Site Servicing and Stormwater Management Report
6171 Hazeldean Road, Ottawa, ON

Client:
11654128 Canada Inc.
768 Boulevard St. Joseph
Gatineau, QC

Submitted for:
Zoning By-law Amendment and Plan of Subdivision

Project Name:
6171 Hazeldean Road

Project Number:
OTT-00258780-A0

Prepared By:
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Date Submitted:
October 18, 2022

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Date Submitted:
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1 Introduction

1.1 Overview

EXP Services Inc. (EXP) was retained by 11654128 Canada Inc to prepare a Site Servicing and Stormwater Management Report for the proposed redevelopment of 6171 Hazeldean Road in support of Zoning By-law Amendment and Plan of Subdivision applications.

The 9.02-hectare site is situated along Hazeldean Road as illustrated in **Figure 1-1** below. The site is within the City of Ottawa's urban boundary, outside the Greenbelt, and situated in Ward 6 (Stittsville-Kanata West). The description of the subject property is noted below:

- Part of Lot 23, Concession 12, Geographic Township of Goulbourn, City of Ottawa.
- Parts 2, 4 and 6 of Plan 4R-23045, consisting of PIN 044871709

The proposed development will consist of twenty (20) single family detached homes, one hundred and fifty (148) townhomes, two (2) semi-detach, two hundred and forty (240) condominium units consisting of five 4-storey buildings having 48 units each, and one hundred and sixty (160) apartment units consisting of one 9-storey mixed-use rental building. The 9-storey apartment building will also contain 1,800 square metres of ground floor commercial space. This report will discuss the adequacy of the adjacent municipal watermain, sanitary sewers and storm sewers to provide the required water supply, convey the sewage and stormwater flows that will result from the proposed development. This report provides a design brief for submission, along with the engineering drawings, for City approval.

Figure 1-1: Site Locaption

2 Existing Conditions

The existing property is surrounded by the Jackson Trails subdivision, which began development in 2006 and the more recent Potter's Key Development. The existing site is vacant, with most of the ground surface containing sparse vegetation, fill material from adjacent construction, with a small area of trees in the north-western portion of the site.

The existing site topography slopes in a north easterly direction, ranging in elevation from ±122m to ±116m and having an average slope of 1.8% from west to east, however only 0.5% average slope from south to north.

The following reports have been prepared describing the existing conditions:

- Geotechnical Investigation, EXP Services Inc.
- Phase 1 Environmental Site Assessment, Exp Services Inc.
- Phase 2 Environmental Site Assessment, Exp Services Inc.
- Environmental Impact Statement/Tree Conservation Report, Bowfin Environmental Consulting Inc.
- Stage 1 and 2 Archaeological Assessment, Paterson Group

3 Existing Infrastructure

The property is vacant and there are no existing services within the site. Municipal services stubs are present along the north, south and east sides of the property.

Along the north side of the property a 22.0 metre municipal right-of-way (Samantha Eastop Avenue) was constructed as part of the Potter's Key Subdivision and contains a 300mm watermain stub. Along the easterly property line, a 7.5m wide portion of a wider 12m sewer/water/walkway block is present and contains both sanitary and the storm and sewer stubs for the property. The entire southern property boundary of the site fronts onto Hazeldean Road, which contains both watermain and storm sewers. An existing 200mm watermain stub is provided off the 750mm watermain on Hazeldean Road, near the entrance of the property.

From review of the sewer and watermain mapping, as-built drawings and Utility Central Registry (UCC) plans, the following summarizes the infrastructure within the subject property and the infrastructure on the adjacent streets along the frontage of the property and adjacent offsite infrastructure:

<u>Samantha Eastop Avenue.</u>

- 300mm PVC watermain.
- 300mm PVC storm sewer.

<u>12m walkway block off Bandelier Way.</u>

- 300mm PVC sanitary sewer.
- 1050mm concrete storm sewer.

<u>Hazeldean Road.</u>

- 2-200mm PVC watermains (stubbed) & 762mm watermain.
- 300mm, 375mm, 750mm and 825mm concrete storm sewers.
- Gas /Bell / Streetlighting / Hydro.

As-built drawings for key areas in Potter's Key Subdivision were obtained from the City of Ottawa and are included in **Appendix I** for reference.

4 Pre-Consultation / Permits / Approvals

A pre-consultation meeting was held with the City of Ottawa prior to design commencement. This meeting outlined the submission requirements and provided information to assist with the development proposal. The proposed site is located within the Mississippi Valley Conservation Authority (MVCA) jurisdiction, therefore signoff from the MVCA will be required prior to final approval. The MVCA was contacted to confirm the stormwater management quality control requirements. A copy of the correspondence with the MVCA is attached **Appendix H**. Specific design criteria noted in the Pre-Consultation meeting is further described in the relevant sections of this report.

It is expected that an Environmental Compliance Approval (ECA) will be required from the Ministry of Environment, Conservation and Parks (MECP), formerly the Ministry of the Environment and Climate Change (MOECC), for the municipal and private sewage works. The onsite sewage works will include the onsite stormwater works for flow controls and associated stormwater detention. From discussions with City of Ottawa staff it is expected that the submission will be permitted under the Transfer-of-Review program.

5 References

Various background reports and design manuals were referred to in preparing the current report including:

- ATREL Engineering Ltd. 2017. "Stormwater Management, Watermain, Storm Sewer and Sanitary Sewer Design Brief Potter's Key Subdivision." Ottawa.
- CHI Press. November 2010. "User's Guide To SWMM 5." Guelph.
- City of Ottawa. July 2010. "Ottawa Design Guidelines - Water Distribution (WDG001)." Ottawa.
- City of Ottawa. October 2012. "Sewer Design Gudelines, SDG002." Ottawa.
- Fire Underwriter Survey. 1999. "Water Supply for Public Fire Protection (FUS)."
- IBI Group. June 2006. "Jackson Trails Stormwater Management Design Brief." Stittsville.
- J. F. Sabourin and Associates Inc. April 30 2018. "Feedmill Creek Stormwater Managemetn Criteria Study." Ottawa.
- Mather, C.W. Thornthwaite and J.R. 1957. "Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance."
- Mississippi Valley Conservation AUthority / Rideau Valley Conservation Authority. 2009. "Tier 1 Water Budget and Water Quantity Stress Assessment - Preliminary Draft (Revised)."
- Ontario Ministry of Environment and Energy. April 1995. "MOEE Hydrogeological Technical Information Requirements for Land Development Applicaitons."
- Ontario Ministry of the Environment and Climate Change. March 2003. "Stormwater Management Planning and Design Manual (SMPDM)."
- Ontario Ministry of the Environment. 2008. "Design Guidelines for Drinking-Water Systems (GSWS)."
- Ontario Ministry of the Environment. 2008. "Design Guidelines for Sewage Works."
- Robinson Consultants Inc. 2004. "Carp River Watershed / Subwatershed Study."
- United States Environmental Portection Agency. January 2016. "Storm Water Management Model Reference Manual, Volume 1 - Hydrology." Cincinnati.
- United States Environmental Protection Agency. May 2017. "Storm Water Management Model Reference Manual Volume II - Hydraulics." Cincinnati.

- United States Environmental Protection Agency. July 2016. "Storm Water Management Model Reference Manual Volume III - Water Quality." Cincinnati.

In addition, for City of Ottawa Design Guidelines referred to above, additional Technical Bulletins were referenced including:

- Ottawa Sewer Design Guidelines (SDG002) Bulletins:
  - Bulletin ISDTB-2012-4 (20 June 2012)
  - Technical Bulletin ISDTB-2014-01 (05 February 2014)
  - Technical Bulletin PIEDTB-2016-01 (September 6, 2016)
  - Technical Bulletin ISDTB-2018-01 (21 March 2018)
  - Technical Bulletin ISDTB-2018-04 (27 June 2018)
- Ottawa Design Guidelines – Water Distribution (WDG001) Bulletins:
  - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
  - Technical Bulletin ISTB-2018-02 (21 March 2018)
  - Technical Bulletin ISTB-2021-03 (18th August 2021)

6 Water Servicing

6.1 Existing Water Servicing Conditions

The site is within the City of Ottawa 3W pressure zone and supplied from the Stittsville elevated reservoir, which is adjacent to the site along the western limit of the property. As previously noted, two 200 mm watermains have been stubbed off the 762mm watermain on Hazeldean Road, and a 300mm watermain is stubbed at the property line coming off Samantha Eastop Avenue.

6.2 Water Servicing Proposal

The proposed water supply system will consist of 200mm diameter and 300mm diameter watermains and associated appurtenances to provide water for consumption and fire protection. The site will be serviced by connection to the existing stubs at Hazeldean Road and Samantha Eastop Avenue.

The 9-storey high-rise building will require independent and twin watermain feeds, which is the result of the average day water demands exceeding 50 m^3/day. This building will be protected by an automatic sprinkler system and will have a fire department connection (or siamese) located within 45 metres of an adjacent municipally owned fire hydrant. **Figure A4** in **Appendix A** illustrates the proposed water distribution system. Water supply for each single family, townhome or condominium building will be provided by individual water services connecting to the proposed municipal or onsite private watermain. l

6.3 Water Servicing Design Criteria

The design parameters that were used to establish water and fire flow demands are summarized in the table below.

Table 6-1 : Summary of Water Supply Design Criteria

Design Parameter	Value	Applies
Population Density – Single-family Home	3.4 persons/unit	✓
Population Density – Semi-detached Home	2.7 persons/unit	✓
Population Density – Townhome or Terrace Flat	2.7 persons/unit	✓
Population Density – Bachelor Apartment	1.4 persons/unit	
Population Density – Bachelor + Den Apartment	1.4 persons/unit	
Population Density – One Bedroom Apartment	1.4 persons/unit	✓
Population Density – One Bedroom plus Den Apartment	1.4 persons/unit	
Population Density – Two Bedroom Apartment	2.1 persons/unit	✓
Population Density – Two Bedroom plus Den Apartment	2.1 persons/unit	
Population Density – Three Bedroom Apartment	3.1 persons/unit	✓
Average Day Demands – Residential	280 L/person/day	✓
Average Day Demands – Commercial / Institutional	28,000 L/gross ha/day or 5.0 L/m2/day	✓
Average Day Demands – Light Industrial / Heavy Industrial	35,000 or 55,000 L/gross ha/day	
Maximum Day Peak Factor – Residential	2.5 x Average Day Demands	✓
Maximum Day Demands Peak Factor – Commercial / Institutional	1.5 x Average Day Demands	✓
Peak Hour Factor – Residential	2.5x2.2 = 5.5 x Average Day Demands	✓
Peak Hour Factor – Commercial / Institutional	2.7 x Average Day Demands	✓
Fire Flow Requirements Calculation	FUS	✓
Depth of Cover Required	2.4m	✓
Maximum Allowable Pressure	551.6 kPa (80 psi)	✓
Minimum Allowable Pressure	275.8 kPa (40 psi)	✓
Minimum Allowable Pressure during fire flow conditions	137.9 kPa (20 psi)	✓

6.4 Fire Flow Requirements

Water for fire protection will be available utilizing the proposed fire hydrants located along the adjacent roadways. The required fire flows for all proposed buildings were calculated based on typical values as established by the Fire Underwriters Survey 1999 (FUS). The following equation from the Fire Underwriters document "Water Supply for Public Fire Protection", 1991, was used for calculation of the on-site supply rates required to be supplied by the hydrants:

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

where:

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

The proceeding **Table 6-2** summarizes the parameters used for estimating the Required Fire Flows (RFF) based on the Fire Underwriters Survey (FUS) and the latest City of Ottawa Technical Bulletins. The RFFs were estimated in accordance with ISTB-

2018-02 and based on floor areas provided by the architect. The following summarizes the parameters used for the proposed types of residential buildings.

Table 6-2 :Summary of FUS Method Parameters Used for Proposed Building Types

Design Parameter	Single Family	Townhome	4-Storey Condominium	9-Storey Mixed-Use
Type of Construction (Coeff, C) Wood-Framed (C=1.5), Ordinary (C=1.0), Non-Combustible (C=0.8), Fire-Resistive (C=0.6)	Wood Framed	Wood Framed	Ordinary	Non-Combustible
Occupancy Type Non-combustible (-25%), Limited Combustible (-15%), Combustible (0%), Free Burning (+15%), Rapid Burning (+25%)	Limited Combustible	Limited Combustible	Limited Combustible	Limited Combustible
Sprinkler Protection Sprinkler Conforming to NFPA 13 (-30%), Standard Water Supply (-10%), Fully Supervised Sprinkler (-10%)	None	None	Fully Supervised Sprinkler	Fully Supervised Sprinkler

The following **Table 6-3** below summaries the individual parameters used and the resultant Required Fire Flows (RFFs) for each building type. The maximum allowable footprints based on zoning setbacks were used to determine the RFFs for the single family and townhome units. A combined fire area of 14 single family homes and one block of townhomes was used to calculate the largest anticipated required fire flow, due to the spatial separation between adjacent units being less than 3.0m. As per the City of Ottawa's Technical Bulletin ISTB-2018-02, the required fire flows for single and townhomes can be capped at 167 L/sec since there is more then 10m of spatial separation between the backs of adjacent units, and all townhomes are proposed to include a fire wall with a minimum two-hour fire-resistance rating that complies with the OBC where required. Detailed calculations of the RFFs necessary for each building is provided in **Appendix B.**

Table 6-3 : Summary of Parameters Used and Estimation of Required Fire Flows (RFF) – Singles and Townhomes

	Single Family	Combined Fire Area (14 Singles + Block 22)	Townhomes						
			Block 26	Block 23	Block 28	Block 29	Block 31	Block 42	Block 36
Construction Coefficient, C	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Total Floor Area (m2)	122	2088	969	807.8	1037.8	1034.4	784	776.1	795
Fire Flow prior to reduction (L/min)	5,000	14,000	10,000	9,000	11,000	11,000	9,000	9,000	9,000
Reduction Due to Occupancy	-15%	-15%	-15%	-15%	-15%	-15%	-15%	-15%	-15%
Reduction due to Sprinkler	0%	0%	0%	0%	0%	0%	0%	0%	0%
Increase due to Exposures	58%	45%	42%	44%	46%	36%	54%	53%	49%
Total RFF	117	283	200	183	183	167	183	183	183
Capped at 10,000 L/min (167 L/sec) based on ISTB-2018-02" (yes/no)	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Actual Total RFF	117	167	167	167	167	167	167	167	167

Table 6-4 : Summary of Parameters Used and Estimation of Required Fire Flows (RFF) – Condos and Mixed-Use Buildings

	Condominium Units					9-storey Mixed-Use
	Bldg A	Bldg B	Bldg C	Bldg D	Bldg E	
Construction Coefficient, C	1	1	1	1	1	0.8
Total Floor Area (m2)	4,140	4,140	4,140	4,140	4,140	9,940
Fire Flow prior to reduction (L/min)	14,000	14,000	14,000	14,000	14,000	18,000
Reduction Due to Occupancy	-15%	-15%	-15%	-15%	-15%	-15%
Reduction due to Sprinkler	-50%	-50%	-50%	-50%	-50%	-50%
Increase due to Exposures	28%	32%	34%	50%	31%	29%
Capped at 10,000 L/min (167 L/sec) based on ISTB-2018-02" (yes/no)	No	No	No	No	No	No
Total RFF	150	167	167	200	167	200

The estimated required fire flows (RFFs) based on the FUS Method ranges from 117 L/sec for single family homes, 167 L/sec – 200 L/sec for townhomes blocks, 200 L/sec for the 9-storey mixed use building and 167 L/sec – 200 L/sec for the 4-storey condo units. It should be noted that for the 7 and 8-unit townhomes, a fire wall (2-hour fire-resistance rating) was be used to split the building into two separate areas. In addition, for the singles and townhomes the building areas were expanded to account for the maximum building areas based on minimum setback of 7.5m (rear), 5.2m (front), and 1.2m or 3.0m (side). The RFF for single family and townhomes were capped at 167 L/sec as per Technical Bulletin ISTB-2018-02, as they meet the requirements for rear spatial separation and include fire walls where required.

6.5 Boundary Conditions

Hydraulic Grade Line (HGL) boundary conditions were obtained from the City for design purposes. A copy of the correspondence received from the City of Ottawa is provided in **Appendix H.**

The following hydraulic grade line (HGL) boundary conditions are summarized in **Table 6-5** below.

Table 6-5 : Boundary Conditions and Pressures Summary

Demand Scenario	Connection #1 – Hazeldean Rd		Connection #2 – Samantha Eastop Ave	
	HGL or Head (m)	Pressure (psi)	HGL or Head (m)	Pressure (psi)
Maximum HGL	160.7	57.0	160.7	59.6
Peak Hour	156.7	51.3	156.6	53.6
Max Day + Fire Flow	152.8	45.8	147.8	41.1

The above noted HGL's are based on a ground elevation of approximately 120.6 m and 118.9 m at Connection #1 and Connection #2 respectively. This results in a system water pressure of 36.1 m (or 51.3 psi) and 37.5 m (or 53.4 psi) at each connection points during peak hour conditions.

6.6 Water Servicing Design

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

- Estimated water demands under average day, maximum day and peak hour conditions. As the total population estimate was greater than 500, standard residential peaking factors were used, rather than based on MECP Table 3-3 which would be necessary when the design population is than 500 persons.
- Estimated the required fire flow (RFF) based on the Fire Underwriters Survey (FUS).
- Obtained hydraulic boundary conditions (HGL) from the City, based on the above water demands and required fire flows.
- Boundary condition data and water demands were used to estimate the pressure at the proposed junctions, and this was compared to the City's design criteria.

Please refer to **Appendix B** for detailed calculations of the total water demands.

6.7 Estimated Water Demands

Table 6-6 below summarizes the anticipated domestic water demands for all units under average day, maximum day and peak hour conditions.

Table 6-6 : Total Water Demand Summary

Water Demand Conditions	Water Demands (L/sec)
Average Day	3.93
Max Day	9.72
Peak Hour	21.32

6.8 Modelling Scenarios

A total of five (6) scenarios were analyzed. The performance of the proposed water distribution system within the development was analyzed under each scenario. The following summarizes the modelling scenarios that were analyzed. Please refer to **Figure A4** in Appendix A which illustrates the water distribution layout.

- Scenario 1A: Average Day (using connection #1)
- Scenario 1B: Max Day Plus Fire Flow (using connection #1)
- Scenario 1C: Peak Hour (using connection #1)
- Scenario 2A: Average Day (using connection #2)
- Scenario 2B: Max Day Plus Fire Flow (using connection #2)
- Scenario 2C: Peak Hour (using connection #2)

6.9 Water Modeling Results

The results of the WaterGEMS modelling under peak hourly conditions are summarized in **Table 6-7** and **Table 6-8** below for Scenarios 1C and 2C. These results represent anticipated pressures that would be available assuming a single connection from ether Connection #1 (Hazeldean Rd) or Connection #2 (Samantha Eastop). The complete results for all scenarios are provided in **Appendix C**.

Table 6-7 : Summary of Peak Hour Results of (Scenario 1C)

Junction	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-01	122.19	6.29	156.76	49.1
J-02	119.69	1.27	156.76	52.6
J-03	118.67	0.65	156.76	54.1

J-04	118.45	1.01	156.76	54.4
J-05	117.43	1.25	156.76	55.8
J-06	117.02	1.35	156.76	56.4
J-07	118.88	0.77	156.76	53.8
J-08	119.76	0.39	156.77	52.5
J-09	117.12	0.67	156.76	56.3
J-10	120.76	0.00	156.77	51.1
J-13	117.92	3.07	156.76	55.1
J-16	119.76	0.00	156.77	52.5
J-17	118.80	0.00	156.76	53.9
J-18	120.40	0.00	156.80	51.7
J-22	118.21	0.00	156.76	54.7
J-23	120.51	0.00	156.79	51.5
J-24	119.50	1.53	156.79	52.9
J-25	118.80	1.53	156.79	53.9
J-28	118.00	1.53	156.80	55.1
J-29	120.44	0.00	156.80	51.6

Table 6-8 : Summary of Peak Hour Results of (Scenario 2C)

Junction	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-01	122.19	6.29	156.63	48.9
J-02	119.69	1.27	156.65	52.5
J-03	118.67	0.65	156.67	53.9
J-04	118.45	1.01	156.66	54.2
J-05	117.43	1.25	156.64	55.7
J-06	117.02	1.35	156.64	56.2
J-07	118.88	0.77	156.64	53.6
J-08	119.76	0.39	156.64	52.3
J-09	117.12	0.67	156.64	56.1
J-10	120.76	0.00	156.63	50.9
J-13	117.92	3.07	156.63	55.0
J-16	119.76	0.00	156.64	52.3
J-17	118.80	0.00	156.70	53.8
J-18	120.40	0.00	156.63	51.4
J-22	118.21	0.00	156.64	54.5
J-23	120.51	0.00	156.63	51.3
J-24	119.50	1.53	156.63	52.7
J-25	118.80	1.53	156.63	53.7
J-28	118.00	1.53	156.63	54.8
J-29	120.44	0.00	156.63	51.4

The calculated range of working pressures anticipated within the development under peak hour conditions was estimated at between 49.0 psi and 56.4 psi under Scenario 1C, and between 48.9 psi and 56.2 psi under Scenario 2C. This meets the minimum 40 psi as per City of Ottawa Guidelines.

Similarly, below provides the Maximum Day Plus Fire Flow results under Scenarios 1B and 2B. It should be noted that the fire flows required at various junctions were determined based on FUS calculations. Complete modelling results are provided in **Appendix C**.

Table 6-9 : Summary of Maximum Day Plus Fire Flow Conditions

Junction Node	FUS Required Fire Flows, RFF (L/sec)	Total Flow Available (L/sec)		Satisfies Fire Flow Constraints for Scenario 1B / 2B (True or False)
		For Scenario 1B	For Scenario 2B	
J-01	200	>200	>200	True / True
J-02	167	>167	>167	True / True
J-03	167	>167	>167	True / True
J-04	167	>167	>167	True / True
J-05	167	>167	>167	True / True
J-06	167	>167	>167	True / True
J-07	167	>167	>167	True / True
J-08	167	>167	>167	True / True
J-09	167	>167	>167	True / True
J-10	167	>167	>167	True / True
J-13	167	>167	>167	True / True
J-16	167	>167	>167	True / True
J-17	167	>167	>167	True / True
J-18	167	>167	>167	True / True
J-22	167	>167	>167	True / True
J-23	167	>167	>167	True / True
J-24	200	>200	>200	True / True
J-25	200	>200	>200	True / True
J-28	167	>167	>167	True / True
J-29	167	>167	>167	True / True

In summary, under Maximum Day + Fire Flow conditions the available fire flows are in excess of the required fire flows (RFF) based on a water distribution system with a connection to both Hazeldean Road and Samantha Eastop Avenue.

The difference in the available fire flows, is at most 20% lower based on a single connection to Samantha Eastop Ave. This does not imply that the appropriate fire flows are not available at all buildings, as the total contribution of available fire flows are based on hydrant spacing. Further analysis was completed to review the contributions of the proposed fire hydrants to meet the required fire flows based on their proximity to each of the 4-storey condominium buildings and the mixed use 9-storey building, as per the City of Ottawa's Technical Bulletin ISTB-2018-02. Hydrants within 75m of a building face were estimated to contribute up to 5,000 L/min, and hydrants between 75m and 150m from a building face contribute 3,800 L/min. A summary of the number of contributing hydrants for each building is shown below in **Table 6-10**.

Table 6-10 :Fire Flow Based on Hydrant Spacing

Building No.	No. of Available Hydrants within 0m to 75m	No. of Available Hydrants within >75m to 150m	Fire Flow Contribution		Required Fire Flow		Meets Fire Flow Requirements?
			L/min	L/sec	L/min	L/sec	
Building A	6	3	45,600	760	9,000	150	Yes
Building B	5	4	43,700	728	10,020	167	Yes
Building C	5	4	43,700	728	10,020	167	Yes
Building D	5	3	39,900	665	12,000	200	Yes
Building E	3	4	32,300	538	10,020	167	Yes
Mixed Used	4	3	34,200	570	12,000	200	Yes

A review of the available fire flow contributions from adjacent hydrants to each of the residential and mixed-use buildings shows that there is adequate fire flow protection throughout the site.

No pressure reducing measures are required as operating pressures are within 50 psi and 80 psi. It was estimated that the anticipated pressures under average day demands will range between 54.7 psi and 62 psi.

7 Sewage Servicing

7.1 Existing Sewage Conditions

The site is an open field with no services within the site. There is a stub that comes off the existing sanitary sewer from Bandelier Way that goes up to the property line at was placed for the future development of 6171 Hazeldean Road.

7.2 Proposed Sewage Conditions

The sanitary sewers were sized based on a population flow with an area-based infiltration allowance. Both 200mm and 250mm diameter sanitary sewer are proposed with a minimum of 0.34% and 0.30% slope, having a capacity of 19.8 L/sec and 35.9 L/sec based on Manning's Equation under full flow conditions. **Table 7-1** below summarizes the design parameters used.

Table 7-1 : Summary of Wastewater Design Criteria / Parameters

Design Parameter	Value	Applies
Population Density – Single-family Home	3.4 persons/unit	✓
Population Density – Semi-detached Home	2.7 persons/unit	✓
Population Density – Duplex	2.3 persons/unit	
Population Density – Townhome (row)	2.7 persons/unit	✓
Population Density – Bachelor Apartment	1.4 persons/unit	
Population Density – Bachelor + Den Apartment	1.4 persons/unit	
Population Density – One Bedroom Apartment	1.4 persons/unit	✓
Population Density – One Bedroom plus Den Apartment	1.4 persons/unit	
Population Density – Two Bedroom Apartment	2.1 persons/unit	✓
Population Density – Two Bedroom plus Den Apartment	2.1 persons/unit	
Population Density – Three Bedroom Apartment	3.1 persons/unit	✓
Average Daily Residential Sewage Flow	280 L/person/day	✓
Average Daily Commercial / Intuitional Flow	28,000 L/gross ha/day	✓
Average Light / Heavy Industrial Daily Flow	35,000 / 55,000 L/gross ha/day	
Residential Peaking Factor – Harmon Formula (Min = 2.0, Max =4.0, with K=0.8)	$M = 1 + \frac{14}{4 + P^{0.5}} * k$	✓
Commercial Peaking Factor	1.5 (when area >20%) 1.0 (when area <20%	✓
Institutional Peaking Factor	1.5 (when area >20%) 1.0 (when area <20%	
Industrial Peaking Factor	As per Table 4-B (SDG002)	
Unit of Peak Extraneous Flow (Dry Weather / Wet Weather)	0.05 or 0.28 L/s/gross ha	
Unit of Peak Extraneous Flow (Total I/I)	0.33 L/s/gross ha	✓

The total estimated peak sanitary flow rate from the proposed property is **15.29 L/sec** based on City Design Guidelines. Sewage rates below include a total infiltration allowance of 0.33 L/ha/sec based on the total gross site area.

Table 7-2 : Summary of Anticipated Sewage Rates

Sewage Condition	Sanitary Sewage Flow (L/sec)
Peak Residential Flow	12.25
Peak Commercial Flow	0.06
Infiltration Flow (at 0.33 L/ha/sec)	2.98
Peak Wet Weather Sewage Flow	15.29

The proposed 250mm diameter sanitary sewer from the site will connect into an existing 300mm sanitary sewer stub at the east limits of the property (within easement). This then connects to the local sanitary sewer on Bandelier Way. The sanitary sewer design sheet is in **Appendix I**.

Based on the Potter's Key Design Brief, the allocated sewage flow from the 6171 Hazeldean site to the sanitary sewer on Bandelier Way was 11.84 L/sec. Therefore, the proposed site is expected to release an additional 3.45 L/sec, however the existing sanitary stub has a capacity of 46.05 L/sec and will be able to handle to revised peak sewage flows.

A review of the next four (4) downstream sanitary sewers on Bandelier Way in Potter's Key Subdivision was completed to ensure adequate capacity is available. The peak flows noted in the original sanitary sewer design sheet, as noted in **Appendix I**, ranges from 11.8 L/sec to 18.9 L/sec within these four (4) sewers. Available capacities within these sanitary sewers range between 45.1 L/sec and 46.1 L/sec based on 300mm diameter at 0.20% and 0.23%. The additional increase of 3.73 L/sec has minimal impact to the reserve capacity available in the downstream system. See **Appendix I** for the Potter's Key sanitary design sheet for reference.

8 Storm Servicing & Stormwater Management

8.1 Background

As the proposed site is located within the Mississippi Valley Conservation Authority (MVCA) jurisdiction, the stormwater works are therefore subject to both MVCA and City of Ottawa (COO) approval.

The site is located within the Carp River Subwatershed and stormwater runoff discharges to Feedmill Creek. A 1050mm storm sewer outlet was provided for the site near the south-eastern corner of the site within a 12-metre sewer and drainage easement. This easement connects the site to the municipal right-of-way (Bandelier Way). Downstream of the site the storm sewer flows easterly and then northerly approximately 1.1 kilometres where it enters the Jackson Trails Stormwater Management Facility (JTSWMF). This pond was constructed around 2007/2008 to service lands north of Hazeldean Road between Carp Road and Alon Street. The "Jackson Trails Stormwater Management Design Brief" (JTSMDB) was prepared in June 2006 by IBI Group for the design of this SWM facility.

In addition, the City of Ottawa commissioned J.F. Sabourin and Associates (JFSA) to prepare the Feedmill Creek Storm Management Criteria Study (FCSWMCS) which was finalized in April 2018. It is this document that identifies the stormwater criteria necessary for development of the site. Just prior to this, Minto Communities Inc (Minto), constructed Potter's Key Subdivision in 2017/2018, which surrounds the site on the north and east sides. Sewer and water infrastructure were installed as part of the surrounding subdivision.

8.2 Proposed Storm Servicing

The proposed subject property will be serviced with a conventional stormwater collection system. The storm sewer system will consist of a typical storm system including manholes and catchbasins in the roadway and catchbasins and landscape inlets in the rear yards. For the rear-yards, perforated storm sewers, as per City landscaping standards, will be used. Due to the stormwater criteria requirements, a stormwater facility (dry pond) is necessary.

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

8.2.1 Design Criteria & Constraints

From the Feedmill Creek report the following summarizes the design criteria and constraints that will be followed:

- Criteria #1: Extended Detention Control: Onsite storage to control peak flows 0.51 L/ha/sec in the 3hr 15mm 3-hr Chicago storm (Erosion Control).
- Criteria #2: Retention Control: Provide Low-Impact Development Methods (LID) to retain the 5mm 3-hr Storm event (infiltration).
- Criteria #3: Flood Control: Onsite storage to control peak storm flows to 70 L/ha/sec for the 12hr SCS Type II storm or the 3hr Chicago Storm. Although the Feedmill Creek Report also notes a requirement for the control peak storm flows to 8.0 L/ha/sec for the 12-hour 100-yr SCS Type II storm, this only applies to any new development within the Feedmill Creek Subwatershed that outlets directly to this creek. As the proposed 9.0-hectare site at 6171 Hazeldean Road discharges to an already constructed pond, specifically the Jackson Trails SWM pond, then the previously noted 70 L/ha/sec criteria governs the flood control criteria.

Other design criteria were taken from the JTSMDB and City of Ottawa SDG002 which apply to the stormwater design are included.

- The storm sewer was sized based on the Rational Method and Manning's Equation under free flow conditions for the 2-year storm using a 10-minute inlet time.
- Minor system capture from this development will be directed to the Jackson Trails SWM Pond and limited to 70 L/s/ha as per the design of the facility. This refers to the overall discharge rate from the site, rather than the capture rate at surface inlets.
- Rear yard ponding is permitted as per City of Ottawa Guidelines, up to a maximum of 300mm in depth, however the volume cannot be accounted for.
- The maximum permitted 100-year ponding depth on the private streets is 350mm.
- Overland flow routes are provided to major system outlets.
- The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the 100-year design storm.
- The vertical distance from the spill elevation and the ground elevation at the building is at least 150mm.
- The emergency overflow spill elevation is at least 30 cm below the lowest building opening.
- Minimum sewer slopes to be based on minimum velocities for storm sewers of 0.80 m/sec.

Additional comments provided during the pre-consultation meeting, that are also relevant include:

- *By modelling, demonstrate that there are no adverse impact to the existing downstream developments (Potter's Key and Jackson Trails).*
- *Pond may be required for attenuation as per the attached report.*

8.3 Stormwater Design Methodology

The methodology used for the design of the stormwater system is as follows:

- Established storm drainage area (or subcatchments) based on grading plans and roadway profiles.
- Design storm sewer system based on 2-year storm using the Rational Method. Pipes were sized based on the 2-year return period under free-flow conditions.
- Estimate the appropriate number and the location of inlets based on the developed grading plans and plan and profiles and ensure maximum permitted depth of static ponding meets City guidelines of 35 cm at the edge of pavement.
- For each subcatchment restricted inflow rates to the minor system to approximately the 2-year return period storm. This is completed using standard ICD types, with an attempt to meet the 2-year rate as close as possible. All catchbasins have independent leads complete with separate ICDs, as the City of Ottawa confirmed that no interconnected catchbasins are permitted.
- Developed a PCSWMM model of the storm sewer system, to calculate peak flows and runoff volumes.
- At this detailed design stage, the PCSWMM model was expanded to include the major system components (dual drainage). The model includes all subcatchments, all roadway ponding areas. Storage nodes and orifices and weirs were added to represent the proposed dry pond. Additional information on dual drainage modelling in provided later in this report.

  Ensure allowable discharge rate for the entire site does not exceed 631.6 L/sec (70 L/ha/sec X 9.02-hectare) for the 3hr Chicago storm or for the 12hr SCS storm. This required multiple models runs and modifications to the pond flow controls (orifices) to ensure all criteria was met.

8.4 Pre-Development Conditions

Although Stormwater drainage for the site has already been accounted for as it's tributary to the Jackson Trails Stormwater Management Facility (IBI Group, 2006), it was necessary to review and determine existing runoff conditions, specifically upstream of the proposed site. The rear yard drainage from some of the residential lots along Lloydalex Crescent flows directly to the proposed site as overland flow. A review of the original pre-development and post-development drainage area plan from the Jackson Trails Stormwater Management Design Brief was completed to confirm that external stormwater runoff enters the site from the west. Excerpt pages from the Design Brief is provided in Appendix I.

To confirm this external runoff pattern still exists, PCSWMM was used to establish determine the upstream drainage areas to the 9.0-hectare site. For this, a Digital Terrain Model (DTM) ground surface model was prepared based on Land Inventory Ontario (LIO) Digital Raster Acquisition Project of Eastern Ontario (DRAPE) Digital Terrain Model images. The DRAPE image is based on LIDAR data flown in the spring of 2014. LIDAR (Light Detection and Ranging) is a remote sensing method of measuring distances (or ground surface elevation in this case) using lasers which provides an accurate surface model. The DTM image was loaded into PCSWMM, and the watershed delineation tool was used to establish the watershed subcatchments for sheet 1km184260501302014DRAPE.

Figure A3 in Appendix A illustrates the results of the Watershed delineation. Along with loading the DTM sheet 50cm contours were generated and flow paths were derived for subcatchments. From this analysis subcatchments S49 and S51 are shown to discharge directly towards the subject property as overland flow. These two subcatchments were trimmed at the site boundary and were included in the post-development stormwater model. The upstream area that discharges to the subject site is approximately 1.48 hectares. The residential lots along Lloydalex Crescent that back unto the subject site boundary have walk-out basement with backyards that discharge directly to the adjacent site, with no rear yard storm sewers or catchbasins.

The permitted discharge rates and stormwater criteria was established based on the requirements noted in Section 8.2.1. Rather than having to meet pre-development levels peak flows and runoff volumes under pre-development conditions were nevertheless determined for comparison. Based on the existing onsite cover and soil conditions, the peak flows and runoff volumes were estimated at two (2) outfalls. The majority of runoff from the 9.0-hectare site discharges easterly to the existing walkway block, which is identified as Outfall #1 (OF1) on Figure A3. A small percentage of the 9.0-hectare site flows northerly to Kimpton Drive, which is identified at Outfall #2 (OF2). Upstream, or external to the 9.0-hectare subject site, subcatchments from the rear yards of lots on Lloydalex Crescent discharge through the 9.0 hectares site. These areas are denoted as EXT-1 and EXT-2 on **Figure A3b.**

Subcatchment parameters under pre-development conditions were based on City of Ottawa guidelines as noted in Table 8-5. Levels of subcatchment imperviousness was based on existing 2018 site conditions. The existing soil material onsite consists of gravel/fill material in the west, grass covered soil material in the centre portion of the site, and gravel, treed areas in the west. Subcatchment slopes were established in PCSWMM using average slopes of overland flow paths. The flowing table summarizes the peak flows at each outfall under pre-development conditions.

Table 8-1 : Summary of Pre-Development Peak Flows

Storm Event	Outfall # 1 - OF1		Outfall # 2 - OF2	
	Peak Flow (L/sec)	Volume (m3)	Peak Flow (L/sec)	Volume (m3)
Chicago_3h_5mm	16.1	40	9.2	11
Chicago_3h_15mm	96.2	155	28.1	39
Chicago_3h_2yr	231.1	351	64.8	88
Chicago_3h_5yr	366.3	548	161.6	193
Chicago_3h_100yr	824.9	1,808	537.6	652
Chicago_3h_100yr + 20%	1089.6	2,697	749.0	904
Historic_Jul1-79	844.7	1,820	551.9	674
Historic_Aug4-88	422.2	1,249	260.0	536
Historic_Aug8-96	611.5	2,387	413.0	846
SCS Type II_ 12-hr_2yr	199.9	491	71.1	137
SCS Type II_ 12-hr_5yr	320.6	799	186.3	291
SCS Type II_ 12-hr_100yr	735.8	2,311	505.9	783

Additional information on this external drainage area is provided in proceeding sections of this report and on the storm drainage area plans and within the PCSWMM model.

8.5 Runoff Coefficients

Average runoff coefficients for all subcatchments were calculated using PCSWMM's area weighting routine. This modelling software has a GIS engine which allows for catchment (or polygon) definition including attributes. The runoff coefficients for all catchments were area weighted to derive at average runoff coefficients based on hard surfaces (concrete or asphalt) having an imperviousness of 100%, soft surfaces (landscaping surfaces) having a percent imperviousness of 5%. The conversion from an imperviousness percent to a runoff coefficient was taken as C = (IMP*0.70) / 100 + 0.20, with the imperviousness (IMP) as a percentage. Generally, pervious surfaces would have a level of imperviousness of 0% (C=0.20), however the City of Ottawa staff required the increase in the level of imperviousness for landscaping and grassed areas to 5% (C=0.24). This was completed for all soft landscaping areas. The level of imperviousness of current park plan was calculated as 13% imperviousness (or C=0.29), however was raised to 15.6% (C=0.34), which represents 50% increase.

Since the site plan included building footprints, driveways, roads, and sidewalks, etc., the estimation of the actual level of imperviousness and runoff coefficients was completed. For this detailed design stage imperviousness levels and corresponding runoff coefficients were based on the actual building footprints. This applies to the site plan areas and townhomes as the building layouts are finalized with the developer. For the twenty (20) single family homes there are four (4) different styles proposed by the architect / developer, and therefore the one with the largest footprint was used. This way when area weighting was applied the more conservative percentage was used.

Area weighting was again used to apply imperviousness and average runoff coefficients for all lot types (singles, townhomes, 18m rights-of-way, 22m right of ways, park, walkway blocks, and site plans, etc.). **Table 8-2** below summarizes the average runoff coefficients that were calculated by area weighting.

Table 8-2 : Summary of Runoff Coefficients (Breakdown by Area Type)

Lot Type	Number	Total Area (m^2)	Average Runoff Coefficients Based on Area-Weighting and Site Plan Min → Max, (Average).
PARK	1	8,210	0.29 → 0.29 (0.29)
ROW_18m	3	19,061	0.68 → 0.73 (0.71)
ROW_20m	1	589	0.63 → 0.63 (0.63)
ROW_22m	1	1,192	0.63 → 0.63 (0.63)
SEMI	2	982	0.38 → 0.38 (0.38)
SINGLE	20	7,131	0.38 → 0.58 (0.55)
SITEPLAN 1	1	5,049	0.73 → 0.73 (0.73)
SITEPLAN 2	1	13,918	0.58 → 0.58 (0.58)
SWM	1	3,597	0.24 → 0.24 (0.24)
TOWNHOME	148	29,703	0.41 → 0.65 (0.6)
WALKWAY	3	795	0.44 → 0.57 (0.53)
Totals		90,227	

The average runoff coefficient for the overall site area under post-development conditions was calculated as 0.58. Runoff coefficients for individual subcatchments ranged from 0.24 to 0.73. The runoff coefficients for pre-development and post-development catchments are provided summarized in **Table 8-3** below. The runoff coefficients for each subcatchment were used in the storm sewer design sheet for sizing of the sewers.

Table 8-3 : Summary of Runoff Coefficients (Entire Site)

Location	Area (hectares)	Pre-Development Runoff Coefficient, CAVG	Post-Development Runoff Coefficient, CAVG Based on Site Plan
Entire Site	9.0227	0.28	0.58

8.6 Allowable Release Rate

Minor system capture rate from this development will be directed to the Jackson Trails SWM Pond and limited to the minimum of 70 L/s/ha for the 3hr Chicago Storm (as per the design of the downstream SWM facility) or the 12hr SCS Type II storm as per Feedmill Creek SMM Criteria Study. The allowable minor system discharge rate for the site is therefore 631.6 L/sec. As the City of Ottawa requires no surface ponding with the storm sewers sized to convey the 2-yr storm event without surcharging, an end of pipe stormwater pond is necessary for runoff retention.

The 2-year peak flow as noted in the storm design sheet is ±880 L/sec, based on default time of concentration times of 10 minutes for the front yards and 15 minutes for the backyards. The 2-year peak flow of 880 L/sec represents the peak flow accumulated at the stormwater pond, and results in an overall capture rate of ± 85 L/ha/sec (10.4 ha ÷ 880 L/sec). The required capture rate for the 2-year storm event at the individual subcatchment level would be ± 1,153 L/sec or 118 L/ha/sec. This confirms the requirement for an end of pipe stormwater facility for the control of runoff to the lower rate of 70 L/ha/sec.

The volume required to detain peak volumes will necessitate the review of each of the noted storms on a peak flow and volumetric basis.

8.7 Storm Sewers Design

Since an end-of-pipe SWM dry pond is proposed the overall target capture rate is 70 L/ha/sec, however for sizing of the storm sewer the 2-year capture rate was targeted to ensure no surface ponding. Target capture rates for most areas were increased to near the 2-year to account for the City of Ottawa's no ponding in the 2-year event on public and private streets. The higher rate represents the approximate 2-year level of service and used to avoid surface ponding.

The following **Table 8-4** summarizes the individual stormwater target rates that are necessary to meet the onsite SWM requirements. The table is based on the previously noted average runoff coefficients for each area type with a standard time of concentration of 10 minutes and 2-year storm intensity of 76.8 mm/hr. This represents a target rate (in L/ha/sec) of 218.6 x C, based on Q=2.78 x C x 78.6mm x 1.0 ha.

Table 8-4 : Target Capture Rates for Various Areas

Location	Number of Subcatchments	Area in hectares	Average Runoff Coeff	Target Minor System Capture Rate (L/ha/sec)	Target Minor System Capture Rate USED (L/ha/sec)
Site plan #1	6	0.5069	0.67	143	150
Site plan #2	12	1.392	0.58	123	150
Backyards	15	1.9712	0.48	102	105
Front yards / right-of-way	37	3.9166	0.69	147	150
Park	1	0.821	0.34	73	75
SWM	1	0.3962	0.25	53	n/a
Subtotal (9.0-ha site)	71	9.0039			
External	3	1.4752	0.43	91.8	95
Total (Site + External area)	74	10.4791			

The target minor system rates calculated based on the average runoff coefficients were adjusted slightly, specifically for site plans, to account for anticipated future updates to these site plans as these areas are developed. It is considered appropriate as the capture rates were only used to size the required storm sewers, and to assist in the selection of the inlet control devices.

A storm drainage plan is provided in **Appendix L**. A total sixty-seven (71) subcatchments (or drainage areas) within the development site, and 3 external areas are shown on this drawing with average runoff coefficients calculated for each drainage area. As noted, average runoff coefficients were calculated for all drainage areas for sizing of the storm sewers.

Design sheets for the 2-year sizing of the storm sewer system is included for reference in **Appendix E**. Under the 2-year storm event adequate capacity is provided within the storm sewer system. This subcatchment data was also used in PCSWMM for dual-drainage modelling, and for storm sewer sizing based on the Rational Method, typical with City of Ottawa guidelines.

To meet Criteria # 4 and have no surface ponding is pubic or private roadways during the 2-yr event, the above noted capture rates were used in conjunction with standard inlet control devices (ICDs).

8.8 Stormwater Model Development

PCSWMM was used to create a hydrologic/hydraulic model of the stormwater system. The model includes both the minor system (storm sewer), for estimating peak flows and runoff volumes and the major system (roads and swales, etc.). Calculations of runoff was completed based on the PCSWMM's EPA SWM 5 engine.

PCSWMM is an advanced software application for stormwater, wastewater, watershed, and water distribution system modelling. PCSWMM was developed by Computational Hydraulics International (CHI) https://www.chiwater.com/Home and is based on the EPA storm water management model (SWMM), which is a dynamic rainfall-runoff-routing simulation model used for single event or long-term (continuous) simulation of runoff. PCSWMM was used to determine peak runoff rates and provide hydraulic profiles of the depth of runoff during various storm events. PCSWMM calculates runoff based on the non-linear reservoir model for subcatchments. The model conceptualizes a subcatchment as a rectangular surface that has a uniform slope and a width that drains to a single outlet. The subcatchments receive inflow from precipitation and losses from evaporation and infiltration. The net excess volume ponds atop the subcatchment surface. Ponded water above the depression storage depth, can become runoff outflow. Depression storage accounts for initial rainfall abstractions such as surface ponding, interception by flat roofs and vegetation and surface wetting.

Subcatchment parameters were taken from City of Ottawa's SDG002 Design parameters. The following design parameters and assumptions are noted in **Table 8-5** below:

Table 8-5 : Subcatchment Parameters

Parameter	PCSWMM Parameter	Value
Infiltration Loss Method		Horton
Maximum Infiltration Rate	Max. Infil. Rate	76 mm/hr
Minimum Infiltration Rate	Min. Infil. Rate	13.2 mm/hr
Decay Constant (1/hr)	Decay Constant	4.14
Manning N (Impervious)	N Impev	0.013
Manning N (Pervious)	N Perv	0.25
Depression Storage – Pervious Surfaces	Dstore Imperv	1.57 mm
Depression Storage – Impervious Surfaces	Dstore Perv	4.67 mm
Zero Percent Impervious	Zero Imper	varies
Subcatchment Slopes	Slope	varies

Catchbasins were modelled in either a flow-by condition or in a ponding condition. For catchbasins in flow-by conditions inlet capture curves were developed based on the type of curbs used (mountable curbs or barrier curbs), and the inlet type (surface inlet catchbasins). Ponding areas were modelled as storage nodes with surface ponding represented by area-depth curves above the inlet control devices (ICDs) located at the outlet pipe invert.

The following design parameters and assumptions are noted as follows:

- Subcatchment areas were derived tributary to each surface inlet (catchbasin).
- Runoff coefficient for all subcatchments were determined using area weighting routine and based on actual hard and soft surface areas. Runoff coefficients were calculated from the impervious levels using the relationship C = (IMP x 0.7) + 0.20.
- Subcatchment widths are determined using PCSWMM's SET FLOW LENGTH / WIDTH routine. A Flow-Path layer was created in PCSWMW, and flow paths were created for each subcatchment. The software averages the flow path lengths to calculate the subcatchment widths. The width is equal to the subcatchment area divided by the overland flow path length.
- 2-year, 3-hour Chicago storm used to review minor system design based on Rational Method.
- 3-hr and 12-hr 100-year and 100-year +20% storms, along with Historic storms were used to assess the impact of major event and determine peak flows and depth of runoff.

8.9 Rainfall Data

Rainfall used for stormwater modelling and calculations were based on data provided in the City of Ottawa's Sewer Design Guidelines (SDG002). Generation of storm hyetographs for use in hydraulic/hydraulic modelling were derived from the total rainfall depths for various storm durations noted in the **Table 8-6** below. The derivation of the SCS Type II storms were based on the American Soil Conservation Services (ASCS) cumulative distribution. The SCS Type II distribution is based on the storm duration and the rainfall interval. Chicago storm distributions were established using PCSWMM's Design Strom Creator using a,b,c IDF parameters taken from Section 5.4.2 of the SDG002. The 3hr-5mm and 3hr-15mm storm events were derived using PCSWMM's EDIT feature in the Graph Panel based on proportioning down the 2-yr 3-hour storm event to yield the 5mm event and 15mm total rainfall amounts having the same distribution. In addition, as part of the City's SDG002, additional historic rainfall events were modelled, which includes July 1, 1979, August 4, 1988, and August 8, 1996. These events produced rainfall amounts of 106.7mm, 156.2mm, and 122mm over a 3-hr, 6-hr, and 6-hr periods, respectively. The 1979 and 1988 storms have return periods greater than 100-yr, and the 1996 storm has a 50-year return period. These three (3) historic storms events were inputted directly into PCSWMM based on Table 5.6 of the SDG002.

Table 8-6 : Summary of Rainfall Data (From City of Ottawa SDG002)

Duration	Rainfall Amounts (mm) for Specified Return Period					
	2-year	5-year	10-year	25-year	50-year	100-year
5 mins	9.8	13.1	15.2	17.9	19.9	21.8
10 mins	12.1	16.2	18.7	22.1	24.5	26.9
15 mins	13.7	18.3	21.2	24.9	27.7	30.4
30 mins	16.9	22.5	26.1	30.7	34.1	37.4
1 hour	20.8	27.7	32.1	37.8	42.0	46.1
2 hours	25.6	34.2	39.6	46.6	51.8	56.8
6 hours	35.4	47.4	55.2	64.8	72.0	79.2
12 hours	44.4	58.8	68.4	80.4	85.2	97.2
24 hours	55.2	72.0	84.0	98.4	110.4	120.0

8.9.1 Storm Events Modelled

The SDG002 guidelines specify the use of the Chicago and SCS Type II distributions for generation of stormwater runoff. The 3-hr, and 6-hr Chicago (for urban), and 6-hr, 12-hr, or 24-hr SCS Type II (for rural) are generally used. For this project the 3-hr Chicago and the 12hr SCS Type II storms were modelled along the three historic storms. This is consistent with the storms used in the Feedmill Creek Report.

In addition, the 3hr 5mm, 3hr 15mm and 20% increases in the 100-year storms were modelled. In summary thirteen (13) storm events were modelled including:

- 3-hour 5mm Chicago storm. (10 min timestep), with total rainfall of 5mm.
- 3-hour 15mm Chicago storm. (10 min timestep), with total rainfall of 15mm.
- 3-hour 2-year Chicago storm. (10 min timestep), with total rainfall of 31.88mm.
- 3-hour 5-year Chicago storm. (10 min timestep), with total rainfall of 42.54mm.
- 3-hour 100-year Chicago storm. (10 min timestep), with total rainfall of 71.58mm.
- 3-hour 100-year + 20% Chicago storm. (10 min timestep), with total rainfall of 85.9mm.
- 12-hour 2-year SCS Type II storm. (SCS Type II Distribution with 6min timestep), with total rainfall of 43.2mm.
- 12-hour 5-year SCS Type II storm. (SCS Type II Distribution with 6min timestep), with total rainfall of 57.6mm.
- 12-hour 100-year SCS Type II storm. (SCS Type II Distribution with 6min timestep), with total rainfall of 96.0mm.
- 12-hour 100-year + 20% SCS Type II storm. (SCS Type II Distribution with 6min timestep), with total rainfall of 115.2mm.
- Historical storms occurring July 1, 1979, Aug 4, 1988, August 08, 1996 (5min timestep), with total rainfall of 83.99mm., 80.59mm, and 73.9mm respectively.

8.10 Model Development

The subcatchment (or storm drainage areas) were developed in Autodesk CIVIL 3D and imported into PCSWMM. PCSWMM was then used to generate impervious levels for each subcatchment with the area-weighting command. Storm sewers and manholes were imported from CIVIL 3D as GIS shape files and the node and conduit elevations, and sizes were inputted based on the preliminary sizing completed with the Rational Method analysis. Connections between the catchbasin nodes and the sewer main were converted to OUTLETS to represent the ICDs. Once all the minor system components were inputted, the major system was defined connecting inlets.

The major system was represented as irregular conduits based on a half-street cross-section. The transect editor in PCSWMM was used to establish this transect, which was applied to the majority of the major system. In addition, swale and roadway spill irregular transects were used to represent the overland flows. In flow-by conditions all subcatchments were linked to major system nodes place just upstream (u/s) of the catchbasin storage nodes. Between the u/s node and the catchbasins were represented by a PCSWMM OUTLET. These outlets were established with rating curves to represent the approach-flow and depth, and the inlet capture rate. Additional information on the rating curves under flow-by and ponding conditions is provided in proceeding sections of this report.

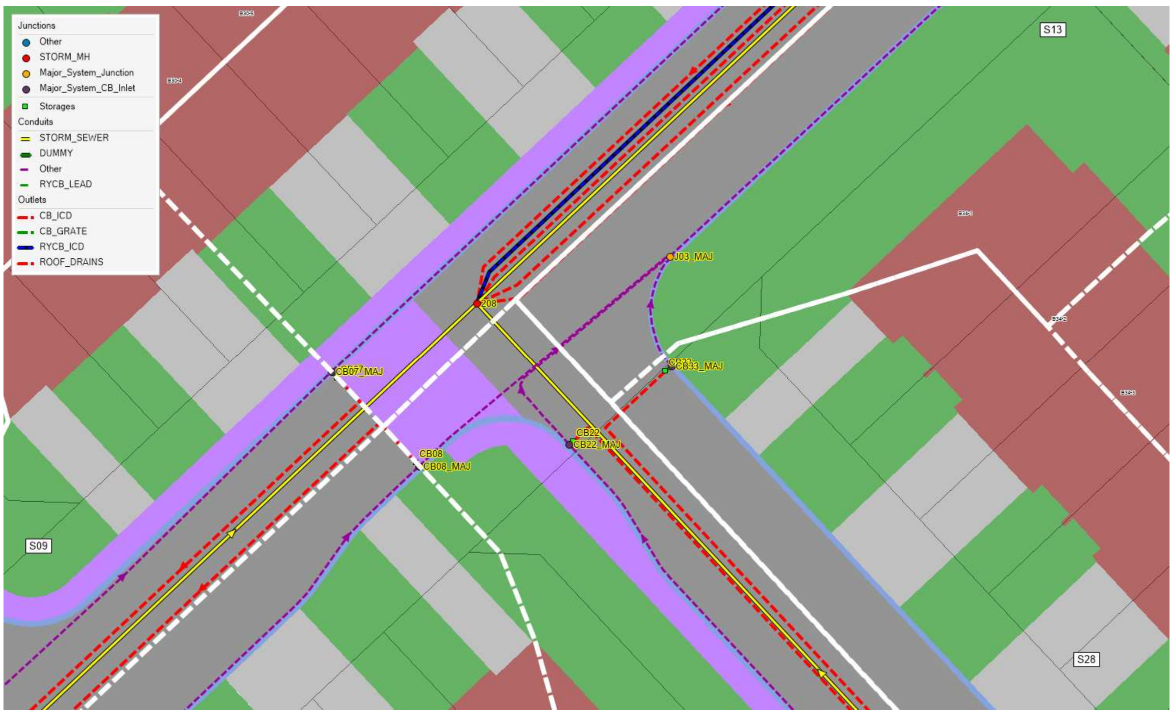


Figure 8-1: Model Schematic Showing Minor and Major System Components

Figure 8-1 above presents a portion of the PCSWMM model which demonstrates the object connectivity. The subcatchment are illustrates as white polygons, the yellow lines and red circles represent the storm sewer system and manholes, with red dashed lines representing the OUTLET links (or ICDs). The dashed purple lines represent the major system street conduits and irregular channels. Catch basins are shown as green squares and looking closely you can see two OUTLETS connecting the CBs to the storm sewer and the major system nodes. Downstream of each CB represent the ICD, whereas upstream of the CB storage nodes the OUTLET represents the inlet capacity. At ponding locations, the storage nodes were defined based on the depth to the ICD.

8.10.1 Modelling of Catchbasins in Ponding Condition

All catchbasins will be equipped with inlet control devices (ICDs) to ensure that captured flows meet acceptable rates and no ponding occurs on road surface in the 2-year event. At low points (sag locations) the use of ICDs will result in surface ponding during large storm events. All catchbasins were established as storage nodes in PCSWMM, with these storage nodes having a volume relationship which was assigned based on the maximum depth and area of ponding. The rating curves use an area versus depth relationship starting at the invert of the inlet control device. **Figure 8-2** below illustrates a typical storage curve used at a roadway low point.

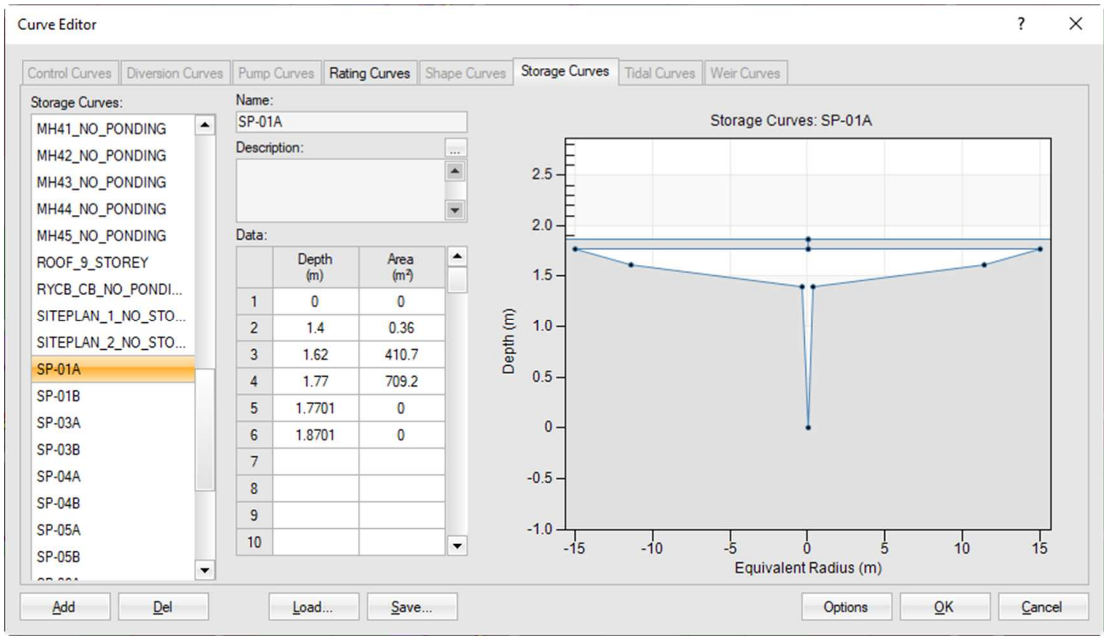


Figure 8-2: Representation of Storage Curves for Modelling of Catchbasins at Ponding Locations

The ponding areas were prepared in CIVIL 3D based on a final ground surface. This final ground surface was defined using roadway templates (or corridors) based on typical City of Ottawa roadway templates. For instance, most of the local streets in the subject site are based on an 18.0m right-of-way having 4.25m lanes (3%) with 0.35m wide mountable curbs and a 1.8m sidewalk on one side. Roadway ponding areas were defined based on the area and depth of ponding at the spill elevation (static ponding), with an additional area 150mm above this static ponding depth (dynamic ponding).

The flow control devices (or ICDs) in each catchbasin were defined as OUTLETS in PCSWMM. There are six (6) primary inlet control devices used in the City of Ottawa for the control of runoff at catchbasins. The standard ICD discharge rates are 13.4 L/sec, 19.8 L/sec, 28.1 L/sec 36.7 L/sec, 53.2 L/sec and 70.8 L/sec for Pedro Plastics Type X, and IPEX Tempests Type A, B, C, D, and F respectively. The selection of each ICD type was based on ensuring no surface ponding in the 2-year storm event.

Table 8-7 below summarizes the discharge rates of all six (6) standard inlet control devices used. Please refer to the Storm Drainage Plan and Site Servicing Plans for the ICD types at each catchbasin.

Table 8-7 : Discharge Rates for Standard ICD Types

Head (m)	Discharge Rate (L/sec)					
	Pedro Plastics Type X	IPEX Type A	IPEX Type B	IPEX Type C	IPEX Type D	IPEX Type F
0.00	0.0	0.0	0.0	0.0	0.0	0.0
0.10	3.9	5.7	8.1	10.6	15.3	20.5
0.20	5.5	8.1	11.5	15.0	21.7	28.9
0.30	6.7	9.9	14.1	18.3	26.6	35.4
0.40	7.8	11.5	16.2	21.2	30.7	40.9
0.50	8.7	12.8	18.1	23.7	34.3	45.7
0.60	9.5	14.0	19.9	25.9	37.6	50.1
0.70	10.3	15.1	21.5	28.0	40.6	54.1
0.80	11.0	16.2	23.0	29.9	43.4	57.8

0.90	11.6	17.2	24.3	31.8	46.0	61.4
1.00	12.3	18.1	25.7	33.5	48.5	64.7
1.20	13.4	19.8	28.1	36.7	53.2	70.8
1.40	14.5	21.4	30.4	39.6	57.4	76.5
1.60	15.5	22.9	32.5	42.4	61.4	81.8
1.80	16.5	24.3	34.4	44.9	65.1	86.8
2.00	17.3	25.6	36.3	47.4	68.6	91.5
2.50	19.4	28.6	40.6	52.9	76.7	102.3
3.00	21.2	31.4	44.4	58.0	84.1	112.0

8.10.2 Modelling of Catchbasins in Flow-By Condition

Roadway catchbasins in a flow-by condition were once again modelled as STORAGE nodes in PCSWMM however no surface ponding was included in the storage curve. For the roadway catchbasins which include a single outlet to the storm sewer a standard storage definition curve was used. The standard curve was based on the typical -1.4m from the structure top of lid to the invert elevation of the ICD. The RIM elevation of the storage node (CB) was raised to allow for dynamic routing of excess runoff to downstream inlets. **Figure 8-3** below illustrates the storage curve used for typical roadway catchbasins in a flow-by condition. The rating curve shows the typical depth of 1.4m above the invert of the ICD and an additional 0.35m above the lid.

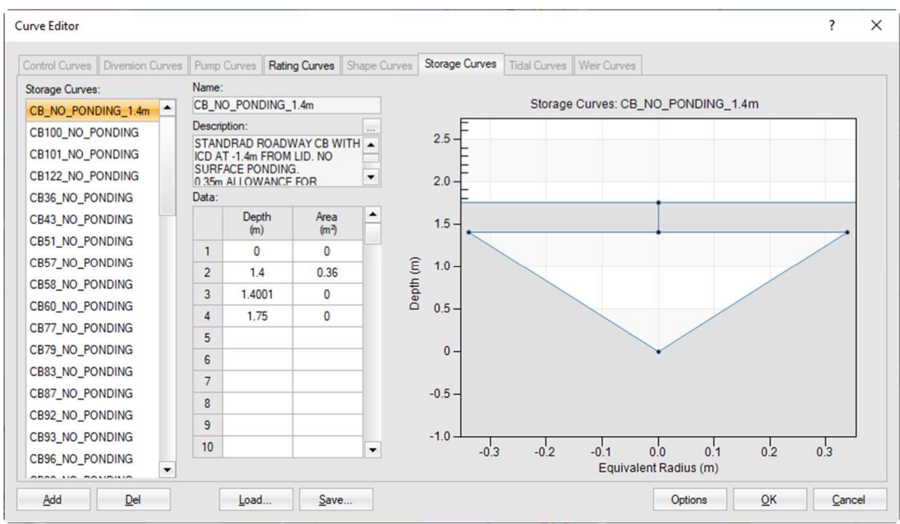


Figure 8-3: Representation of Rating Curves for Modelling of Storage at Ponding Locations

In addition to using a STORAGE node for the catchbasin an OUTLET node was connected upstream of the catchbasin node to simulate the inlet grate. The captured rate through the CB grate is based on the approach flow, depth of flow, type if inlet, roadway cross slope and gutter slope.

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

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

The inlet capacities of the surface inlet catchbasins were derived from Appendix 7-A.6 and 7-A.7. These pages provide the capture rates (Qc) of the inlets at various approach flows (Qt). Rating curves for these surface type inlets are based on a roadway with a 3.0% cross fall and longitudinal slopes of 2%. The following **Table 8-8** below summarizes the rating curves used for the surface catchbasins with a curb & gutter type curb in a flow-by condition. For a complete set of rating curves for catchbasins in a flow by condition refer to tables in **Appendix E**. These tables provide additional information on the development of the rating curve for the catchbasin in flow-by conditions. This exercise was completed since PCSWMM does not have the ability to provide Approach Flow versus Capture Flow at flow-by conditions. PCSWMM requires a depth versus captured flow rate instead.

Table 8-8 : Rating Curves for CB in Flow-By Condition (Mountable Curb & Gutter, 3% cross fall, 2% slope)

Approach Flow (L/sec)	Total Spread, T (m)	Depth of Flow at Gutter (m)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0
5	0.716	0.009	5
10	0.933	0.017	10
50	1.715	0.053	17
100	2.226	0.068	33
125	2.420	0.074	45
150	2.592	0.079	50
200	2.887	0.088	54
250	3.140	0.096	61

8.10.3 Modelling of Dry Pond

For criteria # 3, onsite storage is required to control peak flow of the to 70 L/ha/sec (or 631 L/sec) during either the 3-hour 100-yr Chicago storm or the 100-yr 12hr SCS storm. From **Table 8-10**, the 12-hr SCS storm generates a total runoff volume of ±6,662 m3 and peak runoff rate of ±3,952 L/sec. Similarly, the 3-hr Chicago storm generates a total runoff volume of 5,208 m3, but a slightly higher peak flow of 4,389 L/sec.

PCSWMM's storage routine was used to estimate a preliminary volume necessary based on the allowable discharge rate of 631.6 L/sec during the 100-yr storms. The total volume required would be 3,665 m3 for the SCS storm, which represents the total volume for the entire subcatchment area. Similarly, for the 3hr 100-yr Chicago storm, the retention volume required to meet 631.6 L/sec is 3,317 m3. One can see that the 12hr SCS storm results is the governing storm for establishing retention volume requirements.

To establish the necessary requirements, the PCSWMM model was expanded to include a storage node to represent the stormwater facility. Two (2) flow-controlled ORIFICES were added connecting the pond and the outfall. **Table 8-11** summarizes the orifices sizes and elevations that were used in the model

Table 8-9 : Dry Pond Stage-Storage Data

Description	Elevation (m)	Total Depth (m)	Incr. Depth (m)	Area (m2)	Incr. Volume (m3)	Total Volume (m3)
Top of pond	116.15	2.70	0.25	2564.1	631	5195
Emergency Spill Elev	115.90	2.45	1.35	2480.1	2877	4564
Intermediate point	114.55	1.10	1.00	1782.0	1556	1687
Bottom of Dry Pond	113.55	0.10	0.10	1330.3	131	131
Bottom of Dry Pond	113.45	0.00	0.00	1289.6	0	0

The bottom of proposed dry pond was set an and elevation of 113.45m, which are similar to the underside of footing elevations (USFs) of the closest existing residential units on Bandelier Way, which are 113.78 (semi-detached) and 113.90m (townhome).

It should also be noted that the existing storm and sanitary sewers, located within the 12m easement, are installed at much lower elevations (storm and sanitary inverts of ±112m and ±111m respectively), and therefore it is expected that the GWT would be lower in this vicinity. The proposed dry pond bottom of 113.45m is well above the existing sewers and similar to the USFs of existing homes.

The estimated groundwater table (GWT) elevation taken from the geotechnical report is ±115.6m, however the USF elevations of the existing adjacent homes in ± 113.8m. It is expected that the groundwater table within the rock will lower. To ensure the pond remains dry, perforated underdrains will be installed below the pond bottom. The underdrains will connect back to the outlet structure.

Figure A10 illustrates the difference in original ground versus final ground surfaces. One can see that the majority of the site requires fill, with the exception of a small area on Street 2 that requires less than a metre cut. Fill depths of up to 3.0m are needed for the subdivision. For the stormwater pond a cut of up to ± 4 m is necessary.

Figure A11 illustrate the difference between the bedrock surface and the final gourd surface. Similarly, the majority of the site will require fill, whereas the stormwater pond will require excavation into bedrock.

The depth to bedrock below the ground surface increase as one proceeds north, with the depth to bedrock highest at the northeast corner of the site.

Additional information on the pond drawdown time is provided in proceeding sections of this report.

8.11 Stormwater Model Results

The following bulleted list below re-iterates the SWM design criteria that is required.

- Extended Detention Control. Maximum discharge of 4.6 L/sec in 3-hr 15mm storm event.
- Retention Control (LID). Retain runoff volume for 5mm 3hr storm.
- Flood Control. Maximum discharge of 631.6 L/sec during both the 3-hr Chicago storm event and the 12-hr SCS storm.

The peak flows and volumes in **Table 8-10** represent the peak flow results prior to stormwater detention. This was completed to determine the uncontrolled peak flows and volumes. The estimation of total peak flows and runoff volumes was completed within PCSWMM's GRAPH panel by the selection of all subcatchments to derive a total combined runoff hydrograph (lumped approach). This was completed for all storm events. The peak volumes and volumes presented below are inclusive of the external areas that discharge directly to the site as overland flow. Storm drainage from these areas will be intercepted by new catchbasin inlets located in the rear yards of the proposed residential lots. The 2-yr storm rate will be captured with larger events being conveyed overland to Kimpton Drive right of way.

Table 8-10 : Summary of Post-Development Flows (Uncontrolled)

Storm Event	Peak Flow (L/sec)	Runoff Volume (m3)
Chicago_3h_5mm	144	170
Chicago_3h_15mm	535	710
Chicago_3h_2yr	1,186	1,616
Chicago_3h_5yr	2,067	2,467
Chicago_3h_100yr	4,389	5,208
Chicago_3h_100yr + 20%	5,488	6,598
Historic_Jul1-79	2,766	6,357
Historic_Aug4-88	3,975	5,815

Historic_Aug8-96	2,554	5,078
SCS Type II_ 12-hr_2yr	1,081	2,294
SCS Type II_ 12-hr_5yr	1,925	3,461
SCS Type II_ 12-hr_100yr	3,952	6,662
SCS Type II_ 12-hr_100yr + 20%	4,878	8,259

8.12 Extended Detention Control Design and Outlet Control Structure Design

For Criteria # 1, the extended detention control criteria require that the maximum discharge rate of 0.51 L/ha/sec from development site upstream of the Jackson Trails SWM Facility not be exceeded during the 3-hour 15mm storm event. This criterion was established to provide to mitigate peak flow increases during frequent storm events and erosion within Feedmill Creek.

From above, the peak flow and runoff volume from the 3-hr storm 15mmm is 535 L/sec and 710 m3. PCSWWM's storage function was used to estimate the volume necessary to control to the allowable rate of 4.6 L/sec (9.02 ha x 0.51 L/ha/sec). The volume necessary to control the peak rate to 4.6 L/sec is 679 m3. This is the maximum volume necessary if one were to not consider any upstream storage, where in fact a portion of the necessary volume will be stored in the rear yards and within the right-of-way with infiltration. **Table 8-18** identifies that ± 19% of the area represents backyards, and therefore it is appropriate to assume that the same proportion of the total 15mm runoff volume of 710 m3 (or 135 m3) can be stored in the rear yards. Similarly additional infiltration in the rights-of-way will assist in lowering the peak runoff during the 15mm event.

The City of Ottawa staff has confirmed that the retention control can contribute to the 15mm volume control, but it shall not contribute to 100-yr quantity control. Using PCSWMM, the total inflow hydrograph entering the pond's STORAGE node during the 15mm event is 461.7 L/sec and using the allowable rat of 4.6 L/sec results in a storage requirement of 663 m3. Since the rear yard infiltration trenches (City S29) will be used, depression storage for impervious and impervious surfaces were adjusted to5mm. This would ensure that there would be no runoff from these areas during the 5mm event. This would ensure that a more appropriate peak flow and runoff volume was determined entering the SWM pond.

The depth in the pond, based on its geometry is approximately ± 0.43m. This implies that the depth required for minimum 24hr drawdown of the pond is 0.43m. Therefore, the flood control office will be placed a minimum of 0.43m above the pond bottom (or elevation ±114.0m). As noted previously the pond will require excavation into the bedrock to establish the appropriate depth. It is expected that over blasting of 0.5m of bedrock would be required to achieve this.

The extended detention storage, which represents the storage immediately above the pond's bottom, was designed for slow release of the ED volume over a minimum drawdown time of 24-48 hours. For the dry pond the orifice equation was used for determining the extended detention control requirements. The orifice equation is as follows:

$Q_{ORIFICE}$ = $C*A\,(2*g*H)^{0.5}$ Orifice Equation

where:

C	= Discharge Coefficient (0.61 used)
H	= head difference across the weir.
G	= acceleration due to gravity (9.81 m/sec^2)
A	= area of orifice (m^2)

The drawdown time for the dry pond facility was calculated using Equation 4.11 from the Stormwater Management Planning and Design Manual, as expressed below:

$$t_d = \frac{0.66 \times C_2 \times {h_1}^{1.5} + 2 \times C_3 \times {h_1}^{0.5}}{2.75 \times A_0}$$

where:

td	is the drawdown time, seconds
h	is the maximum water elevation above the orifice, m
A_0	is the cross-sectional area of the extended detention orifice, m^2
C_2	is the slope coefficient from the area-depth linear regression
C_3	is the intercept from the area-depth linear regression.

The following orifice sizes were established to provide meet the extended detention discharge rate of 0.51 L/ha/sec (4.6 L/sec) and the flood control requirement of 70 L/ha/sec (631 L/sec).

Table 8-11 : Dry Pond Stage-Storage Data

Description	Elevation (m)	Orifice Size
Orifice 1 – upper	114.20	460mm x 470mm rectangular
Orifice 2 – lower	113.55	57mm CIRCULAR (Required) 100mm CIRCULAR (Selected)

The drawdown time is based on the extended detention height and the orifice size used. A minimum of 24 hours is necessary for the facility based on the required extended detention volume, and height occurring for that ED volume. The estimated detention times for a drawdown time is **71.8 hours** based on the **57mm orifice.** Additional design considerations on the pond's ED criteria in noted in **Section 8.14.** As noted in this section, and through meetings with City staff, the use of the 100mm orifice Is required by City staff. Therefore, the larger 100mm DIA orifice will be used, however the drawdown time will be 22.8 hrs, and just under the minimum 24 hr requirement. It should be noted that outflows from the subject property will not be discharging directly to the Feedmill Creek, rather that to an existing stormwater facility.

8.13 Pond Results

Figure 8-4 illustrates the pond volumes and maximum water surface elevations (WSEL), whereas **Table 8-12** provides peak flows, volumes and WSEL's from the dry pond during major storm events. It also provides the depths and corresponding volumes within the pond. Two orifices were used to establish preliminary results, which will be refined during detailed design. The volumes and depths presented below confirm that the dry pond has adequate depth and volume to contain the 100-yr 20 % storm. The volume available in the pond (prior to spill) is 4,563 m3. Also, there is at least 300mm of freeboard above the most critical 100-yr event of 115.36m, as the emergency spill is set to 115.9m.

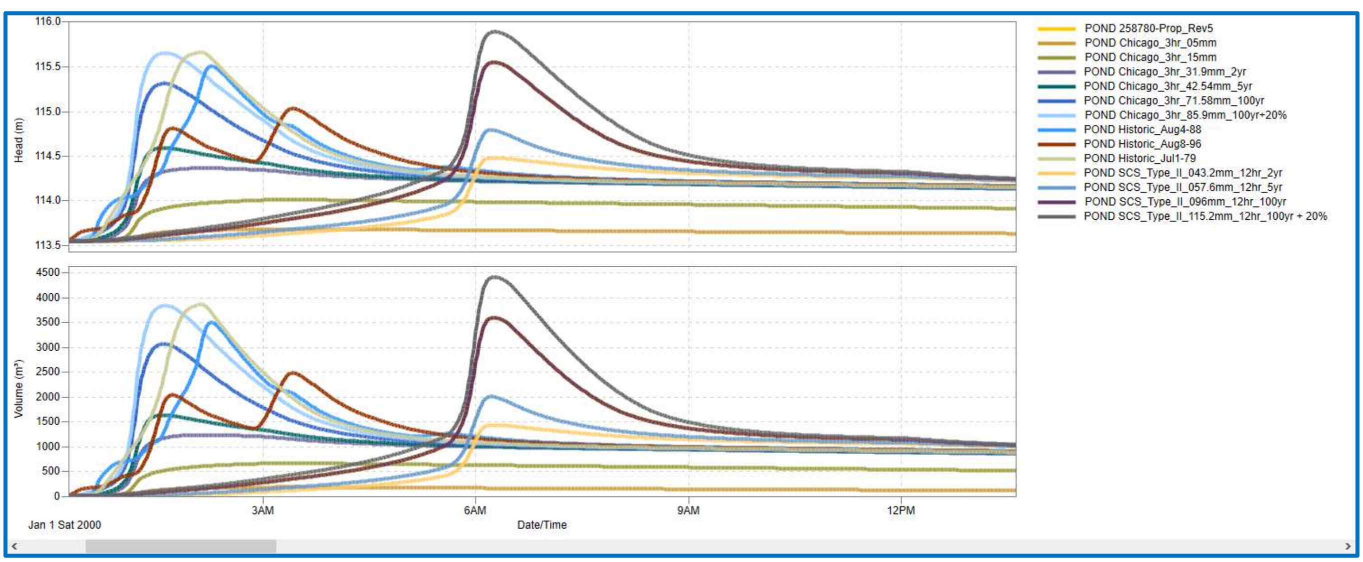


Figure 8-4 : Dry Pond Volume and Elevations for All Storm Scenarios

Table 8-12 : Dry Pond 100-yr Peak Outflows, Volumes, Elevations

Storm Event	Peak Inflow to Pond (L/sec)	Peak Outflow to Pond (L/sec)	Volume (m3)	Maximum Pond Stage	Pond Depth During Storm
Chicago_3h_5mm	104.3	1.6	150	113.55	0.10
Chicago_3h_15mm	463.2	12.5	575	113.87	0.42
Chicago_3h_2yr	954.6	46.2	1,233	114.30	0.85
Chicago_3h_5yr	1364.5	154.6	1,543	114.48	1.03
Chicago_3h_100yr	2662.4	513.9	2,742	115.13	1.68
Chicago_3h_100yr + 20%	3487.2	614.7	3,391	115.43	1.98
Historic_Aug4-88	2023.6	589.4	3,213	115.35	1.90
Historic_Aug8-96	1533.3	450.0	2,411	114.96	1.51
Historic_Jul1-79	2028.3	635.4	3,546	115.51	2.06
SCS Type II_ 12-hr_2yr	887.5	82.5	1,354	114.37	0.92
SCS Type II_ 12-hr_5yr	1366.3	289.1	1,834	114.65	1.20
SCS Type II_ 12-hr_100yr	2573.3	590.3	3,219	115.36	1.91
SCS Type II_ 12-hr_100yr + 20%	3230.0	683.1	3,934	115.68	2.23
1) Maximum Pond Volume of 5,195 m3 at Elev 116.15m					
2) Pond Volume is 4,564 m3 at Spill Elevation of 115.90m					
3) Pond bottom is 113.45m					

8.14 Additional Design Considerations

The Extended Detention requirement is 4.6 L/sec (based on 9.02 ha x 0.51 L/ha/sec) during the 3-hr storm 15mmm storm, which requires the lower orifice to be 57 mm diameter (as noted above). The use of a 57mm orifice does not meet the City of Ottawa's (or MECPs) guidelines of 75mm minimum diameter to prevent freezing. The 57mm diameter ED orifice will result in a drawdown time of ±72 hours.

To meet the City/MECPs requirement for minimum orifice size of 75mm diameter, we prepared a separate PCSWMM model using a larger diameter orifice. At first, we increased the orifice size to 75mm, which results in an extended detention drawdown time of 41.5 hrs, pond discharge rate of 7.6 L/sec during the 3-hr 15mm storm, and 619 L/sec during the 100-yr 12-hr SCS storm.

We then enlarged the ED orifice to 100mm diameter to meet the MECP's desired minimum diameter size. This results in a drawdown time of 23.3 hours, pond discharge rate of 12.8 L/sec during the3-hr 15mm storm, and 619 L/sec during the 100-yr 12-hr SCS storm. A drawdown time of 23.3 Hours is just under the MECP minimum requirement of 24hours, however in Table 4.6 of the MECP guidelines 12hr drawdown is permitted if it conflicts with orifice size. The following summarizes additional design consideration relating to the pond's extended detention.

57mm Orifice (required to meet discharge criteria)

- Drawdown time = 72 hours
- Pond discharge rate during the 3-hr 15mm storm = 4.5 L/sec
- Pond discharge rate during 12-hr 100-yr SCS storm = 615.9 L/sec

75mm Orifice

- Drawdown time = 41.5 hours
- Pond discharge rate during the 3-hr 15mm storm = 7.6 L/sec
- Pond discharge rate during 12-hr 100-yr SCS storm = 619.0 L/sec

<u>100mm Orifice (City Preferred)</u>

- Drawdown time = 23.3 hours
- Pond discharge rate during the 3-hr 15mm storm = 12.8 L/sec
- Pond discharge rate during 12-hr 100-yr SCS storm = 625.9 L/sec

In summary, although the Feedmill Creek (FC) study sets an extended detention criteria of 0.51 L/ha/sec during the 15mm event, and to order to ensure a minimum 24 drawdown within any stormwater facility discharging the Feedmill Creek, this criterion would be better served for new developments only. In this case, the subject 9.0-ha site already discharges to a stormwater management facility (Jackson Trails SWM pond), which is sized for enhanced treatment.

We recommend to the City of Ottawa that the larger 100mm diameter orifice should be used. Using this would result in a slight exceedance of the 0.51 L/ha/sec discharge criteria during the 3hr 15mm storm event but would be acceptable from a flood control and drawdown time.

8.15 Pond Inlet Channel

The major system channel that runs from Street 2 to the pond was modelled as trapezoidal channel 5.0m wide with a maximum depth of 300mm. The slope of the channel from the roadway to the bottom of the pond is 33.3% (3:1). The 100-year and 100-year +20% peak flows and velocities within this channel are noted in following table.

The depth of flow in the inlet channel during either the 100-yr or 100-yr +20% storm is only 0.18m and 0.19m respectively.

Table 8-13 : Pond Inlet Channel Flows and Velocities

Storm Event	Peak Inflow to Pond (L/sec)	Channel Velocity (m/sec)
SCS Type II_ 12-hr_100yr	± 709	0.71
SCS Type II_ 12-hr_100yr + 20%	± 1,192	1.12
3hr Chicago _100yr	±847	0.83
3hr Chicago _100yr + 20%	± 1,472	1.34

It is proposed to use a reinforced mat which consist of Terrafix Flexmat. This mat is a geogrid reinforced mat containing concrete block which will allow for vegetation growth through the mat. The mats come is standard widths that can be laid out on ground surface. These mats are considered for use over the typical riprap and geotextile.

8.16 Pond Outlet Channel and Emergency Spillway

The stormwater pond will contain an emergency spillway that is oriented towards the 12.0m walkway easement that runs between the site and Bandelier Way.

A review of the peak flows discharging through the pond's emergency spillway and through the walkway block was completed to ensure adequate capacity during the 100-yr and 100-yr plus 20% storm events. The MTO manual clarifies that an emergency spill way is needed to prevent overtopping of the entire pond top of berm, therefore a depression in the top of pond is generally set 0.5m below the top. The City of Ottawa specifies that dry ponds require freeboard of 0.3m from the 100-year elevation to the overflow elevation. The following summarizes the emergency spillway parameter:

- 100-yr WSEL in dry pond 115.36 m
- 100-yr +20% WSEL in dry pond 115.68 m
- Spillway invert elevation 115.90 m
- Spill Height (or top of pond) 116.15 m
- Spill dimensions (trapezoidal weir) 4m bottom, 3:1 side slope, 0.25m high

Peak flows were estimated in PCSWMM in the event of a blockage within the dry pond outlet structure. This was completed to ensure that the pond's emergency spill way had adequate capacity to convey peak flows to the walkway block. In addition, an TRANSECT was added to the PCSWMM model to determine the depth of runoff that could possibly occur in the walkway block if the event of a pond blockage. The walkway block was defined as a 12m easement with a maximum possible depth of 300mm and longitudinal slope of 0.60% with a 2.0m wide pathway centred in the easement. Refer to **Figure 8-5** below showing the definition of the walkway block.

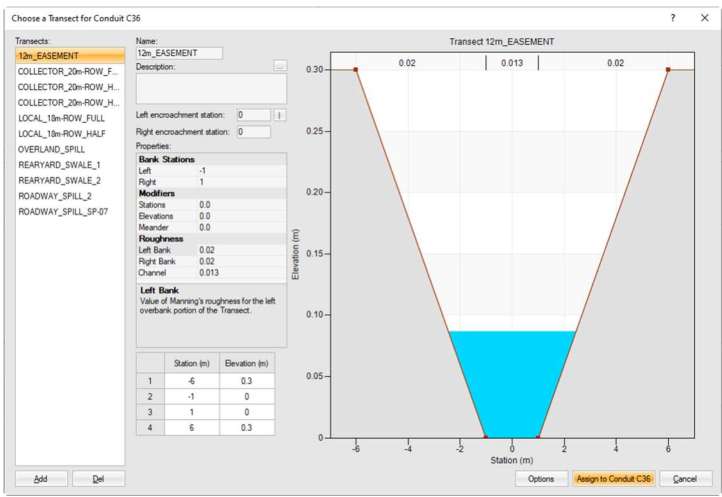


Figure 8-5: Definition of Walkway Block TRANSECT

Two separate scenarios were run in PCSWMM to simulate the peak flows through the pond's emergency spill way and peak flows within the walkway block in the event of a blockage. This was completed by revising the two pond orifices to infinitely small size.

The 100-year and 100-year +20% peak flows and depths though the spillway and the easement are noted in **Table 8-14** below.

Table 8-14 : Review of Pond Outlet Channel and Walkway Block Flows and Velocities

Storm Event	Peak Inflow and depth through Pond's Emergency Overflow Weir	Peak Inflow and depth through Walkway Block
SCS Type II_ 12-hr_100yr	234 L/sec at 79mm depth	234 L/sec at 86mm depth
SCS Type II_ 12-hr_100yr + 20%	± 1,005 L/sec at 220mm depth	± 1,005 L/sec at 180mm depth

For the emergency overflow, it is again proposed to use a reinforced mat which consist of Terrafix Flexmat. For the walkway block, estimated 100-yr and 100-yr +20% velocities of 0.80 m/sec and 1.1 m/sec would be anticipated, therefore the typical bluegrass mixture having permissible velocities of 1.8 m/sec for erosion resistant soils would be acceptable.

It should be noted that there will be no overflow from the dry pond

8.16.1 Review Roadway Ponding Depths

The City of Ottawa SDG002 requires that maximum ponding depths for local roadways is 350 mm at the edge of pavement (curb line), and that the water elevations in the 100-yr +20% (stress test) must not touch any part of the building envelop. Also, there must be 15cm of clearance from the spill elevation on the street and the building envelope.

