971
																		110	100.15	1.111	114.0	53.4	99.039
																		111	100.32	1.218	114.0	64.8	99.102
																		112	100.48	1.312	114.0	77	99.168
																		113	100.57	1.341	114.0	88.2	99.229
																		114	100.57	1.285	114.0	98.4	99.285
																		115	100.65	1.308	114.0	108.8	99.342
MH_122	MH_123	99.663	99.461	300	13.0	1.6	0.013	102.490	102.270	1.705	0.12	0.00	0.0	-0.290	01:12	99.673	99.527	131	100.61	0.937			

Table C-1F: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm + 20%

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
MH_123	MH_127	99.407	98.583	300	49.5	1.6	0.013	102.270	101.675	1.730	0.12	0.04	0.3	-0.180	01:10	99.527	99.322	135	99.89	0.363			
MH_124	MH_125	99.069	98.715	375	101.0	0.4	0.013	102.060	101.870	0.939	0.10	0.07	0.7	0.235	01:27	99.679	99.541	72	99.77	0.091			
																		82	99.89	0.342	101.0	5.4	99.548
																		69	99.84	0.288	101.0	8.4	99.552
																		70	99.78	0.214	101.0	18.6	99.566
																		81	99.89	0.322	101.0	19.6	99.568
																		71	99.78	0.198	101.0	29.7	99.582
																		80	99.92	0.337	101.0	31	99.583
																		72	99.77	0.174	101.0	39.9	99.596
																		79	100.04	0.435	101.0	46.9	99.605
																		73	99.82	0.209	101.0	51.1	99.611
																		78	100.04	0.425	101.0	54.4	99.615
																		74	99.88	0.255	101.0	61.3	99.625
																		77	100	0.371	101.0	64.6	99.629
																		413	99.93	0.289	101.0	73.4	99.641
																		415	100.08	0.436	101.0	75.2	99.644
																		412	99.98	0.327	101.0	82.3	99.653
																		414	100.1	0.441	101.0	86.4	99.659
																		75	99.98	0.311	101.0	94	99.669
																		76	100.16	0.485	101.0	98.1	99.675
MH_125	MH_127	98.481	98.583	600	91.5	0.3	0.013	101.870	101.675	1.086	0.31	0.27	0.9	0.460	01:37	99.541	99.322	65	99.58	0.039			
																		88	99.82	0.460	91.5	16	99.360
																		63	99.59	0.228	91.5	16.6	99.362
																		87	99.82	0.427	91.5	29.7	99.393
																		64	99.59	0.195	91.5	30.3	99.395
																		86	99.65	0.230	91.5	41.1	99.420
																		65	99.58	0.153	91.5	43.9	99.427
																		85	99.74	0.285	91.5	55.5	99.455
																		66	99.69	0.228	91.5	58.6	99.462
																		84	99.76	0.267	91.5	71.3	99.493
																		67	99.78	0.280	91.5	74.4	99.500
																		83	99.89	0.363	91.5	85.7	99.527
																		68	99.84	0.305	91.5	88.8	99.535
MH_126	MH_127	98.697	98.583	300	28.5	0.4	0.013	101.500	101.675	0.865	0.06	0.17	2.7	1.560	01:11	100.557	99.322	#N/A	#N/A	#N/A			
MH_127	MH_128	98.102	97.994	750	54.0	0.2	0.013	101.675	101.395	1.127	0.50	0.47	0.9	0.470	01:11	99.322	99.194	47	99.56	0.238			
MH_128	MH_129	97.964	97.923	750	13.5	0.3	0.013	101.395	101.315	1.389	0.61	0.47	0.8	0.480	01:11	99.194	99.148	45	99.49	0.296			
MH_129	MH_130	97.848	97.732	825	77.0	0.2	0.013	101.315	101.420	1.043	0.56	0.59	1.1	0.475	01:11	99.148	99.022	43	99.41	0.262			
MH_130	MH_131	97.732	97.581	825	100.5	0.2	0.013	101.420	101.200	1.040	0.56	0.71	1.3	0.465	01:11	99.022	98.776	33	99.18	0.158			
MH_1302	MH_302	97.470	96.430	600	98.5	0.2	0.013	101.160	101.140	0.971	0.27	0.16	0.6	0.510	01:05	98.580	98.490	Est. Fut	99.36	0.780			
MH_1303	MH_303	97.245	96.351	750	109.0	0.2	0.013	101.090	101.080	0.976	0.43	0.36	0.8	0.570	01:14	98.565	98.411	Est. Fut	99.29	0.725			
MH_1304	MH_304	97.175	96.196	600	87.0	0.2	0.013	100.660	100.730	0.971	0.27	0.19	0.7	0.520	01:11	98.295	98.186	Est. Fut	98.86	0.565			
MH_131	MH_132	97.206	97.188	1200	12.0	0.2	0.013	101.200	101.320	1.335	1.51	0.71	0.5	0.370	01:11	98.776	98.748	#N/A	#N/A	#N/A			
MH_1312	MH_310	97.627	97.113	750	62.0	0.2	0.013	100.940	100.940	1.127	0.50	0.19	0.4	-0.420	01:13	97.957	97.893	Est. Fut	99.14	1.183			
MH_132	MH_136	97.128	97.084	1200	59.5	0.2	0.013	101.320	101.190	1.542	1.74	2.15	1.2	0.420	01:12	98.748	98.564	103	99.33	0.582			
MH_133	MH_134	97.509	97.393	1500	77.0	0.2	0.013	101.660	101.550	1.554	2.75	1.88	0.7	-0.270	01:27	98.739	98.683	#N/A	#N/A	#N/A			
MH_134	MH_135	97.363	97.271	1500	61.0	0.2	0.013	101.550	101.440	1.554	2.75	1.94	0.7	-0.180	01:27	98.683	98.641	#N/A	#N/A	#N/A			
MH_135	MH_136	97.121	97.084	1650	37.0	0.1	0.013	101.440	101.190	1.348	2.88	1.96	0.7	-0.130	01:27	98.641	98.564	#N/A	#N/A	#N/A			
MH_136	MH_302	96.484	96.430	2250	54.0	0.1	0.013	101.190	101.140	1.658	6.59	7.93	1.2	-0.170	01:14	98.564	98.490	1	99.38	0.816			
MH_201	MH_202	105.214	104.138	375	119.5	0.9	0.013	108.120	107.180	1.506	0.17	0.12	0.7	-0.135	01:10	105.454	104.583	321	105.28	-0.174			
																		321	105.28	0.635	119.5	8.5	104.645
																		430	107.31	2.650	119.5	10.6	104.660
																		431	107.37	2.668	119.5	16.3	104.702
																		428	105.36	0.615	119.5	22.2	104.745
																		233	107.4	2.602	119.5	29.5	104.798
																		429	105.37	0.557	119.5	31.5	104.813
																		234	107.46	2.620	119.5	35.2	104.840
																		320	105.45	0.548	119.5	43.7	104.902

Table C-1F: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm + 20%

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		235	107.5	2.569	119.5	47.7	104.931
																		319	105.56	0.578	119.5	54.8	104.982
																		236	107.62	2.637	119.5	54.9	104.983
																		318	105.66	0.603	119.5	65	105.057
																		237	107.69	2.616	119.5	67.3	105.074
																		238	107.8	2.685	119.5	73	105.115
																		317	105.77	0.632	119.5	76.2	105.138
																		239	107.87	2.659	119.5	86.2	105.211
																		316	105.9	0.673	119.5	88.4	105.227
																		240	107.99	2.737	119.5	91.9	105.253
																		315	106.02	0.710	119.5	99.8	105.310
																		241	108.06	2.711	119.5	105.1	105.349
																		242	108.16	2.769	119.5	110.8	105.391
																		314	106.13	0.716	119.5	114	105.414
MH_202	MH_203	104.063	104.035	450	14.0	0.2	0.013	107.180	107.090	0.802	0.13	0.16	1.3	0.070	01:08	104.583	104.515	230	105.39	0.807			
MH_203	MH_206	103.975	103.281	450	54.5	0.5	0.013	107.090	106.720	1.203	0.19	0.25	1.3	0.090	01:09	104.515	103.847	225	104.9	0.385			
MH_204	MH_205	103.579	103.343	525	118.0	0.2	0.013	106.620	106.610	0.888	0.19	0.16	0.8	-0.055	01:16	104.049	103.943	285	104.64	0.591			
MH_205	MH_206	103.313	103.281	525	16.0	0.2	0.013	106.610	106.720	0.888	0.19	0.22	1.2	0.105	01:16	103.943	103.847	#N/A	#N/A	#N/A			
MH_206	MH_207	103.197	102.999	600	49.5	0.4	0.013	106.720	106.460	1.373	0.39	0.48	1.2	0.050	01:11	103.847	103.359	221	104.52	0.673			
MH_207	MH_208	102.969	102.731	600	12.5	1.9	0.013	106.460	106.320	2.997	0.85	0.48	0.6	-0.210	01:11	103.359	103.081	219	104.39	1.031			
MH_208	MH_215	102.671	100.768	600	112.0	1.9	0.013	106.320	104.150	2.993	0.85	0.56	0.7	-0.190	01:11	103.081	101.643	212	102.46	-0.621			
																		271	102.46	0.703	112.0	8.9	101.757
																		212	102.46	0.654	112.0	12.7	101.806
																		270	102.67	0.730	112.0	23.1	101.940
																		213	102.68	0.719	112.0	24.8	101.961
																		214	102.89	0.798	112.0	35	102.092
																		269	102.93	0.826	112.0	35.9	102.104
																		215	103.1	0.864	112.0	46.2	102.236
																		268	103.18	0.930	112.0	47.3	102.250
																		216	103.36	0.967	112.0	58.4	102.393
																		267	103.42	1.013	112.0	59.5	102.407
																		217	103.62	1.081	112.0	69.8	102.539
																		266	103.68	1.129	112.0	70.7	102.551
																		423	103.94	1.258	112.0	80.9	102.682
																		421	103.83	1.134	112.0	82	102.696
																		422	104.04	1.216	112.0	92	102.824
																		420	104.04	1.202	112.0	93.1	102.838
																		265	104.35	1.376	112.0	103.7	102.974
																		218	104.3	1.301	112.0	105.6	102.999
MH_209	MH_201	105.830	105.316	300	13.0	2.4	0.013	108.630	108.120	2.120	0.15	0.00	0.0	-0.300	00:00	105.830	105.454	313	106.24	0.410			
MH_209	MH_210	105.830	105.518	300	13.0	2.4	0.013	108.630	108.320	2.120	0.15	0.00	0.0	-0.300	00:00	105.830	105.596	254	108.31	2.480			
MH_210	MH_212	105.486	103.807	300	54.0	3.8	0.013	108.320	107.010	2.668	0.19	0.05	0.3	-0.190	01:10	105.596	103.807	258	105.12	-0.476			
																		258	105.12	0.793	54.0	15.7	104.327
																		257	105.54	0.825	54.0	27.4	104.715
																		256	106.05	0.961	54.0	38.7	105.089
																		255	106.58	1.156	54.0	48.8	105.424
MH_211	MH_212	103.900	103.807	300	26.5	0.4	0.013	106.090	107.010	0.810	0.06	0.02	0.4	-0.160	01:10	104.040	103.807	#N/A	#N/A	#N/A			
MH_212	MH_204	103.359	103.804	375	49.5	0.5	0.013	107.010	106.620	1.066	0.12	0.07	0.6	-0.155	01:11	103.579	104.049	284	104.71	1.131			
MH_212	MH_213	103.359	103.136	375	49.5	0.5	0.013	107.010	106.020	1.066	0.12	0.07	0.6	-0.155	01:11	103.579	103.233	203	104.1	0.521			
MH_213	MH_214	103.053	102.918	375	13.5	1.0	0.013	106.020	105.800	1.587	0.18	0.07	0.4	-0.195	01:11	103.233	103.063	204	104.02	0.787			
MH_214	MH_215	102.883	100.768	375	90.0	2.4	0.013	105.800	104.150	2.434	0.27	0.12	0.5	-0.195	01:10	103.063	101.643	272	102.37	-0.693			
																		272	102.37	0.610	90.0	7.4	101.760
																		211	102.46	0.568	90.0	15.8	101.892
																		273	102.59	0.606	90.0	21.6	101.984
																		210	102.68	0.595	90.0	28	102.085
																		274	102.86	0.636	90.0	36.8	102.224
																		209	102.89	0.644	90.0	38.2	102.246

Table C-1F: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm + 20%

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S (1) (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (2) (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
																		275	103.11	0.707	90.0	48.2	102.403
																		208	103.15	0.728	90.0	49.4	102.422
																		276	103.37	0.774	90.0	60.4	102.596
																		207	103.4	0.754	90.0	63.6	102.646
																		277	103.55	0.836	90.0	67.9	102.714
																		206	103.66	0.834	90.0	75	102.826
																		278	103.55	0.586	90.0	83.7	102.964
																		205	103.83	0.838	90.0	85.5	102.992
MH_215	MH_119	100.303	99.423	675	55.0	1.6	0.013	104.150	103.010	2.971	1.06	1.05	1.0	0.665	01:11	101.643	100.194	#N/A	#N/A	#N/A			
MH_216	MH_217	105.251	104.798	375	75.5	0.6	0.013	108.100	107.980	1.230	0.14	0.12	0.9	-0.105	01:16	105.521	105.113	346	105.85	0.329			
MH_217	MH_218	104.573	104.347	600	113.0	0.2	0.013	107.980	107.690	0.971	0.27	0.26	1.0	-0.060	01:18	105.113	104.937	356	105.71	0.597			
MH_218	MH_220	104.327	104.986	600	80.5	0.2	0.013	107.690	107.790	0.971	0.27	0.30	1.1	0.010	01:20	104.937	104.986	357	105.75	0.813			
MH_219	MH_220	105.649	104.986	300	25.0	2.7	0.013	108.450	107.790	2.228	0.16	0.00	0.0	-0.300	00:00	105.649	104.986	#N/A	#N/A	#N/A			
MH_220	MH_224	103.644	101.954	600	59.0	1.9	0.013	107.790	105.620	2.993	0.85	0.32	0.4	-0.340	01:17	103.904	102.035	259	104.74	0.836			
MH_221	MH_222	103.008	102.620	300	77.5	0.5	0.013	105.960	105.420	0.968	0.07	0.01	0.2	-0.210	01:10	103.098	102.821	396-1	103.56	0.462			
MH_222	MH_223	102.311	102.168	600	95.5	0.2	0.013	105.420	105.450	0.841	0.24	0.23	0.9	-0.090	01:11	102.821	102.708	366-1	103.37	0.549			
MH_2	MH_2260	101.916	102.191	675	10.0	0.4	0.013	105.290	105.290	1.486	0.53	0.38	0.7	-0.085	00:52	102.506	102.191	Est. Fut	103.49	0.984			
MH_223	MH_224	102.148	101.954	600	97.0	0.2	0.013	105.450	105.620	0.971	0.27	0.27	1.0	-0.040	01:12	102.708	102.035	365-1	103.42	0.712			
MH_224	MH_105	101.625	100.067	600	82.0	1.9	0.013	105.620	103.170	2.993	0.85	0.68	0.8	-0.190	01:13	102.035	100.102	141	101.9	-0.135			
																		141	101.9	1.529	82.0	11.4	100.371
																		140	102.18	1.475	82.0	25.6	100.705
																		139	102.55	1.578	82.0	36.9	100.972
																		138	102.92	1.708	82.0	47.1	101.212
																		137	103.3	1.826	82.0	58.2	101.474
																		136	103.81	2.015	82.0	71.8	101.795
MH_225	MH_226	103.412	102.914	300	99.5	0.5	0.013	106.390	105.720	0.968	0.07	0.05	0.7	-0.120	01:10	103.592	103.173	388-3	103.75	0.158			
																		389-2	103.75	0.553	99.5	5.8	103.197
																		389-1	103.75	0.506	82.0	13.8	103.244
																		388-3	103.75	0.452	82.0	24.4	103.298
																		388-2	103.88	0.543	82.0	32.1	103.337
																		388-1	103.88	0.502	82.0	40.1	103.378
																		387-4	104.02	0.588	82.0	50.7	103.432
																		387-3	104.02	0.547	82.0	58.7	103.473
																		387-2	104.02	0.510	82.0	65.9	103.510
																		387-1	104.02	0.469	82.0	73.9	103.551
MH_2260	MH_227	101.816	101.049	675	49.5	1.6	0.013	105.290	104.230	2.925	1.05	0.49	0.5	-0.345	01:06	102.146	101.149	392-1	102.46	0.314			
MH_226	MH_2260	102.863	102.191	300	64.0	1.1	0.013	105.720	105.290	1.402	0.10	0.11	1.1	0.010	01:06	103.173	102.191	391-3	103.08	-0.093			
																		391-3	103.08	0.854	64.0	2.3	102.226
																		391-2	103.45	1.112	64.0	9.6	102.338
																		391-1	103.45	0.989	64.0	17.6	102.461
																		390-3	103.58	0.956	64.0	28.2	102.624
																		390-2	103.58	0.834	64.0	36.2	102.746
																		390-1	103.58	0.717	64.0	43.8	102.863
																		389-4	103.75	0.723	64.0	54.5	103.027
																		389-3	103.75	0.600	64.0	62.5	103.150
MH_227	MH_109	100.759	99.306	675	93.0	1.6	0.013	104.230	102.650	2.971	1.06	0.60	0.6	-0.285	01:10	101.149	100.231	394-3	100.86	-0.289			
																		394-4	100.86	0.439	93.0	19.2	100.421
																		394-3	100.86	0.361	93.0	27.2	100.499
																		394-2	101.26	0.688	93.0	34.5	100.572
																		394-1	101.26	0.609	93.0	42.5	100.651
																		393-3	101.49	0.725	93.0	54.1	100.765
																		393-2	101.81	0.970	93.0	61.7	100.840
																		393-1	101.81	0.891	93.0	69.7	100.919
																		392-4	102.21	1.176	93.0	81.4	101.034
																		392-3	102.21	1.097	93.0	89.4	101.113
MH_228	MH_229	102.472	100.982	300	74.5	2.0	0.013	105.270	103.790	1.935	0.14	0.08	0.6	-0.140	01:11	102.632	101.093	384-3	102.12	-0.512			
																		384-3	102.12	0.977	74.5	2.4	101.143