There are seven (7) surface ponding areas and fifteen (15) catchbasins within the right-of-way. All catchbasins used at these ponding locations have separate inlet control devices (ICDs) to control runoff. As a result, ponding will occur in storm events greater than the 2-year event. **Table 8-15** below summarizes the 100-year and 100-yr +20% (stress test) depths. All depths are within the allowable depth of 35cm as required in the SDG002. The depths and HGLs below are provided for the 3hr Chicago storm.

Table 8-15 : Review of Roadway Ponding Depths

Catchbasin Number	Rim Elevation (m)	100-year HGL (m)	100-year+20% HGL (m)	[1]100-year Ponding Depth (m)	[1]100yr+20% Ponding Depth (m)
CB03	119.96	120.09	120.11	0.13	0.15
CB04	119.96	120.05	120.07	0.09	0.11
CB09	118.79	118.91	118.93	0.12	0.14
CB10	118.79	118.92	118.95	0.13	0.16
CB11	118.65	118.79	118.81	0.13	0.15
CB12	118.65	118.77	118.81	0.12	0.16
CB13	118.51	118.64	118.66	0.13	0.15
CB14	118.51	118.69	118.73	0.17	0.22
CB15	118.50	118.60	118.66	0.10	0.15
CB16	118.40	118.53	118.55	0.13	0.15
CB17	118.44	118.59	118.61	0.14	0.17
CB18	117.90	118.18	118.23	0.27	0.33
CB19	117.90	118.17	118.23	0.27	0.33
CB24	119.23	119.44	119.40	0.21	0.17
CB25	119.23	119.29	119.30	0.06	0.07

Notes:
1) A negative value indicates that the water surface is below the lid

8.16.2 Rear Yard Swales

The rear yard swales that located in the rear yards of the residential lots were included in the PCSWMM model. The rear yard catchbasins were modelled as STORAGE nodes, with major system channels included. The major system channels were defined as irregular conduits with 3:1 sideslopes having maximum depth of 300mm. As required by the SDG002 guidelines, stormwater storage is not to be accounted for, however only major system channels (or swales) were included connecting each rear yard catch basin which was routed to outfalls. Inlet Control Devices (ICDs) were included in roadway storm manholes as per City detail S29. During major storm event runoff would upheave through the structure's lid and then be conveyed downstream to the next inlet. Channel slopes were adjusted to 1.5% consistent with City guidelines by using user-defined lengths to ensure 1.5% channel slopes.

Two different swale cross sections were used to ensure that major system flows were conveyed downstream, and that depth of flow was minimized. Channel depths in the 100-yr and 100-yr +20% storms are summarized in **Table 8-16** below.

Table 8-16 : Review of Rear Yard Swale Capacities

CB → CB	Conduit No.	Location	Swale Type	[1]100-year Depth (m)	[1]100yr+20% Depth (m)
CB77 → CB79	C92	Lots B13 → B10	#2	0.10	0.12
CB79 → Kimpton Dr	C93	Lots B9 → B07 → Kimpton Dr	#2	0.11	0.13
CB83 → CB87	C90	Blocks 32 → 33 → 42	#1	0.13	0.14
CB87 → CB57	C91	Block 43	#1	0.16	0.18
CB57 → Dry Pond	C34_1	Blocks 44 → 45 → 46	#1	0.17	0.19
B51 → CB122	C94_1	Block 23 → Street 2	#1	0.10	0.11
CB60 → MH42	C23	Block 37 → Street 3	#1	0.12	0.14
CB58 → MH41	C01	Block 41 → Street 2	#1	0.11	0.12

Notes
Rear yard Swale #1 is 2m wide, 3:1 side slopes, bottom width = 0m, Max depth 0.33m
Rear yard Swale #2 is 3m wide, 3:1 side slopes, bottom width = 1.0m, Max depth 0.33m
The 100-yr depths are indicated for the 3hr Chicago Storm

From the results of **Table 8-16** the maximum depths in the rear yard swales is 0.17m (100-yr) or 0.19 m (100-yr +20%) which occurs in behind Blocks 44 → 45 → 46. Therefore, an additional 150mm height for the adjacent retaining wall is proposed.

8.17 Peak Flows at Outfalls

The flowing table summarizes the peak flows at each outfall location. Four outfall locations were added to the PCSWMM model to estimate runoff at critical locations. Three major system outfalls and one (1) minor system outfall were included in the model. The following summarizes the outfall locations used.

<u>Major System Outfall at Kimpton</u>

This outfall was added to provide peak flows resulting from overland flow leaving the subdivision to Kimpton Drive. This includes overland flow that is directed towards the subdivision from the rear of lots on Lloydalex Crescent. Runoff from this external area will be captured at the 2year rate into rear yard swales and infiltration trenches with the remain runoff directed to Kimpton Drive

<u>Major System Outfall at Samantha Eastop</u>

This outfall was included to determine the peak flows and volumes resulting from overland flow from the rear of six single family lots (B01-B06). This includes the major system flow during storm events greater than the 2yr storm.

<u>Major System Outfall at Bandelier Way</u>

This outfall was included to review the capacity of the overland flow channel (walkway block) in the event of the stormwater pond overflow. A separate OUTFALL from the minor system outfall (noted below) was added as PCSMMM will not allow two connections into a outfall node.

<u>Minor System Outfall at Bandelier Way</u>

This outfall was required to confirm that the peak flows meet the design criteria during various storm events.

Table 8-17 : Peak Flows at Outfalls

Storm Event	Peak Flow in L/sec and Runoff Volumes (m^3) at Outfall Locations							
	Outfall #1		Outfall #2		Outfall #3		Outfall #4	
	OF_Kimpton		OF_Samantha		OF_Bandlier_Major		STM106286	
	Kimpton Dr Major System		Samantha Eastop Major System		Bandelier Way Major System		Bandelier Way Minor System	
Chicago_3h_5mm	0.0	(0)	1.3	(2)	0.0	(0)	1.6	(168)
Chicago_3h_15mm	0.0	(0)	3.9	(5)	0.0	(0)	12.5	(701)
Chicago_3h_2yr	0.0	(0)	8.9	(12)	0.0	(0)	46.2	(1600)
Chicago_3h_5yr	77.5	(21)	16.1	(18)	0.0	(0)	154.6	(2440)
Chicago_3h_100yr	351.9	(212)	68.2	(50)	0.0	(0)	513.9	(4950)
Chicago_3h_100yr + 20%	490.7	(333)	92.7	(70)	0.0	(0)	614.7	(6120)
Historic_Jul1-79	328.4	(186)	57.2	(47)	0.0	(0)	589.4	(5580)
Historic_Aug4-88	130.4	(110)	21.4	(37)	0.0	(0)	450.0	(4930)
Historic_Aug8-96	219.2	(253)	31.0	(49)	0.0	(0)	635.4	(6040)
SCS Type II_ 12-hr_2yr	8.6	(1)	8.1	(17)	0.0	(0)	82.5	(2280)
SCS Type II_ 12-hr_5yr	72.5	(38)	15.1	(25)	0.0	(0)	289.1	(3410)
SCS Type II_ 12-hr_100yr	319.0	(237)	58.5	(60)	0.0	(0)	590.3	(6370)
SCS Type II_ 12-hr_100yr + 20%	430.6	(346)	79.0	(81)	0.0	(0)	683.1	(7780)

8.18 Low Impact Design

For Criteria #2, the Feedmill Creek Stormwater Management Study requires that LID controls be implemented to retain the volume from a 3-hr 5mm rainfall event. There are various LID methods available, however the most appropriate and currently used method in the City of Ottawa is the infiltration trench and swale. Modifications to the typical trench will be necessary to ensure that the runoff is retained and infiltrated, prior to being captured at inlets.

The peak flow and total runoff volume that occurs during the 5mm storm event is 159 L/sec and 200 m3 over the entire site. To provide the appropriate volume for infiltration, perforated pipes will be utilized in the rear-yards. However, for a typical residential subdivision, only a portion of the rainfall and resultant runoff will be directed towards the rear yards. The following table summarizes the approximate proportion of subcatchments that flow towards varying outlets.

Table 8-18 : 3-hour 5mm Peak Flows and Runoff Volumes by Location

Storm Event	Area in hectares (% of Total)		Peak Flow in L/sec (% of Total)		Runoff Volume in m^3 (% of Total)	
Backyards	1.971	19%	0.0	0%	0.0	0%
Front yards / ROWs	3.917	37%	92.0	64%	110.7	65%
Park	0.821	8%	0.0	0%	0.0	0%
SWM	0.396	4%	1.0	1%	1.2	1%
Site plan 1	0.507	5%	11.4	8%	13.4	8%
Site plan 2	1.392	13%	24.0	17%	26.9	16%
Subtotal (9.0-ha site)	9.004		128.4		152.2	

External	1.475	14%	15.2	11%	17.7	10%
Totals (9.0-ha site + external)	10.479	100%	143.6	100%	169.9	100%

The majority or (64%) of the runoff volume occurring during the 5mm storm event would necessitate the infiltration within the right-of way using BMP source controls. It is therefore proposed to incorporate a sand filter at the dry pond. **Figure A8b** – Low Impact Development Area Plan (Front Yards)

Figure A9 illustrates the areas where infiltration trenches will be used and **Figure A8** illustrates the areas and level of imperviousness for each. The 5mm rainfall volume for the entire site is estimated below. This represents the total rainfall prior to depression storage and/or infiltration.

5mm Rainfall Volume = A * 5mm * 10 m3/ha*mm
= 9.02 ha * 5mm * 10 m3/ha*mm
= 451 m3

The 5mm runoff volume considers the subtraction of depression storage for pervious surfaces (4.67mm) and impervious surfaces (1.67mm) based on the area and level of impervious. The runoff volume for the entire 9.0-hectare site area based on an average site imperviousness of 54% (0.54 as fraction) is estimated as follows:

5mm Runoff Volume, V_5 = ((IMP/100)*A*(R-1.57) + (100-IMP)/100*A*(R-4.67)) * 10 m3/ha*mm

where:

V_5 = Runoff volume (m3)
R = Rainfall (5 mm)
A = Area (9.02 ha)
IMP = Impervious (54.0%)

5mm Runoff Volume, V_5 = (%IMP * A * (5mm - 1.57mm) + A * (100 - %IMP) *(5mm – 4.67mm)) * 10 m3/ha*mm
= (%IMP * 9.02 * (5mm - 1.57mm) + 9.02 * (100 - %IMP) *(5mm – 4.67mm)) * 10 m3/ha*mm
= (0.54 * 9.02 * (5mm - 1.57mm) + 9.02 * (1 – 0.54) *(5mm – 4.67mm)) * 10 m3/ha*mm
= 181 m3

This volume of 181 m3 corelates well with the 5mm volume noted in the first row of **Table 8-10** which is 211 m3. The volume is slightly higher since it also includes the runoff from the external areas west of the subject site. The proposed Infiltration galleries within the subject property should not include upstream drainage areas.

8.18.1 Proposed Low Impact Development in Rear Yards

To estimate the 5mm runoff volumes for rear yard and right-of-way areas, PCSWMM was used to automatically estimate the runoff volumes based on areas to each dry swale LID galley. Again, this was done with area-weighting in PCSWMM. **Figure A8** illustrates the LID areas with their corresponding area and level of imperviousness. It is proposed to use a dry swale which consists of 50mm clear stone, surrounding a 250mm perforated pipes and filter media in the rear yards.

As per the TRCA LDSMPDM, dry swales are simply enhanced grass swales that include an engineered soil (or filter media) and an optional underdrain. Underdrains are specified when the surrounding soil has an infiltrate rate of less than 15 mm/hr. As the native soil is not specifically conducive to infiltration, the use of the perforated underdrain with the engineering soil will be used for this application. It will be necessary to modify the City of Ottawa S29 detail to include an upper soil layer above the perforated pipe. As noted in the TRCA guidelines a minimum 500mm of milter media is recommended.

For all subcatchment areas that incorporate these rear yard swales, the minimum volume required for 5mm retention is based on the equation in the previous section, which is:

V_{5mm} = ((IMP/100) *A*(R-1.57) + (100-IMP)/100*A*(R-4.67)) * 10 m3/ha*mm

where:

V_{5mm}	=	5mm Runoff volume (m3)
A	=	Area (2.61 ha for all rear yard areas)
IMP	=	Impervious (42.3%)

5mm Runoff Volume, V_5 = (%IMP * 2.61 * (5mm - 1.57mm) + 2.61 * (100 - %IMP) *(5mm – 4.67mm)) * 10 m3/ha*mm
= 41.7 m3

The area required to retain the 5mm runoff volume in each area was calculated using the equation below.

A = 1000 * V / (P * n * t)

where:

n	=	Porosity of storage media (0.40 used)
A	=	Bottom area of trench in m2
P	=	percolation rate of filter media in mm/hr (10mm/hr used)
t	=	retention time (24 – 48 hrs. 24 hrs. used)

A = 1000*41.7 / (10* 0.40*24) = 434 m2

For rear yard area, 250mm perforated pipes (as per City detail S29) will be used, however at each outlet catchbasin a raised outlet will be used to promote infiltration of the 5mm storm. The raised outlet is set 600mm above the invert of the perforated pipe. The following summarizes the LIDs proposed for the rearyard areas.

<u>LID Galleries in rear yards</u>

- Total area required for retention of 5mm volume = 434 m^2
- Dry swale trench width = 0.85 m.
- Total area of trenches provided = 934.3 m^2

Table 8-19 below provides total 5mm retention volumes and infiltration trench areas requirements for the rear yard areas. This is based on trenches set on soil having minimum design infiltration rates of 10 mm/hr. In summary the total infiltration area required for the LIDs in the rear yards is ±434 m^2 with ± 934 m^2 provided. These results are highlighted below in each table.

Table 8-19 : Low Impact Development Areas in Rear Yards

Area Name	Condition	Drainage Area (ha)	IMP (%)	5mm Runoff Volume (m3)	Trench Area Required for Full Infiltration (m^2)	Provided		
						Total Length of Trench (m)	Trench Width (m)	Trench Area (m2)
RY-01	PONDING	0.1281	18.9	1.2	12.5	14.7	0.85	91.3
RY-02	PONDING	0.0883	12.0	0.6	6.2	7.3	0.85	35.9
RY-03	PONDING	0.1574	42.5	2.6	27.1	31.9	0.85	62.4
RY-04	PONDING	0.0915	45.0	1.6	16.7	19.6	0.85	47.3

RY-05	PONDING	0.1295	33.3	1.8	18.8	22.1	0.85	42.2
RY-06	PONDING	0.1583	46.4	2.8	29.2	34.4	0.85	39
RY-07	PONDING	0.1802	42.9	3	31.2	36.7	0.85	95.9
RY-08	PONDING	0.2814	32.0	3.7	38.5	45.3	0.85	120.9
RY-09	PONDING	0.1309	47.2	2.3	24	28.2	0.85	85.4
RY-10	PONDING	0.3008	46.7	5.3	55.2	64.9	0.85	44.6
RY-11	PONDING	0.3248	44.0	5.5	57.3	67.4	0.85	44.8
RY-12	FLOWBY	0.0704	47.0	1.3	13.5	15.9	0.85	75.7
RY-13	FLOWBY	0.5656	52.5	11.1	115.6	136	0.85	148.9
Total		2.6072	AVG=42.3%	42.8	445.8	524.4		934.3

In addition to providing the appropriate area for infiltration of the 5mm volume, the total estimated volume within the subsurface infiltration trenches was completed to ensure that subsurface trenches can contain the stormwater volumes prior to exfiltrating to surrounding soil. The following summarizes the volumes available at each location.

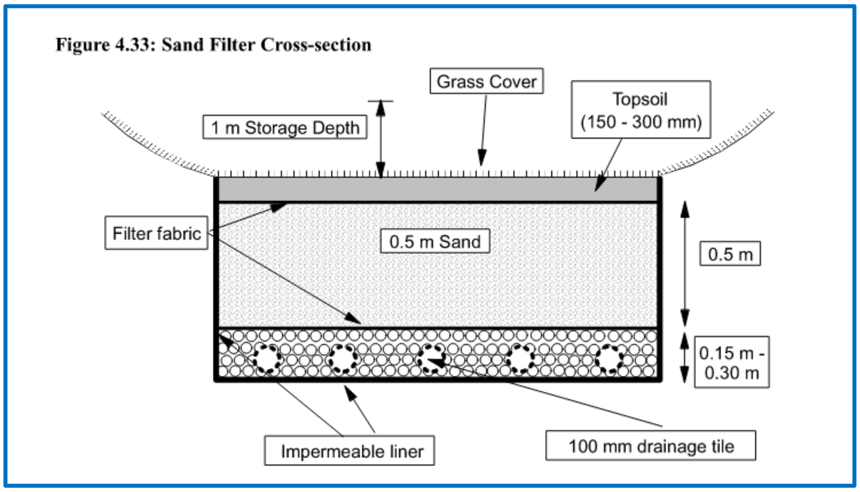
<u>LID Galleries in Rear Yards</u>

- Total Length of subsurface infiltration trenches = 445.8 m of 250mm pipe
- Infiltration trench width = 0.85m
- Infiltration trench height = 0.3m below invert and 0.60m total
- Void ratio of stone = 0.40
- Total volume available for Infiltration of 5mm volume = 45.4 m^3

From above, the total volume available within the infiltration trenches is 45.5 m^3, which represents the volume below the outlets of each LID gallery. This exceeds the 5mm runoff volume of 41.7 m^3.

8.18.2 Proposed Low Impact Development at Dry Pond

Discussions with City staff has confirmed that use of a subsurface exfiltration pipe at the roadways catchbasin within the right-of-way would not be acceptable. The existing in-situ soil conditions is not conducive to this type of infiltration. As a result of this, staff confirmed that a bioretention type utilizing filtration and evaporation (evapotranspiration) would be more suited. It is proposed to utilize a sand filter at the dry pond location rather than within the right-of-way (at source). As per MECP SWPDM guidelines, the use of a sand filter is appropriate for the filtration of stormwater. Below is an excerpt from the SMPDM.



Underdrains are required to capture the runoff which percolates downward through the sand layer. The discharge rate through the sand is dependent on the area of sand filter and the sand's infiltration rate. Equation 4.20 from the guidelines was used to establish the discharge rate and was used in PCSWMM. The volume available in the sand pore space was included in the pond's STORAGE function. **Table E9** provided additional detail on the sand filter storage and infiltration rate.

Based on the total area of sand filters below the pond bottom and the percolation rate of sand, approximately 119 m3 of storage is available at a design infiltration rate of 1.59 L/sec.

Similar to the estimate completed in **Section 8.18.1**, the estimated 5mm runoff volume from all areas that drain to the right-of-way was determined. This accounts for all areas, but exclude rear-yard, park and flat roofs areas where dry swales, bioretention, and rainwater harvesting will be used.

V_{5mm} = ((IMP/100) *A*(R-1.57) + (100-IMP)/100*A*(R-4.67)) * 10 m3/ha*mm

where:

V_{5mm}	=	5mm Runoff volume (m3)
A	=	Area (5.11 ha for all rear yard areas)
IMP	=	Impervious (61.4%)

5mm Runoff Volume, V_5	=	(%IMP * 5.11 * (5mm - 1.57mm) + 2.61 * (100 - %IMP) *(5mm – 4.67mm)) * 10 m3/ha*mm
	=	(0.614 * 5.11 * (5mm - 1.57mm) + 5.11 * (1 – 0.614) *(5mm – 4.67mm)) * 10 m3/ha*mm
	=	114 m3

The estimated 5mm runoff volume from these areas is 114 m3, whereas approximately 119 m3 is available.

8.19 Water Balance

8.19.1 Review of Requirements

Water Balance calculations have been prepared to assist with clarification on the Low Impact Development (LID) strategy proposed for the subject site. This section of the report is prepared in response to an email received on September 9, 2022, from Eric Surprenant of the City of Ottawa.

The 5mm retention criteria is based on recommendations from the Feedmill Creek Stormwater Management Criteria Study (FCSMCS), and an excerpt from Page iii is provided below. The final version of the FCSMCS reviewed three (3) modelling scenarios to arrive at the optimum SWM control strategies for the subwatershed. The scenarios included: Interim, Near Future, and Ultimate (B). The draft version of the report had additional scenarios under Ultimate conditions, however only Scenario B was carried forward to the final report. The site requirements specific to Low Impact Development were for the retention of the 5mm rainfall event.

The SWM criteria are as follows:

1. Extended Detention Control: Provide sufficient on-site storage volume to control the peak flow from a 15 mm 3-hour Chicago design storm to 0.51 L/s/ha.
2. Flood Control: Provide sufficient on-site storage volume and quantity control structure to control the peak flow from a 100-year 12-hour SCS Type II storm to 8.0 L/s/ha[1].
3. Retention Control: Provide on-site Low Impact Development (LID) controls to retain the entire volume (no runoff) from either a 5 mm or 10 mm rainfall depending on location:
    a. 5 mm for catchments located east of Carp Road (FS206_2, FS204, FS203a, FS203b, FS067_4, FS075_1, FS081_2 and FS107); and
    b. 10 mm for catchments located west of Carp Road (FS103_2b and FS104_2b)[2]
4. In-stream works are required in addition to the SWM controls detailed above. A conceptual design has been prepared by Coldwater (2018b)[3].

Screenshot 1 – Excerpt from FCSMCS (page iii)

For the site we are proposing to utilize three (3) low impact development strategies to meet the 5mm retention requirement. The following summaries the LID methods and their locations.

- Bioretention with filtration (pond)
- Rainwater Harvesting (flat roofs)
- Perforated Pipe System (rear yards)

Potential runoff impacts to the existing site were estimated using standard water balance calculations; the Thornthwaite-Mather water balance method, as described in the "Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance, C.W. Thornthwaite and J.R. Mather, 1957", was used to calculate total runoff under pre-development and post-development conditions. Historical precipitation and temperature data from Environment Canada for the Ottawa Station CDA was used to calculate the runoff surplus and total precipitation for the site. **Table F9** through **Table F12** provides months rainfall, snowfall, and total precipitation for Ottawa Statin CDA for years 1998 through 2018. **Table F13** summarizes these results. These results were used in the Thornthwaite-Mather method to establish the Potential Evaporation and Transpiration (evapotranspiration or PET) under pre-development and post development conditions.

Site areas were calculated for existing pre-development conditions based on Google Earth Satellite imagery (2018). Site areas for the conceptual site plan were calculate using PCSWMM, along with percent of pervious and impervious areas for each area. Pre-development site conditions is illustrated in **Figure A3.**

<u>Pre-development conditions were subdivided as follows:</u>

Soil[1]:

- Clay, Hydrologic Soil Group (HSG) D.

Pervious Land[2]:

- Grass;
- Forest; and
- Fill.

<u>Post-development conditions were subdivided as follows:</u>

1 Ontario Ministry of Agriculture, Food and Rural Affairs. (2022). AgMaps Geographic Information Portal. http://omafra.gov.on.ca/english/landuse/gis/portal.htm

2 Google Earth Imagery (2018).

Soils:

- Clay, Hydrologic Soil Group D.

Pervious Land:

- Park;
- Backyard;
- Stormwater management.

Impervious Land:

- Right of way (ROW); and
- Site plan 1
- Site plan 2.

Each of the pervious categories was reviewed based on Table 10 of the Thornthwaite – Mather literature to obtain the applicable soil moisture retention of the underlying soils; a corresponding site-specific soil moisture retention value was obtained. For this case a 75 mm soil moisture retention value was used. These soil moisture retention values are used to determine the soil moisture storage, given the accumulated water losses which are calculated based on the historical climatic data for the site. **Table F1** provides the water balance values for a soil moisture retention value of 75 mm.

8.19.2 Pre-Development and Post-Development Water Budgets

Infiltration factors were chosen based on the *Tier 1 Water Budget and Water Quantity Stress Assessment* (Mississippi-Rideau Source Protection Region, 2009).

Under pre-development conditions, the site slopes are generally under 1.5%, and each of the subdivided areas was assigned a topographic infiltration factor of 0.172 as noted in **Table F2**. The existing site conditions is comprised of areas of clay areas, and variable fill areas with assigned soil infiltration factors of 0.10, and 0.40, respectively. The site is comprised of vegetated areas and aggregate areas, which were assigned land cover infiltration values of 0.10 and 0.05, respectively.

Post-development conditions are expected to have slopes under 1.5% and each subdivided area was assigned a topographic infiltration factor of 0.172. The pervious post-development areas (Park, Stormwater Management, and Backyards) were each assigned soil infiltration factors of 0.10 – the soil classification of the site will not change from pre-development conditions to post-development conditions for pervious areas. The assigned runoff coefficients for each of the pervious areas, the Park; the Stormwater Management Pond; and the Backyards, were assigned runoff coefficients of 0.35; 0.25; and 0.47, respectively. The impervious areas, the Right-of-Way; the Site Plan 1; and the Site Plan 2, were assigned runoff coefficients of 0.70; 0.73, and 0.56, respectively.

Pre-development and post-development water budgets were reviewed both with and without the 5 mm retention criteria

8.19.2.1 Pre-Development and Post-Development Water Budgets - Overall

Table F3 and **Table F4** detail the pre-development and post-development water budgets with no 5 mm retention criteria. This represents the water balance for the annual average precipitation for 1998-2018.

Total runoff under pre-development conditions is 6,357 m^3/year while total runoff under post-development conditions is 3,412 m^3/year. The difference between the post-development runoff and the pre-development runoff is -2,945 m^3/year; under post-development conditions, 2,945 m^3/year of water is being retained on site from the current pre-development conditions.

8.19.2.2 Pre-Development and Post-Development Water Budgets – 5mm

To account for the 5 mm retention criteria, as directed by the FCSMCS, the monthly water balance was recalculated by using 5 mm rainfall event values obtained from Environment Canada, as displayed in **Table F5**. **Table F5** displays the monthly average days with rain for rain volumes greater than or equal to 0.2 mm and rain volumes greater than or equal to 5 mm. The monthly average 5 mm rainfall volume was calculated by subtracting the number of days with rainfall greater than or equal to 0.5 mm from the number of days with rainfall greater than or equal to 0.2 mm and multiplying the difference by 5 mm. The annual average rainfall volume for 5 mm events was calculated by summing the monthly average rainfall volumes. **Table F5** displays the monthly and annual average rainfall volumes for 5 mm events. These precipitation values were used to create a water balance that only accounts for the 5 mm retention criteria. **Table F6** displays the recalculated monthly water balance with a total average annual rainfall of 360 mm. **Table F7** and **Table F8** detail the pre-development and post-development water budgets with 5 mm retention criteria, respectively.

Total runoff under pre-development conditions is 1,652 m^3/year while total runoff under post-development conditions is 835 m^3/year. The difference between the post-development runoff and the pre-development runoff is -817 m^3/year; under post-development conditions, an additional 2,246 m^3/year of water from 5 mm rainfall events will be retained on site from the current pre-development site conditions.

Table 8-20 below summarizes the estimated yearly infiltration depths and yearly runoff volumes that is anticipated under pre-development and post-development conditions

Table 8-20 : Summary of Water Balance Results

Development Condition	Yearly Infiltration (mm/yr)	Yearly Runoff (m3/yr)
Pre- Development	264	6,357
Post Development	310	3,412
Pre – Post difference	+ 46	-2,945
Pre- Development – 5mm	139	1,652
Post Development – 5mm	172	835
Pre – Post difference – 5mm	+ 33	-817

8.19.2.3 Review of Yearly Infiltration Targets

The Carp River Watershed/ Subwatershed Study (2004) was referenced for target infiltration rates for the water balance. The site is located in north of Hazeldean Road which has moderate (104 mm/year) infiltration rate targets. Based on the water budget analysis, under total annual precipitation conditions, the pre-development infiltration rate was 264 mm/year, as noted in **Table 8-20** above. Also, the post-development infiltration rate was 310 mm/yr. An increase of 46 mm/year occurred from pre-development conditions to post-development conditions. The infiltration targets from the Carp River Watershed/ Subwatershed Study were exceeded for the moderate infiltration area.

Under the 5 mm retention criteria, the pre-development infiltration rate was 139 mm/yr. The post-development infiltration rate was 172 mm/yr. An increase of 33 mm/yr occurred from pre-development conditions to post-development conditions. Under the 5 mm retention criteria, the infiltration targets from the Carp River Watershed/ Subwatershed Study were exceeded for the moderate infiltration area.

Based on the water balance analysis, and noted from the results above, there is an anticipated increase in early infiltration rate under post development conditions, as well as a decrease in yearly runoff. In addition, anticipated yearly infiltration rates under post development conditions meet the Carp River Subwatershed requirements of 104 mm/yr

8.20 Hydraulic Grade Line Analysis

A hydraulic grade line (HGL) analysis was completed to confirm the 100-year water surface profile is at least 300mm below the proposed underside of footing elevations of the units. In addition, the HGL of the 100-year plus 20% (stress test event) was completed to ensure that the water surface profile was below the building footings.

Figure 8-6 below illustrates a profile of the main storm sewer along Street 2 from its starting point through the Dry Pond to the outlet on Bandelier Way. Plotted on this figure is the 100-yr and 100yr+20% HGL.

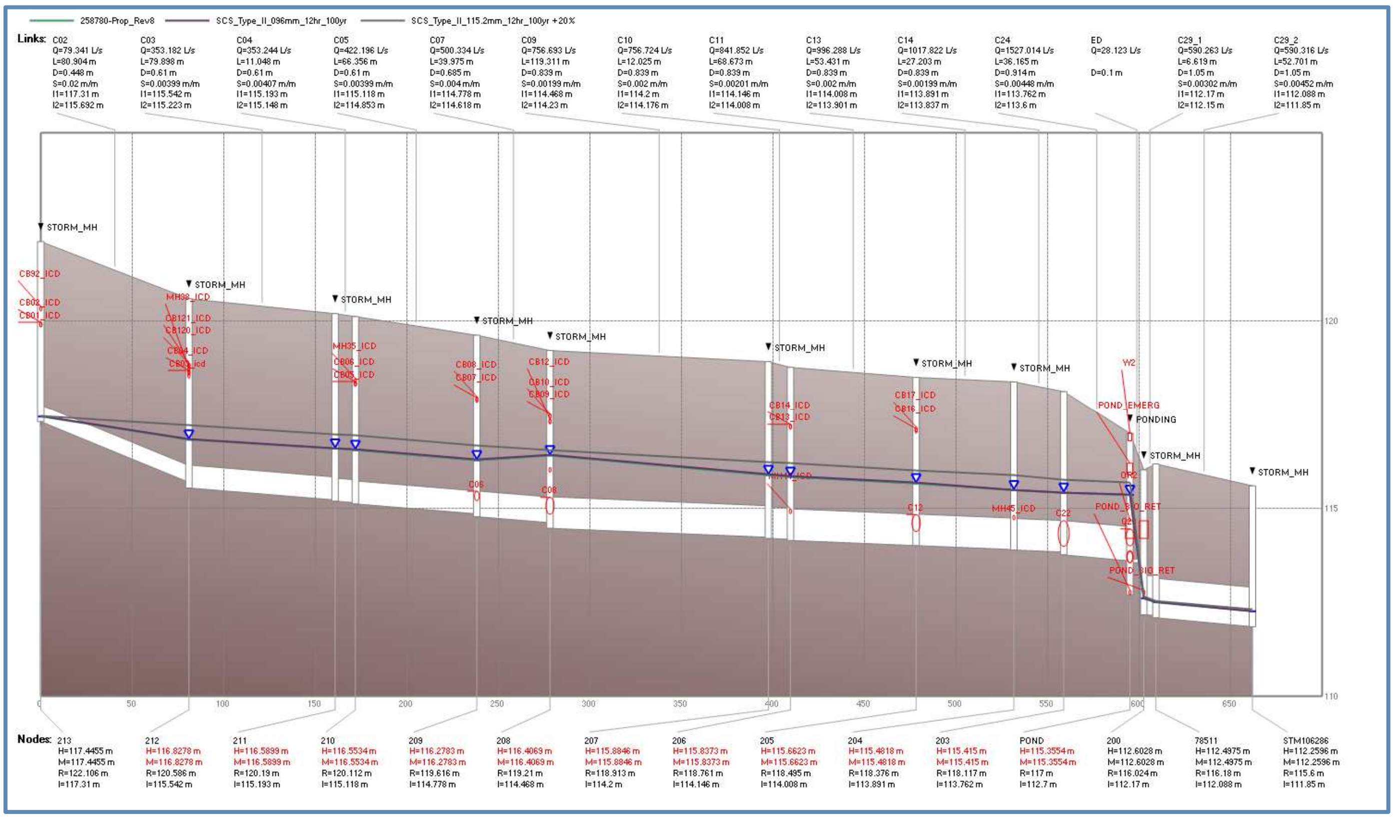


Figure 8-6: Hydraulic Grade Lines of 100-yr and 100yr+20% Storms

Maximum hydraulic grade line (HGL) elevations at each storm sewer manhole during the 100-yr and 100-yr+20% storms were derived in PCSWMM and inputted into **Table E23** . This table compares the 100-yr and 100-yr+20% HGLs by interpolating the distance between manholes to establish the HGL's at each building connection. The HGLs were then compared to the USF elevations for each unit.

Based on this analysis, we can confirm the maximum 100-yr HGL meet the City's clearance requirements. Although the there will be no surcharging of the storm sewer during the 2-yr event, the storm sewer will surcharge and result in the HGL raising above the obvert of the storm sewer system in major events. This is strictly from backwater effect from the downstream dry pond.

The results show that during the 100-yr event the maximum water surface elevations will remain below the underside of footing (USFs) with at least 300mm clearance, and for the 100-year Plus 20%, the HGL is below the USFs.

9 Erosion & Sediment Control

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

- Filter bags shall be installed between the frame and cover of all adjacent catch basins and catch basin manhole structures.
- Light duty silt fencing will be used to control runoff around the construction area. Silt fencing locations are identified on the site grading and erosion control plan.
- A mud mat will be installed at the construction entrance to help avoid mud from being transported to offsite roads.
- Visual inspection shall be completed daily on sediment control barriers and any damage repaired immediately. Care will be taken to prevent damage during construction operations.
- In some cases, barriers may be removed temporarily to accommodate the construction operations. The affected barriers will be reinstated at night when construction is completed.
- Sediment control devices will be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract.
- During the course of construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer.
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) OPSS 805 and City of Ottawa specifications.

10 Conclusions and Recommendations

This Servicing & Stormwater Report outlines the rationale which will be used to service the proposed development. The following summarizes the servicing requirements for the site:

Water

- Domestic water demands of 3.9 L/sec, 9.7 L/sec, and 21.3 L/sec was estimated based on City of Ottawa Guidelines.
- The mixed-use building (Building F – Block 27) will require a double watermain feed as its average day demands exceed 50 m^3/day as per City guidelines.
- The 4-storey residential buildings (Building A through E – Block 47) will NOT require a double watermain feed as their average day demands is under the 50 m^3/day as per City guidelines. Each 4-storey apartment building will sit on top of a single storey underground parking structure. Each building will contain separate metering rooms located in the underground parking structure and each building will have separate 100mm water services. A single 200mm watermain will be used for the sprinkler system servicing the parking structure and each building.
- Required Fire Flows for all buildings based on the Fire Underwriters Survey (FUS) method at between 117 L/sec and 167 L/sec for singles family homes, 167 L/sec for 5-unit townhomes, 167 L/sec for 8-unit townhomes (includes firewalls), 200 L/sec for the Mixed Use (building F), and between 150 L/sec and 200 L/sec for the remaining 4-storey residential units (Buildings A-E).
- A WaterGems hydraulic model was prepared to confirm that adequate pressure / flow is available, based on boundary conditions provided by the City of Ottawa. Peak hour pressures of between 49.1 and 56.4 psi are anticipated. This exceeds the City's guideline of 20 psi.

Sewage

- The estimated peak sewage flows from the proposed site are 15.29 L/sec. Based on the Potter's Key Design Brief, the allocated sewage flow from the 6171 Hazeldean site to the sanitary sewer on Bandelier Way was 11.84 L/sec. Therefore, the proposed site is expected to release an additional 3.45 L/sec, above the previous estimate. A review of the sanitary sewers immediately downstream of the site did not identify any capacity issues to accommodate the additional peak flow.
- 250mm diameter sanitary sewers are proposed with a minimum of 0.30% slope, having a capacity of 33.1 L/sec.

Stormwater

- The peak overland flows were estimated at two outfall locations under pre-development conditions.
- An extended detention control criterion requires that the maximum discharge rate of 0.51 L/ha/sec from development site upstream of the Jackson trails SWM Facility not be exceeded during the 3-hour 15mm storm event. The estimated peak flow and runoff volume from the 3-hr storm 15mmm is 535 L/sec and 710 m3 respectively. The volume necessary to control to the allowable rate of 4.6 L/sec (9.02 ha x 0.51 L/ha/sec) is 679 m3.
- The extended detention orifice was set at the minimum diameter of 100mm. Based on this minimum diameter the estimated drawdown is 22.8 hours, which is slightly below the preferred 24hr requirement. Discussion with City staff confirmed that they would accept the use of the minimum 100mm diameter.
- Runoff volume control is necessary to retain the volume from a 3-hr 5mm rainfall event. This will be achieved using Low impact Development (LID) methods. The peak flow and total runoff volume that occurs during the 5mm storm event is 144 L/sec and ±170 m3 over the entire site. Within the backyards an infiltration trench and swale will be used. Approximately ±43 m^3 of necessary runoff volume can be infiltrated in rear yard swales. The remaining 127 m3 will be achieved using evapotranspiration and filtration at the dry pond.
- A comparison of the pre-development and post-development peak flows during the 3-hr 5mm event indicates that a reduction of peak flows and runoff volumes will result. The 5mm pre-development flow areas estimated at 16.1+9.2 = 25.3 L/sec whereas under post-development conditions will be controlled to 1.6 L/sec with the use of LID features in the dry pond (sand filter), bioretention in the park, and rainwater harvesting for the flat roofs within the two site plan areas.

- The roofs of the five (5) 4-storey buildings in Block 47, will have flow-controlled roof drains to control runoff for up to the 100-year event. Modelling of each roof was based on 4-drains in OPEN position with maximum discharge rate of 7.6 L/sec at 150mm depth. The retention of the 5mm runoff volume of these roof is required. Cistern(s) will be utilized to capture a minimum of the 5mm runoff. Since each roof is ± 1,036 m2, the estimated 5mm runoff volume is 3.8 m3 per roof or 18.9 m3 for all five roofs. The cistern will be located within the underground parking level.
- The roof of the 9-storey buildings in Block 27, will have flow-controlled roof drains to control runoff for up to the 100-year event. Modelling of this roof was based on 10-drains in OPEN position with maximum discharge rate of 18.9 L/sec at 150mm depth. Like above, the retention of the 5mm runoff volume is required. A cistern will be utilized to capture a minimum of the 5mm runoff. The roof area is ± 1,980 m2, the estimated 5mm runoff volume is 7.8 m3. The cistern will be located within the underground parking level.
- The flood control criteria require that onsite storage be provided to control peak flows from the storm 100-yr 12hr SCS storm to 70 L/ha/sec. Both the 3hr Chicago and 12hr SCS storms were analyzed to result in peak flows (and volumes) of 4,389 L/sec (5,208 m3) and 3,952 L/sec (6,662 m3), respectively. The volumes required to control to the 630.2 L/sec (9.02 ha*70 L/ha/sec) is 3319 m3 for the 3hr Chicago storm or 3,668 m3 for the 12hr SCS storm. A downstream stormwater facility (dry pond) will be used in conjunction with roadway ponding.
- A dry pond is proposed having a bottom elevation of 113.45m and top elevation of 116.15m. The dry ponds maximum available volume is 4,564m3 at its emergency spill elevation of 115.9m, and 5,195m3 at the top of pond elevation of 116.15m. An emergency spill weir (4m wide) and set at 115.9m will ensure runoff will overflow towards the existing and adjacent walkway block. The dry pond will have 3:1 side slopes and include concrete inlet and an outlet control structure. The outlet structure will contain two (2) orifices for flow control. A 100mm diameter round and 460mm x 470mm rectangular weir will be used to control runoff to the allowable rate during the 100-yr SSC storm.
- A sand filter will be used at the dry pond, which will consist of ± 680 m2 of sand filter trenches. The sand filter will have a total depth of 700mm below the pond bottom.
- The storm sewer was sized based on the Rational Method and Manning's Equation under free flow conditions for the 2-year storm using a 10-minute inlet time. Inlet control devices will be used in all catch basins, with the some of roadway catch basins requiring interconnect catch basins. Capture rates at low points (trap lows) are set to the 2-year runoff rate to ensure no surface ponding.

11 Legal Notification

This report was prepared by EXP Services Inc. for the account of 11654128 Canada Inc.

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

Appendix A – Figures

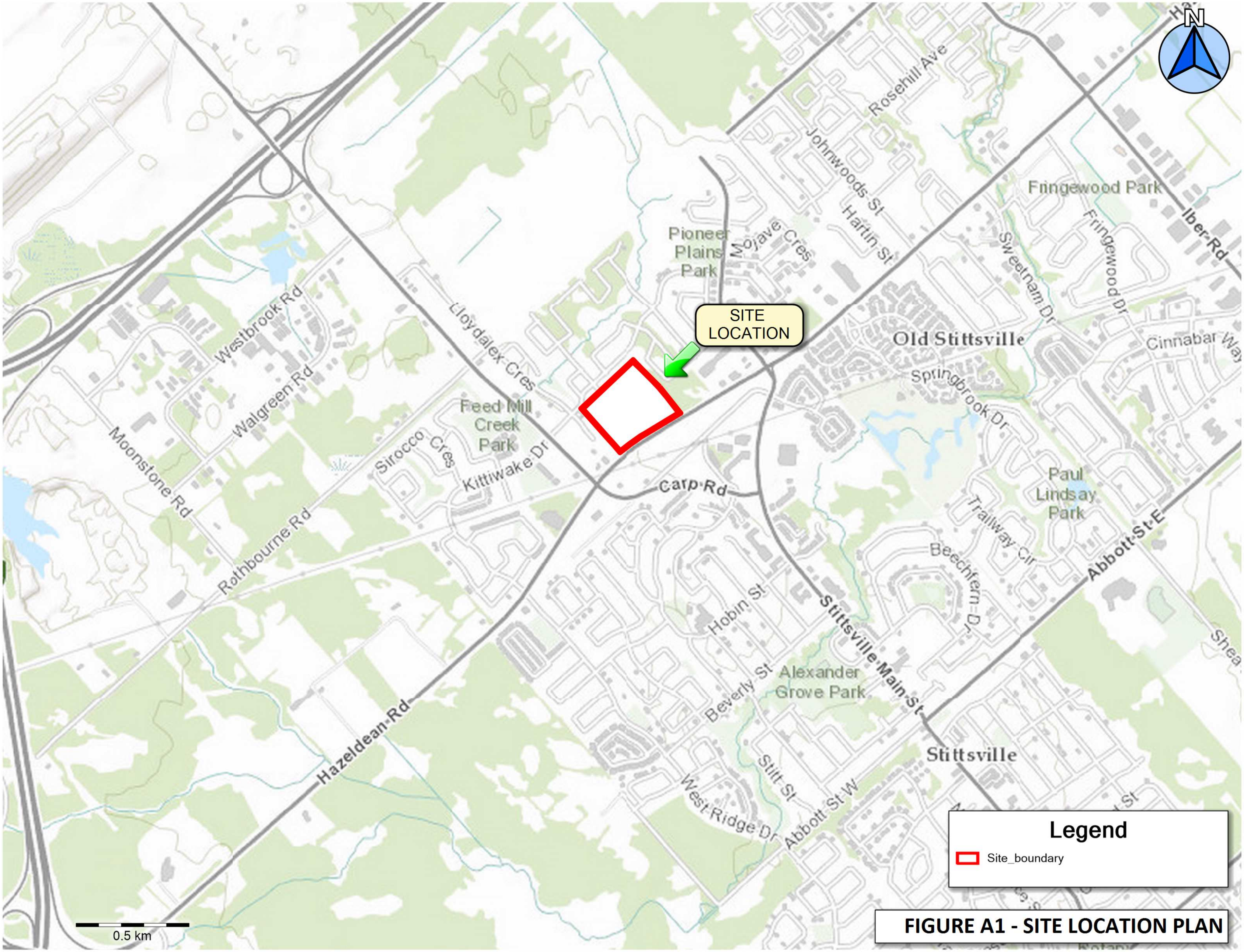


FIGURE A1 - SITE LOCATION PLAN

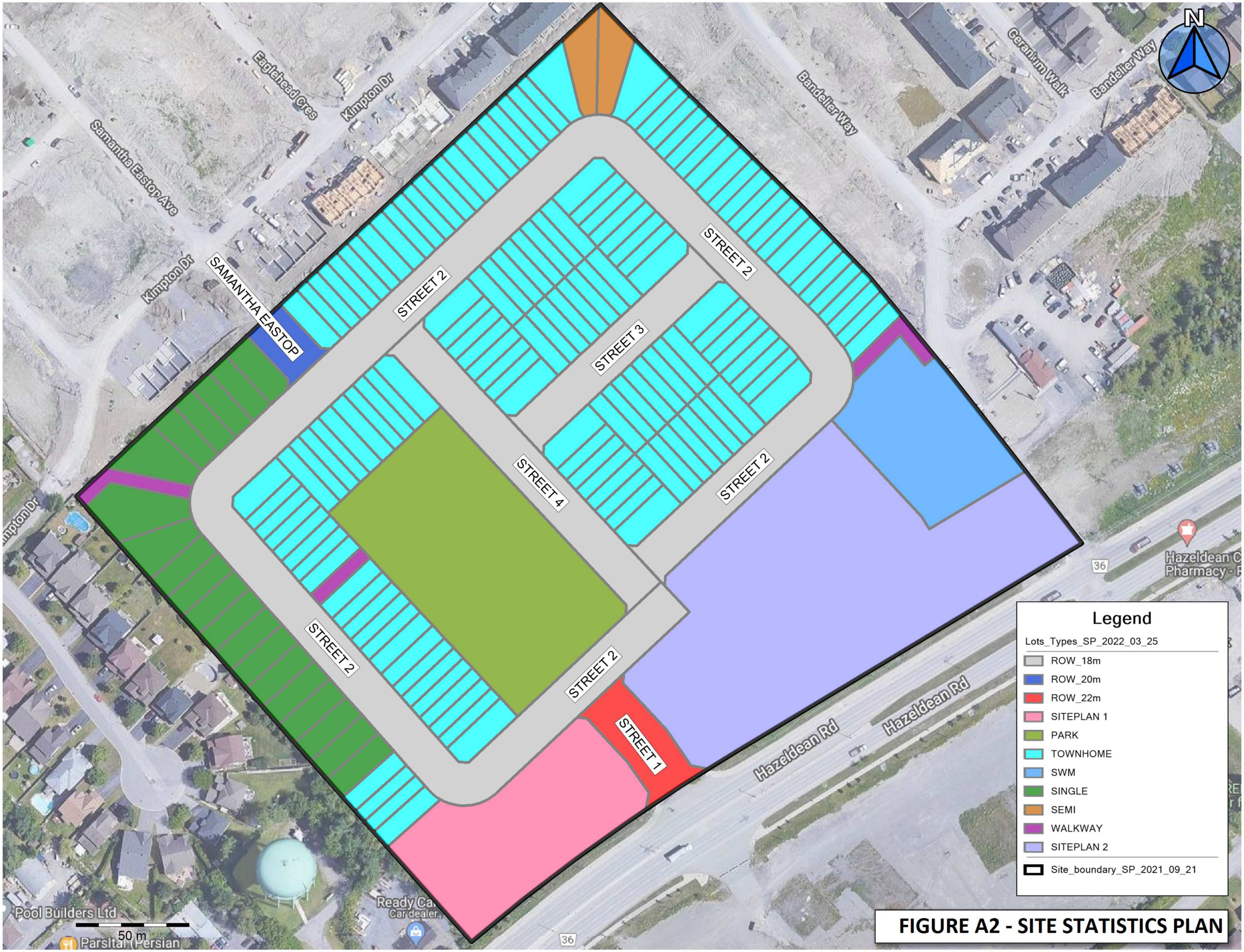


FIGURE A2 - SITE STATISTICS PLAN

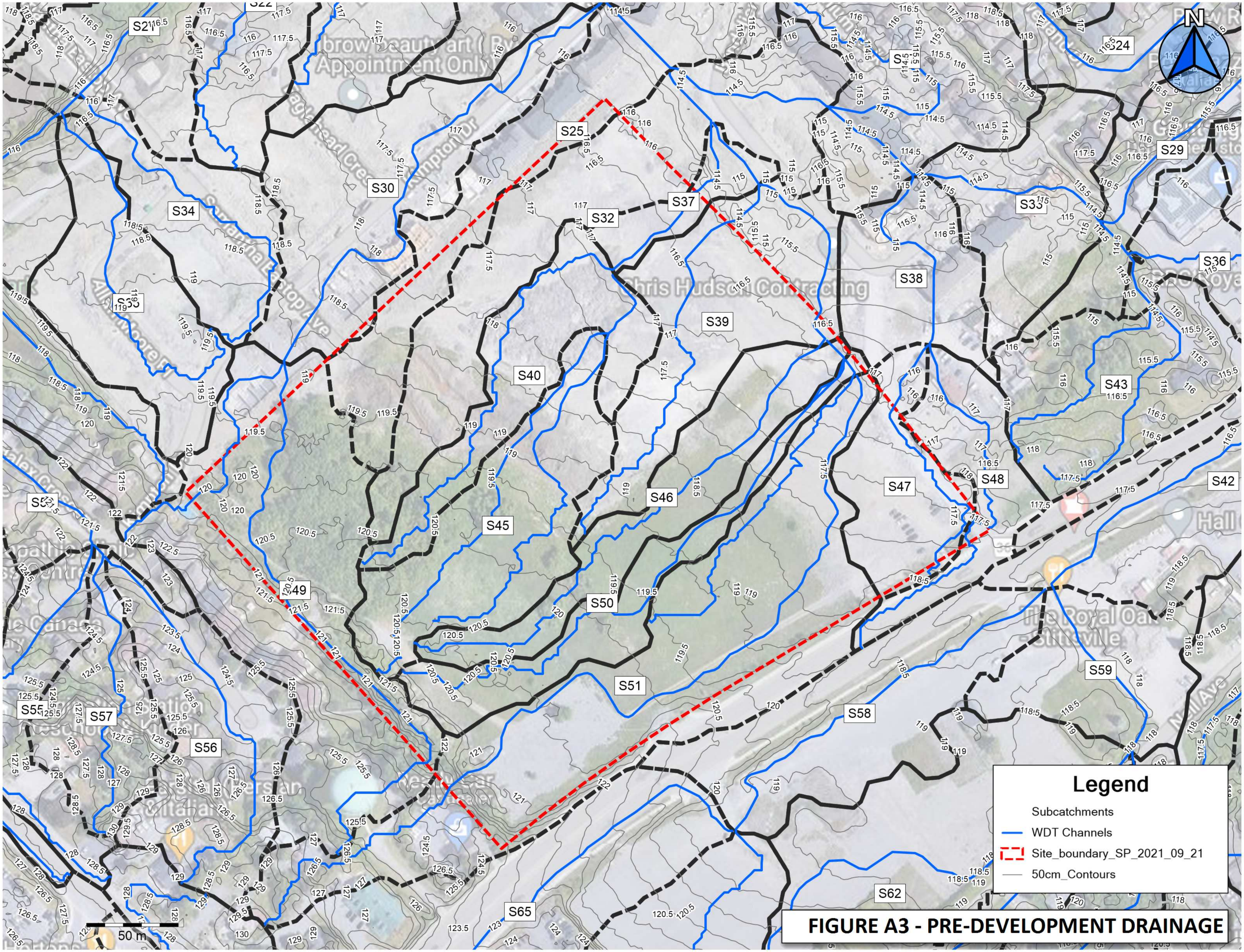
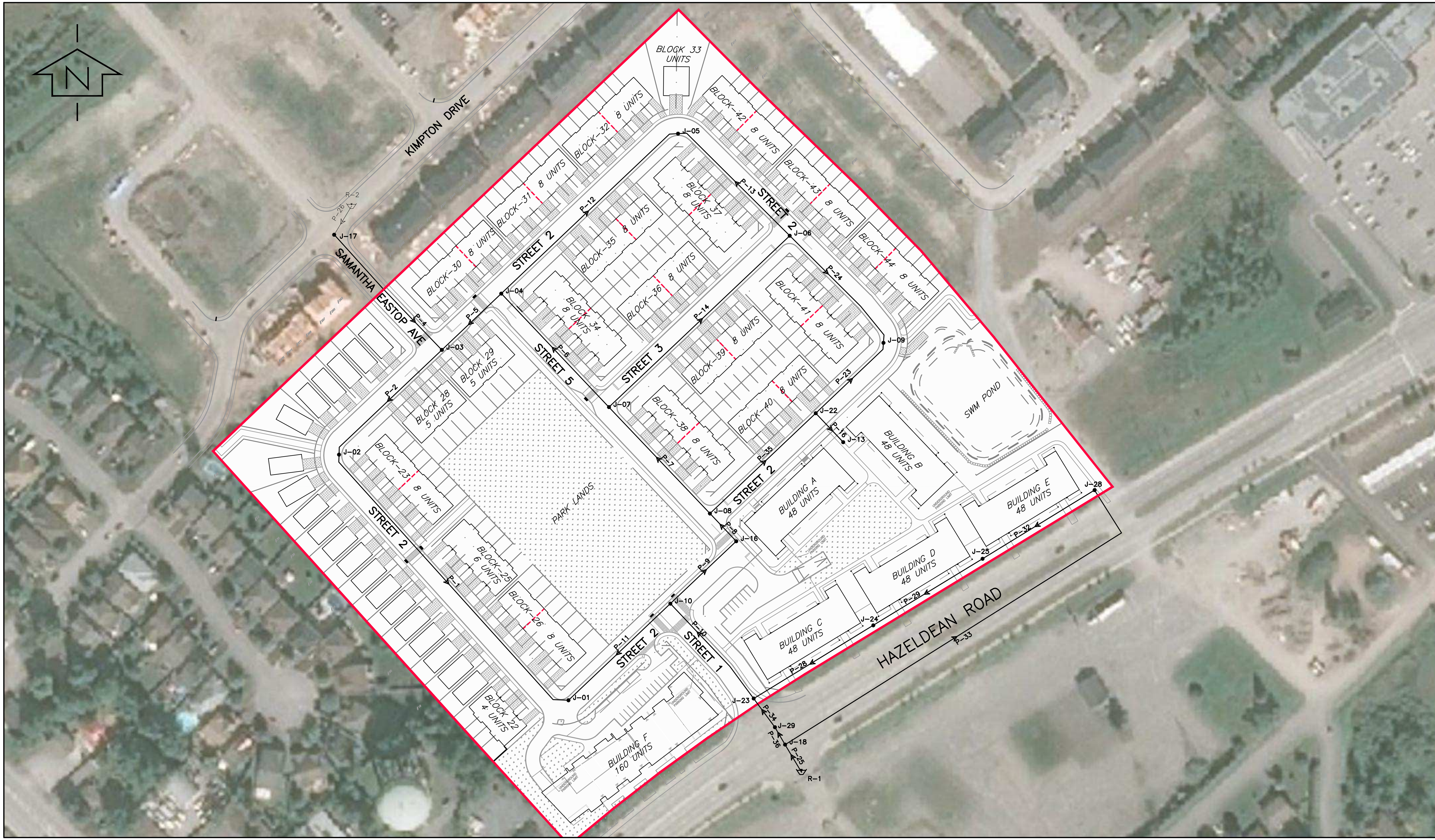


FIGURE A3 - PRE-DEVELOPMENT DRAINAGE

FIGURE A3b - PRE-DEVELOPMENT DRAINAGE AREA PLAN



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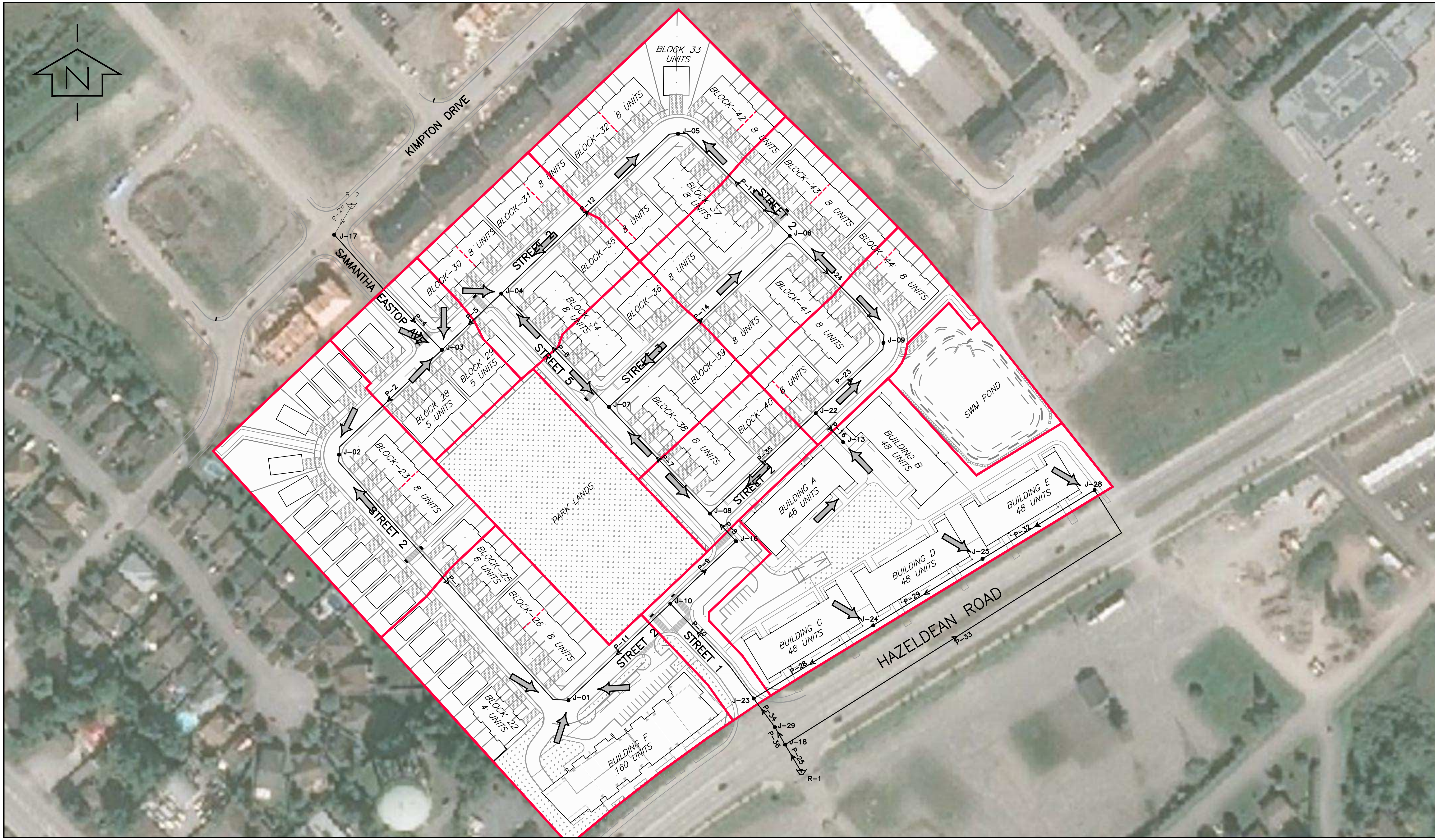
LEGEND

- J-100 / P-100: JUNCTION NODE & I.D. / PROPOSED PIPE & I.D.
- FIRE WALL (2HR)

DESIGN	JLF	6171 HAZELDEAN ROAD	SCALE 1:1750
DRAWN	SAB		FIGURE NO
DATE	APR 2022	WATER DISTRIBUTION PLAN	FIG A4
FILE NO	258780		



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LEGEND

Symbol	Description
J-100 / P-100	JUNCTION NODE & I.D. / PROPOSED PIPE & I.D.
red dashed line	FIRE WALL (2HR)
arrow	DEMAND ALLOCATION DIRECTION
red line	LIMIT OF ALLOCATION AREA

DESIGN	JLF	6171 HAZELDEAN ROAD	SCALE 1:1750
DRAWN	SAB		FIGURE NO
DATE	APR 2022	DEMAND ALLOCATION PLAN	FIG A5
FILE NO	258780		

FIGURE A6 - SUBCATCHMENTS

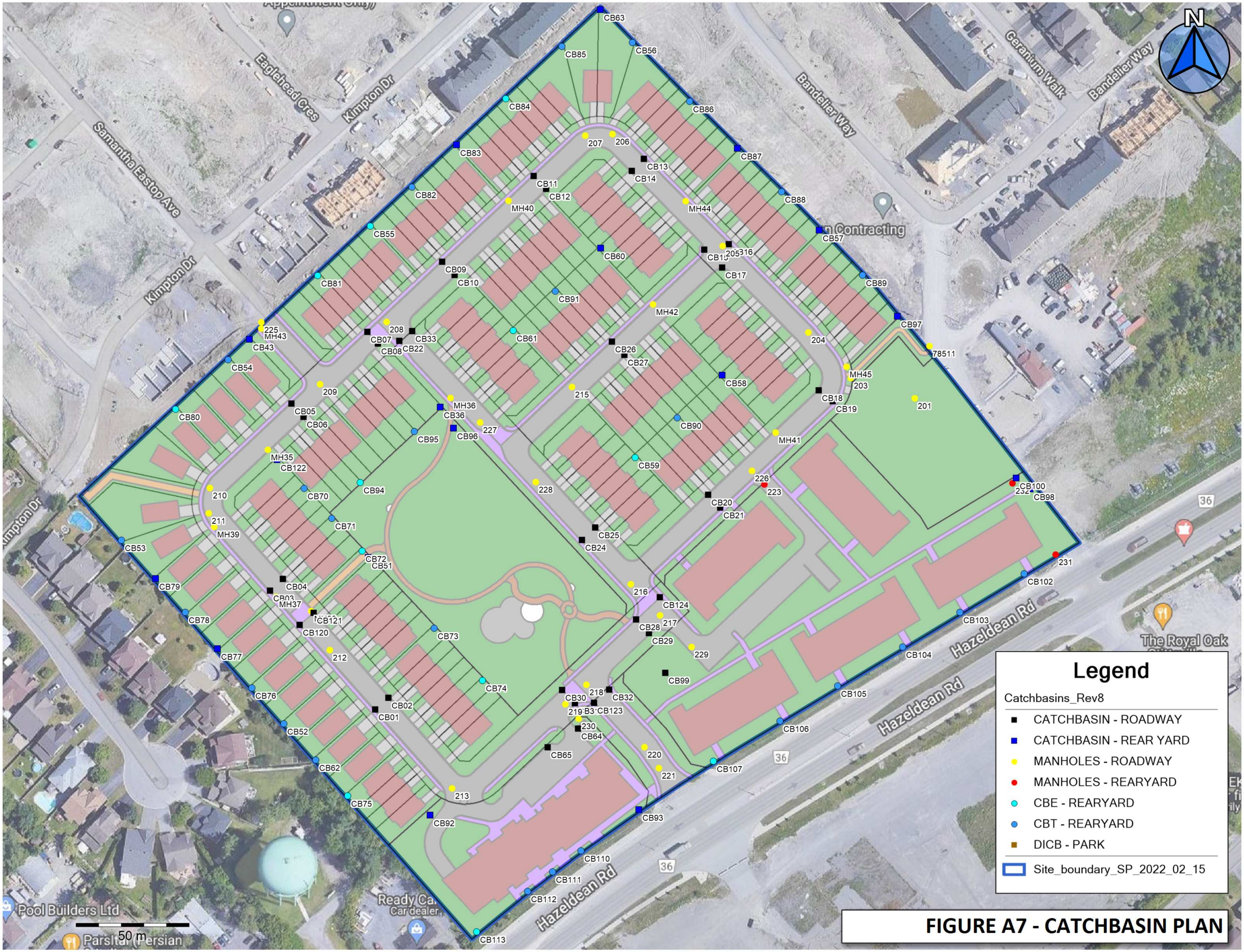


FIGURE A7 - CATCHBASIN PLAN

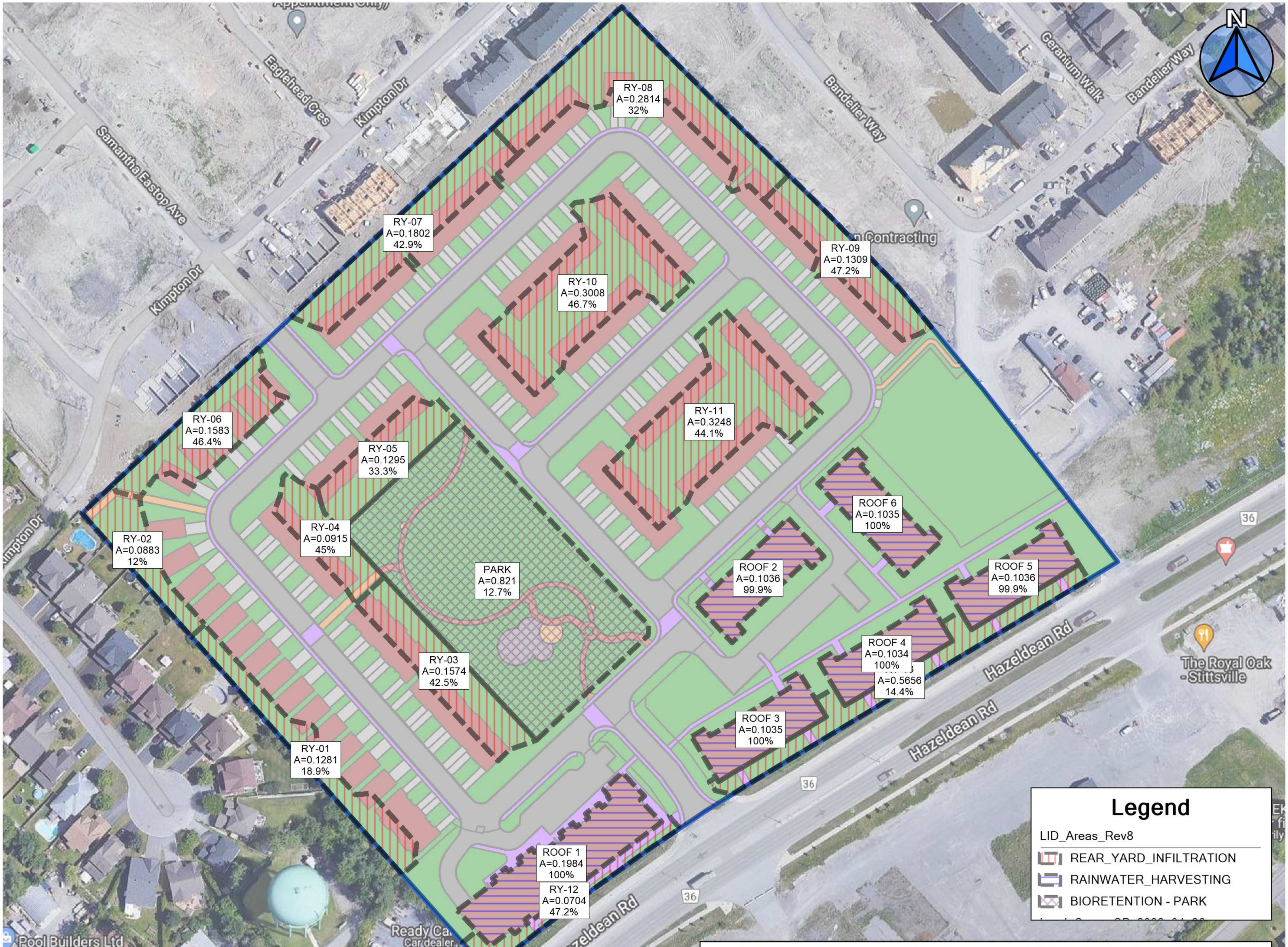


FIGURE A8 - LOW IMPACT DEVELOPMENT AREA PLAN

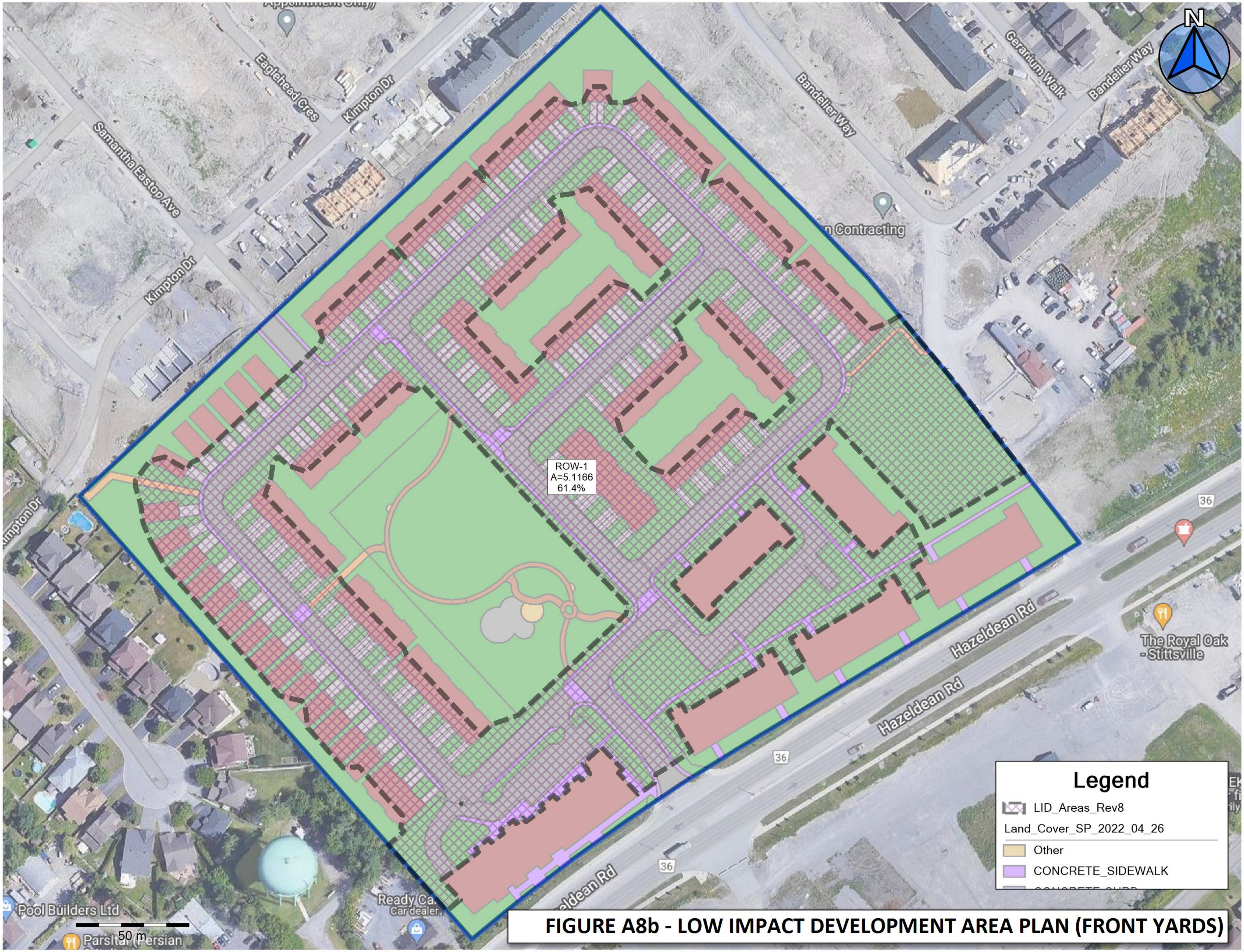


FIGURE A8b - LOW IMPACT DEVELOPMENT AREA PLAN (FRONT YARDS)

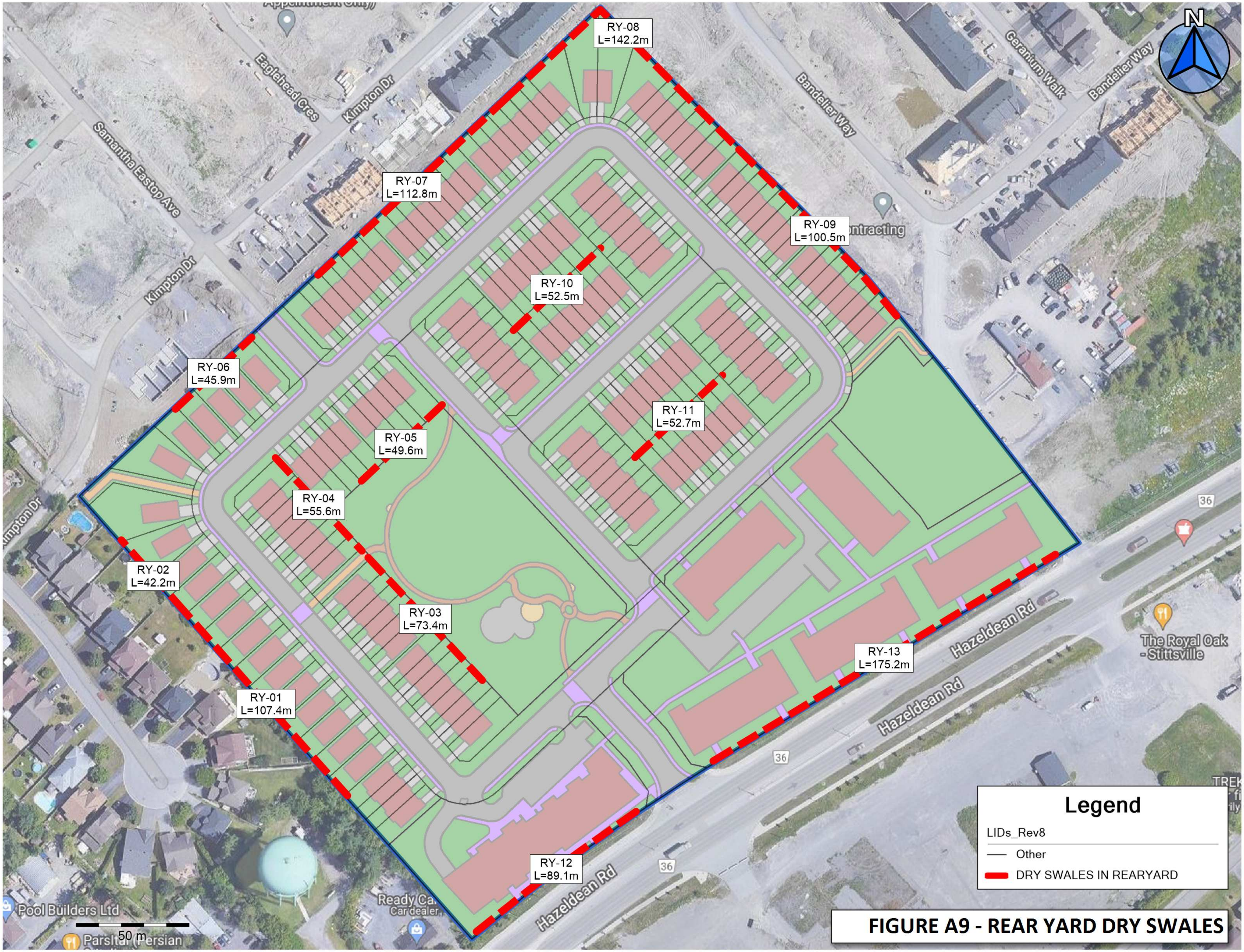
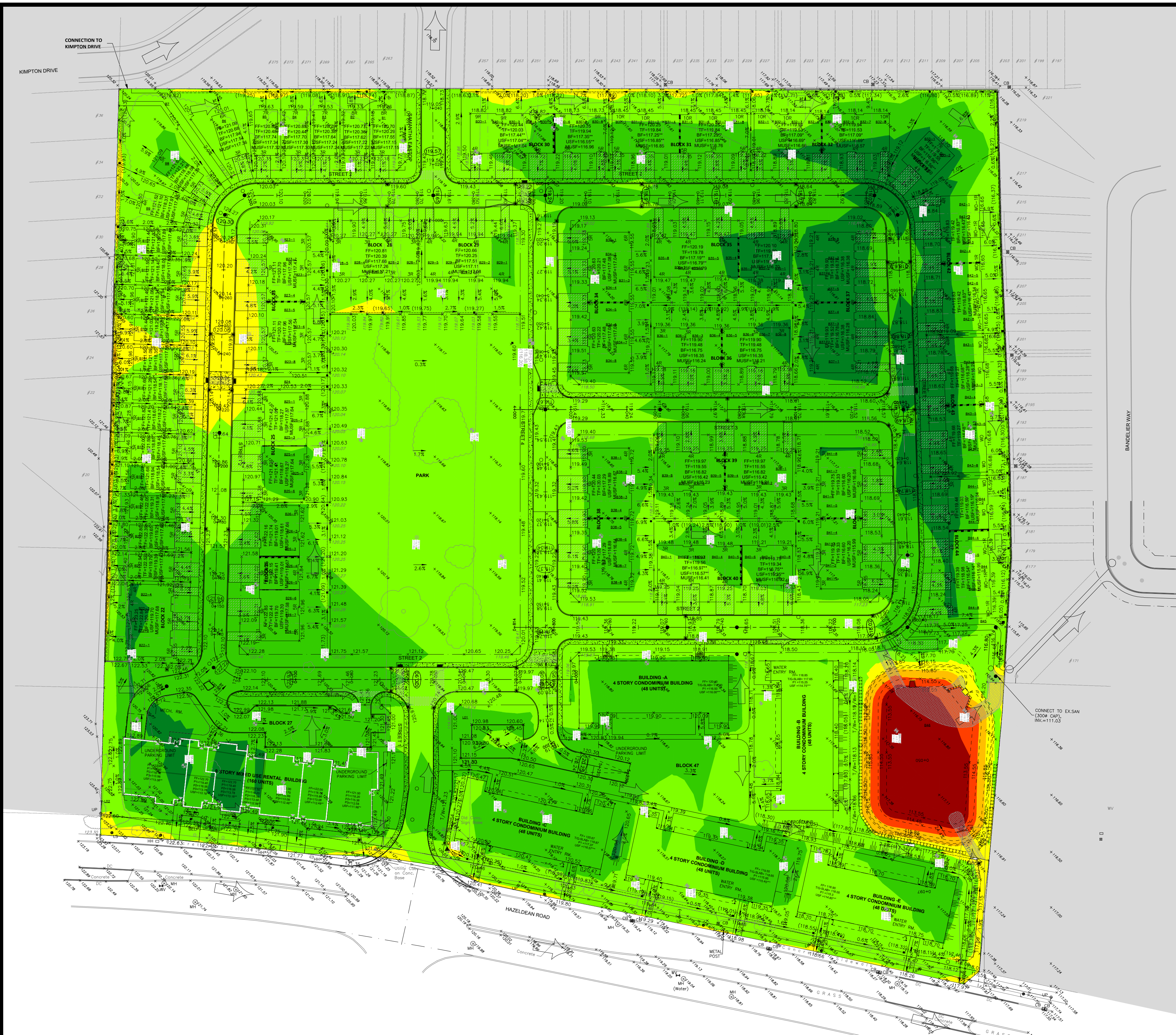


FIGURE A9 - REAR YARD DRY SWALES



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	-4.000	-3.000	
2	-3.000	-2.000	
3	-2.000	-1.000	
4	-1.000	0.000	
5	0.000	1.000	
6	1.000	2.000	
7	2.000	3.000	

CUT

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DRAWN	SK
DATE	12/04/22
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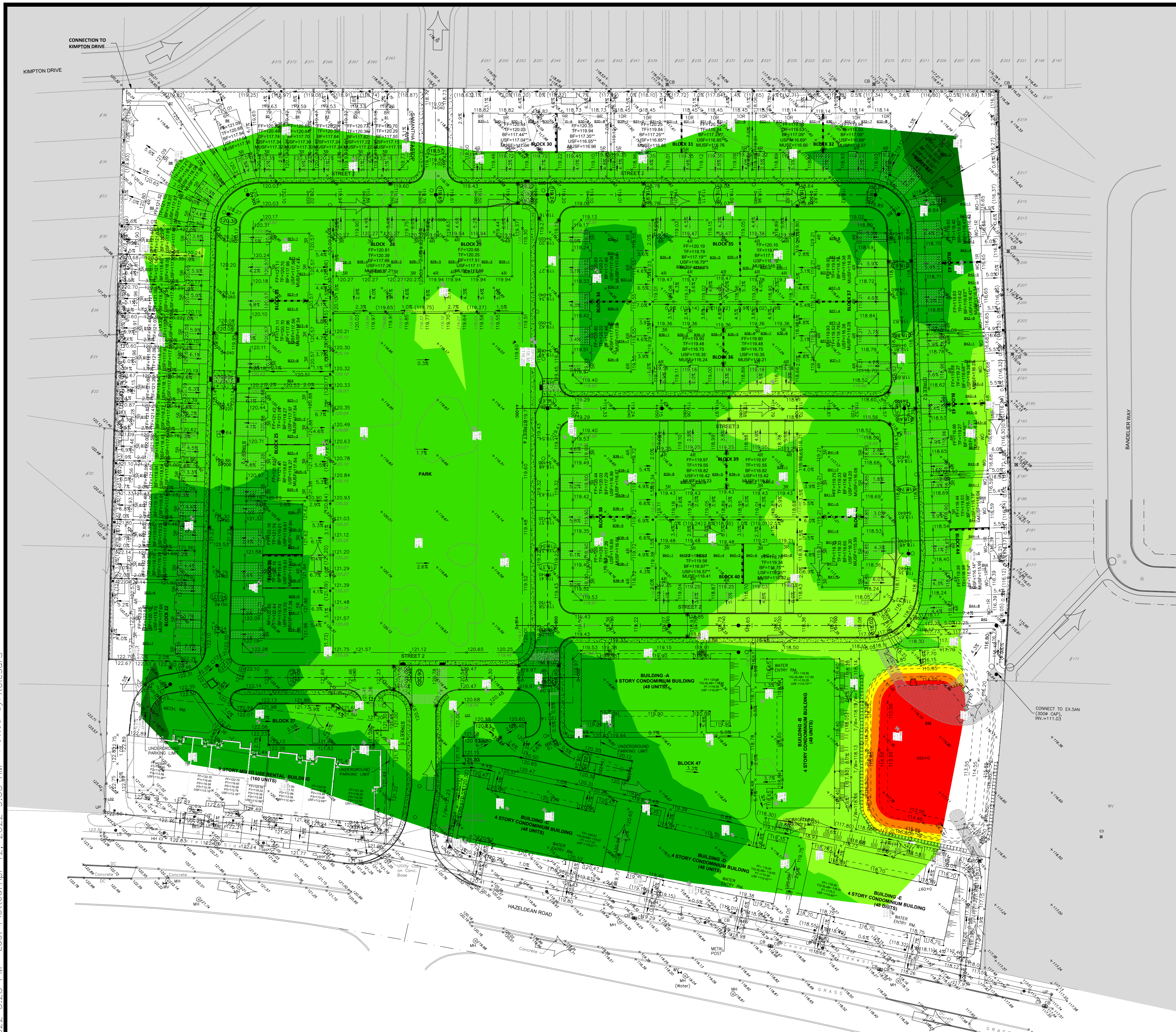
6171 HAZELDEAN

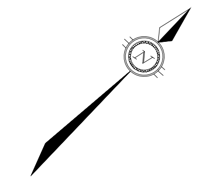
COMPARISON BETWEEN ORIGINAL GROUND AND PROPOSED SURFACE

SCALE N.T.S.

SKETCH NO FIG A10

Filename: \\exp\data\OTT\OTT-00258780-A0\60 Execution\65 Drawings\SGP1-CF SITE GRADING PLAN CUT AND FILL.dwg
Last Saved: Apr 11, 2022 5:28 PM Last Plotted: Apr 12, 2022 9:04 AM Plotted by: KolesarS





Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	−3.309	−2.000	Red
2	−2.000	−1.000	Orange
3	−1.000	0.000	Yellow
4	0.000	2.000	Light green
5	2.000	4.000	Green
6	4.000	6.000	Medium green
7	6.000	7.900	Dark green

CUT

FILL

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DESIGN	JLF	6171 HAZELDEAN	SCALE N.T.S.
DRAWN	SK		SKETCH NO
DATE	11/04/22	COMPARISON BETWEEN BEDROCK AND PROPOSED SURFACE	FIG A11
FILE NO	258780		

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Appendix B – Water Servicing Tables

TABLE B1

WATER DEMAND CHART

Location: 6171 Hazeldean Rd
Project No: OTT-00258780
Designed by: J.Fitzpatrick
Checked By: B.Thomas
Date Revised: Oct 2022

Water Consumption

Residential = **280** L/cap/day
Commercial = 5.0 $L/m^2/day$

Population Densities

Single Family	3.4	person/unit
Semi-Detahced	2.7	person/unit
Duplex	2.3	person/unit
Townhome (Row)	2.7	person/unit
Bachelor Apartment	1.4	person/unit
1 Bedroom Apartment	1.4	person/unit
2 Bedroom Apartment	2.1	person/unit
3 Bedroom Apartment	3.1	person/unit
4 Bedroom Apartment	4.1	person/unit
Avg. Apartment	1.8	person/unit

	No. of Residential Units											Residential Demands in (L/sec)					Commercial						Total Demands (L/sec)		
	Singles/Semis/Towns				Apartments								Peaking Factors (x Avg Day)						Peaking Factors (x Avg Day)						
Proposed Buildings	**Single Family**	**Semi-Detached**	**Duplex**	**Townhome**	**Studio**	**1 Bedroom**	**2 Bedroom**	**3 Bedroom**	**4 Bedroom**	**Avg Apt.**	**Total Persons (pop)**	**Avg. Day Demand (L/day)**	**Max Day**	**Peak Hour**	**Max Day Demand (L/day)**	**Peak Hour Demand (L/day)**	**Area (m^2)**	**Avg Demand (L/day)**	**Max Day**	**Peak Hour**	**Max Day Demand (L/day)**	**Peak Hour Demand (L/day)**	**Avg Day (L/s)**	**Max Day (L/s)**	**Max Hour (L/s)**
J-1	5			16		95	57	8			337.7	94,556	2.50	5.50	236,390	520,058	1,736.4	8,682	1.50	2.70	13,023	23,441	1.19	2.89	6.29
J-2	13			10							71.2	19,936	2.50	5.50	49,840	109,648							0.23	0.58	1.27
J-3	2			11							36.5	10,220	2.50	5.50	25,550	56,210							0.12	0.30	0.65
J-4				21							56.7	15,876	2.50	5.50	39,690	87,318							0.18	0.46	1.01
J-5		2		24							70.2	19,656	2.50	5.50	49,140	108,108							0.23	0.57	1.25
J-6				28							75.6	21,168	2.50	5.50	52,920	116,424							0.25	0.61	1.35
J-7				16							43.2	12,096	2.50	5.50	30,240	66,528							0.14	0.35	0.77
J-8				8							21.6	6,048	2.50	5.50	15,120	33,264							0.07	0.18	0.39
J-9				14							37.8	10,584	2.50	5.50	26,460	58,212							0.12	0.31	0.67
J-10																									
J-13						42	54				172.2	48,216	2.50	5.50	120,540	265,188							0.56	1.40	3.07
J-24						21	27				86.1	24,108	2.50	5.50	60,270	132,594							0.28	0.70	1.53
J-25						21	27				86.1	24,108	2.50	5.50	60,270	132,594							0.28	0.70	1.53
J-28						21	27				86.1	24,108	2.50	5.50	60,270	132,594							0.28	0.70	1.53
Total =	**20**	**2**		**148**		**200**	**192**	**8**			**1,181**	**330,680**			**826,700**	**1,818,740**	**1,736**						**3.93**	**9.72**	**21.32**

TABLE B2
Summary of Required Fire Flows (RFF) for 6171 Hazeldean Road

Type of Resdential	Reference Table	Requried Fire Flow (L/s)
Combined Fire Area = Single (x14) + Block 22 (4 Units)	TABLE B3	167
Single	TABLE B4	117
Block 26 / Townhome (8 Units) - With Firewall (Split 5:3)	TABLE B5	167
Block 23 / Townhome (8 Units) - With Firewall (Split 4:4)	TABLE B6	167
Block 28 /Townhome (5 Units)	TABLE B7	167
Block 29 / Townhome (5 Units)	TABLE B8	167
Block 31 / Townhome (8 Units) - With Firewall (Split 4:4)	TABLE B9	167
Block 42 / Townhome (8 Units) - With Firewall (Split 4:4)	TABLE B10	167
Block 36 / Townhome (8 Units) - With Firewall (Split 4:4)	TABLE B11	167
Building A	TABLE B12	150
Building B	TABLE B13	167
Building C	TABLE B14	167
Building D	TABLE B15	200
Building E	TABLE B16	167
Mixed Use Building	TABLE B17	200

TABLE B3
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: **Combined Fire Area = Single (x14) + Block 22 (4 Units)**

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Ordinary Construction			1	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	4176.0 m²	
	Floor 2 (14x122m^2 + 380m^2)		2088	100%	2088		
	Floor 1 (14x122m^2 + 380m^2)		2088	100%	2088		
	Basement		2088	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						14,217
Fire Flow (F)	Rounded to nearest 1,000						**14,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-2,100	11,900
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	11,900
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	11,900
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	11,900
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
						Exposed Wall Length							
Choose Structure Exposure Distance	Side 1	30	4	20.1 to 30	Type A	15	9	135	4E	10%	45%	5,355	17,255
	Side 2	14	3	10.1 to 20	Type A	16	2	32	3B	13%			
	Front	30	4	20.1 to 30	Type A	88	2	176	4E	10%			
	Back	20	3	10.1 to 20	Type A	12	2	24	3A	12%			

Task	Description	Value
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**17,000**
	Total Required Fire Flow (RFF), L/sec =	**283**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	**Yes**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	**167**

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

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

Conditons for Separation

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

TABLE B4
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: Single

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	244.0 m²	
	Floor 2		122	100%	122		
	Floor 1		122	100%	122		
	Basement		122	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						5,155
Fire Flow (F)	Rounded to nearest 1,000						5,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-750	4,250
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	4,250
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	4,250
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	4,250
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	2.4	1	0 to 3	Type A	15.2	2	30.4	1A	22%	58%	2,465	6,715
	Side 2	2.4	1	0 to 3	Type A	17.8	2	35.6	1B	23%			
	Front	26.4	4	20.1 to 30	Type A	8.7	2	17.4	4A	8%			
	Back	44.4	5	30.1 to 45	Type A	8.7	2	17.4	5A	5%			

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

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

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

Conditons for Separation

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

TABLE B5
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: **Block 26 / Townhome (8 Units) - With Firewall (Split 5:3)**

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	825.0 m²	
	Floor 2		660	63%	412.5		
	Floor 1		660	63%	412.5		
	Basement (At least 50% below grade, not included)		660	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,479
Fire Flow (F)	Rounded to nearest 1,000						9,000

Reductions/Increases Due to Factors Effecting Burning

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

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
Choose Structure Exposure Distance	Side 1	0.0	1	0 to 3	Type A	14.2	2	28.4	1A	22%	53%	4,055	11,705
	Side 2	2.4	1	0 to 3	Type A	14.2	2	28.4	1A	22%			
	Front	28.4	4	20.1 to 30	Type A	43.5	2	87	4C	9%			
	Back	50	6	> 45.1	Type A	0	2	0	6	0%			

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

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

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

Conditons for Separation

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

TABLE B6

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

Building # / Type: Block 23 / Townhome (8 Units) - With Firewall (Split 4:4)

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

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute

A = total floor area in m² (including all storeys, but excluding basements at least 50% below grade)

C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	660.0 m²	
	Floor 2		660	50%	330		
	Floor 1		660	50%	330		
	Basement (At least 50% below grade, not included)		660	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						8,478
Fire Flow (F)	Rounded to nearest 1,000						**8,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,200	6,800
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	6,800
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	6,800
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	6,800
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	24.4	4	20.1 to 30	Type A	15.9	2	31.8	4B	8%	57%	3,876	10,676
	Side 2	0	1	0 to 3	Type A	15.9	2	31.8	1B	23%			
	Front	28.4	4	20.1 to 30	Type A	20.6	2	41.2	4B	8%			
	Back	8.7	2	3.1 to 10	Type A	16.9	2	33.8	2B	18%			

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

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

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

Conditons for Separation

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

TABLE B7
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: Block 28 /Townhome (5 Units)

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	824.0 m²	
	Floor 2		412	100%	412		
	Floor 1		412	100%	412		
	Basement (At least 50% below grade, not included)		412	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,473
Fire Flow (F)	Rounded to nearest 1,000						9,000

Reductions/Increases Due to Factors Effecting Burning

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

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
Choose Structure Exposure Distance	Side 1	2.4	1	0 to 3	Type A	17	2	34	1B	23%	46%	3,519	11,169
	Side 2	8.7	2	3.1 to 10	Type A	17	2	34	2B	18%			
	Front	32.4	5	30.1 to 45	Type A	17.3	2	34.6	5B	5%			
	Back	50	6	> 45.1	Type A	0	2	0	6	0%			

(Exposed Wall Length spans Length (m) through Charge (%).)

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

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

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

Conditons for Separation

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

TABLE B8

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

Building # / Type: Block 29 / Townhome (5 Units)

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	824.0 m²	
	Floor 2		412	100%	412		
	Floor 1		412	100%	412		
	Basement (At least 50% below grade, not included)		412	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,473
Fire Flow (F)	Rounded to nearest 1,000						9,000

Reductions/Increases Due to Factors Effecting Burning

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

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance						Exposed Wall Length							
	Side 1	2.4	1	0 to 3	Type A	17	2	34	1B	23%	36%	2,754	10,404
	Side 2	28.4	4	20.1 to 30	Type A	17	2	34	4B	8%			
	Front	32.4	5	30.1 to 45	Type A	14.9	2	29.8	5A	5%			
	Back	50	6	> 45.1	Type A	0	2	0	6	0%			

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

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

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

Conditons for Separation

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

TABLE B9

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

Building # / Type: **Block 31 / Townhome (8 Units) - With Firewall (Split 4:4)**

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

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute

A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)

C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	660.0 m²	
	Floor 2		660	50%	330		
	Floor 1		660	50%	330		
	Basement (At least 50% below grade, not included)		660	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						8,478
Fire Flow (F)	Rounded to nearest 1,000						**8,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,200	6,800
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	6,800
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	6,800
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	6,800
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	2.4	1	0 to 3	Type A	16.3	2	32.6	1B	23%	67%	4,556	11,356
	Side 2	0	1	0 to 3	Type A	16.3	2	32.6	1B	23%			
	Front	28.4	4	20.1 to 30	Type A	24.1	2	48.2	4B	8%			
	Back	15.5	3	10.1 to 20	Type A	24.1	2	48.2	3B	13%			

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

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

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

Conditons for Separation

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

TABLE B10

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

Building # / Type: Block 42 / Townhome (8 Units) - With Firewall (Split 4:4)

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

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute

A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)

C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	660.0 m²	
	Floor 2		660	50%	330		
	Floor 1		660	50%	330		
	Basement (At least 50% below grade, not included)		660	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						8,478
Fire Flow (F)	Rounded to nearest 1,000						8,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,200	6,800
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	6,800
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	6,800
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	6,800
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	11.5	3	10.1 to 20	Type A	4.5	2	9	3A	12%	55%	3,740	10,540
	Side 2	0	1	0 to 3	Type A	13.7	2	27.4	1A	22%			
	Front	28.4	4	20.1 to 30	Type A	24.1	2	48.2	4B	8%			
	Back	19.8	3	10.1 to 20	Type A	24.1	2	48.2	3B	13%			

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

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

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

Conditons for Separation

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

TABLE B11
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: **Block 36 / Townhome (8 Units) - With Firewall (Split 4:4)**

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	660.0 m²	
	Floor 2		660	50%	330		
	Floor 1		660	50%	330		
	Basement (At least 50% below grade, not included)		660	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						8,478
Fire Flow (F)	Rounded to nearest 1,000						8,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,200	6,800
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	6,800
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	6,800
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	6,800
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	8.7	2	3.1 to 10	Type A	13.7	2	27.4	2A	17%	60%	4,080	10,880
	Side 2	0	1	0 to 3	Type A	13.7	2	27.4	1A	22%			
	Front	28.4	4	20.1 to 30	Type A	24.3	2	48.6	4B	8%			
	Back	15	3	10.1 to 20	Type A	24.3	2	48.6	3B	13%			

(Length, No of Storeys, Length-height Factor, Sub-Conditon and Charge are under the heading "Exposed Wall Length".)

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

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

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

Conditons for Separation

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

TABLE B12
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: **Building A**

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Ordinary Construction			1	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	4140.0 m²	
	Floor 4		1035	100%	1035		
	Floor 3		1035	100%	1035		
	Floor 2		1035	100%	1035		
	Floor 1		1035	100%	1035		
Fire Flow (F)	F = 220 * C * SQRT(A)						14,155
Fire Flow (F)	Rounded to nearest 1,000						**14,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-2,100	11,900
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-3,570	8,330
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,190	7,140
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,190	5,950
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	50.0	6	> 45.1	Type A	0.0	2	0	6	0%	28%	3,332	9,282
	Side 2	13	3	10.1 to 20	Type A	7.0	4	28	3A	12%			
	Front	30	4	20.1 to 30	Type A	7.0	4	28	4A	8%			
	Back	25.7	4	20.1 to 30	Type A	14.8	2	29.6	4A	8%			

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

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

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

Conditons for Separation

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

TABLE B13

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

Building # / Type: Building B

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

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute

A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)

C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Ordinary Construction			1	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	4140.0 m²	
	Floor 4		1035	100%	1035		
	Floor 3		1035	100%	1035		
	Floor 2		1035	100%	1035		
	Floor 1		1035	100%	1035		
Fire Flow (F)	F = 220 * C * SQRT(A)						14,155
Fire Flow (F)	Rounded to nearest 1,000						**14,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-2,100	11,900
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-3,570	8,330
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,190	7,140
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,190	5,950
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	13.0	3	10.1 to 20	Type A	7.0	4	28	3A	12%	32%	3,808	9,758
	Side 2	27.0	4	20.1 to 30	Type A	9.5	2	19	4A	8%			
	Front	13.0	3	10.1 to 20	Type A	7	4	28	3A	12%			
	Back	50.0	6	> 45.1	Type A	0	2	0	6	0%			

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

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

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

Conditons for Separation

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

TABLE B14
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: Building C

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Ordinary Construction			1	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	4140.0 m²	
	Floor 4		1035	100%	1035		
	Floor 3		1035	100%	1035		
	Floor 2		1035	100%	1035		
	Floor 1		1035	100%	1035		
Fire Flow (F)	F = 220 * C * SQRT(A)						14,155
Fire Flow (F)	Rounded to nearest 1,000						**14,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-2,100	11,900
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-3,570	8,330
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,190	7,140
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,190	5,950
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
Choose Structure Exposure Distance	Side 1	9.3	2	3.1 to 10	Type A	22.2	4	88.6	2C	19%	34%	4,046	9,996
	Side 2	30	4	20.1 to 30	Type A	22.2	9	199.8	4E	10%			
	Front	30.7	5	30.1 to 45	Type A	16.49	4	65.96	5C	5%			
	Back	50	6	> 45.1	Type A	0	2	0	6	0%			

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

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

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

Conditons for Separation

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

TABLE B15
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: **Building D**

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Ordinary Construction			1	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	4140.0 m²	
	Floor 4		1035	100%	1035		
	Floor 3		1035	100%	1035		
	Floor 2		1035	100%	1035		
	Floor 1		1035	100%	1035		
Fire Flow (F)	F = 220 * C * SQRT(A)						14,155
Fire Flow (F)	Rounded to nearest 1,000						**14,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-2,100	11,900
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-3,570	8,330
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,190	7,140
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,190	5,950
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
Choose Structure Exposure Distance	Side 1	9.3	2	3.1 to 10	Type A	22.2	4	88.6	2C	19%	50%	5,950	11,900
	Side 2	9.3	2	3.1 to 10	Type A	22.2	4	88.6	2C	19%			
	Front	13	3	10.1 to 20	Type A	7	4	28	3A	12%			
	Back	50	6	> 45.1	Type A	0	2	0	6	0%			

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

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

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

Conditons for Separation

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

TABLE B16
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: Building E

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Ordinary Construction			1	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	4140.0 m²	
	Floor 4		1035	100%	1035		
	Floor 3		1035	100%	1035		
	Floor 2		1035	100%	1035		
	Floor 1		1035	100%	1035		
Fire Flow (F)	F = 220 * C * SQRT(A)						14,155
Fire Flow (F)	Rounded to nearest 1,000						**14,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-2,100	11,900
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-3,570	8,330
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,190	7,140
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,190	5,950
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	9.4	2	3.1 to 10	Type A	22.2	4	88.6	2C	19%	31%	3,689	9,639
	Side 2	50	6	> 45.1	Type A	22.2	4	88.6	6	0%			
	Front	15.89	3	10.1 to 20	Type A	2.92	4	11.68	3A	12%			
	Back	50	6	> 45.1	Type A	0	2	0	6	0%			

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

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

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

Conditons for Separation

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

TABLE B17
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: Mixed Use Building

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input	Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Non-combustible Construction	0.8	
	Ordinary Construction	1			
	Non-combustible Construction	0.8			
	Fire Resistive Construction	0.6			

Task	Options	Area	% Used	Area Used	Value Used	Fire Flow Total (L/min)
Input Building Floor Areas (A)	Floor 9	1590	50%	795	9940.0 m²	
	Floor 8	1790	50%	895		
	Floor 7	1790	50%	895		
	Floor 6	1790	50%	895		
	Floor 5	1790	50%	895		
	Floor 4	1790	50%	895		
	Floor 3	1790	50%	895		
	Floor 2	1790	100%	1790		
	Floor 1	1985	100%	1985		
Fire Flow (F)	F = 220 * C * SQRT(A)					17,547
Fire Flow (F)	Rounded to nearest 1,000					**18,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-2,700	15,300
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-4,590	10,710
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,530	9,180
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,530	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
Choose Structure Exposure Distance	Side 1	17.0	3	10.1 to 20	Type A	10.0	3	30	3A	12%	29%	4,437	12,087
	Side 2	30	4	20.1 to 30	Type A	22.0	4	88	4C	9%			
	Front	30	4	20.1 to 30	Type A	14.8	2	29.6	4A	8%			
	Back	50	6	> 45.1	Type A	0	0	0	6	0%			

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

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

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

Conditons for Separation

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

Appendix C – WaterGems Output Tables

- Scenario 1A Result Tables (Peak Hour) Based on Single Feed from Connection #1
    - Junction Table
    - Pipe Table
    - Reservoir Table
- Scenario 1B Result Tables (Peak Hour) Based on Single Feed from Connection #1
    - Junction Table
    - Pipe Table
    - Reservoir Table
- Scenario 1C Result Tables (Max Day Plus Fire Flow) Based on Single Feed from Connection #1
    - Junction Table
    - Pipe Table
    - Reservoir Table
    - Fire Flow Report
- Scenario 2A Result Tables (Peak Hour) Based on Single Feed from Connection #2
    - Junction Table
    - Pipe Table
    - Reservoir Table
- Scenario 2B Result Tables (Peak Hour) Based on Single Feed from Connection #2
    - Junction Table
    - Pipe Table
    - Reservoir Table
- Scenario 2C Result Tables (Max Day Plus Fire Flow) Based on Single Feed from Connection #2
    - Junction Table
    - Pipe Table
    - Reservoir Table
    - Fire Flow Report

6171 Hazeldean Road, Ottawa, ON

Average Day - Boundary Conditon, Location 1

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-01	122.19	1.19	160.70	54.7
J-02	119.69	0.23	160.70	58.2
J-03	118.67	0.12	160.70	59.7
J-04	118.45	0.18	160.70	60.0
J-05	117.43	0.23	160.70	61.4
J-06	117.02	0.25	160.70	62.0
J-07	118.88	0.15	160.70	59.4
J-08	119.76	0.07	160.70	58.1
J-09	117.12	0.12	160.70	61.9
J-10	120.76	0.00	160.70	56.7
J-13	117.92	0.56	160.70	60.7
J-16	119.76	0.00	160.70	58.1
J-17	118.80	0.00	160.70	59.5
J-18	120.40	0.00	160.70	57.2
J-22	118.21	0.00	160.70	60.3
J-23	120.51	0.00	160.70	57.0
J-24	119.50	0.28	160.70	58.5
J-25	118.80	0.28	160.70	59.5
J-28	118.00	0.28	160.70	60.6
J-29	120.44	0.00	160.70	57.1

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-1	J-01	J-02	204.0	167	110.0	-0.14	PVC	0.00
P-2	J-02	J-03	204.0	73	110.0	-0.37	PVC	0.01
P-11	J-10	J-01	204.0	69	110.0	1.05	PVC	0.03
P-12	J-04	J-05	204.0	117	110.0	0.21	PVC	0.01
P-13	J-05	J-06	204.0	75	110.0	-0.02	PVC	0.00
P-14	J-06	J-07	204.0	122	110.0	-0.32	PVC	0.01
P-24	J-06	J-09	204.0	71	110.0	0.04	PVC	0.00
P-23	J-09	J-22	204.0	48	110.0	-0.08	PVC	0.00
P-35	J-22	J-08	204.0	71	110.0	-0.64	PVC	0.02
P-16	J-22	J-13	204.0	20	110.0	0.56	PVC	0.02
P-28	J-23	J-24	204.0	68	110.0	-0.31	PVC	0.01
P-29	J-24	J-25	204.0	62	110.0	-0.59	PVC	0.02
P-32	J-25	J-28	204.0	64	110.0	-0.87	PVC	0.03
P-36	J-29	J-18	204.0	10	110.0	-2.79	PVC	0.09
P-4	J-03	J-17	297.0	77	120.0	0.00	PVC	0.00
P-5	J-03	J-04	297.0	40	120.0	-0.49	PVC	0.01
P-6	J-04	J-07	297.0	76	120.0	-0.88	PVC	0.01
P-7	J-07	J-08	297.0	72	120.0	-1.34	PVC	0.02
P-8	J-08	J-16	297.0	19	120.0	-2.05	PVC	0.03

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Average Day - Boundary Conditon, Location 1

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-9	J-16	J-10	297.0	44	120.0	-2.05	PVC	0.03
P-10	J-10	J-23	297.0	62	120.0	-3.10	PVC	0.04
P-34	J-23	J-29	297.0	17	120.0	-2.79	PVC	0.04
P-25	R-1	J-18	600.0	16	130.0	3.94	PVC	0.01
P-26	R-2	J-17	600.0	16	130.0	(N/A)	PVC	(N/A)
P-33	J-18	J-28	762.0	219	130.0	1.15	Concrete	0.00

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Average Day - Boundary Conditon, Location 1

Reservoir Table - Time: 0.00 hours

Label	Elevation (m)	Hydraulic Grade (m)
R-1	160.70	160.70
R-2	160.70	(N/A)

6171 Hazeldean Road, Ottawa, ON

Peak Hour - Boundary Conditon, Location 1

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-01	122.19	6.29	156.76	49.1
J-02	119.69	1.27	156.76	52.6
J-03	118.67	0.65	156.76	54.1
J-04	118.45	1.01	156.76	54.4
J-05	117.43	1.25	156.76	55.8
J-06	117.02	1.35	156.76	56.4
J-07	118.88	0.77	156.76	53.8
J-08	119.76	0.39	156.77	52.5
J-09	117.12	0.67	156.76	56.3
J-10	120.76	0.00	156.77	51.1
J-13	117.92	3.07	156.76	55.1
J-16	119.76	0.00	156.77	52.5
J-17	118.80	0.00	156.76	53.9
J-18	120.40	0.00	156.80	51.7
J-22	118.21	0.00	156.76	54.7
J-23	120.51	0.00	156.79	51.5
J-24	119.50	1.53	156.79	52.9
J-25	118.80	1.53	156.79	53.9
J-28	118.00	1.53	156.80	55.1
J-29	120.44	0.00	156.80	51.6

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-1	J-01	J-02	204.0	167	110.0	-0.68	PVC	0.02
P-2	J-02	J-03	204.0	73	110.0	-1.95	PVC	0.06
P-11	J-10	J-01	204.0	69	110.0	5.61	PVC	0.17
P-12	J-04	J-05	204.0	117	110.0	1.14	PVC	0.03
P-13	J-05	J-06	204.0	75	110.0	-0.11	PVC	0.00
P-14	J-06	J-07	204.0	122	110.0	-1.73	PVC	0.05
P-24	J-06	J-09	204.0	71	110.0	0.27	PVC	0.01
P-23	J-09	J-22	204.0	48	110.0	-0.40	PVC	0.01
P-35	J-22	J-08	204.0	71	110.0	-3.47	PVC	0.11
P-16	J-22	J-13	204.0	20	110.0	3.07	PVC	0.09
P-28	J-23	J-24	204.0	68	110.0	-0.06	PVC	0.00
P-29	J-24	J-25	204.0	62	110.0	-1.59	PVC	0.05
P-32	J-25	J-28	204.0	64	110.0	-3.12	PVC	0.10
P-36	J-29	J-18	297.0	10	120.0	-16.66	PVC	0.24
P-4	J-03	J-17	297.0	77	120.0	0.00	PVC	0.00
P-5	J-03	J-04	297.0	40	120.0	-2.60	PVC	0.04
P-6	J-04	J-07	297.0	76	120.0	-4.74	PVC	0.07
P-7	J-07	J-08	297.0	72	120.0	-7.24	PVC	0.10
P-8	J-08	J-16	297.0	19	120.0	-11.11	PVC	0.16

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Peak Hour - Boundary Conditon, Location 1

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-9	J-16	J-10	297.0	44	120.0	-11.11	PVC	0.16
P-10	J-10	J-23	297.0	62	120.0	-16.72	PVC	0.24
P-34	J-23	J-29	297.0	17	120.0	-16.66	PVC	0.24
P-25	R-1	J-18	600.0	16	130.0	21.31	PVC	0.08
P-26	R-2	J-17	600.0	16	130.0	(N/A)	PVC	(N/A)
P-33	J-18	J-28	762.0	219	130.0	4.65	Concrete	0.01

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Peak Hour - Boundary Conditon, Location 1

Reservoir Table - Time: 0.00 hours

Label	Elevation (m)	Hydraulic Grade (m)
R-1	156.80	156.80
R-2	156.70	(N/A)

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Max Day Plus Fire Flow - Boundary Conditon, Location 1

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-01	122.19	2.89	160.69	54.6
J-02	119.69	0.58	160.69	58.2
J-03	118.67	0.30	160.69	59.6
J-04	118.45	0.46	160.69	60.0
J-05	117.43	0.57	160.69	61.4
J-06	117.02	0.61	160.69	62.0
J-07	118.88	0.35	160.69	59.3
J-08	119.76	0.18	160.69	58.1
J-09	117.12	0.31	160.69	61.8
J-10	120.76	0.00	160.69	56.7
J-13	117.92	1.40	160.69	60.7
J-16	119.76	0.00	160.69	58.1
J-17	118.80	0.00	160.69	59.5
J-18	120.40	0.00	160.70	57.2
J-22	118.21	0.00	160.69	60.3
J-23	120.51	0.00	160.70	57.0
J-24	119.50	0.70	160.70	58.5
J-25	118.80	0.70	160.70	59.5
J-28	118.00	0.70	160.70	60.6
J-29	120.44	0.00	160.70	57.1

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-1	J-01	J-02	204.0	167	110.0	-0.32	PVC	0.01
P-2	J-02	J-03	204.0	73	110.0	-0.90	PVC	0.03
P-11	J-10	J-01	204.0	69	110.0	2.57	PVC	0.08
P-12	J-04	J-05	204.0	117	110.0	0.52	PVC	0.02
P-13	J-05	J-06	204.0	75	110.0	-0.05	PVC	0.00
P-14	J-06	J-07	204.0	122	110.0	-0.79	PVC	0.02
P-24	J-06	J-09	204.0	71	110.0	0.12	PVC	0.00
P-23	J-09	J-22	204.0	48	110.0	-0.19	PVC	0.01
P-35	J-22	J-08	204.0	71	110.0	-1.59	PVC	0.05
P-16	J-22	J-13	204.0	20	110.0	1.40	PVC	0.04
P-28	J-23	J-24	204.0	68	110.0	-0.76	PVC	0.02
P-29	J-24	J-25	204.0	62	110.0	-1.46	PVC	0.04
P-32	J-25	J-28	204.0	64	110.0	-2.16	PVC	0.07
P-36	J-29	J-18	204.0	10	110.0	-6.89	PVC	0.21
P-4	J-03	J-17	297.0	77	120.0	0.00	PVC	0.00
P-5	J-03	J-04	297.0	40	120.0	-1.20	PVC	0.02
P-6	J-04	J-07	297.0	76	120.0	-2.17	PVC	0.03
P-7	J-07	J-08	297.0	72	120.0	-3.31	PVC	0.05
P-8	J-08	J-16	297.0	19	120.0	-5.08	PVC	0.07

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Max Day Plus Fire Flow - Boundary Conditon, Location 1

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-9	J-16	J-10	297.0	44	120.0	-5.08	PVC	0.07
P-10	J-10	J-23	297.0	62	120.0	-7.65	PVC	0.11
P-34	J-23	J-29	297.0	17	120.0	-6.89	PVC	0.10
P-25	R-1	J-18	600.0	16	130.0	9.75	PVC	0.03
P-26	R-2	J-17	600.0	16	130.0	(N/A)	PVC	(N/A)
P-33	J-18	J-28	762.0	219	130.0	2.86	Concrete	0.01

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Max Day Plus Fire Flow - Boundary Conditon, Location 1

Fire Flow Report - Time: 0.00 hours

Label	Fire Flow (Available) (L/s)	Flow (Total Needed) (L/s)	Junction w/ Minimum Pressure (System)	Pressure (Calculated System Lower Limit) (psi)	Velocity of Maximum Pipe (m/s)	Satisfies Fire Flow Constraints ?
J-01	300.00	202.89	J-02	39.1	7.71	True
J-02	300.00	167.58	J-01	36.0	7.71	True
J-03	300.00	167.30	J-17	37.0	7.71	True
J-04	300.00	167.46	J-17	38.9	7.71	True
J-05	300.00	167.57	J-06	38.0	7.71	True
J-06	300.00	167.61	J-05	36.5	7.71	True
J-07	300.00	167.35	J-17	41.6	7.71	True
J-08	300.00	167.18	J-01	42.6	7.71	True
J-09	300.00	167.31	J-22	32.7	7.71	True
J-10	300.00	167.00	J-01	43.7	7.71	True
J-13	282.21	168.40	J-22	30.5	8.68	True
J-16	300.00	167.00	J-01	42.9	7.71	True
J-17	300.00	167.00	J-03	37.2	7.71	True
J-18	300.00	167.00	J-01	54.6	1.10	True
J-22	300.00	167.00	J-13	27.4	7.71	True
J-23	300.00	167.00	J-01	49.1	7.71	True
J-24	300.00	200.70	J-25	50.6	5.38	True
J-25	300.00	200.70	J-24	49.3	5.60	True
J-28	300.00	267.70	J-01	54.6	1.10	True
J-29	300.00	167.00	J-01	50.1	7.87	True

Reservoir Table - Time: 0.00 hours

Label	Elevation (m)	Hydraulic Grade (m)
R-1	160.70	160.70
R-2	160.70	(N/A)

6171 Hazeldean Road, Ottawa, ON

Average Day - Boundary Conditon, Location 2

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-01	122.19	1.19	160.70	54.7
J-02	119.69	0.23	160.70	58.2
J-03	118.67	0.12	160.70	59.7
J-04	118.45	0.18	160.70	60.0
J-05	117.43	0.23	160.70	61.4
J-06	117.02	0.25	160.70	62.0
J-07	118.88	0.15	160.70	59.4
J-08	119.76	0.07	160.70	58.1
J-09	117.12	0.12	160.70	61.9
J-10	120.76	0.00	160.70	56.7
J-13	117.92	0.56	160.70	60.7
J-16	119.76	0.00	160.70	58.1
J-17	118.80	0.00	160.70	59.5
J-18	120.40	0.00	160.70	57.2
J-22	118.21	0.00	160.70	60.3
J-23	120.51	0.00	160.70	57.0
J-24	119.50	0.28	160.70	58.5
J-25	118.80	0.28	160.70	59.5
J-28	118.00	0.28	160.70	60.6
J-29	120.44	0.00	160.70	57.1

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-1	J-01	J-02	204.0	167	110.0	-0.68	PVC	0.02
P-2	J-02	J-03	204.0	73	110.0	-0.91	PVC	0.03
P-11	J-10	J-01	204.0	69	110.0	0.51	PVC	0.02
P-12	J-04	J-05	204.0	117	110.0	0.59	PVC	0.02
P-13	J-05	J-06	204.0	75	110.0	0.36	PVC	0.01
P-14	J-06	J-07	204.0	122	110.0	-0.30	PVC	0.01
P-24	J-06	J-09	204.0	71	110.0	0.41	PVC	0.01
P-23	J-09	J-22	204.0	48	110.0	0.29	PVC	0.01
P-35	J-22	J-08	204.0	71	110.0	-0.27	PVC	0.01
P-16	J-22	J-13	204.0	20	110.0	0.56	PVC	0.02
P-28	J-23	J-24	204.0	68	110.0	0.29	PVC	0.01
P-29	J-24	J-25	204.0	62	110.0	0.01	PVC	0.00
P-32	J-25	J-28	204.0	64	110.0	-0.27	PVC	0.01
P-36	J-29	J-18	297.0	10	120.0	0.55	PVC	0.01
P-4	J-03	J-17	297.0	77	120.0	-3.94	PVC	0.06
P-5	J-03	J-04	297.0	40	120.0	2.91	PVC	0.04
P-6	J-04	J-07	297.0	76	120.0	2.14	PVC	0.03
P-7	J-07	J-08	297.0	72	120.0	1.69	PVC	0.02
P-8	J-08	J-16	297.0	19	120.0	1.35	PVC	0.02

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Average Day - Boundary Conditon, Location 2

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-9	J-16	J-10	297.0	44	120.0	1.35	PVC	0.02
P-10	J-10	J-23	297.0	62	120.0	0.84	PVC	0.01
P-34	J-23	J-29	297.0	17	120.0	0.55	PVC	0.01
P-25	R-1	J-18	600.0	16	130.0	(N/A)	PVC	(N/A)
P-26	R-2	J-17	600.0	16	130.0	3.94	PVC	0.01
P-33	J-18	J-28	762.0	219	130.0	0.55	Concrete	0.00

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Average Day - Boundary Conditon, Location 2

Reservoir Table - Time: 0.00 hours

Label	Elevation (m)	Hydraulic Grade (m)
R-1	160.70	(N/A)
R-2	160.70	160.70

6171 Hazeldean Road, Ottawa, ON

Peak Hour - Boundary Conditon, Location 2

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-01	122.19	6.29	156.63	48.9
J-02	119.69	1.27	156.65	52.5
J-03	118.67	0.65	156.67	53.9
J-04	118.45	1.01	156.66	54.2
J-05	117.43	1.25	156.64	55.7
J-06	117.02	1.35	156.64	56.2
J-07	118.88	0.77	156.64	53.6
J-08	119.76	0.39	156.64	52.3
J-09	117.12	0.67	156.64	56.1
J-10	120.76	0.00	156.63	50.9
J-13	117.92	3.07	156.63	55.0
J-16	119.76	0.00	156.64	52.3
J-17	118.80	0.00	156.70	53.8
J-18	120.40	0.00	156.63	51.4
J-22	118.21	0.00	156.64	54.5
J-23	120.51	0.00	156.63	51.3
J-24	119.50	1.53	156.63	52.7
J-25	118.80	1.53	156.63	53.7
J-28	118.00	1.53	156.63	54.8
J-29	120.44	0.00	156.63	51.4

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-1	J-01	J-02	204.0	167	110.0	-3.64	PVC	0.11
P-2	J-02	J-03	204.0	73	110.0	-4.91	PVC	0.15
P-11	J-10	J-01	204.0	69	110.0	2.65	PVC	0.08
P-12	J-04	J-05	204.0	117	110.0	3.20	PVC	0.10
P-13	J-05	J-06	204.0	75	110.0	1.95	PVC	0.06
P-14	J-06	J-07	204.0	122	110.0	-1.65	PVC	0.05
P-24	J-06	J-09	204.0	71	110.0	2.25	PVC	0.07
P-23	J-09	J-22	204.0	48	110.0	1.58	PVC	0.05
P-35	J-22	J-08	204.0	71	110.0	-1.49	PVC	0.05
P-16	J-22	J-13	204.0	20	110.0	3.07	PVC	0.09
P-28	J-23	J-24	204.0	68	110.0	1.74	PVC	0.05
P-29	J-24	J-25	204.0	62	110.0	0.21	PVC	0.01
P-32	J-25	J-28	204.0	64	110.0	-1.32	PVC	0.04
P-36	J-29	J-18	204.0	10	110.0	2.85	PVC	0.09
P-4	J-03	J-17	297.0	77	120.0	-21.31	PVC	0.31
P-5	J-03	J-04	297.0	40	120.0	15.75	PVC	0.23
P-6	J-04	J-07	297.0	76	120.0	11.54	PVC	0.17
P-7	J-07	J-08	297.0	72	120.0	9.12	PVC	0.13
P-8	J-08	J-16	297.0	19	120.0	7.24	PVC	0.10

6171 Hazeldean Road, Ottawa, ON

Peak Hour - Boundary Conditon, Location 2

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-9	J-16	J-10	297.0	44	120.0	7.24	PVC	0.10
P-10	J-10	J-23	297.0	62	120.0	4.59	PVC	0.07
P-34	J-23	J-29	297.0	17	120.0	2.85	PVC	0.04
P-25	R-1	J-18	600.0	16	130.0	(N/A)	PVC	(N/A)
P-26	R-2	J-17	600.0	16	130.0	21.31	PVC	0.08
P-33	J-18	J-28	762.0	219	130.0	2.85	Concrete	0.01

6171 Hazeldean Road, Ottawa, ON

Peak Hour - Boundary Conditon, Location 2

Reservoir Table - Time: 0.00 hours

Label	Elevation (m)	Hydraulic Grade (m)
R-1	156.80	(N/A)
R-2	156.70	156.70

6171 Hazeldean Road, Ottawa, ON

Max Day Plus Fire Flow - Boundary Conditon, Location 2

Junction Table - Time: 0.00 hours

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
J-01	122.19	2.89	150.88	40.7
J-02	119.69	0.58	150.89	44.3
J-03	118.67	0.30	150.89	45.7
J-04	118.45	0.46	150.89	46.0
J-05	117.43	0.57	150.89	47.5
J-06	117.02	0.61	150.89	48.1
J-07	118.88	0.35	150.89	45.4
J-08	119.76	0.18	150.89	44.2
J-09	117.12	0.31	150.89	47.9
J-10	120.76	0.00	150.88	42.8
J-13	117.92	1.40	150.88	46.8
J-16	119.76	0.00	150.89	44.2
J-17	118.80	0.00	150.90	45.6
J-18	120.40	0.00	150.88	43.3
J-22	118.21	0.00	150.88	46.4
J-23	120.51	0.00	150.88	43.1
J-24	119.50	0.70	150.88	44.5
J-25	118.80	0.70	150.88	45.5
J-28	118.00	0.70	150.88	46.7
J-29	120.44	0.00	150.88	43.2

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-1	J-01	J-02	204.0	167	110.0	-1.67	PVC	0.05
P-2	J-02	J-03	204.0	73	110.0	-2.25	PVC	0.07
P-11	J-10	J-01	204.0	69	110.0	1.22	PVC	0.04
P-12	J-04	J-05	204.0	117	110.0	1.46	PVC	0.04
P-13	J-05	J-06	204.0	75	110.0	0.89	PVC	0.03
P-14	J-06	J-07	204.0	122	110.0	-0.75	PVC	0.02
P-24	J-06	J-09	204.0	71	110.0	1.03	PVC	0.03
P-23	J-09	J-22	204.0	48	110.0	0.72	PVC	0.02
P-35	J-22	J-08	204.0	71	110.0	-0.68	PVC	0.02
P-16	J-22	J-13	204.0	20	110.0	1.40	PVC	0.04
P-28	J-23	J-24	204.0	68	110.0	0.73	PVC	0.02
P-29	J-24	J-25	204.0	62	110.0	0.03	PVC	0.00
P-32	J-25	J-28	204.0	64	110.0	-0.67	PVC	0.02
P-36	J-29	J-18	297.0	10	120.0	1.37	PVC	0.02
P-4	J-03	J-17	297.0	77	120.0	-9.75	PVC	0.14
P-5	J-03	J-04	297.0	40	120.0	7.20	PVC	0.10
P-6	J-04	J-07	297.0	76	120.0	5.28	PVC	0.08
P-7	J-07	J-08	297.0	72	120.0	4.18	PVC	0.06
P-8	J-08	J-16	297.0	19	120.0	3.32	PVC	0.05

6171 Hazeldean Road, Ottawa, ON

Max Day Plus Fire Flow - Boundary Conditon, Location 2

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)	Hazen-Williams C	Flow (L/s)	Material	Velocity (m/s)
P-9	J-16	J-10	297.0	44	120.0	3.32	PVC	0.05
P-10	J-10	J-23	297.0	62	120.0	2.10	PVC	0.03
P-34	J-23	J-29	297.0	17	120.0	1.37	PVC	0.02
P-25	R-1	J-18	600.0	16	130.0	(N/A)	PVC	(N/A)
P-26	R-2	J-17	600.0	16	130.0	9.75	PVC	0.03
P-33	J-18	J-28	762.0	219	140.0	1.37	Steel	0.00

6171 Hazeldean Road, Ottawa, ON

Max Day Plus Fire Flow - Boundary Conditon, Location 2

Fire Flow Report - Time: 0.00 hours

Label	Fire Flow (Available) (L/s)	Flow (Total Needed) (L/s)	Junction w/ Minimum Pressure (System)	Pressure (Calculated System Lower Limit) (psi)	Velocity of Maximum Pipe (m/s)	Satisfies Fire Flow Constraints ?
J-01	234.38	202.89	J-10	33.4	4.49	True
J-02	274.36	167.58	J-01	27.7	5.65	True
J-03	300.00	167.30	J-01	33.8	4.47	True
J-04	300.00	167.46	J-01	31.5	4.47	True
J-05	282.63	167.57	J-01	31.6	4.40	True
J-06	300.00	167.61	J-09	27.9	4.47	True
J-07	300.00	167.35	J-01	29.1	4.47	True
J-08	300.00	167.18	J-01	26.9	4.47	True
J-09	277.17	167.31	J-22	25.1	4.44	True
J-10	300.00	167.00	J-23	24.5	4.47	True
J-13	231.81	168.40	J-22	27.2	7.13	True
J-16	300.00	167.00	J-01	26.2	4.47	True
J-17	300.00	167.00	J-01	40.7	1.10	True
J-18	283.21	167.00	J-29	20.6	4.23	True
J-22	276.22	167.00	J-13	20.4	5.02	True
J-23	294.29	167.00	J-29	20.1	4.39	True
J-24	229.91	200.70	J-25	25.6	4.14	True
J-25	235.09	200.70	J-24	23.8	4.24	True
J-28	283.30	267.70	J-18	20.0	4.23	True
J-29	286.71	167.00	J-18	20.1	4.28	True

Reservoir Table - Time: 0.00 hours

Label	Elevation (m)	Hydraulic Grade (m)
R-1	156.30	(N/A)
R-2	150.90	150.90

Appendix D – Sanitary Servicing Tables

Table D1 – Sanitary Sewer Design Sheet

TABLE D1: SANITARY SEWER CALCULATION SHEET

LOCATION				RESIDENTIAL AREAS AND POPULATIONS												COMMERCIAL			INDUSTRIAL			INSTITUTIONAL		INFILTRATION				SEWER DATA						
					NUMBER OF UNITS							POPULATION				AREA (ha)			AREA (ha)					AREA (ha)										
Street	U/S MH	D/S MH	Area Number	Area (ha)	Singles	Semis	Towns	Batch or 1-Bed Apt.	2-Bed Apt.	3-Bed Apt.	Total Units	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	Peak Flow (L/sec)	INDIV	ACCU	Peak Factor (per MOE)	AREA (Ha)	ACCU AREA (Ha)	INDIV	ACCU	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q$_{CAP}$ (%)	Full Velocity (m/s)
STREET 2																																		
9-storey bldg	MH 114	MH113	SA01	0.5063				95	57	8	160	277.5	277.5	3.47	3.12	0.1985	0.1985	0.06						0.5063	0.5063	0.17	3.35	250	251.46	3.00	18.00	104.61	0.03	2.09
	MH113	MH112	SA02	0.6490	5		16				21	60.2	337.7	3.44	3.76		0.1985	0.06						0.6490	1.1553	0.38	4.21	250	251.46	2.00	83.70	85.42	0.05	1.70
	MH112	MH111	SA03	0.6206	8		10				18	54.2	391.9	3.42	4.34		0.1985	0.06						0.6206	1.7759	0.59	4.99	250	251.46	0.60	77.77	46.78	0.11	0.93
	MH111	MH110	SA04	0.1186	1						1	3.4	395.3	3.42	4.38		0.1985	0.06						0.1186	1.8945	0.63	5.07	250	251.46	0.60	9.83	46.78	0.11	0.93
	MH110	MH109	SA05	0.4742	6		5				11	33.9	429.2	3.41	4.74		0.1985	0.06						0.4742	2.3687	0.78	5.59	250	251.46	0.60	67.23	46.78	0.12	0.93
	MH109	MH108	SA06	0.3145			9				9	24.3	453.5	3.4	5.00		0.1985	0.06						0.3145	2.6832	0.89	5.95	250	251.46	0.60	39.97	46.78	0.13	0.93
STREET 4																																		
	MH122	MH121	SA18	0.3460			8				8	21.6	21.6	3.7	0.26									0.3460	0.3460	0.11	0.37	200	201.2	0.65	59.67	26.87	0.01	0.84
	MH121	MH108	SA19	0.2962			8				8	21.6	43.2	3.66	0.51									0.2962	0.6422	0.21	0.72	200	201.2					
			Park	0.8213									43.2	3.66	0.51									0.8213	1.4635	0.48	1.00	200	201.2	0.65	76.39	26.87	0.04	0.84
STREET 2																																		
	MH108	MH107	SA07	0.7216			28				28	75.6	572.3	3.35	6.21		0.1985	0.06						0.7216	4.8683	1.61	7.88	250	251.46	0.30	117.25	33.08	0.24	0.66
	MH107	MH106	SA08	0.1160		2					2	5.4	577.7	3.35	6.27		0.1985	0.06						0.116	4.9843	1.64	7.98	250	251.46	0.30	10.81	33.08	0.24	0.66
	MH106	MH105	SA09	0.5252			20				20	54	631.7	3.34	6.84		0.1985	0.06						0.5252	5.5095	1.82	8.72	250	251.46	0.30	69.45	33.08	0.26	0.66
STREET 3																																		
	MH115	MH105	SA10	0.4976			16				16	43.2	43.2	3.66	0.51									0.4976	0.4976	0.16	0.68	200	201.2	0.65	86.64	26.87	0.03	0.84
STREET 2																																		
	MH105	MH104	SA11	0.3569			14				14	37.8	712.7	3.31	7.65		0.1985	0.06						0.3569	6.3640	2.10	9.81	250	251.46	0.30	51.89	33.08	0.30	0.66
	MH104	MH103	SA12	0.1686			6				6	16.2	728.9	3.31	7.82		0.1985	0.06						0.1686	6.5326	2.16	10.04	250	251.46	0.30	25.70	33.08	0.30	0.66
STREET 2																																		
	MH116	MH120	SA13	0.1963			6				6	16.2	16.2	3.71	0.19									0.1963	0.1963	0.06	0.26							
			SA17	0.3481									16.2	3.71	0.19									0.3481	0.5444	0.18	0.37	250	251.46	1.00	24.74	60.40	0.01	1.21
STREET 2																																		
Block A - E	MH123	MH120	SA15	1.3937				105	135		240	430.5	430.5	3.41	4.76									1.3937	1.3937	0.46	5.22	250	251.46	2.00	7.42	85.42	0.06	1.70
STREET 2																																		
	MH120	MH103	SA14	0.1591			2				2	5.4	452.1	3.4	4.98									0.1591	2.0972	0.69	5.67	250	251.46	0.60	60.78	46.78	0.12	0.93
OUTLET																																		
	MH103	MH102											1181.0	3.2	12.25		0.1985	0.06							8.6298	2.85	15.16	250	251.46	3.00	31.46	104.61	0.14	2.09
	MH102	MH100	Pond	0.3892									1181.0	3.2	12.25		0.1985	0.06						0.3892	9.0190	2.98	15.29	250	251.46	3.00	17.46	104.61	0.15	2.09
	MHSA81096	MHSA71780	Pathway										1181.0	3.2	12.25		0.1985	0.06							9.0190	2.98	15.29	300	299.36	0.22	55.50	45.10	0.34	0.64
				9.0190	20	2	148	200	192	8	570	1181.0				0.199								9.0190							991.66			

Residential Avg. Daily Flow, q (L/p/day) =	280	Commercial Peak Factor =	1.5	(when area >20%)	
Commercial Avg. Daily Flow (L/gross ha/day) =	28,000		1.0	(when area <20%)	
or L/gross ha/sec =	0.324				
Institutianal Avg. Daily Flow (L/day/ha) =	28,000	Institutional Peak Factor =	1.5	(when area >20%)	
or L/gross ha/day =	0.324		1.0	(when area <20%)	
Light Industrial Flow (L/gross ha/day) =	35,000				
or L/gross ha/sec =	0.40509	Residential Correction Factor, K =	0.80		
Light Industrial Flow (L/gross ha/day) =	55,000	Manning N =	0.013		
or L/gross ha/sec =	0.637	Peak extraneous flow, I (L/s/ha) =	0.33	(Total I/I)	

Peak Population Flow, (L/sec) =	P*q*M/86.4	Unit Type	Persons/Unit
Peak Extraneous Flow, (L/sec) =	I*Ac	Singles	3.4
Residential Peaking Factor, M =	1 + (14/(4+P^0.5)) * K	Semi-Detached	2.7
A_c = Cumulative Area (hectares)		Townhomes	2.7
P = Population (thousands)		Batchelor or	
		1-bed Apt. Unit	1.4
Sewer Capacity, Qcap (L/sec) =	1/N $S^{1/2}$ $R^{2/3}$ A_c	2-bed Apt. Unit	2.1
(Manning's Equation)		3-bed Apt. Unit	3.1
		4-bed Apt. Unit	3.8

Designed:	Project:
K. Hinds, P.Eng.	6171 Hazeldean Road
Checked:	Location:
B. Thomas, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
258780 Sanitary - Sewer Design Sheet, Oct 2022.xlsx	**1 of 1**

Appendix E – Stormwater Tables

Table E1 - Storm Sewer Calculation Sheet. 2-Year.

Table E2 - Storm Sewer Calculation Sheet. 2-Year - Includes Flow Controls.

Table E3 – Stage-Storage Table of Dry Pond

Chart E4 - Stage-Storage Curve of Dry Pond

Table E5 – Storage-Outflow Table of Dry Pond

Chart E6 – Storage-Outflow Curve of Dry Pond

Table E7 – Area-Depth Table of Dry Pond

Table E8 – Drawdown Table of Dry Pond

Table E9 – Storage-Depth and Outflow Through Sand Filter in Dry Pond

Table E10 – Estimation of Roof Storage and Outflow of 9-Storey Building

Table E11 – Estimation of Roof Storage and Outflow of 4-Storey Building A

Table E12 – Estimation of Roof Storage and Outflow of 4-Storey Building B

Table E13 – Estimation of Roof Storage and Outflow of 4-Storey Building C

Table E14 – Estimation of Roof Storage and Outflow of 4-Storey Building D

Table E15 – Estimation of Roof Storage and Outflow of 4-Storey Building E

Table E16 – Major System (Street Segment) Characteristics. Barrier Curb at 2% Longitudinal Slope.

Table E17 – Major System (Street Segment) Characteristics. Barrier Curb at 2% Longitudinal Slope.

Table E18 – Major System (Street Segment) Characteristics. Mountable Curb at 1% Longitudinal Slope.

Table E19 – Major System (Street Segment) Characteristics. Mountable Curb at 2% Longitudinal Slope.

Table E20 – Major System (Street Segment) Characteristics. Mountable Curb at 3% Longitudinal Slope.

Table E21 – Rating Curves for Modelling of Catchbasins – Surface Ponding Areas on Roadways (6 pages)

Table E22 – Rating Curves for Modelling of Catchbasins – Surface Ponding Areas on Roadways (10 pages)

Table E23 – Clearances Between USF and HGL (100-year, & 100-yea + 20%) Based on PCSWMM Results

TABLE E1
STORM SEWER CALCULATION SHEET

Return Period Storm = 2-year
Default Inlet Time= 10 (frontyard/row)
Default Inlet Time= 15 (rearyard)
Manning Coefficient = 0.013

Street	Storm MH No:		AREA INFO					PEAK FLOWS (UNRESTRICTED - RATIONAL METHOD)							SEWER DATA										
	U/S	D/S	Catchment No:	Type	Area (ha)	Accum. Area (ha)	Runoff Coeff, C	Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow	Return Period	Q (L/s)	Diameter (mm) Act	Diameter (mm) Nom	Type	Slope (%)	Length (m)	Capacity, Q_{CAP} (L/sec)	Velocity (m/s) Vf	Velocity (m/s) Va	Time in Pipe, Tt (min)	Hydraulic Ratios Q/Q_{CAP}	Hydraulic Ratios Va/Vf
Street 2	213	212	EXT_1	External	0.4761	0.4761	0.48	0.6353	0.6353	15.00	61.77	39.2	2-year	39.2											
			S63_3	Siteplan 1	0.0715	0.5476	0.47	0.0934	0.7287	10.00	76.81	7.2	2-year	56.0											
			S02	Frontyard/ROW	0.1522	0.6998	0.72	0.3046	1.0334	10.00	76.81	23.4	2-year	79.4											
			S03	Frontyard/ROW	0.1038	0.8036	0.73	0.2107	1.2440	10.00	76.81	16.2	2-year	95.5	447.9	450	PVC	2.00	80.90	398.13	2.54	1.70	0.79	0.24	0.67
	212	211	S04	Frontyard/ROW	0.1355	0.9391	0.73	0.2750	1.5190	10.00	76.81	21.1	2-year	116.7											
			S05	Frontyard/ROW	0.1095	1.0486	0.70	0.2131	1.7321	10.00	76.81	16.4	2-year	133.0											
			S40	Backyard	0.1574	1.2060	0.50	0.2188	1.9509	15.00	61.77	13.5	2-year	120.5											
			EXT_2	Offsite	0.7228	1.9288	0.37	0.7435	2.6944	15.00	61.77	45.9	2-year	166.4											
			S36	Backyard	0.1281	2.0569	0.33	0.1175	2.8119	15.00	61.77	7.3	2-year	173.7											
			S38	Frontyard/ROW	0.1960	2.2529	0.71	0.3869	3.1987	10.00	76.81	29.7	2-year	245.7											
			S39	Frontyard/ROW	0.1303	2.3832	0.71	0.2572	3.4559	10.00	76.81	19.8	2-year	265.4											
			S37	Backyard	0.0883	2.4715	0.28	0.0687	3.5247	15.00	61.77	4.2	2-year	217.7											
			EXT_3	External	0.2763	2.7478	0.44	0.3380	3.8626	10.79	73.89	25.0	2-year	285.4	610.0	600	CONC	0.40	79.89	405.83	1.37	1.32	1.01	0.70	0.96
	211	210				2.7478			3.8626	11.80	70.51		2-year	272.4	610.0	600	CONC	0.40	11.05	405.83	1.37	1.15	0.16	0.67	0.84
	210	209	S41	Backyard	0.0915	2.8393	0.51	0.130	3.9924	15.00	61.77	8.0	2-year	246.6											
			S06	Frontyard/ROW	0.1707	3.0100	0.66	0.313	4.3056	10.00	76.81	24.1	2-year	330.7											
			S07	Frontyard/ROW	0.0901	3.1001	0.66	0.165	4.4709	11.96	70.01	11.6	2-year	313.0	610.0	600	CONC	0.40	66.35	405.83	1.37	1.35	0.82	0.77	0.98
Samantha Eastop	225	209	S49	Backyard	0.1583	0.1583	0.52	0.229	0.2288	15.00	61.77	14.1	2-year	14.1	251.5	250	PVC	1.41	37.45	71.72	1.44	0.96	0.65	0.20	0.67
Street 2	209	208	S10	Frontyard/ROW	0.0960	3.3544	0.70	0.187	4.8865	12.78	67.54	12.6	2-year	330.1											
			S09	Frontyard/ROW	0.0752	3.4296	0.73	0.610	5.4965	12.78	67.54	41.2	2-year	371.3	685.0	675	CONC	0.40	39.97	552.90	1.49	1.25	0.53	0.67	0.84
Street 4	227	208	S60	Park	0.8210	0.8210	0.27	0.616	0.6162	15.00	61.77	38.1	2-year	38.1											
			S42	Backyard	0.1295	0.9505	0.43	0.155	0.7710	15.00	61.77	9.6	2-year	47.6											
			S28	Frontyard/ROW	0.1209	1.0714	0.71	0.239	1.0097	10.00	76.81	18.3	2-year	77.5											
			S11	Frontyard/ROW	0.0753	1.1467	0.66	0.138	1.1478	12.78	67.54	9.3	2-year	77.5	447.9	450	PVC	0.65	60.14	226.97	1.45	1.01	0.99	0.34	0.70
Street 2	208	207	S12	Frontyard/ROW	0.1564	4.7327	0.76	0.330	6.9748	10.00	76.81	25.4	2-year	535.7											
			S13	Frontyard/ROW	0.1116	4.8443	0.62	0.192	7.1672	10.00	76.81	14.8	2-year	550.5											
			S50	Backyard	0.1802	5.0245	0.50	0.250	7.4176	15.00	61.77	15.5	2-year	458.2											
			S14	Frontyard/ROW	0.1245	5.1490	0.76	0.263	7.6807	10.00	76.81	20.2	2-year	589.9											
			S15	Frontyard/ROW	0.0931	5.2421	0.68	0.176	7.8567	13.78	64.82	11.4	2-year	509.2	839.0	825	CONC	0.20	119.30	671.41	1.20	1.18	1.69	0.76	0.98
	207	206				5.2421			7.8567	15.47	60.69		2-year	476.8	839.0	825	CONC	0.20	12.00	671.41	1.20	1.18	0.17	0.71	0.98
	206	205	S16	Frontyard/ROW	0.1480	5.3901	0.74	0.304	8.1611	10.00	76.81	23.4	2-year	626.8											
			S17	Frontyard/ROW	0.0953	5.4854	0.71	0.188	8.3492	10.00	76.81	14.4	2-year	641.3											
			S51	Backyard	0.2814	5.7668	0.42	0.329	8.6778	15.64	60.31	19.8	2-year	523.3	839.0	825	CONC	0.20	68.67	671.41	1.20	1.18	0.97	0.78	0.98
Street 3	215	205	S25	Frontyard/ROW	0.1143	0.1143	0.69	0.219	0.2193	10.00	76.81	16.8	2-year	16.8											
			S26	Frontyard/ROW	0.1219	0.2362	0.63	0.213	0.4327	10.00	76.81	16.4	2-year	33.2											
			S43	Backyard	0.0557	0.2919	0.58	0.090	0.5226	15.00	61.77	5.5	2-year	32.3											
			S47	Backyard	0.1518	0.4437	0.50	0.211	0.7336	15.00	61.77	13.0	2-year	45.3											
			S48	Backyard	0.0932	0.5369	0.54	0.140	0.8735	15.00	61.77	8.6	2-year	54.0											
			S19	Frontyard/ROW	0.1222	0.6591	0.70	0.238	1.1113	10.00	76.81	18.3	2-year	85.4											
			S20	Frontyard/ROW	0.1267	0.7858	0.67	0.236	1.3473	10.00	76.81	18.1	2-year	103.5	447.9	450	PVC	0.65	90.53	226.97	1.45	1.02	1.48	0.46	0.71
Street 2	205	204	S52	Backyard	0.1309	6.6835	0.53	0.193	10.2179	15.00	61.77	11.9	2-year	631.1											
			S18	Frontyard/ROW	0.1135	6.7970	0.75	0.237	10.4546	16.61	58.22	13.8	2-year	608.6	839.0	825	CONC	0.20	53.43	671.41	1.20	1.20	0.74	0.91	1.00
	204	203				6.7970			10.4546	17.35	56.73		2-year	593.1	839.0	825	CONC	0.20	27.20	671.41	1.20	1.20	0.38	0.88	1.00
Street 1	221	220	S63_2	Siteplan 1	0.0704	0.0704	0.53	0.104	0.1037	10.00	76.81	8.0	2-year	8.0											
	220	218	S35	Frontyard/ROW	0.0478	0.1182	0.62	0.082	0.1861	10.00	76.81	6.3	2-year	14.3	299.4	300	PVC	1.07	11.19	99.46	1.42	0.83	0.22	0.14	0.59
			S32	Frontyard/ROW	0.0481	0.1663	0.62	0.083	0.2690	10.00	76.81	6.4	2-year	20.7											
			S63_6	Siteplan 1	0.0185	0.1848	0.62	0.032	0.3009	10.00	76.81	2.4	2-year	23.1											
			S62_4	Siteplan 2	0.0222	0.2070	0.46	0.028	0.3293	10.22	75.96	2.2	2-year	25.0	299.4	300	PVC	0.99	37.40	95.67	1.36	0.95	0.65	0.26	0.70
		`																							
Street 2	230	219	S63_1	Siteplan 1	0.1984	0.1984	0.90	0.496	0.4964	10.00	76.81	38.1	2-year	38.1											

STORM SEWER CALCULATION SHEET

Return Period Storm = **2-year**
Default Inlet Time= 10 (frontyard/row)
Default Inlet Time= 15 (rearyard)
Manning Coefficient = 0.013

Street	Storm MH No:		AREA INFO					PEAK FLOWS (UNRESTRICTED - RATIONAL METHOD)							SEWER DATA										
	U/S	D/S	Catchment No:	Type	Area (ha)	Accum. Area (ha)	Runoff Coeff, C	Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow	Return Period	Q (L/s)	Diameter (mm) Act	Diameter (mm) Nom	Type	Slope (%)	Length (m)	Capacity, Q_{CAP} (L/sec)	Velocity (m/s) Vf	Velocity (m/s) Va	Time in Pipe, Tt (min)	Hydraulic Ratios Q/Q_{CAP}	Hydraulic Ratios Va/Vf
			S63_5	Siteplan 1	0.0263	0.2247	0.88	0.064	0.5607	10.00	76.81	4.9	2-year	43.1											
			S63_4	Siteplan 1	0.1202	0.3449	0.73	0.244	0.8047	10.00	76.81	18.7	2-year	61.8	299.4	300	PVC	1.75	8.58	127.20	1.81	1.28	0.11	0.49	0.71
	219	218	S31	Frontyard/ROW	0.0641	0.4090	0.52	0.093	0.8973	10.00	76.81	7.1	2-year	68.9											
			S32_2	Frontyard/ROW	0.0612	0.4702	0.72	0.122	1.0198	10.11	76.38	9.4	2-year	77.9	299.4	300	PVC	3.28	12.50	174.14	2.48	1.75	0.12	0.45	0.71
Street 2	218	217	S33	Frontyard/ROW	0.0456	0.7228	0.71	0.090	1.4391	10.00	76.81	6.9	2-year	110.5											
			S34	Frontyard/ROW	0.0498	0.7726	0.70	0.097	1.5360	10.00	76.81	7.4	2-year	118.0											
			S62_5	Frontyard/ROW	0.0254	0.7980	0.30	0.021	1.5572	10.88	73.59	1.6	2-year	114.6	366.4	375	PVC	2.10	44.30	238.87	2.30	1.63	0.45	0.48	0.71
	229	217	S62_7	Siteplan 2	0.1274	0.1274	0.69	0.244	0.2444	10.00	76.81	18.8	2-year	18.8	251.5	250	PVC	2.10	19.45	87.53	1.76	1.16	0.28	0.21	0.66
Street 4	217	216	S29	Frontyard/ROW	0.0132	0.9386	0.67	0.025	1.8262	11.33	72.04	1.8	2-year	131.6	366.4	375	PVC	2.00	18.65	233.11	2.25	1.59	0.20	0.56	0.71
	228	216	S24	Frontyard/ROW	0.0872	0.0872	0.69	0.167	0.1673	10.00	76.81	12.8	2-year	12.8											
			S30	Frontyard/ROW	0.1290	0.2162	0.71	0.255	0.4219	10.00	76.81	19.6	2-year	32.4	299.4	300	PVC	0.65	61.18	77.52	1.10	0.78	1.31	0.42	0.71
Street 2	216	226	S62_6	Siteplan 2	0.0614	1.2162	0.69	0.118	2.3659	10.00	76.81	9.0	2-year	181.7											
			S27	Frontyard/ROW	0.0486	1.2648	0.72	0.097	2.4631	10.00	76.81	7.5	2-year	189.2											
			S23	Frontyard/ROW	0.0803	1.3451	0.57	0.127	2.5904	11.53	71.40	9.1	2-year	185.0	533.0	525	PVC	0.60	72.69	346.83	1.54	1.09	1.11	0.53	0.71
	223	226	S62_2	Siteplan 2	0.0481	0.0481	0.55	0.074	0.0735	10.00	76.81	5.6	2-year	5.6											
			S62_1	Siteplan 2	0.5423	0.5904	0.53	0.799	0.8726	10.00	76.81	61.4	2-year	67.0	366.4	375	PVC	2.00	8.10	233.11	2.25	1.57	0.09	0.29	0.70
	226	203	S44	Backyard	0.0619	1.9974	0.55	0.095	3.5576	15.00	61.77	5.8	2-year	219.7											
			S45	Backyard	0.1558	2.1532	0.49	0.212	3.7698	15.00	61.77	13.1	2-year	232.9											
			S46	Backyard	0.1072	2.2604	0.51	0.152	3.9218	15.00	61.77	9.4	2-year	242.2											
			S62_9	Siteplan 2	0.3388	2.5992	0.57	0.537	4.4587	10.00	76.81	41.2	2-year	342.4											
			S62_8	Siteplan 2	0.2267	2.8259	0.56	0.353	4.8116	10.00	76.81	27.1	2-year	369.6											
			S22	Frontyard/ROW	0.2112	3.0371	0.70	0.411	5.2226	10.00	76.81	31.6	2-year	401.1											
			S21	Frontyard/ROW	0.1809	3.2180	0.73	0.367	5.5897	12.64	67.96	25.0	2-year	379.9	685.0	675	PVC	0.55	59.34	648.33	1.74	1.57	0.63	0.59	0.90
	203	POND				10.0150			16.0443	17.73	56.00		2-year	898.5	914.0	900	PVC	0.93	17.47	1816.22	2.74	1.94	0.15	0.49	0.71
	POND	201	S61	SWM	0.3962	10.4112	0.25	0.275	16.3197	17.88	55.72	15.3	2-year	909.3											
	201	200				10.4112			16.3197	17.88	55.72		2-year	909.3	976.0	975	PVC	0.30	12.42	1230.83	1.64	1.61	0.13	0.74	0.98
	200	78511				10.4112			16.3197	18.01	55.48		2-year	905.4	1068.0	1050	PVC	0.30	6.62	1565.03	1.73	1.22	0.09	0.58	0.71
	78511	78508				10.4112			16.3197	18.10	55.31		2-year	902.7	1068.0	1050	PVC	0.30	52.70	1565.03	1.73	1.22	0.72	0.58	0.71
TOTALS =					**10.411**		**0.56**	**16.320**				**1156.7**													

Definitions:
Q = 2.78*AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Watershed Area (hectares)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficients (dimensionless)

Ottawa Rainfall Intensity Values from Sewer Design Guidelines, SDG002

	a	b	c
2-year	732.951	6.199	0.810
5-year	998.071	6.053	0.814
100-year	1735.688	6.014	0.820

Designed:	Project:	
J. Fitzpatrick, P.Eng.	6171 Hazeldean Road	
Checked:	Location:	
B. Thomas, P.Eng.	6171 Hazeldean Road	
Dwg Reference:	File Ref:	Sheet No:
Drawing C09	258780 Storm - Sewer Design Sheets, Oct 2022.xlsx	1 of 1

TABLE E2

STORM SEWER CALCULATION SHEET - INCLUDES FLOW CONTROL

Return Period Storm = 2-year
Default Inlet Time= 10 (frontyard/row)
Default Inlet Time= 15 (rearyard)
Manning Coefficient = 0.013

	Storm MH No:		AREA INFO					PEAK FLOWS (UNRESTRICTED - RATIONAL METHOD)								CAPTURED FLOWS BASED ON NUMBER OF INTLETS																												SEWER DATA										
Street	U/S	D/S	Catchment No:	Type	Area (ha)	Accum. Area (ha)	Runoff Coeff, C	Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow	Return Period	Q (L/s)	Type of ICD	Type X (at 13.4 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv	Captured Flows (L/s) Cum	Type A (at 19.8 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv	Captured Flows (L/s) Cum	Type B (at 28.4 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv	Captured Flows (L/s) Cum	Type C (at 38.2 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv.	Captured Flows (L/s) Cumul.	Type D (at 53.0 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv.	Captured Flows (L/s) Cumul.	Type F (at 71.0 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv.	Captured Flows (L/s) Cumul.	Custom Captured Flows (L/s) Indiv.	Custom Captured Flows (L/s) Cumul.	Indv Captured Flows (L/sec)	Total Captured Flows (L/sec)	Diameter (mm) Act	Diameter (mm) Nom	Type	Slope (%)	Length (m)	Capacity, Q_{CAP} (L/sec)	Velocity (m/s) Vf	Velocity (m/s) Va	Time in Pipe, Tt (min)	Hydraulic Ratios Q/Q_{CAP}	Hydraulic Ratios Va/Vf
Street 2	213	212	EXT_1	External	0.4761	0.4761	0.48	0.6353	0.6353	15.00	61.77	39.2	2-year	39.2																																								
			S63_3	Siteplan 1	0.0715	0.5476	0.47	0.0934	0.7287	10.00	76.81	7.2	2-year	56.0	Type D																	1	1	53.0	53.0							53.0	53.0											
			S02	Frontyard/ROW	0.1522	0.6998	0.72	0.3046	1.0334	10.00	76.81	23.4	2-year	79.4	Type C													1	1	38.2	38.2		1		53.0							38.2	91.2											
			S03	Frontyard/ROW	0.1038	0.8036	0.73	0.2107	1.2440	10.00	76.81	16.2	2-year	95.5	Type B									1	1	28.4	28.4		1		38.2		1		53.0							28.4	119.6	447.9	450	PVC	2.00	80.90	398.13	2.54	1.70	0.79	0.24	0.67
	212	211	S04	Frontyard/ROW	0.1355	0.9391	0.73	0.2750	1.5190	10.00	76.81	21.1	2-year	116.7	Type B									1	2	28.4	56.8		1		38.2		1		53.0							28.4	148.0											
			S05	Frontyard/ROW	0.1095	1.0486	0.70	0.2131	1.7321	10.00	76.81	16.4	2-year	133.0	Type A					1	1	19.8	19.8		2		56.8		1		38.2		1		53.0							19.8	167.8											
			S40	Backyard	0.1574	1.2060	0.50	0.2188	1.9509	15.00	61.77	13.5	2-year	120.5	Type A					1	2	19.8	39.6		2		56.8		1		38.2		1		53.0							19.8	187.6											
			EXT_2	Offsite	0.7228	1.9288	0.37	0.7435	2.6944	15.00	61.77	45.9	2-year	166.4							2		39.6		2		56.8		1		38.2		1		53.0								187.6											
			S36	Backyard	0.1281	2.0569	0.33	0.1175	2.8119	15.00	61.77	7.3	2-year	173.7	Type D						2		39.6		2		56.8		1		38.2	1	2	53.0	106.0							53.0	240.6											
			S38	Frontyard/ROW	0.1960	2.2529	0.71	0.3869	3.1987	10.00	76.81	29.7	2-year	245.7	Type F						2		39.6		2		56.8		1		38.2		2		106.0	1	1.0	71.0	71.0			71.0	311.6											
			S39	Frontyard/ROW	0.1303	2.3832	0.71	0.2572	3.4559	10.00	76.81	19.8	2-year	265.4	Type C						2		39.6		2		56.8	1	2	38.2	76.4		2		106.0		1.0		71.0			38.2	349.8											
			S37	Backyard	0.0883	2.4715	0.28	0.0687	3.5247	15.00	61.77	4.2	2-year	217.7	Type X	1	1	13.4	13.4		2		39.6		2		56.8		2		76.4		2		106.0		1.0		71.0			13.4	363.2											
			EXT_3	External	0.2763	2.7478	0.44	0.3380	3.8626	10.79	73.89	25.0	2-year	285.4			1		13.4		2		39.6		2		56.8		2		76.4		2		106.0		1.0		71.0				363.2	610.0	600	CONC	0.40	79.89	405.83	1.37	1.32	1.01	0.70	0.96
	211	210				2.7478			3.8626	11.80	70.51		2-year	272.4			1		13.4		2		39.6		2		56.8		2		76.4		2		106.0		1.0		71.0				363.2	610.0	600	CONC	0.40	11.05	405.83	1.37	1.15	0.16	0.67	0.84
	210	209	S41	Backyard	0.0915	2.8393	0.51	0.130	3.9924	15.00	61.77	8.0	2-year	246.6	Type X	1	2	13.4	26.8		2		39.6		2		56.8		2		76.4		2		106.0		1.0		71.0			13.4	376.6											
			S06	Frontyard/ROW	0.1707	3.0100	0.66	0.313	4.3056	10.00	76.81	24.1	2-year	330.7	Type B		2		26.8		2		39.6	1	3	28.4	85.2		2		76.4		2		106.0		1.0		71.0			28.4	405.0											
			S07	Frontyard/ROW	0.0901	3.1001	0.66	0.165	4.4709	11.96	70.01	11.6	2-year	313.0	Type A		2		26.8	1	3	19.8	59.4		3		85.2		2		76.4		2		106.0		1.0		71.0			19.8	424.8	610.0	600	CONC	0.40	66.35	405.83	1.37	1.35	0.82	0.77	0.98
Samantha Eastop	225	209	S49	Backyard	0.1583	0.1583	0.52	0.229	0.2288	15.00	61.77	14.1	2-year	14.1	Type B									1	1	28.4	28.4															28.4	28.4	251.5	250	PVC	1.41	37.45	71.72	1.44	0.96	0.65	0.20	0.67
Street 2	209	208	S10	Frontyard/ROW	0.0960	3.3544	0.70	0.187	4.8865	12.78	67.54	12.6	2-year	330.1	Type C		2		26.8		3		59.4		4		113.6	1	3	38.2	114.6		2		106.0		1.0		71.0			38.2	491.4											
			S09	Frontyard/ROW	0.0752	3.4296	0.73	0.610	5.4965	12.78	67.54	41.2	2-year	371.3	Type X	1	3	13.4	40.2		3		59.4		4		113.6		3		114.6		2		106.0		1.0		71.0			13.4	504.8	685.0	675	CONC	0.40	39.97	552.90	1.49	1.25	0.53	0.67	0.84
Street 4	227	208	S60	Park	0.8210	0.8210	0.27	0.616	0.6162	15.00	61.77	38.1	2-year	38.1	Type C													1	1	38.2	38.2											38.2	38.2											
			S42	Backyard	0.1295	0.9505	0.43	0.155	0.7710	15.00	61.77	9.6	2-year	47.6	Type X	1	1	13.4	13.4										1		38.2											13.4	51.6											
			S28	Frontyard/ROW	0.1209	1.0714	0.71	0.239	1.0097	10.00	76.81	18.3	2-year	77.5	Type B		1		13.4					1	1	28.4	28.4		1		38.2											28.4	80.0											
			S11	Frontyard/ROW	0.0753	1.1467	0.66	0.138	1.1478	12.78	67.54	9.3	2-year	77.5	Type A		1		13.4	1	1	19.8	19.8		1		28.4		1		38.2											19.8	99.8	447.9	450	PVC	0.65	60.14	226.97	1.45	1.01	0.99	0.34	0.70
Street 2	208	207	S12	Frontyard/ROW	0.1564	4.7327	0.76	0.330	6.9748	10.00	76.81	25.4	2-year	535.7	Type C		4		53.6		4		79		5		142	1	5	38.2	191		2		106		1		71			38.2	642.8											
			S13	Frontyard/ROW	0.1116	4.8443	0.62	0.192	7.1672	10.00	76.81	14.8	2-year	550.5	Type B		4		53.6		4		79.2	1	6	28.4	170.4		5		191.0		2		106.0		1.0		71.0			28.4	671.2											
			S50	Backyard	0.1802	5.0245	0.50	0.250	7.4176	15.00	61.77	15.5	2-year	458.2	Type A		4		53.6	1	5	19.8	99.0		6		170.4		5		191.0		2		106.0		1.0		71.0			19.8	691.0											
			S14	Frontyard/ROW	0.1245	5.1490	0.76	0.263	7.6807	10.00	76.81	20.2	2-year	589.9	Type A		4		53.6	1	6	19.8	118.8		6		170.4		5		191.0		2		106.0		1.0		71.0			19.8	710.8											
			S15	Frontyard/ROW	0.0931	5.2421	0.68	0.176	7.8567	13.78	64.82	11.4	2-year	509.2	Type A		4		53.6	1	7	19.8	138.6		6		170.4		5		191.0		2		106.0		1.0		71.0			19.8	730.6	839.0	825	CONC	0.20	119.30	671.41	1.20	1.18	1.69	0.76	0.98
	207	206				5.2421			7.8567	15.47	60.69		2-year	476.8			4		53.6		7		138.6		6		170.4		5		191.0		2		106.0		1.0		71.0				730.6	839.0	825	CONC	0.20	12.00	671.41	1.20	1.18	0.17	0.71	0.98
	206	205	S16	Frontyard/ROW	0.1480	5.3901	0.74	0.304	8.1611	10.00	76.81	23.4	2-year	626.8	Type B		4		53.6		7		138.6	1	7	28.4	198.8		5		191.0		2		106.0		1.0		71.0			28.4	759.0											
			S17	Frontyard/ROW	0.0953	5.4854	0.71	0.188	8.3492	10.00	76.81	14.4	2-year	641.3	Type A		4		53.6	1	8	19.8	158.4		7		198.8		5		191.0		2		106.0		1.0		71.0			19.8	778.8											
			S51	Backyard	0.2814	5.7668	0.42	0.329	8.6778	15.64	60.31	19.8	2-year	523.3	Type B		4		53.6		8		158.4	1	8	28.4	227.2		5		191.0		2		106.0		1.0		71.0			28.4	807.2	839.0	825	CONC	0.20	68.67	671.41	1.20	1.18	0.97	0.78	0.98
Street 3	215	205	S25	Frontyard/ROW	0.1143	0.1143	0.69	0.219	0.2193	10.00	76.81	16.8	2-year	16.8	Type A					1	1	19.8	19.8																			19.8	19.8											
			S26	Frontyard/ROW	0.1219	0.2362	0.63	0.213	0.4327	10.00	76.81	16.4	2-year	33.2	Type A					1	2	19.8	39.6																			19.8	39.6											
			S43	Backyard	0.0557	0.2919	0.58	0.090	0.5226	15.00	61.77	5.5	2-year	32.3							2		39.6																				39.6											
			S47	Backyard	0.1518	0.4437	0.50	0.211	0.7336	15.00	61.77	13.0	2-year	45.3							2		39.6																				39.6											
			S48	Backyard	0.0932	0.5369	0.54	0.140	0.8735	15.00	61.77	8.6	2-year	54.0	Type B						2		39.6	1	1	28.4	28.4															28.4	68.0											
			S19	Frontyard/ROW	0.1222	0.6591	0.70	0.238	1.1113	10.00	76.81	18.3	2-year	85.4	Type B						2		39.6	1	2	28.4	56.8															28.4	96.4											
			S20	Frontyard/ROW	0.1267	0.7858	0.67	0.236	1.3473	10.00	76.81	18.1	2-year	103.5	Type B						2		39.6	1	3	28.4	85.2															28.4	124.8	447.9	450	PVC	0.65	90.53	226.97	1.45	1.02	1.48	0.46	0.71
Street 2	205	204	S52	Backyard	0.1309	6.6835	0.53	0.193	10.2179	15.00	61.77	11.9	2-year	631.1	Type A		4		53.6	1	11	19.8	217.8		11		312.4		5		191.0		2		106.0		1.0		71.0			19.8	951.8											
			S18	Frontyard/ROW	0.1135	6.7970	0.75	0.237	10.4546	16.61	58.22	13.8	2-year	608.6	Type A		4		53.6	1	12	19.8	237.6		11		312.4		5		191.0		2		106.0		1.0		71.0			19.8	971.6	839.0	825	CONC	0.20	53.43	671.41	1.20	1.20	0.74	0.91	1.00
	204	203				6.7970			10.4546	17.35	56.73		2-year	593.1			4		53.6		12		237.6		11		312.4		5		191.0		2		106.0		1.0		71.0				971.6	839.0	825	CONC	0.20	27.20	671.41	1.20	1.20	0.38	0.88	1.00
Street 1	221	220	S63_2	Siteplan 1	0.0704	0.0704	0.53	0.104	0.1037	10.00	76.81	8.0	2-year	8.0	Type X	1	1	13.4	13.4																							13.4	13.4											
	220	218	S35	Frontyard/ROW	0.0478	0.1182	0.62	0.082	0.1861	10.00	76.81	6.3	2-year	14.3			1		13.4																								13.4	299.4	300	PVC	1.07	11.19	99.46	1.42	0.83	0.22	0.14	0.59
			S32	Frontyard/ROW	0.0481	0.1663	0.62	0.083	0.2690	10.00	76.81	6.4	2-year	20.7	Type X	1	2	13.4	26.8																							13.4	26.8											
			S63_6	Siteplan 1	0.0185	0.1848	0.62	0.032	0.3009	10.00	76.81	2.4	2-year	23.1			2		26.8																								26.8											
			S62_4	Siteplan 2	0.0222	0.2070	0.46	0.028	0.3293	10.22	75.96	2.2	2-year	25.0			2		26.8																								26.8	299.4	300	PVC	0.99	37.40	95.67	1.36	0.95	0.65	0.26	0.70
		`																																																				
Street 2	230	219	S63_1	Siteplan 1	0.1984	0.1984	0.90	0.496	0.4964	10.00	76.81	38.1	2-year	38.1	Other																																							
			S63_5	Siteplan 1	0.0263	0.2247	0.88	0.064	0.5607	10.00	76.81	4.9	2-year	43.1	Type X	1	1	13.4	13.4																							13.4	13.4											
			S63_4	Siteplan 1	0.1202	0.3449	0.73	0.244	0.8047	10.00	76.81	18.7	2-year	61.8	Type A		1		13.4	1	1	19.8	19.8																			19.8	33.2	299.4	300	PVC	1.75	8.58	127.20	1.81	1.28	0.11	0.49	0.71
	219	218	S31	Frontyard/ROW	0.0641	0.4090	0.52	0.093	0.8973	10.00	76.81	7.1	2-year	68.9	Type X	1	2	13.4	26.8		1		19.8																			13.4	46.6											
			S32_2	Frontyard/ROW	0.0612	0.4702	0.72	0.122	1.0198	10.11	76.38	9.4	2-year	77.9	Type A		2		26.8	1	2	19.8	39.6																			19.8	66.4	299.4	300	PVC	3.28	12.50	174.14	2.48	1.75	0.12	0.45	0.71
Street 2	218	217	S33	Frontyard/ROW	0.0456	0.7228	0.71	0.090	1.4391	10.00	76.81	6.9	2-year	110.5	Type X	1	5	13.4	67.0		2		39.6																			13.4	106.6											
			S34	Frontyard/ROW	0.0498	0.7726	0.70	0.097	1.5360	10.00	76.81	7.4	2-year	118.0	Type X	1	6	13.4	80.4		2		39.6																			13.4	120.0											
			S62_5	Frontyard/ROW	0.0254	0.7980	0.30	0.021	1.5572	10.88	73.59	1.6	2-year	114.6			6		80.4		2		39.6																				120.0	366.4	375	PVC	2.10	44.30	238.87	2.30	1.63	0.45	0.48	0.71
	229	217	S62_7	Siteplan 2	0.1274	0.1274	0.69	0.244	0.2444	10.00	76.81	18.8	2-year	18.8	Type A					1	1	19.8	19.8																			19.8	19.8	251.5	250	PVC	2.10	19.45	87.53	1.76	1.16	0.28	0.21	0.66
Street 4	217	216	S29	Frontyard/ROW	0.0132	0.9386	0.67	0.025	1.8262	11.33	72.04	1.8	2-year	131.6	Type X	1	7	13.4	93.8		3		59.4																			13.4	153.2	366.4	375	PVC	2.00	18.65	233.11	2.25	1.59	0.20	0.56	0.71
	228	216	S24	Frontyard/ROW	0.0872	0.0872	0.69	0.167	0.1673	10.00	76.81	12.8	2-year	12.8	Type X	1	1	13.4	13.4																							13.4	13.4											
			S30	Frontyard/ROW	0.1290	0.2162	0.71	0.255	0.4219	10.00	76.81	19.6	2-year	32.4	Type A		1		13.4	1	1	19.8	19.8																			19.8	33.2	299.4	300	PVC	0.65	61.18	77.52	1.10	0.78	1.31	0.42	0.71
Street 2	216	226	S62_6	Siteplan 2	0.0614	1.2162	0.69	0.118	2.3659	10.00	76.81	9.0	2-year	181.7			8		107.2		4		79.2																				186.4											
			S27	Frontyard/ROW	0.0486	1.2648	0.72	0.097	2.4631	10.00	76.81	7.5	2-year	189.2	Type X	1	9	13.4	120.6		4		79.2																			13.4	199.8											
			S23	Frontyard/ROW	0.0803	1.3451	0.57	0.127	2.5904	11.53	71.40	9.1	2-year	185.0	Type X	1	10	13.4	134.0		4		79.2																			13.4	213.2	533.0	525	PVC	0.60	72.69	346.83	1.54	1.09	1.11	0.53	0.71
	223	226	S62_2	Siteplan 2	0.0481	0.0481	0.55	0.074	0.0735	10.00	76.81	5.6	2-year	5.6																																								
			S62_1	Siteplan 2	0.5423	0.5904	0.53	0.799	0.8726	10.00	76.81	61.4	2-year	67.0																														366.4	375	PVC	2.00	8.10	233.11	2.25	1.57	0.09	0.29	0.70
	226	203	S44	Backyard	0.0619	1.9974	0.55	0.095	3.5576	15.00	61.77	5.8	2-year	219.7			10		134.0		#####		#####																				213.2											
			S45	Backyard	0.1558	2.1532	0.49	0.212	3.7698	15.00	61.77	13.1	2-year	232.9			10		134.0		4		79.2																				213.2											
			S46	Backyard	0.1072	2.2604	0.51	0.152	3.9218	15.00	61.77	9.4	2-year	242.2	Type C		10		134.0		4		79.2					1	1	38.2	38.2											38.2	251.4											
			S62_9	Siteplan 2	0.3388	2.5992	0.57	0.537	4.4587	10.00	76.81	41.2	2-year	342.4	Type C		10		134.0		4		79.2					1	2	38.2	76.4											38.2	289.6											
			S62_8	Siteplan 2	0.2267	2.8259	0.56	0.353	4.8116	10.00	76.81	27.1	2-year	369.6			10		134.0		4		79.2						2		76.4												289.6											
			S22	Frontyard/ROW	0.2112	3.0371	0.70	0.411	5.2226	10.00	76.81	31.6	2-year	401.1	Type D		10		134.0		4		79.2						2		76.4	1	1	53.0	53.0							53.0	342.6											
			S21	Frontyard/ROW	0.1809	3.2180	0.73	0.367	5.5897	12.64	67.96	25.0	2-year	379.9	Type D		10		134.0		4		79.2						2		76.4	1	2	53.0	106.0							53.0	395.6	685.0	675	PVC	0.55	59.34	648.33	1.74	1.57	0.63	0.59	0.90
	203	POND				10.0150			16.0443	17.73	56.00		2-year	898.5			14	14	201.6		16		316.8		11		312.4		7		267.4		4		212.0		1		71			14.0	1381.2	914.0	900	PVC	0.93	17.47	1816.22	2.74	1.94	0.15	0.49	0.71

STORM SEWER CALCULATION SHEET - INCLUDES FLOW CONTROL

Return Period Storm = 2-year
Default Inlet Time= 10 (frontyard/row)
Default Inlet Time= 15 (rearyard)
Manning Coefficient = 0.013

Street	Storm MH No: U/S	Storm MH No: D/S	AREA INFO: Catchment No:	Type	Area (ha)	Accum. Area (ha)	Runoff Coeff, C	PEAK FLOWS (UNRESTRICTED - RATIONAL METHOD): Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow	Return Period	Q (L/s)
	POND	201	S61	SWM	0.3962	10.4112	0.25	0.275	16.3197	17.88	55.72	15.3	2-year	909.3
	201	200				10.4112			16.3197	17.88	55.72		2-year	909.3
	200	78511				10.4112			16.3197	18.01	55.48		2-year	905.4
	78511	78508				10.4112			16.3197	18.10	55.31		2-year	902.7
TOTALS =					**10.411**		**0.56**	**16.320**				**1156.7**		

CAPTURED FLOWS BASED ON NUMBER OF INTLETS

U/S	Type of ICD	Type X (at 13.4 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv	Captured Flows (L/s) Cum	Type A (at 19.8 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv	Captured Flows (L/s) Cum	Type B (at 28.4 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv	Captured Flows (L/s) Cum	Type C (at 38.2 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv.	Captured Flows (L/s) Cumul.	Type D (at 53.0 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv.	Captured Flows (L/s) Cumul.	Type F (at 71.0 L/sec) No. of ICDs Indiv	No. of ICDs Cum	Captured Flows (L/s) Indiv.	Captured Flows (L/s) Cumul.	Custom Captured Flows (L/s) Indiv.	Custom Captured Flows (L/s) Cumul.	Indv Captured Flows (L/sec)	Total Captured Flows (L/sec)
POND			14		202		16		317		11		312		7		267		4		212		1		71				1381.2
201			14		202		16		317		11		312		7		267		4		212		1		71				1381.2
200			14		202		16		317		11		312		7		267		4		212		1		71				1381.2
78511			14		202		16		317		11		312		7		267		4		212		1		71				1381.2
TOTALS =		**14**		**201.6**		**16**		**316.8**		**11**		**312.4**		**7**		**267.4**		**4**		**212.0**		**1**		**71.0**				**1381.2**	

SEWER DATA

U/S	Diameter (mm) Act	Diameter (mm) Nom	Type	Slope (%)	Length (m)	Capacity, Q_{CAP} (L/sec)	Velocity (m/s) Vf	Velocity (m/s) Va	Time in Pipe, Tt (min)	Hydraulic Ratios Q/Q_{CAP}	Hydraulic Ratios Va/Vf
POND											
201	976.0	975	PVC	0.30	12.42	1230.83	1.64	1.61	0.13	0.74	0.98
200	1068.0	1050	PVC	0.30	6.62	1565.03	1.73	1.22	0.09	0.58	0.71
78511	1068.0	1050	PVC	0.30	52.70	1565.03	1.73	1.22	0.72	0.58	0.71