Table C-1F: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm + 20%

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S (1) (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (2) (m)	Interpolated HGL: Length HGL (m)	Interpolated HGL: Dist. From D/S MH (m)	Interpolated HGL: HGL (m)
																		379-2	102.14	0.977	74.5	3.4	101.163
																		384-4	102.12	0.812	74.5	10.4	101.308
																		379-1	102.14	0.812	74.5	11.4	101.328
																		385-1	102.35	0.823	74.5	21	101.527
																		378-3	102.57	1.023	74.5	22	101.547
																		385-2	102.65	0.966	74.5	28.6	101.684
																		378-2	102.67	0.963	74.5	29.7	101.707
																		385-3	102.65	0.801	74.5	36.6	101.849
																		378-1	102.67	0.798	74.5	37.7	101.872
																		386-1	102.73	0.660	74.5	47.3	102.070
																		377-4	103.02	0.929	74.5	48.3	102.091
																		386-2	103.08	0.845	74.5	55.3	102.235
																		377-3	103.28	1.024	74.5	56.3	102.256
																		377-2	103.34	0.935	74.5	63.5	102.405
																		377-1	103.34	0.770	74.5	71.5	102.570
MH_229	MH_102	100.723	99.988	525	86.5	0.9	0.013	103.790	103.240	1.832	0.40	0.28	0.7	-0.155	01:11	101.093	100.327	381-1	101.35	0.257			
																		382-1	101.52	1.072	86.5	13.7	100.448
																		381-4	101.35	0.893	86.5	14.7	100.457
																		382-2	101.52	1.001	86.5	21.7	100.519
																		381-3	101.35	0.822	86.5	22.7	100.528
																		382-3	101.52	0.937	86.5	28.9	100.583
																		381-2	101.35	0.757	86.5	30	100.593
																		382-4	101.52	0.866	86.5	36.9	100.654
																		381-1	101.35	0.686	86.5	38	100.664
																		383-1	101.62	0.871	86.5	47.6	100.749
																		380-3	101.59	0.833	86.5	48.6	100.757
																		383-2	101.62	0.801	86.5	55.6	100.819
																		380-2	101.59	0.762	86.5	56.6	100.828
																		383-3	101.62	0.733	86.5	63.2	100.887
																		380-1	101.59	0.694	86.5	64.2	100.896
																		384-1	101.95	0.969	86.5	73.8	100.981
																		379-4	101.96	0.970	86.5	74.9	100.990
																		384-2	101.95	0.899	86.5	81.8	101.051
																		379-3	101.96	0.899	86.5	82.9	101.061
MH_230	MH_231	102.417	100.947	300	73.5	2.0	0.013	105.220	103.750	1.935	0.14	0.08	0.6	-0.130	01:11	102.587	101.012	374-3	102.03	-0.557			
																		374-3	102.03	0.964	73.5	2.5	101.066
																		368-3	102.24	1.121	73.5	5	101.119
																		374-4	102.03	0.793	73.5	10.5	101.237
																		368-2	102.24	0.949	73.5	13	101.291
																		368-1	102.24	0.787	73.5	20.6	101.453
																		375-1	102.4	0.934	73.5	21.2	101.466
																		375-2	102.57	0.941	73.5	28.8	101.629
																		367-3	102.71	1.027	73.5	31.3	101.683
																		375-3	102.57	0.769	73.5	36.8	101.801
																		367-2	102.71	0.856	73.5	39.3	101.854
																		367-1	102.71	0.693	73.5	46.9	102.017
																		376-1	103	0.972	73.5	47.4	102.028
																		376-2	103	0.801	73.5	55.4	102.199
																		376-3	103.37	1.014	73.5	62.7	102.356
																		376-4	103.37	0.843	73.5	70.7	102.527
MH_231	MH_103	100.722	98.982	525	87.0	2.0	0.013	103.750	102.350	2.810	0.61	0.31	0.5	-0.235	01:11	101.012	100.075	371-1	100.56	-0.452			
																		371-3	100.56	0.345	87.0	13	100.215
																		372-1	100.95	0.725	87.0	13.9	100.225
																		371-2	100.56	0.259	87.0	21	100.301
																		372-2	100.95	0.639	87.0	21.9	100.311
																		371-1	100.56	0.177	87.0	28.6	100.383
																		372-3	100.95	0.561	87.0	29.2	100.389

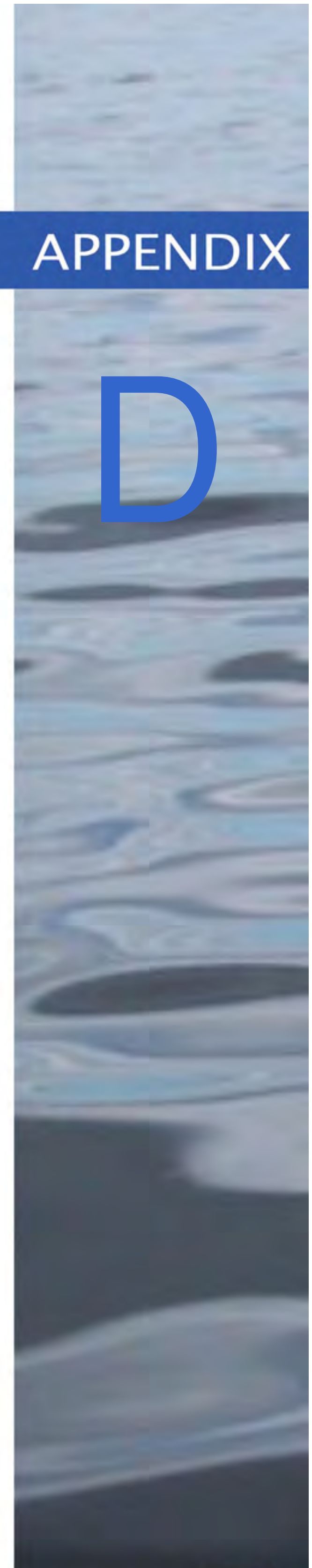
Table C-1F: Pipe Data and Hydraulic Simulation Results for the 100-Year, 3-Hour Chicago Storm + 20%

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Time to Peak (hh:mm)	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard [2] (m)	Interpolated HGL		
																					Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
																		372-4	100.95	0.474	87.0	37.2	100.476
																		370-3	101.09	0.592	87.0	39.3	100.498
																		370-2	101.09	0.506	87.0	47.3	100.584
																		373-1	100.97	0.380	87.0	47.8	100.590
																		370-1	101.09	0.424	87.0	54.9	100.666
																		373-2	101.32	0.644	87.0	55.8	100.676
																		373-3	101.32	0.562	87.0	63.4	100.758
																		369-3	101.61	0.830	87.0	65.5	100.780
																		369-2	101.61	0.743	87.0	73.5	100.867
																		374-1	101.56	0.687	87.0	74.1	100.873
																		369-1	101.61	0.660	87.0	81.2	100.950
																		374-2	101.56	0.601	87.0	82.1	100.959
MH_302	MH_303	96.410	96.351	2250	59.0	0.1	0.013	101.140	101.080	1.658	6.59	8.14	1.2	-0.170	01:13	98.490	98.411	#N/A	#N/A	#N/A			
MH_303	MH_304	96.331	96.196	2250	134.5	0.1	0.013	101.080	100.730	1.658	6.59	8.61	1.3	-0.170	01:14	98.411	98.186	#N/A	#N/A	#N/A			
MH_304	MH_306TEE	96.176	96.133	2250	42.5	0.1	0.013	100.730	100.350	1.666	6.62	8.85	1.3	-0.240	01:15	98.186	97.903	#N/A	#N/A	#N/A			
MH_306TEE	MH_307	96.133	96.100	2250	13.0	0.1	0.013	100.350	100.350	1.658	6.59	8.98	1.4	-0.480	01:14	97.903	97.610	#N/A	#N/A	#N/A			
MH_313	MH_307	96.099	96.100	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.83	0.7	-0.850	01:13	97.499	97.610	#N/A	#N/A	#N/A			
MH_307	MH_400	96.100	96.076	2250	22.7	0.1	0.013	100.350	100.350	1.707	6.79	5.85	0.9	-0.740	01:13	97.610	97.577	#N/A	#N/A	#N/A			
MH_309	MH_310	97.139	97.113	1200	17.5	0.1	0.013	100.990	100.940	1.331	1.50	0.94	0.6	-0.320	01:18	98.019	97.893	#N/A	#N/A	#N/A			
MH_310	MH_311	97.053	96.959	1200	62.5	0.2	0.013	100.940	100.830	1.335	1.51	1.18	0.8	-0.360	01:20	97.893	97.819	#N/A	#N/A	#N/A			
MH_3	MH_109	99.346	99.306	600	10.0	0.4	0.013	102.650	102.650	1.373	0.39	0.25	0.6	0.300	01:10	100.246	100.231	#N/A	#N/A	#N/A			
MH_3111TEE	MH_312	96.831	96.716	1200	76.5	0.2	0.013	100.640	100.450	1.335	1.51	1.33	0.9	-0.320	01:21	97.711	97.576	#N/A	#N/A	#N/A			
MH_311	MH_3111TEE	96.939	96.831	1200	72.0	0.2	0.013	100.830	100.640	1.335	1.51	1.30	0.9	-0.320	01:20	97.819	97.711	#N/A	#N/A	#N/A			
MH_312	MH_313	96.656	96.624	1200	21.5	0.1	0.013	100.450	100.350	1.331	1.50	1.35	0.9	-0.280	01:18	97.576	97.499	#N/A	#N/A	#N/A			
MH_313	MH_500	96.099	96.065	2250	33.1	0.1	0.013	100.350	100.350	1.682	6.69	4.83	0.7	-0.850	01:13	97.499	97.456	#N/A	#N/A	#N/A			
MH_400	OGS_1	96.067	96.057	750	4.9	0.2	0.013	100.350	100.500	1.133	0.50	0.99	2.0	0.760	00:58	97.577	97.567	#N/A	#N/A	#N/A			
OGS_1	OGS_1-Out	96.037	96.027	750	4.9	0.2	0.013	100.500	100.350	1.138	0.50	0.99	2.0	0.780	00:58	97.567	97.305	#N/A	#N/A	#N/A			
OGS_1-Out	MH_401	96.015	96.000	2250	14.7	0.1	0.013	100.350	100.350	1.674	6.66	6.85	1.0	-0.960	01:13	97.305	97.180	#N/A	#N/A	#N/A			
MH_4	MH_104	98.554	98.516	525	9.5	0.4	0.013	101.580	101.590	1.256	0.27	0.20	0.7	0.585	01:10	99.664	99.585	#N/A	#N/A	#N/A			
MH_500	OGS_2	96.056	96.046	750	5.0	0.2	0.013	100.350	100.428	1.127	0.50	0.96	1.9	0.650	01:42	97.456	97.446	#N/A	#N/A	#N/A			
OGS_2	OGS_2-Out	96.026	96.016	750	5.1	0.2	0.013	100.428	100.350	1.118	0.49	0.96	1.9	0.670	01:42	97.446	97.214	#N/A	#N/A	#N/A			
OGS_2-Out	MH_501	96.004	96.000	2250	4.2	0.1	0.013	100.350	100.350	1.624	6.46	5.92	0.9	-1.040	01:15	97.214	97.180	#N/A	#N/A	#N/A			

(2) Conservative estimate of freeboard based on U/S HGL and lowest USF connected to pipe. Actual HGL / freeboard at all connecting lots interpolated where conservative estimate does not meet freeboard requirements.

(3) Future USF elevations estimated as 1.8 m below the upstream top of manhole elevations.

(green)	Interpolated HGL elevation
(yellow)	Freebaord Less than 0.3m
(red)	Freebaord Less than 0.0m



APPENDIX

D

Tables and Calculation Sheets

JFSA Water Resources and Environmental Consultants

Table D-1: Approach Flows and Captured Flows for the 100-Year Chicago Storm

Catch Basin ID	Approach Flow (m^3/s)	Captured Flow (m^3/s)	Catch Basin ID	Approach Flow (m^3/s)	Captured Flow (m^3/s)	Catch Basin ID	Approach Flow (m^3/s)	Captured Flow (m^3/s)
CB_001	0.032	0.021	CB_048	0.307	0.090	CB_098	0.059	0.018
CB_002	0.032	0.019	CB_049	0.168	0.045	CB_099	0.146	0.045
CB_003	0.222	0.099	CB_050	0.168	0.072	CB_100	0.146	0.050
CB_004	0.222	0.045	CB_051	0.192	0.073	CB_101	0.016	0.004
CB_005	0.132	0.044	CB_052	0.192	0.046	CB_102	0.178	0.073
CB_006	0.132	0.071	CB_053	0.496	0.033	CB_103	0.178	0.020
CB_007	0.180	0.038	CB_054	0.412	0.029	CB_104	0.060	0.029
CB_008	0.133	0.034	CB_055	0.428	0.042	CB_105	0.060	0.029
CB_009	0.133	0.034	CB_056	0.130	0.030	CB_106	0.199	0.066
CB_010	0.070	0.020	CB_057	0.130	0.030	CB_107	0.199	0.100
CB_011	0.070	0.020	CB_058	0.273	0.039	CB_108	0.164	0.028
CB_012	0.043	0.031	CB_059	0.210	0.029	CB_109	0.152	0.023
CB_013	0.043	0.018	CB_060	0.210	0.029	CB_111	0.182	0.046
CB_014	0.048	0.014	CB_061	0.112	0.022	CB_112	0.062	0.028
CB_015	0.048	0.014	CB_062	0.112	0.022	CB_113	0.062	0.028
CB_016	0.064	0.016	CB_065	0.032	0.006	CB_114	0.181	0.072
CB_017	0.747	0.195	CB_066	0.047	0.016	CB_115	0.181	0.072
CB_018	0.414	0.036	CB_067	0.047	0.016	CB_116	0.071	0.043
CB_019	0.453	0.034	CB_068	0.074	0.017	CB_118	0.059	0.027
CB_020	0.406	0.033	CB_069	0.074	0.017	CB_119	0.059	0.024
CB_021	0.120	0.033	CB_070	0.067	0.018	CB_120	0.112	0.070
CB_022	0.120	0.033	CB_071	0.067	0.018	CB_121	0.112	0.044
CB_023	0.085	0.021	CB_072	0.133	0.020	CB_123	0.071	0.048
CB_024	0.177	0.073	CB_073	0.278	0.074	CB_124	0.050	0.035
CB_025	0.177	0.046	CB_074	0.278	0.067	CB_125	0.050	0.018
CB_026	0.077	0.019	CB_075	0.273	0.043	CB_126	0.069	0.021
CB_027	0.077	0.024	CB_076	0.273	0.043	CB_127	0.069	0.032
CB_028	0.076	0.032	CB_077	0.300	0.029	CB_128	0.180	0.038
CB_029	0.076	0.019	CB_078	0.204	0.036	CB_129	0.045	0.015
CB_030	0.204	0.051	CB_079	0.204	0.029	CB_130	0.045	0.015
CB_031	0.204	0.073	CB_080	0.225	0.101	CB_131	0.402	0.037
CB_032	0.101	0.070	CB_081	0.225	0.091	CB_201	0.012	0.012
CB_033	0.101	0.019	CB_082	0.165	0.066	CB_203	0.103	0.020
CB_034	0.054	0.011	CB_083	0.165	0.100	CB_204	0.014	0.014
CB_035	0.056	0.012	CB_084	0.172	0.034	CB_205	0.146	0.048
CB_036	0.113	0.026	CB_085	0.172	0.046	CB_206	0.090	0.021
CB_037	0.113	0.026	CB_086	0.141	0.071	CB_207	0.086	0.021
CB_038	0.249	0.035	CB_087	0.141	0.044	CB_208	0.018	0.018
CB_039	0.190	0.098	CB_088	0.109	0.020	DCB_063	0.170	0.033
CB_040	0.190	0.064	CB_089	0.109	0.046	DCB_064	0.170	0.051
CB_041	0.112	0.023	CB_090	0.058	0.011	DCB_110	0.182	0.073
CB_042	0.112	0.023	CB_091	0.101	0.018	DCB_117	0.160	0.082
CB_043	0.192	0.030	CB_092	0.101	0.018	DCB_122	0.160	0.042
CB_044	0.192	0.030	CB_093	0.234	0.025	DICB_1	0.052	0.019
CB_045	0.197	0.089	CB_095	0.135	0.036	DICB_2	0.052	0.019
CB_046	0.197	0.065	CB_096	0.135	0.036	DICB_3	0.097	0.025
CB_047	0.307	0.090	CB_097	0.059	0.018	DICB_4	0.097	0.025

Table D-2: Major System Flow Depths for the 100-Year Chicago Storm

Catch Basin ID	Depth (cm)	Catch Basin ID	Depth (cm)	Catch Basin ID	Depth (cm)
CB_001	20	CB_048	29	CB_098	6
CB_002	20	CB_049	27	CB_099	27
CB_003	28	CB_050	27	CB_100	27
CB_004	28	CB_051	29	CB_101	3
CB_005	21	CB_052	29	CB_102	31
CB_006	21	CB_053	10	CB_103	31
CB_007	10	CB_054	9	CB_104	9
CB_008	9	CB_055	12	CB_105	9
CB_009	9	CB_056	9	CB_106	30
CB_010	7	CB_057	9	CB_107	30
CB_011	7	CB_058	10	CB_108	8
CB_012	15	CB_059	8	CB_109	6
CB_013	15	CB_060	8	CB_111	29
CB_014	5	CB_061	6	CB_112	9
CB_015	5	CB_062	6	CB_113	9
CB_016	5	CB_065	3	CB_114	26
CB_017	9	CB_066	6	CB_115	26
CB_018	10	CB_067	6	CB_116	12
CB_019	10	CB_068	6	CB_118	19
CB_020	9	CB_069	6	CB_119	19
CB_021	27	CB_070	6	CB_120	19
CB_022	27	CB_071	6	CB_121	19
CB_023	13	CB_072	6	CB_123	12
CB_024	29	CB_073	35	CB_124	16
CB_025	29	CB_074	35	CB_125	16
CB_026	23	CB_075	13	CB_126	19
CB_027	23	CB_076	13	CB_127	19
CB_028	23	CB_077	8	CB_128	10
CB_029	23	CB_078	28	CB_129	6
CB_030	28	CB_079	28	CB_130	6
CB_031	28	CB_080	35	CB_131	11
CB_032	20	CB_081	35	CB_201	0
CB_033	20	CB_082	29	CB_203	11
CB_034	5	CB_083	29	CB_204	0
CB_035	4	CB_084	34	CB_205	14
CB_036	8	CB_085	34	CB_206	16
CB_037	8	CB_086	21	CB_207	16
CB_038	9	CB_087	21	CB_208	0
CB_039	25	CB_088	31	DCB_063	28
CB_040	25	CB_089	31	DCB_064	28
CB_041	7	CB_090	4	DCB_110	29
CB_042	7	CB_091	6	DCB_117	5
CB_043	9	CB_092	6	DCB_122	5
CB_044	9	CB_093	8	DICB_1	22
CB_045	27	CB_095	9	DICB_2	22
CB_046	27	CB_096	9	DICB_3	25
CB_047	29	CB_097	6	DICB_4	25

Note: Depth calculated as per PCSWMM model

Table D-3A: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A102NE	0.134	90	0.5	66	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A103NE	0.135	83	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A103SW	0.058	70	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A104NE	0.138	80	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A104NW	0.047	31	0.5	43	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A104SE	0.053	64	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A104SW	0.047	31	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A105NE	0.058	48	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A105NW	0.105	49	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A105SE	0.058	48	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A105SW	0.104	49	0.5	82	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A106N1	0.085	48	0.5	80	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A106N2	0.077	45	0.5	82	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A106NE	0.063	30	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A106NW	0.064	30	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A106R1	0.047	46	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A106R2	0.151	116	0.5	36	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A106SE	0.073	43	0.5	83	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A106SW	0.067	40	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A108N1	0.052	48	0.5	42	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A108NE	0.039	30	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A108NW	0.029	30	0.5	49	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A108R1	0.223	152	0.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A108R2	0.114	96	0.5	38	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A108SE	0.114	46	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A108SW	0.051	46	0.5	62	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A109NE	0.029	30	0.5	43	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A109NW	0.053	39	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A109SE	0.094	56	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A110NE	0.103	59	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A110NW	0.087	50	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A110R1	0.039	32	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110R10	0.038	27	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110R2	0.036	29	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110R3	0.039	32	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110R4	0.047	41	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110R5	0.045	32	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110R6	0.042	29	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110R7	0.046	32	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110R8	0.059	41	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110R9	0.032	27	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A110SE	0.059	41	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A110SW	0.082	47	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A111NW	0.091	52	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A111SE	0.087	50	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A112NE	0.118	68	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A112NW	0.053	31	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A112R3	0.056	50	0.5	50	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A112R4	0.098	80	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A112SE	0.119	69	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A112SW	0.044	29	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A112WK	0.039	43	0.5	32	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A113R1	0.135	112	0.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A113R2	0.084	72	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A114NE	0.029	24	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A114R1	0.068	58	0.5	50	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A114R2	0.053	44	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A114R3	0.074	60	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A114R4	0.145	118	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7