Definitions:

Q = 2.78*AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Watershed Area (hectares)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficients (dimensionless)

Ottawa Rainfall Intensity Values from Sewer Design Guidelines, SDG002

	a	b	c
2-year	732.951	6.199	0.810
5-year	998.071	6.053	0.814
100-year	1735.688	6.014	0.820

Summary of Flows (for 10.41 ha)

TOTAL NUMBER OF ICDS = **53**
TOTAL CAPTURE OF ALL ICDs (L/sec) = **1381 L/sec**
TOTAL CAPTURE RATE (L/ha/sec)= **132.7 L/ha/sec**
TOTAL 2YR RATE (L/ha/sec)= **87.0 L/ha/sec**

ICD Types and Flow Rates

Type X	**13.4**	**L/sec**
Type A	**19.8**	**L/sec**
Type B	**28.4**	**L/sec**
Type C	**38.2**	**L/sec**
Type D	**53.0**	**L/sec**
Type F	**71.0**	**L/sec**
Other	**Custom**	**L/sec**

Designed:	Project:	
J. Fitzpatrick, P.Eng.	6171 Hazeldean Road	
Checked:	Location:	
B. Thomas, P.Eng.	6171 Hazeldean Road	
Dwg Reference:	File Ref:	Sheet No:
Drawing C09	258780 Storm - Sewer Design Sheets, Oct 2022.xlsx	1 of 1

TABLE E3
Stage-Storage Table of DRY POND
6171 Hazeldean Road

Description	Elev	Incr. Elev	Tot. Depth	End Area	Average Area	Volume	Cumulative Volume
	(m)	(m)	(m)	(m2)	(m2)	(m3)	(m3)
Active Storage							
Top of Pond Elev	116.15	0.25	2.70	2564.1	2522	631	5195
Emergency Spill Elev	115.90	1.35	2.45	2480.1	2131	2877	4564
Intermediate point	114.55	1.00	1.10	1782.0	1556	1556	1687
	113.55	0.10	0.10	1330.3	1310	131	131
Bottom of Drypond	113.45	0.00	0.00	1289.6	0	0	0
Below Pond Bottom							
Normal Water Level (NWL)	113.45	0.00	0.00	0	0	0	0
Slope change (5:1)	113.45	0.00	0.00	0	0	0	0
Bottom of Main Cell	113.45	0.00	0.00	0	0	0	0
Sediment Forebay							
Normal Water Level (NWL)	113.45	0.00	0.00	0	0	0	0
Top of forebay berm	113.45	0.00	0.00	0	0	0	0
Slope change	113.45	0.00	0.00	0	0	0	0
Bottom of sediment forebay	113.45	0.00	0.00	0	0	0	0
Maximum Active Storage =							5,195
Permanent Storage (Below NWL) =							0
Total Pond Storage (Active and Permanent) =							5,195

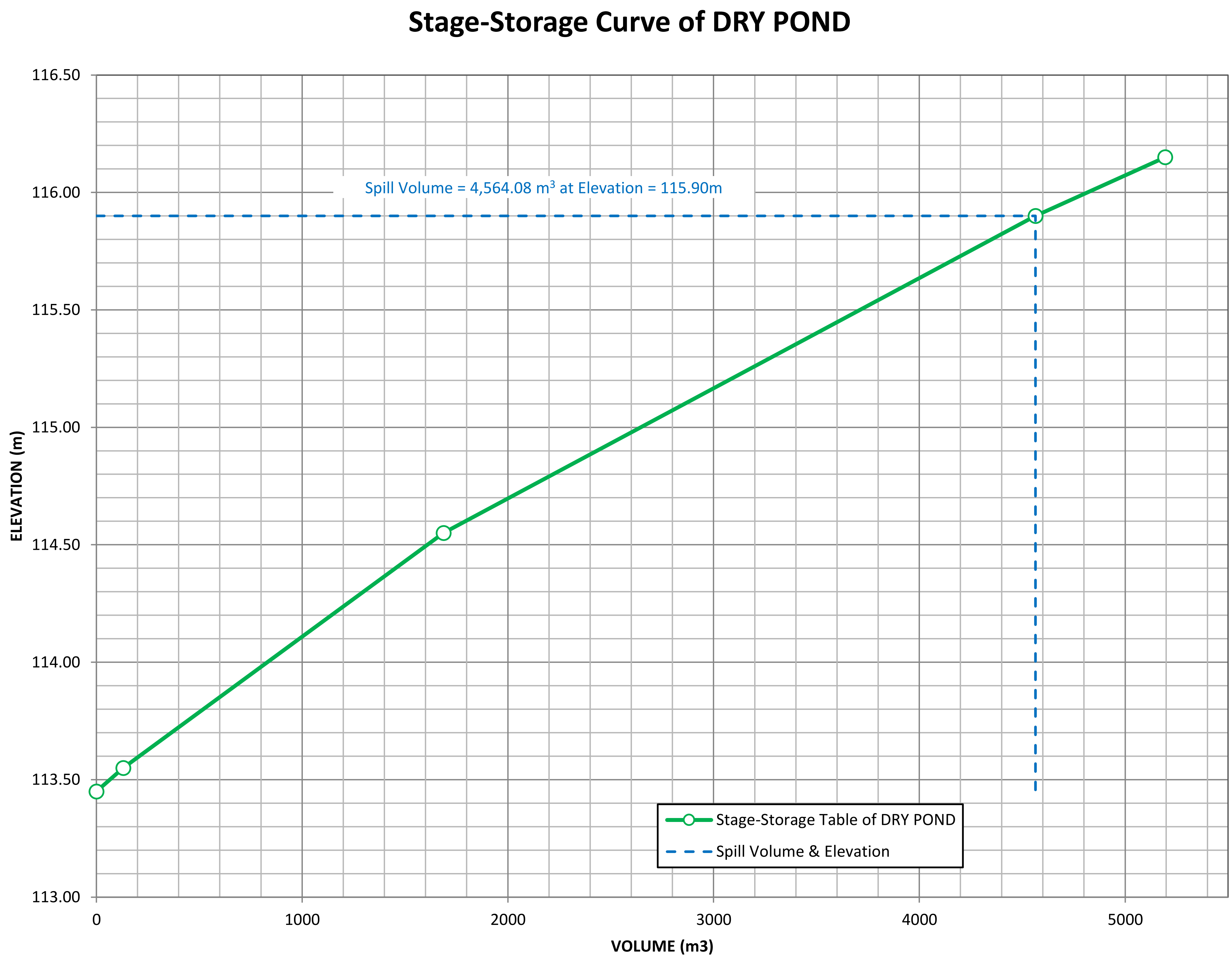

Stage-Storage Curve of DRY POND
ELEVATION (m)
116.50
116.00
115.50
115.00
114.50
114.00
113.50
113.00
Spill Volume = 4,564.08 m3 at Elevation = 115.90m
0
1000
2000
3000
4000
5000
VOLUME (m3)
Stage-Storage Table of DRY POND
Spill Volume & Elevation

TABLE E5

Storage-Outflow Table of DRY POND

3934	100-year +20% Storm Volume (12-hr SCS Storm)
115.68	100-year+20% Storm Elev.
3219	100-year Storm Volume (12-hr SCS Storm)
115.36	100-year Storm Elev.
1834	5 -year Storm Volume (12-hr SCS Storm)
114.65	5-year Storm Elev.
1354	2 -year Storm Volume (12-hr SCS Storm)
114.37	2-year Storm Elev.
575.0	15mm Storm Volume
113.87	15mm Storm Elev.

from PCSWMM

USED		USED		*XX NOT USED XX*		*XX NOT USED XX*		USED	
ED Control 1		**Quantity Control 1**		**Quantity Control 2**		**Quantity Control 3**		**Emergency Overflow**	
Vertical Circular Orifice		**Vertical Rectangular Orifice**		**Vertical Circular Orifice**		**Vertical Circular Orifice**		**Broad-Crested Weir (Rect)**	
Dia (mm):	100	Width (mm)	460	Dia (mm):		Dia (mm):		Length (m)	4.0
		Height (mm)	470					Height (m)	0.30
Area (mm2):	7,854	Area (mm2):	216,200	Area (mm2):		Area (mm2):			
Coeff, C:	0.60	Coeff, C:	0.61	Coeff, C:	0.61	Coeff, Cw	0.61	Coeff, C:	1.837
Orifice Inv:	113.55 m	Orifice Inv:	114.20 m	Orifice Inv:	133.55 m	Invert (m)	133.55 m	Weir Inv:	115.90 m
Orifice Cen:	113.60 m	Orifice Cen:	114.435 m	Orifice Cen:	133.550 m	Orifice Cen:	133.550 m		

WSE Elev (m)	**Comments**	**Quantity Volume (Note 1)** (m3)	**Head (Note 4)** (m)	**Orifice 1 Flow** (m3/sec)	**Head** (m)	**Orifice 2 Flow** (m3/sec)	**Head, H** (m)	**Outflow** (m3/sec)	**Head, H** (m)	**Outflow** (m3/sec)	**Head, H** (m)	**Outflow** (m3/sec)	**Total Flow** (m3/sec)	**Storage** (ha.m)
116.15	Top Pond	5066	2.55	0.0333	1.95	0.816					0.25	0.918	1.768	0.507
116.05		4872	2.45	0.0327	1.85	0.795					0.15	0.427	1.254	0.487
115.95	Emerg Spill 115.9	4678	2.35	0.0320	1.75	0.773					0.05	0.082	0.887	0.468
115.85		4484	2.25	0.0313	1.65	0.750							0.782	0.448
115.80		4387	2.20	0.0310	1.60	0.739							0.770	0.439
115.75		4291	2.15	0.0306	1.55	0.727							0.758	0.429
115.65		4097	2.05	0.0299	1.45	0.703							0.733	0.410
115.55		3903	1.95	0.0291	1.35	0.679							0.708	0.390
115.45		3709	1.85	0.0284	1.25	0.653							0.682	0.371
115.35		3515	1.75	0.0276	1.15	0.626							0.654	0.352
115.25		3322	1.65	0.0268	1.05	0.599							0.625	0.332
115.15		3128	1.55	0.0260	0.95	0.569							0.595	0.313
115.05		2934	1.45	0.0251	0.85	0.539							0.564	0.293
114.95		2740	1.35	0.0243	0.75	0.506							0.530	0.274
114.85		2547	1.25	0.0233	0.65	0.471							0.494	0.255
114.75		2353	1.15	0.0224	0.55	0.433							0.456	0.235
114.65		2159	1.05	0.0214	0.45	0.392							0.413	0.216
114.55		1965	0.95	0.0203	0.35	0.346							0.366	0.197
114.45		1771	0.85	0.0192	0.25	0.292							0.311	0.177
114.35		1578	0.75	0.0181	0.15	0.226							0.244	0.158
114.25		1384	0.65	0.0168	0.05	0.131							0.147	0.138
114.15		1190	0.55	0.0155									0.015	0.119
114.05		996	0.45	0.0140									0.014	0.100
113.95		803	0.35	0.0123									0.012	0.080
113.85		609	0.25	0.0104									0.010	0.061
113.75		415	0.15	0.0081									0.008	0.041
113.65		221	0.05	0.0047									0.005	0.022
113.55		27												0.003
113.45	Bottom of pond													

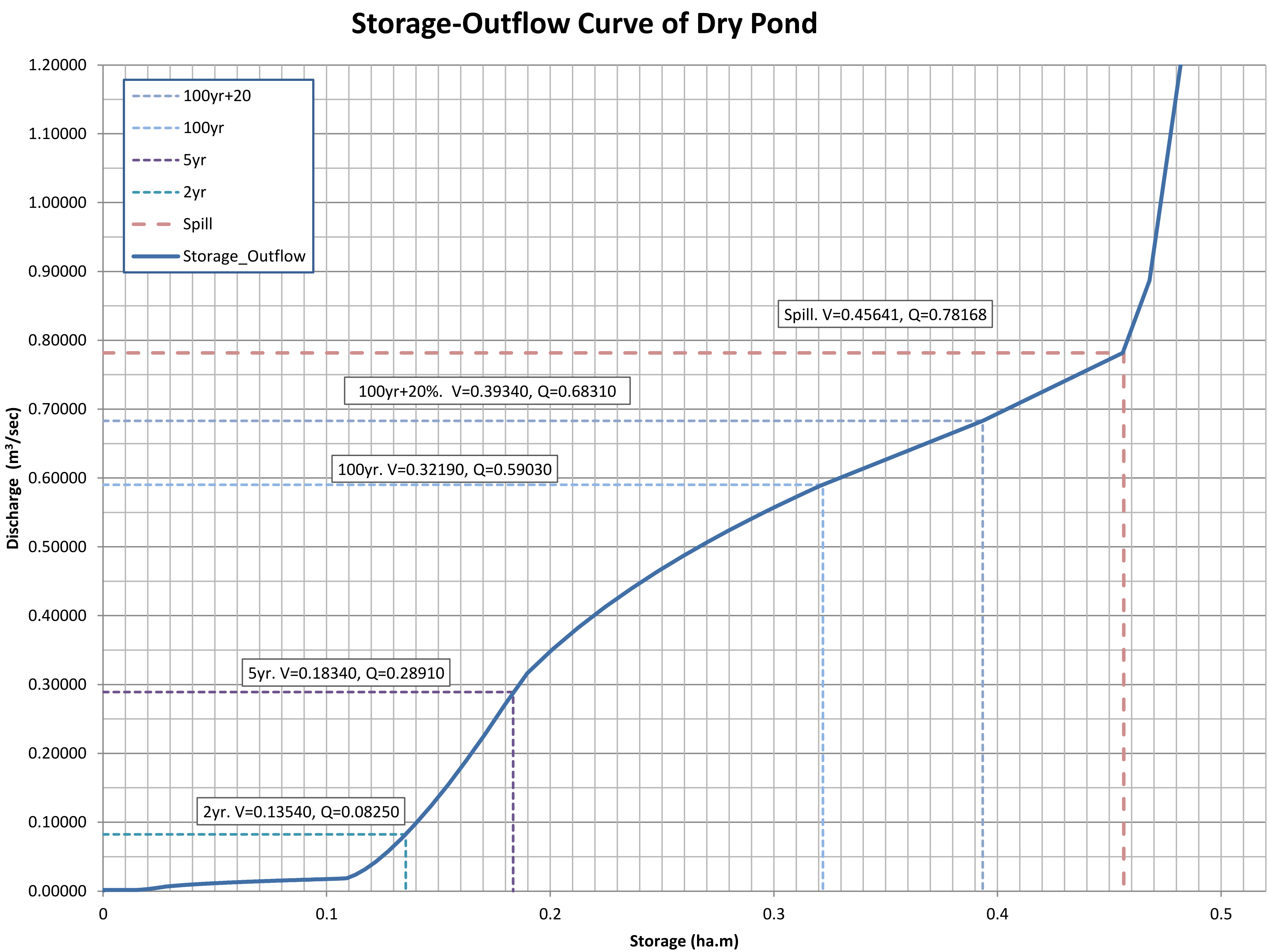
NOTES:

1) Quantity Storage values based on pond geometry and stage-storage data at 0.10m increments

2) Top of Pond = *116.15 m*

3) WSE Interval = *0.10 m*

*4) Discharge for Circular Orifices (fully submerged), Q= C*A*SQRT(2*g*H), where H is the effective head from WSEL to centroid of orifice.*



Storage-Outflow Curve of Dry Pond
100yr+20
100yr
5yr
2yr
Spill
Storage_Outflow
Spill. V=0.45641, Q=0.78168
100yr+20%. V=0.39340, Q=0.68310
100yr. V=0.32190, Q=0.59030
5yr. V=0.18340, Q=0.28910
2yr. V=0.13540, Q=0.08250
Discharge (m³/sec)
Storage (ha.m)
1.20000
1.10000
1.00000
0.90000
0.80000
0.70000
0.60000
0.50000
0.40000
0.30000
0.20000
0.10000
0.00000
0
0.1
0.2
0.3
0.4
0.5

TABLE E7

Area-Depth Table of DRY POND

Elev (m)	Depth Above NWL (m)	End Area (m^2)	Comments
116.15	2.70	2,564	Top of Pond Elev
115.90	2.45	2,480	Emergency Spill Elev
114.55	1.10	1,782	Intermediate point
113.45		1,290	Bottom of Drypond

Slope coefficient from the area-depth linear regression, C2 =	447.6
Intercept from the area-depth linear regression, C3 =	1289.6

TABLE E8
Drawdown Table of DRY POND

			Comments
Top of Pond Elev (m) =	116.15		
Bottom of Pond Elev (m) =	113.45		
WQCV (m3) =	1,599		Water Quality Control Volume Based on MOE Criteria(Table 3.2)
WQCE (m) =	114.49		Water Surface Elevation for Storage of WQCV.
WCD (m) =	1.04		Depth (or height) of Water Control Volume.
Extended Detention Volume, EDV (m3)	660		Runoff Volume Required to Control Peak Flows to 0.51 L/ha/sec During 3hr 15mm Chicago Storm. (0.51 x 9.02 = 4.6 L/sec)
Extended Detention Elev, EDE (m)	113.88		
Extended Detention Depth, EDD (m)	0.430		
Orifice #1 Dia (mm) =	100	Lower Orifice #1	Vertical Circular Orifice
Orifice # 1 Area (m2) =	0.0079		
Orifice # 1 Invert Elev (m) =	113.55		
Orifice # 1 Centroid Elev (m) =	113.60		
Orifice # 1 Discharge Coefficient =	0.61		
Orifice #2 width(mm) =	460	Upper Orifice #2	Vertical Rectangualar Orifice (width)
Orifice #2 height (mm) =	470		Vertical Rectangualar Orifice (height)
Orifice # 2 Area (m2) =	0.2162		
Orifice # 2 Invert Elev (m) =	114.20		
Orifice # 2 Centroid Elev (m) =	114.43		
Orifice # 2 Discharge Coefficient =	0.61		
C2 =	448		Slope coefficient from the area-depth linear regression
C3 =	1,290		Intercept from the area-depth linear regression

	Active Storage Above NWL			Orifce #1			Orifce # 2			Drawdown Time (hours)			
WSE Elev (m)	VOLUME (m3)	AREA (m2)	TOTAL DEPTH ABOVE NWL (m)	Height (m)	Area (m2)	Indiv Drawdown Time (hrs)	Height (m)	Area (m2)	Indiv Drawdown Time (hrs)	HOURS	DAYS	Outflow (m3/sec)	Comments
116.05	4,942	2,209	2.50	2.50	0.0079	67.5	1.85	0.2162	2.0	24.8	1.03	1.254	
115.95	4,690	2,110	2.40	2.40	0.0079	65.5	1.75	0.2162	1.9	24.7	1.03	0.887	Emerg Spill 115.9
115.85	4,458	2,067	2.30	2.30	0.0079	63.6	1.65	0.2162	1.8	24.7	1.03	0.782	
115.75	4,244	2,025	2.20	2.20	0.0079	61.6	1.55	0.2162	1.8	24.6	1.02	0.758	
115.65	4,031	1,982	2.10	2.10	0.0079	59.6	1.45	0.2162	1.7	24.5	1.02	0.733	
115.55	3,818	1,939	2.00	2.00	0.0079	57.7	1.35	0.2162	1.6	24.4	1.02	0.708	
115.45	3,605	1,897	1.90	1.90	0.0079	55.7	1.25	0.2162	1.5	24.4	1.02	0.682	
115.35	3,392	1,854	1.80	1.80	0.0079	53.7	1.15	0.2162	1.5	24.3	1.01	0.654	
115.25	3,179	1,812	1.70	1.70	0.0079	51.7	1.05	0.2162	1.4	24.2	1.01	0.625	
115.15	2,966	1,769	1.60	1.60	0.0079	49.6	0.95	0.2162	1.3	24.1	1.01	0.595	
115.05	2,753	1,726	1.50	1.50	0.0079	47.6	0.85	0.2162	1.2	24.1	1.00	0.564	
114.95	2,540	1,684	1.40	1.40	0.0079	45.5	0.75	0.2162	1.1	24.0	1.00	0.530	
114.85	2,326	1,641	1.30	1.30	0.0079	43.5	0.65	0.2162	1.0	23.9	0.99	0.494	
114.75	2,113	1,599	1.20	1.20	0.0079	41.3	0.55	0.2162	0.9	23.8	0.99	0.456	
114.65	1,900	1,556	1.10	1.10	0.0079	39.2	0.45	0.2162	0.9	23.7	0.99	0.413	
114.55	1,687	1,415	1.00	1.00	0.0079	37.0	0.35	0.2162	0.7	23.6	0.98	0.366	
114.45	1,534	1,273	0.90	0.90	0.0079	34.7	0.25	0.2162	0.6	23.5	0.98	0.311	
114.35	1,380	1,132	0.80	0.80	0.0079	32.4	0.15	0.2162	0.5	23.3	0.97	0.244	
114.25	1,227	990	0.70	0.70	0.0079	30.0	0.05	0.2162	0.3	23.1	0.96	0.147	
114.15	1,074	849	0.60	0.60	0.0079	27.5				22.8	0.95	0.015	
114.05	920	707	0.50	0.50	0.0079	24.8				22.8	0.95	0.014	
113.95	767	566	0.40	0.40	0.0079	21.9				21.9	0.91	0.012	
113.85	614	424	0.30	0.30	0.0079	18.8				18.8	0.78	0.010	
113.75	460	283	0.20	0.20	0.0079	15.2				15.2	0.63	0.008	
113.65	307	141	0.10	0.10	0.0079	10.6				10.6	0.44	0.005	
113.55	153				0.0079								
113.45													Bottom of pond

NOTES:

2) Top of Pond = *116.15 m*
3) WSE Interval = *0.10 m*

Elev of ED Volume =	113.880
Depth of ED Volume =	0.430
Drawdown for ED Volume =	**22.8**

$$t = \frac{0.66\ C_2 h^{1.5} + 2\ C_3 h^{0.5}}{2.75\ A_o}$$

Equation 4.11 Drawdown Time.
(Page 4-58 MOE Stormwater Management Planning and Design Manual)

where:

t = *Drawdown time (seconds)*
C2 = *Slope coefficient from the area-depth linear regression*
C3 = *Intercept fronm the area-depth linear regression*
Ao = *Cross-sectional area of the orifice (m2)*
h = *Maximium water Elevation above the orifice*

TABLE E9
STORAGE-DEPTH AND OUTFLOW THROUGH SAND FILTER IN DRY POND

Description	Elev (m)	Area (m2)	Dist from INV
Max Top of Pond	116.15	2564.1	3.45
Spill Elev	115.9	2480.13	3.2
intermed	114.55	1782	1.85
Bottom Elev (orig)	113.55	1330.3	0.85
Bottom Elev (new)	113.45	1289.6	0.75
Areas from CAD (Refer to Table E3)			

Flood Control Orifice #3 Elev (m)	114.20	
ED Control Orifice # 2 Elev (m)	113.55	
Infiltration Orifice # 1 Elev (m)	112.70	
Bottom of Pond Elev (m) =	113.45	
Topsoil Depth (m)	0.15	
Area of Infiltration Pratice (m2) =	680	
Top of Infiltration Pratice (m)	113.3	
Bottom of Infiltration Pratice Eelv (m)	112.60	
Depth of Infiltration Pratice, (m) (m) =	0.70	
Void Ratio of Soil, n =	0.25	Sand

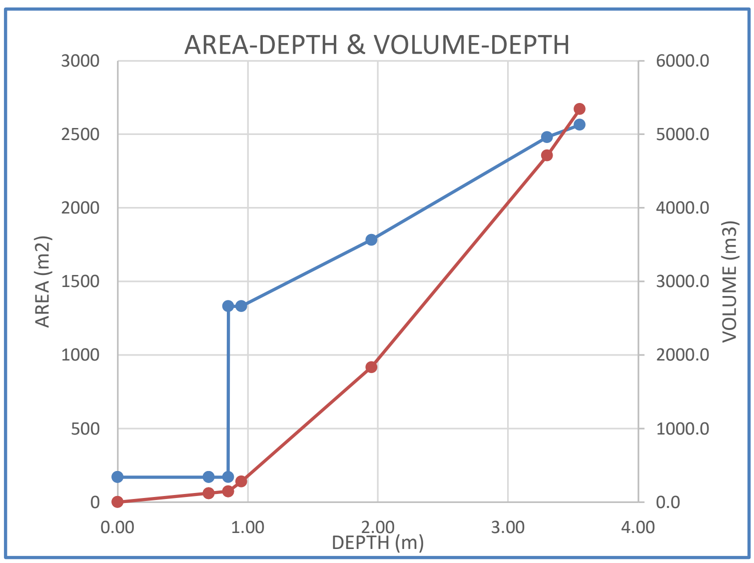
STORAGE FUNCTION OF DRY POND WITH RETENTION

Elev(m)	Incr Depth (m)	Total Depth (m)	Granular				Pond Storage			Tot Vol (m3)	
			Area (m2) (note 1)	Incr Depth (m)	Incr Vol (m)	Cumul Vol (m3)	Area (m2)	Incr Vol (m3)	Cumul Vol (m3)	Indiv (m3)	Cumul (m3)
112.6	0	0	170.0		0	0	0.0	0.0	0.0	**0.0**	**0.0**
112.601	0.001	0.001	170.0		0.17	0.17	0.0	0.0	0.0	**0.2**	**0.2**
113.3	0.699	0.7	170.0		118.83	119	0.0	0.0	0.0	**118.8**	**119.0**
113.301	0.001	0.701	170.0		0	119	0.0	0.0	0.0	**0.0**	**119.0**
113.45	0.149	0.85	170.0		0	119	1330.3	0.0	0.0	**0.0**	**119.0**
113.451	0.001	0.851	0.00		0	119	1330.3	1.3	1.3	**1.3**	**120.3**
113.55	0.099	0.95	0.00		0	119	1330.3	131.7	133.0	**131.7**	**252.0**
114.55	1	1.95	0.00		0	119	1782.0	1556.2	1689.2	**1556.2**	**1808.2**
115.9	1.35	3.3	0.00		0	119	2480.1	2876.9	4566.1	**2876.9**	**4685.1**
116.15	0.25	3.55	0.00		0	119	2564.1	630.5	5196.6	**630.5**	**5315.6**

Notes
*1) Areas takes into account Void Ratio (A = A*Vr)*

AREA-DEPTH curve for PCSWMM

Depth (m)	Area (m2)	Ind V	Cum V
0.000	**170.0**	**0.0**	**0.0**
0.001	**170.0**	**0.2**	**0.2**
0.700	**170.0**	**118.8**	**119.0**
0.701	**170.0**	**0.2**	**119.2**
0.850	**170.0**	**25.3**	**144.5**
0.851	**1330.3**	**0.8**	**145.3**
0.950	**1330.3**	**131.7**	**276.9**
1.950	**1782.0**	**1556.2**	**1833.1**
3.300	**2480.1**	**2876.9**	**4710.0**
3.550	**2564.1**	**630.5**	**5340.6**



Outflow - Depth Curve for PCSWMM RATING Curve

Depth (m)	Outlfow
0.0000	1.59
0.0010	1.59
0.7000	1.59
0.7010	1.59
0.8500	1.59
0.8510	1.59
0.9500	1.59
1.9500	1.59
3.3000	1.59
3.5500	1.59

Rating Curve for Bioretention Cell (MECP Equation 4.20)

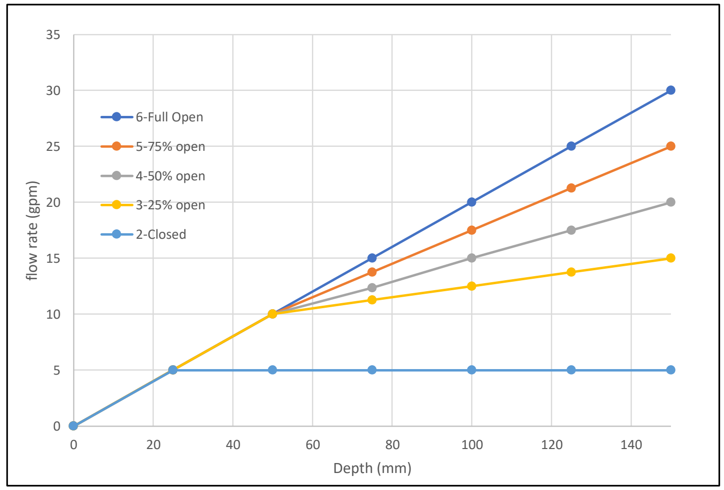
Longevity factor, f =	0.75	SMPDM Table 4.12
Percolation Rate of Soil, P (mm/hr) =	45	SMPDM Page 4-95
Area of Infiltraiton Pratice A =	680	m2
Void Ratio of Soil, n =	0.25	Sand. SMPDM Page 4-118

TABLE E10
ESTIMATION OF ROOF STORAGE AND OUTFLOW OF 9-STOREY BUILDING

WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

BUILDING ROOF INFORMATION

Buidling Number	**TABLE E10**	
Total Roof Area (m2)	**1976**	
Minimum Number of Drains Required	2.2	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	45,448	
Max Permitted Load from All Drains (L/sec)	50.5	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	256	
Estimated Distance from roof edge to drains (m)	**8**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	8	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	10	*Assumed*
Effecive Roof Percentage (%)	**85%**	*Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	1680	
Area per Drain (m2)	168	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	98.8	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	18.9	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.19	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00315	0.025	4.7	0.0	0.4
0.05	10	0.63	0.00631	0.05	18.7	0.3	3.1
0.075	15	0.95	0.00946	0.075	42.0	1.0	10.5
0.1	20	1.26	0.01262	0.1	74.6	2.5	24.9
0.125	25	1.58	0.01577	0.125	116.6	4.9	48.6
0.15	30	1.89	0.01893	0.15	168.0	8.4	84.0
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	3.1545
0.05	6.3090
0.075	9.4635
0.1	12.6180
0.125	15.7726
0.15	18.9271

RATING CURVE FOR MODELLING ROOF STORAGE

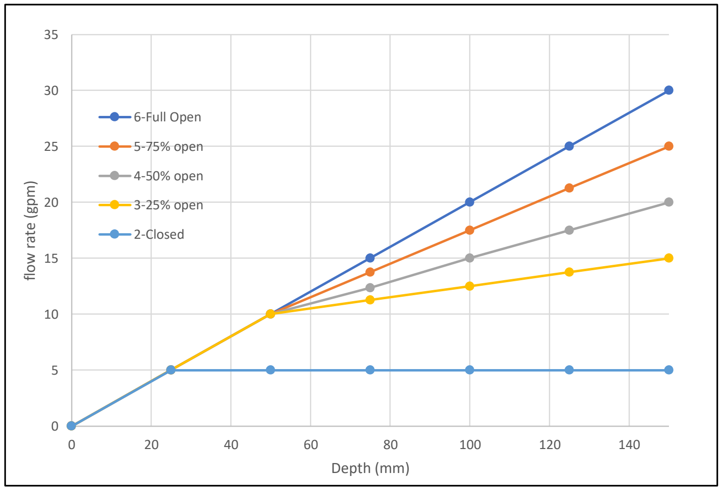
Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	46.7
0.05	186.6
0.075	419.9
0.1	746.5
0.125	1166.4
0.15	1679.6

TABLE E11
ESTIMATION OF ROOF STORAGE AND OUTFLOW OF 4-STOREY BUILDING A

WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

BUILDING ROOF INFORMATION

Buidling Number	**TABLE E11**	
Total Roof Area (m2)	**1036**	
Minimum Number of Drains Required	1.2	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	23,828	
Max Permitted Load from All Drains (L/sec)	26.5	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	324	
Estimated Distance from roof edge to drains (m)	**9**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	4	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	4	*Assumed*
Effecive Roof Percentage (%)	**85%**	*Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	881	
Area per Drain (m2)	220	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	51.8	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	7.6	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.15	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00126	0.025	6.1	0.1	0.2
0.05	10	0.63	0.00252	0.05	24.5	0.4	1.6
0.075	15	0.95	0.00379	0.075	55.0	1.4	5.5
0.1	20	1.26	0.00505	0.1	97.8	3.3	13.0
0.125	25	1.58	0.00631	0.125	152.9	6.4	25.5
0.15	30	1.89	0.00757	0.15	220.2	11.0	44.0
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	1.2618
0.05	2.5236
0.075	3.7854
0.1	5.0472
0.125	6.3090
0.15	7.5708

RATING CURVE FOR MODELLING ROOF STORAGE

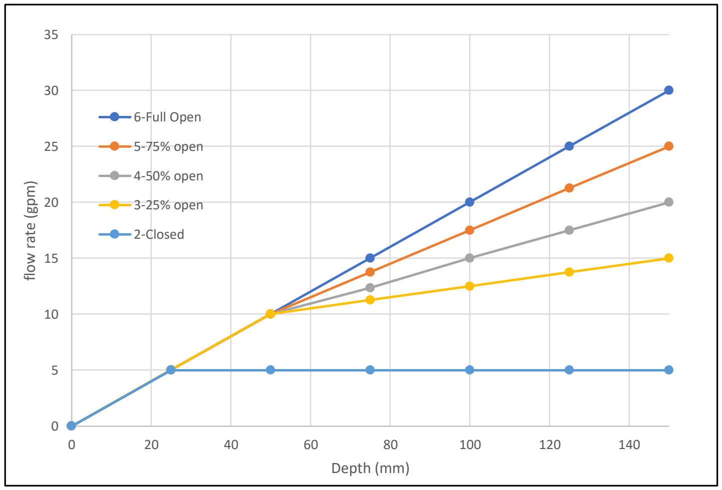
Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	24.5
0.05	97.8
0.075	220.2
0.1	391.4
0.125	611.5
0.15	880.6

TABLE E12
ESTIMATION OF ROOF STORAGE AND OUTFLOW OF 4-STOREY BUILDING B

WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

BUILDING ROOF INFORMATION

Buidling Number	**TABLE E12**	
Total Roof Area (m2)	**1036**	
Minimum Number of Drains Required	1.2	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	23,828	
Max Permitted Load from All Drains (L/sec)	26.5	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	324	
Estimated Distance from roof edge to drains (m)	**9**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	4	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	4	*Assumed*
Effecive Roof Percentage (%)	**85%**	*Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	881	
Area per Drain (m2)	220	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	51.8	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	7.6	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.15	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00126	0.025	6.1	0.1	0.2
0.05	10	0.63	0.00252	0.05	24.5	0.4	1.6
0.075	15	0.95	0.00379	0.075	55.0	1.4	5.5
0.1	20	1.26	0.00505	0.1	97.8	3.3	13.0
0.125	25	1.58	0.00631	0.125	152.9	6.4	25.5
0.15	30	1.89	0.00757	0.15	220.2	11.0	44.0
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outlfow (L/sec)
0	0.0000
0.025	1.2618
0.05	2.5236
0.075	3.7854
0.1	5.0472
0.125	6.3090
0.15	7.5708

RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	24.5
0.05	97.8
0.075	220.2
0.1	391.4
0.125	611.5
0.15	880.6

TABLE E13
ESTIMATION OF ROOF STORAGE AND OUTFLOW OF 4-STOREY BUILDING C

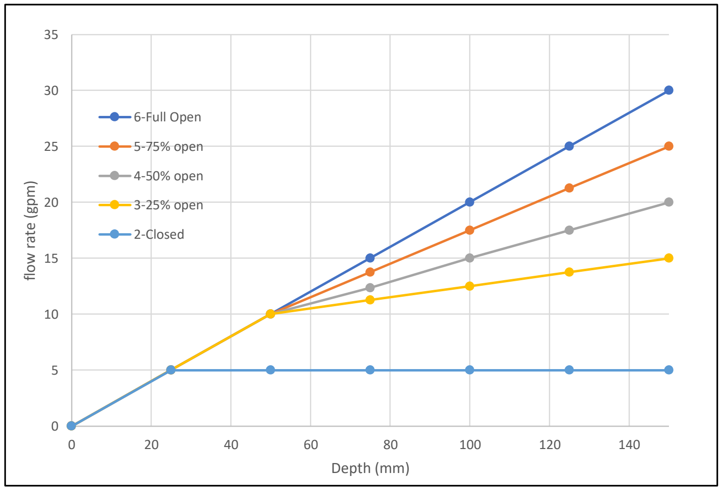
WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



BUILDING ROOF INFORMATION

Buidling Number	**TABLE E13**	
Total Roof Area (m2)	**1036**	
Minimium Number of Drains Required	1.2	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	23,828	
Max Permitted Load from All Drains (L/sec)	26.5	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	324	
Estimated Distance from roof edge to drains (m)	**9**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	4	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	4	*Assumed*
Effective Roof Percentage (%)	**85%**	*Allowance for Mechanical units on this roof*
Effective Total Roof Area (m2)	881	
Area per Drain (m2)	220	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	51.8	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	7.6	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.15	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00126	0.025	6.1	0.1	0.2
0.05	10	0.63	0.00252	0.05	24.5	0.4	1.6
0.075	15	0.95	0.00379	0.075	55.0	1.4	5.5
0.1	20	1.26	0.00505	0.1	97.8	3.3	13.0
0.125	25	1.58	0.00631	0.125	152.9	6.4	25.5
0.15	30	1.89	0.00757	0.15	220.2	11.0	44.0
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	1.2618
0.05	2.5236
0.075	3.7854
0.1	5.0472
0.125	6.3090
0.15	7.5708

RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	24.5
0.05	97.8
0.075	220.2
0.1	391.4
0.125	611.5
0.15	880.6

TABLE E14
ESTIMATION OF ROOF STORAGE AND OUTFLOW OF 4-STOREY BUILDING D

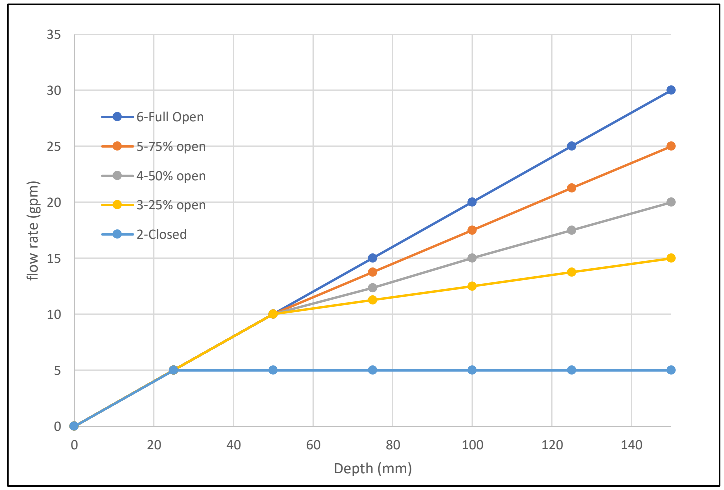
WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position: 1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



BUILDING ROOF INFORMATION

Buidling Number	**TABLE E14**	
Total Roof Area (m2)	**1036**	
Minimum Number of Drains Required	1.2	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	23,828	
Max Permitted Load from All Drains (L/sec)	26.5	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	324	
Estimated Distance from roof edge to drains (m)	**9**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	4	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	4	*Assumed*
Effecive Roof Percentage (%)	**85%**	*Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	881	
Area per Drain (m2)	220	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	51.8	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	7.6	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.15	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH: Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	AREA VERSUS DEPTH: Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	Total Ponding Volume - All Drains (m3)
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00126	0.025	6.1	0.1	0.2
0.05	10	0.63	0.00252	0.05	24.5	0.4	1.6
0.075	15	0.95	0.00379	0.075	55.0	1.4	5.5
0.1	20	1.26	0.00505	0.1	97.8	3.3	13.0
0.125	25	1.58	0.00631	0.125	152.9	6.4	25.5
0.15	30	1.89	0.00757	0.15	220.2	11.0	44.0
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	1.2618
0.05	2.5236
0.075	3.7854
0.1	5.0472
0.125	6.3090
0.15	7.5708

RATING CURVE FOR MODELLING ROOF STORAGE

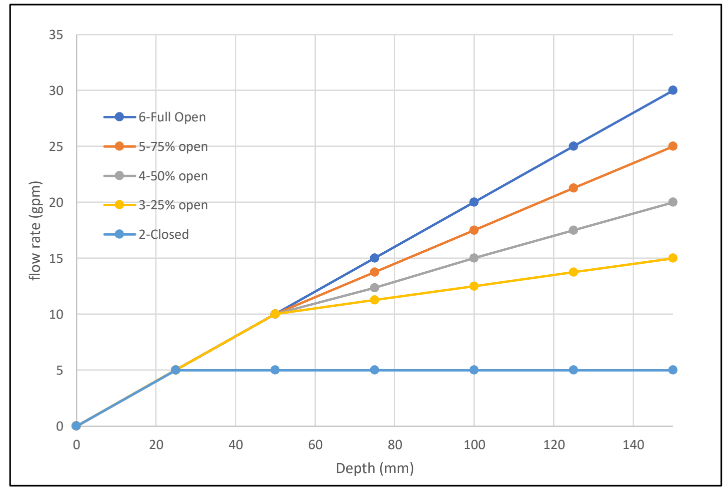
Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	24.5
0.05	97.8
0.075	220.2
0.1	391.4
0.125	611.5
0.15	880.6

TABLE E15
ESTIMATION OF ROOF STORAGE AND OUTFLOW OF 4-STOREY BUILDING E

WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

BUILDING ROOF INFORMATION

Buidling Number	**TABLE E15**	
Total Roof Area (m2)	**1036**	
Minimum Number of Drains Required	1.2	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	23,828	
Max Permitted Load from All Drains (L/sec)	26.5	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	324	
Estimated Distance from roof edge to drains (m)	**9**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	4	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	4	*Assumed*
Effecive Roof Percentage (%)	**85%**	*Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	881	
Area per Drain (m2)	220	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	51.8	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	7.6	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.15	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00126	0.025	6.1	0.1	0.2
0.05	10	0.63	0.00252	0.05	24.5	0.4	1.6
0.075	15	0.95	0.00379	0.075	55.0	1.4	5.5
0.1	20	1.26	0.00505	0.1	97.8	3.3	13.0
0.125	25	1.58	0.00631	0.125	152.9	6.4	25.5
0.15	30	1.89	0.00757	0.15	220.2	11.0	44.0
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outlfow (L/sec)
0	0.0000
0.025	1.2618
0.05	2.5236
0.075	3.7854
0.1	5.0472
0.125	6.3090
0.15	7.5708

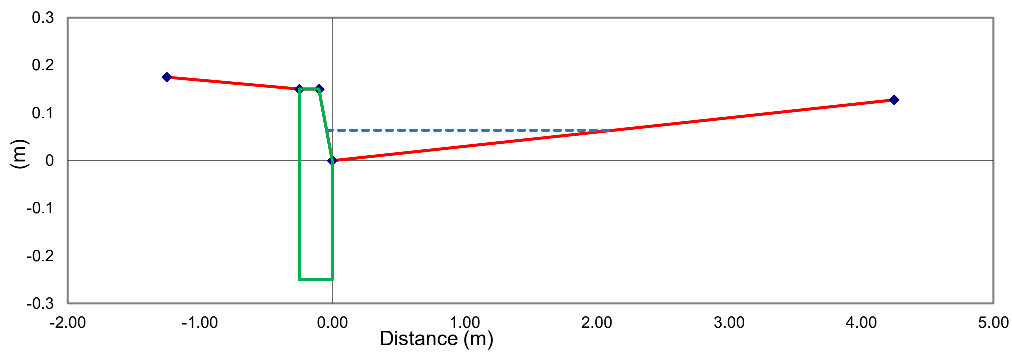
RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	24.5
0.05	97.8
0.075	220.2
0.1	391.4
0.125	611.5
0.15	880.6

TABLE E11: MAJOR SYSTEM (STREET SEGMENT) CHARACTERISTICS

ROAD AND CURB DATA (For Barrier Curb at 2% Longitudinal Slope)

Asphalt width, W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.250	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.020	*2.0%*
Curb Type =	SC1.1	*Mountable Curb and Gutter*
Inlet Type =	S19	*Curb inlet CB*
Curb height, H_C (m) =	0.150	
Total curb height, H_T (m) =	0.400	
Curb top width, W_C (m) =	0.150	
Curb bottom width, W (m) =	0.250	
Gutter width, W_G (m) =	0.000	
Gutter slope, S_G (m/m) =	0.000	*$S_G = D_G / W_G$*
Gutter depth, D_G (m) =	0.000	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.125	*Max Permitted Spread = 1/2 Asphalt width, W_A + W_G*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.064	*$D_{MAX} = D_{SMAX} + D_G$*



Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.725	0.725	0.022	0.022	0.0000	0.0000	0.0000	0.0050	5.00
10	0.940	0.940	0.028	0.028	0.0000	0.0000	0.0000	0.0100	10.00
50	1.718	1.718	0.052	0.052	0.0000	0.0000	0.0000	0.0500	50.00
100	2.228	2.228	0.067	0.067	0.0000	0.0000	0.0000	0.1000	100.00
125	2.423	2.423	0.073	0.073	0.0000	0.0000	0.0000	0.1250	125.00
150	2.594	2.594	0.078	0.078	0.0000	0.0000	0.0000	0.1500	150.00
200	2.890	2.890	0.087	0.087	0.0000	0.0000	0.0000	0.2000	200.00
250	3.142	3.142	0.094	0.094	0.0000	0.0000	0.0000	0.2500	250.00

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

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON
Lane Crossfall = 0.030 m/m
Gutter Grade = 0.020 m/m

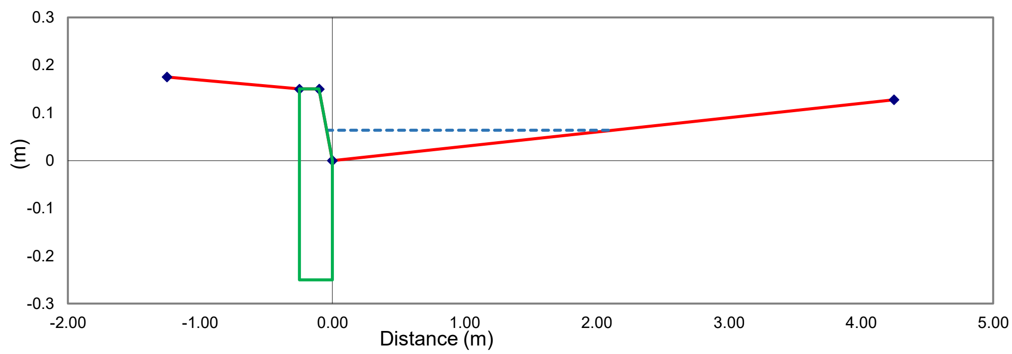
Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.725	0.725	0.022	0.013	13
10	0.940	0.940	0.028	0.017	17
50	1.718	1.718	0.052	0.033	33
100	2.228	2.228	0.067	0.045	45
125	2.423	2.423	0.073	0.050	50
150	2.594	2.594	0.078	0.054	54
200	2.890	2.890	0.087	0.061	61
250	3.142	3.142	0.094	0.000	61

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

TABLE E11: MAJOR SYSTEM (STREET SEGMENT) CHARACTERISTICS

ROAD AND CURB DATA (For Barrier Curb at 3% Longitudinal Slope)

Asphalt width, W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.250	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.030	*3.0%*
Curb Type =	SC1.1	*Mountable Curb and Gutter*
Inlet Type =	S19	*Curb inlet CB*
Curb height, H_C (m) =	0.150	
Total curb height, H_T (m) =	0.400	
Curb top width, W_C (m) =	0.150	
Curb bottom width, W (m) =	0.250	
Gutter width, W_G (m) =	0.000	
Gutter slope, S_G (m/m) =	0.000	*$S_G = D_G / W_G$*
Gutter depth, D_G (m) =	0.000	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.125	*Max Permitted Spread = 1/2 Asphalt width, $W_A + W_G$*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.064	*$D_{MAX} = D_{SMAX} + D_G$*



Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.672	0.672	0.020	0.020	0.0000	0.0000	0.0000	0.0050	5.00
10	0.871	0.871	0.026	0.026	0.0000	0.0000	0.0000	0.0100	10.00
50	1.593	1.593	0.048	0.048	0.0000	0.0000	0.0000	0.0500	50.00
100	2.065	2.065	0.062	0.062	0.0000	0.0000	0.0000	0.1000	100.00
125	2.245	2.245	0.067	0.067	0.0000	0.0000	0.0000	0.1250	125.00
150	2.404	2.404	0.072	0.072	0.0000	0.0000	0.0000	0.1500	150.00
200	2.678	2.678	0.080	0.080	0.0000	0.0000	0.0000	0.2000	200.00
250	2.912	2.912	0.087	0.087	0.0000	0.0000	0.0000	0.2500	250.00

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

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = 0.030 m/m

Gutter Grade = 0.030 m/m

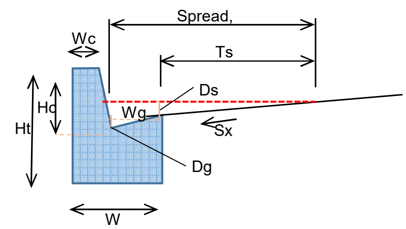
Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.672	0.672	0.020	0.016	16
10	0.871	0.871	0.026	0.019	19
50	1.593	1.593	0.048	0.036	36
100	2.065	2.065	0.062	0.048	48
125	2.245	2.245	0.067	0.052	52
150	2.404	2.404	0.072	0.055	55
200	2.678	2.678	0.080	0.062	62
250	2.912	2.912	0.087	0.000	62

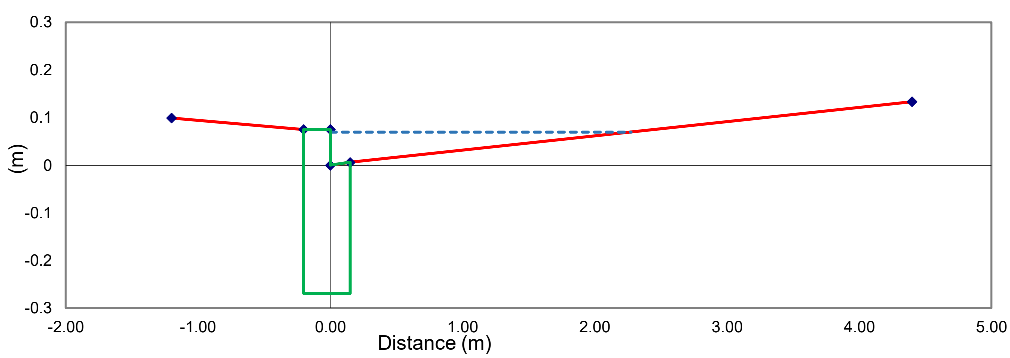
Note: The Total Spread (T), includes Gutter width, (Wg) plus spread on lane, (Ts) for curb & gutter type curbs

TABLE E11: MAJOR SYSTEM (STREET SEGMENT) CHARACTERISTICS

ROAD AND CURB DATA (For Mountable Curb at 1% Longitudinal Slope)

Asphalt width,W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.400	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.010	*1.0%*
Curb Type =	SC1.3	*Mountable Curb and Gutter*
Inlet Type =	S19	*Surface inlet CB*
Curb height, H_C (m) =	0.075	
Total curb height, H_T (m) =	0.350	
Curb top width, W_C (m) =	0.200	
Curb bottom width, W (m) =	0.350	
Gutter width, W_G (m) =	0.150	
Gutter slope, S_G (m/m) =	0.040	*$S_G = D_G / W_G$*
Gutter depth, D_G (m) =	0.006	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.275	*Max Permitted Spread = 1/2 Asphalt width, W_A + W_G (minor storm)*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.070	*$D_{MAX} = D_{SMAX} + D_G$*





Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.818	0.668	0.020	0.026	0.0043	0.0021	0.0022	0.0028	5.00
10	1.064	0.914	0.027	0.033	0.0084	0.0049	0.0034	0.0066	10.00
50	1.954	1.804	0.054	0.060	0.0399	0.0302	0.0098	0.0402	50.00
100	2.535	2.385	0.072	0.078	0.0788	0.0636	0.0152	0.0848	100.00
125	2.757	2.607	0.078	0.084	0.0981	0.0806	0.0176	0.1074	125.00
150	2.952	2.802	0.084	0.090	0.1174	0.0977	0.0197	0.1303	150.00
200	3.289	3.139	0.094	0.100	0.1559	0.1322	0.0237	0.1763	200.00
250	3.576	3.426	0.103	0.109	0.1943	0.1670	0.0273	0.2227	250.00

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

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = 0.030 m/m

Gutter Grade = 0.010 m/m

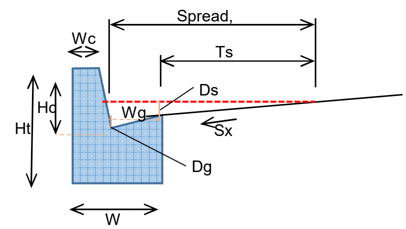
Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.818	0.668	0.009	0.007	5
10	1.064	0.914	0.017	0.011	10
50	1.954	1.804	0.060	0.013	13
100	2.535	2.385	0.078	0.028	28
125	2.757	2.607	0.084	0.040	40
150	2.952	2.802	0.090	0.044	44
200	3.289	3.139	0.100	0.048	48
250	3.576	3.426	0.109	0.055	55

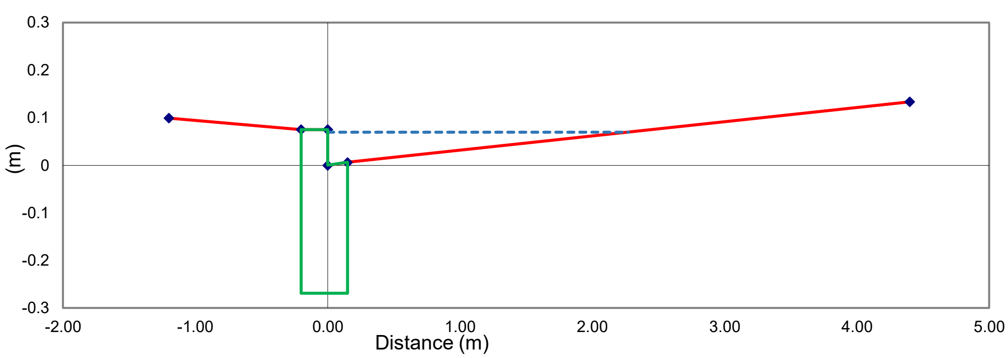
Note: The Total Spread (T), includes Gutter width, (Wg) plus spread on lane, (Ts) for curb & gutter type curbs

TABLE E11: MAJOR SYSTEM (STREET SEGMENT) CHARACTERISTICS

ROAD AND CURB DATA (For Mountable Curb at 2% Longitudinal Slope)

Parameter	Value	Note
Asphalt width, W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.400	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.020	*2.0%*
Curb Type =	SC1.3	*Mountable Curb and Gutter*
Inlet Type =	S19	*Surface inlet CB*
Curb height, H_C (m) =	0.075	
Total curb height, H_T (m) =	0.350	
Curb top width, W_C (m) =	0.200	
Curb bottom width, W (m) =	0.350	
Gutter width, W_G (m) =	0.150	
Gutter slope, S_G (m/m) =	0.040	*$S_G = D_G / W_G$*
Gutter depth, D_G (m) =	0.006	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.275	*Max Permitted Spread = 1/2 Asphalt width, W_A + W_G (minor storm)*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.070	*$D_{MAX} = D_{SMAX} + D_G$*





Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.716	0.566	0.017	0.023	0.0044	0.0019	0.0024	0.0026	5.00
10	0.933	0.783	0.023	0.029	0.0085	0.0046	0.0038	0.0062	10.00
50	1.715	1.565	0.047	0.053	0.0403	0.0292	0.0110	0.0390	50.00
100	2.226	2.076	0.062	0.068	0.0793	0.0621	0.0173	0.0827	100.00
125	2.420	2.270	0.068	0.074	0.0987	0.0788	0.0199	0.1051	125.00
150	2.592	2.442	0.073	0.079	0.1181	0.0957	0.0224	0.1276	150.00
200	2.887	2.737	0.082	0.088	0.1567	0.1298	0.0269	0.1731	200.00
250	3.140	2.990	0.090	0.096	0.1952	0.1643	0.0310	0.2190	250.00

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

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = 0.030 m/m

Gutter Grade = 0.020 m/m

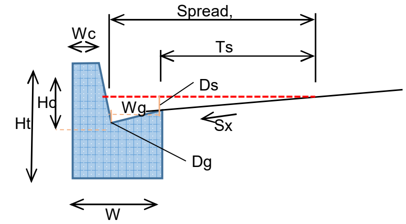
Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.716	0.566	0.009	0.010	5
10	0.933	0.783	0.017	0.013	10
50	1.715	1.565	0.053	0.017	17
100	2.226	2.076	0.068	0.033	33
125	2.420	2.270	0.074	0.045	45
150	2.592	2.442	0.079	0.050	50
200	2.887	2.737	0.088	0.054	54
250	3.140	2.990	0.096	0.061	61

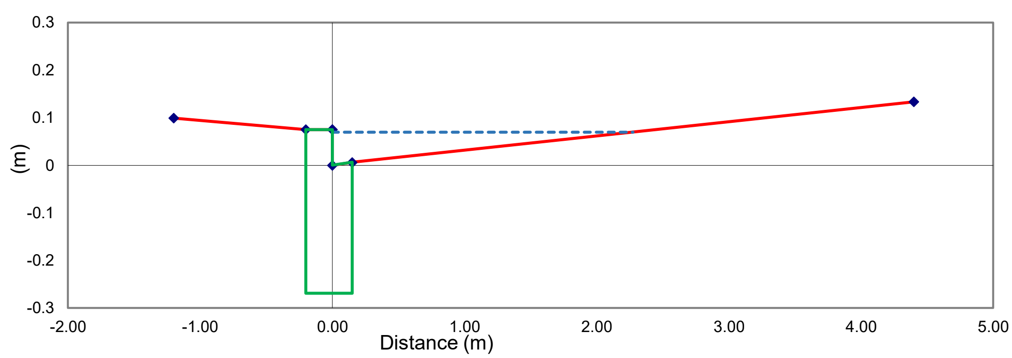
Note: The Total Spread (T), includes Gutter width, (Wg) plus spread on lane, (Ts) for curb & gutter type curbs

TABLE E11: MAJOR SYSTEM (STREET SEGMENT) CHARACTERISTICS

ROAD AND CURB DATA (For Mountable Curb at 3% Longitudinal Slope)

Parameter	Value	Note
Asphalt width, W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.400	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.030	*3.0%*
Curb Type =	SC1.3	*Mountable Curb and Gutter*
Inlet Type =	S19	*Surface inlet CB*
Curb height, H_C (m) =	0.075	
Total curb height, H_T (m) =	0.350	
Curb top width, W_C (m) =	0.200	
Curb bottom width, W (m) =	0.350	
Gutter width, W_G (m) =	0.150	
Gutter slope, S_G (m/m) =	0.040	*$S_G = D_G / W_G$*
Gutter depth, D_G (m) =	0.006	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.275	*Max Permitted Spread = 1/2 Asphalt width, W_A + W_G (minor storm)*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.070	*$D_{MAX} = D_{SMAX} + D_G$*





Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.663	0.513	0.015	0.021	0.0044	0.0018	0.0026	0.0024	5.00
10	0.864	0.714	0.021	0.027	0.0085	0.0044	0.0041	0.0059	10.00
50	1.589	1.439	0.043	0.049	0.0405	0.0286	0.0119	0.0381	50.00
100	2.062	1.912	0.057	0.063	0.0796	0.0611	0.0186	0.0814	100.00
125	2.243	2.093	0.063	0.069	0.0991	0.0777	0.0214	0.1036	125.00
150	2.402	2.252	0.068	0.074	0.1185	0.0945	0.0241	0.1259	150.00
200	2.676	2.526	0.076	0.082	0.1572	0.1283	0.0289	0.1711	200.00
250	2.910	2.760	0.083	0.089	0.1958	0.1625	0.0333	0.2167	250.00

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

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = 0.030 m/m

Gutter Grade = 0.030 m/m

Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.663	0.513	0.009	0.011	5
10	0.864	0.714	0.017	0.016	10
50	1.589	1.439	0.049	0.019	19
100	2.062	1.912	0.063	0.036	36
125	2.243	2.093	0.069	0.048	48
150	2.402	2.252	0.074	0.052	52
200	2.676	2.526	0.082	0.055	55
250	2.910	2.760	0.089	0.055	55

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

TABLE E21
RATING CURVES FOR MODELLING OF CATCHBASINS - SURFACE PONDING AREA ON ROADWAYS (6 pages)

Ponding Information	
Ponding Area (trap low) No:	SP-01A
Structure / Inlet No:	CB04
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	120.17
Min. Ponding Elev (Lid Elev) (m):	119.95
Max. Ponding Area at Spill (m2) =	410.70
Max Ponding Depth At Spill Elev (m) =	0.22
Max. Prism Volume (m3) At Spill	30.1
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	118.55
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	120.32
Ponding Elev 2 Above Spill (m) =	120.32
Ponding Area 2 Above Spill (m2) =	709.20

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
118.55	0.0000	0.0000	0.00	0.00
119.95	1.4000	0.36	0.50	0.50
120.17	1.6200	410.7	30.12	30.62
120.32	1.7700	709.2	83.99	114.61
120.3201	1.7701	0.0	0.04	114.65
120.4201	1.8701	0.0	0.00	114.65
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-01B
Structure / Inlet No:	CB03
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	120.17
Min. Ponding Elev (Lid Elev) (m):	119.95
Max. Ponding Area at Spill (m2) =	409.20
Max Ponding Depth At Spill Elev (m) =	0.22
Max. Prism Volume (m3) At Spill	30.0
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	118.55
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	120.32
Ponding Elev 2 Above Spill (m) =	120.32
Ponding Area 2 Above Spill (m2) =	704.50

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
118.55	0.0000	0.0000	0.00	0.00
119.95	1.4000	0.36	0.50	0.50
120.17	1.6200	409.2	30.01	30.51
120.32	1.7700	704.5	83.53	114.04
120.3201	1.7701	0.0	0.04	114.07
120.4201	1.8701	0.0	0.00	114.07
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-03A
Structure / Inlet No:	CB10
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	119.03
Min. Ponding Elev (Lid Elev) (m):	118.78
Max. Ponding Area at Spill (m2) =	328.40
Max Ponding Depth At Spill Elev (m) =	0.25
Max. Prism Volume (m3) At Spill	27.4
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	117.38
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	119.18
Ponding Elev 2 Above Spill (m) =	119.18
Ponding Area 2 Above Spill (m2) =	632.30

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.38	0.0000	0.0000	0.00	0.00
118.78	1.4000	0.36	0.50	0.50
119.03	1.6500	328.4	27.37	27.87
119.18	1.8000	632.3	72.05	99.92
119.1801	1.8001	0.0	0.03	99.95
119.2801	1.9001	0.0	0.00	99.95
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-03B
Structure / Inlet No:	CB09
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	119.03
Min. Ponding Elev (Lid Elev) (m):	118.78
Max. Ponding Area at Spill (m2) =	333.20
Max Ponding Depth At Spill Elev (m) =	0.25
Max. Prism Volume (m3) At Spill	27.8
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	117.38
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	119.18
Ponding Elev 2 Above Spill (m) =	119.18
Ponding Area 2 Above Spill (m2) =	657.60

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.38	0.0000	0.0000	0.00	0.00
118.78	1.4000	0.36	0.50	0.50
119.03	1.6500	333.2	27.77	28.27
119.18	1.8000	657.6	74.31	102.58
119.1801	1.8001	0.0	0.03	102.61
119.2801	1.9001	0.0	0.00	102.61
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-04A
Structure / Inlet No:	CB12
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.89
Min. Ponding Elev (Lid Elev) (m):	118.64
Max. Ponding Area at Spill (m2) =	288.00
Max Ponding Depth At Spill Elev (m) =	0.25
Max. Prism Volume (m3) At Spill	24.0
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	117.24
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	119.04
Ponding Elev 2 Above Spill (m) =	119.04
Ponding Area 2 Above Spill (m2) =	570.00

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.24	0.0000	0.0000	0.00	0.00
118.64	1.4000	0.36	0.50	0.50
118.89	1.6500	288.0	24.00	24.50
119.04	1.8000	570.0	64.35	88.85
119.0401	1.8001	0.0	0.03	88.88
119.1401	1.9001	0.0	0.00	88.88
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-04B
Structure / Inlet No:	CB11
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.89
Min. Ponding Elev (Lid Elev) (m):	118.64
Max. Ponding Area at Spill (m2) =	287.10
Max Ponding Depth At Spill Elev (m) =	0.25
Max. Prism Volume (m3) At Spill	23.9
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	117.24
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	119.04
Ponding Elev 2 Above Spill (m) =	119.04
Ponding Area 2 Above Spill (m2) =	561.90

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.24	0.0000	0.0000	0.00	0.00
118.64	1.4000	0.36	0.50	0.50
118.89	1.6500	287.1	23.93	24.43
119.04	1.8000	561.9	63.68	88.10
119.0401	1.8001	0.0	0.03	88.13
119.1401	1.9001	0.0	0.00	88.13
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-05A
Structure / Inlet No:	CB14
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.75
Min. Ponding Elev (Lid Elev) (m):	118.50
Max. Ponding Area at Spill (m2) =	278.90
Max Ponding Depth At Spill Elev (m) =	0.25
Max. Prism Volume (m3) At Spill	23.2
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	117.10
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	118.90
Ponding Elev 2 Above Spill (m) =	118.90
Ponding Area 2 Above Spill (m2) =	488.20

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.10	0.0000	0.0000	0.00	0.00
118.50	1.4000	0.36	0.50	0.50
118.75	1.6500	278.9	23.24	23.75
118.90	1.8000	488.2	57.53	81.28
118.9001	1.8001	0.0	0.02	81.30
119.0001	1.9001	0.0	0.00	81.30
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-05B
Structure / Inlet No:	CB13
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.75
Min. Ponding Elev (Lid Elev) (m):	118.50
Max. Ponding Area at Spill (m2) =	295.60
Max Ponding Depth At Spill Elev (m) =	0.25
Max. Prism Volume (m3) At Spill	24.6
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	117.10
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	118.90
Ponding Elev 2 Above Spill (m) =	118.90
Ponding Area 2 Above Spill (m2) =	638.10

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.10	0.0000	0.0000	0.00	0.00
118.50	1.4000	0.36	0.50	0.50
118.75	1.6500	295.6	24.63	25.14
118.90	1.8000	638.1	70.03	95.16
118.9001	1.8001	0.0	0.03	95.20
119.0001	1.9001	0.0	0.00	95.20
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-06A
Structure / Inlet No:	CB15
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.61
Min. Ponding Elev (Lid Elev) (m):	118.35
Max. Ponding Area at Spill (m2) =	354.50
Max Ponding Depth At Spill Elev (m) =	0.26
Max. Prism Volume (m3) At Spill	30.7
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	116.95
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	118.91
Ponding Elev 2 Above Spill (m) =	118.76
Ponding Area 2 Above Spill (m2) =	689.10

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
116.95	0.0000	0.0000	0.00	0.00
118.35	1.4000	0.36	0.50	0.50
118.61	1.6600	354.5	30.72	31.23
118.76	1.8100	689.1	78.27	109.50
118.7601	1.8101	0.0	0.03	109.53
118.8601	1.9101	0.0	0.00	109.53
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	**SP-06B**
Structure / Inlet No:	**CB17**
Location	**ROADWAY**
Area Type (Flowby / Ponding)	**PONDING**
Structrue / Inlet Type	**Catcbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600.00**
Structure Width (mm)	**600.00**
Max. Ponding Elev at Spill (m):	**118.61**
Min. Ponding Elev (Lid Elev) (m):	**118.35**
Max. Ponding Area at Spill (m2) =	**458.30**
Max Ponding Depth At Spill Elev (m) =	**0.26**
Max. Prism Volume (m3) At Spill	**39.7**
Depth to Inv below ground (m)	**1.40**
Inv Elev of Storage Node (m)	**116.95**
Allowance for Overland Flow Above Spill Elev (m)	**0.30**
Ponding Rim Elevation (m)	**118.91**
Ponding Elev 2 Above Spill (m) =	**118.76**
Ponding Area 2 Above Spill (m2) =	**789.00**

Storage Function for Modelling				
Elev (m)	**Head / Depth (m)**	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
116.95	**0.0000**	**0.0000**	0.00	0.00
118.35	**1.4000**	**0.36**	0.50	0.50
118.61	**1.6600**	**458.3**	39.72	40.22
118.76	**1.8100**	**789.0**	93.55	133.77
118.7601	**1.8101**	**0.0**	0.04	133.81
118.8601	**1.9101**	**0.0**	0.00	133.81
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	**SP-06C**
Structure / Inlet No:	**CB16**
Location	**ROADWAY**
Area Type (Flowby / Ponding)	**PONDING**
Structrue / Inlet Type	**Catcbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600.00**
Structure Width (mm)	**600.00**
Max. Ponding Elev at Spill (m):	**118.61**
Min. Ponding Elev (Lid Elev) (m):	**118.35**
Max. Ponding Area at Spill (m2) =	**285.50**
Max Ponding Depth At Spill Elev (m) =	**0.26**
Max. Prism Volume (m3) At Spill	**24.7**
Depth to Inv below ground (m)	**1.40**
Inv Elev of Storage Node (m)	**116.95**
Allowance for Overland Flow Above Spill Elev (m)	**0.15**
Ponding Rim Elevation (m)	**118.76**
Ponding Elev 2 Above Spill (m) =	**118.76**
Ponding Area 2 Above Spill (m2) =	**551.80**

Storage Function for Modelling				
Elev (m)	**Head / Depth (m)**	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
116.95	**0.0000**	**0.0000**	0.00	0.00
118.35	**1.4000**	**0.36**	0.50	0.50
118.61	**1.6600**	**285.5**	24.74	25.25
118.76	**1.8100**	**551.8**	62.80	88.04
118.7601	**1.8101**	**0.0**	0.03	88.07
118.8601	**1.9101**	**0.0**	0.00	88.07
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	**SP-07A**
Structure / Inlet No:	**CB18**
Location	**ROADWAY**
Area Type (Flowby / Ponding)	**PONDING**
Structrue / Inlet Type	**Catcbasin**
Include Structure Storage (yes/no)	**Yes**
Structure Shape (rect / round)	**Rect**
Structure Length or DIA (mm)	**600.00**
Structure Width (mm)	**600.00**
Max. Ponding Elev at Spill (m):	**118.03**
Min. Ponding Elev (Lid Elev) (m):	**117.90**
Max. Ponding Area at Spill (m2) =	**62.90**
Max Ponding Depth At Spill Elev (m) =	**0.13**
Max. Prism Volume (m3) At Spill	**2.7**
Depth to Inv below ground (m)	**1.40**
Inv Elev of Storage Node (m)	**116.50**
Allowance for Overland Flow Above Spill Elev (m)	**0.35**
Ponding Rim Elevation (m)	**118.38**
Ponding Elev 2 Above Spill (m) =	**118.18**
Ponding Area 2 Above Spill (m2) =	**227.90**

Storage Function for Modelling				
Elev (m)	**Head / Depth (m)**	**Area (m2)**	**Incr Vol (m3)**	**Tot Vol (m3)**
116.50	**0.0000**	**0.0000**	0.00	0.00
117.90	**1.4000**	**0.36**	0.50	0.50
118.03	**1.5300**	**62.9**	2.73	3.23
118.18	**1.6800**	**227.9**	21.81	25.04
118.1801	**1.6801**	**0.0**	0.01	25.05
118.2801	**1.7801**	**0.0**	0.00	25.05
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-07B
Structure / Inlet No:	CB19
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.03
Min. Ponding Elev (Lid Elev) (m):	117.90
Max. Ponding Area at Spill (m2) =	100.50
Max Ponding Depth At Spill Elev (m) =	0.13
Max. Prism Volume (m3) At Spill	4.4
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	116.50
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	118.38
Ponding Elev 2 Above Spill (m) =	118.18
Ponding Area 2 Above Spill (m2) =	335.80

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
116.50	0.0000	0.0000	0.00	0.00
117.90	1.4000	0.36	0.50	0.50
118.03	1.5300	100.5	4.35	4.86
118.18	1.6800	335.8	32.72	37.58
118.1801	1.6801	0.0	0.02	37.60
118.2801	1.7801	0.0	0.00	37.60
Copy to PCSWMM (depth / area)				

Ponding Information	
Ponding Area (trap low) No:	SP-08A
Structure / Inlet No:	CB25
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	119.43
Min. Ponding Elev (Lid Elev) (m):	119.27
Max. Ponding Area at Spill (m2) =	331.20
Max Ponding Depth At Spill Elev (m) =	0.16
Max. Prism Volume (m3) At Spill	17.7
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	117.87
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	119.58
Ponding Elev 2 Above Spill (m) =	119.64
Ponding Area 2 Above Spill (m2) =	539.00

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.87	0.0000	0.0000	0.00	0.00
119.27	1.4000	0.36	0.50	0.50
119.43	1.5600	331.2	17.66	18.17
119.64	1.7700	539.0	91.37	109.54
119.6401	1.7701	0.0	0.03	109.57
119.7401	1.8701	0.0	0.00	109.57
Copy to PCSWMM (depth / area)				

Ponding Information	
Ponding Area (trap low) No:	SP-08B
Structure / Inlet No:	CB24
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	119.43
Min. Ponding Elev (Lid Elev) (m):	119.27
Max. Ponding Area at Spill (m2) =	218.40
Max Ponding Depth At Spill Elev (m) =	0.16
Max. Prism Volume (m3) At Spill	11.6
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	117.87
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	119.58
Ponding Elev 2 Above Spill (m) =	119.64
Ponding Area 2 Above Spill (m2) =	525.10

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.87	0.0000	0.0000	0.00	0.00
119.27	1.4000	0.36	0.50	0.50
119.43	1.5600	218.4	11.65	12.15
119.64	1.7700	525.1	78.07	90.22
119.6401	1.7701	0.0	0.03	90.25
119.7401	1.8701	0.0	0.00	90.25
Copy to PCSWMM (depth / area)				

Ponding Information	
Ponding Area (trap low) No:	SP-09
Structure / Inlet No:	CB64
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	121.36
Min. Ponding Elev (Lid Elev) (m):	121.20
Max. Ponding Area at Spill (m2) =	86.30
Max Ponding Depth At Spill Elev (m) =	0.16
Max. Prism Volume (m3) At Spill	4.6
Depth to Inv below ground (m)	1.40
Inv Elev of Storage Node (m)	119.80
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	121.51
Ponding Elev 2 Above Spill (m) =	121.51
Ponding Area 2 Above Spill (m2) =	194.00

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
119.80	0.0000	0.0000	0.00	0.00
121.20	1.4000	0.36	0.50	0.50
121.36	1.5600	86.3	4.60	5.11
121.51	1.7100	194.0	21.02	26.13
121.5101	1.7101	0.0	0.01	26.14
121.6101	1.8101	0.0	0.00	26.14
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-10
Structure / Inlet No:	CB65
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	121.50
Min. Ponding Elev (Lid Elev) (m):	121.30
Max. Ponding Area at Spill (m2) =	49.10
Max Ponding Depth At Spill Elev (m) =	0.20
Max. Prism Volume (m3) At Spill	3.3
Depth to Inv below ground (m)	1.89
Inv Elev of Storage Node (m)	119.41
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	121.65
Ponding Elev 2 Above Spill (m) =	121.65
Ponding Area 2 Above Spill (m2) =	136.90

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
119.41	0.0000	0.0000	0.00	0.00
121.30	1.8900	0.36	0.68	0.68
121.50	2.0900	49.1	3.27	3.95
121.65	2.2400	136.9	13.95	17.90
121.6501	2.2401	0.0	0.01	17.91
121.7501	2.3401	0.0	0.00	17.91
	Copy to PCSWMM (depth / area)			

Ponding Information	
Ponding Area (trap low) No:	SP-11
Structure / Inlet No:	CB99
Location	ROADWAY
Area Type (Flowby / Ponding)	PONDING
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	120.34
Min. Ponding Elev (Lid Elev) (m):	120.24
Max. Ponding Area at Spill (m2) =	20.10
Max Ponding Depth At Spill Elev (m) =	0.10
Max. Prism Volume (m3) At Spill	0.7
Depth to Inv below ground (m)	1.00
Inv Elev of Storage Node (m)	119.24
Allowance for Overland Flow Above Spill Elev (m)	0.15
Ponding Rim Elevation (m)	120.49
Ponding Elev 2 Above Spill (m) =	120.49
Ponding Area 2 Above Spill (m2) =	92.59

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
119.24	0.0000	0.0000	0.00	0.00
120.24	1.0000	0.36	0.36	0.36
120.34	1.1000	20.1	0.67	1.03
120.49	1.2500	92.6	8.45	9.48
120.4901	1.2501	0.0	0.00	9.49
120.5901	1.3501	0.0	0.00	9.49
	Copy to PCSWMM (depth / area)			

TABLE E22
RATING CURVES FOR MODELLING OF CATCHBASINS - NO SURFACE PONDING (12 pages)

Ponding Information	
Ponding Area (trap low) No:	MH35_NO_PONDING
Structure / Inlet No:	MH35
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Manhole
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	119.85
Min. Ponding Elev (Lid Elev) (m):	119.85
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.500
Inv Elev of Storage Node (m)	118.35
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	120.197

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
118.35	0.0000	0.0000	0.00	0.00
119.847	1.5000	1.13	1.70	1.70
119.847	1.5001	0.0	0.00	1.70
120.197	1.8500	0.0	0.00	1.70
Copy to PCSWMM (depth / area)				

CB Lid Elev = 119.847
Oultet Elev = 118.347

Dist Lid → Outlet = 1.500

Ponding Information	
Ponding Area (trap low) No:	MH36_NO_PONDING
Structure / Inlet No:	MH36
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Manhole
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	119.28
Min. Ponding Elev (Lid Elev) (m):	119.28
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.500
Inv Elev of Storage Node (m)	117.78
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	119.630

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.78	0.0000	0.0000	0.00	0.00
119.280	1.5000	1.13	1.70	1.70
119.280	1.5001	0.0	0.00	1.70
119.630	1.8500	0.0	0.00	1.70
Copy to PCSWMM (depth / area)				

CB Lid Elev = 119.280
Oultet Elev = 117.780

Dist Lid → Outlet = 1.500

Ponding Information	
Ponding Area (trap low) No:	CB36_NO_PONDING
Structure / Inlet No:	CB36
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	119.43
Min. Ponding Elev (Lid Elev) (m):	119.43
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.559
Inv Elev of Storage Node (m)	117.87
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	119.729

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.87	0.0000	0.0000	0.00	0.00
119.429	1.5590	0.36	0.56	0.56
119.429	1.5591	0.0	0.00	0.56
119.729	1.8590	0.0	0.00	0.56
Copy to PCSWMM (depth / area)				

CB Lid Elev = 119.429
Oultet Elev = 117.870

Dist Lid → Outlet = 1.559

Ponding Information	
Ponding Area (trap low) No:	MH37_NO_PONDING
Structure / Inlet No:	MH37
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	MANHOLE
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	119.98
Min. Ponding Elev (Lid Elev) (m):	119.98
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.500
Inv Elev of Storage Node (m)	118.48
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	120.326

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
118.48	0.0000	0.0000	0.00	0.00
119.976	1.5000	1.13	1.70	1.70
119.976	1.5001	0.0	0.00	1.70
120.326	1.8500	0.0	0.00	1.70
Copy to PCSWMM (depth / area)				

CB Lid Elev = 119.976
Oultet Elev = 118.476

Dist Lid → Outlet = 1.500

Ponding Information	
Ponding Area (trap low) No:	MH38_NO_PONDING
Structure / Inlet No:	MH38
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	Manhole
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	120.132
Min. Ponding Elev (Lid Elev) (m):	120.132
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.50
Inv Elev of Storage Node (m)	118.63
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	120.482

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
118.63	0.0000	0.0000	0.00	0.00
120.132	1.5020	1.13	1.70	1.70
120.132	1.5021	0.0	0.00	1.70
120.482	1.8520	0.0	0.00	1.70
Copy to PCSWMM (depth / area)				

CB Lid Elev = 120.132
Oultet Elev = 118.630

Dist Lid → Outlet = 1.502

Ponding Information	
Ponding Area (trap low) No:	MH39_NO_PONDING
Structure / Inlet No:	MH39
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	Manhole
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	120.182
Min. Ponding Elev (Lid Elev) (m):	120.182
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.500
Inv Elev of Storage Node (m)	118.68
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	120.532

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
118.68	0.0000	0.0000	0.00	0.00
120.182	1.5000	1.13	1.70	1.70
120.182	1.5001	0.0	0.00	1.70
120.532	1.8500	0.0	0.00	1.70
Copy to PCSWMM (depth / area)				

CB Lid Elev = 120.182
Oultet Elev = 118.682

Dist Lid → Outlet = 1.500

Ponding Information	
Ponding Area (trap low) No:	MH40_NO_PONDING
Structure / Inlet No:	MH40
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Manhole
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	118.863
Min. Ponding Elev (Lid Elev) (m):	118.863
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	2.900
Inv Elev of Storage Node (m)	115.96
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	119.213

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
115.96	0.0000	0.0000	0.00	0.00
118.863	2.9000	1.13	3.28	3.28
118.863	2.9001	0.0	0.00	3.28
119.213	3.2500	0.0	0.00	3.28
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.863
Oultet Elev = 115.963

Dist Lid → Outlet = 2.900

Ponding Information	
Ponding Area (trap low) No:	MH41_NO_PONDING
Structure / Inlet No:	MH41
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	MANHOLE
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	ROUND
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	118.30
Min. Ponding Elev (Lid Elev) (m):	118.30
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.500
Inv Elev of Storage Node (m)	116.80
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	118.646

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
116.80	0.0000	0.0000	0.00	0.00
118.296	1.5000	1.13	1.70	1.70
118.296	1.5001	0.0	0.00	1.70
118.646	1.8500	0.0	0.00	1.70
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.296
Oultet Elev = 116.796

Dist Lid → Outlet = 1.500

Ponding Information	
Ponding Area (trap low) No:	CB42_NO_PONDING
Structure / Inlet No:	CB42_NO_PONDING
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	CATCHBASIN
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	RECTANGULAR
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.59
Min. Ponding Elev (Lid Elev) (m):	118.59
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.500
Inv Elev of Storage Node (m)	117.09
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	118.940

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.09	0.0000	0.0000	0.00	0.00
118.590	1.5000	0.28	0.42	0.42
118.590	1.5001	0.0	0.00	0.42
118.940	1.8500	0.0	0.00	0.42
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.590
Oultet Elev = 117.090

Dist Lid → Outlet = 1.500

Ponding Information	
Ponding Area (trap low) No:	CB43_NO_PONDING
Structure / Inlet No:	CB43
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	CATCHBASIN
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	RECTANGULAR
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.871
Min. Ponding Elev (Lid Elev) (m):	118.871
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.500
Inv Elev of Storage Node (m)	117.37
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	119.221

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.37	ucs	0.0000	0.00	0.00
118.871	1.5000	0.28	0.42	0.42
118.871	1.5001	0.0	0.00	0.42
119.221	1.8500	0.0	0.00	0.42
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.871
Oultet Elev = 117.371

Dist Lid → Outlet = 1.500

Ponding Information	
Ponding Area (trap low) No:	MH43_NO_PONDING
Structure / Inlet No:	MH43
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	MANHOLE
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	ROUND
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	118.77
Min. Ponding Elev (Lid Elev) (m):	118.77
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.500
Inv Elev of Storage Node (m)	117.27
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	119.116

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.27	0.0000	0.0000	0.00	0.00
118.766	1.5000	1.13	1.70	1.70
118.766	1.5001	0.0	0.00	1.70
119.116	1.8500	0.0	0.00	1.70
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.766
Oultet Elev = 117.266

Dist Lid → Outlet = 1.500

Ponding Information	
Ponding Area (trap low) No:	MH44_NO_PONDING
Structure / Inlet No:	MH44
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	Manhole
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	1200.00
Max. Ponding Elev at Spill (m):	118.76
Min. Ponding Elev (Lid Elev) (m):	118.76
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	3.900
Inv Elev of Storage Node (m)	114.86
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	119.109

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
114.86	0.0000	0.0000	0.00	0.00
118.759	3.9000	1.13	4.41	4.41
118.759	3.9001	0.0	0.00	4.41
119.109	4.2500	0.0	0.00	4.41
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.759
Oultet Elev = 114.859

Dist Lid → Outlet = 3.900

Ponding Information	
Ponding Area (trap low) No:	MH45_NO_PONDING
Structure / Inlet No:	MH45
Location	ROADWAY
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Manhole
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	1200.00
Max. Ponding Elev at Spill (m):	118.14
Min. Ponding Elev (Lid Elev) (m):	118.14
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	3.750
Inv Elev of Storage Node (m)	114.39
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	118.490

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
114.39	0.0000	0.0000	0.00	0.00
118.140	3.7500	1.13	4.24	4.24
118.140	3.7501	0.0	0.00	4.24
118.490	4.1000	0.0	0.00	4.24
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.140
Oultet Elev = 114.390

Dist Lid → Outlet = 3.750

Ponding Information	
Ponding Area (trap low) No:	CB51_NO_PONDING
Structure / Inlet No:	CB51
Location	REARYAD
Area Type (Flowby / Ponding)	PONDING
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	120.18
Min. Ponding Elev (Lid Elev) (m):	120.18
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.172
Inv Elev of Storage Node (m)	119.00
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	120.48

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
119.00	0.0000	0.0000	0.00	0.00
120.176	1.1720	0.36	0.42	0.42
120.176	1.1721	0.0	0.00	0.42
120.476	1.4720	0.0	0.00	0.42
Copy to PCSWMM (depth / area)				

CB Lid Elev = 120.176
Oultet Elev = 119.004

Dist Lid → Outlet = 1.172

Ponding Information	
Ponding Area (trap low) No:	CB58_NO_PONDING
Structure / Inlet No:	CB58
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.68
Min. Ponding Elev (Lid Elev) (m):	118.68
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.507
Inv Elev of Storage Node (m)	117.17
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	118.980

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.17	0.0000	0.0000	0.00	0.00
118.680	1.5070	0.36	0.54	0.54
118.680	1.5071	0.0	0.00	0.54
118.980	1.8070	0.0	0.00	0.54
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.680
Oultet Elev = 117.173

Dist Lid → Outlet = 1.507

Ponding Information	
Ponding Area (trap low) No:	CB60_NO_PONDING
Structure / Inlet No:	CB60
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	118.79
Min. Ponding Elev (Lid Elev) (m):	118.79
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.274
Inv Elev of Storage Node (m)	117.52
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	119.090

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.52	0.0000	0.0000	0.00	0.00
118.790	1.2740	0.36	0.46	0.46
118.790	1.2741	0.0	0.00	0.46
119.090	1.5740	0.0	0.00	0.46
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.790
Oultet Elev = 117.516

Dist Lid → Outlet = 1.274

Ponding Information	
Ponding Area (trap low) No:	CB65_ponding
Structure / Inlet No:	CB77
Location	REARYARD
Area Type (Flowby / Ponding)	PONDING
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	120.34
Min. Ponding Elev (Lid Elev) (m):	120.34
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.491
Inv Elev of Storage Node (m)	118.85
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	120.640

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
118.85	0.0000	0.0000	0.00	0.00
120.340	1.4910	0.36	0.54	0.54
120.340	1.4911	0.0	0.00	0.54
120.640	1.7910	0.0	0.00	0.54
Copy to PCSWMM (depth / area)				

CB Lid Elev = 120.340
Oultet Elev = 118.849

Dist Lid → Outlet = 1.491

Ponding Information	
Ponding Area (trap low) No:	CB77_NO_PONDING
Structure / Inlet No:	CB77
Location	REARYARD
Area Type (Flowby / Ponding)	PONDING
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	120.34
Min. Ponding Elev (Lid Elev) (m):	120.34
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.491
Inv Elev of Storage Node (m)	118.85
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	120.640

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
118.85	0.0000	0.0000	0.00	0.00
120.340	1.4910	0.36	0.54	0.54
120.340	1.4911	0.0	0.00	0.54
120.640	1.7910	0.0	0.00	0.54
Copy to PCSWMM (depth / area)				

CB Lid Elev = 120.340
Oultet Elev = 118.849

Dist Lid → Outlet = 1.491

Ponding Information	
Ponding Area (trap low) No:	CB79_NO_PONDING
Structure / Inlet No:	CB79
Location	REARYAD
Area Type (Flowby / Ponding)	PONDING
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	120.25
Min. Ponding Elev (Lid Elev) (m):	120.25
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.193
Inv Elev of Storage Node (m)	119.06
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	120.548

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
119.06	0.0000	0.0000	0.00	0.00
120.248	1.1930	0.36	0.43	0.43
120.248	1.1931	0.0	0.00	0.43
120.548	1.4930	0.0	0.00	0.43
	Copy to PCSWMM (depth / area)			

CB Lid Elev = 120.248
Oultet Elev = 119.055

Dist Lid → Outlet = 1.193

Ponding Information	
Ponding Area (trap low) No:	CB83_NO_PONDING
Structure / Inlet No:	CB83
Location	REARYARD
Area Type (Flowby / Ponding)	PONDING
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	117.65
Min. Ponding Elev (Lid Elev) (m):	117.65
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.260
Inv Elev of Storage Node (m)	116.39
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	117.947

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
116.39	0.0000	0.0000	0.00	0.00
117.647	1.2600	0.36	0.45	0.45
117.647	1.2601	0.0	0.00	0.45
117.947	1.5600	0.0	0.00	0.45
	Copy to PCSWMM (depth / area)			

CB Lid Elev = 117.647
Oultet Elev = 116.387

Dist Lid → Outlet = 1.260

Ponding Information	
Ponding Area (trap low) No:	CB87_NO_PONDING
Structure / Inlet No:	CB87
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	CATCHBASIN
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	116.25
Min. Ponding Elev (Lid Elev) (m):	116.25
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.132
Inv Elev of Storage Node (m)	115.12
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	116.552

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
115.12	0.0000	0.0000	0.00	0.00
116.252	1.1320	0.36	0.41	0.41
116.252	1.1321	0.0	0.00	0.41
116.552	1.4320	0.0	0.00	0.41
	Copy to PCSWMM (depth / area)			

CB Lid Elev = 116.252
Oultet Elev = 115.120

Dist Lid → Outlet = 1.132

Ponding Information	
Ponding Area (trap low) No:	CB92_NO_PONDING
Structure / Inlet No:	CB92
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	122.46
Min. Ponding Elev (Lid Elev) (m):	122.46
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	2.200
Inv Elev of Storage Node (m)	120.26
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	122.764

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
120.26	0.0000	0.0000	0.00	0.00
122.464	2.2000	0.36	0.79	0.79
122.464	2.2001	0.0	0.00	0.79
122.764	2.5000	0.0	0.00	0.79
	Copy to PCSWMM (depth / area)			

CB Lid Elev = 122.464
Oultet Elev = 120.264

Dist Lid → Outlet = 2.200

Ponding Information	
Ponding Area (trap low) No:	CB93_NO_PONDING
Structure / Inlet No:	CB93
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	121.10
Min. Ponding Elev (Lid Elev) (m):	121.10
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.400
Inv Elev of Storage Node (m)	119.70
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	121.400

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
119.70	0.0000	0.0000	0.00	0.00
121.100	1.4000	0.36	0.50	0.50
121.100	1.4001	0.0	0.00	0.50
121.400	1.7000	0.0	0.00	0.50
	Copy to PCSWMM (depth / area)			

CB Lid Elev = 121.100
Oultet Elev = 119.700

Dist Lid → Outlet = 1.400

Ponding Information	
Ponding Area (trap low) No:	CB96_NO_PONDING
Structure / Inlet No:	CB96
Location	PARK
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	119.60
Min. Ponding Elev (Lid Elev) (m):	119.60
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	2.400
Inv Elev of Storage Node (m)	117.20
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	119.895

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
117.20	0.0000	0.0000	0.00	0.00
119.595	2.4000	0.36	0.86	0.86
119.595	2.4001	0.0	0.00	0.86
119.895	2.7000	0.0	0.00	0.86
	Copy to PCSWMM (depth / area)			

CB Lid Elev = 119.595
Oultet Elev = 117.195

Dist Lid → Outlet = 2.400

Ponding Information	
Ponding Area (trap low) No:	CB97_NO_PONDING
Structure / Inlet No:	CB97
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	116.06
Min. Ponding Elev (Lid Elev) (m):	116.06
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.325
Inv Elev of Storage Node (m)	114.73
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	116.355

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
114.73	0.0000	0.0000	0.00	0.00
116.055	1.3250	0.36	0.48	0.48
116.055	1.3251	0.0	0.00	0.48
116.355	1.6250	0.0	0.00	0.48
Copy to PCSWMM (depth / area)				

CB Lid Elev = 116.055
Oultet Elev = 114.730

Dist Lid → Outlet = 1.325

Ponding Information	
Ponding Area (trap low) No:	CB98_NO_PONDING
Structure / Inlet No:	CB98
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	116.85
Min. Ponding Elev (Lid Elev) (m):	116.85
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.400
Inv Elev of Storage Node (m)	115.45
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	117.150

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
115.45	0.0000	0.0000	0.00	0.00
116.850	1.4000	0.36	0.50	0.50
116.850	1.4001	0.0	0.00	0.50
117.150	1.7000	0.0	0.00	0.50
Copy to PCSWMM (depth / area)				

CB Lid Elev = 116.850
Oultet Elev = 115.450

Dist Lid → Outlet = 1.400

Ponding Information	
Ponding Area (trap low) No:	CB100X_NO_PONDING
Structure / Inlet No:	CB100X
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structure / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	117.11
Min. Ponding Elev (Lid Elev) (m):	117.11
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.000
Inv Elev of Storage Node (m)	116.11
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	117.46

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
116.11	0.0000	0.0000	0.00	0.00
117.110	1.0000	0.36	0.36	0.36
117.110	1.0001	0.0	0.00	0.36
117.460	1.3500	0.0	0.00	0.36
Copy to PCSWMM (depth / area)				

CB Lid Elev = 117.110
Oultet Elev = 116.110

Dist Lid → Outlet = 1.000

Ponding Information	
Ponding Area (trap low) No:	CB100_NO_PONDING
Structure / Inlet No:	CB100
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	117.11
Min. Ponding Elev (Lid Elev) (m):	117.11
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.400
Inv Elev of Storage Node (m)	115.71
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	117.46

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
115.71	0.0000	0.0000	0.00	0.00
117.110	1.4000	0.36	0.50	0.50
117.110	1.4001	0.0	0.00	0.50
117.460	1.7500	0.0	0.00	0.50
	Copy to PCSWMM (depth / area)			

CB Lid Elev = 117.110
Oultet Elev = 116.110

Dist Lid → Outlet = 1.400

Ponding Information	
Ponding Area (trap low) No:	231_NO_PONDING
Structure / Inlet No:	MH231
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	Manhole
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	118.04
Min. Ponding Elev (Lid Elev) (m):	118.04
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.060
Inv Elev of Storage Node (m)	116.98
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	118.340

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
116.98	0.0000	0.0000	0.00	0.00
118.040	1.0600	1.13	1.20	1.20
118.040	1.0601	0.0	0.00	1.20
118.340	1.3600	0.0	0.00	1.20
	Copy to PCSWMM (depth / area)			

CB Lid Elev = 118.040
Oultet Elev = 116.980

Dist Lid → Outlet = 1.060

Ponding Information	
Ponding Area (trap low) No:	CB122_NO_PONDING
Structure / Inlet No:	CB122
Location	REARYARD
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	Catchbasin
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Rect
Structure Length or DIA (mm)	600.00
Structure Width (mm)	600.00
Max. Ponding Elev at Spill (m):	119.98
Min. Ponding Elev (Lid Elev) (m):	119.98
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	1.400
Inv Elev of Storage Node (m)	118.58
Allowance for Overland Flow Above Spill Elev (m)	0.30
Ponding Rim Elevation (m)	120.282

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
118.58	0.0000	0.0000	0.00	0.00
119.982	1.4000	0.36	0.50	0.50
119.982	1.4001	0.0	0.00	0.50
120.282	1.7000	0.0	0.00	0.50
	Copy to PCSWMM (depth / area)			

CB Lid Elev = 119.982
Oultet Elev = 118.582

Dist Lid → Outlet = 1.400

Ponding Information	
Ponding Area (trap low) No:	MH223_NO_PONDING
Structure / Inlet No:	MH223
Location	FRONTYARD
Area Type (Flowby / Ponding)	FLOWBY
Structrue / Inlet Type	Manhole
Include Structure Storage (yes/no)	Yes
Structure Shape (rect / round)	Round
Structure Length or DIA (mm)	1200.00
Structure Width (mm)	
Max. Ponding Elev at Spill (m):	118.67
Min. Ponding Elev (Lid Elev) (m):	118.67
Max. Ponding Area at Spill (m2) =	0.00
Max Ponding Depth At Spill Elev (m) =	0.00
Max. Prism Volume (m3) At Spill	0.0
Depth to Inv below ground (m)	3.853
Inv Elev of Storage Node (m)	114.82
Allowance for Overland Flow Above Spill Elev (m)	0.35
Ponding Rim Elevation (m)	119.020

Storage Function for Modelling				
Elev (m)	Head / Depth (m)	Area (m2)	Incr Vol (m3)	Tot Vol (m3)
114.82	0.0000	0.0000	0.00	0.00
118.670	3.8530	1.13	4.36	4.36
118.670	3.8531	0.0	0.00	4.36
119.020	4.2030	0.0	0.00	4.36
Copy to PCSWMM (depth / area)				

CB Lid Elev = 118.670

Oultet Elev = 114.817

Dist Lid → Outlet = 3.853

TABLE E23
CLEARANCES BETWEEN USF AND HGL (100-YR, & 100-YR+20%) BASED ON PCSWMM RESULTS

Connected Building		Manholes		Dist. MH-MH (m)	Distance from Bldg Lateral Connection to D/S Manhole	Top of Road Elevations			[2]BFF Elevation (m)	USF Elevation (m)	100-year HGL Elev's			100-year + 20% HGL Elev's			Clearances		
Lot #	Type	U/S	D/S			At U/S MH	At D/S MH	[1]At Building (m)			At U/S MH	At D/S MH	[1]At Building (m)	At U/S MH	At D/S MH	[1]At Building (m)	USF-100yr HGL (m) (note 3)	USF - 100yr+20% (note 4)	CL Road - 100-yr HGL
B47	SITEPLAN	213	212	80.9	0	122.11	120.59	120.59	n/a	n/a	117.44	116.90	116.90	117.44	116.71	116.71			3.68
B27	SITEPLAN	213	212	80.9	0	122.11	120.59	120.59	n/a	n/a	117.44	116.90	116.90	117.44	116.71	116.71			3.68
B22-1	TOWNHOME	213	212	80.9	73	122.11	120.59	121.95	120.10	119.70	117.44	116.90	117.39	117.44	116.71	117.37	2.31	2.33	4.57
B22-2	TOWNHOME	213	212	80.9	72	122.11	120.59	121.94	120.10	119.70	117.44	116.90	117.38	117.44	116.71	117.36	2.32	2.34	4.56
B22-3	TOWNHOME	213	212	80.9	61	122.11	120.59	121.73	120.10	119.70	117.44	116.90	117.31	117.44	116.71	117.26	2.39	2.44	4.42
B22-4	TOWNHOME	213	212	80.9	60	122.11	120.59	121.71	120.10	119.70	117.44	116.90	117.30	117.44	116.71	117.25	2.40	2.45	4.41
B21	SINGLE	213	212	80.9	44	122.11	120.59	121.42	119.79	119.39	117.44	116.90	117.20	117.44	116.71	117.11	2.19	2.28	4.22
B20	SINGLE	213	212	80.9	39	122.11	120.59	121.32	119.65	119.25	117.44	116.90	117.16	117.44	116.71	117.07	2.09	2.18	4.16
B19	SINGLE	213	212	80.9	23	122.11	120.59	121.02	119.31	118.91	117.44	116.90	117.06	117.44	116.71	116.92	1.85	1.99	3.96
B18	SINGLE	213	212	80.9	18	122.11	120.59	120.93	118.94	118.54	117.44	116.90	117.02	117.44	116.71	116.87	1.52	1.67	3.90
B17	SINGLE	213	212	80.9	2	122.11	120.59	120.62	118.85	118.45	117.44	116.90	116.92	117.44	116.71	116.73	1.53	1.72	3.71
B16	SINGLE	212	211	79.9	76	120.59	120.19	120.57	118.67	118.27	116.90	116.66	116.89	116.71	116.47	116.70	1.38	1.57	3.67
B15	SINGLE	212	211	79.9	60	120.59	120.19	120.49	118.54	118.14	116.90	116.66	116.84	116.71	116.47	116.65	1.30	1.49	3.64
B14	SINGLE	212	211	79.9	55	120.59	120.19	120.46	118.35	117.95	116.90	116.66	116.83	116.71	116.47	116.63	1.12	1.32	3.63
B13	SINGLE	212	211	79.9	39	120.59	120.19	120.38	118.29	117.89	116.90	116.66	116.78	116.71	116.47	116.59	1.11	1.30	3.60
B12	SINGLE	212	211	79.9	34	120.59	120.19	120.36	118.34	117.94	116.90	116.66	116.77	116.71	116.47	116.57	1.17	1.37	3.59
B11	SINGLE	212	211	79.9	18	120.59	120.19	120.28	118.40	118.00	116.90	116.66	116.72	116.71	116.47	116.52	1.28	1.48	3.56
B10	SINGLE	212	211	79.9	13	120.59	120.19	120.25	118.29	117.89	116.90	116.66	116.70	116.71	116.47	116.51	1.19	1.38	3.55
B09	SINGLE	212	211	79.9	0	120.59	120.19	120.19	118.37	117.97	116.90	116.66	116.66	116.71	116.47	116.47	1.31	1.50	3.53
B08	SINGLE	211	210	11.0	4	120.19	120.11	120.14	118.48	118.08	116.66	116.63	116.64	116.47	116.42	116.44	1.44	1.64	3.50
B07	WALKWAY	213	212	80.9															
B06	SINGLE	210	209	66.4	2	120.11	119.62	119.63	117.94	117.54	116.63	116.36	116.37	116.42	116.20	116.20	1.17	1.34	3.26
B05	SINGLE	210	209	66.4	56	120.11	119.62	120.03	117.74	117.34	116.63	116.36	116.58	116.42	116.20	116.38	0.76	0.96	3.45
B04	SINGLE	210	209	66.4	51	120.11	119.62	120.00	117.70	117.30	116.63	116.36	116.56	116.42	116.20	116.37	0.74	0.93	3.43
B03	SINGLE	210	209	66.4	35	120.11	119.62	119.87	117.64	117.24	116.63	116.36	116.50	116.42	116.20	116.31	0.74	0.93	3.38
B02	SINGLE	210	209	66.4	30	120.11	119.62	119.84	117.62	117.22	116.63	116.36	116.48	116.42	116.20	116.30	0.74	0.92	3.36
B01	SINGLE	210	209	66.4	13	120.11	119.62	119.72	117.55	117.15	116.63	116.36	116.41	116.42	116.20	116.24	0.74	0.91	3.30
B30-1	TOWNHOME	209	208	40.0	20	119.62	119.21	119.41	117.44	117.04	116.36	116.24	116.30	116.20	116.11	116.15	0.74	0.89	3.11
B30-2	TOWNHOME	209	208	40.0	19	119.62	119.21	119.40	117.44	117.04	116.36	116.24	116.30	116.20	116.11	116.15	0.74	0.89	3.10
B30-3	TOWNHOME	209	208	40.0	8	119.62	119.21	119.29	117.44	117.04	116.36	116.24	116.27	116.20	116.11	116.12	0.77	0.92	3.02
B30-4	TOWNHOME	209	208	40.0	7	119.62	119.21	119.28	117.44	117.04	116.36	116.24	116.26	116.20	116.11	116.12	0.78	0.92	3.02
B30-5	TOWNHOME	208	207	119.3	115	119.21	118.91	119.20	117.44	117.04	116.24	115.96	116.23	116.11	115.87	116.10	0.81	0.94	2.97
B30-6	TOWNHOME	208	207	119.3	114	119.21	118.91	119.20	117.35	116.95	116.24	115.96	116.23	116.11	115.87	116.09	0.72	0.86	2.97
B30-7	TOWNHOME	208	207	119.3	103	119.21	118.91	119.17	117.35	116.95	116.24	115.96	116.20	116.11	115.87	116.07	0.75	0.88	2.97
B30-8	TOWNHOME	208	207	119.3	102	119.21	118.91	119.17	117.35	116.95	116.24	115.96	116.20	116.11	115.87	116.07	0.75	0.88	2.97
B31-1	TOWNHOME	208	207	119.3	88	119.21	118.91	119.13	117.25	116.85	116.24	115.96	116.17	116.11	115.87	116.04	0.68	0.81	2.96
B31-2	TOWNHOME	208	207	119.3	87	119.21	118.91	119.13	117.25	116.85	116.24	115.96	116.17	116.11	115.87	116.04	0.68	0.81	2.96
B31-3	TOWNHOME	208	207	119.3	76	119.21	118.91	119.10	117.25	116.85	116.24	115.96	116.14	116.11	115.87	116.02	0.71	0.83	2.96
B31-4	TOWNHOME	208	207	119.3	75	119.21	118.91	119.10	117.25	116.85	116.24	115.96	116.14	116.11	115.87	116.02	0.71	0.83	2.96
B31-5	TOWNHOME	208	207	119.3	64	119.21	118.91	119.07	117.25	116.85	116.24	115.96	116.11	116.11	115.87	115.99	0.74	0.86	2.96
B31-6	TOWNHOME	208	207	119.3	63	119.21	118.91	119.07	117.25	116.85	116.24	115.96	116.11	116.11	115.87	115.99	0.74	0.86	2.96
B31-7	TOWNHOME	208	207	119.3	52	119.21	118.91	119.04	117.25	116.85	116.24	115.96	116.08	116.11	115.87	115.97	0.77	0.88	2.96
B31-8	TOWNHOME	208	207	119.3	51	119.21	118.91	119.04	117.25	116.85	116.24	115.96	116.08	116.11	115.87	115.97	0.77	0.88	2.96
B32-1	TOWNHOME	208	207	119.3	37	119.21	118.91	119.01	117.09	116.69	116.24	115.96	116.05	116.11	115.87	115.94	0.64	0.75	2.96
B32-2	TOWNHOME	208	207	119.3	36	119.21	118.91	119.00	117.09	116.69	116.24	115.96	116.05	116.11	115.87	115.94	0.64	0.75	2.96
B32-3	TOWNHOME	208	207	119.3	25	119.21	118.91	118.98	117.09	116.69	116.24	115.96	116.02	116.11	115.87	115.92	0.67	0.77	2.96
B32-4	TOWNHOME	208	207	119.3	24	119.21	118.91	118.97	117.09	116.69	116.24	115.96	116.02	116.11	115.87	115.92	0.67	0.77	2.96
B32-5	TOWNHOME	208	207	119.3	13	119.21	118.91	118.95	117.09	116.69	116.24	115.96	115.99	116.11	115.87	115.89	0.70	0.80	2.96
B32-6	TOWNHOME	208	207	119.3	13	119.21	118.91	118.94	117.09	116.69	116.24	115.96	115.99	116.11	115.87	115.89	0.70	0.80	2.96
B32-7	TOWNHOME	208	207	119.3	2	119.21	118.91	118.92	117.09	116.69	116.24	115.96	115.96	116.11	115.87	115.87	0.73	0.82	2.95
B32-8	TOWNHOME	208	207	119.3	1	119.21	118.91	118.92	117.09	116.69	116.24	115.96	115.96	116.11	115.87	115.87	0.73	0.82	2.95
B33-1	SEMI	207	206	12.0	10	118.91	118.76	118.89	116.93	116.53	115.96	115.92	115.95	115.87	115.83	115.86	0.58	0.67	2.94
B33-2	SEMI	207	206	12.0	2	118.91	118.76	118.79	116.93	116.53	115.96	115.92	115.93	115.87	115.83	115.84	0.60	0.69	2.86

TABLE E23

CLEARANCES BETWEEN USF AND HGL (100-YR, & 100-YR+20%) BASED ON PCSWMM RESULTS

Connected Building		Manholes		Dist. MH-MH (m)	Distance from Bldg Lateral Connection to D/S Manhole	Top of Road Elevations			[2]BFF Elevation (m)	USF Elevation (m)	100-year HGL Elev's			100-year + 20% HGL Elev's			Clearances		
Lot #	Type	U/S	D/S			At U/S MH	At D/S MH	[1]At Building (m)			At U/S MH	At D/S MH	[1]At Building (m)	At U/S MH	At D/S MH	[1]At Building (m)	USF-100yr HGL (m) (note 3)	USF - 100yr+20% (note 4)	CL Road - 100-yr HGL
B42-1	TOWNHOME	206	205	68.7	68	118.76	118.50	118.76	116.83	116.43	115.92	115.75	115.92	115.83	115.69	115.83	0.51	0.60	2.84
B42-2	TOWNHOME	206	205	68.7	67	118.76	118.50	118.76	116.83	116.43	115.92	115.75	115.92	115.83	115.69	115.83	0.51	0.60	2.84
B42-3	TOWNHOME	206	205	68.7	57	118.76	118.50	118.71	116.83	116.43	115.92	115.75	115.89	115.83	115.69	115.81	0.54	0.62	2.82
B42-4	TOWNHOME	206	205	68.7	56	118.76	118.50	118.71	116.83	116.43	115.92	115.75	115.89	115.83	115.69	115.80	0.54	0.63	2.82
B42-5	TOWNHOME	206	205	68.7	45	118.76	118.50	118.67	116.83	116.43	115.92	115.75	115.86	115.83	115.69	115.78	0.57	0.65	2.81
B42-6	TOWNHOME	206	205	68.7	44	118.76	118.50	118.67	116.83	116.43	115.92	115.75	115.86	115.83	115.69	115.78	0.57	0.65	2.81
B42-7	TOWNHOME	206	205	68.7	33	118.76	118.50	118.62	116.83	116.43	115.92	115.75	115.83	115.83	115.69	115.76	0.60	0.67	2.79
B42-8	TOWNHOME	206	205	68.7	32	118.76	118.50	118.62	116.83	116.43	115.92	115.75	115.83	115.83	115.69	115.75	0.60	0.68	2.79
B43-1	TOWNHOME	206	205	68.7	18	118.76	118.50	118.56	116.69	116.29	115.92	115.75	115.79	115.83	115.69	115.72	0.50	0.57	2.77
B43-2	TOWNHOME	206	205	68.7	17	118.76	118.50	118.56	116.69	116.29	115.92	115.75	115.79	115.83	115.69	115.72	0.50	0.57	2.77
B43-3	TOWNHOME	206	205	68.7	6	118.76	118.50	118.52	116.69	116.29	115.92	115.75	115.76	115.83	115.69	115.70	0.53	0.59	2.76
B43-4	TOWNHOME	206	205	68.7	5	118.76	118.50	118.52	116.69	116.29	115.92	115.75	115.76	115.83	115.69	115.70	0.53	0.59	2.75
B43-5	TOWNHOME	205	204	53.4	48	118.50	118.38	118.48	116.69	116.29	115.75	115.64	115.74	115.69	115.57	115.67	0.55	0.62	2.75
B43-6	TOWNHOME	205	204	53.4	47	118.50	118.38	118.48	116.69	116.29	115.75	115.64	115.73	115.69	115.57	115.67	0.56	0.62	2.75
B43-7	TOWNHOME	205	204	53.4	36	118.50	118.38	118.46	116.69	116.29	115.75	115.64	115.71	115.69	115.57	115.65	0.58	0.64	2.75
B43-8	TOWNHOME	205	204	53.4	35	118.50	118.38	118.45	116.69	116.29	115.75	115.64	115.71	115.69	115.57	115.64	0.58	0.65	2.74
B44-1	TOWNHOME	205	204	53.4	21	118.50	118.38	118.42	116.59	116.19	115.75	115.64	115.68	115.69	115.57	115.61	0.51	0.58	2.74
B44-2	TOWNHOME	205	204	53.4	20	118.50	118.38	118.42	116.59	116.19	115.75	115.64	115.68	115.69	115.57	115.61	0.51	0.58	2.74
B44-3	TOWNHOME	205	204	53.4	9	118.50	118.38	118.40	116.59	116.19	115.75	115.64	115.66	115.69	115.57	115.59	0.53	0.60	2.74
B44-4	TOWNHOME	205	204	53.4	8	118.50	118.38	118.39	116.54	116.14	115.75	115.64	115.65	115.69	115.57	115.58	0.49	0.56	2.74
B44-5	TOWNHOME	204	203	27.2	20	118.38	118.12	118.31	116.54	116.14	115.64	115.54	115.61	115.57	115.51	115.55	0.53	0.59	2.70
B44-6	TOWNHOME	204	203	27.2	19	118.38	118.12	118.30	116.54	116.14	115.64	115.54	115.61	115.57	115.51	115.55	0.53	0.59	2.69
B44-7	TOWNHOME	204	203	27.2	8	118.38	118.12	118.19	116.54	116.14	115.64	115.54	115.57	115.57	115.51	115.53	0.57	0.61	2.62
B44-8	TOWNHOME	204	203	27.2	7	118.38	118.12	118.19	116.54	116.14	115.64	115.54	115.57	115.57	115.51	115.53	0.57	0.61	2.62
B38-8	TOWNHOME	228	216	61.2	22	119.45	119.74	119.63	117.29	116.89	116.06	115.95	115.99	115.95	115.85	115.89	0.90	1.00	3.64
B38-7	TOWNHOME	228	216	61.2	23	119.45	119.74	119.63	117.29	116.89	116.06	115.95	115.99	115.95	115.85	115.89	0.90	1.00	3.64
B38-6	TOWNHOME	228	216	61.2	34	119.45	119.74	119.57	117.29	116.89	116.06	115.95	116.01	115.95	115.85	115.91	0.88	0.98	3.57
B38-5	TOWNHOME	228	216	61.2	36	119.45	119.74	119.57	117.29	116.89	116.06	115.95	116.01	115.95	115.85	115.91	0.88	0.98	3.55
B38-4	TOWNHOME	228	216	61.2	46	119.45	119.74	119.52	117.29	116.89	116.06	115.95	116.03	115.95	115.85	115.93	0.86	0.96	3.49
B38-3	TOWNHOME	228	216	61.2	47	119.45	119.74	119.51	117.29	116.89	116.06	115.95	116.03	115.95	115.85	115.93	0.86	0.96	3.48
B38-2	TOWNHOME	228	216	61.2	58	119.45	119.74	119.46	117.29	116.89	116.06	115.95	116.05	115.95	115.85	115.95	0.84	0.94	3.41
B38-1	TOWNHOME	228	216	61.2	59	119.45	119.74	119.45	117.29	116.89	116.06	115.95	116.05	115.95	115.85	115.95	0.84	0.94	3.40
B39-8	TOWNHOME	215	205	86.6	83	119.08	118.50	119.05	116.82	116.42	115.86	115.75	115.85	115.79	115.69	115.78	0.57	0.64	3.20
B39-7	TOWNHOME	215	205	86.6	82	119.08	118.50	119.05	116.82	116.42	115.86	115.75	115.85	115.79	115.69	115.78	0.57	0.64	3.19
B39-6	TOWNHOME	215	205	86.6	71	119.08	118.50	118.97	116.82	116.42	115.86	115.75	115.84	115.79	115.69	115.77	0.58	0.65	3.13
B39-5	TOWNHOME	215	205	86.6	70	119.08	118.50	118.97	116.82	116.42	115.86	115.75	115.84	115.79	115.69	115.77	0.58	0.65	3.13
B39-4	TOWNHOME	215	205	86.6	59	119.08	118.50	118.89	116.82	116.42	115.86	115.75	115.82	115.79	115.69	115.75	0.60	0.67	3.07
B39-3	TOWNHOME	215	205	86.6	59	119.08	118.50	118.89	116.82	116.42	115.86	115.75	115.82	115.79	115.69	115.75	0.60	0.67	3.06
B39-2	TOWNHOME	215	205	86.6	47	119.08	118.50	118.81	116.82	116.42	115.86	115.75	115.81	115.79	115.69	115.74	0.61	0.68	3.00
B39-1	TOWNHOME	215	205	86.6	47	119.08	118.50	118.81	116.82	116.42	115.86	115.75	115.81	115.79	115.69	115.74	0.61	0.68	3.00
B41-8	TOWNHOME	205	204	53.4	31	118.50	118.38	118.45	116.60	116.20	115.75	115.64	115.70	115.69	115.57	115.64	0.50	0.56	2.74
B41-7	TOWNHOME	205	204	53.4	31	118.50	118.38	118.44	116.60	116.20	115.75	115.64	115.70	115.69	115.57	115.64	0.50	0.56	2.74
B41-6	TOWNHOME	205	204	53.4	19	118.50	118.38	118.42	116.60	116.20	115.75	115.64	115.68	115.69	115.57	115.61	0.52	0.59	2.74
B41-5	TOWNHOME	205	204	53.4	19	118.50	118.38	118.42	116.60	116.20	115.75	115.64	115.68	115.69	115.57	115.61	0.52	0.59	2.74
B41-4	TOWNHOME	205	204	53.4	7	118.50	118.38	118.39	116.60	116.20	115.75	115.64	115.65	115.69	115.57	115.58	0.55	0.62	2.74
B41-3	TOWNHOME	205	204	53.4	6	118.50	118.38	118.39	116.60	116.20	115.75	115.64	115.65	115.69	115.57	115.58	0.55	0.62	2.74
B41-2	TOWNHOME	204	203	27.2	18	118.38	118.12	118.29	116.60	116.20	115.64	115.54	115.60	115.57	115.51	115.55	0.60	0.65	2.68
B41-1	TOWNHOME	204	203	27.2	17	118.38	118.12	118.28	116.60	116.20	115.64	115.54	115.60	115.57	115.51	115.55	0.60	0.65	2.68
B40-8	TOWNHOME	226	203	59.3	44	118.63	118.12	118.50	116.75	116.35	115.74	115.54	115.69	115.67	115.51	115.63	0.66	0.72	2.81
B40-7	TOWNHOME	226	203	59.3	45	118.63	118.12	118.50	116.75	116.35	115.74	115.54	115.69	115.67	115.51	115.63	0.66	0.72	2.81
B40-6	TOWNHOME	216	226	72.7	1	119.74	118.63	118.65	116.75	116.35	115.95	115.74	115.75	115.85	115.67	115.67	0.60	0.68	2.90
B40-5	TOWNHOME	216	226	72.7	2	119.74	118.63	118.66	116.85	116.45	115.95	115.74	115.75	115.85	115.67	115.68	0.70	0.77	2.91
B40-4	TOWNHOME	216	226	72.7	13	119.74	118.63	118.83	116.85	116.45	115.95	115.74	115.78	115.85	115.67	115.70	0.67	0.75	3.05

TABLE E23

CLEARANCES BETWEEN USF AND HGL (100-YR, & 100-YR+20%) BASED ON PCSWMM RESULTS

Connected Building		Manholes		Dist. MH-MH (m)	Distance from Bldg Lateral Connection to D/S Manhole	Top of Road Elevations			[2]BFF Elevation (m)	USF Elevation (m)	100-year HGL Elev's			100-year + 20% HGL Elev's			Clearances		
Lot #	Type	U/S	D/S			At U/S MH	At D/S MH	[1]At Building (m)			At U/S MH	At D/S MH	[1]At Building (m)	At U/S MH	At D/S MH	[1]At Building (m)	USF-100yr HGL (m) (note 3)	USF - 100yr+20% (note 4)	CL Road - 100-yr HGL
B40-3	TOWNHOME	216	226	72.7	14	119.74	118.63	118.84	116.85	116.45	115.95	115.74	115.78	115.85	115.67	115.71	0.67	0.74	3.06
B40-2	TOWNHOME	216	226	72.7	25	119.74	118.63	119.01	116.85	116.45	115.95	115.74	115.81	115.85	115.67	115.73	0.64	0.72	3.19
B40-1	TOWNHOME	216	226	72.7	26	119.74	118.63	119.02	116.85	116.45	115.95	115.74	115.82	115.85	115.67	115.74	0.63	0.71	3.21
B34-8	TOWNHOME	227	208	60.1	58	119.47	119.21	119.46	117.48	117.08	116.36	116.24	116.35	116.21	116.11	116.21	0.73	0.87	3.11
B34-7	TOWNHOME	227	208	60.1	57	119.47	119.21	119.46	117.48	117.08	116.36	116.24	116.35	116.21	116.11	116.21	0.73	0.87	3.11
B34-6	TOWNHOME	227	208	60.1	46	119.47	119.21	119.41	117.48	117.08	116.36	116.24	116.33	116.21	116.11	116.19	0.75	0.89	3.08
B34-5	TOWNHOME	227	208	60.1	45	119.47	119.21	119.40	117.48	117.08	116.36	116.24	116.33	116.21	116.11	116.18	0.75	0.90	3.08
B34-4	TOWNHOME	227	208	60.1	34	119.47	119.21	119.35	117.48	117.08	116.36	116.24	116.31	116.21	116.11	116.16	0.77	0.92	3.05
B34-3	TOWNHOME	227	208	60.1	33	119.47	119.21	119.35	117.48	117.08	116.36	116.24	116.30	116.21	116.11	116.16	0.78	0.92	3.05
B34-2	TOWNHOME	227	208	60.1	22	119.47	119.21	119.30	117.48	117.08	116.36	116.24	116.28	116.21	116.11	116.14	0.80	0.94	3.02
B34-1	TOWNHOME	227	208	60.1	21	119.47	119.21	119.30	117.48	117.08	116.36	116.24	116.28	116.21	116.11	116.14	0.80	0.94	3.02
B35-8	TOWNHOME	208	207	119.3	72	119.21	118.91	119.09	117.19	116.79	116.24	115.96	116.13	116.11	115.87	116.01	0.66	0.78	2.96
B35-7	TOWNHOME	208	207	119.3	72	119.21	118.91	119.09	117.19	116.79	116.24	115.96	116.13	116.11	115.87	116.01	0.66	0.78	2.96
B35-6	TOWNHOME	208	207	119.3	60	119.21	118.91	119.06	117.19	116.79	116.24	115.96	116.10	116.11	115.87	115.99	0.69	0.80	2.96
B35-5	TOWNHOME	208	207	119.3	60	119.21	118.91	119.06	117.19	116.79	116.24	115.96	116.10	116.11	115.87	115.99	0.69	0.80	2.96
B35-4	TOWNHOME	208	207	119.3	49	119.21	118.91	119.03	117.19	116.79	116.24	115.96	116.07	116.11	115.87	115.96	0.72	0.83	2.96
B35-3	TOWNHOME	208	207	119.3	48	119.21	118.91	119.03	117.10	116.70	116.24	115.96	116.07	116.11	115.87	115.96	0.63	0.74	2.96
B35-2	TOWNHOME	208	207	119.3	37	119.21	118.91	119.00	117.10	116.70	116.24	115.96	116.05	116.11	115.87	115.94	0.65	0.76	2.96
B35-1	TOWNHOME	208	207	119.3	36	119.21	118.91	119.00	117.10	116.70	116.24	115.96	116.04	116.11	115.87	115.94	0.66	0.76	2.96
B37-8	TOWNHOME	206	205	68.7	55	118.76	118.50	118.71	116.78	116.38	115.92	115.75	115.89	115.83	115.69	115.80	0.49	0.58	2.82
B37-7	TOWNHOME	206	205	68.7	54	118.76	118.50	118.71	116.78	116.38	115.92	115.75	115.89	115.83	115.69	115.80	0.49	0.58	2.82
B37-6	TOWNHOME	206	205	68.7	43	118.76	118.50	118.66	116.78	116.38	115.92	115.75	115.86	115.83	115.69	115.78	0.52	0.60	2.80
B37-5	TOWNHOME	206	205	68.7	42	118.76	118.50	118.66	116.78	116.38	115.92	115.75	115.86	115.83	115.69	115.78	0.52	0.60	2.80
B37-4	TOWNHOME	206	205	68.7	31	118.76	118.50	118.61	116.78	116.38	115.92	115.75	115.83	115.83	115.69	115.75	0.55	0.63	2.79
B37-3	TOWNHOME	206	205	68.7	30	118.76	118.50	118.61	116.78	116.38	115.92	115.75	115.82	115.83	115.69	115.75	0.56	0.63	2.79
B37-2	TOWNHOME	206	205	68.7	19	118.76	118.50	118.57	116.78	116.38	115.92	115.75	115.80	115.83	115.69	115.73	0.58	0.65	2.77
B37-1	TOWNHOME	206	205	68.7	18	118.76	118.50	118.56	116.78	116.38	115.92	115.75	115.79	115.83	115.69	115.72	0.59	0.66	2.77
B36-8	TOWNHOME	215	205	86.6	48	119.08	118.50	118.82	116.84	116.44	115.86	115.75	115.81	115.79	115.69	115.74	0.63	0.70	3.01
B36-7	TOWNHOME	215	205	86.6	49	119.08	118.50	118.82	116.84	116.44	115.86	115.75	115.81	115.79	115.69	115.74	0.63	0.70	3.01
B36-6	TOWNHOME	215	205	86.6	60	119.08	118.50	118.90	116.84	116.44	115.86	115.75	115.82	115.79	115.69	115.76	0.62	0.68	3.07
B36-5	TOWNHOME	215	205	86.6	61	119.08	118.50	118.90	116.84	116.44	115.86	115.75	115.83	115.79	115.69	115.76	0.61	0.68	3.08
B36-4	TOWNHOME	215	205	86.6	72	119.08	118.50	118.98	116.84	116.44	115.86	115.75	115.84	115.79	115.69	115.77	0.60	0.67	3.14
B36-3	TOWNHOME	215	205	86.6	73	119.08	118.50	118.98	116.84	116.44	115.86	115.75	115.84	115.79	115.69	115.77	0.60	0.67	3.14
B36-2	TOWNHOME	215	205	86.6	84	119.08	118.50	119.06	116.84	116.44	115.86	115.75	115.86	115.79	115.69	115.78	0.58	0.66	3.20
B36-1	TOWNHOME	215	205	86.6	85	119.08	118.50	119.06	116.84	116.44	115.86	115.75	115.86	115.79	115.69	115.78	0.58	0.66	3.21
B26-8	TOWNHOME	213	212	80.9	67	122.11	120.59	121.84	119.70	119.30	117.44	116.90	117.35	117.44	116.71	117.31	1.95	1.99	4.49
B26-7	TOWNHOME	213	212	80.9	66	122.11	120.59	121.82	119.70	119.30	117.44	116.90	117.34	117.44	116.71	117.31	1.96	1.99	4.48
B26-6	TOWNHOME	213	212	80.9	55	122.11	120.59	121.61	119.70	119.30	117.44	116.90	117.27	117.44	116.71	117.20	2.03	2.10	4.35
B26-5	TOWNHOME	213	212	80.9	54	122.11	120.59	121.60	119.41	119.01	117.44	116.90	117.26	117.44	116.71	117.20	1.75	1.81	4.34
B26-4	TOWNHOME	213	212	80.9	43	122.11	120.59	121.39	119.41	119.01	117.44	116.90	117.19	117.44	116.71	117.10	1.82	1.91	4.20
B26-3	TOWNHOME	213	212	80.9	42	122.11	120.59	121.38	119.01	118.61	117.44	116.90	117.18	117.44	116.71	117.09	1.43	1.52	4.19
B26-2	TOWNHOME	213	212	80.9	31	122.11	120.59	121.17	119.01	118.61	117.44	116.90	117.11	117.44	116.71	116.99	1.50	1.62	4.06
B26-1	TOWNHOME	213	212	80.9	30	122.11	120.59	121.15	119.01	118.61	117.44	116.90	117.10	117.44	116.71	116.98	1.51	1.63	4.05
B25-6	TOWNHOME	213	212	80.9	15	122.11	120.59	120.88	118.67	118.27	117.44	116.90	117.01	117.44	116.71	116.85	1.26	1.42	3.87
B25-5	TOWNHOME	213	212	80.9	15	122.11	120.59	120.86	118.67	118.27	117.44	116.90	117.00	117.44	116.71	116.84	1.27	1.43	3.86
B25-4	TOWNHOME	213	212	80.9	3	122.11	120.59	120.65	118.67	118.27	117.44	116.90	116.93	117.44	116.71	116.74	1.34	1.53	3.72
B25-3	TOWNHOME	213	212	80.9	3	122.11	120.59	120.63	118.27	117.87	117.44	116.90	116.92	117.44	116.71	116.73	0.95	1.14	3.71
B25-2	TOWNHOME	212	211	79.9	70	120.59	120.19	120.54	118.27	117.87	116.90	116.66	116.88	116.71	116.47	116.68	0.99	1.19	3.66
B25-1	TOWNHOME	212	211	79.9	70	120.59	120.19	120.53	118.27	117.87	116.90	116.66	116.87	116.71	116.47	116.68	1.00	1.19	3.66
B24	WALKWAY	212	211	79.9	0	120.59	120.19	120.19	n/a	n/a	116.90	116.66	116.66	116.71	116.47	116.47			
B23-8	TOWNHOME	212	211	79.9	49	120.59	120.19	120.43	117.96	117.56	116.90	116.66	116.81	116.71	116.47	116.62	0.75	0.94	3.62
B23-7	TOWNHOME	212	211	79.9	48	120.59	120.19	120.43	117.96	117.56	116.90	116.66	116.81	116.71	116.47	116.61	0.75	0.95	3.62
B23-6	TOWNHOME	212	211	79.9	37	120.59	120.19	120.37	117.96	117.56	116.90	116.66	116.77	116.71	116.47	116.58	0.79	0.98	3.60

TABLE E23
CLEARANCES BETWEEN USF AND HGL (100-YR, & 100-YR+20%) BASED ON PCSWMM RESULTS

Connected Building		Manholes		Dist. MH-MH (m)	Distance from Bldg Lateral Connection to D/S Manhole	Top of Road Elevations			[2]BFF Elevation (m)	USF Elevation (m)	100-year HGL Elev's			100-year + 20% HGL Elev's			Clearances		
Lot #	Type	U/S	D/S			At U/S MH	At D/S MH	[1]At Building (m)			At U/S MH	At D/S MH	[1]At Building (m)	At U/S MH	At D/S MH	[1]At Building (m)	USF-100yr HGL (m) (note 3)	USF - 100yr+20% (note 4)	CL Road - 100-yr HGL
B23-5	TOWNHOME	212	211	79.9	36	120.59	120.19	120.37	117.96	117.56	116.90	116.66	116.77	116.71	116.47	116.58	0.79	0.98	3.60
B23-4	TOWNHOME	212	211	79.9	25	120.59	120.19	120.31	117.96	117.56	116.90	116.66	116.74	116.71	116.47	116.54	0.82	1.02	3.58
B23-3	TOWNHOME	212	211	79.9	24	120.59	120.19	120.31	117.96	117.56	116.90	116.66	116.74	116.71	116.47	116.54	0.82	1.02	3.57
B23-2	TOWNHOME	212	211	79.9	13	120.59	120.19	120.26	117.96	117.56	116.90	116.66	116.70	116.71	116.47	116.51	0.86	1.05	3.55
B23-1	TOWNHOME	212	211	79.9	12	120.59	120.19	120.25	117.96	117.56	116.90	116.66	116.70	116.71	116.47	116.51	0.86	1.05	3.55
B28-5	TOWNHOME	210	209	66.4	28	120.11	119.62	119.83	117.66	117.26	116.63	116.36	116.47	116.42	116.20	116.29	0.79	0.97	3.35
B28-4	TOWNHOME	210	209	66.4	27	120.11	119.62	119.82	117.66	117.26	116.63	116.36	116.47	116.42	116.20	116.29	0.79	0.97	3.35
B28-3	TOWNHOME	210	209	66.4	17	120.11	119.62	119.74	117.66	117.26	116.63	116.36	116.43	116.42	116.20	116.26	0.83	1.00	3.32
B28-2	TOWNHOME	210	209	66.4	10	120.11	119.62	119.69	117.66	117.26	116.63	116.36	116.40	116.42	116.20	116.23	0.86	1.03	3.29
B28-1	TOWNHOME	210	209	66.4	9	120.11	119.62	119.69	117.66	117.26	116.63	116.36	116.40	116.42	116.20	116.23	0.86	1.03	3.29
B29-5	TOWNHOME	209	208	40.0	35	119.62	119.21	119.57	117.51	117.11	116.36	116.24	116.35	116.20	116.11	116.19	0.76	0.92	3.22
B29-4	TOWNHOME	209	208	40.0	35	119.62	119.21	119.56	117.51	117.11	116.36	116.24	116.34	116.20	116.11	116.18	0.77	0.93	3.22
B29-3	TOWNHOME	209	208	40.0	28	119.62	119.21	119.49	117.51	117.11	116.36	116.24	116.32	116.20	116.11	116.17	0.79	0.94	3.17
B29-2	TOWNHOME	209	208	40.0	18	119.62	119.21	119.39	117.51	117.11	116.36	116.24	116.29	116.20	116.11	116.15	0.82	0.96	3.09
B29-1	TOWNHOME	209	208	40.0	17	119.62	119.21	119.38	117.51	117.11	116.36	116.24	116.29	116.20	116.11	116.14	0.82	0.97	3.09
PARK	PARK	226	203																
B46	SWM	226	203																
B45	WALKWAY	226	203																
minimium =																	0.49	0.56	2.62
maximum =																	2.40	2.45	4.57

Notes
1) Interpolated beween manholes
2) BFF elevations are set at 400mm above USF elevations
3) Needs to be greater than 0.30m
4) Needs to be greater than 0m

Appendix F – Water Balance Tables

Table F1 – Monthly Water Balance – 75 mm Soil Moisture Retention (no 5 mm retention criteria)

Table F2 – Infiltration Factors

Table F3 – Pre-Development Water Budget (no 5 mm retention criteria)

Table F4 – Post-Development Water Budget (no 5 mm retention criteria)

Table F5 – Days with Rainfall – 1981 to 2010 Canadian Climate Normals Station Data

Table F6 – Monthly Water Balance – 75 mm Soil Moisture Retention (with 5 mm retention criteria)

Table F7 – Pre-Development Water Budget (with 5 mm retention criteria)

Table F8 – Post-Development Water Budget (with 5 mm retention criteria)

Table F9 – Average Monthly Temperatures for Ottawa, Station CDA, 1998 - 2018

Table F10 – Average Monthly Rainfall for Ottawa, Station CDA, 1998 - 2018

Table F11 – Average Monthly Snowfall for Ottawa, Station CDA, 1998 - 2018

Table F12 – Average Monthly Total Precipitation for Ottawa, Station CDA, 1998 - 2018

Table F13 – Average Monthly Total Rainfall, Snowfall, Total Precipitation for Ottawa, Station CDA, 1998 - 2018

Table F1

Water Balance (without 5 mm Retention Criteria)

Hydrologic Soil Group = D

Soil Moisture Content = 75 mm

Parameter	Variable	Equation	Unit	January	February	March	April	May	June	July	August	September	October	November	December	Annual (Σ Jan - Dec)
Temperature[1]	T		C	-9	-7	-2	7	14	19	21	20	16	9	3	-5	7
Precipitation[1]	P		mm	52	98	98	42	26	57	101	122	77	99	61	75	909
Heat Index[2]	I	$I=\Sigma(T_i/5)^{1.514}$		0	0	0	2	5	8	9	8	6	3	0	0	40
Thornthwaite's Constant	α	$\alpha= (492390 + (17920*I) - (771*I^2)+(0.675*I^3))+10^{-6}$		1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	13.64
Unadjusted Potential Evapotranspiration	U	$U = 16*(10*T/I)^{\alpha}$	mm	0	0	0	28	67	93	106	101	79	41	10	0	525
Adjustment Factor $_{45.25° N Latitude}$[4]		From lookup tables		0.76	0.86	0.99	1.12	1.24	1.30	1.27	1.17	1.05	0.91	0.80	0.73	12.21
Adjusted Potential Evapotranpiration	PET	PET = U*Adjustment Factor	mm	0	0	0	31	84	120	135	118	82	37	8	0	616
P-PET	ΔP	ΔP=P-PET	mm	52	98	98	11	-57	-64	-34	4	-6	62	53	75	293
Accumulated Potential Water Loss	WL		mm					-57	-121	-155	-151	-157	-95			-736
Storage	ST	From lookup tables	mm	203	301	399	75	73	57	33	20	14	75	75	150	1475
Change in Storage	ΔS	Storage=ΔSi-1		0	0	0	0	-2	-16	-24	-13	-6	61	0	0	
Actual Evapotranspiration	AET	Function of PET and ΔS		0	0	0	31	28	73	125	135	82	37	8	0	520
Soil Moisture Deficit	D	Function of PET and AET	mm	0	0	0	0	55	48	10	-17	0	0	0	0	
Soil Moisture Surplus	S	Function of Soil Moisture Storage	mm	0	0	0	335	0	0	0	0	0	3	53	0	391
Water Runoff	RO	Function of Soil Moisture Surplus	mm	7	3	2	168	84	42	21	11	0	2	27	14	
Snow Melt Runoff	SMRO	Function of Total Annual Snow	mm	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Runoff	TR	TR=RO+SMRO	mm	7	3	2	168	84	42	21	11	0	2	27	14	380
Total Moisture Detention	DT	DT=ST+TR		209	304	401	243	157	99	54	31	14	77	102	164	

Notes:

1) Temperature and Precipitation data for the City of Ottawa, Station CDA, 1998 - 2018. Refer to Tables F9, F10, and F11.

2) Heat Index is from TRCA Wetland Water Balance Modeling, Guidance Document, Equation B-7 (page 56).

3) Thorthwaite-Mather Constant is from the TRCA Wetland Water Balance Modeling, Guidance Document, Equation B-8 (page 56).

4) Adjustment Factor for Day and Month based on Latitude from Thornthwaite-Mather Table 8.

Table F2

Infiltration Factors[1]

Desctiption of Area/ Development Site	Value of Infiltration Factor
Topography	
Flat land (<1.5% slope)	0.172
Rolling land (1.5-3% slope)	0.120
Hilly land (>3% slope)	0.073
Soil	
Low (clay, silt)	0.10
Low-Medium (till, sand-silt)	0.15
Medium (till, silty sand)	0.20
Medium-High (sands)	0.30
High (gravel, sands, organic deposits)	0.40
Variable (till)	0.20
Variable (fill)	0.40
Variable (sand)	0.35
Variable (bedrock)	
Precambrian Bedrock	0.20
Paleozoic Bedrock	0.05
Land Cover	
Low Infiltration (urban, aggregate)	0.05
Medium Infiltration (agriculture, pasture, abondoned fields, wetland)	0.10
High Infiltration (forest, plantation)	0.20

Notes:
1) Mississippi-Rideau Source Protection Region. (2009). Tier1 Water Budget and Water Quality Stress Assessment.

Table F3

Pre-Development Water Budget (without 5 mm Retention Criteria)

	Grass	Tree	Gravel	Total[1]
Area (m^2) [2]	27,078	13,368	49,700	90,146
Pervious Area (m^2)	27,078	13,368	49,700	90,146
Impervious Area (m^2)	-	-	-	-
Infiltration Factors				
Topographic Infiltration Factor	0.17	0.17	0.17	
Soil Infiltration Factor	0.10	0.10	0.40	
Land Cover Infiltration Factor	0.10	0.10	0.05	
Actual Infiltration Factor	0.37	0.37	0.62	
Run-off Coefficient	-	-	-	
Inputs (per Unit Area)				
Precipitation (mm/year)	909	909	909	909
Run-on (mm/year)	-	-	-	-
Total Inputs (mm/year)	909	909	909	909
Outputs (per Unit Area)				
Precipitation Surplus (mm/year)	380	380	380	380
Evapotranspiration (mm/year)	529	529	529	529
Infiltration (mm/year)	142	142	237	194
Runoff Pervious Areas	239	239	144	186
Runoff Impervious Areas	-	-	-	-
Total Runoff (mm/year)	239	239	144	186
Total Outputs (mm/year)	909	909	909	909
Difference (Inputs - Outputs)	-	-	-	-
Inputs (Volume)				
Precipitation (m^3/year)	24,622	12,156	45,192	34,114
Run-on (m^3/year)	-	-	-	-
Total Inputs (m^3/year)	24,622	12,156	45,192	34,114
Outputs (Volume)				
Precipitation Surplus (m^3/year)	10,300	5,085	18,906	14,272
Evapotranspiration (m^3/year)	14,321	7,070	26,286	19,843
Infiltration (m^3/year)	3,832	1,892	11,760	7,915
Runoff Pervious Areas	6,469	3,194	7,146	6,357
Runoff Impervious Areas	-	-	-	-
Total Runoff (m^3/year)	6,469	3,194	7,146	6,357
Total Outputs (m^3/year)	24,622	12,156	45,192	34,114
Difference (Inputs - Outputs)	-	-	-	-

Notes:

1) *Total* column represents the sum of weighted averages for each area.

2) Area (m^2) Total is the sum of the pervious and the impervious area.

Table F4
Post-Development Water Budget (without 5 mm Retention Criteria)

	PARK	SWM	BACKYARD	ROW	SITEPLAN 1	SITEPLAN 2	Total[1]
Area (m^2) [2]	8,210	3,962	19,712	39,164	5,069	13,922	90,039
Pervious Area (m^2)	6,461	3,655	11,991	11,448	1,218	6,680	41,452
Impervious Area (m^2)	1,749	307	7,721	27,716	3,851	7,242	48,587
Infiltration Factors							
Topographic Infiltration Factor	0.17	0.17	0.17	-	-	-	
Soil Infiltration Factor	0.10	0.10	0.10	-	-	-	
Land Cover Infiltration Factor	0.20	0.20	0.20	-	-	-	
Actual Infiltration Factor	0.47	0.47	0.47	-	-	-	
Run-off Coefficient	0.35	0.25	0.47	0.70	0.73	0.56	
Inputs (per Unit Area)							
Precipitation (mm/year)	909	909	909	909	909	909	909
Run-on (mm/year)	-	-	-	-	-	-	-
Total Inputs (mm/year)	909	909	909	909	909	909	909
Outputs (per Unit Area)							
Precipitation Surplus (mm/year)	380	380	380	380	380	380	380
Evapotranspiration (mm/year)	529	529	529	529	529	529	529
Infiltration (mm/year)	180	180	180	265	278	215	227
Runoff Pervious Areas	201	201	201	-	-	-	71
Runoff Impervious Areas	-	-	-	116	102	166	82
Total Runoff (mm/year)	201	201	201	116	102	166	153
Total Outputs (mm/year)	909	909	909	909	909	909	909
Difference (Inputs - Outputs)	-	-	-	-	-	-	-
Inputs (Volume)							
Precipitation (m^3/year)	7,465	35,612	17,924	35,612	4,609	12,660	23,879
Run-on (m^3/year)	-	-	-	-	-	-	-
Total Inputs (m^3/year)	7,465	35,612	17,924	35,612	4,609	12,660	23,879
Outputs (Volume)							
Precipitation Surplus (m^3/year)	3,123	1,507	7,498	14,898	1,928	5,296	9,400
Evapotranspiration (m^3/year)	4,342	34,104	10,425	20,714	2,681	7,363	14,478
Infiltration (m^3/year)	1,474	711	3,539	10,360	1,411	2,988	5,988
Runoff Pervious Areas	1,649	796	3,959	-	-	-	1,052
Runoff Impervious Areas	-	-	-	4,538	517	2,308	2,360
Total Runoff (m^3/year)	1,649	796	3,959	4,538	517	2,308	3,412
Total Outputs (m^3/year)	7,465	35,612	17,924	35,612	4,609	12,660	23,879
Difference (Inputs - Outputs)	-	-	-	-	-	-	-

Notes:
1) *Total* column represents the sum of weighted averages for each area.
2) Area (m^2) Total is the sum of the pervious and the impervious area.

Table F5
1981 to 2010 Canadian Climate Normals Station Data - Days with Rainfall

	January	February	March	April	May	June	July	August	September	October	November	December	Annual
>=0.2 mm	4.4	3.9	6.7	10.9	13.4	13.2	11.9	11	12.3	13.7	11	6	118.4
>=5 mm	1.6	1.2	2.1	4	4.9	5.8	5.4	4.8	5.1	5	4.2	2.3	46.4
5 mm Rain Volume (mm)	14	13.5	23	34.5	42.5	37	32.5	31	36	43.5	34	18.5	360

Table F6
Water Balance (with 5 mm Retention Criteria)

Hydrologic Soil Group = D
Soil Moisture Content = 75 mm

Parameter	Variable	Equation	Unit	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Temperature (T)	T		C	-9	-7	-2	7	14	19	21	20	16	9	3	-5	7
Precipitation (P)	P		mm	14	14	23	35	43	37	33	31	36	44	34	19	360
Heat Index (I)	I	$I=\Sigma(T_i/5)^{1.514}$		0	0	0	2	5	8	9	8	6	3	0	0	40
Thornthwaite's Constant (α)	α	$\alpha= (492390 + (17920*I) - (771*I^2)+(0.675*I^3))+10^{-6}$		1	1	1	1	1	1	1	1	1	1	1	1	14
Unadjusted Potential Evapotranspiration (U)	U	$U = 16*(10*T/I)^{\alpha}$	mm	0	0	0	28	67	93	106	101	79	41	10	0	525
Adjustment Factor $_{45.25° Latitude}$		From lookup tables		1	1	1	1	1	1	1	1	1	1	1	1	12
Adjusted Potential Evapotranpiration (PET)	PET	PET = U*Adjustment Factor	mm	0	0	0	31	84	120	135	118	82	37	8	0	616
P-PET (= I + RO)	ΔP	ΔP=P-PET	mm	14	14	23	3	-41	-83	-103	-87	-46	6	26	19	-256
Accumulated Potential Water Loss (soil moisture deficit)	WL		mm					-41	-124	-227	-314	-361	-354			-1422
Storage	ST	From lookup tables	mm	108	121	144	75	73	57	33	20	-26	75	75	94	848
Change in Storage	ΔS	Storage=ΔSi-1		0	0	0	0	-2	-16	-24	-13	-46	101	0	0	
Actual Evapotranspiration	AET	Function of PET and ΔS		0	0	0	31	45	53	57	44	82	37	8	0	357
Soil Moisture Deficit	D	Function of PET and AET	mm	0	0	0	0	39	67	79	74	0	0	0	0	
Soil Moisture Surplus	S	Function of Soil Moisture Storage	mm	0	0	0	72	0	0	0	0	0	3	26	0	101
Water Runoff	RO	Function of Soil Moisture Surplus	mm	3	2	1	36	18	9	5	2	0	2	14	7	
Snow Melt Runoff	SMRO	Function of Total Annual Snow	mm	0	0	0	17	78	39	20	10	5	2	1	1	174
Total Runoff	TR	TR=RO+SMRO	mm	3	2	1	54	96	48	24	12	5	4	15	8	272
Total Moisture Detention	DT	DT=ST+TR		111	123	145	129	169	105	57	32	-21	79	90	101	

Table F7
Pre-Development Water Budget (with 5 mm Retention Criteria)

	Grass	Tree	Gravel	Total[1]
Area (m^2) [2]	27,078	13,368	49,700	90,146
Pervious Area (m^2)	27,078	13,368	49,700	90,146
Impervious Area (m^2)	-	-	-	-
Infiltration Factors				
Topographic Infiltration Factor	0.17	0.17	0.17	
Soil Infiltration Factor	0.10	0.10	0.40	
Land Cover Infiltration Factor	0.10	0.10	0.05	
Actual Infiltration Factor	0.37	0.37	0.62	
Run-off Coefficient	-	-	-	
Inputs (per Unit Area)				
Precipitation (mm/year)	360	360	360	360
Run-on (mm/year)	-	-	-	-
Total Inputs (mm/year)	360	360	360	360
Outputs (per Unit Area)				
Precipitation Surplus (mm/year)	272	272	272	272
Evapotranspiration (mm/year)	88	88	88	88
Infiltration (mm/year)	101	101	169	139
Runoff Pervious Areas	171	171	103	133
Runoff Impervious Areas	-	-	-	-
Total Runoff (mm/year)	171	171	103	133
Total Outputs (mm/year)	360	360	360	360
Difference (Inputs - Outputs)	-	-	-	-
Inputs (Volume)				
Precipitation (m^3/year)	9,748	4,812	17,892	13,506
Run-on (m^3/year)	-	-	-	-
Total Inputs (m^3/year)	9,748	4,812	17,892	13,506
Outputs (Volume)				
Precipitation Surplus (m^3/year)	7,358	3,633	13,506	10,195
Evapotranspiration (m^3/year)	2,390	1,180	4,386	3,311
Infiltration (m^3/year)	2,737	1,351	8,401	5,654
Runoff Pervious Areas	4,621	2,281	5,105	4,541
Runoff Impervious Areas	-	-	-	-
Total Runoff (m^3/year)	4,621	2,281	5,105	4,541
Total Outputs (m^3/year)	9,748	4,812	17,892	13,506
Difference (Inputs - Outputs)	-	-	-	-

Notes:
1) *Total* column represents the sum of weighted averages for each area.
2) Area (m^2) Total is the sum of the pervious and the impervious area.

Table F8
Post-Development Water Budget (with 5 mm Retention Criteria)

	Park	Backyard	SWM	ROW	Siteplan 1	Siteplan 2	Total[1]
Area (m^2) [2]	8,210	19,712	3,962	39,164	5,069	13,922	90,039
Pervious Area (m^2)	6,461	11,991	3,655	11,448	1,218	6,680	41,452
Impervious Area (m^2)	1,749	7,721	307	27,716	3,851	7,242	48,587
Infiltration Factors							
Topographic Infiltration Factor	0.17	0.17	0.17	-	-	-	
Soil Infiltration Factor	0.20	0.20	0.20	-	-	-	
Land Cover Infiltration Factor	0.20	0.20	0.20	-	-	-	
Actual Infiltration Factor	0.57	0.57	0.57	-	-	-	
Run-off Coefficient	0.35	0.47	0.25	0.70	0.73	0.56	
Inputs (per Unit Area)							
Precipitation (mm/year)	360	360	360	360	360	360	360
Run-on (mm/year)	-	-	-	-	-	-	-
Total Inputs (mm/year)	360	360	360	360	360	360	360
Outputs (per Unit Area)							
Precipitation Surplus (mm/year)	272	272	272	272	272	272	272
Evapotranspiration (mm/year)	88	88	88	88	88	88	88
Infiltration (mm/year)	155	155	155	189	199	153	172
Runoff Pervious Areas	116	116	116	-	-	-	41
Runoff Impervious Areas	-	-	-	83	73	118	58
Total Runoff (mm/year)	116	116	116	83	73	118	100
Total Outputs (mm/year)	360	360	360	360	360	360	360
Difference (Inputs - Outputs)	-	-	-	-	-	-	-
Inputs (Volume)							
Precipitation (m^3/year)	2,955	7,096	1,426	14,099	1,825	5,012	8,896
Run-on (m^3/year)	-	-	-	-	-	-	-
Total Inputs (m^3/year)	2,955	7,096	1,426	14,099	1,825	5,012	8,896
Outputs (Volume)							
Precipitation Surplus (m^3/year)	2,231	5,357	1,077	10,643	1,377	3,783	6,715
Evapotranspiration (m^3/year)	725	1,740	350	3,456	447	1,229	2,181
Infiltration (m^3/year)	1,276	3,064	616	7,401	1,008	2,134	4,420
Runoff Pervious Areas	955	2,293	461	-	-	-	609
Runoff Impervious Areas	-	-	-	3,242	369	1,649	1,686
Total Runoff (m^3/year)	955	2,293	461	3,242	369	1,649	2,295
Total Outputs (m^3/year)	2,955	7,096	1,426	14,099	1,825	5,012	8,896
Difference (Inputs - Outputs)	-	-	-	-	-	-	-

Notes:
1) *Total* column represents the sum of weighted averages for each area.
2) Area (m^2) Total is the sum of the pervious and the impervious area.

TABLE F9 - AVERAGE MONTHLY TEMPERATURES FOR OTTAWA, STATION CDA, 1998 - 2018

	Year	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mean Temp	1998	-7.45	-3.30	-0.49	8.87	17.51	19.33	20.86	20.57	16.01	10.00	3.63	-2.55
	1999	-10.02	-5.68	-2.43	7.09	16.37	20.96	22.76	19.51	17.57	8.08	5.05	-3.59
	2000	-9.61	-6.60	2.37	5.56	13.55	17.52	19.64	19.59	14.17	9.36	2.32	-10.21
	2001	-9.21	-8.65	-2.79	6.98	14.83	19.93	20.27	22.55	16.63	9.96	5.24	-0.69
	2002	-4.27	-5.92	-2.57	7.05	11.48	17.51	22.15	21.24	18.07	7.95	0.75	-5.40
	2003	-12.64	-11.17	-3.39	4.26	13.45	19.05	20.96	21.46	17.22	7.60	2.79	-4.39
	2004	-14.68	-7.26	0.45	6.33	13.47	17.64	20.82	18.94	16.65	9.17	2.35	-8.38
	2005	-11.54	-6.65	-3.27	7.34	11.74	21.43	22.61	21.68	17.70	10.08	2.75	-5.68
	2006	-4.63	-7.27	-0.88	7.71	14.74	19.39	22.43	19.56	14.50	7.63	4.46	-1.06
	2007	-7.47	-10.86	-2.66	6.13	13.88	19.53	19.91	20.17	16.89	11.33	1.16	-6.75
	2008	-5.81	-8.01	-4.96	8.25	12.07	19.39	20.44	19.01	15.38	7.92	1.54	-7.08
	2009	-13.83	-6.79	-0.86	7.42	12.72	18.01	19.35	20.11	15.06	6.94	4.58	-6.14
	2010	-6.87	-4.51	3.71	9.71	15.83	18.53	22.86	20.35	15.61	8.44	2.38	-5.33
	2011	-10.45	-7.60	-2.41	6.83	14.16	19.77	22.76	20.72	17.86	10.34	5.50	-3.00
	2012	-8.38	-4.60	3.81	6.79	16.26	19.82	23.13	21.55	15.69	10.55	0.88	-4.37
	2013	-8.74	-7.35	-1.55	5.86	14.93	18.04	21.79	20.04	14.59	10.38	0.36	-9.04
	2014	-10.87	-9.72	-6.59	5.38	14.60	19.55	19.95	19.17	15.82	10.34	1.36	-3.82
	2015	-12.76	-15.80	-4.71	6.52	16.35	17.77	21.55	20.33	18.52	8.01	4.95	1.85
	2016	-7.50	-7.77	-0.80	3.87	14.78	18.86	21.64	22.29	17.04	9.36	3.74	-4.67
	2017	-5.40	-4.78	-5.01	7.72	12.86	18.59	20.55	19.36	17.88	12.54	1.10	-7.75
	2018	-9.25	-4.78	-1.26	3.34	15.87	18.66	23.44	21.75	16.79	7.07	-0.96	-5.82
	Average	**-9.11**	**-7.38**	**-1.73**	**6.62**	**14.36**	**19.01**	**21.42**	**20.48**	**16.46**	**9.19**	**2.66**	**-4.95**

TABLE F10 - AVERAGE MONTHLY RAINFALL FOR OTTAWAm STATION CDA, 1998 - 2018

	Year	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Total Raifall	1998	64	15.9	76.2	42.4	34.2	139.1	60.6	57.5	84.2	59.2	49.4	47.1
	1999	42.2	18.4	11.9	20.5	39.5	48.7	123.3	35.3	136.5	61.6	76.5	48.6
	2000	28.1	5	52.5	72.8	115.7	171.3	69.3	103.7	85.1	30	71.3	19
	2001	0	26.7	10.3	11.6	95.6	78	40.8	37.7	88.1	103	76.7	52.1
	2002	6.4	16.6	31.2	62.8	105.8	188.8	49.2	43.2	54.7	87.1	28.7	9.9
	2003	0.5	13.9	40.4	35.5	152.9	52.6	113.9	97.2	74	145.4	95.1	89.4
	2004	2.6	0	57.4	67.3	98.2	75.2	65.9	84.1	137.7	71.7	79.8	45.7
	2005	16.9	8.4	9	134.8	38.7	107.2	94.8	75.1	101.9	89.3	91	34.3
	2006	55.9	30	27.3	63.4	107	113.8	107	96.5	156.2	126.7	97.9	60.9
	2007	27.4	0	32.3	84.4	53.8	48.3	168.6	81.7	35.9	103.4	34	31.6
	2008	38.7	14.2	53.3	64.3	82.6	126.3	82.1	68.7	89	83.6	49.2	24.2
	2009	0	35.7	38.1	77.5	82.9	64.4	205.6	84.5	55.6	103.3	41.7	45.1
	2010	44.5	7.5	35	55	44.6	101.5	51.2	187.5	152.7	71.8	89.7	42.2
	2011	4.2	11.7	65.9	135.5	107.2	77.9	57.9	77.2	42.5	87.2	49.9	43.1
	2012	28.7	3	37.8	51.1	82.7	68.9	16.6	95	143.3	57	16.9	54.2
	2013	35.8	6.4	6.6	61.3	77.7	158.5	57.6	74.9	78.3	86.2	30.1	8.2
	2014	17.5	26.5	16.2	98.3	75.1	156.2	85.6	104.3	97.1	64.8	27.8	22.5
	2015	10.7	0	8.1	57.9	65	108	63.1	76.5	96.6	84	32.4	61.5
	2016	28.4	41.4	78.5	20.8	26.4	56.6	100.8	122.4	76.6	91.2	47.3	15
	2017	29.3	34	37	159	172.4	156.8	169.6	82.4	51.6	142.4	75.8	4.6
	2018	18.2	23.2	18	50.4	44.2	72	154.8	68.4	77.2	38.4	48.2	51.6
	Average	**23.81**	**16.12**	**35.38**	**67.93**	**81.06**	**103.34**	**92.30**	**83.51**	**91.18**	**85.11**	**57.59**	**38.61**

TABLE F11 - AVERAGE MONTHLY SNOWFALL FOR OTTAWA, STATION CDA, 1998 - 2018

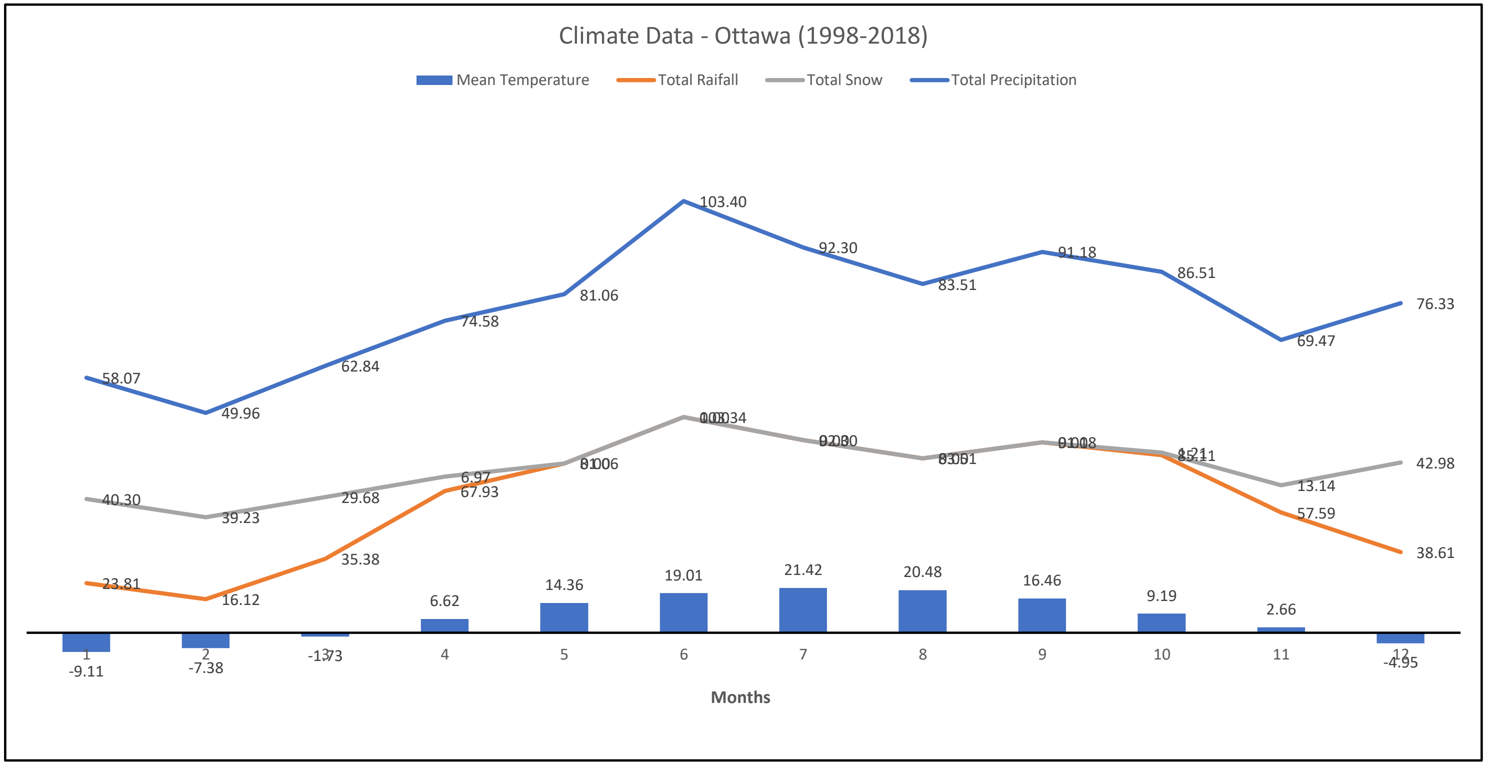
	Year	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Total Snow	1998	54.3	6.6	52.5	0	0	0	0	0	0	0	0.2	17.2
	1999	58.5	19.3	70.3	0	0	0	0	0	0	0	1.2	22.4
	2000	23.3	53.8	14.5	22.8	0	0	0	0	0	0	4.5	81.2
	2001	52.8	39.1	29.3	1.1	0	0	0	0	0	0	5	28.9
	2002	32.4	27	41.8	19.5	0	0	0	0	0	0	44.1	17.5
	2003	33.1	38.5	42.9	13.4	0	0	0	0	0	0	12.9	23.3
	2004	40	30.8	15	9	0	0	0	0	0	0	6.4	48.7
	2005	29.3	29.5	19	4	0	0	0	0	0	0	12.5	47
	2006	55.9	25.5	0.5	1.8	0	0	0	0	0	0	0	25.7
	2007	25.2	21.5	26.6	19.7	0	0	0	0	0	0	36.1	93.7
	2008	33.7	92.4	97.4	5.2	0	0	0	0	0	0	25.1	69
	2009	76.8	14.2	2.7	1.4	0	0	0	0	0	0	1.3	44.7
	2010	24.2	46.1	0	5.4	0	0	0	0	0	6.5	2.2	16.7
	2011	32.5	36	31	3.1	0	0	0	0	0	0	6.8	27.9
	2012	40.4	22.7	5.9	4.2	0	0	0	0	0	0	3	88.4
	2013	36.3	73	27.8	6.5	0	0	0	0	0	0	27	58.2
	2014	29.8	39.2	44.4	0	0	0	0	0	0	0	10.7	21.3
	2015	45.7	54	18.7	4	0	0	0	0	0	0	1	31.3
	2016	30.8	61.1	19.5	25.2	0	0	0	0	0	8	14.4	75.6
	2017	36.4	64.6	35.4	0	0	0	0	0	0	0	14.4	38.8
	2018	55	29	28	0	0	0	0	0	0	11	47.2	25
	Average	**40.30**	**39.23**	**29.68**	**6.97**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.21**	**13.14**	**42.98**

TABLE F12 - AVERAGE MONTHLY TOTAL PRECEIPATION FOR OTTAWA STATION CDA, 1998 - 2018

	Year	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Total Precip	1998	117.7	22.5	112.1	42.4	34.2	139.1	60.6	57.5	84.2	59.2	49.6	62.5
	1999	97.2	37.7	85.4	20.5	39.5	48.7	123.3	35.3	136.5	61.6	77.7	67.1
	2000	48.5	40.7	67.5	96.8	115.7	171.3	69.3	103.7	85.1	30	75.9	80.5
	2001	35.3	58.6	41.1	12.7	95.6	78	40.8	37.7	88.1	103	81.7	81
	2002	38.8	43.6	73	82.3	105.8	190	49.2	43.2	54.7	87.1	72.8	27.4
	2003	33.6	52.4	83.3	45.3	152.9	52.6	113.9	97.2	74	145.4	105.2	112.7
	2004	30.7	28.2	72	76.3	98.2	75.2	65.9	84.1	137.7	71.7	86.2	92.5
	2005	43.1	37.9	28	138.8	38.7	107.2	94.8	75.1	101.9	89.3	103.5	81.3
	2006	111.8	55.5	27.8	65.2	107	113.8	107	96.5	156.2	126.7	97.9	86.6
	2007	50.4	15.7	57.3	103.7	53.8	48.3	168.6	81.7	35.9	103.4	68.7	113.5
	2008	68.7	84.6	141.3	69.5	82.6	126.3	82.1	68.7	89	83.6	74.1	87.1
	2009	53.8	49.9	40.7	78.9	82.9	64.4	205.6	84.5	55.6	103.3	43	83.9
	2010	59.4	56.7	35	60.4	44.6	101.5	51.2	187.5	152.7	78.3	91.6	51.3
	2011	29	40.6	96.9	138.6	107.2	77.9	57.9	77.2	42.5	87.2	56.7	66.5
	2012	64.1	21.1	43.1	55.3	82.7	68.9	16.6	95	143.3	57	19.1	141.1
	2013	67.2	77.5	32.3	67.8	77.7	158.5	57.6	74.9	78.3	86.2	50.8	52.6
	2014	34.2	53.3	54.9	98.3	75.1	156.2	85.6	104.3	97.1	64.8	37.2	42.1
	2015	47.6	33.8	24.5	61.5	65	108	63.1	76.5	96.6	84	33	92.1
	2016	52.2	98.4	98	42.4	26.4	56.6	100.8	122.4	76.6	99.2	60.9	75.4
	2017	64.9	88.8	61.8	159	172.4	156.8	169.6	82.4	51.6	142.4	86.4	32.4
	2018	71.2	51.6	43.6	50.4	44.2	72	154.8	68.4	77.2	53.4	86.8	73.4
	Average	**58.07**	**49.96**	**62.84**	**74.58**	**81.06**	**103.40**	**92.30**	**83.51**	**91.18**	**86.51**	**69.47**	**76.33**

TABLE F13 - AVERAGE MONTHLY TOTAL PRECEIPATION, SNOWFALL, PRECIPATION FOR OTTAWA STATION CDA, 1998 - 2018

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mean Temperature	-9.11	-7.38	-1.73	6.62	14.36	19.01	21.42	20.48	16.46	9.19	2.66	-4.95
Total Raifall	23.81	16.12	35.38	67.93	81.06	103.34	92.30	83.51	91.18	85.11	57.59	38.61
Total Snow	40.30	39.23	29.68	6.97	0.00	0.00	0.00	0.00	0.00	1.21	13.14	42.98
Total Precipitation	58.07	49.96	62.84	74.58	81.06	103.40	92.30	83.51	91.18	86.51	69.47	76.33



Appendix G – PCSWMM Information

258780-Prop_Rev8 (100-year)

PCSWMM Report

Rev8_Results_100yr

Model 258780-Prop_Rev8.inp

exp Services Inc.