Table D-3A: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A114SE	0.105	95	0.5	65	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A114SW	0.184	95	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A115NE	0.080	46	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A115NW	0.050	39	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A115R1	0.044	39	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A115R2	0.043	35	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A115R3	0.035	28	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A115R4	0.036	25	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A115R5	0.050	35	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A115R6	0.041	28	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A115SE	0.022	24	0.5	45	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A115SW	0.039	39	0.5	44	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A115W1	0.035	30	0.5	63	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A116E1	0.037	30	0.5	61	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A116NE	0.081	57	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A116NW	0.075	43	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A116R1	0.108	76	0.5	36	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A116R2	0.102	86	0.5	30	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A116R3	0.080	72	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A116R4	0.059	48	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A116R5	0.069	47	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A116R6	0.066	48	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A116R7	0.062	45	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A116SE	0.079	57	0.5	64	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A116SW	0.076	44	0.5	81	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A117NE	0.084	48	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A117NW	0.082	47	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A117R1	0.085	70	0.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A117R2	0.062	50	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A117R3	0.094	70	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A117R4	0.068	50	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A117SE	0.077	44	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A117SW	0.086	49	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A117W1	0.079	56	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A117W2	0.087	57	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A119NE	0.146	85	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A119NW	0.114	65	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A119R1	0.160	124	0.5	20	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A119R2	0.228	194	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A119R3	0.147	126	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A119SE	0.060	43	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A119SW	0.092	61	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A121NE	0.062	60	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A121NW	0.099	58	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A121R1	0.042	36	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A121R2	0.072	59	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A121R3	0.044	36	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A121R4	0.059	98	0.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A121S1	0.154	65	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A121SE	0.122	100	0.5	56	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A121SW	0.077	45	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A122NE	0.128	54	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A122R1	0.073	64	0.5	30	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A122R2	0.214	170	0.5	30	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A124NE	0.047	27	0.5	65	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A124NW	0.131	86	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A124R1	0.092	76	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A124R2	0.136	120	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A124SE	0.047	27	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7

Table D-3A: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A124SW	0.136	86	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A125E1	0.058	64	0.5	47	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A125NE	0.048	36	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A125NW	0.093	53	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A125R1	0.105	92	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A125R2	0.109	90	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A125SE	0.048	36	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A125SW	0.093	53	0.5	80	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A126E1	0.033	23	0.5	80	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A126NE	0.033	36	0.5	46	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A126NW	0.026	27	0.5	45	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A126R1	0.098	86	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A126SE	0.032	36	0.5	60	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A126SW	0.026	27	0.5	58	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A126W1	0.077	52	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A129NE	0.172	87	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A129NW	0.066	38	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A129R1	0.123	106	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A129R2	0.127	104	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A129SE	0.097	88	0.5	58	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A129SW	0.064	37	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A130NE	0.150	86	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A130NW	0.047	38	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A130R1	0.175	152	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A130SE	0.147	85	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A130SW	0.055	39	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A132N1	0.029	30	0.5	45	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A132NE	0.028	27	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A132NW	0.033	29	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A132R1	0.088	80	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A132R2	0.112	92	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A132R3	0.115	94	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A132R4	0.101	84	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A132SE	0.033	33	0.5	57	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A132SW	0.048	28	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A133NE	0.043	43	0.5	37	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A133NW	0.095	95	0.5	37	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A133SE	0.060	43	0.5	26	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A133SW	0.132	95	0.5	26	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A133W1	0.043	43	0.5	37	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A133W2	0.060	43	0.5	26	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A133W3	0.062	70	0.5	42	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A133W4	0.088	70	0.5	30	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A134NE	0.047	28	0.5	22	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A134NW	0.126	95	0.5	28	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A134SE	0.025	28	0.5	43	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A134SW	0.115	95	0.5	30	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A135R1	0.023	22	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A136NE	0.031	30	0.5	55	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A136NE1	0.024	29	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A136NW	0.039	30	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A136NW1	0.025	29	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A136NW2	0.033	32	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A136R1	0.034	33	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A136SE	0.028	30	0.5	45	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A201NE	0.139	80	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A201S1	0.098	56	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A201SW	0.133	76	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A203NE	0.103	37	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7

Table D-3A: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A203NW	0.098	73	0.5	67	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A203R1	0.116	98	0.5	26	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A203R2	0.088	72	0.5	34	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A203R3	0.111	91	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A204E1	0.154	96	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A204E2	0.154	96	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A204NE	0.096	55	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A204NW	0.107	71	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A204R1	0.136	120	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A204R2	0.067	54	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A204R3	0.135	112	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A204R4	0.081	66	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A204R5	0.073	66	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A204SE	0.096	55	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A205SE	0.109	71	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A205SW	0.037	35	0.5	40	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A206NE	0.138	79	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A206R1	0.078	128	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A208NW	0.183	87	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A208R1	0.092	84	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A208R2	0.114	94	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A208R3	0.120	98	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A208R4	0.064	52	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A208R5	0.049	40	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A208R6	0.037	36	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A208SE	0.135	108	0.5	59	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A209NW	0.141	81	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A209R1	0.053	44	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A209SE	0.112	63	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A210NW	0.061	67	0.5	48	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A210SE	0.136	67	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A211R1	0.033	32	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A211R2	0.153	122	0.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A211R3	0.080	81	0.5	22	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A213NE	0.121	61	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A214NE	0.117	64	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A214NW	0.119	68	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A214SE	0.094	86	0.5	56	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A214SW	0.108	62	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A215NE	0.055	59	0.5	45	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A215NW	0.055	59	0.5	45	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A215SE	0.027	24	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A215SW	0.063	44	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A216E1	0.031	31	0.5	45	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A216NE	0.092	61	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A216NW	0.089	51	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A216R1	0.048	36	0.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A216R2	0.041	33	0.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A216R3	0.060	36	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A216R4	0.055	33	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A216SE	0.089	60	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A216SW	0.092	53	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A217NE	0.152	87	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A217NW	0.078	45	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A217R1	0.061	50	0.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A217R2	0.068	53	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A217R3	0.068	52	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A217R4	0.050	38	0.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A217R5	0.084	50	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7

Table D-3A: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A217R6	0.088	53	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A217R7	0.086	52	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A217R8	0.063	38	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A217SE	0.152	87	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A217SW	0.078	45	0.5	82	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A218NE	0.051	40	0.5	69	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A218SE	0.052	40	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A218W3	0.036	30	0.5	62	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A220NE	0.046	30	0.5	83	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A220NW	0.058	63	0.5	60	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A220SW	0.125	59	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A221NE	0.033	26	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A221SE	0.056	59	0.5	44	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A222E1	0.025	25	0.5	44	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A222E2	0.044	25	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A222E3	0.033	34	0.5	44	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A222E4	0.118	68	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A222NE	0.064	44	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A222NW	0.130	75	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A222R1	0.031	25	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A222R2	0.048	39	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A222R3	0.035	29	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A222R4	0.116	102	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A222R5	0.095	78	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A222R6	0.108	88	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A222R7	0.091	76	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A222R8	0.106	88	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A222R9	0.112	96	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A222SE	0.076	44	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A222SW	0.130	75	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A223NE	0.067	47	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A223SE	0.065	47	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A223SW	0.071	59	0.5	62	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A224NE	0.062	55	0.5	68	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A224NW	0.099	55	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A224R1	0.112	98	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A224R2	0.032	28	0.5	50	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A224SW	0.058	63	0.5	46	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A225NE	0.068	76	0.5	49	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A225NW	0.123	76	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A225SE	0.075	83	0.5	49	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A226NE	0.068	76	0.5	50	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A226NW	0.135	75	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A227NE	0.029	32	0.5	50	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A227NW	0.065	72	0.5	50	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A227SE	0.068	76	0.5	50	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A227SW	0.098	63	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A228NE	0.105	60	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A228NW	0.137	87	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A228R1	0.063	52	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A228R2	0.104	92	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A228SE	0.065	60	0.5	47	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A229N2	0.031	25	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A229NE	0.059	60	0.5	56	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A229NW	0.060	43	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A229R1	0.122	100	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A229R2	0.080	66	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A229SE	0.105	60	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A229SW	0.140	89	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7

Table D-3A: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A230NE	0.110	72	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A230NW	0.079	64	0.5	62	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A230R1	0.037	31	0.5	42	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A230R2	0.027	24	0.5	50	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A230R3	0.063	52	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A230R4	0.098	88	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A230WK	0.013	21	0.5	50	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A231N1	0.060	59	0.5	55	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A231NE	0.060	43	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A231NW	0.047	34	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A231R1	0.024	22	0.5	50	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A231R2	0.033	27	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A231R3	0.032	26	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A231R4	0.032	26	0.5	44	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A231R5	0.117	96	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A231R6	0.091	76	0.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A231SE	0.107	61	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A231SW	0.137	79	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A302NE	0.020	24	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A302NW	0.020	24	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A302NW1	0.026	24	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A302R1	0.063	59	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A302SE	0.028	34	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A302SW	0.028	34	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A302SW1	0.037	34	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A303NE1	0.025	30	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A303NW1	0.025	30	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A303NW2	0.032	30	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A303R1	0.102	96	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A303R2	0.088	83	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A303SE	0.030	36	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A303SE1	0.044	53	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A303SW	0.030	36	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A303SW1	0.044	53	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A303SW2	0.056	53	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A303SW3	0.039	36	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A306NE	0.111	71	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A306NW	0.156	71	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A306R2	0.127	122	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A306SE	0.051	62	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A306SW	0.051	62	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A306SW1	0.064	60	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A310NE	0.043	25	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A310NE1	0.028	23	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A310NW	0.054	29	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A310R1	0.044	42	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A310SE	0.034	25	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A310SW	0.054	29	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A311NE	0.120	76	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A311NW	0.067	36	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A311R1	0.107	99	0.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	76.2	13.2	4.14	7
A311SE	0.119	64	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
A311SW	0.067	36	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7
APOND2	0.019	21	0.5	56	0.013	0.25	1.57	4.67	OUTLET	100	76.2	13.2	4.14	7

Table D-3B: SWMHYMO Subcatchment Parameters

Name	Area (ha)	XIMP (%)	TIMP (5)	Fo (mm/hr)	Fc (mm/hr)	DCAY (1/Hr)	IA Perv (mm)	Slope Perv (%)	LGP (m)	MNP	IA Imp (mm)	Slope Imp (%)	LGI (m)	MNI MNI
A104PK	1.72	19	29	76.2	13.2	4.14	4.67	2	135	0.25	1.57	0.5	107	0.013
A109RES	1.64	59	69	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	104	0.013
A133COM	13.831	69	79	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	303	0.013
A2260COM	2.68	69	79	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	133	0.013
A303EXT	2.451	59	69	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	127	0.013
A302EXT	0.99	59	69	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	81	0.013
A304EXT	1.199	59	69	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	89	0.013
A310EXT1	1.223	59	69	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	90	0.013
A310EXT2	7.636	59	69	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	226	0.013
A303COM	7.381	69	79	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	222	0.013
APOND1	3.94	93	93	76.2	13.2	4.14	4.67	2	40	0.25	1.57	0.5	162	0.013

Table D-3C: SWMHYMO Subcatchment Release Rates

	A104PK		A109RES		A2260COM		A303EXT		A302EXT		A304EXT		A310EXT1		A310EXT2		A133COM		A303COM	
Event	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major
25mm CHI 3Hr	0.050	0.000	0.148	0.000	0.271	0.000	0.216	0.000	0.092	0.000	0.109	0.000	0.112	0.000	0.595	0.000	1.174	0.000	0.210	0.000
2 Year CHI 3Hr	0.065	0.000	0.201	0.000	0.371	0.000	0.294	0.000	0.125	0.000	0.150	0.000	0.153	0.000	0.818	0.000	1.606	0.000	0.210	0.000
5 Year CHI 3Hr	0.099	0.000	0.230	0.000	0.382	0.000	0.336	0.000	0.146	0.000	0.173	0.000	0.177	0.000	0.877	0.000	1.800	0.000	0.210	0.000
100 Year CHI 3Hr	0.199	0.000	0.230	0.000	0.382	0.000	0.336	0.000	0.146	0.000	0.173	0.000	0.177	0.000	0.877	0.000	1.800	0.000	0.210	0.000
100 Year CHI 3Hr +20%	0.199	0.260	0.241	0.000	0.382	0.743	0.360	0.131	0.156	0.660	0.185	0.074	0.189	0.000	0.939	0.282	1.800	0.000	0.210	0.000
2 years SCS 24 Hr	0.063	0.000	0.184	0.000	0.327	0.000	0.269	0.000	0.114	0.000	0.136	0.000	0.138	0.000	0.767	0.000	1.465	0.000	0.210	0.000
5 years SCS 24 Hr	0.112	0.000	0.230	0.000	0.382	0.000	0.336	0.000	0.146	0.000	0.173	0.000	0.177	0.000	0.877	0.000	1.800	0.000	0.210	0.000
10 years SCS 24 Hr	0.150	0.000	0.230	0.000	0.382	0.000	0.336	0.000	0.146	0.000	0.173	0.000	0.177	0.000	0.877	0.000	1.800	0.000	0.210	0.000
25 years SCS 24 Hr	0.199	0.000	0.230	0.000	0.382	0.000	0.336	0.000	0.146	0.000	0.173	0.000	0.177	0.000	0.877	0.000	1.800	0.000	0.210	0.000
50 years SCS 24 Hr	0.199	0.000	0.230	0.000	0.382	0.000	0.336	0.000	0.146	0.000	0.173	0.000	0.177	0.000	0.877	0.000	1.800	0.000	0.210	0.000
100 years SCS 24 Hr	0.199	0.000	0.230	0.000	0.382	0.000	0.336	0.000	0.146	0.000	0.173	0.000	0.177	0.000	0.877	0.000	1.800	0.000	0.210	0.000
100 years SCS 24 Hr +20%	0.199	0.180	0.233	0.000	0.382	0.444	0.344	0.000	0.149	0.000	0.177	0.000	0.180	0.000	0.899	0.000	1.800	0.000	0.210	0.000

Table D-4A: Catch Basin Depth-Outflow Rating Curves - Constant Slope

16m ROW								24m ROW							
1 Catch Basin Slope = 0.5%		1 Catch Basin Slope = 1.0%		1 Catch Basin Slope = 2.0%		1 Catch Basin Slope = 3.0%		1 Catch Basin Slope = 0.5%		1 Catch Basin Slope = 1.0%		1 Catch Basin Slope = 2.0%		1 Catch Basin Slope = 3.0%	
Depth (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00
0.03	0.00	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.00	0.03	0.01	0.03	0.01	0.03	0.01
0.04	0.01	0.04	0.01	0.04	0.01	0.04	0.01	0.04	0.01	0.04	0.01	0.04	0.01	0.04	0.01
0.05	0.01	0.05	0.02	0.05	0.02	0.05	0.01	0.05	0.01	0.05	0.02	0.05	0.02	0.05	0.02
0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02
0.07	0.02	0.07	0.03	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.03	0.07	0.02	0.07	0.02
0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03
0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.04	0.09	0.03	0.09	0.03
0.10	0.03	0.10	0.04	0.10	0.04	0.10	0.03	0.10	0.03	0.10	0.04	0.10	0.04	0.10	0.03
0.11	0.04	0.11	0.04	0.11	0.04	0.11	0.04	0.11	0.04	0.11	0.04	0.11	0.04	0.11	0.04
0.12	0.04	0.12	0.05	0.12	0.05	0.12	0.04	0.12	0.04	0.12	0.05	0.12	0.05	0.12	0.04
0.13	0.04	0.13	0.05	0.13	0.05	0.13	0.04	0.13	0.05	0.13	0.05	0.13	0.05	0.13	0.04
0.14	0.05	0.14	0.05	0.14	0.05	0.14	0.04	0.14	0.05	0.14	0.05	0.14	0.05	0.14	0.04
0.15	0.05	0.15	0.05	0.15	0.05	0.15	0.04	0.15	0.05	0.15	0.05	0.15	0.05	0.15	0.04
0.16	0.05	0.16	0.05	0.16	0.05	0.16	0.04	0.16	0.05	0.16	0.05	0.16	0.05	0.16	0.04
0.17	0.05	0.17	0.05	0.17	0.05	0.17	0.04	0.17	0.05	0.17	0.05	0.17	0.05	0.17	0.04
0.18	0.05	0.18	0.05	0.18	0.05	0.18	0.04	0.18	0.05	0.18	0.05	0.18	0.05	0.18	0.04
0.19	0.05	0.19	0.05	0.19	0.05	0.19	0.04	0.19	0.05	0.19	0.05	0.19	0.05	0.19	0.04
0.20	0.05	0.20	0.05	0.20	0.05	0.20	0.04	0.20	0.05	0.20	0.05	0.20	0.05	0.20	0.04
0.21	0.05	0.21	0.05	0.21	0.05	0.21	0.04	0.21	0.05	0.21	0.05	0.21	0.05	0.21	0.04
0.22	0.05	0.22	0.05	0.22	0.05	0.22	0.04	0.22	0.05	0.22	0.05	0.22	0.05	0.22	0.04
0.23	0.05	0.23	0.05	0.23	0.05	0.23	0.04	0.23	0.05	0.23	0.05	0.23	0.05	0.23	0.04
0.24	0.05	0.24	0.05	0.24	0.05	0.24	0.04	0.24	0.05	0.24	0.05	0.24	0.05	0.24	0.04
0.25	0.05	0.25	0.05	0.25	0.05	0.25	0.04	0.25	0.05	0.25	0.05	0.25	0.05	0.25	0.04
0.26	0.05	0.26	0.05	0.26	0.05	0.26	0.04	0.26	0.05	0.26	0.05	0.26	0.05	0.26	0.04
0.27	0.05	0.27	0.05	0.27	0.05	0.27	0.04	0.27	0.05	0.27	0.05	0.27	0.05	0.27	0.04
0.28	0.05	0.28	0.05	0.28	0.05	0.28	0.04	0.28	0.05	0.28	0.05	0.28	0.05	0.28	0.04
0.29	0.05	0.29	0.05	0.29	0.05	0.29	0.04	0.29	0.05	0.29	0.05	0.29	0.05	0.29	0.04
0.30	0.05	0.30	0.05	0.30	0.05	0.30	0.04	0.30	0.05	0.30	0.05	0.30	0.05	0.30	0.04
0.31	0.05	0.31	0.05	0.31	0.05			0.31	0.05	0.31	0.05	0.31	0.05		
0.32	0.05	0.32	0.05	0.32	0.05			0.32	0.05	0.32	0.05	0.32	0.05		
0.33	0.05	0.33	0.05					0.33	0.05	0.33	0.05				
0.34	0.05	0.34	0.05					0.34	0.05	0.34	0.05				
0.35	0.05	0.35	0.05					0.35	0.05	0.35	0.05				
0.36	0.05	0.36	0.05					0.36	0.05	0.36	0.05				
0.37	0.05	0.37	0.05					0.37	0.05	0.37	0.05				
0.38	0.05							0.38	0.05						
0.39	0.05							0.39	0.05						
0.40	0.05							0.40	0.05						

D-4B- ICD Depth Flow Rating Curves

Depth [1]	Flow (m^3/s)						
	83 mm	94 mm	102 mm	108 mm	127 mm	152 mm	178 mm
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.005	0.018	0.023	0.027	0.030	0.041	0.059	0.081
0.15	0.018	0.024	0.028	0.031	0.043	0.062	0.085
0.3	0.020	0.025	0.030	0.033	0.046	0.066	0.090
0.35	0.020	0.026	0.030	0.034	0.047	0.067	0.092

(1) Depth taken at the top of catchbasin

Table D-5A: Capacity of Grates

Water Depth H (m)	$Q_{captured}$ (L/s) OPSD 400.01 SINGLE * (L/s)	TWIN * (L/s)
0.00	0	0
0.01	1	1
0.02	2	3
0.03	4	5
0.04	7	9
0.05	11	16
0.06	16	27
0.07	20	36
0.08	36	54
0.09	48	71
0.10	61	91
0.11	73	109
0.12	86	127
0.13	99	140
0.14	109	155
0.15	120	169
0.16	129	183
0.17	136	196
0.18	145	211
0.19	150	228
0.20	156	243
0.21	161	259
0.22	167	275
0.23	172	291
0.24	176	307
0.25	181	322
0.26	186	337
0.27	189	354
0.28	194	371
0.29	199	387
0.30	202	403

* From MTO Drainage Management Manual (
Design Chart 4.19

Table D-5B: Capacity of Side Inlet [1]

Water Depth (m)	SINGLE Capacity (L/s)	TWIN Capacity (L/s)
0.00	0	0
0.01	1	2
0.02	3	6
0.03	6	12
0.04	9	18
0.05	13	26
0.06	17	34
0.07	22	44
0.08	26	52
0.09	32	64
0.10	37	74
0.11	43	86
0.12	49	98
0.13	62	124
0.14	67	134
0.15	71	142
0.16	75	150
0.17	79	158
0.18	83	166
0.19	86	172
0.20	89	178
0.21	93	186
0.22	96	192
0.23	99	198
0.24	102	204
0.25	105	210
0.26	107	214
0.27	110	220
0.28	113	226
0.29	115	230
0.30	118	236

[1] As per $Q_{weir} = CLH^{3/2}$ where C = 1.8,
and $Q_{orifice} = CA\times(2gh)^{0.5}$ where C = 0.65
for a 13 cm high x 65 cm wide side inlet.