October 14, 2022

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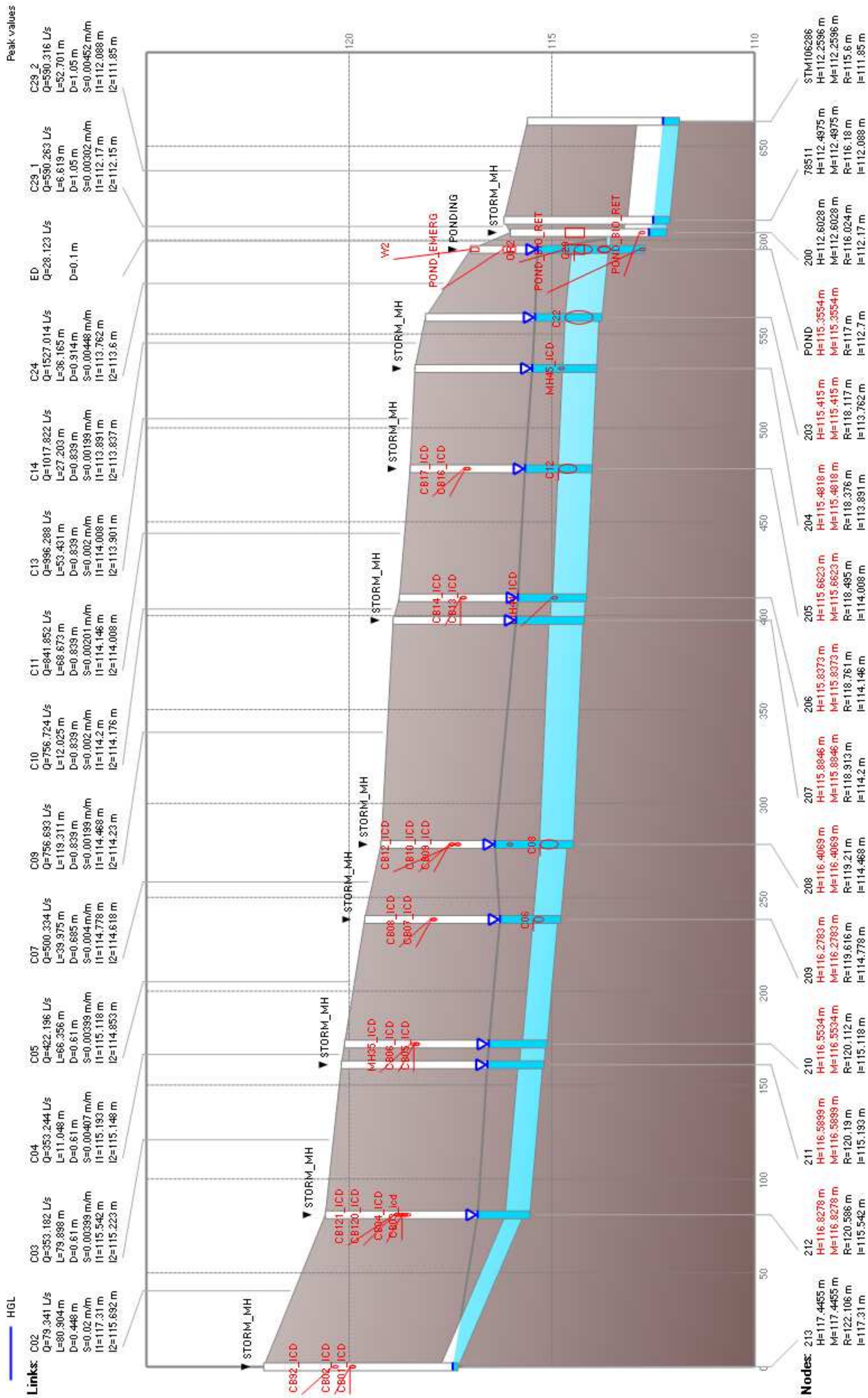

Figure 1: Node 213 to Node STM106286

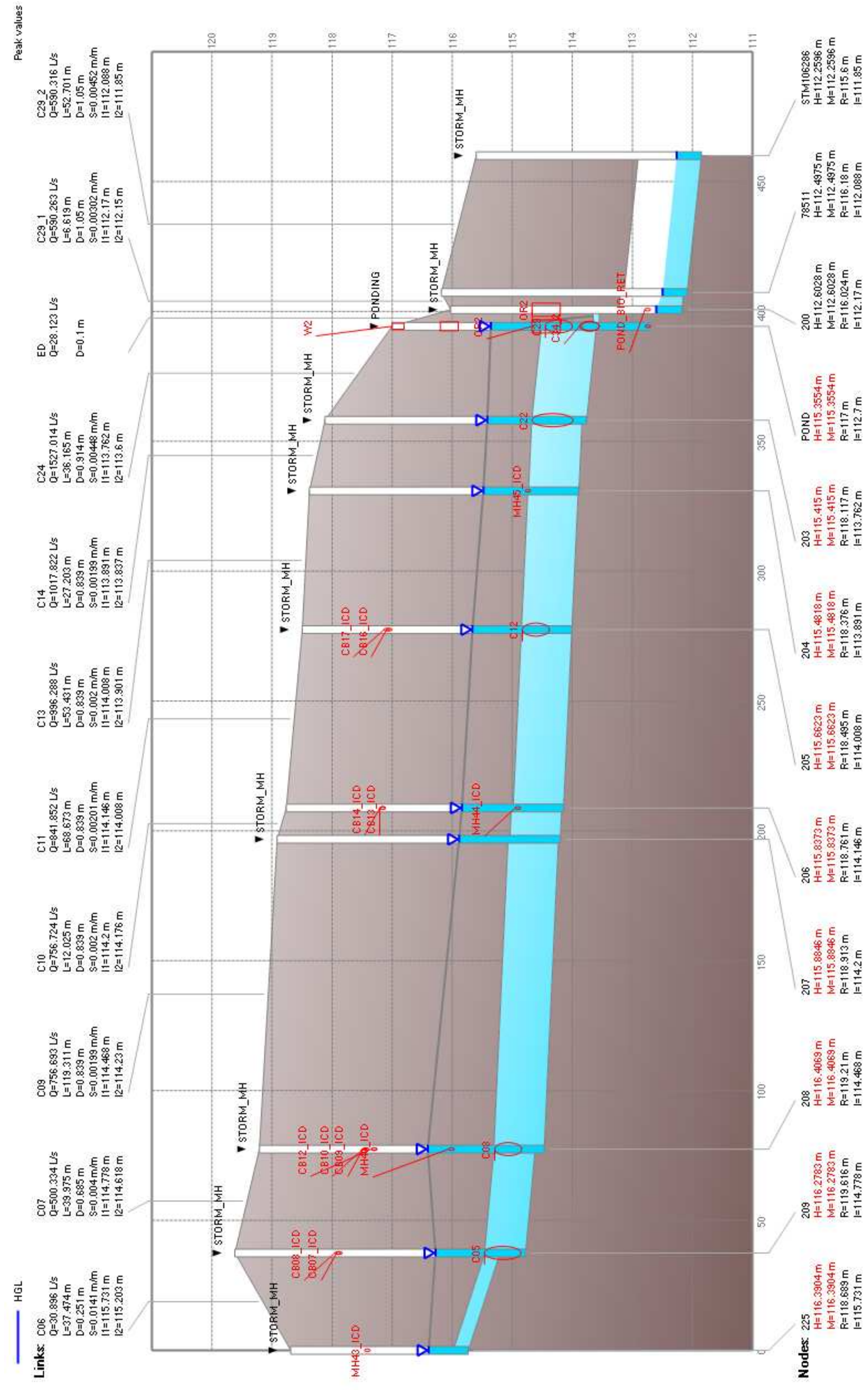

Figure 2: Node 225 to Node STM106286

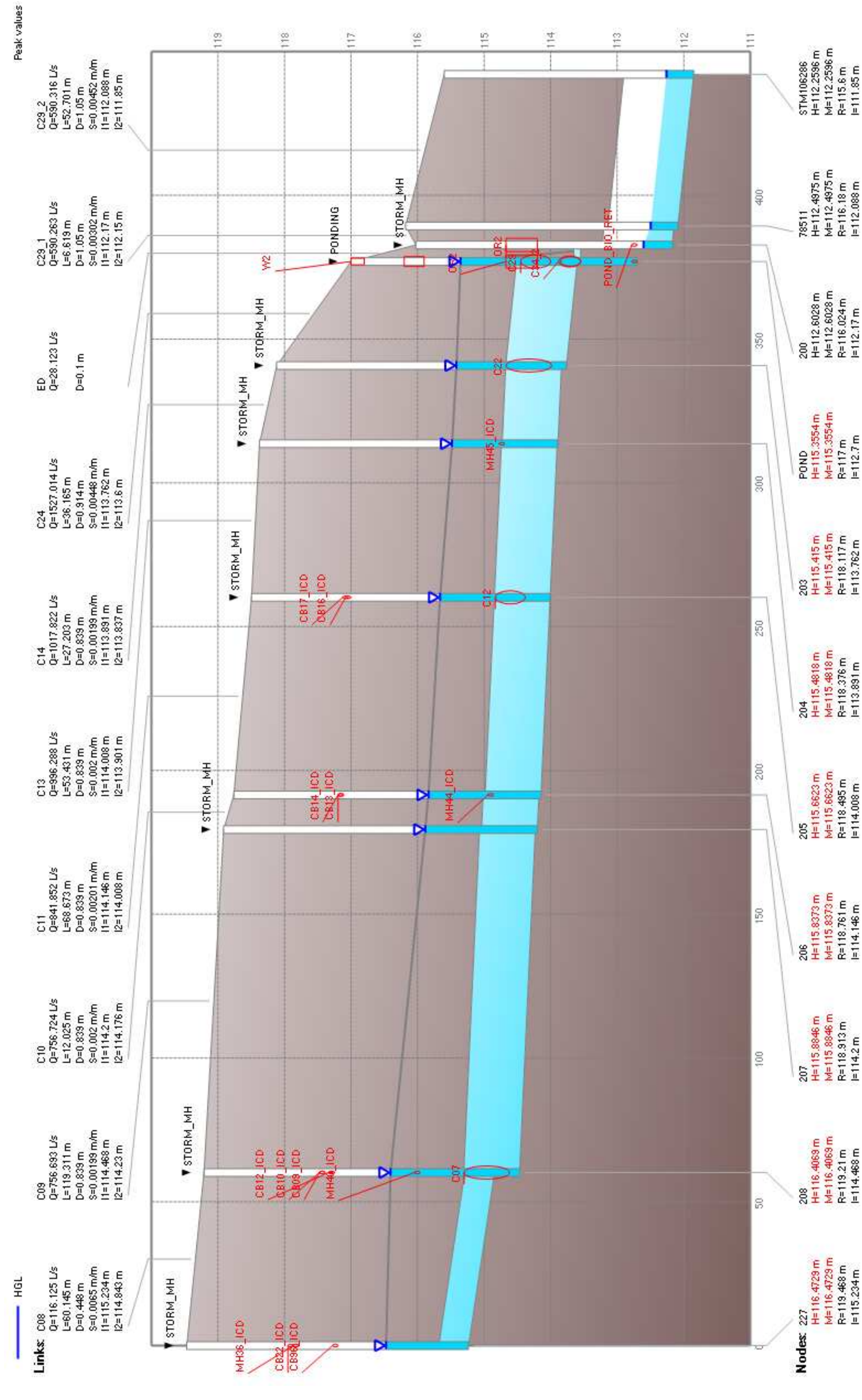

Figure 3: Node 227 to Node STM106286

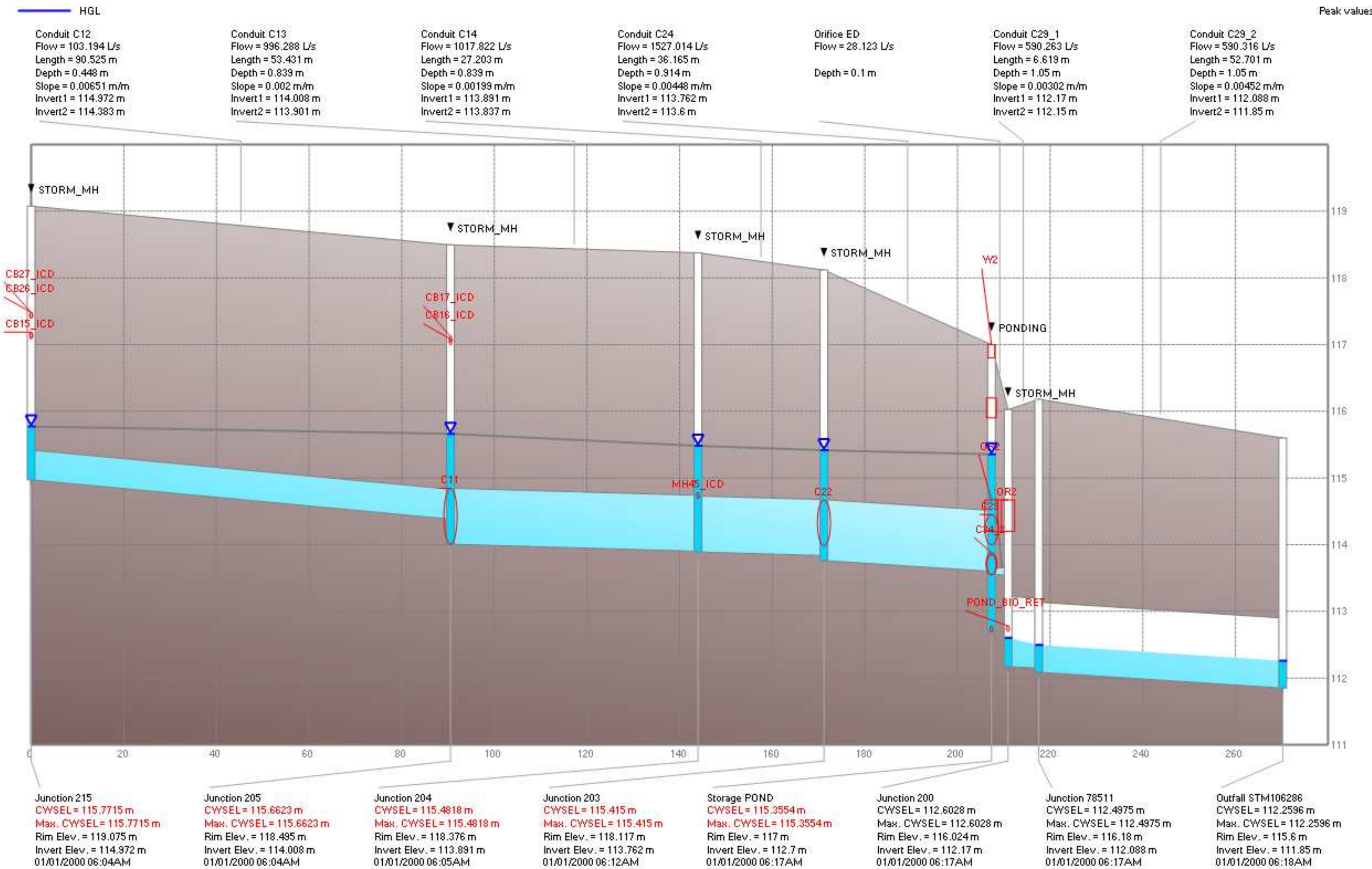

Figure 4: Node 215 to Node STM106286

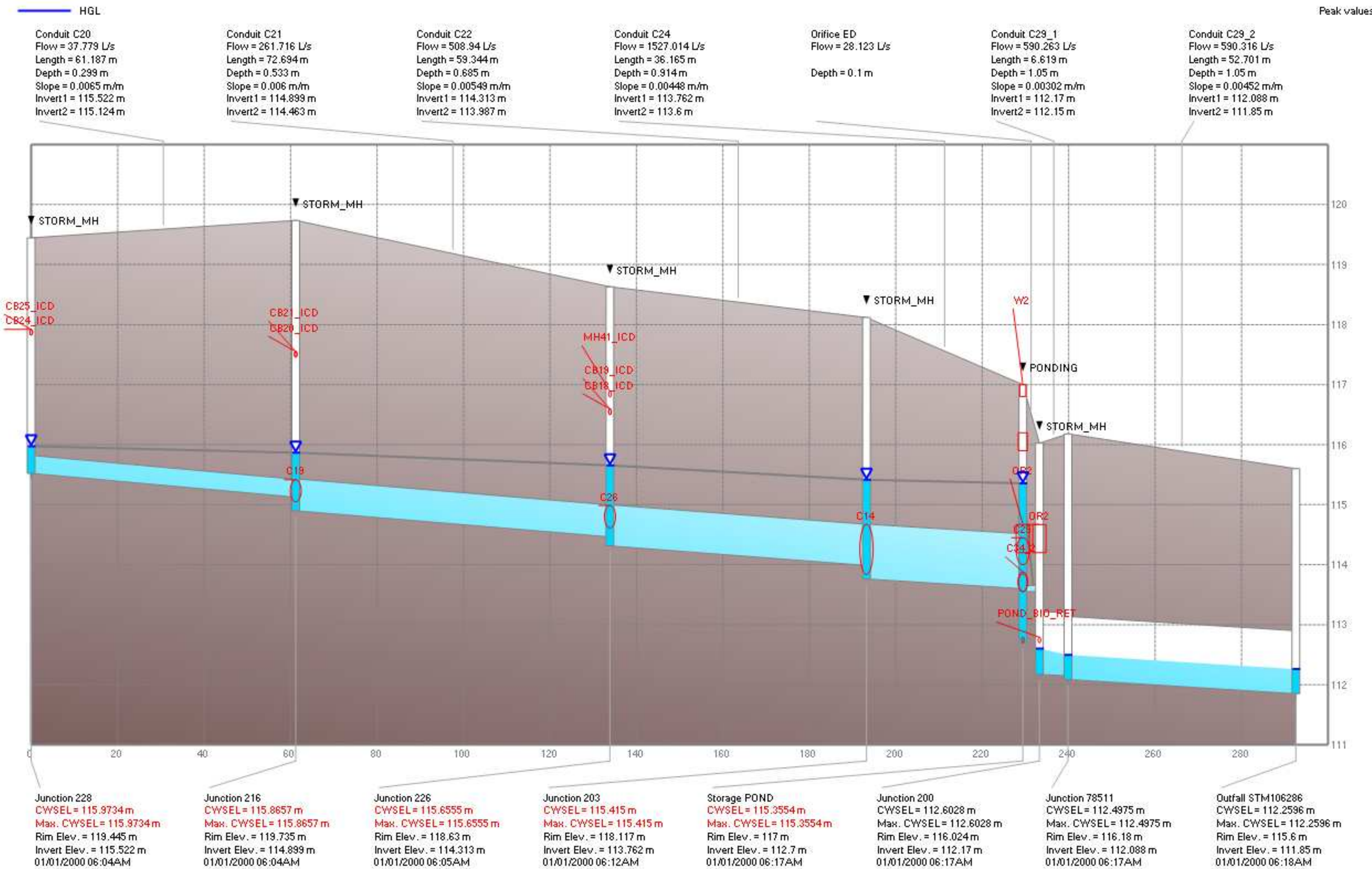

Figure 5: Node 228 to Node STM106286

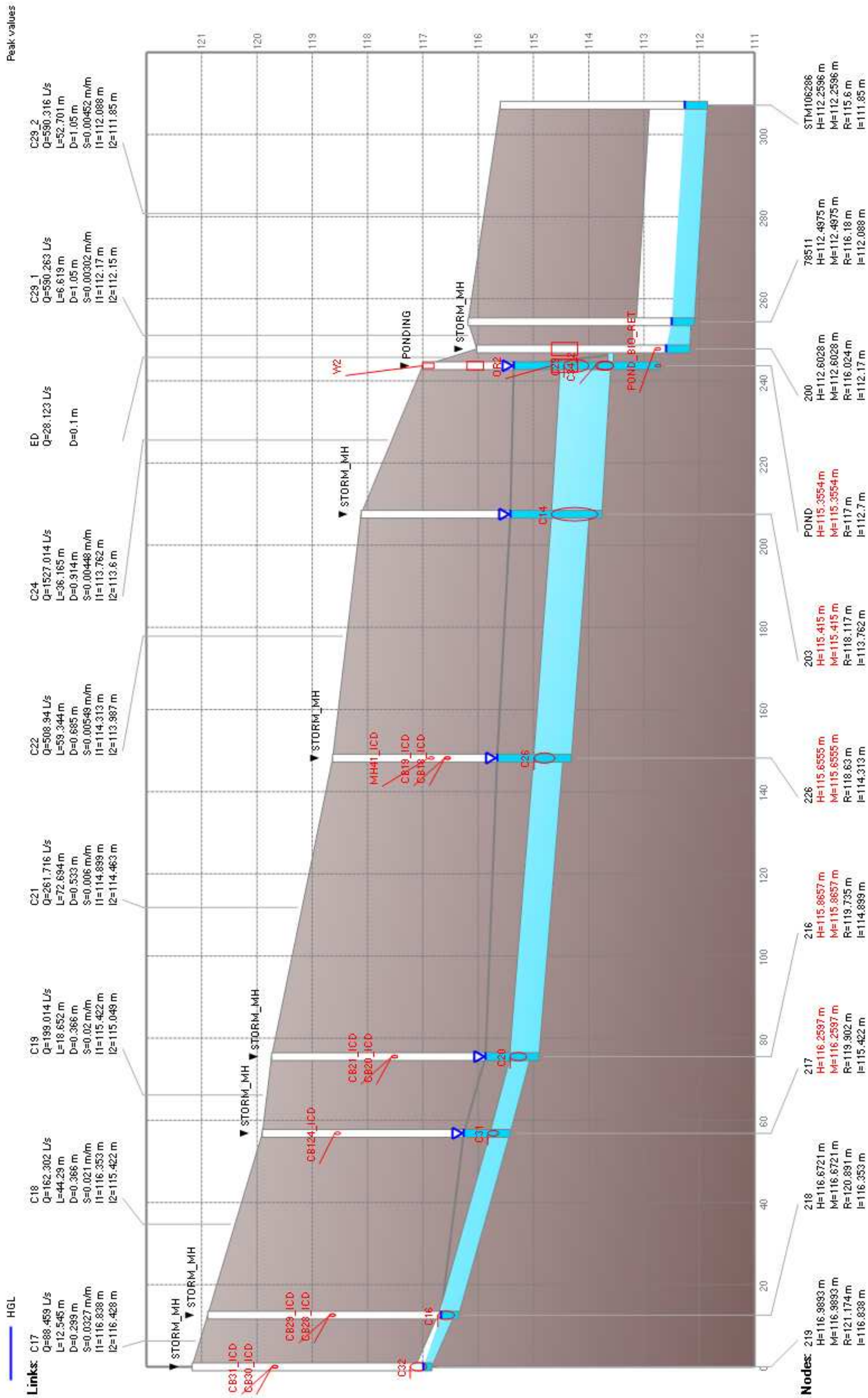

Figure 6: Node 219 to Node STM106286

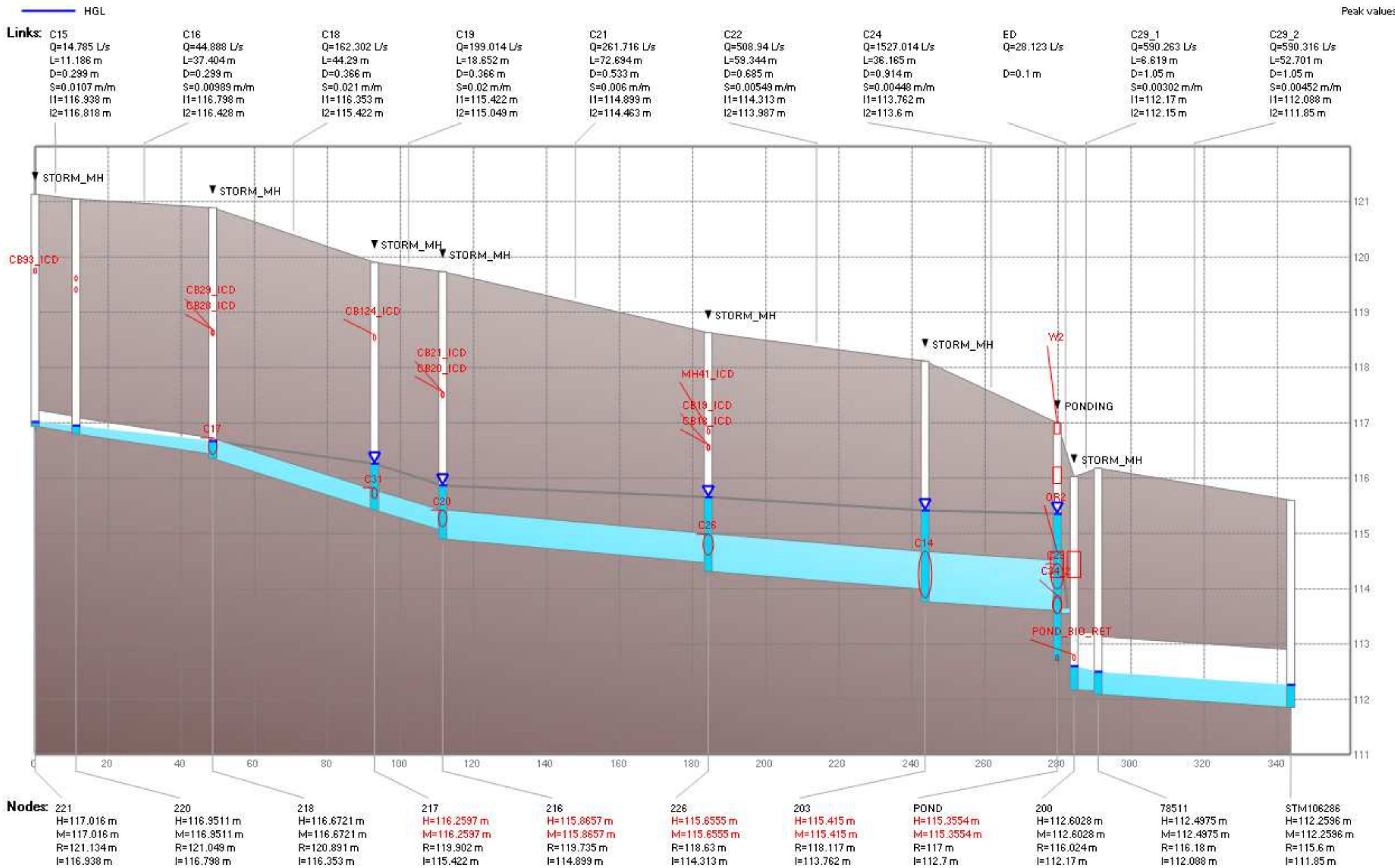

Figure 7: Node 221 to Node STM106286

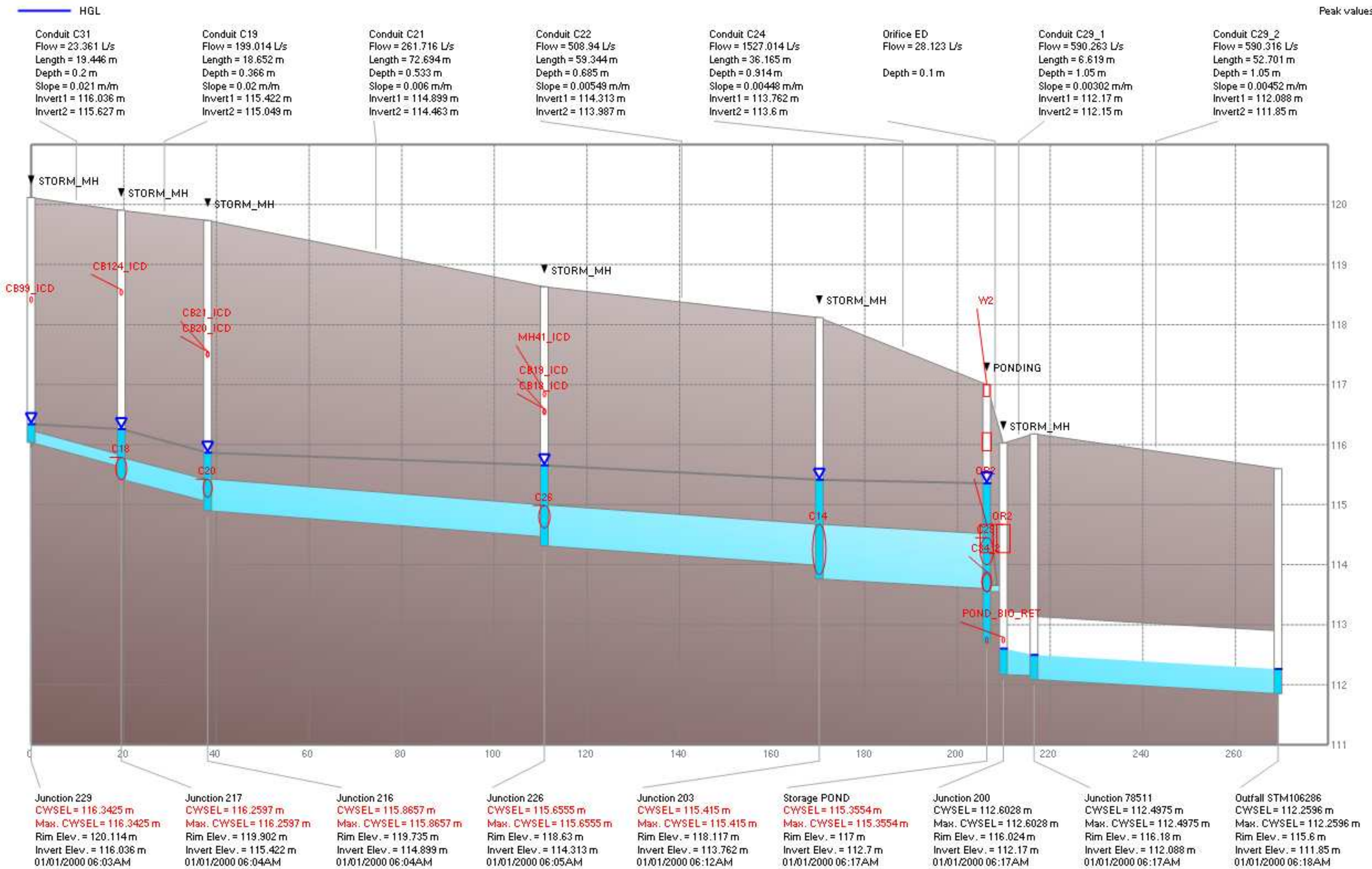

Figure 8: Node 229 to Node STM106286

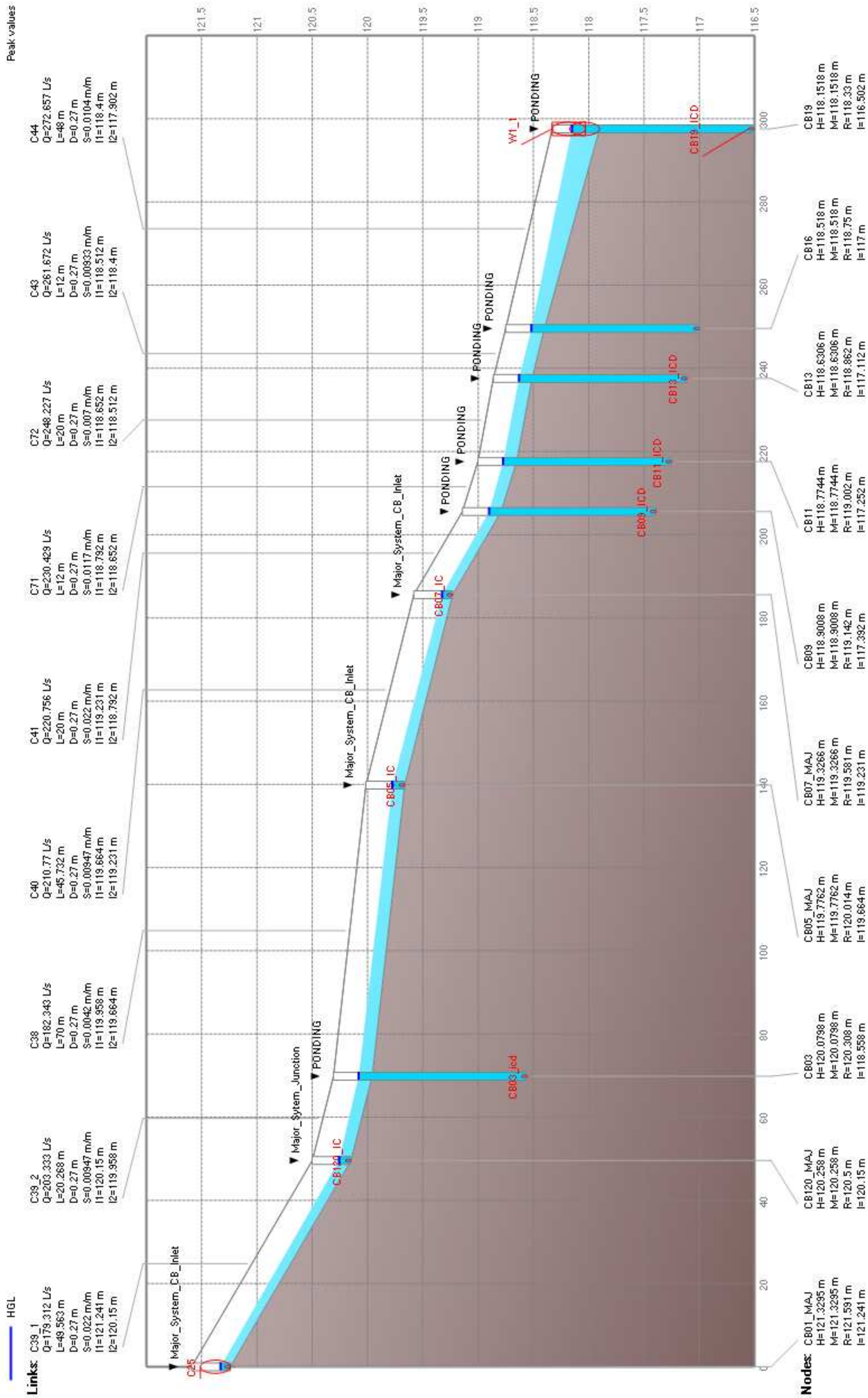

Figure 9: Node CB01_MAJ to Node CB19 (Street2 - Outet EP)

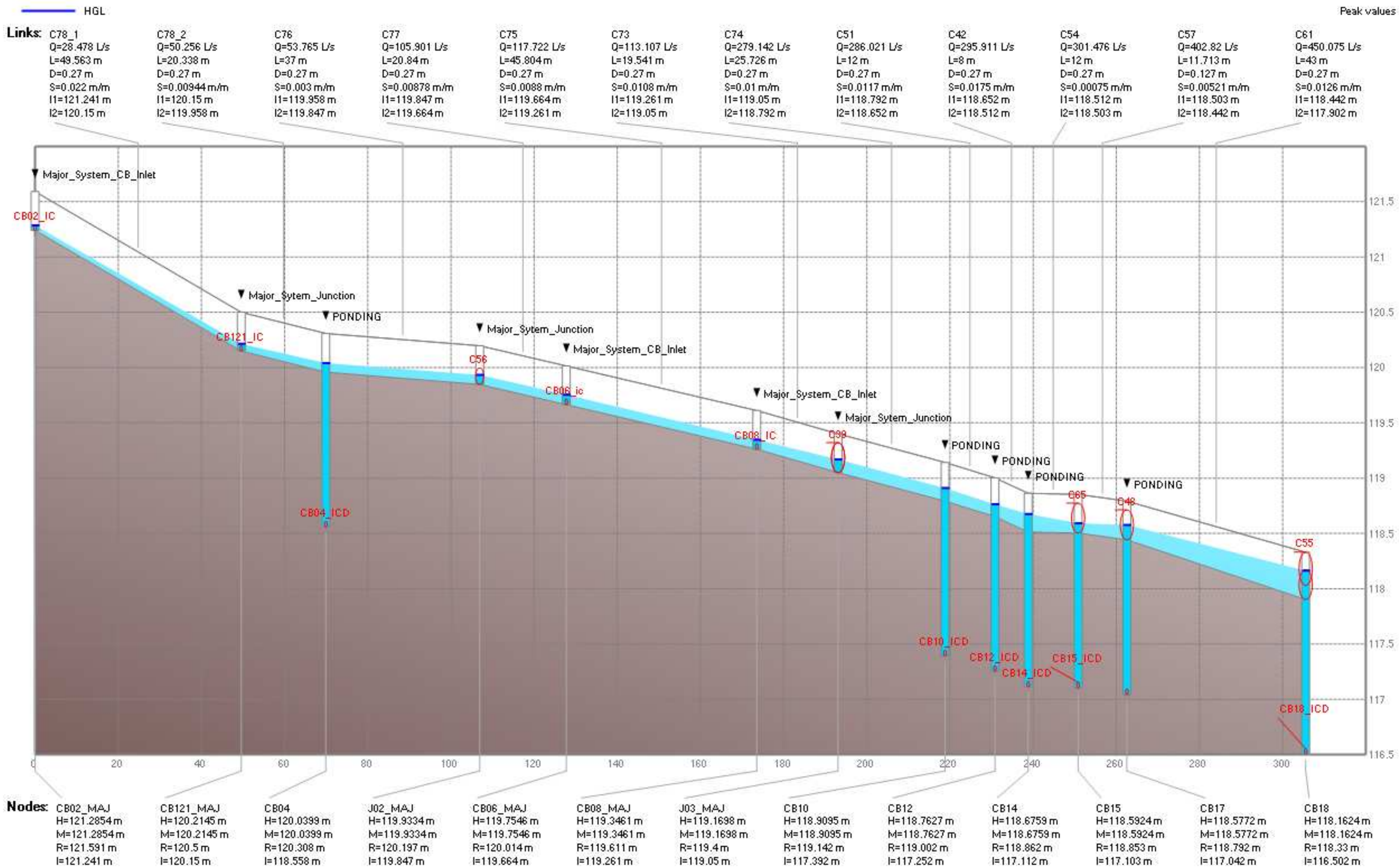

Figure 10: Node CB02_MAJ to Node CB18 (Street2 - Inner EP)

Table 1: Storages

Name	LOCATION	TYPE	Tag	Rim Elev. (m)	Invert Elev. (m)	Storage Curve	Curve Name	DEPTH_INV
223	ROADWAY	MANHOLE	CLOSED-LID	119.02	114.817	TABULAR	MH223_NO_PONDING	VARIES
231	REARYARD	MANHOLE	FLOW_BY	118.34	116.98	TABULAR	MH231_NO_PONDING	VARIES
CB01	ROADWAY	CATCHBASIN	FLOW_BY	121.591	119.841	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB02	ROADWAY	CATCHBASIN	FLOW_BY	121.591	119.841	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB03	ROADWAY	CATCHBASIN	PONDING	120.308	118.558	TABULAR	SP-01B	1.4m_TO_INV
CB04	ROADWAY	CATCHBASIN	PONDING	120.308	118.558	TABULAR	SP-01A	1.4m_TO_INV
CB05	ROADWAY	CATCHBASIN	FLOW_BY	120.014	118.264	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB06	ROADWAY	CATCHBASIN	FLOW_BY	120.014	118.264	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB07	ROADWAY	CATCHBASIN	FLOW_BY	119.581	117.831	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB08	ROADWAY	CATCHBASIN	FLOW_BY	119.611	117.861	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB09	ROADWAY	CATCHBASIN	PONDING	119.142	117.392	TABULAR	SP-03B	1.4m_TO_INV
CB10	ROADWAY	CATCHBASIN	PONDING	119.142	117.392	TABULAR	SP-03A	1.4m_TO_INV
CB100	REARYARD	CATCHBASIN	FLOW_BY	117.11	115.41	TABULAR	CB100_NO_PONDING	VARIES
CB11	ROADWAY	CATCHBASIN	PONDING	119.002	117.252	TABULAR	SP-04B	1.4m_TO_INV
CB12	ROADWAY	CATCHBASIN	PONDING	119.002	117.252	TABULAR	SP-04A	1.4m_TO_INV
CB120	ROADWAY	CATCHBASIN	FLOW_BY	120.5	118.75	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB121	ROADWAY	CATCHBASIN	FLOW_BY	120.5	118.75	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB122	REARYARD	CATCHBASIN	FLOW_BY	120.282	118.582	TABULAR	CB122_NO_PONDING	VARIES
CB123	ROADWAY	CATCHBASIN	FLOW_BY	121.312	119.562	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB124	ROADWAY	CATCHBASIN	FLOW_BY	120.241	118.491	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB13	ROADWAY	CATCHBASIN	PONDING	118.862	117.112	TABULAR	SP-05B	1.4m_TO_INV
CB14	ROADWAY	CATCHBASIN	PONDING	118.862	117.112	TABULAR	SP-05A	1.4m_TO_INV
CB15	ROADWAY	CATCHBASIN	PONDING	118.853	117.103	TABULAR	SP-06A	1.4m_TO_INV
CB16	ROADWAY	CATCHBASIN	PONDING	118.75	117	TABULAR	SP-06C	1.4m_TO_INV
CB17	ROADWAY	CATCHBASIN	PONDING	118.792	117.042	TABULAR	SP-06B	1.4m_TO_INV
CB18	ROADWAY	CATCHBASIN	PONDING	118.252	116.502	TABULAR	SP-08A	1.4m_TO_INV
CB19	ROADWAY	CATCHBASIN	PONDING	118.252	116.502	TABULAR	SP-07B	1.4m_TO_INV

Table 1: Storages (continued...)

Name	LOCATION	TYPE	Tag	Rim Elev. (m)	Invert Elev. (m)	Storage Curve	Curve Name	DEPTH_INV
CB20	ROADWAY	CATCHBASIN	FLOW_BY	119.209	117.459	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB21	ROADWAY	CATCHBASIN	FLOW_BY	119.209	117.459	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB22	ROADWAY	CATCHBASIN	FLOW_BY	119.615	117.865	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB24	ROADWAY	CATCHBASIN	PONDING	119.577	117.827	TABULAR	SP-08B	1.4m_TO_INV
CB25	ROADWAY	CATCHBASIN	PONDING	119.577	117.827	TABULAR	SP-08A	1.4m_TO_INV
CB26	ROADWAY	CATCHBASIN	FLOW_BY	119.15	117.4	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB27	ROADWAY	CATCHBASIN	FLOW_BY	119.149	117.399	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB28	ROADWAY	CATCHBASIN	FLOW_BY	120.335	118.585	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB29	ROADWAY	CATCHBASIN	FLOW_BY	120.331	118.581	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB30	ROADWAY	CATCHBASIN	FLOW_BY	121.377	119.627	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB31	ROADWAY	CATCHBASIN	FLOW_BY	121.37	119.62	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB32	ROADWAY	CATCHBASIN	FLOW_BY	121.109	119.359	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB33	ROADWAY	CATCHBASIN	FLOW_BY	119.551	117.801	TABULAR	CB_NO_PONDING_1.4m	1.4m_TO_INV
CB36	REARYARD	CATCHBASIN	FLOW_BY	119.729	117.87	TABULAR	CB36_NO_PONDING	VARIES
CB43	REARYARD	CATCHBASIN	FLOW_BY	119.171	117.371	TABULAR	CB43_NO_PONDING	VARIES
CB51	REARYARD	CATCHBASIN	FLOW_BY	120.476	119.004	TABULAR	CB51_NO_PONDING	VARIES
CB57	REARYARD	CATCHBASIN	FLOW_BY	116.47	114.98	TABULAR	CB57_NO_PONDING	VARIES
CB58	REARYARD	CATCHBASIN	FLOW_BY	118.98	117.173	TABULAR	CB58_NO_PONDING	VARIES
CB60	REARYARD	CATCHBASIN	FLOW_BY	119.09	117.456	TABULAR	CB60_NO_PONDING	VARIES
CB64	ROADWAY	CATCHBASIN	PONDING	121.551	119.801	TABULAR	SP-09	1.4m_TO_INV
CB65	ROADWAY	CATCHBASIN	PONDING	121.65	119.41	TABULAR	SP-10	1.4m_TO_INV
CB77	REARYARD	CATCHBASIN	FLOW_BY	120.64	118.849	TABULAR	CB77_NO_PONDING	VARIES
CB79	REARYARD	CATCHBASIN	FLOW_BY	120.548	119.055	TABULAR	CB79_NO_PONDING	VARIES
CB83	REARYARD	CATCHBASIN	FLOW_BY	117.947	116.327	TABULAR	CB83_NO_PONDING	VARIES
CB87	REARYARD	CATCHBASIN	FLOW_BY	116.552	115.12	TABULAR	CB87_NO_PONDING	VARIES
CB92	REARYARD	CATCHBASIN	FLOW_BY	122.764	120.264	TABULAR	CB92_NO_PONDING	VARIES
CB93	REARYARD	CATCHBASIN	FLOW_BY	121.4	119.7	TABULAR	CB93_NO_PONDING	VARIES

Table 1: Storages (continued...)

Name	LOCATION	TYPE	Tag	Rim Elev. (m)	Invert Elev. (m)	Storage Curve	Curve Name	DEPTH_INV
CB96	REARYARD	CATCHBASIN	FLOW_BY	119.895	117.195	TABULAR	CB96_NO_PONDING	VARIES
CB97	REARYARD	CATCHBASIN	FLOW_BY	116.355	114.73	TABULAR	CB97_NO_PONDING	VARIES
CB98	REARYARD	CATCHBASIN	FLOW_BY	117.11	115.44	TABULAR	CB98_NO_PONDING	VARIES
CB99	ROADWAY	CATCHBASIN	PONDING	120.59	118.37	TABULAR	SP-11_NO_PONDING	1.4m_TO_INV
MH35	ROADWAY	MANHOLE	CLOSED-LID	120.197	118.347	TABULAR	MH35_NO_PONDING	VARIES
MH36	ROADWAY	MANHOLE	CLOSED-LID	119.63	117.78	TABULAR	MH36_NO_PONDING	VARIES
MH37	ROADWAY	MANHOLE	CLOSED-LID	120.326	118.476	TABULAR	MH37_NO_PONDING	VARIES
MH38	ROADWAY	MANHOLE	CLOSED-LID	120.482	118.63	TABULAR	MH38_NO_PONDING	VARIES
MH39	ROADWAY	MANHOLE	CLOSED-LID	120.532	118.682	TABULAR	MH39_NO_PONDING	VARIES
MH40	ROADWAY	MANHOLE	CLOSED-LID	119.213	115.963	TABULAR	MH40_NO_PONDING	VARIES
MH41	ROADWAY	MANHOLE	CLOSED-LID	118.646	116.796	TABULAR	MH41_NO_PONDING	VARIES
MH42	ROADWAY	MANHOLE	CLOSED-LID	118.94	117.09	TABULAR	MH42_NO_PONDING	VARIES
MH43	ROADWAY	MANHOLE	CLOSED-LID	119.116	117.366	TABULAR	MH43_NO_PONDING	VARIES
MH44	ROADWAY	MANHOLE	CLOSED-LID	119.109	114.859	TABULAR	MH44_NO_PONDING	VARIES
MH45	ROADWAY	MANHOLE	CLOSED-LID	118.49	114.694	TABULAR	MH45_NO_PONDING	VARIES
POND	POND	SWM_POND	PONDING	117	112.7	TABULAR	DRY_POND_REV8-B	3.3m_TO_INV
ROOF_4_STOREY_BLDG_A	ROOF	ROOF_PONDING	ROOF_STORAGE	125.15	124.85	TABULAR	ROOF_4-STOREY_BLDGS_A-E	0.15m_TO_INV
ROOF_4_STOREY_BLDG_B	ROOF	ROOF_PONDING	ROOF_STORAGE	125.15	124.85	TABULAR	ROOF_4-STOREY_BLDGS_A-E	0.15m_TO_INV
ROOF_4_STOREY_BLDG_C	ROOF	ROOF_PONDING	ROOF_STORAGE	125.15	124.85	TABULAR	ROOF_4-STOREY_BLDGS_A-E	0.15m_TO_INV
ROOF_4_STOREY_BLDG_D	ROOF	ROOF_PONDING	ROOF_STORAGE	125.15	124.85	TABULAR	ROOF_4-STOREY_BLDGS_A-E	0.15m_TO_INV
ROOF_4_STOREY_BLDG_E	ROOF	ROOF_PONDING	ROOF_STORAGE	125.15	124.85	TABULAR	ROOF_4-STOREY_BLDGS_A-E	0.15m_TO_INV
ROOF_9_STOREY	ROOF	ROOF_PONDING	ROOF_STORAGE	125.15	124.85	TABULAR	ROOF_9_STOREY	0.15m_TO_INV

Table 2A: Subcatchments

Name	Tag	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Zero Imperv (%)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)
EXT_1	WDT	CB92	0.4761	200.078	23.796	5.136	39.334	0.013	0.25	1.57	4.67	10	76.2	13.2
EXT_2	WDT	CB77	0.7228	141.205	51.188	7.31	24.199	0.013	0.25	1.57	4.67	10	76.2	13.2
EXT_3	WDT	CB79	0.2763	81.981	33.703	7.31	34.188	0.013	0.25	1.57	4.67	10	76.2	13.2
S02	PROPOSED	CB01_MAJ	0.1522	68.259	22.297	4	74.943	0.013	0.25	1.57	4.67	20	76.2	13.2
S03	PROPOSED	CB02_MAJ	0.1038	57.89	17.931	4	75.311	0.013	0.25	1.57	4.67	20	76.2	13.2
S04	PROPOSED	CB120_MAJ	0.1355	127.258	10.648	2.7	75.097	0.013	0.25	1.57	4.67	20	76.2	13.2
S05	PROPOSED	CB121_MAJ	0.1095	136.874	8	4	71.528	0.013	0.25	1.57	4.67	20	76.2	13.2
S06	PROPOSED	CB05_MAJ	0.1707	109.154	15.638	4	65.282	0.013	0.25	1.57	4.67	20	76.2	13.2
S07	PROPOSED	CB06_MAJ	0.0901	66.938	13.46	4	63.192	0.013	0.25	1.57	4.67	20	76.2	13.2
S08	PROPOSED	OF_Samantha	0.0683	71.083	9.608	4	56.822	0.013	0.25	1.57	4.67	20	76.2	13.2
S09	PROPOSED	CB07_MAJ	0.0752	55.79	13.479	4	75.843	0.013	0.25	1.57	4.67	20	76.2	13.2
S10	PROPOSED	CB08_MAJ	0.096	53.776	17.852	4	69.279	0.013	0.25	1.57	4.67	20	76.2	13.2
S11	PROPOSED	CB22_MAJ	0.0753	102.029	7.38	4	68.885	0.013	0.25	1.57	4.67	20	76.2	13.2
S12	PROPOSED	CB09	0.1564	90.205	17.338	4	80.229	0.013	0.25	1.57	4.67	20	76.2	13.2
S13	PROPOSED	CB10	0.1116	79.05	14.118	4	59.864	0.013	0.25	1.57	4.67	20	76.2	13.2
S14	PROPOSED	CB11	0.1245	77.041	16.16	4	79.982	0.013	0.25	1.57	4.67	20	76.2	13.2
S15	PROPOSED	CB12	0.0931	61.728	15.082	4	67.379	0.013	0.25	1.57	4.67	20	76.2	13.2
S16	PROPOSED	CB13	0.148	92.677	15.969	4	77.727	0.013	0.25	1.57	4.67	20	76.2	13.2
S17	PROPOSED	CB14	0.0953	53.43	17.836	4	71.782	0.013	0.25	1.57	4.67	20	76.2	13.2
S18	PROPOSED	CB16	0.1135	66.232	17.137	4	79.395	0.013	0.25	1.57	4.67	20	76.2	13.2
S19	PROPOSED	CB15	0.1222	72.498	16.856	4	71.376	0.013	0.25	1.57	4.67	20	76.2	13.2
S20	PROPOSED	CB17	0.1267	90.521	13.997	4	66.774	0.013	0.25	1.57	4.67	20	76.2	13.2
S21	PROPOSED	CB19	0.1809	100.648	17.974	4	77.462	0.013	0.25	1.57	4.67	20	76.2	13.2
S22	PROPOSED	CB18	0.2112	134.621	15.688	4	71.299	0.013	0.25	1.57	4.67	20	76.2	13.2
S23	PROPOSED	CB20_MAJ	0.0803	55.155	14.559	4	51.719	0.013	0.25	1.57	4.67	20	76.2	13.2
S24	PROPOSED	CB24	0.0872	113.766	7.665	4	69.436	0.013	0.25	1.57	4.67	20	76.2	13.2

Table 2A: Subcatchments (continued...)

Name	Tag	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Zero Imperv (%)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)
S25	PROPOSED	CB26_MAJ	0.1143	70.487	16.216	4	70.171	0.013	0.25	1.57	4.67	20	76.2	13.2
S26	PROPOSED	CB27_MAJ	0.1219	88.251	13.813	2.7	61.559	0.013	0.25	1.57	4.67	20	76.2	13.2
S27	PROPOSED	CB21_MAJ	0.0486	145.241	3.346	4	74.746	0.013	0.25	1.57	4.67	20	76.2	13.2
S28	PROPOSED	CB33_MAJ	0.1209	71.457	16.919	4	72.238	0.013	0.25	1.57	4.67	20	76.2	13.2
S29	PROPOSED	CB21_MAJ	0.0132	145.241	0.909	4	67.119	0.013	0.25	1.57	4.67	20	76.2	13.2
S30	PROPOSED	CB25	0.129	53.464	24.128	2.7	72.576	0.013	0.25	1.57	4.67	20	76.2	13.2
S31	PROPOSED	CB30_MAJ	0.0641	104.246	6.149	4	44.419	0.013	0.25	1.57	4.67	20	76.2	13.2
S32	PROPOSED	CB123	0.0481	75.766	6.348	4	57.912	0.013	0.25	1.57	4.67	20	76.2	13.2
S32_2	PROPOSED	CB31_MAJ	0.0595	166.537	3.573	4	75.259	0.013	0.25	1.57	4.67	20	76.2	13.2
S33	PROPOSED	CB28_MAJ	0.0456	89.837	5.076	4	76.803	0.013	0.25	1.57	4.67	20	76.2	13.2
S34	PROPOSED	CB29_MAJ	0.0498	83.618	5.956	4	71.364	0.013	0.25	1.57	4.67	20	76.2	13.2
S35	PROPOSED	CB32_MAJ	0.0478	88.26	5.416	4	60.341	0.013	0.25	1.57	4.67	20	76.2	13.2
S36	PROPOSED	CB77	0.1281	150.779	8.496	4	18.895	0.013	0.25	5	5	0	76.2	13.2
S37	PROPOSED	CB79	0.0883	91.823	9.616	4	11.96	0.013	0.25	5	5	0	76.2	13.2
S38	PROPOSED	CB03	0.196	127.258	15.402	2.2	73.242	0.013	0.25	1.57	4.67	20	76.2	13.2
S39	PROPOSED	CB04	0.1303	136.874	9.52	4	73.242	0.013	0.25	1.57	4.67	20	76.2	13.2
S40	PROPOSED	CB51	0.1574	102.03	15.427	4	42.458	0.013	0.25	5	5	0	76.2	13.2
S41	PROPOSED	CB122	0.0915	64.681	14.146	4	44.97	0.013	0.25	5	5	0	76.2	13.2
S42	PROPOSED	CB36	0.1295	74.553	17.37	4	33.275	0.013	0.25	5	5	0	76.2	13.2
S43	PROPOSED	CB60	0.0557	38.765	14.369	4	54.126	0.013	0.25	5	5	0	76.2	13.2
S44	PROPOSED	CB58	0.0619	40.071	15.448	4	49.606	0.013	0.25	5	5	0	76.2	13.2
S45	PROPOSED	CB58	0.1558	98.633	15.796	4	41.571	0.013	0.25	5	5	0	76.2	13.2
S46	PROPOSED	CB58	0.1072	73.088	14.667	4	44.464	0.013	0.25	5	5	0	76.2	13.2
S47	PROPOSED	CB60	0.1518	99.936	15.19	4	42.714	0.013	0.25	5	5	0	76.2	13.2
S48	PROPOSED	CB60	0.0932	68.368	13.632	4	48.595	0.013	0.25	5	5	0	76.2	13.2
S49	PROPOSED	CB43	0.1583	72.781	21.75	4	46.402	0.013	0.25	5	5	0	76.2	13.2

Table 2A: Subcatchments (continued...)

Name	Tag	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Zero Imperv (%)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)
S50	PROPOSED	CB83	0.1802	124.882	14.43	4	42.931	0.013	0.25	5	5	0	76.2	13.2
S51	PROPOSED	CB87	0.2814	163.848	17.174	4	32.047	0.013	0.25	5	5	0	76.2	13.2
S52	PROPOSED	CB57	0.1309	94.845	13.801	4	47.248	0.013	0.25	5	5	0	76.2	13.2
S60	PROPOSED	CB96	0.821	129.664	63.317	2	20	0.013	0.25	5	5	0	76.2	13.2
S61	PROPOSED	POND	0.3962	275.969	14.357	33	7.757	0.013	0.25	1.57	4.67	0	76.2	13.2
S62	PROPOSED	CB99	0.1273	56.965	22.347	0.893	29.337	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_01	PROPOSED	223	0.3825	213.309	17.932	1	39.332	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_02	PROPOSED	CB19	0.0202	57.206	3.531	0.5	21.18	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_04	PROPOSED	CB32_MAJ	0.0182	31.644	5.751	4	12.762	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_06	PROPOSED	CB21_MAJ	0.0239	66.25	3.608	0.5	11.693	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_08	PROPOSED	CB98	0.153	132.885	11.514	1	12.576	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_09	PROPOSED	231	0.1493	206.58	7.227	1	14.321	0.013	0.25	5	5	0	76.2	13.2
S62_10	PROPOSED	ROOF_4_STOREY_BLDG_A	0.1036	128.748	8.047	1	99.941	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_11	PROPOSED	ROOF_4_STOREY_BLDG_C	0.1035	122.585	8.443	1	99.966	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_12	PROPOSED	ROOF_4_STOREY_BLDG_B	0.1035	114.206	9.063	1	99.999	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_13	PROPOSED	ROOF_4_STOREY_BLDG_D	0.1034	118.255	8.744	1	99.964	0.013	0.25	1.57	4.67	0	76.2	13.2
S62_14	PROPOSED	ROOF_4_STOREY_BLDG_E	0.1036	119.606	8.662	1	99.896	0.013	0.25	1.57	4.67	0	76.2	13.2
S63_1	PROPOSED	ROOF_9_STOREY	0.1984	230.006	8.626	1	100	0.013	0.25	1.57	4.67	20	76.2	13.2
S63_2	PROPOSED	CB93	0.0704	118.742	5.929	1	47.216	0.013	0.25	5	5	0	76.2	13.2
S63_3	PROPOSED	CB65	0.0715	17.054	41.926	1	38.94	0.013	0.25	1.57	4.67	0	76.2	13.2
S63_4	PROPOSED	CB65	0.1202	93.408	12.868	1	75.242	0.013	0.25	1.57	4.67	0	76.2	13.2
S63_5	PROPOSED	CB64	0.0279	93.408	2.987	1	91.509	0.013	0.25	1.57	4.67	0	76.2	13.2
S63_6	PROPOSED	CB123	0.0185	39.283	4.709	4	51.314	0.013	0.25	1.57	4.67	0	76.2	13.2

Table 2B: Subcatchments

Name	Decay Constant (1/hr)	CAVG	LOCATION
EXT_1	4.14	0.48	EXTERNAL
EXT_2	4.14	0.37	EXTERNAL
EXT_3	4.14	0.44	EXTERNAL
S02	4.14	0.72	FRONTYARD
S03	4.14	0.73	FRONTYARD
S04	4.14	0.73	FRONTYARD
S05	4.14	0.7	FRONTYARD
S06	4.14	0.66	FRONTYARD
S07	4.14	0.64	FRONTYARD
S08	4.14	0.6	FRONTYARD
S09	4.14	0.73	FRONTYARD
S10	4.14	0.68	FRONTYARD
S11	4.14	0.68	FRONTYARD
S12	4.14	0.76	FRONTYARD
S13	4.14	0.62	FRONTYARD
S14	4.14	0.76	FRONTYARD
S15	4.14	0.67	FRONTYARD
S16	4.14	0.74	FRONTYARD
S17	4.14	0.7	FRONTYARD
S18	4.14	0.76	FRONTYARD
S19	4.14	0.7	FRONTYARD
S20	4.14	0.67	FRONTYARD
S21	4.14	0.74	FRONTYARD
S22	4.14	0.7	FRONTYARD
S23	4.14	0.56	FRONTYARD
S24	4.14	0.69	FRONTYARD

Table 2B: Subcatchments (continued...)

Name	Decay Constant (1/hr)	CAVG	LOCATION
S25	4.14	0.69	FRONTYARD
S26	4.14	0.63	FRONTYARD
S27	4.14	0.72	FRONTYARD
S28	4.14	0.71	FRONTYARD
S29	4.14	0.67	FRONTYARD
S30	4.14	0.71	FRONTYARD
S31	4.14	0.51	FRONTYARD
S32	4.14	0.61	FRONTYARD
S32_2	4.14	0.73	FRONTYARD
S33	4.14	0.74	FRONTYARD
S34	4.14	0.7	FRONTYARD
S35	4.14	0.62	FRONTYARD
S36	4.14	0.33	BACKYARD
S37	4.14	0.28	BACKYARD
S38	4.14	0.71	FRONTYARD
S39	4.14	0.71	FRONTYARD
S40	4.14	0.5	BACKYARD
S41	4.14	0.51	BACKYARD
S42	4.14	0.43	BACKYARD
S43	4.14	0.58	BACKYARD
S44	4.14	0.55	BACKYARD
S45	4.14	0.49	BACKYARD
S46	4.14	0.51	BACKYARD
S47	4.14	0.5	BACKYARD
S48	4.14	0.54	BACKYARD
S49	4.14	0.52	BACKYARD

Table 2B: Subcatchments (continued...)

Name	Decay Constant (1/hr)	CAVG	LOCATION
S50	4.14	0.5	BACKYARD
S51	4.14	0.42	BACKYARD
S52	4.14	0.53	BACKYARD
S60	4.14	0.34	PARK
S61	4.14	0.25	SWM
S62	4.14	0.41	SITEPLAN 2
S62_01	4.14	0.48	SITEPLAN 2
S62_02	4.14	0.35	SITEPLAN 2
S62_04	4.14	0.29	SITEPLAN 2
S62_06	4.14	0.28	SITEPLAN 2
S62_08	4.14	0.29	SITEPLAN 2
S62_09	4.14	0.3	SITEPLAN 2
S62_10	4.14	0.9	SITEPLAN 2
S62_11	4.14	0.9	SITEPLAN 2
S62_12	4.14	0.9	SITEPLAN 2
S62_13	4.14	0.9	SITEPLAN 2
S62_14	4.14	0.9	SITEPLAN 2
S63_1	4.14	0.9	SITEPLAN 1
S63_2	4.14	0.53	SITEPLAN 1
S63_3	4.14	0.47	SITEPLAN 1
S63_4	4.14	0.73	SITEPLAN 1
S63_5	4.14	0.84	SITEPLAN 1
S63_6	4.14	0.56	SITEPLAN 1

Table 3A: Outlets

Name	Inlet Node	Outlet Node	Inlet Elev. (m)	Rating Curve	TYPE	Tag
CB01_IC	CB01_MAJ	CB01	121.241	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB02_IC	CB02_MAJ	CB02	121.241	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB05_IC	CB05_MAJ	CB05	119.664	TABULAR/HEAD	INLET_CONTROL_GRATE	CB_GRATE
CB06_ic	CB06_MAJ	CB06	119.664	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB07_IC	CB07_MAJ	CB07	119.231	TABULAR/HEAD	INLET_CONTROL_GRATE	CB_GRATE
CB08_IC	CB08_MAJ	CB08	119.261	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB120_IC	CB120_MAJ	CB120	120.15	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB121_IC	CB121_MAJ	CB121	120.15	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB20_IC	CB20_MAJ	CB20	118.859	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB21_IC	CB21_MAJ	CB21	118.859	TABULAR/HEAD	INLET_CONTROL_GRATE	CB_GRATE
CB22_IC	CB22_MAJ	CB22	119.265	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB26_IC	CB26_MAJ	CB26	118.8	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB27_IC	CB27_MAJ	CB27	118.799	TABULAR/HEAD	INLET_CONTROL_GRATE	CB_GRATE
CB28_IC	CB28_MAJ	CB28	119.985	TABULAR/HEAD	INLET_CONTROL_GRATE	CB_GRATE
CB29_IC	CB29_MAJ	CB29	119.981	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB30_IC	CB30_MAJ	CB30	121.027	TABULAR/HEAD	INLET_CONTROL_GRATE	CB_GRATE
CB31_IC	CB31_MAJ	CB31	121.02	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB32_IC	CB32_MAJ	CB32	120.759	TABULAR/HEAD	INLET_CONTROL_GRATE	CB_GRATE
CB33_IC	CB33_MAJ	CB33	119.201	TABULAR/DEPTH	INLET_CONTROL_GRATE	CB_GRATE
CB01_ICD	CB01	213	119.841	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB02_ICD	CB02	213	119.841	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB03_icd	CB03	212	118.558	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB04_ICD	CB04	212	118.558	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB05_ICD	CB05	210	118.264	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB06_ICD	CB06	210	118.264	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB07_ICD	CB07	209	117.831	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB08_ICD	CB08	209	117.861	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD

Table 3A: Outlets (continued...)

Name	Inlet Node	Outlet Node	Inlet Elev. (m)	Rating Curve	TYPE	Tag
CB09_ICD	CB09	208	117.392	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB10_ICD	CB10	208	117.392	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB11_ICD	CB11	208	117.252	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB12_ICD	CB12	208	117.252	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB120_ICD	CB120	212	118.75	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB121_ICD	CB121	212	118.75	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB123_ICD	CB123	220	119.562	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB124_ICD	CB124	217	118.491	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB13_ICD	CB13	206	117.112	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB14_ICD	CB14	206	117.112	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB15_ICD	CB15	215	117.103	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB16_ICD	CB16	205	117	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB17_ICD	CB17	205	117.042	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB18_ICD	CB18	226	116.502	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB19_ICD	CB19	226	116.502	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB20_ICD	CB20	216	117.459	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB21_ICD	CB21	216	117.459	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB22_ICD	CB22	227	117.865	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB24_ICD	CB24	228	117.827	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB25_ICD	CB25	228	117.827	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB26_ICD	CB26	215	117.4	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB27_ICD	CB27	215	117.399	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB28_ICD	CB28	218	118.585	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB29_ICD	CB29	218	118.581	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB30_ICD	CB30	219	119.627	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB31_ICD	CB31	219	119.62	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB32_ICD	CB32	220	119.359	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD

Table 3A: Outlets (continued...)

Name	Inlet Node	Outlet Node	Inlet Elev. (m)	Rating Curve	TYPE	Tag
CB33_ICD	CB33	227	117.801	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB64_ICD	CB64	230	119.801	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB65_ICD	CB65	230	119.41	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
CB99_ICD	CB99	229	118.37	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	CB_ICD
OL1	ROOF_4_STOREY_BLDG_A	223	124.85	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	FC_ROOF_DRAINS
ROOF_DRAINS_4_Storey_B	ROOF_4_STOREY_BLDG_B	223	124.85	TABULAR/DEPTH	FLOW_CONTROLLED_ROOF	FC_ROOF_DRAINS
ROOF_DRAINS_4_Storey_C	ROOF_4_STOREY_BLDG_C	223	124.85	TABULAR/DEPTH	FLOW_CONTROLLED_ROOF	FC_ROOF_DRAINS
ROOF_DRAINS_4_Storey_D	ROOF_4_STOREY_BLDG_D	223	124.85	TABULAR/DEPTH	FLOW_CONTROLLED_ROOF	FC_ROOF_DRAINS
ROOF_DRAINS_4_Storey_E	ROOF_4_STOREY_BLDG_E	223	124.85	TABULAR/DEPTH	FLOW_CONTROLLED_ROOF	FC_ROOF_DRAINS
Roof_DRAINS_9_storey	ROOF_9_STOREY	230	124.85	TABULAR/DEPTH	FLOW_CONTROLLED_ROOF	FC_ROOF_DRAINS
POND_BIO_RET	POND	200	112.7	TABULAR/DEPTH		INFILT
CB100_ICD	CB100	232	115.41	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	RYCB_ICD
CB92_ICD	CB92	213	120.264	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	RYCB_ICD
CB93_ICD	CB93	221	119.7	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	RYCB_ICD
CB96_ICD	CB96	227	117.195	TABULAR/HEAD	FLOW_CONTROLLED_CATCHBASIN	RYCB_ICD
CB98_ICD	CB98	232	115.44	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	RYCB_ICD
MH231_ICD	231	232	116.98	TABULAR/DEPTH	FLOW_CONTROLLED_CATCHBASIN	RYCB_ICD
MH35_ICD	MH35	210	118.347	TABULAR/HEAD	FLOW_CONTROLLED_MANHOLE	RYCB_ICD
MH36_ICD	MH36	227	117.78	TABULAR/HEAD	FLOW_CONTROLLED_MANHOLE	RYCB_ICD
MH37_ICD	MH37	212	118.476	TABULAR/DEPTH	FLOW_CONTROLLED_MANHOLE	RYCB_ICD
MH38_ICD	MH38	212	118.63	TABULAR/DEPTH	FLOW_CONTROLLED_MANHOLE	RYCB_ICD
MH39_ICD	MH39	212	118.682	TABULAR/DEPTH	FLOW_CONTROLLED_MANHOLE	RYCB_ICD
MH40_ICD	MH40	208	115.963	TABULAR/DEPTH	FLOW_CONTROLLED_MANHOLE	RYCB_ICD
MH41_ICD	MH41	226	116.796	TABULAR/DEPTH	FLOW_CONTROLLED_MANHOLE	RYCB_ICD
MH42_ICD	MH42	215	117.09	TABULAR/DEPTH	FLOW_CONTROLLED_MANHOLE	RYCB_ICD
MH43_ICD	MH43	225	117.266	TABULAR/DEPTH	FLOW_CONTROLLED_MANHOLE	RYCB_ICD
MH44_ICD	MH44	206	114.859	TABULAR/DEPTH	FLOW_CONTROLLED_MANHOLE	RYCB_ICD

Table 3A: Outlets (continued...)

Name	Inlet Node	Outlet Node	Inlet Elev. (m)	Rating Curve	TYPE	Tag
MH45_ICD	MH45	204	114.39	TABULAR/DEPTH	FLOW_CONTROLLED_MANHOLE	RYCB_ICD

Table 3B: Outlets

Name	Curve Name	LOCATION	DIST_INVERT	GIS_UID
CB01_IC	IC_MOUNTABLE_CURB_2%	ROADWAY	0m FROM LID TO INV	1
CB02_IC	IC_MOUNTABLE_CURB_2%	ROADWAY	0m FROM LID TO INV	3
CB05_IC	IC_MOUNTABLE_CURB_1%	ROADWAY	0m FROM LID TO INV	7
CB06_ic	IC_MOUNTABLE_CURB_1%	ROADWAY	0m FROM LID TO INV	9
CB07_IC	IC_MOUNTABLE_CURB_1%	ROADWAY	0m FROM LID TO INV	11
CB08_IC	IC_MOUNTABLE_CURB_1%	ROADWAY	0m FROM LID TO INV	13
CB120_IC	IC_MOUNTABLE_CURB_2%	ROADWAY	0m FROM LID TO INV	20
CB121_IC	IC_MOUNTABLE_CURB_2%	ROADWAY	0m FROM LID TO INV	22
CB20_IC	IC_MOUNTABLE_CURB_3%	ROADWAY	0m FROM LID TO INV	33
CB21_IC	IC_MOUNTABLE_CURB_3%	ROADWAY	0m FROM LID TO INV	35
CB22_IC	IC_BARRIER_CURB_2%	ROADWAY	0m FROM LID TO INV	37
CB26_IC	IC_MOUNTABLE_CURB_3%	ROADWAY	0m FROM LID TO INV	41
CB27_IC	IC_MOUNTABLE_CURB_3%	ROADWAY	0m FROM LID TO INV	43
CB28_IC	IC_BARRIER_CURB_2%	ROADWAY	0m FROM LID TO INV	45
CB29_IC	IC_BARRIER_CURB_2%	ROADWAY	0m FROM LID TO INV	47
CB30_IC	IC_BARRIER_CURB_2%	ROADWAY	0m FROM LID TO INV	49
CB31_IC	IC_BARRIER_CURB_2%	ROADWAY	0m FROM LID TO INV	51
CB32_IC	IC_BARRIER_CURB_2%	ROADWAY	0m FROM LID TO INV	53
CB33_IC	IC_BARRIER_CURB_2%	ROADWAY	0m FROM LID TO INV	55
CB01_ICD	ICD_TYPE_C	ROADWAY	STANDARD	2
CB02_ICD	ICD_TYPE_B	ROADWAY	STANDARD	4

Table 3B: Outlets (continued...)

Name	Curve Name	LOCATION	DIST_INVERT	GIS_UID
CB03_icd	ICD_TYPE_F	ROADWAY	STANDARD	5
CB04_ICD	ICD_TYPE_C	ROADWAY	STANDARD	6
CB05_ICD	ICD_TYPE_B	ROADWAY	STANDARD	8
CB06_ICD	ICD_TYPE_A	ROADWAY	STANDARD	10
CB07_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	12
CB08_ICD	ICD_TYPE_C	ROADWAY	STANDARD	14
CB09_ICD	ICD_TYPE_C	ROADWAY	STANDARD	15
CB10_ICD	ICD_TYPE_B	ROADWAY	STANDARD	16
CB11_ICD	ICD_TYPE_A	ROADWAY	STANDARD	18
CB12_ICD	ICD_TYPE_A	ROADWAY	STANDARD	19
CB120_ICD	ICD_TYPE_B	ROADWAY	STANDARD	21
CB121_ICD	ICD_TYPE_A	ROADWAY	STANDARD	23
CB123_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	24
CB124_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	25
CB13_ICD	ICD_TYPE_B	ROADWAY	STANDARD	26
CB14_ICD	ICD_TYPE_A	ROADWAY	STANDARD	27
CB15_ICD	ICD_TYPE_B	ROADWAY	STANDARD	28
CB16_ICD	ICD_TYPE_A	ROADWAY	STANDARD	29
CB17_ICD	ICD_TYPE_B	ROADWAY	STANDARD	30
CB18_ICD	ICD_TYPE_D	ROADWAY	STANDARD	31
CB19_ICD	ICD_TYPE_D	ROADWAY	STANDARD	32
CB20_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	34
CB21_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	36
CB22_ICD	ICD_TYPE_A	ROADWAY	STANDARD	38
CB24_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	39
CB25_ICD	ICD_TYPE_A	ROADWAY	STANDARD	40
CB26_ICD	ICD_TYPE_A	ROADWAY	STANDARD	42

Table 3B: Outlets (continued...)

Name	Curve Name	LOCATION	DIST_INVERT	GIS_UID
CB27_ICD	ICD_TYPE_A	ROADWAY	STANDARD	44
CB28_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	46
CB29_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	48
CB30_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	50
CB31_ICD	ICD_TYPE_A	ROADWAY	STANDARD	52
CB32_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	54
CB33_ICD	ICD_TYPE_B	ROADWAY	STANDARD	56
CB64_ICD	PEDRO_TYPE_X	ROADWAY	STANDARD	57
CB65_ICD	ICD_TYPE_A	ROADWAY	STANDARD	58
CB99_ICD	ICD_TYPE_A	ROADWAY	2.0m TO INVERT	63
OL1	ROOFDRAINS_4_STOREY_A-E	ROOF	0.15m TO INVERT	76
ROOF_DRAINS_4_Storey_B	ROOFDRAINS_4_STOREY_A-E	ROOF	0.15m TO INVERT	78
ROOF_DRAINS_4_Storey_C	ROOFDRAINS_4_STOREY_A-E	ROOF	0.15m TO INVERT	79
ROOF_DRAINS_4_Storey_D	ROOFDRAINS_4_STOREY_A-E	ROOF	0.15m TO INVERT	80
ROOF_DRAINS_4_Storey_E	ROOFDRAINS_4_STOREY_A-E	ROOF	0.15m TO INVERT	81
Roof_DRAINS_9_storey	ROOFDRAINS_9_STOREY_ROOF	ROOF	0.15m TO INVERT	82
POND_BIO_RET	POND_INFILT_2			77
CB100_ICD	PEDRO_TYPE_X	REARYARD	STANDARD	17
CB92_ICD	PEDRO_TYPE_X	REARYARD	2.20m TO INVERT	59
CB93_ICD	PEDRO_TYPE_X	REARYARD	STANDARD	60
CB96_ICD	ICD_TYPE_C	REARYARD	2.40m TO INVERT	61
CB98_ICD	PEDRO_TYPE_X	REARYARD	STANDARD	62
MH231_ICD	ICD_TYPE_C	REARYARD	VARIES	64
MH35_ICD	PEDRO_TYPE_X	ROADWAY	VARIES	65
MH36_ICD	PEDRO_TYPE_X	ROADWAY	VARIES	66
MH37_ICD	ICD_TYPE_D	ROADWAY	VARIES	67
MH38_ICD	ICD_TYPE_A	ROADWAY	VARIES	68

Table 3B: Outlets (continued...)

Name	Curve Name	LOCATION	DIST_INVERT	GIS_UID
MH39_ICD	PEDRO_TYPE_X	ROADWAY	VARIES	69
MH40_ICD	ICD_TYPE_A	ROADWAY	VARIES	70
MH41_ICD	ICD_TYPE_C	ROADWAY	VARIES	71
MH42_ICD	ICD_TYPE_B	ROADWAY	VARIES	72
MH43_ICD	ICD_TYPE_B	ROADWAY	VARIES	73
MH44_ICD	ICD_TYPE_B	ROADWAY	VARIES	74
MH45_ICD	ICD_TYPE_A	ROADWAY	VARIES	75

Table 4A: Conduits

Name	Inlet Node	Outlet Node	Tag	Length (m)	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section	Geom1 (m)	Transect	Slope (m/m)
C01	CB58	J06_MAJ	Major_System	33.797	118.68	118.28	IRREGULAR	0	REARYARD_SWALE_1	0.01184
C02	213	212	STORM_SEWER	80.904	117.31	115.692	CIRCULAR	0.448		0.02
C03	212	211	STORM_SEWER	79.898	115.542	115.223	CIRCULAR	0.61		0.00399
C04	211	210	STORM_SEWER	11.048	115.193	115.148	CIRCULAR	0.61		0.00407
C05	210	209	STORM_SEWER	66.356	115.118	114.853	CIRCULAR	0.61		0.00399
C06	225	209	STORM_SEWER	37.474	115.731	115.203	CIRCULAR	0.251		0.01409
C07	209	208	STORM_SEWER	39.975	114.778	114.618	CIRCULAR	0.685		0.004
C08	227	208	STORM_SEWER	60.145	115.234	114.843	CIRCULAR	0.448		0.0065
C09	208	207	STORM_SEWER	119.311	114.468	114.23	CIRCULAR	0.839		0.00199
C10	207	206	STORM_SEWER	12.025	114.2	114.176	CIRCULAR	0.839		0.002
C11	206	205	STORM_SEWER	68.673	114.146	114.008	CIRCULAR	0.839		0.00201
C12	215	205	STORM_SEWER	90.525	114.972	114.383	CIRCULAR	0.448		0.00651
C13	205	204	STORM_SEWER	53.431	114.008	113.901	CIRCULAR	0.839		0.002
C14	204	203	STORM_SEWER	27.203	113.891	113.837	CIRCULAR	0.839		0.00199
C15	221	220	STORM_SEWER	11.186	116.938	116.818	CIRCULAR	0.299		0.01073

Table 4A: Conduits (continued...)

Name	Inlet Node	Outlet Node	Tag	Length (m)	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section	Geom1 (m)	Transect	Slope (m/m)
C16	220	218	STORM_SEWER	37.404	116.798	116.428	CIRCULAR	0.299		0.00989
C17	219	218	STORM_SEWER	12.545	116.838	116.428	CIRCULAR	0.299		0.0327
C18	218	217	STORM_SEWER	44.29	116.353	115.422	CIRCULAR	0.366		0.02103
C19	217	216	STORM_SEWER	18.652	115.422	115.049	CIRCULAR	0.366		0.02
C20	228	216	STORM_SEWER	61.187	115.522	115.124	CIRCULAR	0.299		0.0065
C21	216	226	STORM_SEWER	72.694	114.899	114.463	CIRCULAR	0.533		0.006
C22	226	203	STORM_SEWER	59.344	114.313	113.987	CIRCULAR	0.685		0.00549
C23	CB60	J01_MAJ	Major_System	13.333	118.79	118.59	IRREGULAR	0	REARYARD_SWALE_1	0.015
C24	203	POND	STORM_SEWER	36.165	113.762	113.6	CIRCULAR	0.914		0.00448
C25	CB92	CB01_MAJ	Major_System	60.361	122.464	121.241	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.02027
C26	223	226	STORM_SEWER	8.101	114.775	114.613	CIRCULAR	0.375		0.02
C28	CB99	223	Major_System	101.873	119.77	118.67	IRREGULAR	0	OVERLAND_SPILL	0.0108
C29	232	POND	STORM_SEWER	62.99	114.4	114	CIRCULAR	0.45		0.00635
C29_1	200	78511	STORM_SEWER	6.619	112.17	112.15	CIRCULAR	1.05		0.00302
C29_2	78511	STM106286	STORM_SEWER	52.701	112.088	111.85	CIRCULAR	1.05		0.00452
C30	223	CB100	Major_System	139.933	118.67	116.8	IRREGULAR	0	REARYARD_SWALE_1	0.01336
C30_1	CB93	CB123	Major_System	59.345	121.1	120.962	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00233
C30_2	CB123	CB31_MAJ	Major_System	8.519	120.962	121.02	IRREGULAR	0	LOCAL_18m-ROW_HALF	-0.00681
C31	229	217	STORM_SEWER	19.446	116.036	115.627	CIRCULAR	0.2		0.02104
C32	230	219	STORM_SEWER	8.578	117.078	116.927	CIRCULAR	0.3		0.01761
C33	CB24	J07_MAJ	Major_System	30	119.43	119.32	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00367
C34_1	CB57	CB97	Major_System	7.333	116.17	116.06	IRREGULAR	0	REARYARD_SWALE_1	0.015
C34_2	CB97	POND	Major_System	37.791	116.06	113.55	IRREGULAR	0	REARYARD_SWALE_1	0.06656
C35	CB30_MAJ	CB28_MAJ	Major_System	44.358	121.027	119.985	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.0235
C36	J10_MAJ	OF_Bandlier_Major	Major_System	53.709	115.86	115.6	IRREGULAR	0	12m_EASEMENT	0.00484
C36_1	CB29_MAJ	CB124	Major_System	19.796	119.981	119.891	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00455
C36_2	CB124	CB21_MAJ	Major_System	54.135	119.891	118.859	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01907

Table 4A: Conduits (continued...)

Name	Inlet Node	Outlet Node	Tag	Length (m)	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section	Geom1 (m)	Transect	Slope (m/m)
C37	CB31_MAJ	J04_MAJ	Major_System	23.811	121.02	120.41	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.02563
C38	CB03	CB05_MAJ	Major_System	70	119.958	119.664	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.0042
C39	CB22_MAJ	J03_MAJ	Major_System	16.355	119.265	119.05	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01315
C39_1	CB01_MAJ	CB120_MAJ	Major_System	49.563	121.241	120.15	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.02202
C39_2	CB120_MAJ	CB03	Major_System	20.268	120.15	119.958	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00947
C40	CB05_MAJ	CB07_MAJ	Major_System	45.732	119.664	119.231	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00947
C41	CB07_MAJ	CB09	Major_System	20	119.231	118.792	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.02196
C42	CB12	CB14	Major_System	8	118.652	118.512	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.0175
C43	CB13	CB16	Major_System	12	118.512	118.4	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00933
C44	CB16	CB19	Major_System	48	118.4	117.902	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01038
C45	CB28_MAJ	CB24	Major_System	26	119.985	119.43	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.02135
C46	CB25	CB27_MAJ	Major_System	60	119.227	118.799	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00713
C47	CB96	J07_MAJ	Major_System	7.651	119.595	119.32	IRREGULAR	0	OVERLAND_SPILL	0.03597
C48	CB27_MAJ	CB17	Major_System	16	118.799	118.442	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.02232
C49	CB33_MAJ	J03_MAJ	Major_System	7.118	119.201	119.05	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.02122
C50	CB21_MAJ	J08_MAJ	Major_System	22.777	118.859	118.58	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01225
C51	CB10	CB12	Major_System	12	118.792	118.652	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01167
C52	CB32_MAJ	J04_MAJ	Major_System	11.049	120.759	120.41	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.0316
C53	CB64	CB31_MAJ	Major_System	14.007	121.201	121.02	IRREGULAR	0	OVERLAND_SPILL	0.01292
C54	CB14	CB15	Major_System	12	118.512	118.503	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00075
C55	CB18	CB19	Major_System	8.26	118.03	118.03	IRREGULAR	0	ROADWAY_SPILL_SP-07	0
C56	CB122	J02_MAJ	Major_System	5.482	119.982	119.847	IRREGULAR	0	OVERLAND_SPILL	0.02463
C57	CB15	CB17	Major_System	11.713	118.503	118.442	IRREGULAR	0	ROADWAY_SPILL_2	0.00521
C58	CB43	MH43	RYCB_LEAD	7.037	117.371	117.296	CIRCULAR	0.25		0.01066
C59	CB26_MAJ	J01_MAJ	Major_System	16	118.8	118.59	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01313
C60	CB20_MAJ	J06_MAJ	Major_System	39.784	118.859	118.28	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01456
C61	CB17	CB18	Major_System	43	118.442	117.902	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01256

Table 4A: Conduits (continued...)

Name	Inlet Node	Outlet Node	Tag	Length (m)	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section	Geom 1 (m)	Transect	Slope (m/m)
C62	MH41	J06_MAJ	Major_System	0.93	118.296	118.28	IRREGULAR	0	OVERLAND_SPILL	0.01721
C63	J06_MAJ	CB18	Major_System	27.058	118.28	117.902	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01397
C64	MH42	J01_MAJ	Major_System	0.864	118.59	118.59	IRREGULAR	0	LOCAL_18m-ROW_HALF	0
C65	J01_MAJ	CB15	Major_System	33.521	118.59	118.503	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.0026
C67	J05_MAJ	CB22_MAJ	Major_System	33.299	119.28	119.265	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00045
C68	J04_MAJ	CB29_MAJ	Major_System	20.951	120.41	119.981	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.02048
C69	J08_MAJ	CB19	Major_System	35	118.58	117.902	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01938
C70	J07_MAJ	J05_MAJ	Major_System	10.479	119.32	119.28	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00382
C71	CB09	CB11	Major_System	12	118.792	118.652	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01167
C72	CB11	CB13	Major_System	20	118.652	118.512	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.007
C73	CB08_MAJ	J03_MAJ	Major_System	19.541	119.261	119.05	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.0108
C74	J03_MAJ	CB10	Major_System	25.726	119.05	118.792	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.01003
C75	CB06_MAJ	CB08_MAJ	Major_System	45.804	119.664	119.261	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.0088
C76	CB04	J02_MAJ	Major_System	37	119.958	119.847	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.003
C77	J02_MAJ	CB06_MAJ	Major_System	20.84	119.847	119.664	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00878
C78	231	CB98	Major_System	34.714	118.04	116.85	IRREGULAR	0	REARYARD_SWALE_1	0.0343
C78_1	CB02_MAJ	CB121_MAJ	Major_System	49.563	121.241	120.15	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.02202
C78_2	CB121_MAJ	CB04	Major_System	20.338	120.15	119.958	IRREGULAR	0	LOCAL_18m-ROW_HALF	0.00944
C80	MH43	OF_Samantha	Major_System	6.677	118.766	118.55	IRREGULAR	0	OVERLAND_SPILL	0.03237
C81	CB65	CB31_MAJ	Major_System	25.013	121.3	121.02	IRREGULAR	0	OVERLAND_SPILL	0.01119
C82	MH36	J05_MAJ	Major_System	0.674	119.28	119.28	IRREGULAR	0	OVERLAND_SPILL	0
C86	CB36	MH36	RYCB_LEAD	6.096	117.87	117.78	CIRCULAR	0.25		0.01477
C90	CB83	CB87	Major_System	93	117.647	116.252	IRREGULAR	0	REARYARD_SWALE_1	0.015
C91	CB87	CB57	Major_System	5.467	116.252	116.17	IRREGULAR	0	REARYARD_SWALE_1	0.015
C92	CB77	CB79	Major_System	6.133	120.34	120.248	IRREGULAR	0	REARYARD_SWALE_2	0.015
C93	CB79	OF_Kimpton	Major_System	6.533	120.248	120.15	IRREGULAR	0	REARYARD_SWALE_2	0.015
C94_1	CB51	CB122	Major_System	12.933	120.176	119.982	IRREGULAR	0	REARYARD_SWALE_1	0.015

Table 4A: Conduits (continued...)

Name	Inlet Node	Outlet Node	Tag	Length (m)	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section	Geom1 (m)	Transect	Slope (m/m)
C94_2	CB122	MH35	RYCB_LEAD	6.186	118.582	118.377	CIRCULAR	0.25		0.03316
C95	J09_MAJ	POND	Major_System	27.928	116.15	113.55	TRAPEZOIDAL	0.3		0.0935
C96	CB98	CB100	Major_System	7.827	116.85	116.81	IRREGULAR	0	REARYARD_SWALE_1	0.00511
CB51_LEAD	CB51	MH38	RYCB_LEAD	34.348	119.004	118.66	CIRCULAR	0.25		0.01002
CB57_LEAD	CB97	MH45	RYCB_LEAD	31.213	114.73	114.41	CIRCULAR	0.25		0.01025
CB58_LEAD	CB58	MH41	RYCB_LEAD	34.171	117.173	116.826	CIRCULAR	0.25		0.01016
CB60_LEAD	CB60	MH42	RYCB_LEAD	33.557	117.516	117.12	CIRCULAR	0.25		0.0118
CB77_LEAD	CB77	MH37	RYCB_LEAD	34.297	118.849	118.476	CIRCULAR	0.25		0.01088
CB79_LEAD	CB79	MH39	RYCB_LEAD	34.295	119.055	118.712	CIRCULAR	0.25		0.01
CB83_LEAD	CB83	MH40	RYCB_LEAD	33.358	116.327	115.993	CIRCULAR	0.25		0.01001
CB87_LEAD	CB87	MH44	RYCB_LEAD	32.454	115.12	114.889	CIRCULAR	0.25		0.00712

Table 4B: Conduits

Name	TYPE	LENGTH_ADJ	GIS_UID
C01	REARYARD_SWALE	YES	1
C02	MINOR		2
C03	MINOR		3
C04	MINOR		4
C05	MINOR		5
C06	MINOR		6
C07	MINOR		7
C08	MINOR		8
C09	MINOR		9
C10	MINOR		10
C11	MINOR		11

Table 4B: Conduits (continued...)

Name	TYPE	LENGTH_ADJ	GIS_UID
C12	MINOR		12
C13	MINOR		13
C14	MINOR		14
C15	MINOR		15
C16	MINOR		16
C17	MINOR		17
C18	MINOR		18
C19	MINOR		19
C20	MINOR		20
C21	MINOR		21
C22	MINOR		22
C23	REARYARD_SWALE	YES	23
C24	MINOR	YES	24
C25	ROADWAY		25
C26	MINOR		26
C28	ROADWAY		27
C29	MAJOR	YES	28
C29_1	MINOR		29
C29_2	MINOR		30
C30	REARYARD_SWALE		31
C30_1	ROADWAY		32
C30_2	ROADWAY		33
C31	MINOR		34
C32	MINOR		35
C33	ROADWAY	YES	36
C34_1	REARYARD_SWALE	YES	37
C34_2	REARYARD_SWALE		38

Table 4B: Conduits (continued...)

Name	TYPE	LENGTH_ADJ	GIS_UID
C35	ROADWAY		39
C36	MINOR		40
C36_1	ROADWAY		41
C36_2	ROADWAY		42
C37	ROADWAY		43
C38	ROADWAY	YES	44
C39	ROADWAY	YES	45
C39_1	ROADWAY		46
C39_2	ROADWAY		47
C40	ROADWAY		48
C41	ROADWAY	YES	49
C42	ROADWAY	YES	50
C43	ROADWAY	YES	51
C44	ROADWAY	YES	52
C45	ROADWAY	YES	53
C46	ROADWAY	YES	54
C47	ROADWAY		55
C48	ROADWAY	YES	56
C49	ROADWAY		57
C50	ROADWAY		58
C51	ROADWAY	YES	59
C52	ROADWAY		60
C53	ROADWAY		61
C54	ROADWAY	YES	62
C55	ROADWAY		63
C56	ROADWAY		64
C57	ROADWAY		65

Table 4B: Conduits (continued...)

Name	TYPE	LENGTH_ADJ	GIS_UID
C58	MINOR		66
C59	ROADWAY	YES	67
C60	ROADWAY		68
C61	ROADWAY	YES	69
C62	ROADWAY		70
C63	ROADWAY	YES	71
C64	ROADWAY		72
C65	ROADWAY		73
C67	ROADWAY		74
C68	ROADWAY		75
C69	ROADWAY	YES	76
C70	ROADWAY		77
C71	ROADWAY	YES	78
C72	ROADWAY	YES	79
C73	ROADWAY		80
C74	ROADWAY		81
C75	ROADWAY		82
C76	ROADWAY	YES	83
C77	ROADWAY		84
C78	REARYARD_SWALE		85
C78_1	ROADWAY		86
C78_2	ROADWAY		87
C80	ROADWAY		88
C81	ROADWAY		89
C82	ROADWAY		90
C86	MINOR		91
C90	REARYARD_SWALE		92

Table 4B: Conduits (continued...)

Name	TYPE	LENGTH_ADJ	GIS_UID
C91	REARYARD_SWALE	YES	93
C92	REARYARD_SWALE	YES	94
C93	REARYARD_SWALE	YES	95
C94_1	REARYARD_SWALE	YES	96
C94_2	MINOR		97
C95	REARYARD_SWALE		98
C96			99
CB51_LEAD	MINOR		100
CB57_LEAD	MINOR		101
CB58_LEAD	MINOR		102
CB60_LEAD	MINOR		103
CB77_LEAD	MINOR		104
CB79_LEAD	MINOR		105
CB83_LEAD	MINOR		106
CB87_LEAD	MINOR		107

Table 5: Catchbasins_Rev8

NAME	LOCATION	RIM_ELEV	DRAINAGE_TYPE	ICD	GIS_UID	STRUCTURE_TYPE	MODELLED	STRUCT_SIZE
CB01	ROADWAY	121.241	FLOW_BY	YES	2	CATCHBASIN	YES	600X600
CB02	ROADWAY	121.241	FLOW_BY	YES	1	CATCHBASIN	YES	600X600
CB03	ROADWAY	119.958	PONDING	YES	3	CATCHBASIN	YES	600X600
CB04	ROADWAY	119.958	PONDING	YES	4	CATCHBASIN	YES	600X600
CB05	ROADWAY	119.664	FLOW_BY	YES	6	CATCHBASIN	YES	600X600
CB06	ROADWAY	119.664	FLOW_BY	YES	7	CATCHBASIN	YES	600X600
CB07	ROADWAY	119.231	FLOW_BY	YES	40	CATCHBASIN	YES	600X600
CB08	ROADWAY	119.261	FLOW_BY	YES	39	CATCHBASIN	YES	600X600

Table 5: Catchbasins_Rev8 (continued...)