Table D-5C: Capacity of Lead Pipes

	Release Rate (L/s) by Pipe Diameter (mm)						
Head (m)	100	150	200	250	300	375	450
0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.050	6.4	14.4	25.5	39.9	57.4	89.7	129.2
0.100	9.0	20.3	36.1	56.4	81.2	126.9	182.7
0.150	11.0	24.9	44.2	69.1	99.4	155.4	223.7
0.200	12.8	28.7	51.0	79.7	114.8	179.4	258.3
0.250	14.3	32.1	57.1	89.1	128.4	200.6	288.8
0.300	15.6	35.2	62.5	97.7	140.6	219.7	316.4
0.350	16.9	38.0	67.5	105.5	151.9	237.3	341.8
0.400	18.0	40.6	72.2	112.8	162.4	253.7	365.3
0.450	19.1	43.1	76.5	119.6	172.2	269.1	387.5
0.500	20.2	45.4	80.7	126.1	181.5	283.7	408.5
0.550	21.2	47.6	84.6	132.2	190.4	297.5	428.4
0.600	22.1	49.7	88.4	138.1	198.9	310.7	447.5
0.650	23.0	51.7	92.0	143.7	207.0	323.4	465.7
0.700	23.9	53.7	95.5	149.2	214.8	335.6	483.3
0.750	24.7	55.6	98.8	154.4	222.3	347.4	500.3
0.800	25.5	57.4	102.1	159.5	229.6	358.8	516.7
0.850	26.3	59.2	105.2	164.4	236.7	369.8	532.6
0.900	27.1	60.9	108.3	169.1	243.6	380.6	548.0
0.950	27.8	62.6	111.2	173.8	250.2	391.0	563.0
1.000	28.5	64.2	114.1	178.3	256.7	401.2	577.7
1.050	29.2	65.8	116.9	182.7	263.1	411.1	591.9
1.100	29.9	67.3	119.7	187.0	269.3	420.7	605.9
1.150	30.6	68.8	122.4	191.2	275.3	430.2	619.5
1.200	31.2	70.3	125.0	195.3	281.2	439.4	632.8
1.250	31.9	71.8	127.6	199.3	287.0	448.5	645.9
1.300	32.5	73.2	130.1	203.3	292.7	457.4	658.6
1.350	33.1	74.6	132.6	207.2	298.3	466.1	671.2
1.400	33.8	75.9	135.0	211.0	303.8	474.7	683.5
1.450	34.4	77.3	137.4	214.7	309.2	483.1	695.6
1.500	34.9	78.6	139.8	218.4	314.4	491.3	707.5
1.550	35.5	79.9	142.1	222.0	319.6	499.4	719.2
1.600	36.1	81.2	144.3	225.5	324.8	507.4	730.7

Short tube orifice coefficient = 0.82

Short tube release rate = $C\pi(Dia/1000)^2/4\times(2\times9.81\times H)^{0.5}\times1000$

Table D-6: ICD Type and Inlet Capture Results for the 2-Year Chicago Storm (1)

Catch Basin ID	Peak Flow (m^3/s)	Actual Capture (m^3/s)	Max Depth (cm)	Flow Spread (m)	% of Total Travel Lane (1)	ICD Type	Comment
CB_001	0.011	0.011	0.0	0.00	0%	83mm	Low Point CB
CB_002	0.011	0.010	0.0	0.00	0%	83mm	Low Point CB
CB_003	0.081	0.081	0.0	0.00	0%	178mm	Low Point CB
CB_004	0.036	0.036	0.0	0.00	0%	127mm	Low Point CB
CB_005	0.029	0.029	0.0	0.00	0%	127mm	Low Point CB
CB_006	0.047	0.047	0.0	0.00	0%	152mm	Low Point CB
CB_007	0.038	0.016	5.0	1.63	19%	-	CB on Slope
CB_008	0.043	0.017	5.0	1.63	19%	-	CB on Slope
CB_009	0.043	0.017	5.0	1.63	19%	-	CB on Slope
CB_010	0.023	0.008	4.0	1.31	15%	-	CB on Slope
CB_011	0.023	0.008	4.0	1.31	15%	-	CB on Slope
CB_012	0.017	0.017	0.0	0.00	0%	108mm	Low Point CB
CB_013	0.010	0.010	0.0	0.00	0%	83mm	Low Point CB
CB_014	0.015	0.006	3.0	0.98	12%	-	CB on Slope
CB_015	0.015	0.006	3.0	0.98	12%	-	CB on Slope
CB_016	0.018	0.008	3.0	0.98	12%	-	CB on Slope
CB_017	0.149	0.148	1.0	0.33	4%	-	Low Point CB
CB_018	0.065	0.017	5.0	1.63	19%	-	CB on Slope
CB_019	0.081	0.015	5.0	1.63	19%	-	CB on Slope
CB_020	0.048	0.011	4.0	1.31	15%	-	CB on Slope
CB_021	0.029	0.029	0.0	0.00	0%	108mm	Low Point CB
CB_022	0.029	0.029	0.0	0.00	0%	108mm	Low Point CB
CB_023	0.016	0.016	0.0	0.00	0%	83mm	Rearyard CB
CB_024	0.065	0.065	0.0	0.00	0%	152mm	Low Point CB
CB_025	0.040	0.040	0.0	0.00	0%	127mm	Low Point CB
CB_026	0.011	0.011	0.0	0.00	0%	83mm	Low Point CB
CB_027	0.014	0.014	0.0	0.00	0%	94mm	Low Point CB
CB_028	0.022	0.022	0.0	0.00	0%	108mm	Low Point CB
CB_029	0.013	0.013	0.0	0.00	0%	83mm	Low Point CB
CB_030	0.045	0.045	0.0	0.00	0%	127mm	Low Point CB
CB_031	0.064	0.064	0.0	0.00	0%	152mm	Low Point CB
CB_032	0.041	0.041	0.0	0.00	0%	152mm	Low Point CB
CB_033	0.011	0.011	0.0	0.00	0%	83mm	Low Point CB
CB_034	0.015	0.003	3.0	0.98	12%	-	CB on Slope
CB_035	0.016	0.004	3.0	0.98	12%	-	CB on Slope
CB_036	0.033	0.013	4.0	1.31	15%	-	CB on Slope
CB_037	0.033	0.013	4.0	1.31	15%	-	CB on Slope
CB_038	0.059	0.020	6.0	1.96	23%	-	CB on Slope
CB_039	0.058	0.058	0.0	0.00	0%	178mm	Low Point CB
CB_040	0.037	0.037	0.0	0.00	0%	152mm	Low Point CB
CB_041	0.023	0.008	3.0	0.98	12%	-	CB on Slope
CB_042	0.023	0.008	3.0	0.98	12%	-	CB on Slope
CB_043	0.047	0.017	6.0	1.96	23%	-	CB on Slope
CB_044	0.047	0.017	6.0	1.96	23%	-	CB on Slope
CB_045	0.051	0.051	0.0	0.00	0%	178mm	Low Point CB
CB_046	0.037	0.037	0.0	0.00	0%	152mm	Low Point CB
CB_047	0.013	0.013	0.0	0.00	0%	178mm	Low Point CB
CB_048	0.013	0.013	0.0	0.00	0%	178mm	Low Point CB
CB_049	0.034	0.034	0.0	0.00	0%	127mm	Low Point CB
CB_050	0.055	0.055	0.0	0.00	0%	152mm	Low Point CB
CB_051	0.057	0.057	0.0	0.00	0%	152mm	Low Point CB
CB_052	0.035	0.035	0.0	0.00	0%	127mm	Low Point CB
CB_053	0.060	0.009	4.0	1.31	15%	-	CB on Slope
CB_054	0.036	0.006	4.0	1.31	15%	-	CB on Slope
CB_055	0.021	0.005	3.0	0.98	12%	-	CB on Slope
CB_056	0.028	0.011	5.0	1.63	19%	-	CB on Slope

Table D-6: ICD Type and Inlet Capture Results for the 2-Year Chicago Storm (1)

Catch Basin ID	Peak Flow (m^3/s)	Actual Capture (m^3/s)	Max Depth (cm)	Flow Spread (m)	% of Total Travel Lane (1)	ICD Type	Comment
CB_057	0.028	0.011	5.0	1.63	19%	-	CB on Slope
CB_058	0.058	0.017	5.0	1.63	19%	-	CB on Slope
CB_059	0.046	0.011	4.0	1.31	15%	-	CB on Slope
CB_060	0.046	0.011	4.0	1.31	15%	-	CB on Slope
CB_061	0.023	0.009	4.0	1.31	15%	-	CB on Slope
CB_062	0.023	0.009	4.0	1.31	15%	-	CB on Slope
CB_065	0.008	0.001	2.0	0.65	8%	-	CB on Slope
CB_066	0.014	0.006	4.0	1.31	15%	-	CB on Slope
CB_067	0.014	0.006	4.0	1.31	15%	-	CB on Slope
CB_068	0.023	0.007	4.0	1.31	15%	-	CB on Slope
CB_069	0.023	0.007	4.0	1.31	15%	-	CB on Slope
CB_070	0.020	0.008	3.0	0.98	12%	-	CB on Slope
CB_071	0.020	0.008	3.0	0.98	12%	-	CB on Slope
CB_072	0.034	0.009	4.0	1.31	15%	-	CB on Slope
CB_073	0.038	0.038	0.0	0.00	0%	152mm	Low Point CB
CB_074	0.033	0.033	0.0	0.00	0%	152mm	Low Point CB
CB_075	0.022	0.012	5.0	1.63	19%	-	CB on Slope
CB_076	0.022	0.012	5.0	1.63	19%	-	CB on Slope
CB_077	0.030	0.008	3.0	0.98	12%	-	CB on Slope
CB_078	0.051	0.034	6.0	1.96	23%	108mm	Low Point CB
CB_079	0.051	0.027	6.0	1.96	23%	102mm	Low Point CB
CB_080	0.044	0.044	0.0	0.00	0%	178mm	Low Point CB
CB_081	0.039	0.039	0.0	0.00	0%	178mm	Low Point CB
CB_082	0.026	0.026	0.0	0.00	0%	152mm	Low Point CB
CB_083	0.041	0.041	0.0	0.00	0%	178mm	Low Point CB
CB_084	0.024	0.024	0.0	0.00	0%	108mm	Low Point CB
CB_085	0.034	0.034	0.0	0.00	0%	127mm	Low Point CB
CB_086	0.048	0.048	0.0	0.00	0%	152mm	Low Point CB
CB_087	0.030	0.030	0.0	0.00	0%	127mm	Low Point CB
CB_088	0.015	0.015	0.0	0.00	0%	83mm	Low Point CB
CB_089	0.036	0.036	0.0	0.00	0%	127mm	Low Point CB
CB_090	0.020	0.004	3.0	0.98	12%	-	CB on Slope
CB_091	0.022	0.007	3.0	0.98	12%	-	CB on Slope
CB_092	0.022	0.007	3.0	0.98	12%	-	CB on Slope
CB_093	0.056	0.012	4.0	1.31	15%	-	CB on Slope
CB_095	0.034	0.016	5.0	1.63	19%	-	CB on Slope
CB_096	0.034	0.016	5.0	1.63	19%	-	CB on Slope
CB_097	0.020	0.010	4.0	1.31	15%	-	CB on Slope
CB_098	0.020	0.010	4.0	1.31	15%	-	CB on Slope
CB_099	0.038	0.038	0.0	0.00	0%	127mm	Low Point CB
CB_100	0.043	0.043	0.0	0.00	0%	127mm	Low Point CB
CB_101	0.005	0.001	2.0	0.65	8%	-	CB on Slope
CB_102	0.047	0.047	0.0	0.00	0%	152mm	Low Point CB
CB_103	0.012	0.012	0.0	0.00	0%	83mm	Low Point CB
CB_104	0.014	0.006	4.0	1.31	15%	-	CB on Slope
CB_105	0.014	0.006	4.0	1.31	15%	-	CB on Slope
CB_106	0.040	0.040	0.0	0.00	0%	152mm	Low Point CB
CB_107	0.063	0.063	0.0	0.00	0%	178m	Low Point CB
CB_108	0.040	0.012	4.0	1.31	15%	-	CB on Slope
CB_109	0.038	0.009	4.0	1.31	15%	-	CB on Slope
CB_111	0.035	0.035	0.0	0.00	0%	127mm	Low Point CB
CB_112	0.013	0.007	4.0	1.31	15%	-	CB on Slope
CB_113	0.013	0.007	4.0	1.31	15%	-	CB on Slope
CB_114	0.043	0.043	0.0	0.00	0%	152mm	Low Point CB
CB_115	0.043	0.043	0.0	0.00	0%	152mm	Low Point CB
CB_116	0.019	0.019	0.0	0.00	0%	127mm	Low Point CB

Table D-6: ICD Type and Inlet Capture Results for the 2-Year Chicago Storm [(1)]

Catch Basin ID	Peak Flow (m^3/s)	Actual Capture (m^3/s)	Max Depth (cm)	Flow Spread (m)	% of Total Travel Lane [(1)]	ICD Type	Comment
CB_118	0.020	0.020	0.0	0.00	0%	94mm	Low Point CB
CB_119	0.018	0.018	0.0	0.00	0%	94mm	Low Point CB
CB_120	0.043	0.043	0.0	0.00	0%	152mm	Low Point CB
CB_121	0.026	0.026	0.0	0.00	0%	127mm	Low Point CB
CB_123	0.021	0.021	0.0	0.00	0%	127mm	Low Point CB
CB_124	0.019	0.019	0.0	0.00	0%	108mm	Low Point CB
CB_125	0.010	0.010	0.0	0.00	0%	83mm	Low Point CB
CB_126	0.011	0.011	0.0	0.00	0%	83mm	Low Point CB
CB_127	0.016	0.016	0.0	0.00	0%	102mm	Low Point CB
CB_128	0.038	0.016	5.0	1.63	19%	-	CB on Slope
CB_129	0.012	0.006	4.0	1.31	15%	-	CB on Slope
CB_130	0.012	0.006	4.0	1.31	15%	-	CB on Slope
CB_131	0.097	0.018	6.0	1.96	23%	-	CB on Slope
CB_201	0.003	0.003	0.0	-	-	83mm	Rearyard CB
CB_203	0.015	0.015	0.0	-	-	83mm	Rearyard CB
CB_204	0.003	0.003	0.0	-	-	83mm	Rearyard CB
CB_205	0.032	0.032	0.0	-	-	127mm	Rearyard CB
CB_206	0.017	0.017	0.0	-	-	83mm	Rearyard CB
CB_207	0.014	0.014	0.0	-	-	83mm	Rearyard CB
CB_208	0.005	0.005	0.0	-	-	83mm	Rearyard CB
DCB_063	0.027	0.027	0.0	0.00	0%	108mm	Low Point CB
DCB_064	0.043	0.043	0.0	0.00	0%	127mm	Low Point CB
DCB_110	0.056	0.056	0.0	0.00	0%	152mm	Low Point CB
DCB_117	0.058	0.058	0.0	0.00	0%	178mm	Low Point CB
DCB_122	0.030	0.030	0.0	0.00	0%	127mm	Low Point CB
DICB_1	0.010	0.010	0.0	0.00	0%	83mm	Low Point CB
DICB_2	0.010	0.010	0.0	0.00	0%	83mm	Low Point CB
DICB_3	0.020	0.020	0.0	0.00	0%	94mm	Low Point CB
DICB_4	0.020	0.020	0.0	0.00	0%	94mm	Low Point CB

[(1)]Total travel lane width assumed to be 8.5 m (minimum road width in subdivision)

Table D-7: Ponding at Major Low Points for the 100-Year Chicago Storm & 100-Year Chicago Storm +20% (1)

Catch Basin ID	Total Depth (1)		Water Surface Elevation (1)	
	100 Year 3 Hr Chi (cm)	100 Year 3 Hr Chi+20% (cm)	100 Year 3 Hr Chi (m)	100 Year 3 Hr Chi+20% (m)
CB_001	20.0	26.0	107.72	107.78
CB_002	20.0	26.0	107.72	107.78
CB_003	28.0	31.0	107.82	107.85
CB_004	28.0	31.0	107.82	107.85
CB_005	21.0	27.0	107.91	107.97
CB_006	21.0	27.0	107.91	107.97
CB_012	15.0	18.0	106.94	106.97
CB_013	15.0	18.0	106.94	106.97
CB_017	9.0	11.0	104.17	104.19
CB_021	27.0	29.0	106.73	106.74
CB_022	27.0	29.0	106.73	106.74
CB_024	29.0	33.0	106.76	106.80
CB_025	29.0	33.0	106.76	106.80
CB_026	23.0	25.0	105.61	105.63
CB_027	23.0	25.0	105.61	105.63
CB_028	23.0	24.0	105.60	105.62
CB_029	23.0	24.0	105.60	105.62
CB_030	28.0	32.0	105.48	105.51
CB_031	28.0	32.0	105.48	105.51
CB_032	20.0	22.0	105.47	105.49
CB_033	20.0	22.0	105.47	105.49
CB_039	25.0	28.0	103.24	103.27
CB_040	25.0	28.0	103.24	103.27
CB_045	27.0	31.0	102.37	102.41
CB_046	27.0	31.0	102.37	102.41
CB_047	29.0	33.0	103.01	103.05
CB_048	29.0	33.0	103.01	103.05
CB_049	27.0	45.0	101.19	101.36
CB_050	27.0	45.0	101.19	101.36
CB_051	29.0	42.0	101.41	101.54
CB_052	29.0	42.0	101.41	101.54
CB_073	35.0	45.0	101.75	101.85
CB_074	35.0	45.0	101.75	101.85
CB_078	28.0	31.0	101.83	101.85
CB_079	28.0	31.0	101.83	101.85
CB_080	35.0	48.0	101.64	101.77
CB_081	35.0	48.0	101.64	101.77
CB_082	29.0	42.0	101.65	101.78
CB_083	29.0	42.0	101.65	101.78
CB_084	34.0	45.0	101.51	101.62
CB_085	34.0	45.0	101.51	101.62
CB_086	21.0	24.0	101.81	101.83
CB_087	21.0	24.0	101.81	101.83
CB_088	31.0	35.0	101.89	101.94
CB_089	31.0	35.0	101.89	101.94
CB_099	27.0	34.0	101.54	101.62
CB_100	27.0	34.0	101.54	101.62
CB_102	31.0	42.0	101.51	101.62
CB_103	31.0	42.0	101.51	101.62
CB_106	30.0	37.0	101.76	101.83
CB_107	30.0	37.0	101.76	101.83
CB_111	29.0	38.0	101.16	101.25
CB_114	26.0	34.0	101.38	101.46
CB_115	26.0	34.0	101.38	101.46
CB_116	12.0	30.0	100.83	101.01
CB_118	19.0	21.0	100.76	100.78
CB_119	19.0	21.0	100.76	100.78
CB_120	19.0	24.0	100.61	100.66
CB_121	19.0	24.0	100.61	100.66
CB_123	12.0	30.0	100.83	101.01
CB_124	16.0	29.0	100.99	101.12
CB_125	16.0	29.0	100.99	101.12
CB_126	19.0	30.0	101.08	101.18

Table D-7: Ponding at Major Low Points for the 100-Year Chicago Storm & 100-Year Chicago Storm +20% [(1)]

Catch Basin ID	Total Depth [(1)]		Water Surface Elevation [(1)]	
	100 Year 3 Hr Chi (cm)	100 Year 3 Hr Chi+20% (cm)	100 Year 3 Hr Chi (m)	100 Year 3 Hr Chi+20% (m)
CB_127	19.0	30.0	101.08	101.18
DCB_063	28.0	35.0	101.19	101.26
DCB_064	28.0	35.0	101.19	101.26
DCB_110	29.0	38.0	101.16	101.25
DCB_117	5.0	6.0	100.27	100.28
DCB_122	5.0	6.0	100.27	100.28

[(1)] As per PCSWMM models for the 100-year, 3-hour Chicago storm and the 100-year, 3-hour Chicago storm + 20%.

Table D8: Flow Depths 100-Year Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
C1	24mROW-Dbl-Sidewalk	0.00	0.00	0.00
C10	16.5mROW-No-Sidewalk	0.29	0.16	0.05
C100	16.5mROW-No-Sidewalk	0.13	0.28	0.04
C101_2	16.5mROW-No-Sidewalk	1.10	0.06	0.07
C101_3	16.5mROW-No-Sidewalk	0.97	0.09	0.09
C101_4	16.5mROW-No-Sidewalk	2.00	0.27	0.54
C101_5	16.5mROW-No-Sidewalk	0.95	0.07	0.07
C102	16.5mROW-No-Sidewalk	1.11	0.27	0.30
C103_1	16.5mROW-No-Sidewalk	0.73	0.09	0.07
C103_2	16.5mROW-No-Sidewalk	1.22	0.25	0.31
C104	16.5mROW-No-Sidewalk	0.94	0.25	0.24
C105	16.5mROW-Sidewalk	1.02	0.09	0.09
C106_1	16.5mROW-Sidewalk	1.08	0.09	0.10
C106_2	16.5mROW-Sidewalk	0.94	0.11	0.10
C107	16.5mROW-Sidewalk	1.00	0.13	0.13
C108_1	16.5mROW-Sidewalk	1.02	0.13	0.13
C108_2	16.5mROW-Sidewalk	0.86	0.35	0.30
C109	16.5mROW-Sidewalk	0.91	0.35	0.32
C11	16.5mROW-No-Sidewalk	0.60	0.29	0.17
C11_1	16.5mROW-No-Sidewalk	0.37	0.19	0.07
C11_2	24mROW-Dbl-Sidewalk	0.20	0.19	0.04
C110	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C111	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C112_1	16.5mROW-No-Sidewalk	0.00	0.09	0.00
C112_2	16.5mROW-No-Sidewalk	1.02	0.25	0.26
C113	16.5mROW-No-Sidewalk	0.12	0.25	0.03
C114_1	16.5mROW-No-Sidewalk	0.48	0.04	0.02
C114_3	16.5mROW-No-Sidewalk	0.45	0.04	0.02
C114_4	16.5mROW-No-Sidewalk	0.30	0.22	0.07
C116	16.5mROW-No-Sidewalk	0.09	0.07	0.01
C117	16.5mROW-No-Sidewalk	0.08	0.22	0.02
C118_1	16.5mROW-Sidewalk	0.00	0.05	0.00
C118_2	16.5mROW-Sidewalk	0.42	0.23	0.10
C119	16.5mROW-Sidewalk	0.73	0.23	0.17
C12	16.5mROW-Sidewalk	0.27	0.28	0.08
C13	16.5mROW-Sidewalk	0.92	0.28	0.26
C14	16.5mROW-Sidewalk	1.21	0.08	0.10
C144	Major System Overflow	0.78	0.05	0.04
C15	16.5mROW-Sidewalk	0.25	0.27	0.07
C15_1	16.5mROW-No-Sidewalk	0.65	0.10	0.07
C15_2	16.5mROW-No-Sidewalk	0.84	0.10	0.08
C16_2	16.5mROW-No-Sidewalk	0.74	0.09	0.07
C16_3	16.5mROW-No-Sidewalk	0.25	0.12	0.03
C16_4	16.5mROW-No-Sidewalk	0.28	0.09	0.03
C17	16.5mROW-No-Sidewalk	2.00	0.28	0.56
C18	16.5mROW-No-Sidewalk	1.48	0.12	0.18
C2	16.5mROW-No-Sidewalk	0.00	0.19	0.00
C20_1	16.5mROW-No-Sidewalk	1.38	0.10	0.14
C20_3	16.5mROW-No-Sidewalk	0.94	0.12	0.11
C20_4	16.5mROW-No-Sidewalk	1.26	0.10	0.13
C20_5	16.5mROW-No-Sidewalk	1.66	0.10	0.17
C22	16.5mROW-No-Sidewalk	1.01	0.12	0.12
C23	16.5mROW-No-Sidewalk	1.00	0.11	0.11
C24_1	16.5mROW-No-Sidewalk	0.52	0.09	0.05
C24_2	16.5mROW-No-Sidewalk	0.61	0.11	0.07
C25_1	16.5mROW-No-Sidewalk	0.00	0.07	0.00

Table D8: Flow Depths 100-Year Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m^2/s)
C25_2	16.5mROW-No-Sidewalk	0.71	0.07	0.05
C26	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C27	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C28	16.5mROW-No-Sidewalk	0.00	0.15	0.00
C29_1	16.5mROW-No-Sidewalk	0.76	0.04	0.03
C29_2	16.5mROW-No-Sidewalk	0.40	0.08	0.03
C3	16.5mROW-No-Sidewalk	0.21	0.19	0.04
C30	16.5mROW-No-Sidewalk	0.00	0.15	0.00
C31_1	16.5mROW-No-Sidewalk	0.00	0.05	0.00
C31_2	16.5mROW-No-Sidewalk	0.82	0.05	0.04
C32	16.5mROW-No-Sidewalk	0.75	0.09	0.07
C33_1	16.5mROW-No-Sidewalk	0.77	0.12	0.09
C33_2	16.5mROW-No-Sidewalk	1.00	0.12	0.12
C34_1	16.5mROW-No-Sidewalk	1.27	0.10	0.13
C34_2	16.5mROW-No-Sidewalk	1.11	0.13	0.14
C35	16.5mROW-No-Sidewalk	1.41	0.13	0.18
C36	16.5mROW-No-Sidewalk	0.70	0.29	0.20
C39	16.5mROW-No-Sidewalk	0.24	0.29	0.07
C4_1	16.5mROW-No-Sidewalk	0.26	0.19	0.05
C4_2	16.5mROW-No-Sidewalk	0.01	0.19	0.00
C41	16.5mROW-No-Sidewalk	0.26	0.27	0.07
C42	16.5mROW-No-Sidewalk	0.77	0.27	0.21
C43	16.5mROW-Sidewalk	0.70	0.28	0.20
C44	16.5mROW-Sidewalk	0.17	0.28	0.05
C45	16.5mROW-Sidewalk	0.44	0.35	0.15
C46	16.5mROW-Sidewalk	1.13	0.35	0.40
C47_1	16.5mROW-Sidewalk	0.00	0.03	0.00
C47_2	16.5mROW-Sidewalk	0.09	0.13	0.01
C47_3	16.5mROW-Sidewalk	0.30	0.29	0.09
C48	16.5mROW-Sidewalk	0.03	0.29	0.01
C49_1	16.5mROW-Sidewalk	0.02	0.12	0.00
C49_2	16.5mROW-Sidewalk	0.29	0.27	0.08
C5	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C50	16.5mROW-Sidewalk	1.09	0.27	0.29
C51_1	24mROW-Dbl-Sidewalk	0.00	0.00	0.00
C51_2	24mROW-Dbl-Sidewalk	0.00	0.00	0.00
C51_4	24mROW-Dbl-Sidewalk	0.00	0.00	0.00
C51_5	24mROW-Dbl-Sidewalk	0.00	0.00	0.00
C52	24mROW-Dbl-Sidewalk	0.00	0.00	0.00
C53	24mROW-Dbl-Sidewalk	0.63	0.03	0.02
C54	24mROW-Dbl-Sidewalk	0.53	0.03	0.02
C55	16.5mROW-Sidewalk	0.34	0.26	0.09
C56	16.5mROW-Sidewalk	0.20	0.26	0.05
C57_1	16.5mROW-Sidewalk	0.12	0.09	0.01
C57_2	16.5mROW-Sidewalk	0.73	0.29	0.21
C58	16.5mROW-Sidewalk	0.20	0.29	0.06
C59	24mROW-Dbl-Sidewalk	0.00	0.00	0.00
C6	16.5mROW-No-Sidewalk	0.00	0.05	0.00
C60_1	24mROW-Dbl-Sidewalk	0.00	0.04	0.00
C60_2	24mROW-Dbl-Sidewalk	1.18	0.05	0.06
C61_2	24mROW-Dbl-Sidewalk	0.98	0.08	0.08
C61_3	24mROW-Dbl-Sidewalk	1.08	0.05	0.05
C61_4	24mROW-Dbl-Sidewalk	0.83	0.06	0.05
C62_1	24mROW-Dbl-Sidewalk	0.81	0.09	0.07
C62_2	24mROW-Dbl-Sidewalk	1.04	0.09	0.09
C63_1	24mROW-Dbl-Sidewalk	0.56	0.06	0.03

Table D8: Flow Depths 100-Year Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
C63_2	24mROW-Dbl-Sidewalk	0.83	0.27	0.22
C64	16.5mROW-Sidewalk	1.12	0.29	0.32
C65	16.5mROW-Sidewalk	1.16	0.29	0.34
C66	16.5mROW-Sidewalk	0.00	0.21	0.00
C67	16.5mROW-Sidewalk	0.00	0.28	0.00
C68	16.5mROW-Sidewalk	0.00	0.21	0.00
C69	16.5mROW-Sidewalk	0.18	0.28	0.05
C7_1	16.5mROW-No-Sidewalk	0.00	0.06	0.00
C7_2	16.5mROW-No-Sidewalk	0.93	0.06	0.06
C70	16.5mROW-Sidewalk	0.37	0.20	0.07
C71	16.5mROW-Sidewalk	0.00	0.20	0.00
C72	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C73	16.5mROW-No-Sidewalk	0.00	0.03	0.00
C74_1	16.5mROW-No-Sidewalk	0.15	0.06	0.01
C74_2	16.5mROW-No-Sidewalk	0.49	0.06	0.03
C75	16.5mROW-No-Sidewalk	1.18	0.06	0.07
C76_1	16.5mROW-No-Sidewalk	0.70	0.06	0.04
C76_2	16.5mROW-No-Sidewalk	0.80	0.06	0.05
C77_2	16.5mROW-No-Sidewalk	0.82	0.06	0.05
C77_4	16.5mROW-No-Sidewalk	0.92	0.08	0.07
C77_5	16.5mROW-No-Sidewalk	0.76	0.08	0.06
C78	16.5mROW-No-Sidewalk	0.92	0.30	0.28
C79	16.5mROW-No-Sidewalk	0.24	0.30	0.07
C8	16.5mROW-No-Sidewalk	0.00	0.12	0.00
C80_1	16.5mROW-No-Sidewalk	0.19	0.09	0.02
C80_2	16.5mROW-No-Sidewalk	0.65	0.18	0.12
C81	16.5mROW-No-Sidewalk	0.68	0.31	0.21
C82	16.5mROW-No-Sidewalk	0.33	0.31	0.10
C83_1	16.5mROW-No-Sidewalk	0.00	0.15	0.00
C83_2	16.5mROW-No-Sidewalk	0.30	0.31	0.09
C84	16.5mROW-No-Sidewalk	0.84	0.31	0.26
C85	16.5mROW-No-Sidewalk	0.00	0.21	0.00
C86	16.5mROW-No-Sidewalk	0.16	0.21	0.03
C88_1	16.5mROW-No-Sidewalk	0.50	0.07	0.04
C88_2	16.5mROW-No-Sidewalk	0.45	0.16	0.07
C89	16.5mROW-No-Sidewalk	1.20	0.34	0.41
C9_1	16.5mROW-No-Sidewalk	0.22	0.16	0.04
C9_2	16.5mROW-No-Sidewalk	0.60	0.12	0.07
C90	16.5mROW-No-Sidewalk	1.02	0.34	0.35
C91	16.5mROW-No-Sidewalk	0.00	0.06	0.00
C93_1	16.5mROW-No-Sidewalk	0.34	0.05	0.02
C93_2	16.5mROW-No-Sidewalk	0.51	0.05	0.03
C94	16.5mROW-No-Sidewalk	0.68	0.05	0.03
C95	16.5mROW-No-Sidewalk	0.44	0.20	0.09
C96	16.5mROW-No-Sidewalk	0.28	0.20	0.06
C97	16.5mROW-No-Sidewalk	0.28	0.23	0.06
C98	16.5mROW-No-Sidewalk	0.75	0.23	0.17
C99	16.5mROW-No-Sidewalk	0.2	0.28	0.06
	Max	**2.00**	**0.35**	**0.56**

Note: Depth and velocity calculated by PCSWMM model

Table D9: Flow Depths 100-Year 3 Hour Chicago +20% Peak Flow

Link Name	Transcript	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m^2/s)
C1	24mROW-Dbl-Sidewalk	0.00	0.04	0.00
C10	16.5mROW-No-Sidewalk	0.41	0.29	0.12
C100	16.5mROW-No-Sidewalk	0.22	0.32	0.07
C101_2	16.5mROW-No-Sidewalk	1.30	0.08	0.10
C101_3	16.5mROW-No-Sidewalk	1.19	0.10	0.12
C101_4	16.5mROW-No-Sidewalk	1.96	0.30	0.59
C101_5	16.5mROW-No-Sidewalk	1.18	0.09	0.11
C102	16.5mROW-No-Sidewalk	1.07	0.31	0.33
C103_1	16.5mROW-No-Sidewalk	0.79	0.10	0.08
C103_2	16.5mROW-No-Sidewalk	1.14	0.28	0.32
C104	16.5mROW-No-Sidewalk	0.95	0.28	0.27
C105	16.5mROW-Sidewalk	1.74	0.11	0.19
C106_1	16.5mROW-Sidewalk	1.29	0.11	0.14
C106_2	16.5mROW-Sidewalk	1.29	0.14	0.18
C107	16.5mROW-Sidewalk	1.26	0.17	0.21
C108_1	16.5mROW-Sidewalk	1.08	0.18	0.19
C108_2	16.5mROW-Sidewalk	0.79	0.45	0.36
C109	16.5mROW-Sidewalk	0.83	0.45	0.37
C11	16.5mROW-No-Sidewalk	0.64	0.33	0.21
C11_1	16.5mROW-No-Sidewalk	0.43	0.30	0.13
C11_2	24mROW-Dbl-Sidewalk	0.28	0.30	0.08
C110	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C111	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C112_1	16.5mROW-No-Sidewalk	0.00	0.10	0.00
C112_2	16.5mROW-No-Sidewalk	1.01	0.27	0.27
C113	16.5mROW-No-Sidewalk	0.12	0.27	0.03
C114_1	16.5mROW-No-Sidewalk	0.63	0.06	0.04
C114_3	16.5mROW-No-Sidewalk	0.47	0.08	0.04
C114_4	16.5mROW-No-Sidewalk	0.28	0.27	0.08
C116	16.5mROW-No-Sidewalk	0.29	0.13	0.04
C117	16.5mROW-No-Sidewalk	0.10	0.27	0.03
C118_1	16.5mROW-Sidewalk	0.24	0.06	0.01
C118_2	16.5mROW-Sidewalk	0.40	0.25	0.10
C119	16.5mROW-Sidewalk	0.76	0.25	0.19
C12	16.5mROW-Sidewalk	0.33	0.35	0.12
C13	16.5mROW-Sidewalk	0.93	0.35	0.33
C14	16.5mROW-Sidewalk	1.32	0.12	0.16
C144	Major System Overflow	0.91	0.06	0.05
C15	16.5mROW-Sidewalk	0.27	0.34	0.09
C15_1	16.5mROW-No-Sidewalk	0.75	0.12	0.09
C15_2	16.5mROW-No-Sidewalk	0.96	0.12	0.12
C16_2	16.5mROW-No-Sidewalk	0.83	0.11	0.09
C16_3	16.5mROW-No-Sidewalk	0.31	0.14	0.04
C16_4	16.5mROW-No-Sidewalk	0.41	0.11	0.05
C17	16.5mROW-No-Sidewalk	2.05	0.29	0.59
C18	16.5mROW-No-Sidewalk	1.70	0.14	0.24
C2	16.5mROW-No-Sidewalk	0.60	0.21	0.13
C20_1	16.5mROW-No-Sidewalk	1.53	0.12	0.18
C20_3	16.5mROW-No-Sidewalk	1.04	0.13	0.14
C20_4	16.5mROW-No-Sidewalk	1.38	0.11	0.15
C20_5	16.5mROW-No-Sidewalk	1.72	0.12	0.21
C22	16.5mROW-No-Sidewalk	1.07	0.13	0.14
C23	16.5mROW-No-Sidewalk	1.06	0.12	0.13
C24_1	16.5mROW-No-Sidewalk	0.55	0.10	0.06
C24_2	16.5mROW-No-Sidewalk	0.65	0.12	0.08
C25_1	16.5mROW-No-Sidewalk	0.00	0.07	0.00