NAME	LOCATION	RIM_ELEV	DRAINAGE_TYPE	ICD	GIS_UID	STRUCTURE_TYPE	MODELLED	STRUCT_SIZE
CB09	ROADWAY	118.792	PONDING	YES	14	CATCHBASIN	YES	600X600
CB10	ROADWAY	118.792	PONDING	YES	15	CATCHBASIN	YES	600X600
CB100	REARYARD	116.81	FLOW_BY	YES	103	CATCHBASIN	YES	600X600
CB11	ROADWAY	118.652	PONDING	YES	16	CATCHBASIN	YES	600X600
CB12	ROADWAY	118.652	PONDING	YES	17	CATCHBASIN	YES	600X600
CB120	ROADWAY	120.15	FLOW_BY	YES	99	CATCHBASIN	YES	600X600
CB121	ROADWAY	120.15	FLOW_BY	YES	98	CATCHBASIN	YES	600X600
CB122	REARYARD	119.982	FLOW_BY	NO	105	CATCHBASIN	YES	600X600
CB123	ROADWAY	120.962	FLOW_BY	YES	100	CATCHBASIN	YES	600X600
CB124	ROADWAY	119.891	FLOW_BY	YES	101	CATCHBASIN	YES	600X600
CB13	ROADWAY	118.512	PONDING	YES	44	CATCHBASIN	YES	600X600
CB14	ROADWAY	118.512	PONDING	YES	45	CATCHBASIN	YES	600X600
CB15	ROADWAY	118.503	PONDING	YES	20	CATCHBASIN	YES	600X600
CB16	ROADWAY	118.4	PONDING	YES	19	CATCHBASIN	YES	600X600
CB17	ROADWAY	118.442	PONDING	YES	21	CATCHBASIN	YES	600X600
CB18	ROADWAY	117.902	PONDING	YES	28	CATCHBASIN	YES	600X600
CB19	ROADWAY	117.902	PONDING	YES	29	CATCHBASIN	YES	600X600
CB20	ROADWAY	118.859	FLOW_BY	YES	38	CATCHBASIN	YES	600X600
CB21	ROADWAY	118.859	FLOW_BY	YES	37	CATCHBASIN	YES	600X600
CB22	ROADWAY	119.265	FLOW_BY	YES	10	CATCHBASIN	YES	600X600
CB24	ROADWAY	119.227	PONDING	YES	25	CATCHBASIN	YES	600X600
CB25	ROADWAY	119.227	PONDING	YES	26	CATCHBASIN	YES	600X600
CB26	ROADWAY	118.8	FLOW_BY	YES	22	CATCHBASIN	YES	600X600
CB27	ROADWAY	118.799	FLOW_BY	YES	23	CATCHBASIN	YES	600X600
CB28	ROADWAY	119.985	FLOW_BY	YES	34	CATCHBASIN	YES	600X600
CB29	ROADWAY	119.981	FLOW_BY	YES	35	CATCHBASIN	YES	600X600
CB30	ROADWAY	121.027	FLOW_BY	YES	31	CATCHBASIN	YES	600X600
CB31	ROADWAY	121.02	FLOW_BY	YES	32	CATCHBASIN	YES	600X600

Table 5: Catchbasins_Rev8 (continued...)

NAME	LOCATION	RIM_ELEV	DRAINAGE_TYPE	ICD	GIS_UID	STRUCTURE_TYPE	MODELLED	STRUCT_SIZE
CB32	ROADWAY	120.759	FLOW_BY	YES	33	CATCHBASIN	YES	600X600
CB33	ROADWAY	119.201	FLOW_BY	YES	46	CATCHBASIN	YES	600X600
CB36	REARYARD	119.429	FLOW_BY	NO	104	CATCHBASIN	YES	600X600
CB43	REARYARD	118.871	FLOW_BY	NO	106	CATCHBASIN	YES	600X600
CB51	REARYARD	120.176	FLOW_BY	NO	41	CATCHBASIN	YES	600X600
CB57	REARYARD	116.17	PONDING	NO	43	CATCHBASIN	YES	600X600
CB58	REARYARD	118.68	FLOW_BY	NO	27	CATCHBASIN	YES	600X600
CB60	REARYARD	118.79	FLOW_BY	NO	13	CATCHBASIN	YES	600X600
CB63	REARYARD	116.788	FLOW_BY	NO	65	CATCHBASIN	NO	600X600
CB64	ROADWAY	121.201	PONDING	YES	95	CATCHBASIN	YES	600X600
CB65	ROADWAY	121.3	PONDING	YES	96	CATCHBASIN	YES	600X600
CB77	REARYARD	120.34	PONDING	NO	49	CATCHBASIN	YES	600X600
CB79	REARYARD	120.248	FLOW_BY	NO	75	CATCHBASIN	YES	600X600
CB83	REARYARD	117.647	PONDING	NO	12	CATCHBASIN	YES	600X600
CB87	REARYARD	116.252	PONDING	NO	53	CATCHBASIN	YES	600X600
CB92	REARYARD	122.464	FLOW_BY	YES	81	CATCHBASIN	YES	600X600
CB93	REARYARD	121.1	FLOW_BY	YES	80	CATCHBASIN	YES	600x600
CB96	REARYARD	119.595	FLOW_BY	YES	11	CATCHBASIN	YES	600X600
CB97	REARYARD	116.055	PONDING	NO	30	CATCHBASIN	YES	600X600
CB98	REARYARD	116.81	FLOW_BY	YES	163	CATCHBASIN	YES	600X600
CB99	ROADWAY	120.24	PONDING	YES	97	CATCHBASIN	YES	600X600
CB107	REARYARD	120.31	FLOW_BY	NO	87	CBE	NO	300 DIA
CB113	REARYARD	122.6	FLOW_BY	NO	102	CBE	NO	300 DIA
CB55	REARYARD	117.989	PONDING	NO	42	CBE	NO	300 DIA
CB59	REARYARD	119.11	PONDING	NO	60	CBE	NO	300 DIA
CB61	REARYARD	119.01	PONDING	NO	64	CBE	NO	300 DIA
CB72	REARYARD	120.233	PONDING	NO	71	CBE	NO	300 DIA
CB74	REARYARD	121.091	PONDING	NO	61	CBE	NO	300 DIA

Table 5: Catchbasins_Rev8 (continued...)

NAME	LOCATION	RIM_ELEV	DRAINAGE_TYPE	ICD	GIS_UID	STRUCTURE_TYPE	MODELLED	STRUCT_SIZE
CB75	REARYARD	121.76	PONDING	NO	47	CBE	NO	300 DIA
CB80	REARYARD	118.97	PONDING	NO	51	CBE	NO	300 DIA
CB81	REARYARD	118.2	PONDING	NO	58	CBE	NO	300 DIA
CB84	REARYARD	117.278	PONDING	NO	55	CBE	NO	300 DIA
CB94	REARYARD	119.651	PONDING	NO	62	CBE	NO	300 DIA
CB102	REARYARD	118.32	FLOW_BY	NO	93	CBT	NO	300 DIA
CB103	REARYARD	118.55	FLOW_BY	NO	92	CBT	NO	300 DIA
CB104	REARYARD	119.01	FLOW_BY	NO	91	CBT	NO	300 DIA
CB105	REARYARD	119.19	FLOW_BY	NO	90	CBT	NO	300 DIA
CB106	REARYARD	119.98	FLOW_BY	NO	89	CBT	NO	300 DIA
CB110	REARYARD	121.75	FLOW_BY	NO	86	CBT	NO	300 DIA
CB111	REARYARD	122.16	FLOW_BY	NO	85	CBT	NO	300 DIA
CB112	REARYARD	122.39	FLOW_BY	NO	84	CBT	NO	300 DIA
CB52	REARYARD	120.83	PONDING	NO	48	CBT	NO	300 DIA
CB53	REARYARD	119.93	PONDING	NO	50	CBT	NO	300 DIA
CB54	REARYARD	118.74	PONDING	NO	8	CBT	NO	300 DIA
CB56	REARYARD	116.268	PONDING	NO	18	CBT	NO	300 DIA
CB62	REARYARD	121.546	FLOW_BY	NO	82	CBT	NO	300 DIA
CB70	REARYARD	120.261	PONDING	NO	73	CBT	NO	300 DIA
CB71	REARYARD	120.148	PONDING	NO	72	CBT	NO	300 DIA
CB73	REARYARD	120.642	PONDING	NO	5	CBT	NO	300 DIA
CB76	REARYARD	120.759	FLOW_BY	NO	76	CBT	NO	300 DIA
CB78	REARYARD	120.535	SPLIT-POINT	NO	74	CBT	NO	300 DIA
CB82	REARYARD	117.721	PONDING	NO	57	CBT	NO	300 DIA
CB85	REARYARD	116.804	PONDING	NO	56	CBT	NO	300 DIA
CB86	REARYARD	116.265	PONDING	NO	54	CBT	NO	300 DIA
CB88	REARYARD	116.241	PONDING	NO	24	CBT	NO	300 DIA
CB89	REARYARD	116.308	PONDING	NO	52	CBT	NO	300 DIA

Table 5: Catchbasins_Rev8 (continued...)

NAME	LOCATION	RIM_ELEV	DRAINAGE_TYPE	ICD	GIS_UID	STRUCTURE_TYPE	MODELLED	STRUCT_SIZE
CB90	REARYARD	118.901	PONDING	NO	59	CBT	NO	300 DIA
CB91	REARYARD	118.919	PONDING	NO	63	CBT	NO	300 DIA
CB95	REARYARD	119.266	FLOW_BY	NO	9	CBT	NO	300 DIA
J01_MAJ	ROADWAY	116.16	FLOW_BY		154	DUMMY_NODE	YES	NONE
J02_MAJ	ROADWAY	119.847	FLOW_BY		155	DUMMY_NODE	YES	NONE
J03_MAJ	ROADWAY	120.24	FLOW_BY		156	DUMMY_NODE	YES	NONE
J04_MAJ	ROADWAY	120.41	FLOW_BY		157	DUMMY_NODE	YES	NONE
J05_MAJ	ROADWAY	119.28	FLOW_BY		158	DUMMY_NODE	YES	NONE
J06_MAJ	ROADWAY	118.28	FLOW_BY		175	DUMMY_NODE	YES	NONE
J07_MAJ	ROADWAY	118.64	FLOW_BY		159	DUMMY_NODE	YES	NONE
J08_MAJ	ROADWAY	119.73	FLOW_BY		160	DUMMY_NODE	YES	NONE
J09_MAJ	POND	116.15	FLOW_BY		174	DUMMY_NODE	YES	NONE
J10_MAJ	ROADWAY	115.86	FLOW_BY		153	DUMMY_NODE	YES	NONE
CB01_MAJ	ROADWAY	121.241	FLOW_BY		134	GRATE	YES	NONE
CB02_MAJ	ROADWAY	121.53	FLOW_BY		135	GRATE	YES	NONE
CB05_MAJ	ROADWAY	119.94	FLOW_BY		136	GRATE	YES	NONE
CB06_MAJ	ROADWAY	119.94	FLOW_BY		137	GRATE	YES	NONE
CB07_MAJ	ROADWAY	119.52	FLOW_BY		138	GRATE	YES	NONE
CB08_MAJ	ROADWAY	119.52	FLOW_BY		139	GRATE	YES	NONE
CB120_MAJ	ROADWAY	120.49	FLOW_BY		140	GRATE	YES	NONE
CB121_MAJ	ROADWAY	120.49	FLOW_BY		141	GRATE	YES	NONE
CB20_MAJ	ROADWAY	119.15	FLOW_BY		142	GRATE	YES	NONE
CB21_MAJ	ROADWAY	119.15	FLOW_BY		143	GRATE	YES	NONE
CB22_MAJ	ROADWAY	119.55	FLOW_BY		144	GRATE	YES	NONE
CB26_MAJ	ROADWAY	119.04	FLOW_BY		145	GRATE	YES	NONE
CB27_MAJ	ROADWAY	119.04	FLOW_BY		146	GRATE	YES	NONE
CB28_MAJ	ROADWAY	120.4	FLOW_BY		152	GRATE	YES	NONE
CB29_MAJ	ROADWAY	120.27	FLOW_BY		147	GRATE	YES	NONE

Table 5: Catchbasins_Rev8 (continued...)

NAME	LOCATION	RIM_ELEV	DRAINAGE_TYPE	ICD	GIS_UID	STRUCTURE_TYPE	MODELLED	STRUCT_SIZE
CB30_MAJ	ROADWAY	121.3	FLOW_BY		148	GRATE	YES	NONE
CB31_MAJ	ROADWAY	121.3	FLOW_BY		149	GRATE	YES	NONE
CB32_MAJ	ROADWAY	121.05	FLOW_BY		150	GRATE	YES	NONE
CB33_MAJ	ROADWAY	119.49	FLOW_BY		151	GRATE	YES	NONE
200	POND	116.024	FLOW_BY	NO	107	MANHOLE	YES	2400 DIA
201	ROADWAY	115.95	FLOW_BY	NO	108	MANHOLE	YES	1500X1800
203	ROADWAY	118.117	FLOW_BY	NO	109	MANHOLE	YES	1200 DIA
204	ROADWAY	118.376	FLOW_BY	NO	110	MANHOLE	YES	1200 DIA
205	ROADWAY	118.495	FLOW_BY	NO	111	MANHOLE	YES	1200 DIA
206	ROADWAY	118.761	FLOW_BY	NO	112	MANHOLE	YES	1200 DIA
207	ROADWAY	118.913	FLOW_BY	NO	113	MANHOLE	YES	1200 DIA
208	ROADWAY	119.21	FLOW_BY	NO	114	MANHOLE	YES	1200 DIA
209	ROADWAY	119.616	FLOW_BY	NO	115	MANHOLE	YES	1200 DIA
210	ROADWAY	120.112	FLOW_BY	NO	116	MANHOLE	YES	1200 DIA
211	ROADWAY	120.19	FLOW_BY	NO	117	MANHOLE	YES	1200 DIA
212	ROADWAY	120.586	FLOW_BY	NO	118	MANHOLE	YES	1200 DIA
213	ROADWAY	122.106	FLOW_BY	NO	119	MANHOLE	YES	1200 DIA
215	ROADWAY	119.075	FLOW_BY	NO	120	MANHOLE	YES	1200 DIA
216	ROADWAY	119.735	FLOW_BY	NO	121	MANHOLE	YES	1200 DIA
217	ROADWAY	119.902	FLOW_BY	NO	122	MANHOLE	YES	1200 DIA
218	ROADWAY	120.891	FLOW_BY	NO	123	MANHOLE	YES	1200 DIA
219	ROADWAY	121.174	FLOW_BY	NO	124	MANHOLE	YES	1200 DIA
220	ROADWAY	121.049	FLOW_BY	NO	125	MANHOLE	YES	1200 DIA
221	ROADWAY	121.134	FLOW_BY	NO	126	MANHOLE	YES	1200 DIA
223	REARYARD	118.67	CLOSED-LID	NO	161	MANHOLE	YES	1200 DIA
225	ROADWAY	118.689	FLOW_BY	NO	127	MANHOLE	YES	1200 DIA
226	ROADWAY	118.63	FLOW_BY	NO	128	MANHOLE	YES	1200 DIA
227	ROADWAY	119.468	FLOW_BY	NO	129	MANHOLE	YES	1200 DIA

Table 5: Catchbasins_Rev8 (continued...)

NAME	LOCATION	RIM_ELEV	DRAINAGE_TYPE	ICD	GIS_UID	STRUCTURE_TYPE	MODELLED	STRUCT_SIZE
228	ROADWAY	119.445	FLOW_BY	NO	130	MANHOLE	YES	1200 DIA
229	ROADWAY	120.114	FLOW_BY	NO	131	MANHOLE	YES	1200 DIA
230	ROADWAY	121.249	FLOW_BY	NO	132	MANHOLE	YES	1200 DIA
231	REARYARD	118.04	FLOW_BY	NO	94	MANHOLE	NO	1200 DIA
232	REARYARD	117.107	FLOW_BY	NO	88	MANHOLE	NO	1200 DIA
78511	ROADWAY	116.18	FLOW_BY	NO	133	MANHOLE	YES	1200 DIA
MH35	ROADWAY	119.847	FLOW_BY	YES	36	MANHOLE	YES	1200 DIA
MH36	ROADWAY	119.28	FLOW_BY	YES	77	MANHOLE	YES	1200 DIA
MH37	ROADWAY	119.976	FLOW_BY	YES	70	MANHOLE	YES	1200 DIA
MH38	ROADWAY	120.132	FLOW_BY	YES	69	MANHOLE	YES	1200 DIA
MH39	ROADWAY	120.182	FLOW_BY	YES	68	MANHOLE	YES	1200 DIA
MH40	ROADWAY	118.863	FLOW_BY	YES	78	MANHOLE	YES	1200 DIA
MH41	ROADWAY	118.296	FLOW_BY	YES	66	MANHOLE	YES	1200 DIA
MH42	ROADWAY	118.59	FLOW_BY	YES	67	MANHOLE	YES	1200 DIA
MH43	ROADWAY	118.766	FLOW_BY	YES	79	MANHOLE	YES	1200 DIA
MH44	ROADWAY	118.759	FLOW_BY	YES	83	MANHOLE	YES	1200 DIA
MH45	ROADWAY	118.14	FLOW_BY	YES	162	MANHOLE	YES	1200 DIA
OF_Bandlier_Major	OFFSITE	115.6	FLOW_BY	NO	171	OUTFALL	YES	NONE
OF_Kimpton	OFFSITE	120.276	FLOW_BY	NO	172	OUTFALL	YES	NONE
OF_Samantha	OFFSITE	118.6	FLOW_BY	NO	173	OUTFALL	YES	NONE
ROOF_4_STOREY_BLDG_A	ROOF	124.85	PONDING	YES	166	ROOF	YES	NONE
ROOF_4_STOREY_BLDG_B	ROOF	124.85	PONDING	YES	167	ROOF	YES	NONE
ROOF_4_STOREY_BLDG_C	ROOF	124.85	PONDING	YES	168	ROOF	YES	NONE
ROOF_4_STOREY_BLDG_D	ROOF	124.85	PONDING	YES	169	ROOF	YES	NONE
ROOF_4_STOREY_BLDG_E	ROOF	124.85	PONDING	YES	170	ROOF	YES	NONE
ROOF_9_STOREY	ROOF	124.85	PONDING	YES	165	ROOF	YES	NONE
POND	POND	117	PONDING	YES	164	SWM_POND	YES	NONE

Appendix H – Consultation / Correspondence

Email on Water System Boundary Conditions

Email Received from MCVA on Stormwater Management Requirements

Boundary Conditions
6171 Hazeldean

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	240	4.00
Maximum Daily Demand	594	9.90
Peak Hour	1,302	21.70
Fire Flow Demand #1	17,000	283.33

Location

Results

Connection 1 – Hazeldean Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.7	57.0
Peak Hour	156.7	51.3
Max Day plus Fire 1	152.8	45.8

Ground Elevation = 120.6 m

Connection 2 – Samantha Eastop Ave.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.7	59.5
Peak Hour	156.6	53.6
Max Day plus Fire 1	147.8	41.1

Ground Elevation = 118.9 m

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.

Moe Ghadban

From:	Matt Craig <mcraig@mvc.on.ca>
Sent:	Thursday, April 30, 2020 11:08 AM
To:	Moe Ghadban
Cc:	Bruce Thomas; Jason Fitzpatrick
Subject:	RE: Request for SWM Criteria for 6171 Hazeldean Road
Attachments:	jacksontrails-stormwaterdesign.pdf

Hi Moe attached is the report – an invoice of $50.00 will follow, along with my previous comments please consider:

Development should follow the SWM criteria set out in the Feedmill Creek SWM Criteria Study. There are runoff volume capture requirements for retention control (LIDs) based on 5 or 10mm rainfall depend on the drainage area specified in the report.

- Please check the Carp subwatershed study for other requirements,
- Feedmill Creek has some level of temperature mitigation requirement as the creek has tolerant Coldwater fisheries.
- MVCA completes a stream watch survey of Feedmill in 2015. The report is here: http://mvc.on.ca/wp-content/uploads/2015/02/CSW2015_Feedmill-Creek-Final-Report.pdf

Regards

Matt Craig | Manager of Planning and Regulations | Mississippi Valley Conservation Authority

www.mvc.on.ca |t. 613 253 0006 ext. 226| f. 613 253 0122 | mcraig@mvc.on.ca

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From: Moe Ghadban <Moe.Ghadban@exp.com>
Sent: April 24, 2020 4:05 PM
To: Matt Craig <mcraig@mvc.on.ca>
Cc: Bruce Thomas <bruce.thomas@exp.com>; Jason Fitzpatrick <jason.fitzpatrick@exp.com>
Subject: Request for SWM Criteria for 6171 Hazeldean Road

Hi Matt,

We are preparing a site servicing and stormwater report for site plan application for a proposed subdivision at 6171 Hazeldean Road. The proposed subdivision consists of twenty (20) single homes, one-hundred and fifty-four (154) townhomes, five (5) 3-storey condominium buildings (36 units each), and a 9-storey mixed use rental building (160 units). Please see the attached site plan. As the site is within the MVCA's jurisdiction we are requesting CA's clarification on the stormwater management requirements.

In the City of Ottawa's pre-consultation notes, they mentioned that quality control will be provided in the Jackson Trails SWM Pond. The "Jackson Trails Stormwater Management Design Brief" dated June 2006, an Enhanced Level of Protection (80 % removal of Total Suspended Solids).

As required by the City, as noted in the pre-consultation meeting, we are emailing the Conservation Authority to provide any additional water quality requirements for the proposed development.

Also, the City of Ottawa was not able to locate the following reports:

- Feedmill Creek Stormwater Management Criteria Study Draft Final Report (July 2016, JFSA and Coldwater Consulting Ltd.)
- Jackson Trails Stormwater Management Design Brief" dated June 2006

If you have either of those reports on file, could you please share them with us?

Thank you for your review and input.

Regards,

Moe Ghadban, P.Eng
EXP | Engineering Designer
t : +1.613.688.1899 | m : +1.613.808.4089 | e : moe.ghadban@exp.com
2650 Queensview Drive
Suite 100
Ottawa, ON K2B 8H6
CANADA

Appendix I – Background Information

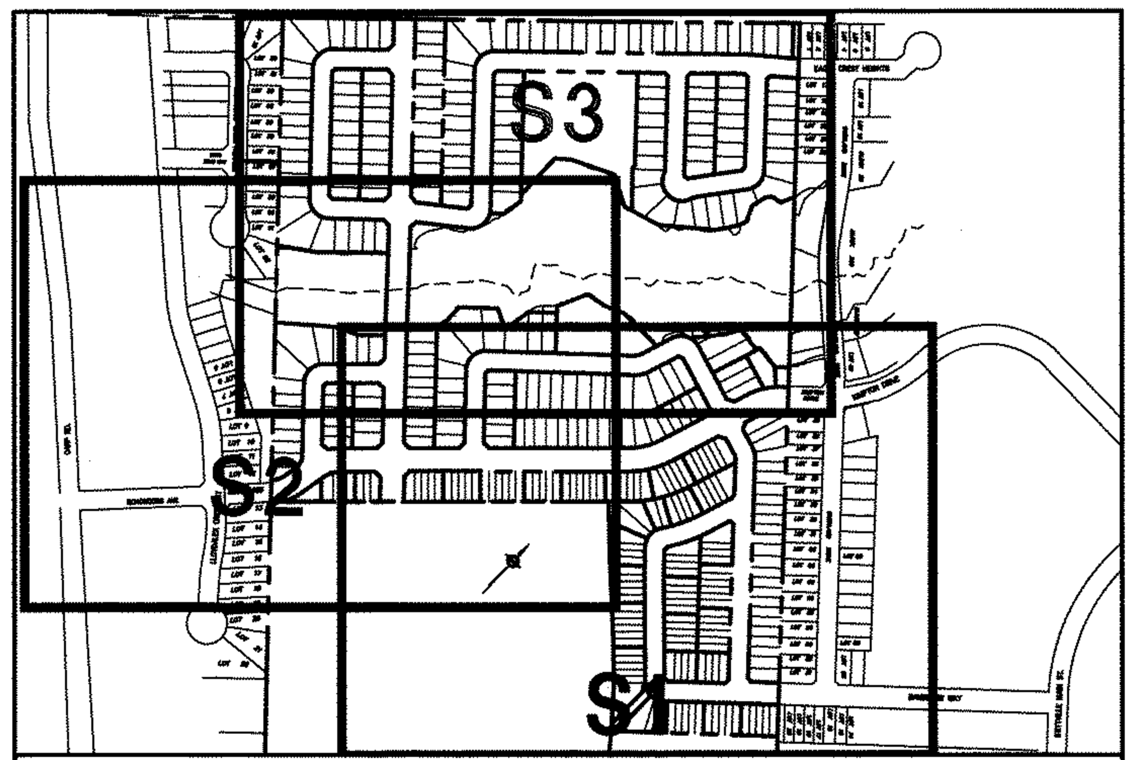
Excerpt pages from Potters Key Subdivision Drawings, Atrel Engineering. (10 pages)

Excerpt pages from 'Stormwater Management, Watermain, Storm Sewer and Sanitary Sewer Design Brief, Potter's Key Subdivision, Atrel Eng. (Cover + 5 page)

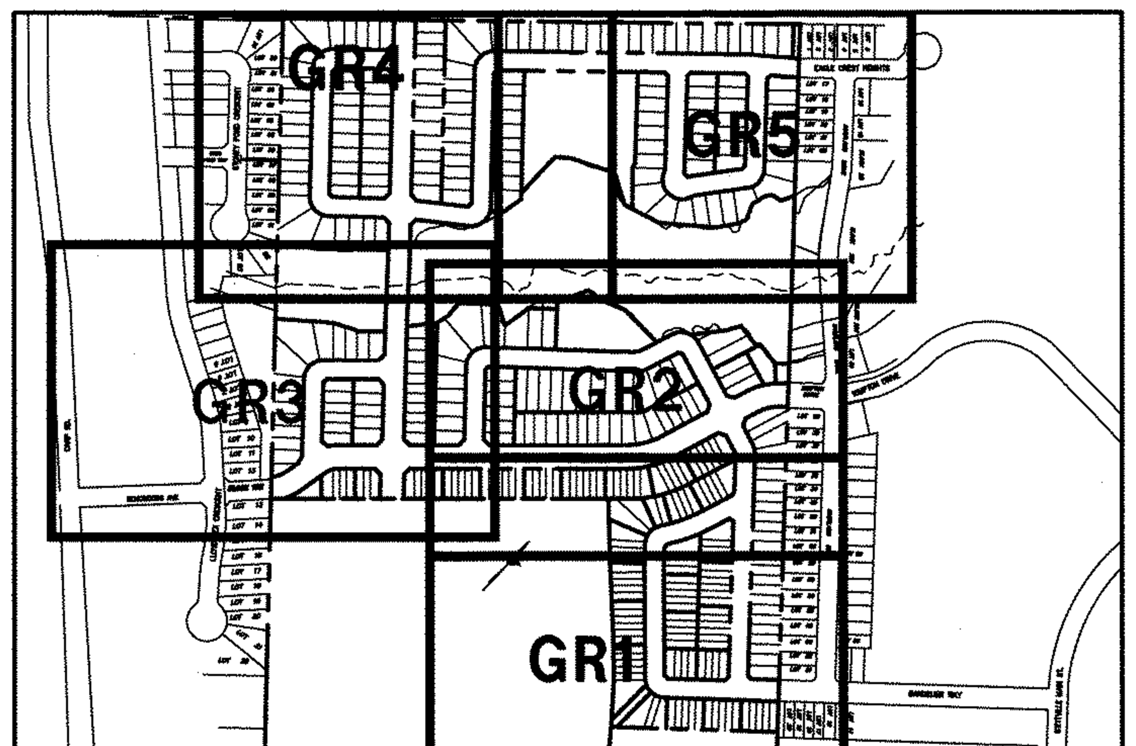
Excerpt pages from "Feedmill Creek Stormwater Management Criteria Study". (Cover + 1 page)

Excerpt pages from "Jackson Trails Stormwater Management Design Brief". (Cover + 2 pages)

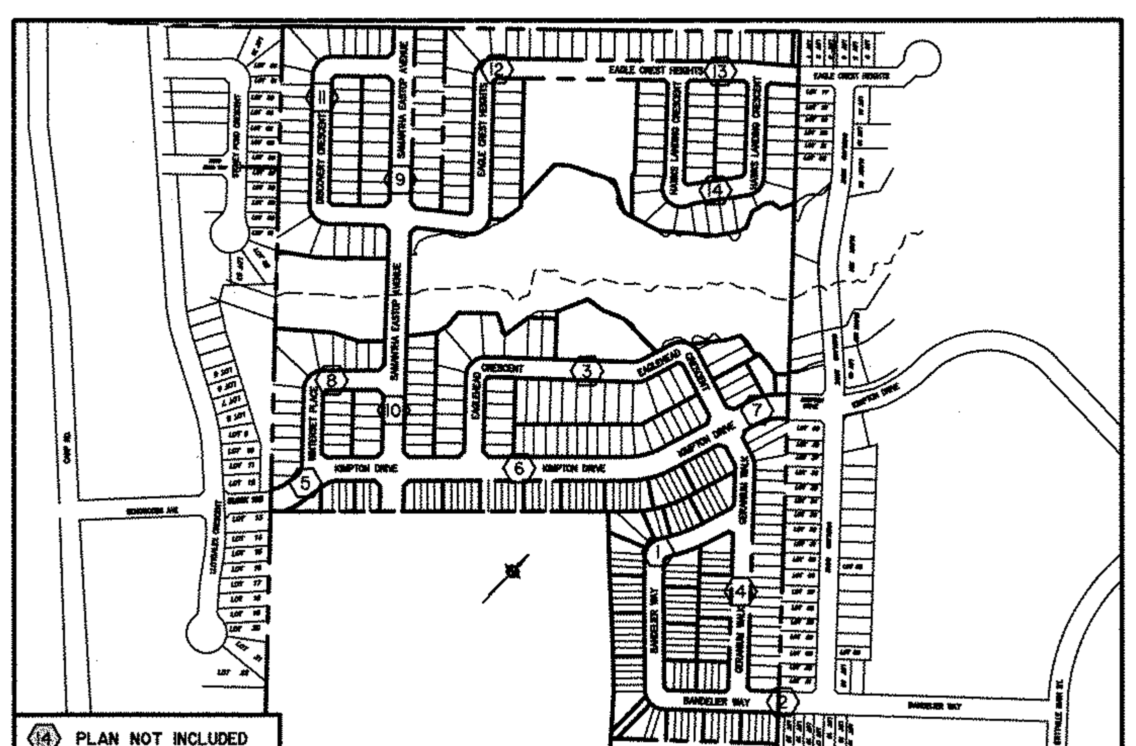
Excerpt pages from "Carp River Watershed / Subwatershed Study" (Cover + 2 pages)



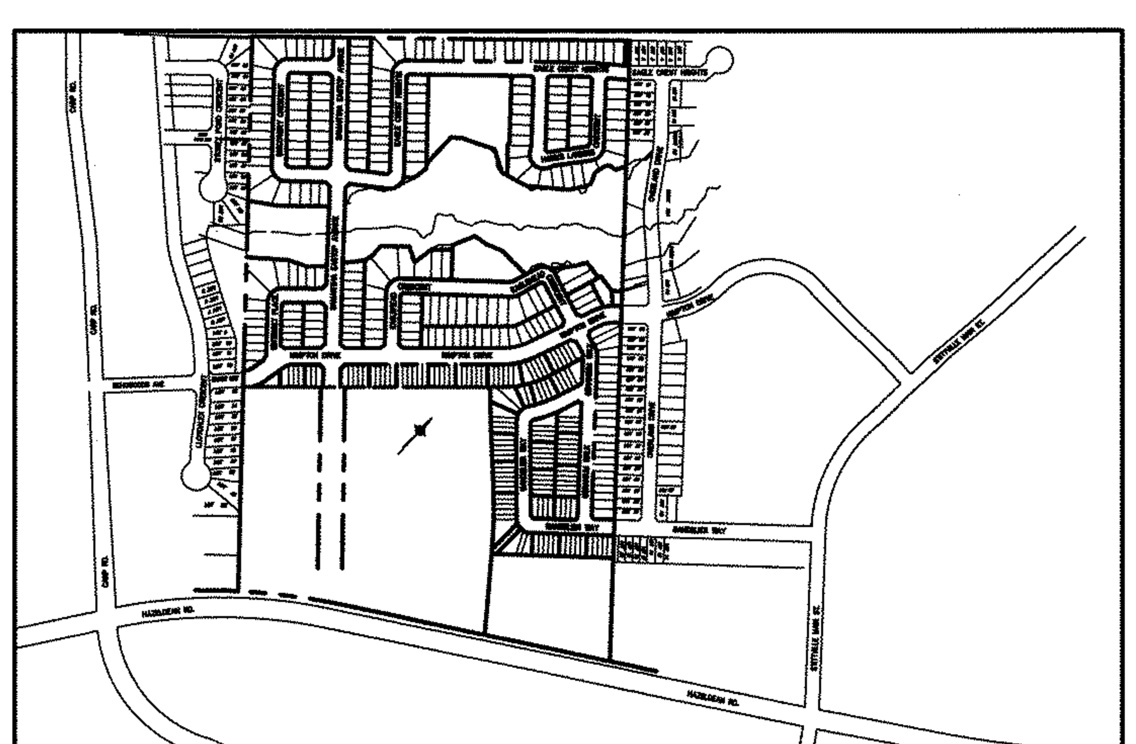
SITE SERVICING KEY PLAN (N.T.S.)



GRADING KEY PLAN (N.T.S.)



PROFILE KEY PLAN (N.T.S.)


STREET MAP KEY PLAN (N.T.S.)

minto

CITY OF
VILLE D' OTTAWA

SITE SERVICING PLAN

POTTER'S KEY SUBDIVISION

CONTRACT NO. 131003

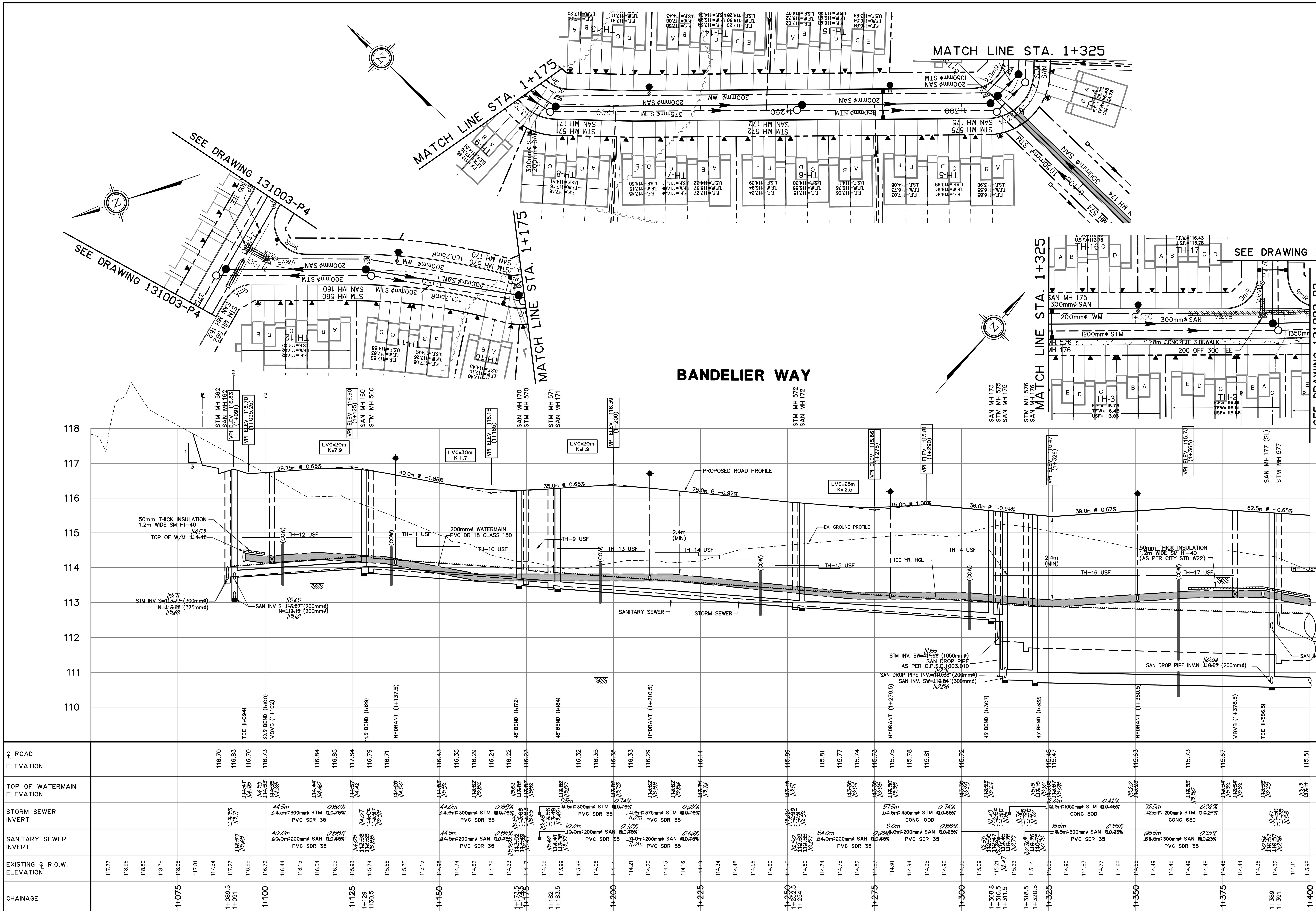
ATREL Engineering Ltd Ltée
Engineers - Ingénieurs

SUBMITTED FOR APPROVAL ONLY APRIL 12/2017

REVIEWED BY DEVELOPMENT REVIEW BRANCH
Signed [signature]
Date May 10 2017
Plan Number 17314

D07-16-14-0013

Dwg# 17314



LEGEND:

(COW) CUT OFF WALL (1.5m WIDE) AS PER CITY STANDARD S8

(SL) SAFETY LANDING

OUTSIDE PROPOSED DEVELOPMENT

TEST PIT REFUSAL

NOTES:

1. WATERMAIN CROSSING BELOW AND OVER SEWERS AS PER CITY STD W25 AND STD W25.2 RESPECTIVELY.
2. THERMAL INSULATION OF WATERMAIN NEAR OPEN STRUCTURES AS PER CITY STD W23.

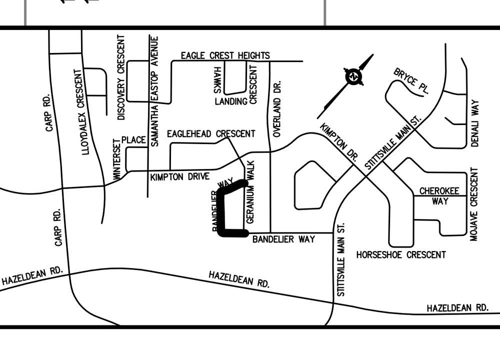
RECORD DRAWING

JANUARY 03, 2018

THIS "RECORD DRAWING" HAS BEEN PREPARED BASED ON INSPECTIONS AND OBSERVATIONS UNDERTAKEN BY FIELD STAFF DURING KEY STAGES OF CONSTRUCTION AND ON INFORMATION SUBMITTED, IN PART BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, ATREL ENGINEERING LTD IS NOT RESPONSIBLE FOR ITS ACCURACY, OR FOR ERRORS OR OMISSIONS THAT MAY HAVE BEEN INCORPORATED INTO THIS DRAWING AS A RESULT.

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

minto



No.	REVISION △-APPLIES WHEN DRAWING MODIFIED	DATE	BY
4	AS PER CITY COMMENTS	DEC. 06/16	JMD
5	FOR ORDERING	FEB. 3/17	JMD
6	AS PER CITY COMMENTS	FEB. 9/17	JMD
7	ISSUED FOR TENDER	FEB. 23/17	JMD
8	ISSUED FOR CONSTRUCTION	MAR. 31/17	JMD
9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD
10	ISSUED FOR ROAD CONSTRUCTION	MAY 17/17	JMD
11	REVISED COMPOSITE UTILITY PLAN	JUNE 06/17	AGS
12	AS PER CITY COMMENTS	AUG. 02/17	AGS
13	RECORD DRAWINGS	JAN. 03/18	AGS

SCALE
1:500 HORIZONTAL
1:50 VERTICAL

DESIGN VLL
CHECKED AGS
DRAWN MAL
CHECKED AGS
APPROVED AGS

ATREL Engineering Ltd. Ltée
Engineers - Ingénieurs
1-2884 CHAMBERLAND STREET, ROCKLAND, ONTARIO K4K 1M6
TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

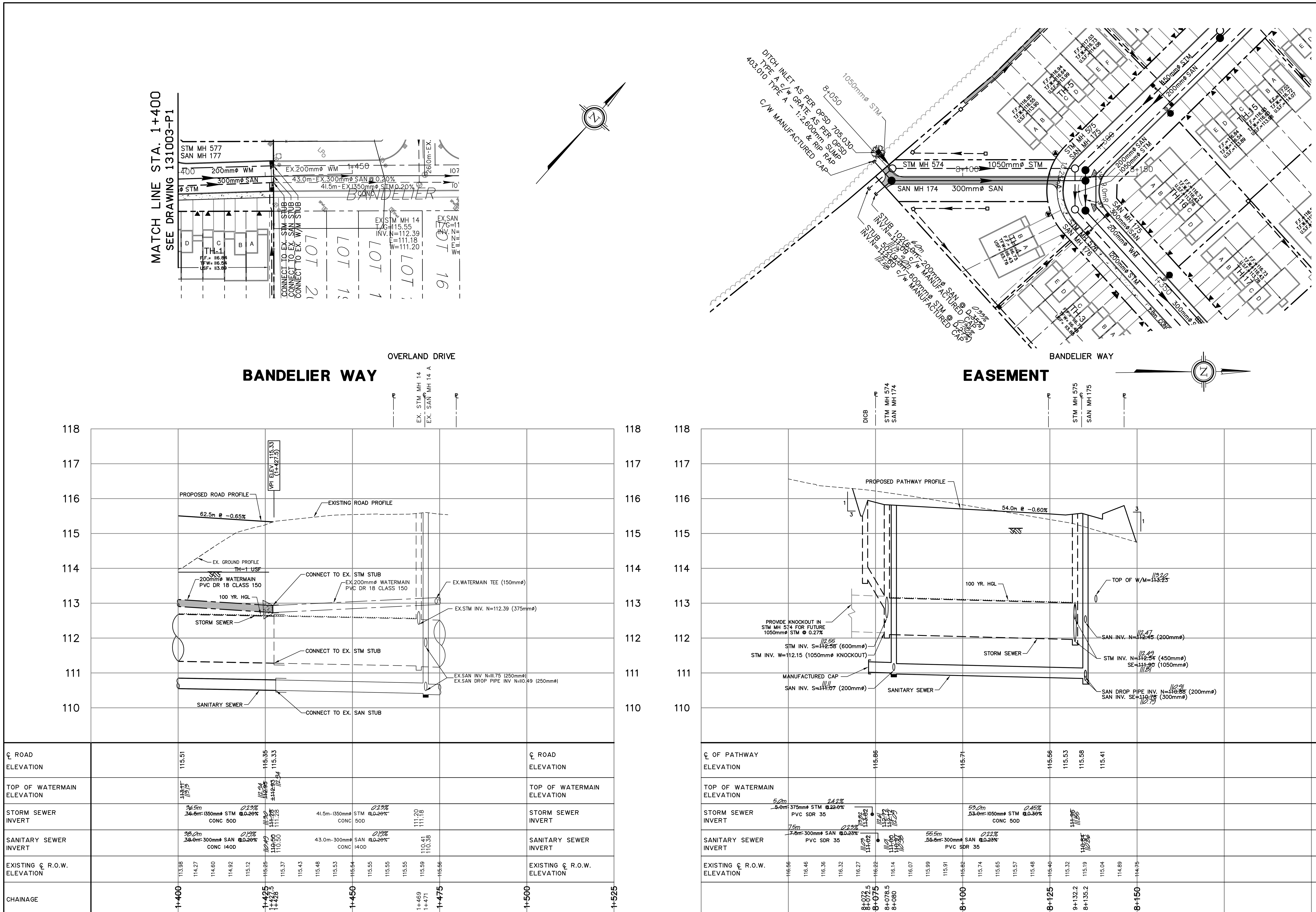
MINTO COMMUNITIES INC.

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014

PLAN AND PROFILE
BANDELIER WAY
STATION 1+075 TO STATION 1+400

DRAWING No. 131003-P1

D07-16-14-0013



LEGEND:

(COW) CUT OFF WALL (1.5m WIDE) AS PER CITY STANDARD S8

(SL) SAFETY LANDING

OUTSIDE PROPOSED DEVELOPMENT

TEST PIT REFUSAL

NOTES:

1. WATERMAIN CROSSING BELOW AND OVER SEWERS AS PER CITY STD W25 AND STD W25.2 RESPECTIVELY.
2. THERMAL INSULATION OF WATERMAIN NEAR OPEN STRUCTURES AS PER CITY STD W23.

RECORD DRAWING

JANUARY 03, 2018

THIS "RECORD DRAWING" HAS BEEN PREPARED BASED ON INSPECTIONS AND OBSERVATIONS UNDERTAKEN BY FIELD STAFF DURING KEY STAGES OF CONSTRUCTION AND ON INFORMATION SUBMITTED, IN PART BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, ATREL ENGINEERING LTD IS NOT RESPONSIBLE FOR ITS ACCURACY, OR FOR ERRORS OR OMISSIONS THAT MAY HAVE BEEN INCORPORATED INTO THIS DRAWING AS A RESULT.

NOTE:
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5	ISSUED FOR CONSTRUCTION	MAR. 3/17	JMD
6	SUBMITTED FOR APPROVAL	APR. 12/17	JMD
7	ISSUED FOR ROAD CONSTRUCTION	MAY 17/17	AGS
8	REVISED COMPOSITE UTILITY PLAN	JUNE 06/17	AGS
9	AS PER CITY COMMENTS	AUG. 02/17	AGS
10	*RECORD DRAWINGS*	JAN. 03/18	AGS

SCALE
1:500 HORIZONTAL
1:50 VERTICAL

DESIGN VLL
CHECKED AGS
DRAWN MAL
CHECKED AGS
APPROVED AGS

ATREL Engineering Ltd. Ltée
Engineers - Ingénieurs
1-2884 CHAMBERLAND STREET, ROCKLAND, ONTARIO K4K 1M6
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CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014

PLAN AND PROFILE
BANDELIER WAY
STATION 1+400 TO STATION 1+725

DRAWING No. 131003-P2

D07-16-14-0013

LEGEND:

(COW) CUT OFF WALL (1.5m WIDE) AS PER CITY STANDARD S8

(SL) SAFETY LANDING

OUTSIDE PROPOSED DEVELOPMENT

TEST PIT REFUSAL

NOTES:

1. WATERMAIN CROSSING BELOW AND OVER SEWERS AS PER CITY STD W25 AND STD W25.2 RESPECTIVELY.
2. THERMAL INSULATION OF WATERMAIN NEAR OPEN STRUCTURES AS PER CITY STD W23.

RECORD DRAWING

JANUARY 03, 2018

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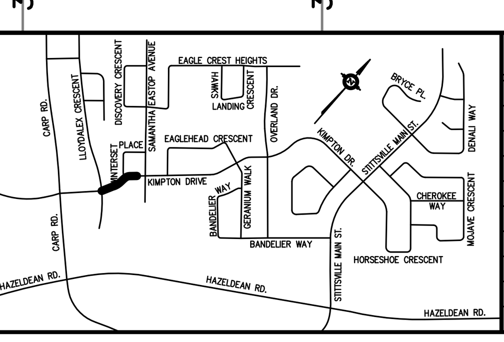

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9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD
10	ISSUED FOR ROAD CONSTRUCTION	MAY 17/17	JMD
11	REVISED COMPOSITE UTILITY PLAN	JUNE 06/17	AGS
12	AS PER CITY COMMENTS	AUG. 02/17	AGS
13	*RECORD DRAWINGS*	JAN. 03/18	AGS

SCALE
1:500 HORIZONTAL (5m 0 15m)
1:50 VERTICAL (0.5m 0 1.5m)

DESIGN	VLL
CHECKED	AGS
DRAWN	PNC
CHECKED	AGS
APPROVED	AGS

ATREL Engineering Ltd. Ltée
Engineers - Ingénieurs
1-2884 CHAMBERLAND STREET, ROCKLAND, ONTARIO K4K 1M6
TEL.: (613) 446-7423

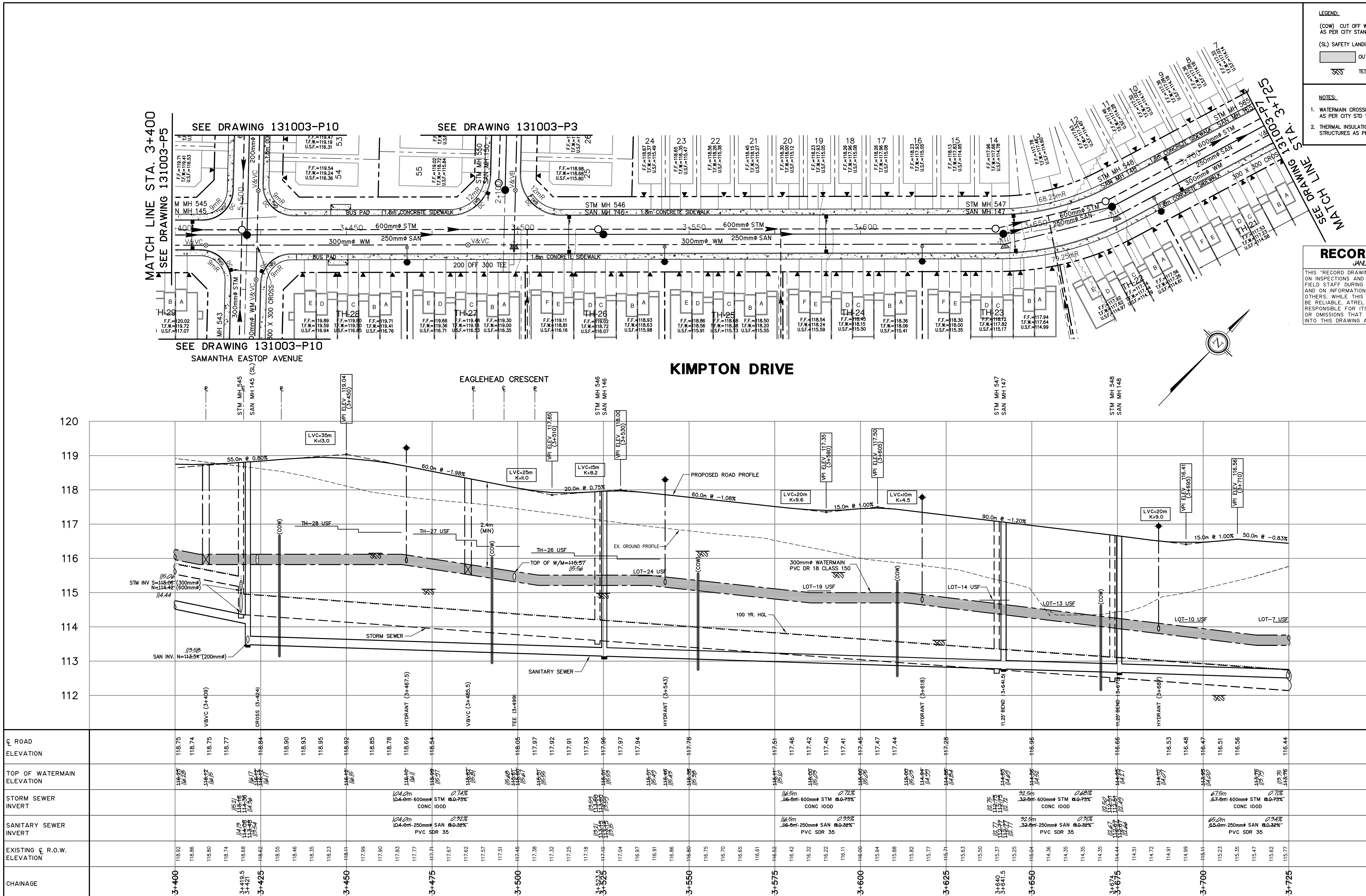
CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

PLAN AND PROFILE
KIMPTON DRIVE
STATION 3+075 TO STATION 3+400

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014
DRAWING No. 131003-P5

D07-16-14-0013



LEGEND:

(COW) CUT OFF WALL (1.5m WIDE) AS PER CITY STANDARD S8

(SL) SAFETY LANDING

OUTSIDE PROPOSED DEVELOPMENT

TEST PIT REFUSAL

NOTES:

1. WATERMAIN CROSSING BELOW AND OVER SEWERS AS PER CITY STD W25 AND STD W25.2 RESPECTIVELY.
2. THERMAL INSULATION OF WATERMAIN NEAR OPEN STRUCTURES AS PER CITY STD W23.

RECORD DRAWING

JANUARY 03, 2018

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8	ISSUED FOR CONSTRUCTION	MAR. 31/17	JMD
9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD
10	ISSUED FOR ROAD CONSTRUCTION	MAY 17/17	JMD
11	REVISED COMPOSITE UTILITY PLAN	JUNE 06/17	AGS
12	AS PER CITY COMMENTS	AUG. 02/17	AGS
13	*RECORD DRAWINGS*	JAN. 03/18	AGS

SCALE
1:500 HORIZONTAL (5m 0 15m)
1:50 VERTICAL (0.5m 0 1.5m)

DESIGN VLL
CHECKED AGS
DRAWN PNC
CHECKED AGS
APPROVED AGS

ATREL Engineering Ltd Ltée
Engineers - Ingénieurs
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TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014

PLAN AND PROFILE
KIMPTON DRIVE
STATION 3+400 TO STATION 3+725

DRAWING No. 131003-P6

D07-16-14-0013

LEGEND

Symbol	Description
117	CONTOURS AT 0.25m INTERVAL
116.81	EXISTING SPOT ELEVATION
115.43 / 115.75	PROPOSED ELEVATION EXISTING GRADE
115.89	PROPOSED ELEVATION
117.16	PROPOSED ELEVATION
VPI 115.73	PROPOSED VPI ELEVATION
115.26 (boxed)	PROPOSED ELEVATION
2.0%	% SLOPE PROPOSED DIRECTION OF FLOW
←	PROPOSED DIRECTION OF FLOW
115.54(s)	PROPOSED SWALE ELEVATION
T/G=115.10 INV=113.70	PROPOSED TOP OF GRATE ELEVATION PROPOSED INVERT ELEVATION
T/W=115.74 B/W=115.30	PROPOSED TOP OF RETAINING WALL PROPOSED BOTTOM OF RETAINING WALL
F.F.=118.46 TFW=118.16 USF/F=115.58	PROPOSED FINISH FLOOR ELEVATION TOP OF FOUNDATION WALL PROPOSED UNDERSIDE OF FOOTING AT FRONT OF HOUSE
4R–WW 5R–SD 7R–LOD	NUMBER OF RISERS WITH WINDOW WELL NUMBER OF RISERS WITH SMALL DECK NUMBER OF RISERS WITH LOOK OUT DECK
*	ADDITIONAL FRONT RISER(S)
■	PROPOSED CATCHBASIN
—□—	PROP. HDPE CB AS PER CITY OF OTTAWA STANDARD S30.
■—	PROPOSED REARYARD CATCHBASIN
⇦	MAJOR DRAINAGE SYSTEM
	TERRACING 3:1 (MAXIMUM SLOPE)
HP •	HYDRO POLES
	OUTSIDE PROPOSED DEVELOPMENT
EASEMENT	REFER TO DRAWING 131003–S1
DC	DEPRESSED CURB

- BUILDERS SHALL INSULATE TO COMPENSATE IF COVER IS LESS THAN 1.5m. (REFER TO SOILS REPORT)
- A GEOTECHNICAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO IS TO INSPECT ALL SUBGRADE SURFACES FOR FOOTINGS AND PAVEMENT STRUCTURES PRIOR TO CONSTRUCTION
- FOR SITE BENCHMARK LOCATION AND ELEVATION REFER TO THE GENERAL PLAN OF SERVICES (131003–S1)

REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed SK

Date August 11, 2017

Plan Number

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

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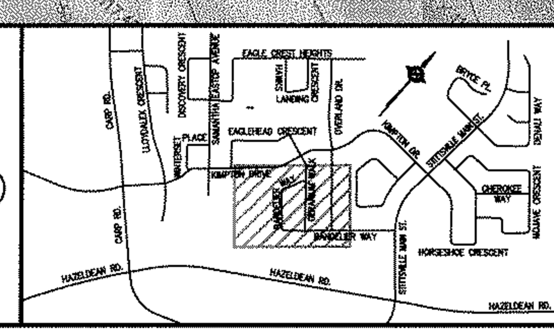

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3	ISSUED FOR TENDER	OCT. 31/16	JMD
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8	ISSUED FOR CONSTRUCTION	MAR. 31/17	JMD
9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD
10	ISSUED FOR ROAD CONSTRUCTION	MAY 17/17	JMD
11	REVISED COMPOSITE UTILITY PLAN	JUNE 06/17	AGS
12	AS PER CITY COMMENTS	AUG. 02/17	AGS

SCALE 1:500 (5m 0 15m) HORIZONTAL

DESIGN	AGS
CHECKED	JMD
DRAWN	SAB
CHECKED	AGS
APPROVED	JMD

LICENSED PROFESSIONAL ENGINEER — A.G.Y. SAUVE 100142393 — Aug. 2, 2017 — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — J.M.J.DECOEUR — Aug 2/2017 — PROVINCE OF ONTARIO

ATREL Engineering Ltd Ltée
Engineers - Ingénieurs
1-2864 CHAMBERLAND STREET, ROCKLAND, ONTARIO K4K 1M6
TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

PLAN
GRADING PLAN

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014
DRAWING No. 131003-GR1

D07-16-14-0013

City Plan No. 17314

LEGEND

117	CONTOURS AT 0.25m INTERVAL
116.81	EXISTING SPOT ELEVATION
116.43 / 115.75	PROPOSED ELEVATION EXISTING GRADE
115.69	PROPOSED ELEVATION
117.16	PROPOSED ELEVATION
VPI 115.73	PROPOSED VPI ELEVATION
115.26	PROPOSED ELEVATION
2.0%	% SLOPE PROPOSED DIRECTION OF FLOW
←	PROPOSED DIRECTION OF FLOW
115.54(s)	PROPOSED SWALE ELEVATION
T/G=115.10 INV=113.70	PROPOSED TOP OF GRATE ELEVATION PROPOSED INVERT ELEVATION
T/W=115.74 B/W=115.30	PROPOSED TOP OF RETAINING WALL PROPOSED BOTTOM OF RETAINING WALL
F.F.=118.46	PROPOSED FINISH FLOOR ELEVATION
TFW=118.16	TOP OF FOUNDATION WALL
USF/F=115.58	PROPOSED UNDERSIDE OF FOOTING AT FRONT OF HOUSE
4R-WW	NUMBER OF RISERS WITH WINDOW WELL
5R-SD	NUMBER OF RISERS WITH SMALL DECK
7R-LOD	NUMBER OF RISERS WITH LOOK OUT DECK
*	ADDITIONAL FRONT RISER(S)
■	PROPOSED CATCHBASIN
—□—	PROP. HDPE CB AS PER CITY OF OTTAWA STANDARD S30.
■—	PROPOSED REARYARD CATCHBASIN
⇦	MAJOR DRAINAGE SYSTEM
	TERRACING 3:1 (MAXIMUM SLOPE)
HP •	HYDRO POLES
	OUTSIDE PROPOSED DEVELOPMENT
EASEMENT	REFER TO DRAWING 131003-S1
DC	DEPRESSED CURB

- BUILDERS SHALL INSULATE TO COMPENSATE IF COVER IS LESS THAN 1.5m. (REFER TO SOILS REPORT)
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REVIEWED BY DEVELOPMENT REVIEW BRANCH

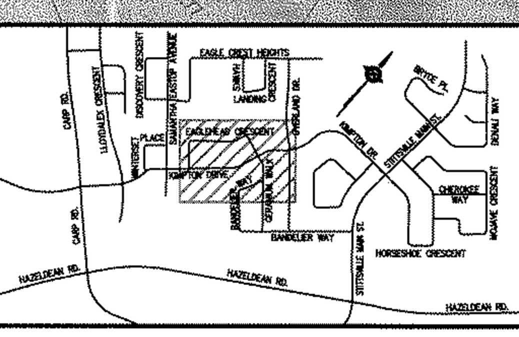
Signed SK

Date August 11, 2017

Plan Number

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

minto



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9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD
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11	REVISED COMPOSITE UTILITY PLAN	JUNE 06/17	AGS
12	AS PER CITY COMMENTS	AUG. 02/17	AGS

SCALE 1:500 HORIZONTAL (5m 0 15m)

DESIGN	AGS
CHECKED	JMD
DRAWN	SAB
CHECKED	AGS
APPROVED	JMD

LICENSED PROFESSIONAL ENGINEER — A. G. Y. SAUVE — 100142393 — Aug. 2, 2017 — PROVINCE OF ONTARIO

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CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

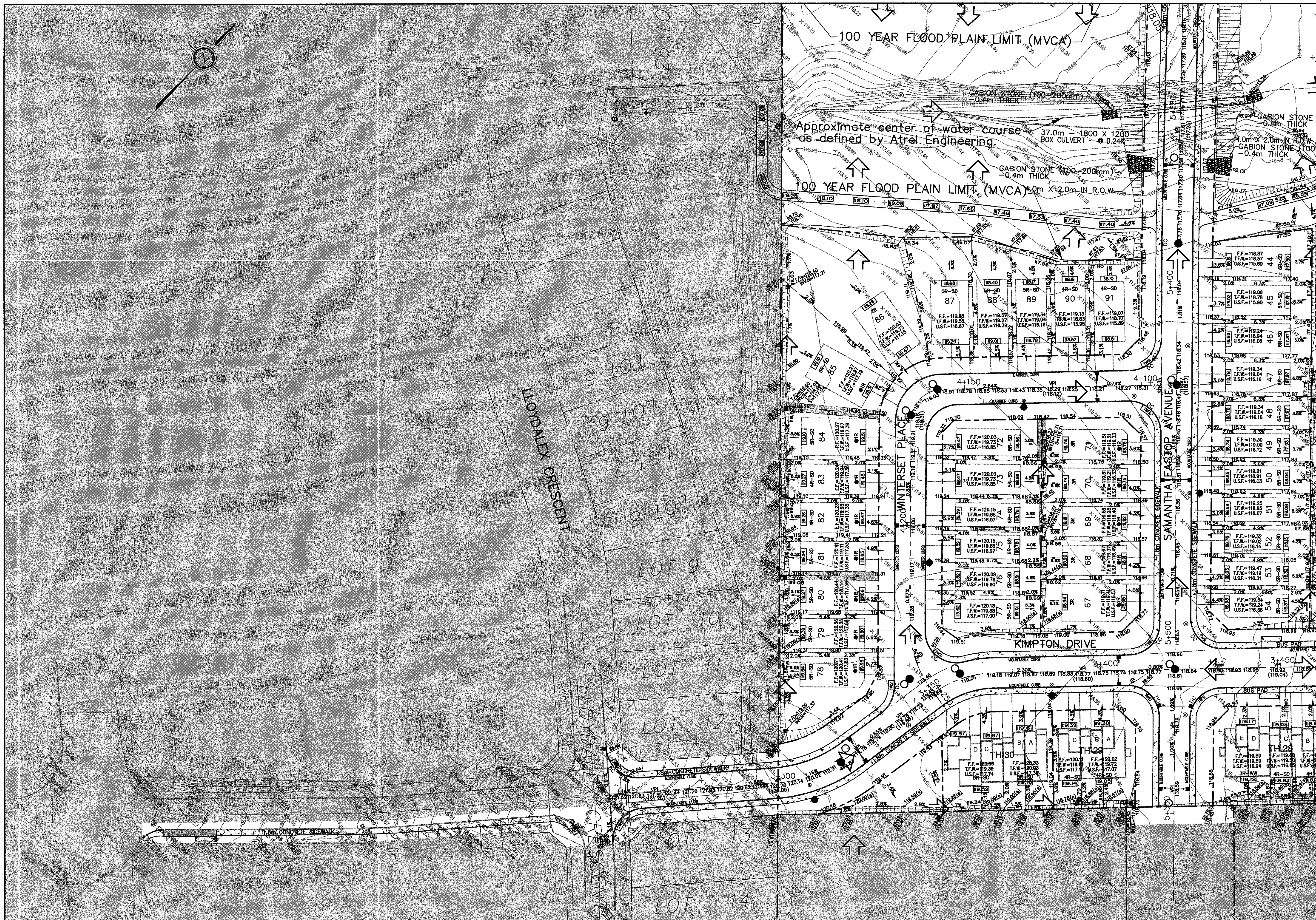
MINTO COMMUNITIES INC.

PLAN
GRADING PLAN

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014
DRAWING No. 131003-GR2

D07-16-14-0013

City Plan No. 17314



LEGEND

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116.81	EXISTING SPOT ELEVATION
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T/G=115.10 INV=113.70	PROPOSED TOP OF GRATE ELEVATION PROPOSED INVERT ELEVATION
T/W=115.74 B/W=115.30	PROPOSED TOP OF RETAINING WALL PROPOSED BOTTOM OF RETAINING WALL
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*	ADDITIONAL FRONT RISER(S)
■	PROPOSED CATCHBASIN
	PROP. HDPE CB AS PER CITY OF OTTAWA STANDARD S30.
	PROPOSED REARYARD CATCHBASIN
	MAJOR DRAINAGE SYSTEM
	TERRACING 3:1 (MAXIMUM SLOPE)
HP •	HYDRO POLES
	OUTSIDE PROPOSED DEVELOPMENT
EASEMENT	REFER TO DRAWING 131003–S1
DC	DEPRESSED CURB

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REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed Sk

Date August 11, 2017

Plan Number

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minto

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12	AS PER CITY COMMENTS	AUG. 02/17	AGS

SCALE 1:500 HORIZONTAL (5m 0 15m)

DESIGN AGS · CHECKED JMD · DRAWN SAB · CHECKED AGS · APPROVED JMD

LICENSED PROFESSIONAL ENGINEER A. G. Y. SAUVE 100142393 Aug. 2, 2017 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.M.J.DECOEUR Aug 2/2017 PROVINCE OF ONTARIO

ATREL Engineering Ltd Ltée
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TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

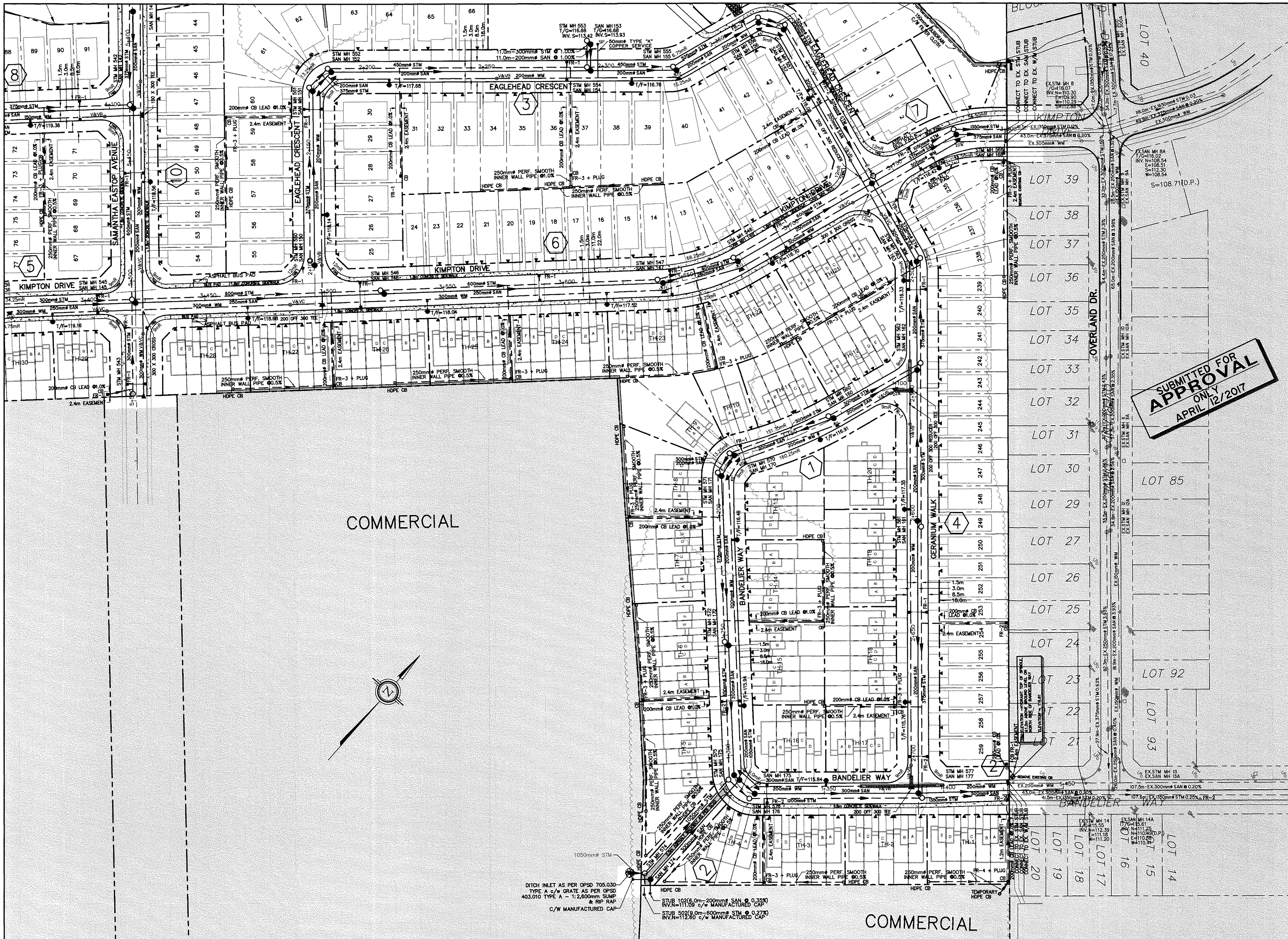
MINTO COMMUNITIES INC.

PLAN
GRADING PLAN

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014
DRAWING No. 131003-GR3

D07-16-14-0013

City Plan No. 17314



NOTES:

1. CONSTRUCT ALL WATERMAIN TO CITY OF OTTAWA'S STANDARD AND SPECIFICATIONS. BEDDING SHALL BE AS PER OPSD 1102.01 AND OPSD 1102.02
2. PROVIDE INSULATION AT CATCHBASINS IN ACCORDANCE WITH CITY OF OTTAWA'S STANDARD DRAWING W23.
3. INSTALL ALL SERVICES IN ACCORDANCE WITH CITY OF OTTAWA'S STANDARD DRAWING R21, W26, W36, W38 AND S11.1.
4. PROVIDE CATHODIC PROTECTION TO CITY OF OTTAWA'S STANDARDS AND SPECIFICATIONS.
5. RESTRAIN ALL BENDS, TEES, AND CAPS TO CITY OF OTTAWA'S STANDARDS AND SPECIFICATIONS.
6. ALL SERVICES SHALL BE PLACED AT A DISTANCE OF 1/3 FROM SIDE PROPERTY LINE.
7. ALL SIDEWALKS SHALL BE HANDICAP ACCESSIBLE AND AS PER CITY STANDARD SC4, SC6 AND SC7.2.
8. ALL CONNECTION TO EXISTING WM STUB BY CITY OF OTTAWA EXCAVATION, BACKFILL AND REINSTATEMENT BY CONTRACTOR.
9. CONNECT TO EXISTING W/M VIA T.V.S. VALVE CHAMBER AS PER CITY OF OTTAWA STANDARD W11.1
10. CONNECT TO EX. SAN AND STM STUBS.
11. IN AREAS WHERE SERVICE TRENCHES ARE LOCATED WITHIN 3 METRES OF RESIDENTIAL FOUNDATION, SUCH AS REAR YARD CATCHBASIN LEADS, IT WILL BE NECESSARY TO BACKFILL THE PORTION OF THE TRENCH BELOW THE FOUNDATION LEVEL WITH ENGINEERED FILL.
12. FOR THRUST BLOCK DESIGN, ON THE WATERMAIN, A SOIL BEARING CAPACITY OF 20 KPA CAN BE USED. (REFER TO 131003-TD1 FOR DESIGN)
13. ALL STORM SEWERS 900mm AND GREATER TO BE BENCHED. ALL SANITARY MANHOLES TO BE BENCHED. SEWER SHALL HAVE CLASS "B" BEDDING.
14. THE CITY OF OTTAWA WILL NOT PERMIT ANY ENCROACHMENTS ONTO ANY REAR YARD CATCH BASIN LEAD DRAINAGE EASEMENTS.
15. ALL STORM AND SANITARY SERVICES ARE TO BE EQUIPPED WITH A BACKWATER VALVES. AS PER CITY STANDARD S14 AND S14.2.
16. ALL HYDRANTS ARE TO BE LOCATED AS PER CITY OF OTTAWA STANDARD DRAWING W18 AND INSTALLED AS PER W19.
17. CONTRACTOR IS TO REPAIR BENCHING TO ALL EXISTING SAN MH PRIOR TO CONNECTIONS.
18. SPECIAL PIPE BEDDING AND COVER IS REQUIRED IN AREAS OF GRAY SILTY CLAY AND SHALL BE INSPECTED BY THE GEOTECHNICAL ENGINEER PRIOR TO BACKFILL.
19. CURBS SHALL BE DEPRESSED AT EVERY ENTRANCE CROSSING AS PER CITY STANDARD SC1.1 AND SC7.1
20. PERFORATED PIPE FOR REAR YARD SHALL BE INSTALLED AS PER CITY STANDARD S29.
21. ALL SANITARY AND STORM MANHOLE COVERS SHALL BE INSTALLED AS PER THE CORRESPONDING CITY OF OTTAWA STANDARD DETAIL DRAWING (REFER TO 131003-TD1).

REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed ______ for James Hall

Date 04, 21 2017

Plan Number 17314

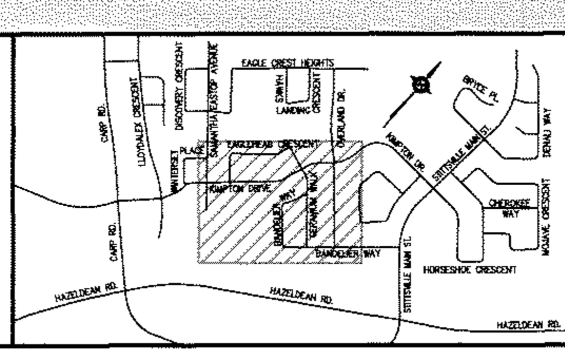
LEGEND

- EXISTING TREE LINE
- EXISTING TREES
- EXISTING FENCE
- EXISTING FIRE HYDRANT
- EXISTING VALVE AND VALVE CHAMBER
- EXISTING VALVE AND VALVE BOX
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- EXISTING LIGHT POLE
- EXISTING HYDRO POST
- EXISTING SIGN
- EX. PADMOUNT HYDRO TRANSFORMER
- EXISTING BELL PEDESTAL
- EXISTING CABLE PEDESTAL
- EXISTING STANDARD IRON BAR
- EXISTING WATERMAIN
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED BEND C/W THRUSTBLOCK (SPECIAL DESIGN)
- PROPOSED CAP C/W THRUSTBLOCK (SPECIAL DESIGN)
- PROPOSED VALVE AND VALVE BOX
- PROPOSED VALVE AND VALVE CHAMBER
- PROPOSED FIRE HYDRANT
- DICB — PROPOSED DITCH INLET CATCHBASIN AS PER OPSD 705.030 C/W 3H:1V SLOPED GRATE
- PROP. HDPE CB AS PER CITY OF OTTAWA STANDARD S30, AND DETAIL IN DRAWING 131003-TD1
- PROPOSED CATCHBASIN
- PROPOSED RETAINING WALLS
- PROPOSED INSULATION (SEE PROFILES FOR DETAILS)
- T/F=114.83 — PROPOSED TOP OF FLANGE ELEVATION
- HOUSE SERVICE
- HOUSE SERVICE IN DRIVEWAY
- NON-TYPICAL HOUSE SERVICE
- FR-1 + PLUG — FLOW RESTRICTOR AND PLUG WHERE APPLICABLE (SEE 131003 TD-1 FOR DETAILS)
- 9mR — CURB RADIUS
- TWSI — TACTILE WALKING SURFACE INDICATORS
- OUTSIDE PROPOSED DEVELOPMENT
- (3) — PROFILE NUMBER

TBM: ELEVATION -HYDRANT TOP OF SPINDLE, ±1.2m ABOVE GROUND LEVEL ON NORTH SIDE OF BANDELIER WAY
ELEVATION = 116.61

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

minto



No.	REVISION △-APPLIES WHEN DRAWING MODIFIED	DATE	BY
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5	FOR ORDERING	FEB. 3/17	JMD
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8	ISSUED FOR CONSTRUCTION	MAR. 31/17	JMD
9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD

SCALE 1:750 (8m 0 24m)

DESIGN AGS
CHECKED JMD
DRAWN SAB
CHECKED AGS
APPROVED JMD

LICENSED PROFESSIONAL ENGINEER — A. G. Y. SAUVE 100142393 — Apr. 12, 2017 — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — J.M.J. DECOEUR — April 12/2017 — PROVINCE OF ONTARIO

ATREL Engineering Ltd. Ltée
Engineers - Ingénieurs
1-2884 CHAMBERLAND STREET, ROCKLAND, ONTARIO K4K 1M8
TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

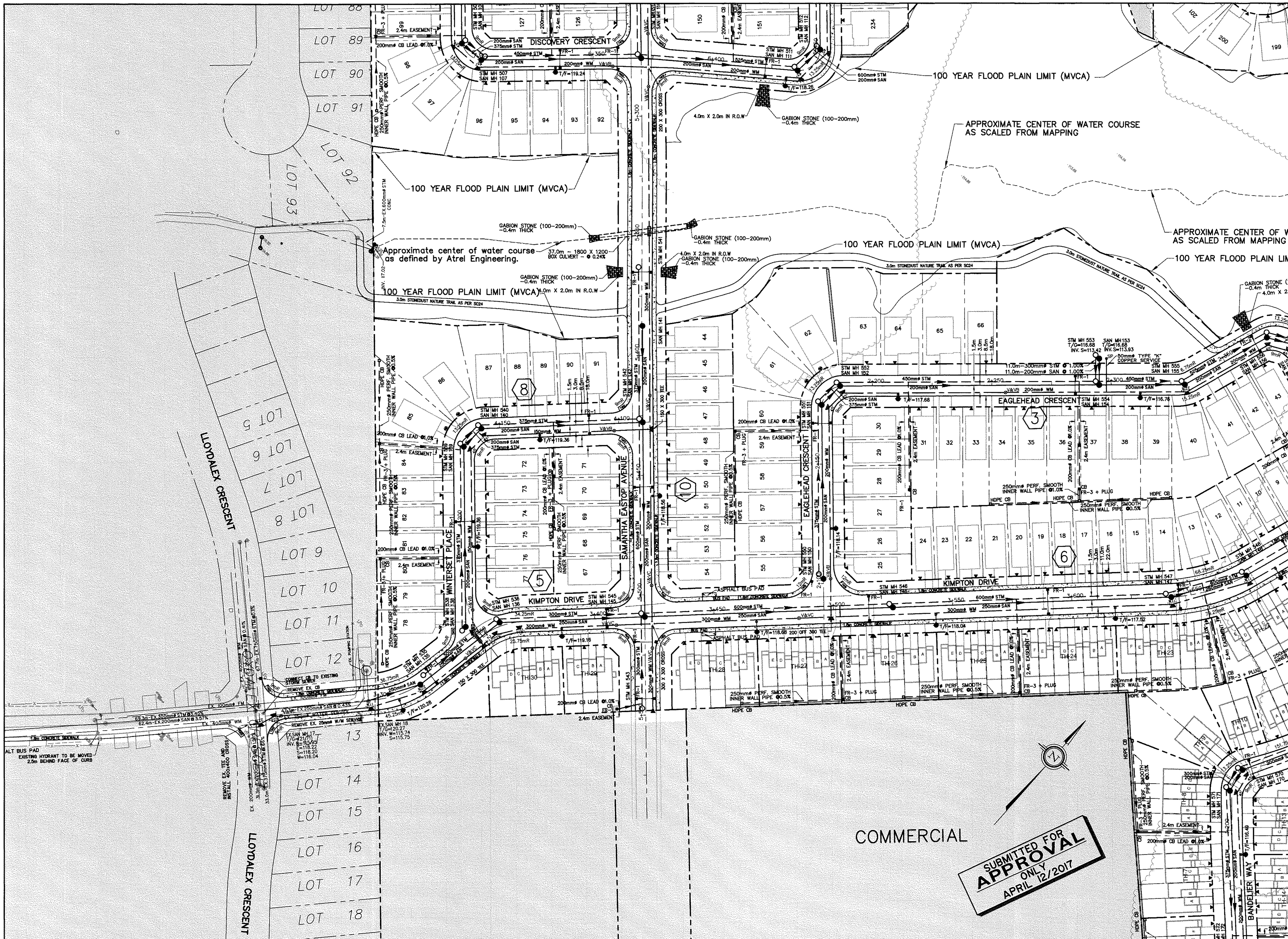
MINTO COMMUNITIES INC.

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014

PLAN
GENERAL PLAN OF SERVICES

DRAWING No. 131003-SI

D07-16-14-0013



NOTES:

1. CONSTRUCT ALL WATERMAIN TO CITY OF OTTAWA'S STANDARD AND SPECIFICATIONS. BEDDING SHALL BE AS PER OPSD 1102.01 AND OPSD 1102.02
2. PROVIDE INSULATION AT CATCHBASINS IN ACCORDANCE WITH CITY OF OTTAWA'S STANDARD DRAWING W23.
3. INSTALL ALL SERVICES IN ACCORDANCE WITH CITY OF OTTAWA'S STANDARD DRAWING R21, W26, W36, W38 AND S11.1.
4. PROVIDE CATHODIC PROTECTION TO CITY OF OTTAWA'S STANDARDS AND SPECIFICATIONS.
5. RESTRAIN ALL BENDS, TEES, AND CAPS TO CITY OF OTTAWA'S STANDARDS AND SPECIFICATIONS.
6. ALL SERVICES SHALL BE PLACED AT A DISTANCE OF 1/3 FROM SIDE PROPERTY LINE.
7. ALL SIDEWALKS SHALL BE HANDICAP ACCESSIBLE AND AS PER CITY STANDARD SC4, SC6 AND SC7.2.
8. ALL CONNECTION TO EXISTING WM STUB BY CITY OF OTTAWA EXCAVATION, BACKFILL AND REINSTATEMENT BY CONTRACTOR.
9. CONNECT TO EXISTING W/M VIA T.V.S. VALVE CHAMBER AS PER CITY OF OTTAWA STANDARD W11.1
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20. PERFORATED PIPE FOR REAR YARD SHALL BE INSTALLED AS PER CITY STANDARD S29.
21. ALL SANITARY AND STORM MANHOLE COVERS SHALL BE INSTALLED AS PER THE CORRESPONDING CITY OF OTTAWA STANDARD DETAIL DRAWING (REFER TO 131003-TD1).

REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed [signature] for James Hall
Date 04/21 2017
Plan Number 17314

LEGEND

- EXISTING TREE LINE
- EXISTING TREES
- EXISTING FENCE
- EXISTING FIRE HYDRANT
- VC — EXISTING VALVE AND VALVE CHAMBER
- EX.V&VB — EXISTING VALVE AND VALVE BOX
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- LP — EXISTING LIGHT POLE
- HP — EXISTING HYDRO POST
- EXISTING SIGN
- Transf. — EX. PADMOUNT HYDRO TRANSFORMER
- BPed — EXISTING BELL PEDESTAL
- TVPed — EXISTING CABLE PEDESTAL
- SIB — EXISTING STANDARD IRON BAR
- EXISTING WATERMAIN
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- 45° — PROPOSED BEND C/W THRUSTBLOCK (SPECIAL DESIGN)
- PROPOSED CAP C/W THRUSTBLOCK (SPECIAL DESIGN)
- V&VB — PROPOSED VALVE AND VALVE BOX
- V&VC — PROPOSED VALVE AND VALVE CHAMBER
- PROPOSED FIRE HYDRANT
- DICB — PROPOSED DITCH INLET CATCHBASIN AS PER OPSD 705.030 C/W 3H:1V SLOPED GRATE
- PROP. HDPE CB AS PER CITY OF OTTAWA STANDARD S30, AND DETAIL IN DRAWING 131003-TD1
- PROPOSED CATCHBASIN
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- T/F=114.83 — PROPOSED TOP OF FLANGE ELEVATION
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- OUTSIDE PROPOSED DEVELOPMENT
- 3 — PROFILE NUMBER

TBM: ELEVATION -HYDRANT TOP OF SPINDLE, ±1.2m ABOVE GROUND LEVEL ON NORTH SIDE OF BANDELIER WAY
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minto

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9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD

SCALE 1:750 (8m 0 24m)

DESIGN	AGS
CHECKED	JMD
DRAWN	SAB
CHECKED	AGS
APPROVED	JMD

LICENSED PROFESSIONAL ENGINEER A.G.Y. SAUVE 100142393 Apr. 12, 2017 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.M.J. DECOEUR April 12/2017 PROVINCE OF ONTARIO

ATREL Engineering Ltd Ltée
Engineers - Ingénieurs
1-2864 CHAMBERLAND STREET, ROCKLAND, ONTARIO K4K 1M6 TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

PLAN
GENERAL PLAN OF SERVICES

MINTO COMMUNITIES INC.