Table D9: Flow Depths 100-Year 3 Hour Chicago +20% Peak Flow

Link Name	Transcept	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m^2/s)
C25_2	16.5mROW-No-Sidewalk	0.75	0.07	0.05
C26	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C27	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C28	16.5mROW-No-Sidewalk	0.00	0.18	0.00
C29_1	16.5mROW-No-Sidewalk	1.05	0.06	0.06
C29_2	16.5mROW-No-Sidewalk	0.62	0.09	0.06
C3	16.5mROW-No-Sidewalk	0.20	0.21	0.04
C30	16.5mROW-No-Sidewalk	0.15	0.18	0.03
C31_1	16.5mROW-No-Sidewalk	0.23	0.05	0.01
C31_2	16.5mROW-No-Sidewalk	0.87	0.06	0.05
C32	16.5mROW-No-Sidewalk	0.77	0.11	0.08
C33_1	16.5mROW-No-Sidewalk	0.93	0.15	0.14
C33_2	16.5mROW-No-Sidewalk	1.20	0.15	0.18
C34_1	16.5mROW-No-Sidewalk	1.50	0.12	0.18
C34_2	16.5mROW-No-Sidewalk	1.32	0.15	0.20
C35	16.5mROW-No-Sidewalk	1.66	0.16	0.27
C36	16.5mROW-No-Sidewalk	0.72	0.42	0.30
C39	16.5mROW-No-Sidewalk	0.31	0.42	0.13
C4_1	16.5mROW-No-Sidewalk	0.28	0.24	0.07
C4_2	16.5mROW-No-Sidewalk	0.18	0.24	0.04
C41	16.5mROW-No-Sidewalk	0.28	0.45	0.13
C42	16.5mROW-No-Sidewalk	0.80	0.45	0.36
C43	16.5mROW-Sidewalk	0.73	0.31	0.23
C44	16.5mROW-Sidewalk	0.23	0.31	0.07
C45	16.5mROW-Sidewalk	0.37	0.48	0.18
C46	16.5mROW-Sidewalk	1.05	0.48	0.50
C47_1	16.5mROW-Sidewalk	0.09	0.07	0.01
C47_2	16.5mROW-Sidewalk	0.12	0.17	0.02
C47_3	16.5mROW-Sidewalk	0.30	0.33	0.10
C48	16.5mROW-Sidewalk	0.18	0.33	0.06
C49_1	16.5mROW-Sidewalk	0.17	0.14	0.02
C49_2	16.5mROW-Sidewalk	0.35	0.29	0.10
C5	16.5mROW-No-Sidewalk	0.66	0.05	0.03
C50	16.5mROW-Sidewalk	1.13	0.29	0.33
C51_1	24mROW-Dbl-Sidewalk	0.00	0.08	0.00
C51_2	24mROW-Dbl-Sidewalk	0.96	0.08	0.08
C51_4	24mROW-Dbl-Sidewalk	0.75	0.10	0.08
C51_5	24mROW-Dbl-Sidewalk	0.21	0.10	0.02
C52	24mROW-Dbl-Sidewalk	0.00	0.00	0.00
C53	24mROW-Dbl-Sidewalk	0.67	0.03	0.02
C54	24mROW-Dbl-Sidewalk	0.56	0.11	0.06
C55	16.5mROW-Sidewalk	0.36	0.34	0.12
C56	16.5mROW-Sidewalk	0.24	0.34	0.08
C57_1	16.5mROW-Sidewalk	0.51	0.18	0.09
C57_2	16.5mROW-Sidewalk	0.70	0.38	0.27
C58	16.5mROW-Sidewalk	0.21	0.38	0.08
C59	24mROW-Dbl-Sidewalk	0.00	0.05	0.00
C6	16.5mROW-No-Sidewalk	0.63	0.06	0.04
C60_1	24mROW-Dbl-Sidewalk	1.24	0.05	0.06
C60_2	24mROW-Dbl-Sidewalk	1.25	0.06	0.08
C61_2	24mROW-Dbl-Sidewalk	1.13	0.09	0.10
C61_3	24mROW-Dbl-Sidewalk	1.30	0.07	0.09
C61_4	24mROW-Dbl-Sidewalk	1.16	0.07	0.08
C62_1	24mROW-Dbl-Sidewalk	0.92	0.11	0.10
C62_2	24mROW-Dbl-Sidewalk	1.15	0.12	0.14
C63_1	24mROW-Dbl-Sidewalk	0.98	0.12	0.12

Table D9: Flow Depths 100-Year 3 Hour Chicago +20% Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
C63_2	24mROW-Dbl-Sidewalk	0.82	0.34	0.28
C64	16.5mROW-Sidewalk	1.04	0.42	0.44
C65	16.5mROW-Sidewalk	1.09	0.42	0.46
C66	16.5mROW-Sidewalk	0.00	0.27	0.00
C67	16.5mROW-Sidewalk	0.00	0.31	0.00
C68	16.5mROW-Sidewalk	0.00	0.27	0.00
C69	16.5mROW-Sidewalk	0.18	0.31	0.06
C7_1	16.5mROW-No-Sidewalk	0.87	0.12	0.10
C7_2	16.5mROW-No-Sidewalk	1.39	0.12	0.17
C70	16.5mROW-Sidewalk	0.35	0.26	0.09
C71	16.5mROW-Sidewalk	0.16	0.26	0.04
C72	16.5mROW-No-Sidewalk	0.00	0.00	0.00
C73	16.5mROW-No-Sidewalk	0.00	0.03	0.00
C74_1	16.5mROW-No-Sidewalk	0.15	0.07	0.01
C74_2	16.5mROW-No-Sidewalk	0.41	0.12	0.05
C75	16.5mROW-No-Sidewalk	1.99	0.12	0.24
C76_1	16.5mROW-No-Sidewalk	1.43	0.09	0.13
C76_2	16.5mROW-No-Sidewalk	1.25	0.10	0.13
C77_2	16.5mROW-No-Sidewalk	1.14	0.10	0.11
C77_4	16.5mROW-No-Sidewalk	1.20	0.11	0.13
C77_5	16.5mROW-No-Sidewalk	1.01	0.11	0.11
C78	16.5mROW-No-Sidewalk	0.95	0.37	0.35
C79	16.5mROW-No-Sidewalk	0.28	0.37	0.10
C8	16.5mROW-No-Sidewalk	0.29	0.30	0.09
C80_1	16.5mROW-No-Sidewalk	0.56	0.20	0.11
C80_2	16.5mROW-No-Sidewalk	0.70	0.29	0.20
C81	16.5mROW-No-Sidewalk	0.64	0.42	0.27
C82	16.5mROW-No-Sidewalk	0.35	0.42	0.15
C83_1	16.5mROW-No-Sidewalk	0.00	0.20	0.00
C83_2	16.5mROW-No-Sidewalk	0.29	0.35	0.10
C84	16.5mROW-No-Sidewalk	0.87	0.35	0.30
C85	16.5mROW-No-Sidewalk	0.00	0.24	0.00
C86	16.5mROW-No-Sidewalk	0.21	0.24	0.05
C88_1	16.5mROW-No-Sidewalk	0.67	0.17	0.11
C88_2	16.5mROW-No-Sidewalk	0.49	0.28	0.14
C89	16.5mROW-No-Sidewalk	1.19	0.45	0.54
C9_1	16.5mROW-No-Sidewalk	0.37	0.29	0.11
C9_2	16.5mROW-No-Sidewalk	0.35	0.30	0.11
C90	16.5mROW-No-Sidewalk	1.01	0.45	0.45
C91	16.5mROW-No-Sidewalk	0.00	0.10	0.00
C93_1	16.5mROW-No-Sidewalk	0.35	0.05	0.02
C93_2	16.5mROW-No-Sidewalk	0.55	0.06	0.03
C94	16.5mROW-No-Sidewalk	0.72	0.06	0.04
C95	16.5mROW-No-Sidewalk	0.44	0.22	0.10
C96	16.5mROW-No-Sidewalk	0.28	0.22	0.06
C97	16.5mROW-No-Sidewalk	0.29	0.24	0.07
C98	16.5mROW-No-Sidewalk	0.77	0.24	0.18
C99	16.5mROW-No-Sidewalk	0.20	0.32	0.06
	Max	**2.05**	**0.48**	**0.59**

Note: Depth and velocity calculated by PCSWMM model

E.3 GEOTECHNCIAL INVESTIGATION REPORT BY PATERSON INC. (MARCH 2020)

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Noise and Vibration Studies

patersongroup

Geotechnical Investigation

Proposed Mixed Use Development
Half Moon Bay South - Phase 8
3718 Greenbank Road - Ottawa

Prepared For

Mattamy Homes

March 30, 2021

Report: PG5690-1

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Table of Contents

Page

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Mattamy Homes to conduct a geotechnical investigation for Phase 8 of Half Moon Bay South development located at 3718 Greenbank Road, in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the investigation was to:

- ❏ determine the subsoil and groundwater conditions at this site by means of a borehole program.

- ❏ provide geotechnical recommendations for the design of the proposed development based on the results of the boreholes and other soil information available.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. The report contains our findings and includes geotechnical recommendations pertaining to the design and construction of the proposed development as understood at the time of this report.

2.0 Proposed Development

It is understood that the current phase of the proposed development will consist of residential condominium blocks with or without basements and commercial areas consisting of slab on grade buildings. Associated driveways, local roadways and landscaping areas are also anticipated as part of the proposed development.

It is further understood that the proposed development will be serviced by future municipal water, sanitary and storm services.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the current geotechnical investigation was carried out between February 17 and 23, 2021 and consisted of advancing a total of 12 boreholes to a maximum depth of 9.8 m below existing grade. Previous investigations were completed within the general area and surroundings of the subject site and consisted of a series of boreholes and test pits advanced to a maximum depth of 9.1 m below ground surface. The borehole locations were distributed in a manner to provide general coverage of the subject site and taking into consideration current site conditions. The test holes locations are shown on Drawing PG5690-1 - Test Hole Location Plan included in Appendix 2.

The test holes were completed using a track mounted drill operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The drilling procedure consisted of drilling to the required depths at the selected locations, and sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler. All soil samples were visually inspected and initially classified on site. The auger, split-spoon and grab samples were placed in sealed plastic bags and transported to the our laboratory for examination and classification. The depths at which the auger, and split-spoon samples were recovered from the test holes are shown as AU, and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as “N” values on the Soil Profile and Test Data sheets. The “N” value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

The thickness of the silty sand deposit was evaluated by a dynamic cone penetration testing (DCPT) completed at BH 7-21. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

The subsurface conditions observed at the test hole locations were recorded in detail in the field. Our findings are presented in the Soil Profile and Test Data sheets in Appendix 1.

Groundwater Monitoring

All boreholes were fitted with flexible piezometers to allow groundwater level monitoring. The groundwater observations are discussed in Subsection 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

All samples from the current investigation will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test hole locations were determined by Paterson personnel and surveyed in the field by Paterson using a handheld, high precision GPS. The ground surface elevation at each test hole location is referenced to a geodetic datum. The locations of the boreholes are presented on Drawing PG5690-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were collected from the subject site during the investigation and were visually examined in our laboratory to review the results of the field logging. Three grain size distribution analyses were completed on selected soil samples. The results of our testing are presented in Subsection 4.2 and on Grain Size Distribution Analysis sheets presented in Appendix 1.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is a former agricultural land. The bulk of the current phase of the proposed development has been recently cleared of topsoil and peat which has been stockpiled in several piles across the site. Generally, the ground surface across the subject site is relatively flat within the central portion and slopes up towards the edges. It should be noted that parts of the subject site had undergone excavation and in-filling activities as part of a previous sand extraction operation. Historical aerial photographs of the site indicating fill movement activities since 1976 are presented in Appendix 2. The area to the south is significantly elevated. The area to the north and west also present a steep slope where fill was encountered.

The site is bordered to the south by a park and vacant land and to the north and west by future residential developments and the east by the future Greenbank Road.

4.2 Subsurface Profile

Generally, the subsurface profile across the subject site consists of varying amounts of fill consisting of silty sand mixed with occasional silty clay, gravel and cobbles. It should be noted that the fill thickness within BH 9-21, BH 10-21 and BH 11-21 ranged from 4.5 m and up to 8.23 m below ground surface.

A deep deposit of compact to dense brown silty sand to underlain the fill layer. Gravel and cobbles were occasionally encountered within the silty sand layer. The silty sand was observed to be underlain by a glacial till deposit composed of dense brown sandy silt to silty sand with gravel, cobbles and boulders within BH 3-21.

Practical refusal to augering was encountered at a range between 4.6 m and 8.3 m below existing ground surface. Practical refusal to DCPT was encountered at 9.8 m below existing ground surface at BH 7-21.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Bedrock

Based on available geological mapping, the bedrock in the subject area consists of Paleozoic interbedded Sandstone and Dolomite from the March formation, with an overburden drift thickness of 10 to 15 m depth.

Grain Size Distribution and Hydrometer Testing

Grain size distribution (sieve and hydrometer analysis) testing was completed on three selected soil samples. The results of the grain size analysis are summarized in Table 1 and presented on the Grain-Size Distribution and Hydrometer Testing Results sheets in Appendix 1.

Table 1 - Grain Size Distribution

Borehole	Sample	Gravel (%)	Sand (%)	Silt and Clay (%)
BH2-21	SS3 & SS4	1.8	89.4	8.8
BH4-21	SS4 & SS5	0	88.9	11.1
BH8-21	SS4 & SS5	46.9	43.1	10

4.3 Groundwater

Groundwater levels were measured in the groundwater monitoring wells on March 4, 2021. The piezometers in BH 7-21, BH 11-21 and BH 12-21 were damaged or buried and could not be recorded. The remaining boreholes were dry upon completion.

Long-term groundwater level can also be estimated based on the observed moisture levels, colour and consistency of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected well below 8 m below existing ground surface. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed mixed-use development. It is anticipated that the proposed buildings will be founded over conventional footings placed over an undisturbed compact to dense silty sand or dense glacial till bearing surface or an engineered fill pad over an approved fill subgrade bearing medium.

To adequately distribute the foundation loads in areas where the existing fill is encountered below the building footprint, a woven geotextile liner, such as Terratrack 200 or equivalent, should be placed 500 mm below design underside of footing level and extend at least 1 m horizontally beyond the footing face. A biaxial geogrid, such as Terrafix TBX2500 or equivalent, should be placed over the woven geotextile liner. A minimum 500 mm thick pad, consisting of a Granular B Type II, compacted to 98% of its SPMDD should be placed up to design underside of footing level. Prior to placement of the abovenoted engineered fill pad, it is recommended that a proof-rolling program be completed by a vibratory roller making several passes and approved by Paterson personnel over the sub-excavated area below the proposed footings.

For areas where a fill layer is encountered below the granular layer for the floor slab, it is recommended to sub-excavate 500 mm below the underside of floor slab granulars and place a woven geotextile liner, such as Terratrack 200W or equivalent, and a biaxial geogrid, such as Terrafix TBX2500 or equivalent. It is recommended that a proof-rolling program be completed by a vibratory roller making several passes and approved by Paterson personnel prior to placement of the geotextile liner and biaxial geogrid. Any poor performing areas should be removed and reinstated with a select subgrade fill compacted to 98% of its SPMDD under dry and above freezing temperatures.

The proof-rolling program should also be completed across paved areas to ensure that any poor performing soils are removed prior to pavement structure placement.

Due to the absence of a silty clay deposit, the aforementioned site will not be subjected to permissible grade raise restrictions. Also, no tree planting setback restrictions are required for the subject phase of the proposed development due to the absence of a silty clay deposit.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the proposed building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be placed in lifts of 300 mm thick or less and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building areas should be compacted to at least 99% of the Standard Proctor Maximum Dry Density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill and beneath parking areas where settlement of the ground surface is of minor concern. In landscaped areas, these materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of the SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

Proof Rolling

Proof rolling of the subgrade is required in areas where the existing fill, free of significant amounts of organics and deleterious materials, is encountered. It is recommended that the subgrade surface be proof-rolled **under dry conditions and in above freezing temperatures** by an adequately sized roller making several passes to achieve optimum compaction levels. The compaction program should be reviewed and approved by the geotechnical consultant at the time of construction.

5.3 Foundation Design

Conventional Spread Footings

Footings placed directly on an undisturbed, compact silty sand or glacial till bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

Footings placed over a minimum 500 mm thick geogrid reinforced engineered pad, consisting of a Granular A or Granular B Type II or approved granular fill alternative placed in maximum 300 mm loose lifts and compacted to 98% of its SPMDD, placed over a subgrade soil approved by the Paterson personnel at the time of construction, can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **250 kPa**.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

Footings placed on a soil bearing surface and designed using the bearing resistance values at SLS given above will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

Where the silty sand subgrade is found to be in a loose state, the contractor should compact the subgrade under dry conditions and above freezing temperatures, using suitable compaction equipment, making several passes and approved by Paterson.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the in-situ bearing medium soils above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D**. Based on the current information, including the level of groundwater table and compactness of the underlying sand layer, the soil underlying the subject site is not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab / Slab-on-Grade Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the native soil and/or approved fill pad (placed as per Subsection 5.0) will be considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab. Any poor performing areas should be removed and reinstated with an engineered fill, such as Granular B Type II.

For slab-on-grade areas, it is recommended that the upper 200 mm of sub-slab fill consist OPSS Granular A crushed stone. For basement slabs, it is recommended that the upper 200 mm of sub-floor fill consist of 19 mm clear crushed stone

5.6 Pavement Structure

Driveways, local residential roadways, heavy truck parking/loading areas and roadways with bus traffic are anticipated at this site. The proposed pavement structures are shown in Tables 2, 3 and 4.

Table 2 - Recommended Pavement Structure - Driveways and at-grade car parking areas

Thickness (mm)	Material Description
50	**Wear Course** - HL 3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 3 - Recommended Pavement Structure - Local Residential Roadways and Heavy Truck Parking / Loading Areas	
Thickness (mm)	**Material Description**
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil	

Table 4 - Recommended Pavement Structure - Roadways with Bus Traffic	
Thickness mm	**Material Description**
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Upper Binder Course** - Superpave 19.0 Asphaltic Concrete
50	**Lower Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
600	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil or OPSS Granular B Type II material placed over in situ soil	

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable vibratory equipment. Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

A perimeter foundation drainage system is recommended for proposed structures. The system should consist of a 100 to 150 mm diameter, geotextile-wrapped, perforated, corrugated, plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining, non frost susceptible granular materials. The site materials will be frost susceptible and, as such, are not recommended for re-use as backfill unless a composite drainage system (such as system Delta Drain 6000 or Miradrain G100N) connected to a perimeter drainage system is provided.

6.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum 1.5 m thick soil cover should be provided for adequate frost protection of heated structured, or an equivalent combination of soil cover and foundation insulation.

Exterior unheated footings, such as those for isolated exterior piers and loading docks, are more prone to deleterious movement associated with frost action than the exterior walls of the heated structure and require additional protection, such as soil cover of 2.1 m or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The side slopes of the excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is expected that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

Unsupported Excavations

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 98% of the material’s SPMDD.

It should generally be possible to re-use the site excavated materials above the cover material if the operations are carried out in dry weather conditions.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone, (about 1.5 m below finished grade) and above the cover material should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 225 mm thick lifts and compacted to 95% of the materials SPMDD.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project, where excavations are completed in proximity of existing structures which may be adversely affected due to the freezing conditions.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the installation of straw, propane heaters and tarpaulins or other suitable means. The base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be considered if such activities are to be completed during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results on analytical testing show that the sulphate content is less than 0.1%. The results are indicative that Type 10 Portland Cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a very low to slightly aggressive corrosive environment.

7.0 Recommendations

It is recommended that the following be completed once the master plan and site development are determined:

- ❏ Review detailed grading plan(s) from a geotechnical perspective.
- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ Sampling and testing of the concrete and fill materials used.
- ❏ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❏ Observation of all subgrades prior to placing backfilling materials.
- ❏ Field density tests to determine the level of compaction achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with Paterson's recommendations could be issued upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with Paterson's present understanding of the project. Paterson requests permission to review the grading plan once available. Paterson's recommendations should be reviewed when the drawings and specifications are complete.

The client should be aware that any information pertaining to soils and the test hole log are furnished as a matter of general information only. Test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests to be notified immediately in order to permit reassessment of the recommendations.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Mattamy Homes or their agent(s) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng. David J. Gilbert, P.Eng.

Report Distribution:

- ❏ Mattamy Homes (1 digital copy)
- ❏ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

GRAIN SIZE DISTRIBUTION ANALYSIS

ANALYTICAL TESTING

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

FILE NO. **PG5690**

REMARKS

HOLE NO. **BH 1-21**

BORINGS BY CME 55 Power Auger **DATE** 2021 February 17

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	103.45
Compact to dense, brown **SILTY SAND**	AU	1				
	SS	2	75	17	1	102.45
	SS	3	75	14	2	101.45
	SS	4	83	17		
- Trace gravel by 3.0 m depth					3	100.45
	SS	5	83	13		
	SS	6	67	25	4	99.45
	SS	7	75	11	5	98.45
	SS	8	75	20		
	SS	9	83	27	6	97.45
	SS	10	92	35	7	96.45
	SS	11	83	24	8	95.45
8.99	SS	12	83	32		
End of Borehole						
(Piezometer dry - March 4, 2021)						

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

FILE NO. PG5690

REMARKS

HOLE NO. BH 2-21

BORINGS BY CME 55 Power Auger

DATE 2021 February 17

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	102.61
Compact to dense, brown **SILTY SAND**	AU	1				
	SS	2	75	25	1	101.61
	SS	3	75	19	2	100.61
	SS	4	75	56		
	SS	5	83	32	3	99.61
	SS	6	67	39	4	98.61
	SS	7	75	28	5	97.61
	SS	8	75	32	6	96.61
	SS	9	75	33		
	SS	10	75	30	7	95.61
- Trace gravel by 7.5 m depth	SS	11	75	37	8	94.61
8.99	SS	12	75	30		
End of Borehole						
(Piezometer dry - March 4, 2021)						

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

FILE NO. PG5690

REMARKS

HOLE NO. BH 3-21

BORINGS BY CME 55 Power Auger **DATE** 2021 February 18

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	107.88
FILL: Brown silty sand, some crushed stone and gravel (to 0.61)		AU	1				
Dense brown **SILTY SAND** some gravel (0.61 – 1.07)						1	106.88
GLACIAL TILL: Dense brown sandy silt to silty sand with gravel, cobbles and boulders (1.07 – 6.86)		SS	2	33	+50		
		SS	3	25	+50	2	105.88
		SS	4	50	+50		
		SS	5	50	+50	3	104.88
		SS	6	33	+50	4	103.88
		SS	7	42	+50	5	102.88
		SS	8	33	+50	6	101.88
		SS	9	42	+50		
End of Borehole (6.86)							

Practical refusal to augering at 6.86 m depth

(Piezometer dry - March 4, 2021)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content % (20, 40, 60, 80)

Piezometer Construction

Shear Strength (kPa) (20, 40, 60, 80, 100)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

FILE NO. PG5690

REMARKS

HOLE NO. BH 4-21

BORINGS BY CME 55 Power Auger

DATE 2021 February 18

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.21
FILL: Brown silty sand some clay, gravel, cobbles, trace topsoil		AU	1				
0.76							
Compact to dense, brown **SILTY SAND**		SS	2	50	14	1	104.21
		SS	3	50	27	2	103.21
		SS	4	83	28		
		SS	5	83	25	3	102.21
		SS	6	83	30	4	101.21
		SS	7	83	28	5	100.21
		SS	8	83	34		
		SS	9	83	35	6	99.21
		SS	10	83	29	7	98.21
		SS	11	75	25	8	97.21
		SS	12	58	31		
8.99							
End of Borehole (Piezometer dry - March 4, 2021)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE 2021 February 18

FILE NO. PG5690

HOLE NO. BH 5-21

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	105.57
FILL: Brown silty sand with clay, gravel, trace topsoil	AU	1				
0.81						
Compact to dense, reddish brown **SILTY SAND**	SS	2	58	25	1	104.57
	SS	3	58	7	2	103.57
- Brown by 2.2 m depth	SS	4	83	14		
	SS	5	83	9	3	102.57
	SS	6	58	18	4	101.57
	SS	7	83	32	5	100.57
	SS	8	100	16		
	SS	9	83	11	6	99.57
	SS	10	75	19	7	98.57
	SS	11	75	23	8	97.57
	SS	12	75	24		
8.99						
End of Borehole (Piezometer dry - March 4, 2021)						

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE 2021 February 19

FILE NO. PG5690

HOLE NO. BH 6-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.25
FILL: Brown silty sand		AU	1				
0.61							
Compact to dense brown **SILTY SAND**		SS	2	75	46	1	102.25
		SS	3	58	22	2	101.25
		SS	4	75	25	3	100.25
		SS	5	75	23		
		SS	6	67	29	4	99.25
		SS	7	67	28	5	98.25
		SS	8	67	26		
		SS	9	75	27	6	97.25
		SS	10	67	22	7	96.25
		SS	11	67	22	8	95.25
		SS	12	67	20		
8.99							
End of Borehole (Piezoemter dry - March 4, 2021)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

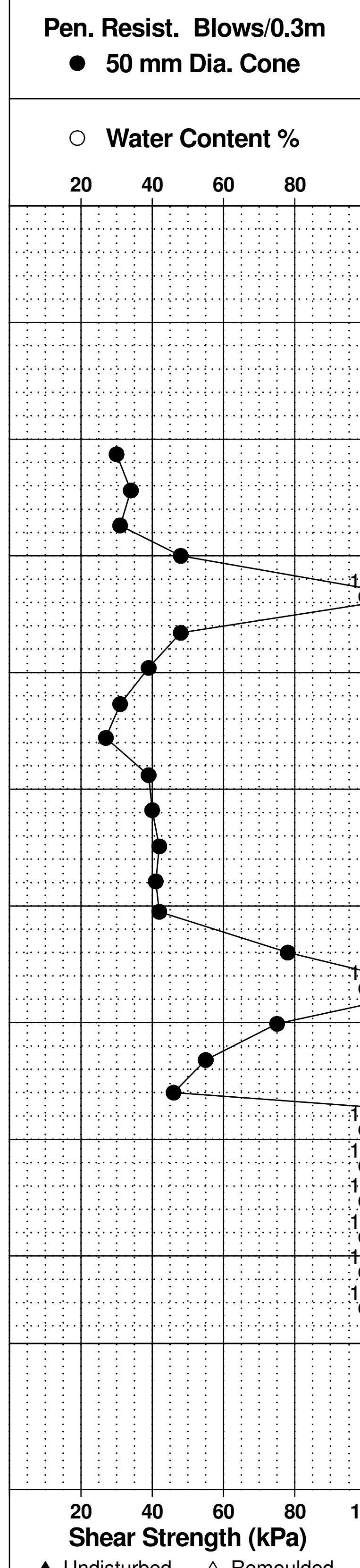
FILE NO. PG5690

REMARKS

HOLE NO. BH 7-21

BORINGS BY CME 55 Power Auger **DATE** 2021 February 19

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	103.78
FILL: Brown silty sand, some gravel	AU	1				
0.84						
Compact to dense, brown **SILTY SAND**	SS	2	50	25	1	102.78
	SS	3	75	28	2	101.78
Dynamic Cone Penetration Test commenced at 2.13 m depth.	SS	4	75	17	3	100.78
	SS	5	75	17		
	SS	6	67	20	4	99.78
- Trace gravel by 4.5 m depth	SS	7	67	53	5	98.78
	SS	8	67	45	6	97.78
	SS	9	67	23		
- Some gravel by 6.7 m depth	SS	10	75	49	7	96.78
	SS	11	67	83	8	95.78
	SS	12	75	57	9	94.78
Practical refusal to augering 8.99 m depth						
9.75						
End of Borehole						
Practical refusal to DCPT at 9.75 m depth						



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE 2021 February 22

FILE NO. PG5690

HOLE NO. BH 8-21

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	106.13
FILL: Brown silty sand with gravel and crushed stone (to 0.61)	AU	1				
Compact to dense, brown **SILTY SAND** with gravel and cobbles	SS	2	75	47	1	105.13
	SS	3	75	55	2	104.13
	SS	4	50	45		
	SS	5	50	51	3	103.13
	SS	6	50	56	4	102.13
	SS	7	33	49	5	101.13
	SS	8	50	61		
	SS	9	50	24	6	100.13
	SS	10	33	31	7	99.13
(to 8.38)	SS	11	50	51	8	98.13

End of Borehole

Practical refusal to augering at 8.38 m depth

(Piezometer dry - March 4, 2021)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

FILE NO. PG5690

REMARKS

HOLE NO. BH 9-21

BORINGS BY CME 55 Power Auger **DATE** 2021 February 22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	109.17		
ORGANICS 0.05									
FILL: Brown silty sand with gravel 0.69		AU	1						
FILL: Brown silty clay with sand, gravel, cobbles, trace topsoil		SS	2	17	21	1	108.17		
		SS	3	25	11	2	107.17		
		SS	4	8	4				
		SS	5	50	7	3	106.17		
4.57		SS	6	17	26	4	105.17		

End of Borehole

Practical refusal to augering at 4.57 m depth

(Piezometer dry - March 4, 2021)

Chart axes: 20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE 2021 February 23

FILE NO. PG5690

HOLE NO. BH10-21

SOIL DESCRIPTION	Strata depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	107.98
TOPSOIL	0.05	AU	1				
FILL: Brown to grey silty clay with sand, gravel, cobbles, trace topsoil		SS	2	42	12	1	106.98
		SS	3	42	5	2	105.98
		SS	4	17	3		
		SS	5	33	5	3	104.98
		SS	6	25	5	4	103.98
	5.49	SS	7	50	10	5	102.98
FILL: Brown silty sand, some gravel	6.02	SS	8	33	7	6	101.98
FILL: Brown to grey silty clay with sand, gravel, trace wood and organics		SS	9	42	8		
		SS	10	33	6	7	100.98
	8.23	SS	11	4	9	8	99.98
End of Borehole							
(Piezometer dry - March 4, 2021)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

FILE NO. PG5690

REMARKS

HOLE NO. BH11-21

BORINGS BY CME 55 Power Auger **DATE** 2021 February 23

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.05				
FILL: Brown silty clay some sand, gravel, trace topsoil - Wood fragments present at 0.9 m depth	3.51	AU	1		
		SS	2	50	4
		SS	3	33	5
		SS	4	50	6
		SS	5	42	23
FILL: Brown silty sand with gravel, trace clay	5.03	SS	6	8	28
		SS	7	33	21
FILL: Brown silty clay with sand, gravel, cobbles, trace organics - Increasing sand with depth	7.54	SS	8	25	11
		SS	9	33	5
		SS	10	17	+50
FILL: Brown silty sand with gravel, trace topsoil	8.23	SS	11	42	28
Compact brown **SILTY SAND** with gravel, trace cobbles	9.14	SS	12	42	67
End of Borehole (Piezometer destroyed - March 4, 2021)		SS	13	0	+50

DEPTH (m)	ELEV. (m)
0	105.87
1	104.87
2	103.87
3	102.87
4	101.87
5	100.87
6	99.87
7	98.87
8	97.87
9	96.87

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed Use Development
3718 Greenbank Road - Ottawa, Ontraio

DATUM Geodetic

FILE NO. PG5690

REMARKS

HOLE NO. BH12-21

BORINGS BY CME 55 Power Auger

DATE 2021 February 23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.30
FILL: Brown silty sand with gravel, trace clay		AU	1				
		SS	2	50	64	1	100.30
		SS	3	50	69	2	99.30
2.90		SS	4	42	28		
End of Borehole (Piezometer destroyed - March 4, 2021)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

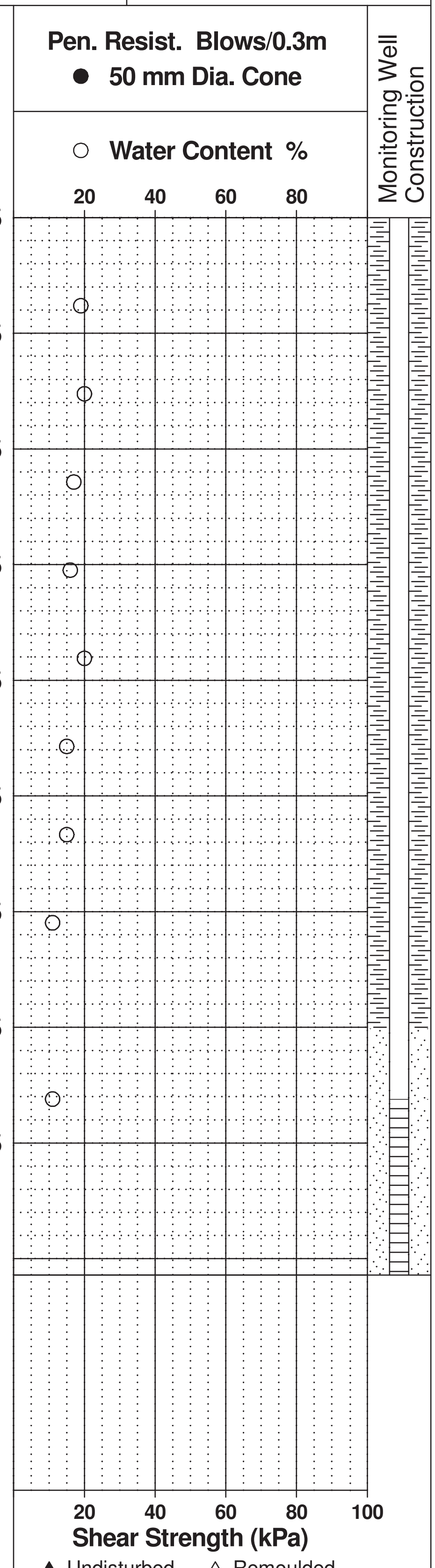
HOLE NO. BH 5-15

BORINGS BY CME 75 Power Auger **DATE** December 10, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	108.75
		SS	1	42	13	1	107.75
		SS	2	25	21	2	106.75
		SS	3	33	5	3	105.75
		SS	4	42	4	4	104.75
FILL: Grey silty sand with clay, gravel and wood		SS	5	42	3		
		SS	6	42	3	5	103.75
		SS	7	17	5	6	102.75
		SS	8	25	37		
		SS	9	0	50+	7	101.75
		SS	10	58	9	8	100.75
		SS	11	0	1	9	99.75
9.14							

End of Borehole

(BH dry to 9.14m depth - July 28, 2016)



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 1-15

BORINGS BY Backhoe **DATE** December 2, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE								20 40 60 80	
TOPSOIL 0.10		G	1			0	105.10		
Compact, brown **SILTY SAND**, trace boulders and cobbles		G	2			1	104.10		
						2	103.10		
3.00						3	102.10		
End of Test Pit									
(TP dry upon completion)									

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 2-15

BORINGS BY Backhoe

DATE December 2, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	106.80		
TOPSOIL 0.10									
Compact, brown **SILTY SAND**		G	1			1	105.80		
		G	2			2	104.80		
3.00						3	103.80		
End of Test Pit									
(TP dry upon completion)									

Water Content % axis: 20, 40, 60, 80

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

REMARKS

BORINGS BY Backhoe

DATE December 1, 2015

FILE NO. PG3607

HOLE NO. TP 8-15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	109.30		
Dense, brown **SILTY SAND**		G	1			1	108.30		
						2	107.30		
3.00		G	2			3	106.30		
End of Test Pit (TP dry upon completion)									

Water Content % axis: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

REMARKS

BORINGS BY Backhoe

DATE December 2, 2015

FILE NO. PG3607

HOLE NO. TP 9-15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.40		
TOPSOIL 0.20									
		G	1			1	107.40		
Brown **SILTY SAND**, trace cobbles						2	106.40		
3.00		G	2			3	105.40		
End of Test Pit									
(TP dry upon completion)									

Water Content % axis: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) ‘N’ value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of “P” denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	‘N’ Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	‘N’ Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC% - Natural water content or water content of sample, %

LL - Liquid Limit, % (water content above which soil behaves as a liquid)

PL - Plastic Limit, % (water content above which soil behaves plastically)

PI - Plasticity Index, % (difference between LL and PL)

Dxx - Grain size at which xx% of the soil, by weight, is of finer grain sizes
These grain size descriptions are not used below 0.075 mm grain size

D10 - Grain size at which 10% of the soil is finer (effective grain size)

D60 - Grain size at which 60% of the soil is finer

Cc - Concavity coefficient = $(D30)^2 / (D10 \times D60)$

Cu - Uniformity coefficient = $D60 / D10$

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

p'_o - Present effective overburden pressure at sample depth

p'_c - Preconsolidation pressure of (maximum past pressure on) sample

Ccr - Recompression index (in effect at pressures below p'_c)

Cc - Compression index (in effect at pressures above p'_c)

OC Ratio Overconsolidaton ratio = p'_c / p'_o

Void Ratio Initial sample void ratio = volume of voids / volume of solids

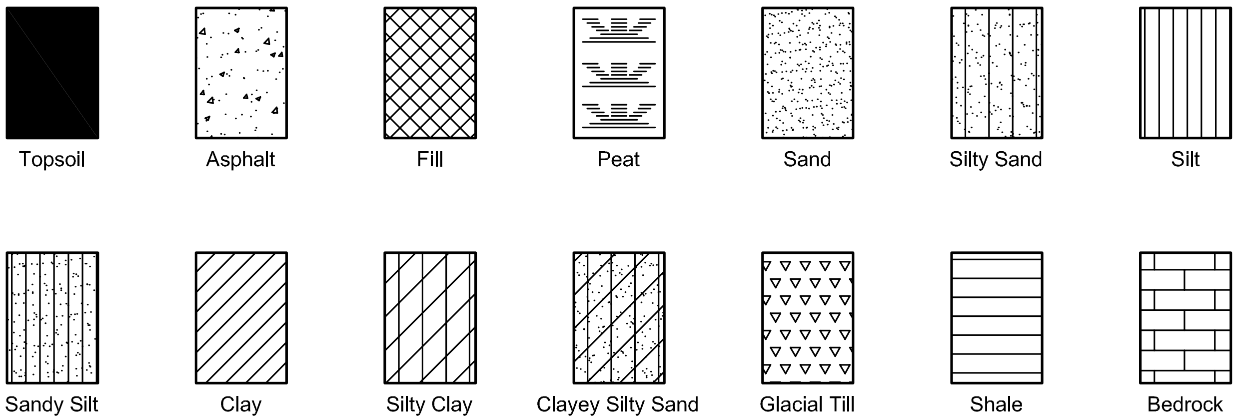
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

k - Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

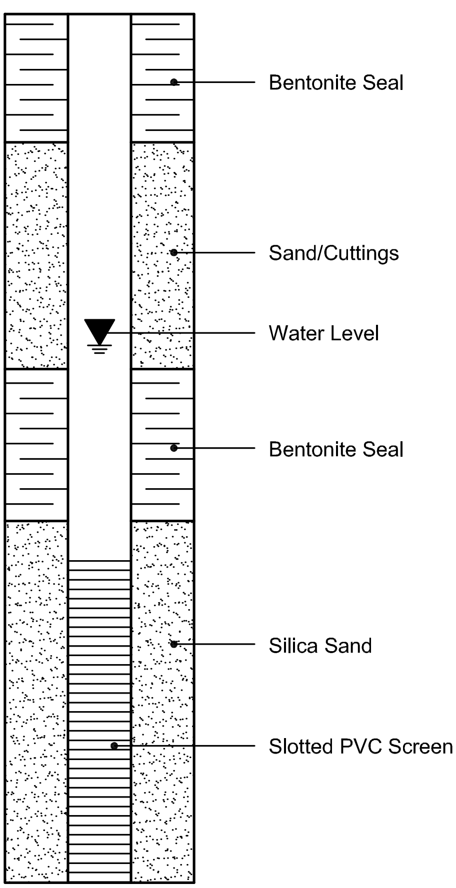
SYMBOLS AND TERMS (continued)

STRATA PLOT

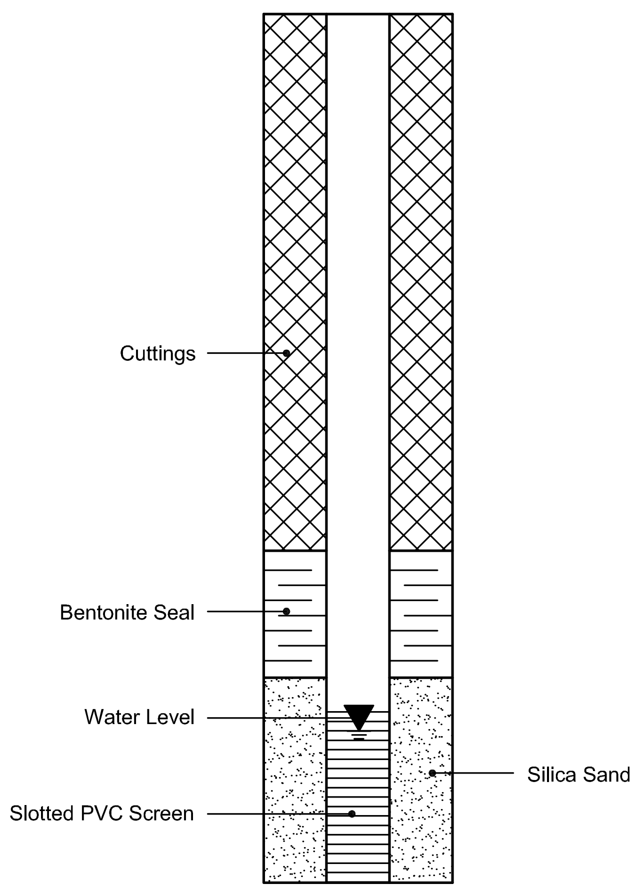


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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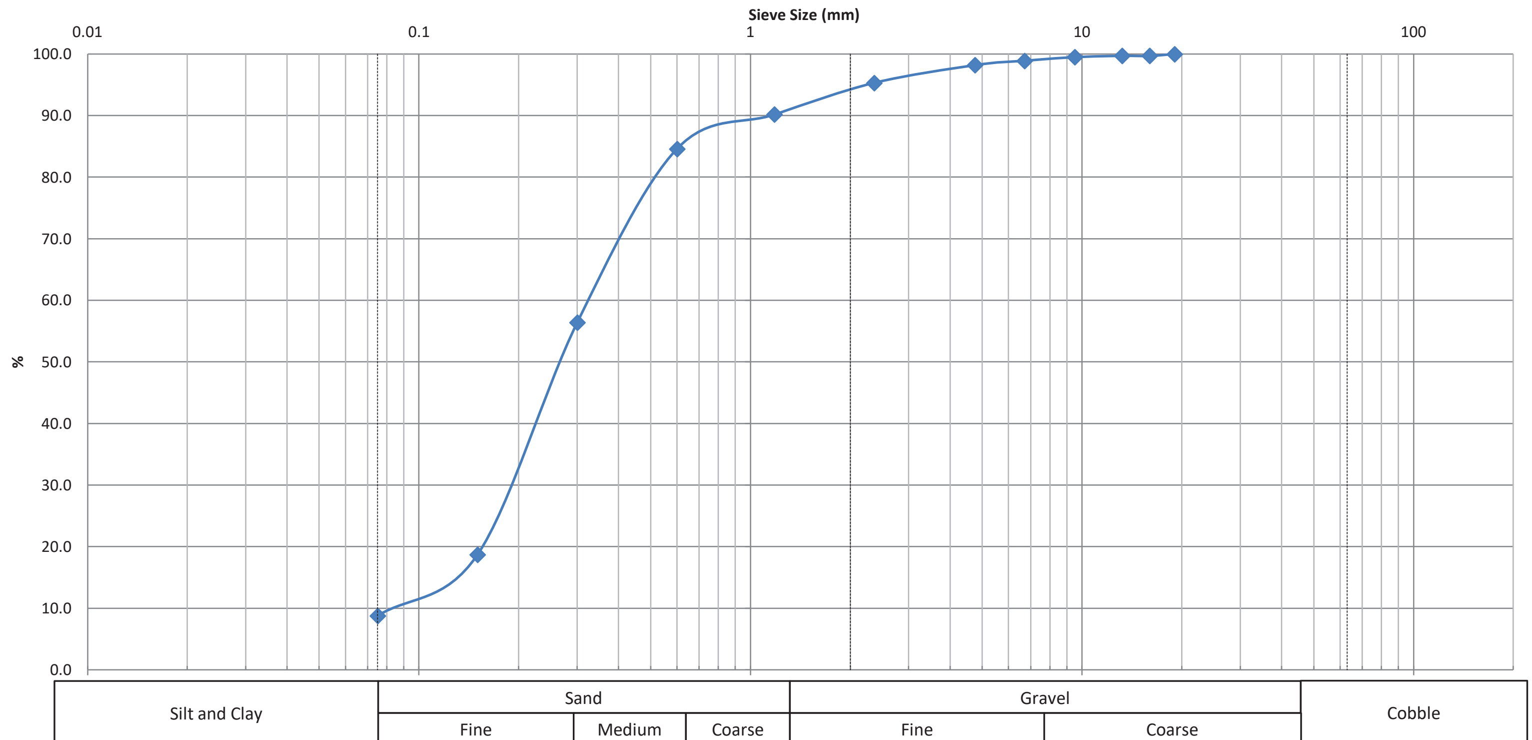
SIEVE ANALYSIS
ASTM C136

CLIENT:	Mattamy Homes	DESCRIPTION:	Soil	FILE NO:	PG5690
CONTRACT NO.:	-	SPECIFICATION:	**Silty Sand**	LAB NO:	23721
PROJECT:	3718 Greenbank Road	INTENDED USE:	-	DATE RECEIVED:	25-Mar-21
		PIT OR QUARRY:	in-Situ	DATE TESTED:	26-Mar-21
DATE SAMPLED:	17-Feb-21	SOURCE LOCATION:	BH2-21 SS3 & SS4	DATE REPORTED:	29-Mar-21
SAMPLED BY:	G. Paterson	SAMPLE LOCATION:	1.5 - 2.9 m	TESTED BY:	DK



Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
									1.38	3.9
	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)		Clay (%)	
	19.0	0.32	0.19	0.082	1.8	89.4	8.8			

Comments:

REVIEWED BY:	Curtis Beadow	Joe Fosyth, P. Eng.
	[signature]	[signature]

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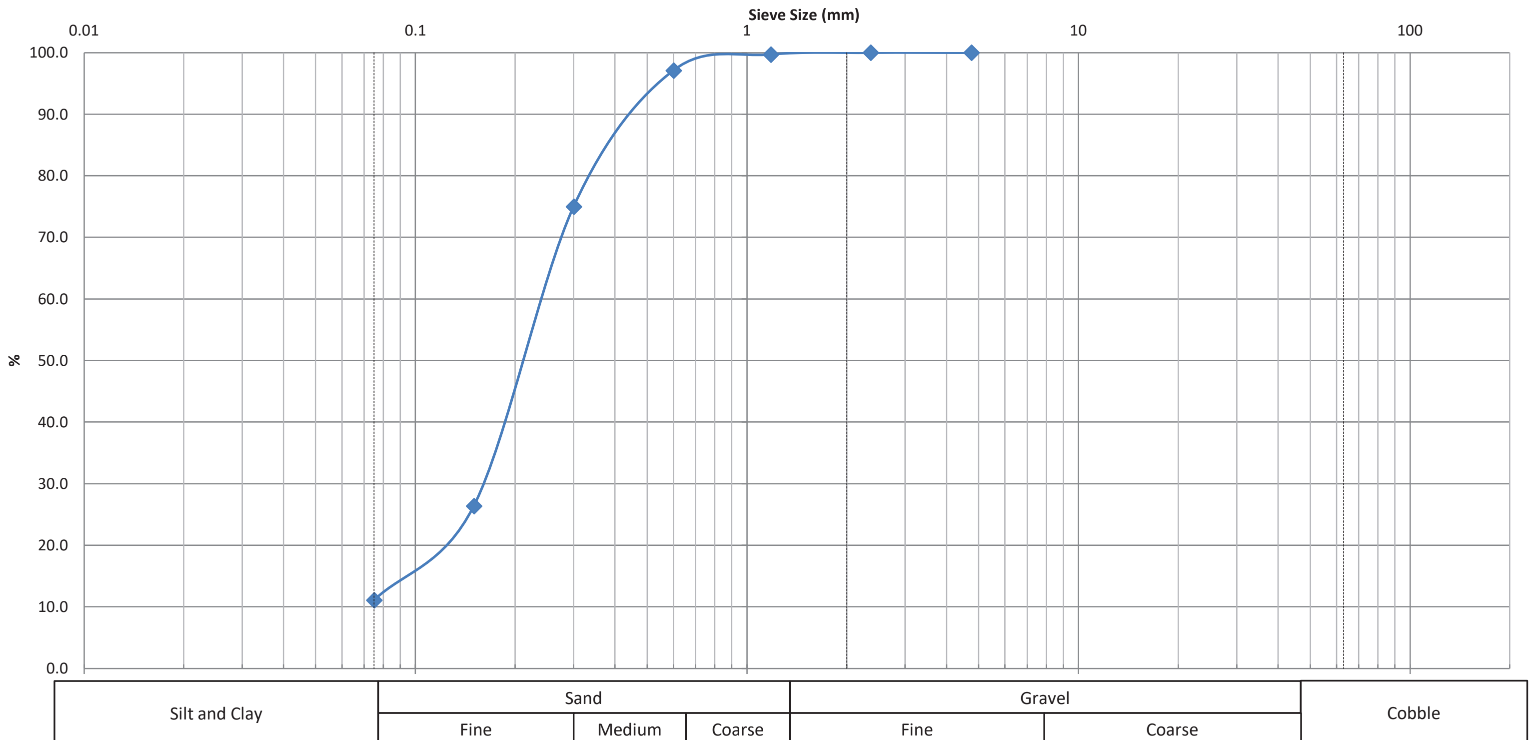
SIEVE ANALYSIS
ASTM C136

CLIENT:	Mattamy Homes	DESCRIPTION:	Soil	FILE NO:	PG5690
CONTRACT NO.:	-	SPECIFICATION:	**Silty Sand**	LAB NO:	23722
PROJECT:	3718 Greenbank Road	INTENDED USE:	-	DATE RECEIVED:	25-Mar-21
		PIT OR QUARRY:	in-Situ	DATE TESTED:	26-Mar-21
DATE SAMPLED:	17-Feb-21	SOURCE LOCATION:	BH4-21 SS4 & SS5	DATE REPORTED:	29-Mar-21
SAMPLED BY:	G. Paterson	SAMPLE LOCATION:	2.29 - 3.66 m	TESTED BY:	DK



Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
									1.80	3.3
	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)		Clay (%)	
	4.8	0.23	0.17	0.07	0.0	88.9	11.1			

Comments:

REVIEWED BY:	Curtis Beadow	Joe Fosyth, P. Eng.

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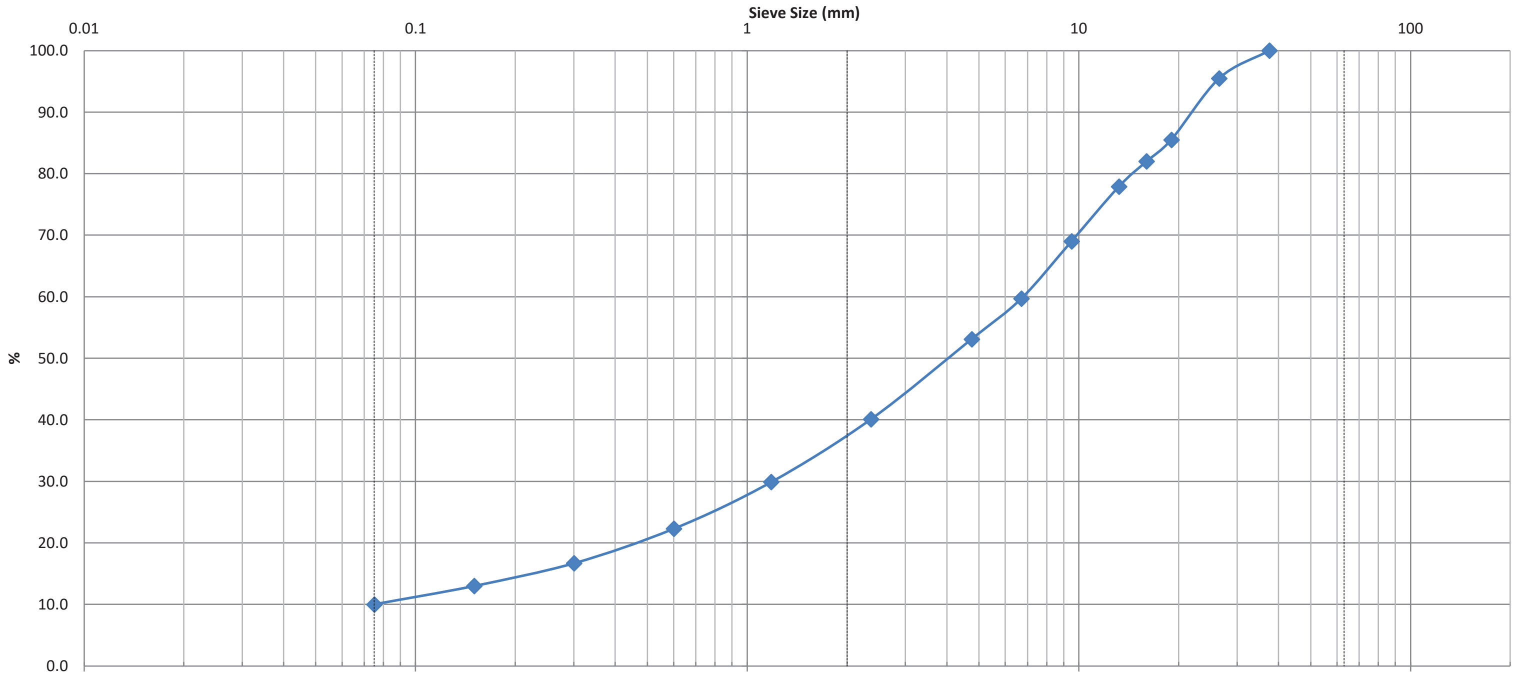
consulting engineers

SIEVE ANALYSIS
ASTM C136

CLIENT:	Mattamy Homes	DESCRIPTION:	Soil	FILE NO:	PG5690
CONTRACT NO.:	-	SPECIFICATION:	**Silty Sand**	LAB NO:	23723
PROJECT:	3718 Greenbank Road	INTENDED USE:	-	DATE RECEIVED:	25-Mar-21
		PIT OR QUARRY:	in-Situ	DATE TESTED:	26-Mar-21
DATE SAMPLED:	17-Feb-21	SOURCE LOCATION:	BH8-21 SS4 & SS5	DATE REPORTED:	29-Mar-21
SAMPLED BY:	G. Paterson	SAMPLE LOCATION:	2.29 - 3.66 m	TESTED BY:	DK



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
									3.54	104.6
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)
	37.5	6.8	1.25	0.065	46.9	43.1		10.0		

Comments:

REVIEWED BY:	**Curtis Beadow**	**Joe Fosyth, P. Eng.**

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 31927

Report Date: 25-Feb-2021

Order Date: 19-Feb-2021

Project Description: PG5690

	Client ID:	BH7-21-SS5	-	-	-
	Sample Date:	19-Feb-21 09:00	-	-	-
	Sample ID:	2108430-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	95.7	-	-	-
General Inorganics					
pH	0.05 pH Units	7.30	-	-	-
Resistivity	0.10 Ohm.m	143	-	-	-
Anions					
Chloride	5 ug/g dry	7	-	-	-
Sulphate	5 ug/g dry	<5	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 2 TO 5 - AERIAL PHOTOGRAPHS

DRAWING PG5690-1 - TEST HOLE LOCATION PLAN

FIGURE 1

KEY PLAN

FIGURE 2

Aerial Photograph - 1976

FIGURE 3

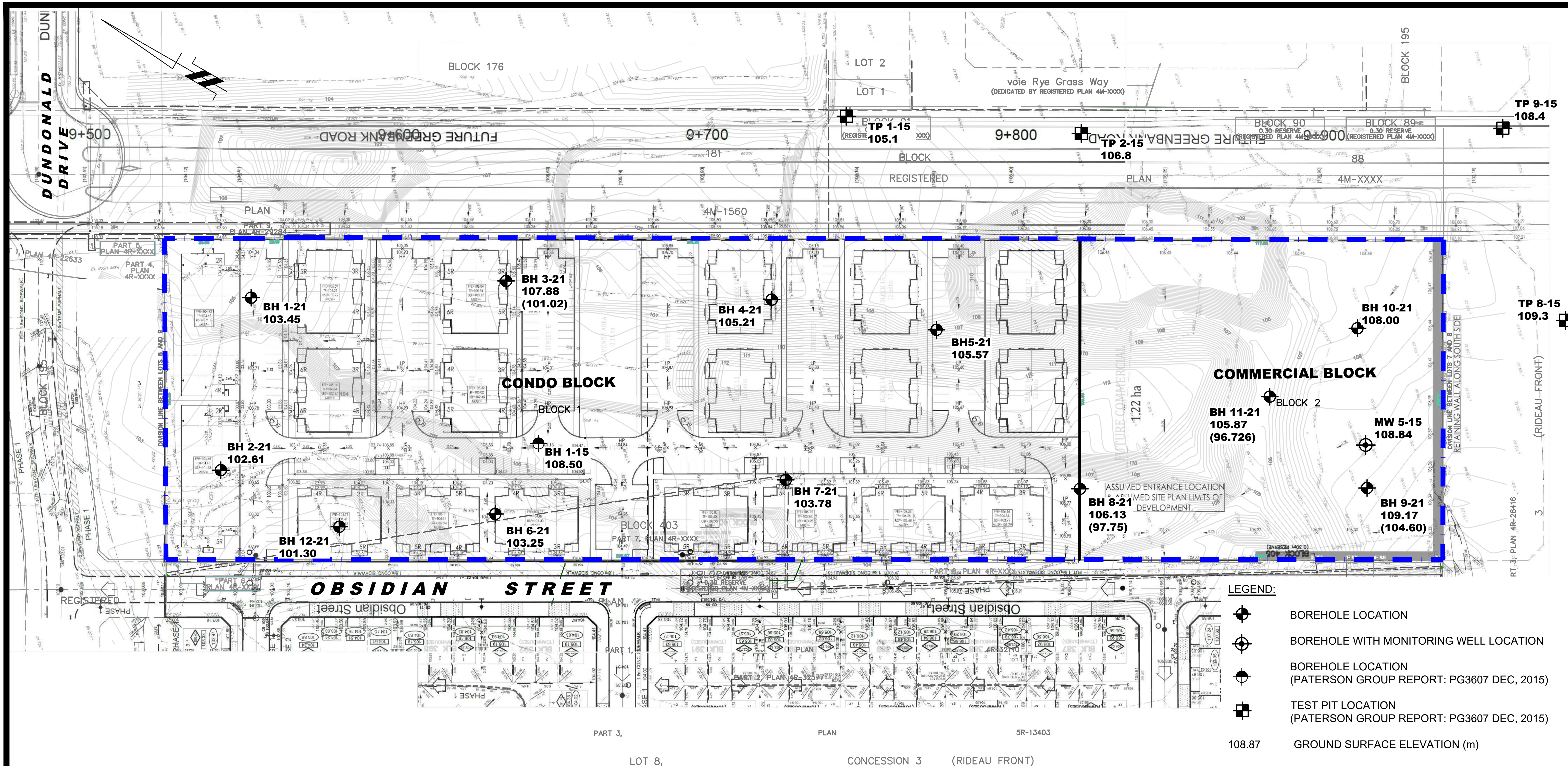
Aerial Photograph - 2002

FIGURE 4

Aerial Photograph - 2008

FIGURE 5

Aerial Photograph - 2019



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION (PATERSON GROUP REPORT: PG3607 DEC, 2015)
- TEST PIT LOCATION (PATERSON GROUP REPORT: PG3607 DEC, 2015)

108.87 GROUND SURFACE ELEVATION (m)

(104.63) PRACTICAL REFUSAL TO AUGERING ELEVATION (m)

GROUND SURFACE ELEVATION AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:1250

0 5 10 15 20 25 50 75m

p:\autocad drawings\geotechnical\pg56xx\pg5690\pg5690-1-thlp.dwg

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NO.	REVISIONS	DATE	INITIAL

MATTAMY HOMES
GEOTECHNICAL INVESTIGATION
PROPOSED BOREHOLES
HALF MOON BAY - SOUTH

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1250	Date: 03/2021
Drawn by: JM	Report No.: PG5690-1
Checked by: OC	Dwg No.: PG5690-1
Approved by: DJG	Revision No.:

Appendix F FUNCTIONAL SERVICING DRAWINGS