CLIENT No.	148
PROJECT No.	131003
DATE	JANUARY, 2014
DRAWING No.	131003-S2

D07-16-14-0013

LEGEND

STATIC PONDING AREA

100 YR CHICAGO STORM +20% STRESS TEST PONDING AREA

PONDING AREA No. — PA10

MAJOR DRAINAGE

REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed ______________________

Date ______________________ 2017

Plan Number ______________________

PONDING AREA TABLE

Area Number	Maximum Ponding Elevation (m)	Top of Grate Elevation (m)	Maximum Ponding Depth (m)	Maximum Ponding Volume (m³)	Maximum Ponding Area (m²)	I.C.D. Flow Release Rate (L/s)
PA100	119.25	119.10	0.15	8.84	176.06	15.50
PA101	119.18	118.98	0.20	33.93	579.38	46.50
PA102	119.90	119.68	0.22	32.26	433.97	15.50
PA103 (highlighted)	119.13	118.87	0.26			15.50
PA104	119.01	118.94	0.07	1.78	65.49	15.50
PA105	118.92	118.79	0.13	5.00	117.26	15.50
PA106	118.90	118.79	0.11	2.29	62.39	7.75
PA107 (highlighted)	118.27	118.02	0.25			15.50
PA108 (highlighted)	118.20	118.00	0.20			15.50
PA109	118.09	117.84	0.25	35.08	412.99	15.50
PA110	118.06	117.86	0.20	25.11	334.66	15.50
PA111	118.94	118.80	0.14	1.37	30.87	7.75
PA120	118.13	117.91	0.22	32.07	444.42	15.50
PA121	115.68	115.55	0.13	6.16	121.89	7.75
PA122	115.80	115.66	0.14	7.90	168.48	15.50
PA123	115.62	115.49	0.13	5.89	144.66	23.25
PA124	115.61	115.49	0.12	2.17	54.34	7.75
PA125	115.60	115.47	0.13	1.00	23.33	7.75
PA126	115.73	115.47	0.26	51.41	600.47	15.50
PA127	115.58	115.47	0.11	4.32	117.98	15.50
PA128 (highlighted)	115.65	115.41	0.24			15.50
PA129	115.56	115.36	0.20	22.28	355.63	15.50
PA130	115.07	114.92	0.15	10.93	204.81	20.00
PA131	114.52	114.36	0.16	10.56	217.99	20.00
PA140	119.67	119.63	0.04	0.19	14.99	15.50
PA141	119.08	118.93	0.15	8.76	166.82	15.50
PA142 (highlighted)	118.75	118.45	0.30			15.50
PA143	118.74	118.46	0.28	76.09	887.19	38.75
PA144	118.62	118.61	0.01	0.00	1.42	7.75
PA145	118.32	118.18	0.14	7.36	152.47	15.50
PA146 (highlighted)	118.42	118.23	0.19			15.50
PA147	118.22	118.08	0.14	8.97	185.15	15.50
PA148	117.67	117.45	0.22	37.98	437.11	15.50
PA150	117.92	117.87	0.05	0.18	10.65	15.50
PA151	117.47	117.31	0.16	16.83	281.56	15.50
PA152	116.57	116.49	0.08	3.29	105.50	15.50
PA153	117.80	117.74	0.06	1.24	56.49	15.50
PA154	117.30	117.23	0.07	1.82	70.74	15.50
PA155	116.34	116.29	0.05	0.74	38.42	15.50
PA156	116.72	116.63	0.09	1.40	47.63	15.50
PA157A (highlighted)	117.84	117.73	0.11			15.50
PA157B (highlighted)	117.16	117.03	0.13			15.50
PA158 (highlighted)	116.33	116.08	0.25			15.50
PA159 (highlighted)	116.25	116.02	0.23			15.50
PA160 (highlighted)	116.47	116.39	0.08			15.50
PA161	116.18	115.99	0.19	21.40	285.82	15.50
PA162	116.16	116.08	0.08	1.44	54.25	7.75
PA163	116.15	115.93	0.22	12.22	179.36	17.75
PA164	116.03	115.93	0.10	0.25	7.53	10.00
PA165 (highlighted)	117.40	117.10	0.30			15.50
PA166 (highlighted)	116.46	116.23	0.23			15.50
PA167 (highlighted)	116.05	115.77	0.28			15.50
PA168	115.97	115.76	0.21	24.96	344.81	20.00
PA169	115.88	115.80	0.08	1.32	54.01	20.00
PA170	116.22	116.09	0.13	9.63	207.61	15.50
PA171	115.68	115.60	0.08	3.15	102.22	20.00
PA172 (highlighted)	116.38	116.14	0.24			15.50
PA173 (highlighted)	115.73	115.43	0.30			15.50
PA174 (highlighted)	115.74	115.47	0.27			20.00
PA175 (highlighted)	115.65	115.35	0.30			15.50
PA176	115.60	115.34	0.26	49.71	573.66	20.00
PA177 (highlighted)	115.93	115.72	0.21			15.50
PA178 (highlighted)	115.58	115.39	0.19			15.50
PA179 (highlighted)	116.05	115.97	0.08			20.00
PA180 (highlighted)	115.53	115.25	0.28			15.50
PA181	115.49	115.28	0.21	80.39	992.64	40.00
PA182	115.44	115.29	0.15	13.06	336.50	20.00
PA183	115.32	115.22	0.10	5.76	169.40	20.00
PA200 (highlighted)	118.82	118.66	0.16			15.50
PA201 (highlighted)	118.70	118.60	0.10			15.50
PA202 (highlighted)	117.48	117.27	0.21			15.50
PA203 (highlighted)	119.79	119.52	0.27			15.50
PA204 (highlighted)	117.96	117.75	0.21			15.50
PA205 (highlighted)	115.68	115.38	0.30			15.50
PA206 (highlighted)	114.60	114.44	0.16			13.40

(highlighted) Ponding volumes for the rear yards are not taken into account for storage capacity

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

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SCALE 1:500 — 5m 0 15m — HORIZONTAL

DESIGN AGS
CHECKED JMD
DRAWN SAB
CHECKED AGS
APPROVED JMD

LICENSED PROFESSIONAL ENGINEER — A.G.Y. SAUVE 100142393 — Apr. 12, 2017 — PROVINCE OF ONTARIO

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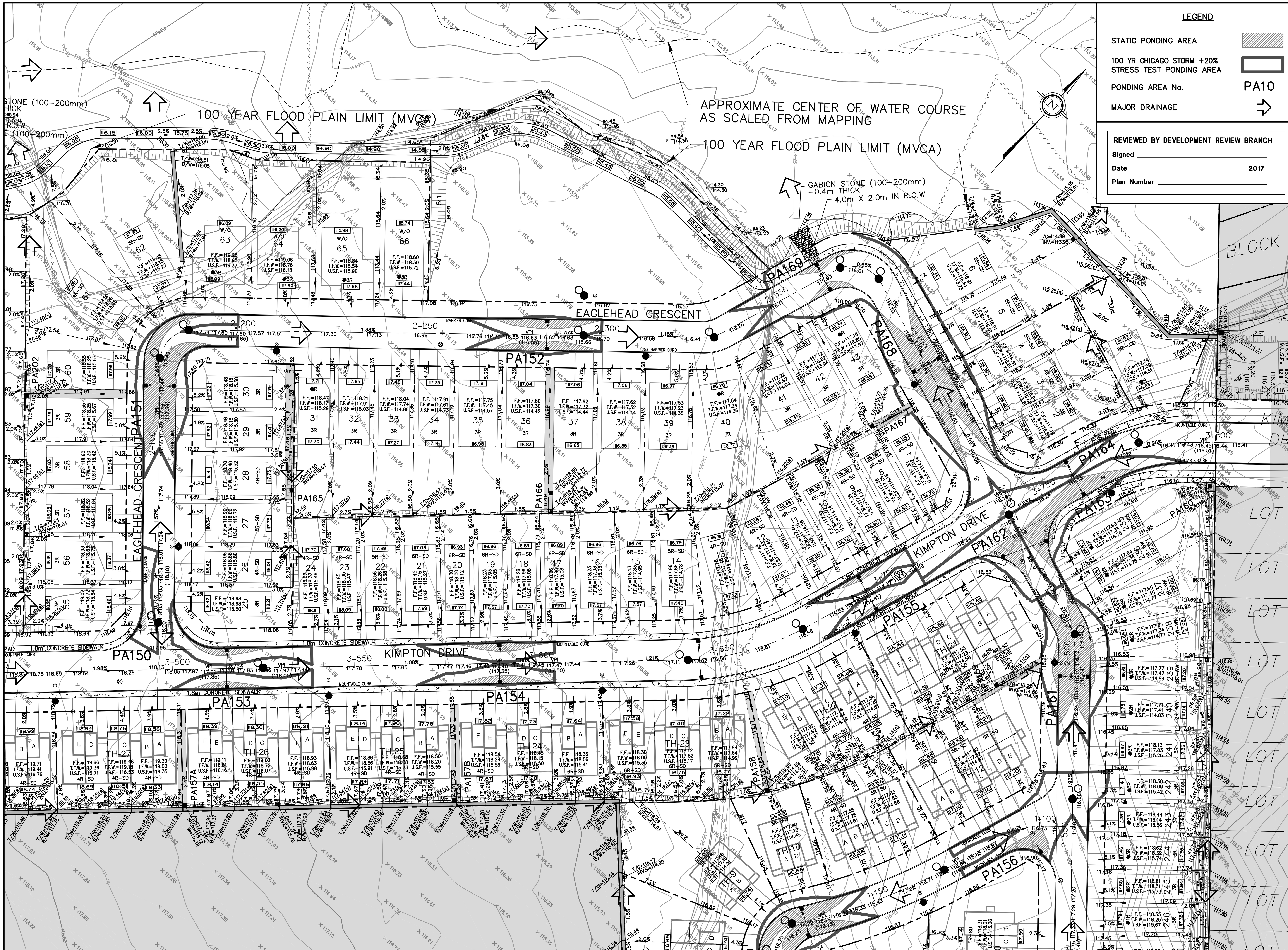
CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014
DRAWING No. 131003-PA1

PLAN
PONDING AREA PLAN

D07-16-14-0013



LEGEND

STATIC PONDING AREA

100 YR CHICAGO STORM +20% STRESS TEST PONDING AREA

PONDING AREA No. — PA10

MAJOR DRAINAGE

REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed ____________________

Date ____________________ 2017

Plan Number ____________________

PONDING AREA TABLE

Area Number	Maximum Ponding Elevation (m)	Top of Grate Elevation (m)	Maximum Ponding Depth (m)	Maximum Ponding Volume (m^3)	Maximum Ponding Area (m^2)	I.C.D. Flow Release Rate (L/s)
PA100	119.25	119.10	0.15	8.84	176.06	15.50
PA101	119.18	118.98	0.20	33.93	579.38	46.50
PA102	119.90	119.68	0.22	32.26	433.97	15.50
PA103	119.13	118.87	0.26			15.50
PA104	119.01	118.94	0.07	1.78	65.49	15.50
PA105	118.92	118.79	0.13	5.00	117.26	15.50
PA106	118.90	118.79	0.11	2.29	62.39	7.75
PA107	118.27	118.02	0.25			15.50
PA108	118.20	118.00	0.20			15.50
PA109	118.09	117.84	0.25	35.08	412.99	15.50
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PA120	118.13	117.91	0.22	32.07	444.42	15.50
PA121	115.68	115.55	0.13	6.16	121.89	7.75
PA122	115.80	115.66	0.14	7.90	168.48	15.50
PA123	115.62	115.49	0.13	5.89	144.66	23.25
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PA126	115.73	115.47	0.26	51.41	600.47	15.50
PA127	115.58	115.47	0.11	4.32	117.98	15.50
PA128	115.65	115.41	0.24			15.50
PA129	115.56	115.36	0.20	22.28	355.63	15.50
PA130	115.07	114.92	0.15	10.93	204.81	20.00
PA131	114.52	114.36	0.16	10.56	217.99	20.00
PA140	119.67	119.63	0.04	0.19	14.99	15.50
PA141	119.08	118.93	0.15	8.76	166.82	15.50
PA142	118.75	118.45	0.30			15.50
PA143	118.74	118.46	0.28	76.09	887.19	38.75
PA144	118.62	118.61	0.01	0.00	1.42	7.75
PA145	118.32	118.18	0.14	7.36	152.47	15.50
PA146	118.42	118.23	0.19			15.50
PA147	118.22	118.08	0.14	8.97	185.15	15.50
PA148	117.67	117.45	0.22	37.98	437.11	15.50
PA150	117.92	117.87	0.05	0.18	10.65	15.50
PA151	117.47	117.31	0.16	16.83	281.56	15.50
PA152	116.57	116.49	0.08	3.29	105.50	15.50
PA153	117.80	117.74	0.06	1.24	56.49	15.50
PA154	117.30	117.23	0.07	1.82	70.74	15.50
PA155	116.34	116.29	0.05	0.74	38.42	15.50
PA156	116.72	116.63	0.09	1.40	47.63	15.50
PA157A	117.84	117.73	0.11			15.50
PA157B	117.16	117.03	0.13			15.50
PA158	116.33	116.08	0.25			15.50
PA159	116.25	116.02	0.23			15.50
PA160	116.47	116.39	0.08			15.50
PA161	116.18	115.99	0.19	21.40	285.82	15.50
PA162	116.16	116.08	0.08	1.44	54.25	7.75
PA163	116.15	115.93	0.22	12.22	179.36	17.75
PA164	116.03	115.93	0.10	0.25	7.53	10.00
PA165	117.40	117.10	0.30			15.50
PA166	116.46	116.23	0.23			15.50
PA167	116.05	115.77	0.28			15.50
PA168	115.97	115.76	0.21	24.96	344.81	20.00
PA169	115.88	115.80	0.08	1.32	54.01	20.00
PA170	116.22	116.09	0.13	9.63	207.61	15.50
PA171	115.68	115.60	0.08	3.15	102.22	20.00
PA172	116.38	116.14	0.24			15.50
PA173	115.73	115.43	0.30			15.50
PA174	115.74	115.47	0.27			20.00
PA175	115.65	115.35	0.30			15.50
PA176	115.60	115.34	0.26	49.71	573.66	20.00
PA177	115.93	115.72	0.21			15.50
PA178	115.58	115.39	0.19			15.50
PA179	116.05	115.97	0.08			20.00
PA180	115.53	115.25	0.28			15.50
PA181	115.49	115.28	0.21	80.39	992.64	40.00
PA182	115.44	115.29	0.15	13.06	336.50	20.00
PA183	115.32	115.22	0.10	5.76	169.40	20.00
PA200	118.82	118.66	0.16			15.50
PA201	118.70	118.60	0.10			15.50
PA202	117.48	117.27	0.21			15.50
PA203	119.79	119.52	0.27			15.50
PA204	117.96	117.75	0.21			15.50
PA205	115.68	115.38	0.30			15.50
PA206	114.60	114.44	0.16			13.40

(highlighted) Ponding volumes for the rear yards are not taken into account for storage capacity

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

minto

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4	AS PER CITY COMMENTS	DEC. 06/16	JMD
5	FOR ORDERING	FEB. 3/17	JMD
6	AS PER CITY COMMENTS	FEB. 9/17	JMD
7	ISSUED FOR TENDER	FEB. 23/17	JMD
8	ISSUED FOR CONSTRUCTION	MAR. 31/17	JMD
9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD

SCALE 1:500 — 5m 0 15m — HORIZONTAL

DESIGN: AGS
CHECKED: JMD
DRAWN: SAB
CHECKED: AGS
APPROVED: JMD

LICENSED PROFESSIONAL ENGINEER — A. G. Y. SAUVE — 100142393 — Apr. 12, 2017 — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — J.M.J. DECOEUR — April 12/2017 — PROVINCE OF ONTARIO

ATREL Engineering Ltd Ltée
Engineers - Ingénieurs
1-2884 CHAMBERLAND STREET, ROCKLAND, ONTARIO K4K 1M6
TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

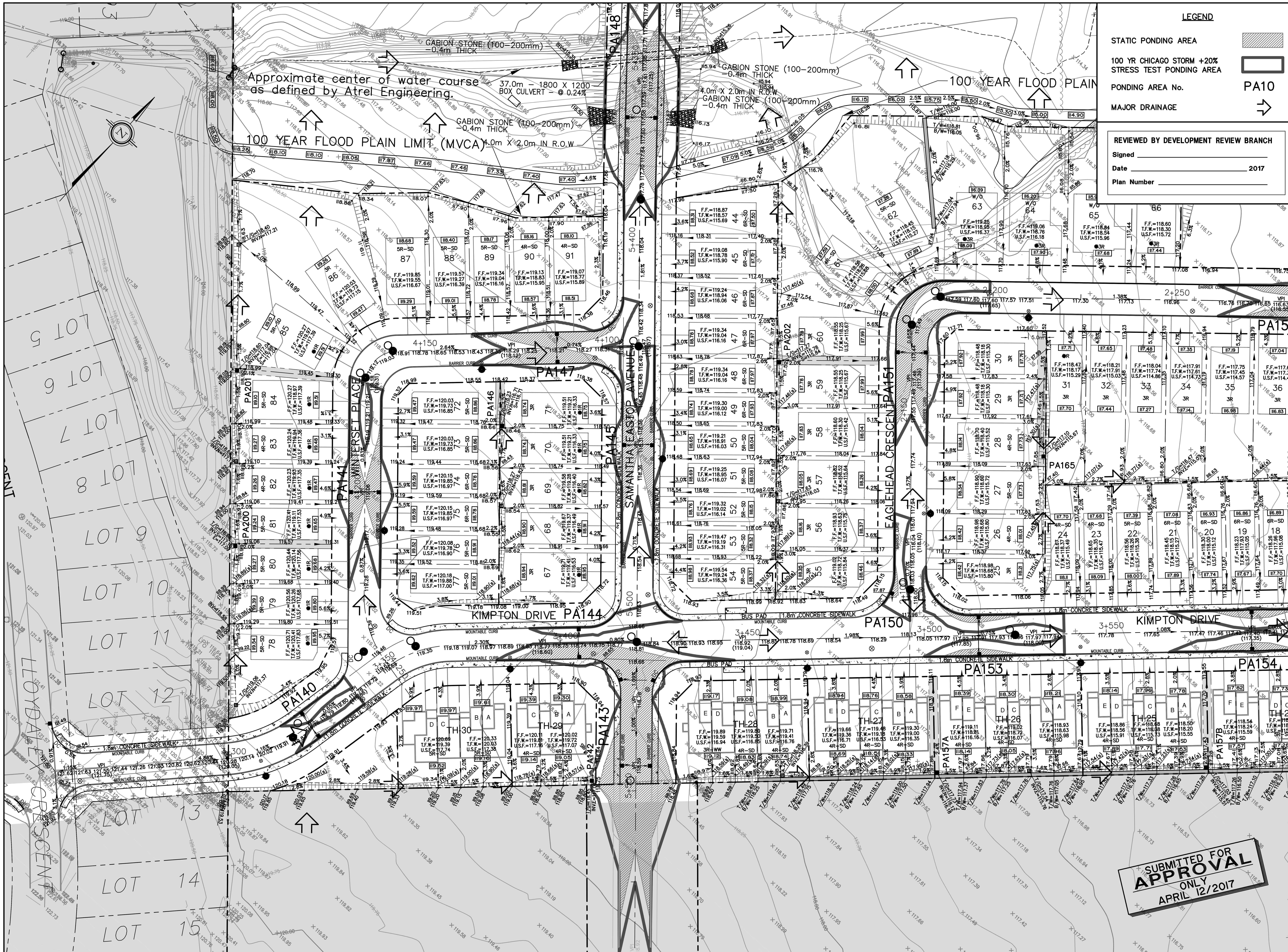
MINTO COMMUNITIES INC.

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014

PLAN
PONDING AREA PLAN

DRAWING No. 131003-PA2

D07-16-14-0013



LEGEND

STATIC PONDING AREA

100 YR CHICAGO STORM +20% STRESS TEST PONDING AREA

PONDING AREA No. — PA10

MAJOR DRAINAGE

REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed ____________________

Date ____________________ 2017

Plan Number ____________________

PONDING AREA TABLE

Area Number	Maximum Ponding Elevation (m)	Top of Grate Elevation (m)	Maximum Ponding Depth (m)	Maximum Ponding Volume (m^3)	Maximum Ponding Area (m^2)	I.C.D. Flow Release Rate (L/s)
PA100	119.25	119.10	0.15	8.84	176.06	15.50
PA101	119.18	118.98	0.20	33.93	579.38	46.50
PA102	119.90	119.68	0.22	32.26	433.97	15.50
PA103	119.13	118.87	0.26			15.50
PA104	119.01	118.94	0.07	1.78	65.49	15.50
PA105	118.92	118.79	0.13	5.00	117.26	15.50
PA106	118.90	118.79	0.11	2.29	62.39	7.75
PA107	118.27	118.02	0.25			15.50
PA108	118.20	118.00	0.20			15.50
PA109	118.09	117.84	0.25	35.08	412.99	15.50
PA110	118.06	117.86	0.20	25.11	334.66	15.50
PA111	118.94	118.80	0.14	1.37	30.87	7.75
PA120	118.13	117.91	0.22	32.07	444.42	15.50
PA121	115.68	115.55	0.13	6.16	121.89	7.75
PA122	115.80	115.66	0.14	7.90	168.48	15.50
PA123	115.62	115.49	0.13	5.89	144.66	23.25
PA124	115.61	115.49	0.12	2.17	54.34	7.75
PA125	115.60	115.47	0.13	1.00	23.33	7.75
PA126	115.73	115.47	0.26	51.41	600.47	15.50
PA127	115.58	115.47	0.11	4.32	117.98	15.50
PA128	115.65	115.41	0.24			15.50
PA129	115.56	115.36	0.20	22.28	355.63	15.50
PA130	115.07	114.92	0.15	10.93	204.81	20.00
PA131	114.52	114.36	0.16	10.56	217.99	20.00
PA140	119.67	119.63	0.04	0.19	14.99	15.50
PA141	119.08	118.93	0.15	8.76	166.82	15.50
PA142	118.75	118.45	0.30			15.50
PA143	118.74	118.46	0.28	76.09	887.19	38.75
PA144	118.62	118.61	0.01	0.00	1.42	7.75
PA145	118.32	118.18	0.14	7.36	152.47	15.50
PA146	118.42	118.23	0.19			15.50
PA147	118.22	118.08	0.14	8.97	185.15	15.50
PA148	117.67	117.45	0.22	37.98	437.11	15.50
PA150	117.92	117.87	0.05	0.18	10.65	15.50
PA151	117.47	117.31	0.16	16.83	281.56	15.50
PA152	116.57	116.49	0.08	3.29	105.50	15.50
PA153	117.80	117.74	0.06	1.24	56.49	15.50
PA154	117.30	117.23	0.07	1.82	70.74	15.50
PA155	116.34	116.29	0.05	0.74	38.42	15.50
PA156	116.72	116.63	0.09	1.40	47.63	15.50
PA157A	117.84	117.73	0.11			15.50
PA157B	117.16	117.03	0.13			15.50
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PA203	119.79	119.52	0.27			15.50
PA204	117.96	117.75	0.21			15.50
PA205	115.68	115.38	0.30			15.50
PA206	114.60	114.44	0.16			13.40

(Highlighted rows:) Ponding volumes for the rear yards are not taken into account for storage capacity

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minto

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6	AS PER CITY COMMENTS	FEB. 9/17	JMD
7	ISSUED FOR TENDER	FEB. 23/17	JMD
8	ISSUED FOR CONSTRUCTION	MAR. 31/17	JMD
9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD

SCALE 1:500 — 5m 0 15m — HORIZONTAL

DESIGN AGS
CHECKED JMD
DRAWN SAB
CHECKED AGS
APPROVED JMD

LICENSED PROFESSIONAL ENGINEER — A. G. Y. SAUVE — 100142393 — Apr. 12, 2017 — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — J.M.J.DECOEUR — April 12/2017 — PROVINCE OF ONTARIO

ATREL Engineering Ltd Ltée
Engineers - Ingénieurs
1-2884 CHAMBERLAND STREET, ROCKLAND, ONTARIO K4K 1M6
TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014

PLAN
PONDING AREA PLAN

DRAWING No. 131003-PA3

D07-16-14-0013

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

minto

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5	FOR ORDERING	FEB. 3/17	JMD
6	AS PER CITY COMMENTS	FEB. 9/17	JMD
7	ISSUED FOR TENDER	FEB. 23/17	JMD
8	ISSUED FOR CONSTRUCTION	MAR. 31/17	JMD
9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD

SCALE 1:750 (8m 0 24m)

DESIGN AGS
CHECKED JMD
DRAWN PNC
CHECKED AGS
APPROVED JMD

LICENSED PROFESSIONAL ENGINEER A. G. Y. SAUVE 100142393 Apr. 12, 2017 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.M.J.DECOEUR April 12/2017 PROVINCE OF ONTARIO

ATREL Engineering Ltd Ltée
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TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014
DRAWING No. 131003-SANI

PLAN
SANITARY DRAINAGE AREA PLAN

D07-16-14-0013

LEGEND

- 0.63ha. / 10 / 40 — SANITARY DRAINAGE SUB AREA; POPULATION EQUIVALENT; NUMBER OF UNITS IN SUB AREA
- DRAINAGE AREA BOUNDARY
- PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER
- OUTSIDE PROPOSED DEVELOPMENT

REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed ______________________

Date ______________________ 2017

Plan Number ______________________

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6	AS PER CITY COMMENTS	FEB. 9/17	JMD
7	ISSUED FOR TENDER	FEB. 23/17	JMD
8	ISSUED FOR CONSTRUCTION	MAR. 31/17	JMD
9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD

SCALE 1:750 (8m 0 24m)

DESIGN AGS · CHECKED JMD · DRAWN PNC · CHECKED AGS · APPROVED JMD

LICENSED PROFESSIONAL ENGINEER A. G. Y. SAUVE 100142393 Apr. 12, 2017 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.M.J.DECOEUR April 12/2017 PROVINCE OF ONTARIO

ATREL Engineering Ltd Ltée — Engineers - Ingénieurs — 1-2884 CHAMBERLAND STREET, ROCKLAND, ONTARIO K4K 1M6 TEL.: (613) 446-7423

CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

PLAN
SANITARY DRAINAGE AREA PLAN

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014
DRAWING No. 131003-SAN2

D07-16-14-0013

LEGEND

- FUTURE STORM DRAINAGE AREA (0.70ha.)
- RUNOFF COEFFICIENT (R=0.20)
- PROPOSED STORM SEWER
- DRAINAGE AREA BOUNDARY
- MAJOR DRAINAGE SYSTEM
- EXISTING STORM SEWER
- OUTSIDE PROPOSED DEVELOPMENT

REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed ____________________

Date ____________________ 2017

Plan Number ____________________

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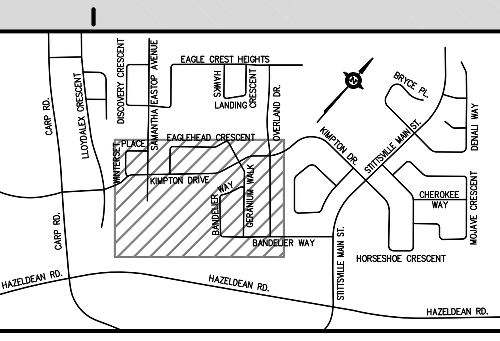
minto



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8	ISSUED FOR CONSTRUCTION	MAR. 31/17	JMD
9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD

SCALE 1:750 (8m 0 24m)

DESIGN	AGS
CHECKED	JMD
DRAWN	PNC
CHECKED	AGS
APPROVED	JMD

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LICENSED PROFESSIONAL ENGINEER J.M.J.DECOEUR April 12/2017 PROVINCE OF ONTARIO

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CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

PLAN
STORM DRAINAGE AREA PLAN

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014
DRAWING No. 131003-STM1

D07-16-14-0013

LEGEND

- 0.70ha. — FUTURE STORM DRAINAGE AREA
- R=0.20 — RUNOFF COEFFICIENT
- PROPOSED STORM SEWER
- DRAINAGE AREA BOUNDARY
- MAJOR DRAINAGE SYSTEM
- EXISTING STORM SEWER
- OUTSIDE PROPOSED DEVELOPMENT

REVIEWED BY DEVELOPMENT REVIEW BRANCH

Signed ______________________

Date ______________________ 2017

Plan Number ______________________

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9	SUBMITTED FOR APPROVAL	APR. 12/17	JMD

SCALE 1:750 (8m 0 24m)

DESIGN AGS
CHECKED JMD
DRAWN PNC
CHECKED AGS
APPROVED JMD

LICENSED PROFESSIONAL ENGINEER A.G.Y. SAUVE 100142393 Apr. 12, 2017 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.M.J. DECOEUR April 12/2017 PROVINCE OF ONTARIO

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CITY OF OTTAWA
POTTER'S KEY SUBDIVISION (STITTSVILLE)

MINTO COMMUNITIES INC.

CLIENT No. 148
PROJECT No. 131003
DATE JANUARY, 2014

PLAN
STORM DRAINAGE AREA PLAN

DRAWING No. 131003-STM2

D07-16-14-0013

MINTO COMMUNITIES INC.

STORMWATER MANAGEMENT, WATERMAIN, STORM SEWER AND SANITARY SEWER

DESIGN BRIEF

PART OF LOT 23 AND 24
CONCESSION 12

POTTER'S KEY SUBDIVISION

CITY OF OTTAWA

FEBRUARY 2017

ATREL Engineering Ltd Ltée
Engineers - Ingénieurs

(Revision 5)

SANITARY SEWER COMPUTATION FORM

Table 20

		PROJECT:	**POTTER'S KEY SUBDIVISION**	q=	350 l/cap.day
DATE:	**February 2017**	CLIENT:	Minto Communities Inc.	I=	0.28 l/ha.s
DESIGNED BY:	VLL	PROJECT #:	131003	PVC/CONC N=	0.013
CHECKED BY:	AGS	BY:	ATREL ENGINEERING LTD	OTHER N=	0.024

Single dwelling= 3.4 person/unit
Townhouse= 2.7 person/unit

STREET NAMES	LOCATION FROM (Up)		TO (Down)		RESIDENTIAL INDIVIDUAL AREA (ha.)	INDIVIDUAL POP.	CUMULATIVE AREA (ha.)	CUMULATIVE POP.	PEAKING FACTOR M	FLOW Q(p) (L/S)	COMMERCIAL , INSTITUTIONAL INDIVIDUAL AREA (ha.)	INDIVIDUAL POP.	CUMULATIVE AREA (ha.)	CUMULATIVE POP.	PEAKING FACTOR M	FLOW Q(p) (L/S)	PEAKING FACTOR M	FLOW Q(p) (L/S)	PEAK EXT.FLOW Q(i) (L/S)	**PEAK DES. Q(d) (L/S)**	SEWER DATA TYPE PIPE	DIA. (N0M) (mm)	(ACT) (MM)	SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	UpStream Obv. (M)	UpStream Inv. (M)	DwnStream Obv. (M)	DwnStream Inv. (M)
Eaglehead Crescent	MH	150	MH	151	0.56	41.0	0.56	41	4.00	0.66									0.16	0.82	PVC	200	201.2	0.85	72.5	30.71	97%	0.97	115.06	114.86	114.44	114.24
Eaglehead Crescent	MH	151	MH	152	0.21	7.0	0.77	48	4.00	0.78									0.22	0.99	PVC	200	201.2	0.85	11.0	30.71	97%	0.97	114.41	114.21	114.32	114.12
Eaglehead Crescent	MH	152	MH	154	0.80	38.0	1.57	86	4.00	1.39									0.44	1.83	PVC	200	201.2	0.85	108.5	30.71	94%	0.97	114.14	113.94	113.22	113.02
Park 2	MH	153	MH	154	0.37		0.37												0.10	0.10	PVC	200	201.2	1.00	11.0	33.31	100%	1.05	114.13	113.93	114.02	113.82
Eaglehead Crescent	MH	154	MH	155	0.16	7.0	2.10	93	4.00	1.51									0.59	2.09	PVC	200	201.2	0.85	36.0	30.71	93%	0.97	113.22	113.02	112.91	112.71
Eaglehead Crescent	MH	155	MH	156	0.30	14.0	2.40	107	4.00	1.73									0.67	2.41	PVC	200	201.2	0.50	39.5	23.55	90%	0.74	112.88	112.68	112.68	112.48
Eaglehead Crescent	MH	156	MH	157			2.40	107	4.00	1.73									0.67	2.41	PVC	200	201.2	0.50	11.0	23.55	90%	0.74	112.65	112.45	112.59	112.39
Eaglehead Crescent	MH	157	MH	165	0.38	17.0	2.78	124	4.00	2.01									0.78	2.79	PVC	200	201.2	1.24	73.5	37.09	92%	1.17	112.56	112.36	111.65	111.45
Bandelier Way	MH	160	MH	162	0.17	14.0	0.17	14	4.00	0.23									0.05	0.27	PVC	200	201.2	0.65	40.0	26.86	99%	0.84	114.18	113.98	113.92	113.72
Geranium Walk	MH	161	MH	162	0.40	34.0	0.40	34	4.00	0.55									0.11	0.66	PVC	200	201.2	0.65	63.0	26.86	98%	0.84	114.28	114.08	113.87	113.67
Geranium Walk	MH	162	MH	163	0.23	17.0	0.80	65	4.00	1.05									0.22	1.28	PVC	200	201.2	0.50	45.5	23.55	95%	0.74	113.32	113.12	113.09	112.89
Geranium Walk	MH	163	MH	165	0.18	11.0	0.98	76	4.00	1.23									0.27	1.51	PVC	200	201.2	0.50	37.5	23.55	94%	0.74	113.06	112.86	112.87	112.67
Kimpton Drive	MH	165	MH	166	0.07		16.43	1020	3.79	15.68									4.60	20.28	PVC	375	366.4	0.20	41.0	73.72	72%	0.70	111.58	111.21	111.50	111.13
Kimpton Drive	MH	166	CAP	Kimpt. Dr	0.13	4.0	16.56	1024	3.79	15.74									4.64	20.37	CONC	375	381.0	0.20	21.0	81.80	75%	0.72	109.04	108.67	109.00	108.63
Kimpton Drive	CAP	Kimpt. Dr	EX	8 A			16.56	1024	3.79	15.74									4.64	20.37	CONC	375	381.0	0.20	43.0	81.80	75%	0.72	109.00	108.63	108.91	108.54
Bandelier Way	MH	160	MH	170	0.26	19.0	0.26	19	4.00	0.31									0.07	0.38	PVC	200	201.2	0.75	44.5	28.85	99%	0.91	114.05	113.85	113.72	113.52
Bandelier Way	MH	170	MH	171	0.12	6.0	0.38	25	4.00	0.41									0.11	0.51	PVC	200	201.2	0.75	10.0	28.85	98%	0.91	113.69	113.49	113.61	113.41
Bandelier Way	MH	171	MH	172	0.61	57.0	0.99	82	4.00	1.33									0.28	1.61	PVC	200	201.2	0.75	71.0	28.85	94%	0.91	113.58	113.38	113.05	112.85
Bandelier Way	MH	172	MH	173	0.40	36.0	1.39	118	4.00	1.91									0.39	2.30	PVC	200	201.2	0.65	54.0	26.86	91%	0.84	113.05	112.85	112.70	112.50
Bandelier Way	MH	173	MH	175			1.39	118	4.00	1.91									0.39	2.30	PVC	200	201.2	0.65	3.0	26.86	91%	0.84	112.67	112.47	112.65	112.45
Commercial (by others)	STUB	101	MH	174	1.17	70.0	1.17	70	4.00	1.13	9.02	1292.0	9.02	1292	1.50	7.85			2.85	11.84	PVC	300	299.2	0.23	7.5	46.05	74%	0.65	111.32	111.02	111.30	111.00
Commercial (by Minto)	STUB	102	MH	174							1.85	265.0	1.85	265	1.50	1.61			0.52	2.13	PVC	200	201.2	0.35	6.0	19.71	89%	0.62	111.29	111.09	111.27	111.07
Easement	MH	174	MH	175			1.17	70	4.00	1.13			10.87	1557	1.50	9.46			3.37	13.97	PVC	300	299.2	0.23	55.5	46.05	70%	0.65	111.27	110.97	111.14	110.84
Bandelier Way	MH	175	MH	176	0.13	6.0	2.69	194	4.00	3.14			10.87	1557	1.50	9.46			3.80	16.40	PVC	300	299.2	0.23	8.5	46.05	64%	0.65	111.08	110.78	111.06	110.76
Bandelier Way	MH	176	MH	177	0.52	52.0	3.21	246	4.00	3.99			10.87	1557	1.50	9.46			3.94	17.39	PVC	300	299.2	0.23	68.5	46.05	62%	0.65	111.03	110.73	110.87	110.57
Geranium Walk	MH	161	MH	177	0.72	68.0	0.72	68	4.00	1.10									0.20	1.30	PVC	200	201.2	1.50	113.5	40.80	97%	1.28	114.14	113.94	112.44	112.24
Bandelier Way	MH	177	CAP	Bandelier Way	0.17	14.0	4.10	328	4.00	5.31			10.87	1557	1.50	9.46			4.19	18.97	CONC	300	304.8	0.20	38.0	44.55	57%	0.61	110.87	110.57	110.80	110.50
Street No.2	CAP	Bandelier Way	EX	14 A			4.10	328	4.00	5.31			10.87	1557	1.50	9.46			4.19	18.97	CONC	300	304.8	0.20	43.0	45.12	58%	0.62	110.80	110.50	110.71	110.41

Existing Sanitary Sewers

LICENSED PROFESSIONAL ENGINEER
A. G. Y. SAUVE
100142393
Feb. 24, 2017
PROVINCE OF ONTARIO

STORM SEWER COMPUTATION FORM

DESIGNED BY: VLL
CHECKED BY: AGS

POTTER'S KEY SUBDIVISION
Minto Communities Inc.
131003
ATREL ENGINEERING LTD
February, 2017

STORM FREQUENCY : 2 YEAR
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 1

STREET NAMES	LOCATION FROM (Up)		LOCATION TO (Down)		AREA (ha.) RUNOFF COEFFICIENT 0.20	0.45	0.55	0.58	0.70	0.75	0.61	0.87	RATIONAL METHOD INDIV. 2.78AR	ACCUM. 2.78AR	2 YEAR TIME CONC. (MIN)	RAINF. INTENS. (MM/HR)	FLOW (L/S)	**ACTUAL PIPE FLOW (L/S)**	PIPE TYPE	DIA. (N0M) (mm)	(ACT)	SEWER DATA SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	UpStream **Hgl at UP-MH (M)**	Hgl Out UP-MH (M)	Down MH Hgl (M)	UpStream USF ELEV (M)	HGL FREEBOARD (M)
Discovery Crescent	MH	501	MH	502											10.00	76.81			PVC	300	299.2	2.00	12.5	135.80	100%	1.93	0.11	117.27	116.97		no	117.02	116.72	117.27	117.27	117.02	117.76	0.49
Discovery Crescent	MH	502	MH	504					0.26				0.51	0.51	10.11	76.39	38.65	38.65	PVC	300	299.2	0.85	64.0	88.53	56%	1.26	0.85	116.99	116.69		no	116.45	116.15	116.99	116.99	116.47	117.42	0.43
Samantha Eastop Avenue	MH	503	MH	504					0.15				0.29	0.29	10.00	76.81	22.42	22.42	PVC	300	299.2	1.00	36.0	96.02	77%	1.37	0.44	116.81	116.51		no	116.45	116.15	116.81	116.81	116.47	117.47	0.66
Samantha Eastop Avenue	MH	504	MH	505					0.24				0.47	1.26	10.96	73.32	92.74	92.74	CONC	450	457.2	0.20	68.0	133.02	30%	0.81	1.40	116.45	116.00		no	116.31	115.86	116.47	116.45	116.31	117.20	0.75
Samantha Eastop Avenue	MH	505	MH	510					0.31				0.60	1.87	12.35	68.81	128.55	128.55	CONC	525	533.4	0.20	68.0	200.65	36%	0.90	1.26	116.31	115.79	0.20	no	116.17	115.65	116.31	116.31	116.17	116.94	0.63
Discovery Crescent	MH	1501	MH	506			0.26		0.32				1.02	1.02	10.00	76.81	78.37	78.37	PVC	375	366.4	0.65	117.0	132.90	41%	1.26	1.55	117.31	116.94		no	116.55	116.18	117.31	117.31	116.55	117.80	0.49
Discovery Crescent	MH	506	MH	507										1.02	11.55	71.33	72.78	72.78	PVC	375	366.4	0.90	11.5	156.38	53%	1.48	0.13	116.52	116.15		no	116.42	116.05	116.53	116.52	116.43	117.46	0.94
Discovery Crescent	MH	507	MH	510			0.41		0.31				1.23	2.25	11.68	70.92	159.60	159.60	CONC	450	457.2	0.80	64.0	266.03	40%	1.62	0.66	116.42	115.97		no	115.91	115.46	116.43	116.42	116.01	117.03	0.61
Eagle Crest Heights	MH	510	MH	511			0.24		0.16				0.68	4.80	13.62	65.24	312.95	312.95	CONC	525	533.4	0.96	66.0	439.59	29%	1.97	0.56	115.91	115.39		no	115.28	114.76	116.01	115.91	115.31	n/a	n/a
Eagle Crest Heights	MH	511	MH	512										4.80	14.18	63.79	305.99	305.99	CONC	600	609.6	0.50	12.5	452.94	32%	1.55	0.13	115.28	114.68		no	115.22	114.62	115.31	115.28	115.24	n/a	n/a
Eagle Crest Heights	MH	512	MH	513					0.23				0.45	5.24	14.31	63.45	332.76	332.76	CONC	750	762.0	0.15	65.0	449.81	26%	0.99	1.10	115.22	114.47		no	115.12	114.37	115.24	115.22	115.12	116.12	0.90
Eagle Crest Heights	MH	513	MH	514			0.39		0.32				1.22	6.46	15.41	60.82	393.11	393.11	CONC	750	762.0	0.15	66.0	449.81	13%	0.99	1.12	115.12	114.37		no	115.02	114.27	115.12	115.12	115.02	116.47	1.35
Eagle Crest Heights	MH	514	MH	515										6.46	16.52	58.39	377.40	377.40	CONC	750	762.0	0.15	8.5	449.81	16%	0.99	0.14	114.99	114.24		no	114.98	114.23	115.00	114.99	114.98	116.57	1.58
Eagle Crest Heights	MH	515	MH	517			0.05		0.22				0.50	6.97	16.67	58.09	404.78	404.78	CONC	750	762.0	1.05	100.5	1190.09	66%	2.61	0.64	114.95	114.20		no	113.89	113.14	114.96	114.95	113.89	116.35	1.40
Park 1	MH	516	MH	517	0.99								0.55	0.55	10.00	76.81	42.28	42.28	PVC	300	299.2	1.00	12.5	96.02	56%	1.37	0.15	114.02	113.72		no	113.89	113.59	114.02	114.02	113.89	n/a	n/a
Eagle Crest Heights	MH	517	MH	525			0.16		0.29				0.81	8.33	17.31	56.81	473.08	473.08	CONC	750	762.0	1.50	73.0	1422.43	67%	3.12	0.39	113.89	113.14		no	112.79	112.04	113.89	113.89	112.79	114.33	0.44
Hawks Landing Crescent	MH	520	MH	521											10.00	76.81			PVC	300	299.2	0.40	13.0	60.73	100%	0.86	0.25	113.37	113.07		no	113.32	113.02	113.37	113.37	113.32	114.17	0.80
Hawks Landing Crescent	MH	521	MH	525					0.40				0.78	0.78	10.25	75.85	59.04	59.04	PVC	375	366.4	0.30	110.5	90.28	35%	0.86	2.15	113.32	112.95	0.20	no	112.99	112.62	113.32	113.32	112.99	114.00	0.68
Eagle Crest Heights	MH	525	MH	528			0.29		0.19				0.81	9.92	17.70	56.05	555.96	555.96	CONC	825	838.2	0.22	77.0	702.39	21%	1.27	1.01	112.79	111.97	0.20	no	112.62	111.80	112.79	112.79	112.62	114.34	1.55
Hawks Landing Crescent	MH	1520	MH	526					0.34				0.66	0.66	10.00	76.81	50.82	50.82	PVC	375	366.4	0.30	62.0	90.28	44%	0.86	1.21	113.38	113.01		no	113.19	112.82	113.38	113.38	113.19	114.00	0.62
Hawks Landing Crescent	MH	526	MH	527										0.66	11.21	72.46	47.94	47.94	PVC	375	366.4	0.30	9.5	90.28	47%	0.86	0.18	113.16	112.79		no	113.13	112.76	113.16	113.16	113.13	113.76	0.60
Hawks Landing Crescent	MH	527	MH	528					0.25				0.49	1.15	11.39	71.84	82.48	82.48	CONC	450	457.2	0.30	102.0	162.91	49%	0.99	1.71	113.13	112.68	0.40	no	112.82	112.37	113.13	113.13	112.82	113.79	0.66
Eagle Crest Heights	MH	528	MH	529										11.07	18.71	54.21	599.95	599.95	CONC	900	914.4	0.20	35.0	844.60	29%	1.29	0.45	112.42	111.52	0.20	no	112.35	111.45	112.42	112.42	112.35	113.55	1.13
Eagle Crest Heights	MH	529	MH	303				0.12	0.10				0.39	11.46	19.16	53.42	611.94	611.94	CONC	1050	1066.8	0.20	41.0	1274.02	52%	1.43	0.48	112.15	111.10		no	112.07	111.02	112.15	112.15	112.07	n/a	n/a
Kimpton Drive	MH	535	MH	536					0.16				0.31	0.31	10.00	76.81	23.92	23.92	PVC	300	299.2	2.00	39.0	135.80	82%	1.93	0.34	117.41	117.11		no	116.63	116.33	117.41	117.41	116.63	n/a	n/a
Kimpton Drive	MH	536	MH	545					0.21				0.41	0.72	10.34	75.54	54.39	54.39	PVC	300	299.2	1.90	60.0	132.36	59%	1.88	0.53	116.60	116.30	0.50	no	115.46	115.16	116.61	116.60	115.46	117.07	0.47
Winterset Place	MH	538	MH	539			0.27		0.26				0.92	0.92	10.00	76.81	70.57	70.57	PVC	375	366.4	0.64	78.0	131.87	46%	1.25	1.04	116.52	116.15		no	116.02	115.65	116.52	116.52	116.02	117.00	0.48
Winterset Place	MH	539	MH	540										0.92	11.04	73.03	67.10	67.10	PVC	375	366.4	0.64	11.0	131.87	49%	1.25	0.15	115.99	115.62		no	115.92	115.55	116.00	115.99	115.92	117.58	1.59
Winterset Place	MH	540	MH	542			0.21		0.25				0.81	1.73	11.19	72.53	125.21	125.21	PVC	375	366.4	1.07	67.5	170.51	27%	1.62	0.70	115.89	115.52	0.03	no	115.17	114.80	115.91	115.89	115.20	116.67	0.78
Samantha Eastop Avenue	MH	541	MH	542						0.34			0.71	0.71	10.00	76.81	54.45	54.45	PVC	375	366.4	0.26	63.0	84.05	35%	0.80	1.32	115.30	114.93		no	115.14	114.77	115.30	115.30	115.20	115.69	0.39
Samantha Eastop Avenue	MH	542	MH	545					0.31				0.60	3.04	11.88	70.26	213.49	213.49	CONC	600	609.6	0.15	81.5	248.09	14%	0.85	1.60	115.14	114.54		no	115.02	114.42	115.20	115.14	115.02	116.16	1.02
Samantha Eastop Avenue	MH	543	MH	545		0.13			0.19				0.53	0.53	10.00	76.81	40.89	40.89	PVC	300	299.2	2.50	39.5	151.83	73%	2.16	0.30	116.35	116.05	0.40	no	115.36	115.06	116.35	116.35	115.36	n/a	n/a
Kimpton Drive	MH	545	MH	546		0.14			0.35				0.86	5.15	13.48	65.60	337.65	337.65	CONC	600	609.6	0.73	104.0	547.29	38%	1.88	0.92	114.96	114.36		no	114.20	113.60	115.02	114.96	114.20	116.89	1.93
Kimpton Drive	MH	546	MH	547		0.13			0.29				0.73	5.87	14.40	63.21	371.30	371.30	CONC	600	609.6	0.73	116.5	547.29	32%	1.88	1.04	114.20	113.60		no	113.35	112.75	114.20	114.20	113.35	115.49	1.29
Kimpton Drive	MH	547	MH	548		0.23			0.18				0.64	6.51	15.44	60.75	395.61	395.61	CONC	600	609.6	0.73	32.5	547.29	28%	1.88	0.29	113.35	112.75		no	113.11	112.51	113.35	113.35	113.15	114.60	1.25
Kimpton Drive	MH	548	MH	565					0.25				0.49	7.00	15.73	60.10	420.62	420.62	CONC	600	609.6	0.73	67.5	547.29	23%	1.88	0.60	113.11	112.51	0.25	no	112.62	112.02	113.15	113.11	112.62	114.28	1.17

STORM SEWER COMPUTATION FORM

DESIGNED BY: VLL
CHECKED BY: AGS

POTTER'S KEY SUBDIVISION
Minto Communities Inc.
131003
ATREL ENGINEERING LTD
February, 2017

STORM FREQUENCY : 2 YEAR
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 1

STREET NAMES	LOCATION FROM (Up)		LOCATION TO (Down)		AREA (ha.) RUNOFF COEFFICIENT 0.20	0.45	0.55	0.58	0.70	0.75	0.61	0.87	RATIONAL METHOD INDIV. 2.78AR	ACCUM. 2.78AR	2 YEAR TIME CONC. (MIN)	RAINF. INTENS. (MM/HR)	FLOW (L/S)	**ACTUAL PIPE FLOW (L/S)**	PIPE TYPE	DIA. (N0M) (mm)	(ACT)	SEWER DATA SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	**UpStream Hgl at UP-MH (M)**	Hgl Out UP-MH (M)	Down MH Hgl (M)	UpStream USF ELEV (M)	HGL FREEBOARD (M)
Eaglehead Crescent	MH	550	MH	551			0.25		0.33				1.02	1.02	10.00	76.81	78.69	78.69	PVC	375	366.4	0.85	72.5	151.97	48%	1.44	0.84	115.27	114.90		no	114.65	114.28	115.27	115.27	114.65	115.75	0.48
Eaglehead Crescent	MH	551	MH	552										1.02	10.84	73.73	75.53	75.53	PVC	375	366.4	0.85	11.0	151.97	50%	1.44	0.13	114.62	114.25		no	114.53	114.16	114.63	114.62	114.55	115.43	0.81
Eaglehead Crescent	MH	552	MH	554			0.72		0.35				1.78	2.81	10.97	73.29	205.68	205.68	CONC	450	457.2	0.85	108.5	274.22	25%	1.67	1.08	114.53	114.08		no	113.61	113.16	114.55	114.53	113.61	115.97	1.44
Park 2	MH	553	MH	554	0.36								0.20	0.20	10.00	76.81	15.37	15.37	PVC	300	299.2	1.00	11.0	96.02	84%	1.37	0.13	113.72	113.42		no	113.61	113.31	113.72	113.72	113.61	n/a	n/a
Eaglehead Crescent	MH	554	MH	555										3.01	12.05	69.74	209.68	209.68	CONC	450	457.2	0.85	36.0	274.22	24%	1.67	0.36	113.61	113.16		no	113.30	112.85	113.61	113.61	113.30	114.44	0.83
Eaglehead Crescent	MH	555	MH	556					0.26				0.51	3.51	12.41	68.65	241.14	241.14	CONC	525	533.4	0.50	41.0	317.25	24%	1.42	0.48	113.30	112.78		no	113.09	112.57	113.30	113.30	113.09	114.04	0.74
Eaglehead Crescent	MH	556	MH	557										3.51	12.89	67.25	236.22	236.22	CONC	525	533.4	0.50	11.5	317.25	26%	1.42	0.14	113.06	112.54		no	113.00	112.48	113.08	113.06	113.00	113.97	0.91
Eaglehead Crescent	MH	557	MH	565			0.22		0.23				0.78	4.30	13.02	66.86	287.26	287.26	CONC	525	533.4	0.50	73.0	317.25	9%	1.42	0.86	112.97	112.45	0.23	no	112.60	112.08	113.00	112.97	112.60	113.73	0.76
Bandelier Way	MH	560	MH	562						0.08			0.17	0.17	10.00	76.81	12.81	12.81	PVC	300	299.2	0.70	44.5	80.34	84%	1.14	0.65	114.34	114.04		no	114.03	113.73	114.34	114.34	114.03	114.87	0.53
Geranium Walk	MH	561	MH	562											10.00	76.81			PVC	300	299.2	0.65	68.5	77.42	100%	1.10	1.04	114.48	114.18		no	114.03	113.73	114.48	114.48	114.03	115.27	0.79
Geranium Walk	MH	562	MH	563		0.24				0.39			1.11	1.28	11.04	73.04	93.51	93.51	PVC	375	366.4	0.90	44.0	156.38	40%	1.48	0.49	114.03	113.66	0.40	no	113.63	113.26	114.03	114.03	113.63	115.25	1.22
Geranium Walk	MH	563	MH	565					0.10				0.19	1.47	11.53	71.39	105.29	105.29	PVC	375	366.4	0.65	39.0	132.90	21%	1.26	0.52	113.20	112.83	0.58	no	112.95	112.58	113.22	113.20	112.95	114.77	1.57
Kimpton Drive	MH	565	MH	566					0.17				0.33	13.10	16.33	58.80	770.32	770.32	CONC	1050	1066.8	0.12	39.0	986.85	22%	1.10	0.59	112.37	111.32	0.60	no	112.32	111.27	112.37	112.37	112.32	n/a	n/a
Kimpton Drive	MH	566	MH	Kimpton Drive		0.43							0.54	13.64	16.92	57.58	785.32	785.32	CONC	1350	1371.6	0.12	22.0	1928.87	59%	1.31	0.28	111.72	110.37		no	111.69	110.34	111.73	111.72	111.69	n/a	n/a
Kimpton Drive	MH	Kimpton Drive	MH	8										13.64	17.20	57.02	777.68	777.68	CONC	1350	1371.6	0.12	41.5	1928.87	60%	1.31	0.53	111.69	110.34		no	111.64	110.29	111.69	111.69	111.64	n/a	n/a
Bandelier Way	MH	1560	MH	570						0.26			0.54	0.54	10.00	76.81	41.64	41.64	PVC	300	299.2	0.70	44.0	80.34	48%	1.14	0.64	114.27	113.97		no	113.96	113.66	114.27	114.27	113.96	114.88	0.61
Bandelier Way	MH	570	MH	571										0.54	10.64	74.43	40.35	40.35	PVC	300	299.2	0.70	9.5	80.34	50%	1.14	0.14	113.93	113.63		no	113.86	113.56	113.94	113.93	113.87	114.51	0.58
Bandelier Way	MH	571	MH	572		0.46							0.58	1.12	10.78	73.93	82.62	82.62	PVC	375	366.4	0.70	71.0	138.31	40%	1.31	0.90	113.86	113.49		no	113.36	112.99	113.87	113.86	113.36	114.51	0.65
Bandelier Way	MH	572	MH	575		0.22				0.40			1.11	2.23	11.68	70.90	157.88	157.88	CONC	450	457.2	0.65	57.5	239.80	34%	1.46	0.66	113.36	112.91	0.04	no	112.99	112.54	113.36	113.36	113.19	114.07	0.71
Commercial (by others)	MH	501	MH	574				1.18		8.86			20.38	20.38	15.00	61.77	1258.61	1258.61	CONC	1050	1066.8	0.27	6.0	1480.28	15%	1.66	0.06	113.22	112.17		no	113.20	112.15	113.39	113.39	113.38	n/a	n/a
Commercial (by Minto)	MH	502	MH	574						1.81			3.77	3.77	10.11	76.39	288.28	288.28	CONC	600	609.6	0.27	9.0	332.84	13%	1.14	0.13	113.20	112.60	0.01	no	113.18	112.58	113.40	113.40	113.38	n/a	n/a
Easement	MH	574	MH	575										24.15	15.06	61.63	1488.34	1488.34	CONC	1050	1066.8	0.30	53.0	1560.35	5%	1.75	0.51	113.17	112.12		no	113.01	111.96	113.38	113.33	113.19	n/a	n/a
Bandelier Way	MH	575	MH	576										26.38	15.57	60.46	1594.71	1594.71	CONC	1050	1066.8	0.45	12.0	1911.03	17%	2.14	0.09	112.95	111.90		no	112.90	111.85	113.19	112.99	112.95	113.77	0.78
Bandelier Way	MH	576	MH	577		0.19				0.33			0.93	27.30	15.66	60.25	1644.95	1644.95	CONC	1200	1219.2	0.27	72.5	2113.43	22%	1.81	0.67	112.90	111.70		no	112.70	111.50	112.95	112.90	112.70	113.77	0.87
Geranium Walk	MH	10561	MH	577		0.62				0.49			1.80	1.80	10.00	76.81	138.05	138.05	PVC	375	366.4	1.50	113.0	201.88	32%	1.91	0.98	114.40	114.03		no	112.70	112.33	114.40	114.40	112.70	115.15	0.75
Bandelier Way	MH	577	MH	Bandelier Way		0.36				0.25			0.97	30.07	16.33	58.80	1768.17	1768.17	CONC	1350	1371.6	0.20	36.5	2490.17	29%	1.69	0.36	112.70	111.35		no	112.63	111.28	112.70	112.70	112.63	113.93	1.23
Bandelier Way	MH	Bandelier Way	MH	14							0.14		0.24	30.31	16.69	58.05	1759.40	1759.40	CONC	1350	1371.6	0.20	41.5	2490.17	29%	1.69	0.41	112.63	111.28		no	112.55	111.20	112.63	112.63	112.55	n/a	n/a

Existing Storm Sewer

STORM SEWER COMPUTATION FORM

DESIGNED BY: VLL
CHECKED BY: AGS

POTTER'S KEY SUBDIVISION
Minto Communities Inc.
131003
ATREL ENGINEERING LTD
February, 2017

RESTRICTED FLOW : 70 L/S/Ha.
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 2

STREET NAMES	LOCATION FROM (Up)		LOCATION TO (Down)		AREA (ha.) RUNOFF COEFFICIENT 0.20	0.45	0.55	0.58	0.70	0.75	0.61	0.87	Above ground Indiv 70.00 L/s/ha	Cumul 70.00 L/s/ha	FLOW (L/S)	Restricted Flow (L/S)	Cum Restricted Flow (L/S)	**ACTUAL PIPE FLOW (L/S)**	PIPE TYPE	DIA. (N0M) (mm)	(ACT)	SEWER DATA SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	**UpStream Hgl at UP-MH (M)**	Hgl Out UP-MH (M)	Down MH Hgl (M)	UpStream USF ELEV (M)	HGL FREEBOARD (M)
Discovery Crescent	MH	501	MH	502															PVC	300	299.2	2.00	12.5	135.80	100%	1.93	0.11	117.27	116.97		no	117.02	116.72	117.27	117.27	117.02	117.76	0.49
Discovery Crescent	MH	502	MH	504					0.26				18.20	18.20	18.20	15.50	15.50	15.50	PVC	300	299.2	0.85	64.0	88.53	82%	1.26	0.85	116.99	116.69		no	116.45	116.15	116.99	116.99	116.46	117.42	0.43
Samantha Eastop Avenue	MH	503	MH	504					0.15				10.50	10.50	10.50	31.00	31.00	31.00	PVC	300	299.2	1.00	36.0	96.02	68%	1.37	0.44	116.81	116.51		no	116.45	116.15	116.81	116.81	116.46	117.47	0.66
Samantha Eastop Avenue	MH	504	MH	505					0.24				16.80	45.50	45.50	15.50	62.00	62.00	CONC	450	457.2	0.20	68.0	133.02	53%	0.81	1.40	116.45	116.00		no	116.31	115.86	116.46	116.45	116.31	117.20	0.75
Samantha Eastop Avenue	MH	505	MH	510					0.31				21.70	67.20	67.20	15.50	77.50	77.50	CONC	525	533.4	0.20	68.0	200.65	61%	0.90	1.26	116.31	115.79	0.20	no	116.17	115.65	116.31	116.31	116.17	116.94	0.63
Discovery Crescent	MH	1501	MH	506			0.26		0.32				40.60	40.60	40.60	31.00	31.00	31.00	PVC	375	366.4	0.65	117.0	132.90	77%	1.26	1.55	117.31	116.94		no	116.55	116.18	117.31	117.31	116.55	117.80	0.49
Discovery Crescent	MH	506	MH	507										40.60	40.60		31.00	31.00	PVC	375	366.4	0.90	11.5	156.38	80%	1.48	0.13	116.52	116.15		no	116.42	116.05	116.52	116.52	116.42	117.46	0.94
Discovery Crescent	MH	507	MH	510			0.41		0.31				50.40	91.00	91.00	46.50	77.50	77.50	CONC	450	457.2	0.80	64.0	266.03	71%	1.62	0.66	116.42	115.97		no	115.91	115.46	116.42	116.42	115.94	117.03	0.61
Eagle Crest Heights	MH	510	MH	511			0.24		0.16				28.00	186.20	186.20	31.00	186.00	186.00	CONC	525	533.4	0.96	66.0	439.59	58%	1.97	0.56	115.91	115.39		no	115.28	114.76	115.94	115.91	115.29	n/a	n/a
Eagle Crest Heights	MH	511	MH	512										186.20	186.20		186.00	186.00	CONC	600	609.6	0.50	12.5	452.94	59%	1.55	0.13	115.28	114.68		no	115.22	114.62	115.29	115.28	115.23	n/a	n/a
Eagle Crest Heights	MH	512	MH	513					0.23				16.10	202.30	202.30	15.50	201.50	201.50	CONC	750	762.0	0.15	65.0	449.81	55%	0.99	1.10	115.22	114.47		no	115.12	114.37	115.23	115.22	115.12	116.12	0.90
Eagle Crest Heights	MH	513	MH	514			0.39		0.32				49.70	252.00	252.00	31.00	232.50	232.50	CONC	750	762.0	0.15	66.0	449.81	48%	0.99	1.12	115.12	114.37		no	115.02	114.27	115.12	115.12	115.02	116.47	1.35
Eagle Crest Heights	MH	514	MH	515										252.00	252.00		232.50	232.50	CONC	750	762.0	0.15	8.5	449.81	48%	0.99	0.14	114.99	114.24		no	114.98	114.23	115.00	114.99	114.98	116.57	1.58
Eagle Crest Heights	MH	515	MH	517			0.05		0.22				18.90	270.90	270.90	31.00	263.50	263.50	CONC	750	762.0	1.05	100.5	1190.09	78%	2.61	0.64	114.95	114.20		no	113.89	113.14	114.96	114.95	113.89	116.35	1.40
Park 1	MH	516	MH	517	0.99								69.30	69.30	69.30	69.30	69.30	69.30	PVC	300	299.2	1.00	12.5	96.02	28%	1.37	0.15	114.02	113.72		no	113.89	113.59	114.02	114.02	113.89	n/a	n/a
Eagle Crest Heights	MH	517	MH	525			0.16		0.29				31.50	371.70	371.70	31.00	363.80	363.80	CONC	750	762.0	1.50	73.0	1422.43	74%	3.12	0.39	113.89	113.14		no	112.79	112.04	113.89	113.89	112.79	114.33	0.44
Hawks Landing Crescent	MH	520	MH	521															PVC	300	299.2	0.40	13.0	60.73	100%	0.86	0.25	113.37	113.07		no	113.32	113.02	113.37	113.37	113.32	114.17	0.80
Hawks Landing Crescent	MH	521	MH	525					0.40				28.00	28.00	28.00	46.50	46.50	46.50	PVC	375	366.4	0.30	110.5	90.28	48%	0.86	2.15	113.32	112.95	0.20	no	112.99	112.62	113.32	113.32	112.99	114.00	0.68
Eagle Crest Heights	MH	525	MH	528			0.29		0.19				33.60	433.30	433.30	31.00	441.30	441.30	CONC	825	838.2	0.22	77.0	702.39	37%	1.27	1.01	112.79	111.97	0.20	no	112.62	111.80	112.79	112.79	112.62	114.34	1.55
Hawks Landing Crescent	MH	1520	MH	526					0.34				23.80	23.80	23.80	15.50	15.50	15.50	PVC	375	366.4	0.30	62.0	90.28	83%	0.86	1.21	113.38	113.01		no	113.19	112.82	113.38	113.38	113.19	114.00	0.62
Hawks Landing Crescent	MH	526	MH	527										23.80	23.80		15.50	15.50	PVC	375	366.4	0.30	9.5	90.28	83%	0.86	0.18	113.16	112.79		no	113.13	112.76	113.16	113.16	113.13	113.76	0.60
Hawks Landing Crescent	MH	527	MH	528					0.25				17.50	41.30	41.30	31.00	46.50	46.50	CONC	450	457.2	0.30	102.0	162.91	71%	0.99	1.71	113.13	112.68	0.40	no	112.82	112.37	113.13	113.13	112.82	113.79	0.66
Eagle Crest Heights	MH	528	MH	529										474.60	474.60		487.80	487.80	CONC	900	914.4	0.20	35.0	844.60	42%	1.29	0.45	112.42	111.52	0.20	no	112.35	111.45	112.42	112.42	112.35	113.55	1.13
Eagle Crest Heights	MH	529	MH	303				0.12	0.10				15.40	490.00	490.00	20.00	507.80	507.80	CONC	1050	1066.8	0.20	41.0	1274.02	60%	1.43	0.48	112.15	111.10		no	112.07	111.02	112.15	112.15	112.07	n/a	n/a
Kimpton Drive	MH	535	MH	536					0.16				11.20	11.20	11.20	15.50	15.50	15.50	PVC	300	299.2	2.00	39.0	135.80	89%	1.93	0.34	117.41	117.11		no	116.63	116.33	117.41	117.41	116.63	n/a	n/a
Kimpton Drive	MH	536	MH	545					0.21				14.70	25.90	25.90	15.50	31.00	31.00	PVC	300	299.2	1.90	60.0	132.36	77%	1.88	0.53	116.60	116.30	0.50	no	115.46	115.16	116.60	116.60	115.46	117.07	0.47
Winterset Place	MH	538	MH	539			0.27		0.26				37.10	37.10	37.10	46.50	46.50	46.50	PVC	375	366.4	0.64	78.0	131.87	65%	1.25	1.04	116.52	116.15		no	116.02	115.65	116.52	116.52	116.02	117.00	0.48
Winterset Place	MH	539	MH	540										37.10	37.10		46.50	46.50	PVC	375	366.4	0.64	11.0	131.87	65%	1.25	0.15	115.99	115.62		no	115.92	115.55	115.99	115.99	115.92	117.58	1.59
Winterset Place	MH	540	MH	542			0.21		0.25				32.20	69.30	69.30	31.00	77.50	77.50	PVC	375	366.4	1.07	67.5	170.51	55%	1.62	0.70	115.89	115.52	0.03	no	115.17	114.80	115.90	115.89	115.17	116.67	0.78
Samantha Eastop Avenue	MH	541	MH	542						0.34			23.80	23.80	23.80	15.50	15.50	15.50	PVC	375	366.4	0.26	63.0	84.05	82%	0.80	1.32	115.30	114.93		no	115.14	114.77	115.30	115.30	115.16	115.69	0.39
Samantha Eastop Avenue	MH	542	MH	545					0.31				21.70	114.80	114.80	15.50	108.50	108.50	CONC	600	609.6	0.15	81.5	248.09	56%	0.85	1.60	115.14	114.54		no	115.02	114.42	115.16	115.14	115.02	116.16	1.02
Samantha Eastop Avenue	MH	543	MH	545		0.13			0.19				22.40	22.40	22.40	46.50	46.50	46.50	PVC	300	299.2	2.50	39.5	151.83	69%	2.16	0.30	116.35	116.05	0.40	no	115.36	115.06	116.35	116.35	115.36	n/a	n/a
Kimpton Drive	MH	545	MH	546		0.14			0.35				34.30	197.40	197.40	31.00	217.00	217.00	CONC	600	609.6	0.73	104.0	547.29	60%	1.88	0.92	114.96	114.36		no	114.20	113.60	114.98	114.96	114.20	116.89	1.93
Kimpton Drive	MH	546	MH	547		0.13			0.29				29.40	226.80	226.80	31.00	248.00	248.00	CONC	600	609.6	0.73	116.5	547.29	55%	1.88	1.04	114.20	113.60		no	113.35	112.75	114.20	114.20	113.35	115.49	1.29
Kimpton Drive	MH	547	MH	548		0.23			0.18				28.70	255.50	255.50	31.00	279.00	279.00	CONC	600	609.6	0.73	32.5	547.29	49%	1.88	0.29	113.35	112.75		no	113.11	112.51	113.35	113.35	113.13	114.60	1.25
Kimpton Drive	MH	548	MH	565					0.25				17.50	273.00	273.00	15.50	294.50	294.50	CONC	600	609.6	0.73	67.5	547.29	46%	1.88	0.60	113.11	112.51	0.25	no	112.62	112.02	113.13	113.11	112.62	114.28	1.17

LICENSED PROFESSIONAL ENGINEER
A. G. Y. SAUVE
100142393
Feb. 24, 2017
PROVINCE OF ONTARIO

STORM SEWER COMPUTATION FORM

DESIGNED BY: VLL
CHECKED BY: AGS

POTTER'S KEY SUBDIVISION
Minto Communities Inc.
131003
ATREL ENGINEERING LTD
February, 2017

RESTRICTED FLOW : 70 L/S/Ha.
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 2

STREET NAMES	LOCATION FROM (Up)		TO (Down)		AREA (ha.) RUNOFF COEFFICIENT 0.20	0.45	0.55	0.58	0.70	0.75	0.61	0.87	Indiv 70.00 L/s/ha	Cumul 70.00 L/s/ha	FLOW (L/S)	Above ground Restricted Flow (L/S)	Cum Restricted Flow (L/S)	**ACTUAL PIPE FLOW (L/S)**	PIPE TYPE	DIA. (N0M) (mm)	(ACT)	SEWER DATA SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	**UpStream Hgl at UP-MH (M)**	Hgl Out UP-MH (M)	Down MH Hgl (M)	UpStream USF ELEV (M)	HGL FREEBOARD (M)
Eaglehead Crescent	MH	550	MH	551			0.25		0.33				40.60	40.60	40.60	46.50	46.50	46.50	PVC	375	366.4	0.85	72.5	151.97	69%	1.44	0.84	115.27	114.90		no	114.65	114.28	115.27	115.27	114.65	115.75	0.48
Eaglehead Crescent	MH	551	MH	552										40.60	40.60		46.50	46.50	PVC	375	366.4	0.85	11.0	151.97	69%	1.44	0.13	114.62	114.25		no	114.53	114.16	114.62	114.62	114.53	115.43	0.81
Eaglehead Crescent	MH	552	MH	554			0.72		0.35				74.90	115.50	115.50	31.00	77.50	77.50	CONC	450	457.2	0.85	108.5	274.22	72%	1.67	1.08	114.53	114.08		no	113.61	113.16	114.53	114.53	113.61	115.97	1.44
Park 2	MH	553	MH	554	0.36								25.20	25.20	25.20	25.20	25.20	25.20	PVC	300	299.2	1.00	11.0	96.02	74%	1.37	0.13	113.72	113.42		no	113.61	113.31	113.72	113.72	113.61	n/a	n/a
Eaglehead Crescent	MH	554	MH	555										140.70	140.70		102.70	102.70	CONC	450	457.2	0.85	36.0	274.22	63%	1.67	0.36	113.61	113.16		no	113.30	112.85	113.61	113.61	113.30	114.44	0.83
Eaglehead Crescent	MH	555	MH	556					0.26				18.20	158.90	158.90	20.00	122.70	122.70	CONC	525	533.4	0.50	41.0	317.25	61%	1.42	0.48	113.30	112.78		no	113.09	112.57	113.30	113.30	113.09	114.04	0.74
Eaglehead Crescent	MH	556	MH	557										158.90	158.90		122.70	122.70	CONC	525	533.4	0.50	11.5	317.25	61%	1.42	0.14	113.06	112.54		no	113.00	112.48	113.07	113.06	113.00	113.97	0.91
Eaglehead Crescent	MH	557	MH	565			0.22		0.23				31.50	190.40	190.40	35.50	158.19	158.19	CONC	525	533.4	0.50	73.0	317.25	50%	1.42	0.86	112.97	112.45	0.23	no	112.60	112.08	112.98	112.97	112.60	113.73	0.76
Bandelier Way	MH	560	MH	562						0.08			5.60	5.60	5.60	15.50	15.50	15.50	PVC	300	299.2	0.70	44.5	80.34	81%	1.14	0.65	114.34	114.04		no	114.03	113.73	114.34	114.34	114.03	114.87	0.53
Geranium Walk	MH	561	MH	562															PVC	300	299.2	0.65	68.5	77.42	100%	1.10	1.04	114.48	114.18		no	114.03	113.73	114.48	114.48	114.03	115.27	0.79
Geranium Walk	MH	562	MH	563		0.24				0.39			44.10	49.70	49.70	31.00	46.50	46.50	PVC	375	366.4	0.90	44.0	156.38	70%	1.48	0.49	114.03	113.66	0.40	no	113.63	113.26	114.03	114.03	113.63	115.25	1.22
Geranium Walk	MH	563	MH	565					0.10				7.00	56.70	56.70	15.50	62.00	62.00	PVC	375	366.4	0.65	39.0	132.90	53%	1.26	0.52	113.20	112.83	0.58	no	112.95	112.58	113.21	113.20	112.95	114.77	1.57
Kimpton Drive	MH	565	MH	566					0.17				11.90	532.00	532.00	20.00	534.69	534.69	CONC	1050	1066.8	0.12	39.0	986.85	46%	1.10	0.59	112.37	111.32	0.60	no	112.32	111.27	112.37	112.37	112.32	n/a	n/a
Kimpton Drive	MH	566	MH	Kimpton Drive		0.43							30.10	562.10	562.10	15.50	550.19	550.19	CONC	1350	1371.6	0.12	22.0	1928.87	71%	1.31	0.28	111.72	110.37		no	111.69	110.34	111.73	111.72	111.69	n/a	n/a
Kimpton Drive	MH	Kimpton Drive	MH	8										562.10	562.10		550.19	550.19	CONC	1350	1371.6	0.12	41.5	1928.87	71%	1.31	0.53	111.69	110.34		no	111.64	110.29	111.69	111.69	111.64	n/a	n/a
Bandelier Way	MH	1560	MH	570						0.26			18.20	18.20	18.20	15.50	15.50	15.50	PVC	300	299.2	0.70	44.0	80.34	81%	1.14	0.64	114.27	113.97		no	113.96	113.66	114.27	114.27	113.96	114.88	0.61
Bandelier Way	MH	570	MH	571										18.20	18.20		15.50	15.50	PVC	300	299.2	0.70	9.5	80.34	81%	1.14	0.14	113.93	113.63		no	113.86	113.56	113.93	113.93	113.86	114.51	0.58
Bandelier Way	MH	571	MH	572		0.46							32.20	50.40	50.40	31.00	46.50	46.50	PVC	375	366.4	0.70	71.0	138.31	66%	1.31	0.90	113.86	113.49		no	113.36	112.99	113.86	113.86	113.36	114.51	0.65
Bandelier Way	MH	572	MH	575		0.22				0.40			43.40	93.80	93.80	35.50	82.00	82.00	CONC	450	457.2	0.65	57.5	239.80	66%	1.46	0.66	113.36	112.91	0.04	no	112.99	112.54	113.36	113.36	113.01	114.07	0.71
Commercial (by others)	MH	501	MH	574				1.18		8.86			702.80	702.80	702.80	702.80	702.80	702.80	CONC	1050	1066.8	0.27	6.0	1480.28	53%	1.66	0.06	113.22	112.17		no	113.20	112.15	113.22	113.22	113.20	n/a	n/a
Commercial (by Minto)	MH	502	MH	574						1.81			126.70	126.70	126.70	126.70	126.70	126.70	CONC	600	609.6	0.27	9.0	332.84	62%	1.14	0.13	113.20	112.60	0.01	no	113.18	112.58	113.20	113.20	113.18	n/a	n/a
Easement	MH	574	MH	575										829.50	829.50		829.50	829.50	CONC	1050	1066.8	0.30	53.0	1560.35	47%	1.75	0.51	113.17	112.12		no	113.01	111.96	113.18	113.17	113.01	n/a	n/a
Bandelier Way	MH	575	MH	576										923.30	923.30		911.50	911.50	CONC	1050	1066.8	0.45	12.0	1911.03	52%	2.14	0.09	112.95	111.90		no	112.90	111.85	113.01	112.95	112.92	113.77	0.82
Bandelier Way	MH	576	MH	577		0.19				0.33			36.40	959.70	959.70	35.50	947.00	947.00	CONC	1200	1219.2	0.27	72.5	2113.43	55%	1.81	0.67	112.90	111.70		no	112.70	111.50	112.92	112.90	112.70	113.77	0.87
Geranium Walk	MH	10561	MH	577		0.62				0.49			77.70	77.70	77.70	71.00	71.00	71.00	PVC	375	366.4	1.50	113.0	201.88	65%	1.91	0.98	114.40	114.03		no	112.70	112.33	114.40	114.40	112.70	115.15	0.75
Bandelier Way	MH	577	MH	Bandelier Way		0.36				0.25			42.70	1080.10	1080.10	55.50	1073.50	1073.50	CONC	1350	1371.6	0.20	36.5	2490.17	57%	1.69	0.36	112.70	111.35		no	112.63	111.28	112.70	112.70	112.63	113.93	1.23
Bandelier Way	MH	Bandelier Way	MH	14							0.14		9.80	1089.90	1089.90	9.80	1083.30	1083.30	CONC	1350	1371.6	0.20	41.5	2490.17	56%	1.69	0.41	112.63	111.28		no	112.55	111.20	112.63	112.63	112.55	n/a	n/a

Existing Storm Sewer

Feedmill Creek
Stormwater Management Criteria Study

Final Report
with Expansion Area 3 and Update
April 30 2018

Submitted to:

City of Ottawa
Planning and Infrastructure

Submitted by:

J.F. Sabourin and Associates Inc.

In association with:

Coldwater Consulting Ltd

JFSA Ref. No.: 1307(01)-17

J.F. Sabourin and Associates Inc.
www.jfsa.com

JFSA Water Resources and Environmental Consultants

5.2 SWM Criteria

The SWM criteria for future developments within the Feedmill Creek subwatershed apply to the approximately 175.10 ha of remaining developable land within the Feedmill Creek subwatershed (refer to Table 1 and Figure 2). The SWM criteria have been developed based on data collected during a field investigation and analysis of hydrologic, hydraulic and geomorphic numerical simulations and calculations. The SWM criteria are setup to resolve both existing and future flood and erosion risk along Feedmill Creek. This study followed a step-by-step process considering four (4) SWM scenarios for the ultimate full build out conditions. The ultimate development conditions SWM control Scenario B has been selected as the 'optimal' scenario and forms the basis for these criteria.

There are four (4) components for SWM criteria, on-site extended detention storage, 100-year on-site storage, on-site LID controls and in-stream works.

The SWM criteria are as follows:

1. Extended Detention Control: Provide sufficient on-site storage volume to control the peak flow from a 15 mm 3-hour Chicago design storm to 0.51 L/s/ha.
2. Flood Control: Provide sufficient on-site storage volume and quantity control structure to control the peak flow from a 100-year 12-hour SCS Type II storm to 8.0 L/s/ha[3].
3. Retention Control: Provide on-site Low Impact Development (LID) controls to retain the entire volume (no runoff) from either a 5 mm or 10 mm rainfall depending on location:
    a. 5 mm for catchments located east of Carp Road (FS206_2, FS204, FS203a, FS203b, FS067_4, FS075_1, FS081_2 and FS107)
    b. 10 mm for catchments located west of Carp Road (FS103_2b and FS104_2b)[4]
4. In-stream works are required in addition to the SWM controls detailed above. A design has been prepared by Coldwater (2017b), refer to Appendix B of this report.

[3] Flood control requirements are listed for the 100-year event only, meeting this 100-year requirement will practically require inherent peak flow controls for more frequent events. The peak flow results from the 15-mm 3-hour Chicago storm and the 2- to 100-year 12-hour SCS Type II storm for near future conditions and ultimate development conditions SWM Scenario B are included in Appendix H for reference. These values should be referenced by detailed designers, in addition to the hydraulic constraints, since the overall goal of post-to-pre control on the subwatershed level applies to all return periods.

[4] The interim, near future and ultimate conditions model results for the Timbermere SWM pond are above the original design report. The proper functioning of that facility must be assessed and resolved before development can occur on the upstream catchments notwithstanding these SWM Criteria.

D07-16-03-0032

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IBI GROUP

3.3 Comparison of Peak Flows

The end-of-pipe stormwater management facility, in combination with the dual drainage system, was adjusted in the SWMHYMO model to ensure that there is no increase in peak outflows above that of the pre-development conditions. The comparison of the simulated pre-development and post-development flows and storages is presented in Table 1. Refer to Appendix A for SWMHYMO calculations and parameters and to Appendix B for the model schematic and output.

Table 1. Comparison of Simulated Peak Flows and Summary of the Required Storage Volumes

Storm Event		25 mm Chicago		2-year SCS Type II		5-year SCS Type II		100-year SCS Type II		100-year Chicago
		Pre-dev.	Post-dev.	Pre-dev.	Post-dev.	Pre-dev.	Post-dev.	Pre-dev.	Post-dev.	Post-dev.
Jackson Trails SWM Facility	Peak Flows (cms)	0.5	0.5	1.0	1.1	1.5	1.8	2.8	3.0	2.6
	Storage (ha-m)	N/A	0.7	N/A	1.1	N/A	1.3	N/A	1.7	1.6
	Elevation (m)	N/A	110.13	N/A	110.35	N/A	110.52	N/A	110.72	N/A
Feedmill Creek downstream of proposed SWM Facility outlet	Peak Flows (cms)	0.8	0.6	1.4	1.4	2.1	2.1	4.0	4.0	3.8

The comparison of peak flows in the above table indicates that the proposed stormwater management facility will meet peak flows to pre-development levels. Design of the stormwater management facility is discussed in Section 4.0.

3.4 Water Quality Benefits

According to the recommendations in the Carp River Watershed/Subwatershed study, the end-of-pipe stormwater management facility should be designed to provide an Enhanced Level of Protection due to the cool water fish habitat in Feedmill Creek. According to the MOE Stormwater Management Planning and Design Manual, March 2003, the treatment volume is a function of the drainage area, the urban imperviousness ratio and the level of protection. The storage requirements suggested by the MOE are summarized in Table 2 and calculations are summarized in Appendix A.

Table 2. Water Quality Volumes

Enhanced Level of Protection – Hybrid Wet Pond			
Overall Removal Efficiency of TSS 80%			
Urban Drainage (ha)	Imperviousness Ratio (Unit Storage for Hybrid Wet Pond) (%)	Permanent Storage (m^3)	Extended Detention Storage (m^3)
79.3	54	8564	3172

The above table indicates that the permanent storage of the facility, a hybrid wet pond, would be 0.86 ha-m, while the extended storage would be 0.32 ha-m. The facility's permanent storage was oversized to 1.89 ha-m to provide a deep pool at the outlet to mitigate thermal impacts as discussed in Section 4.3.

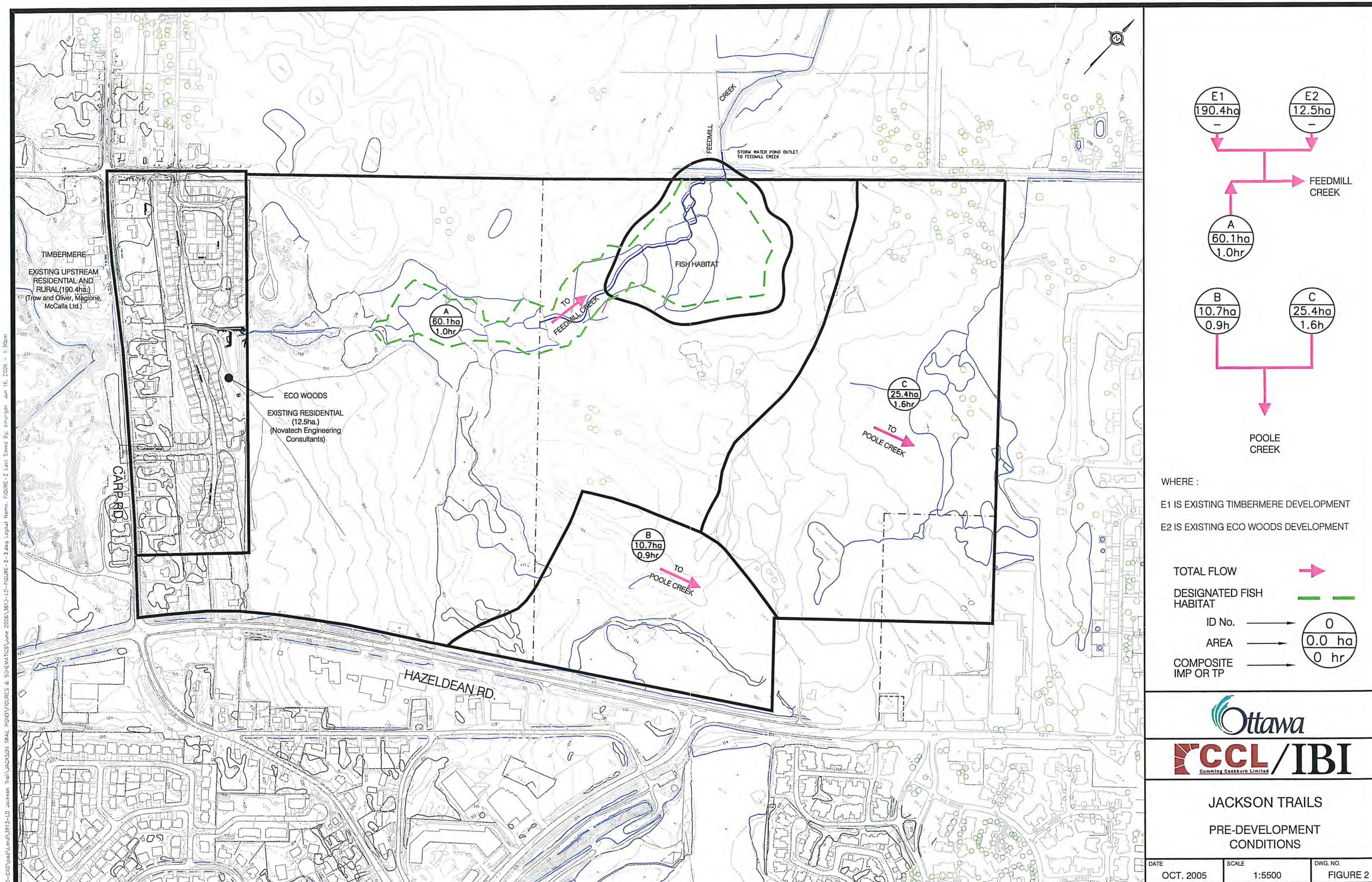
Past studies by CH2M Hill (Kanata North Environmental/Stormwater Management Plan, February 2001), Dillon Consulting (Shirley's Brook/Watts Creek Subwatershed Study, 1999) and CCL (City of Kanata, Kanata Town Centre Master Drainage Study Watts Creek, May 1993) have investigated the issue of erosion protection downstream of stormwater management facilities. In particular, Dillon Consulting found in their 1999 report that "40 m^3 per hectare live storage detention by meeting MOE Level 2 treatment volume requirements will provide sufficient attenuation of flows from relatively frequent runoff events to control the frequency and duration with downstream watercourse flows exceed critical erosive flows."

Although the names of the treatment protection were changed in the March 2003 MOE Manual, according to past experience, any treatment above, but not including, Basic Level of Protection provides erosion control by slowing the release of water from the facility during frequent storms which have an increased potential to cause erosion. CCL/IBI has conducted several studies to evaluate cumulative shear stress erosion and resulting potential for erosion for both pre- and post-development conditions. In all of the studies, Normal Level of Protection implies that watercourse erosion control is provided. The cumulative shear stress is decreased due to the water quality outlet, which reduces outflows below erosion potential. Since the Jackson Trails stormwater management facility is designed to provide a higher level of protection (an Enhanced Level of Protection) the erosion protection will be achieved.

3.5 Groundwater Recharge

In "Tamarack Lands (Jackson Trails) Stormwater Management Report," CCL/IBI, January 2005, several types of BMP's were investigated to promote groundwater recharge into the Poole Creek subwatershed. The suitability of each of the proposed BMP's was assessed during the detailed design of the subdivision, and infiltration techniques based on the principles of infiltration trenches will be implemented.

The proposed site grading is designed on lot split-drainage principles, directing runoff from roofs onto grassed surfaces. There will be significant bedrock blasted within the Jackson Trails development to construct basements and the stormwater management facility, producing a considerable amount of blasted rock. This rock will be



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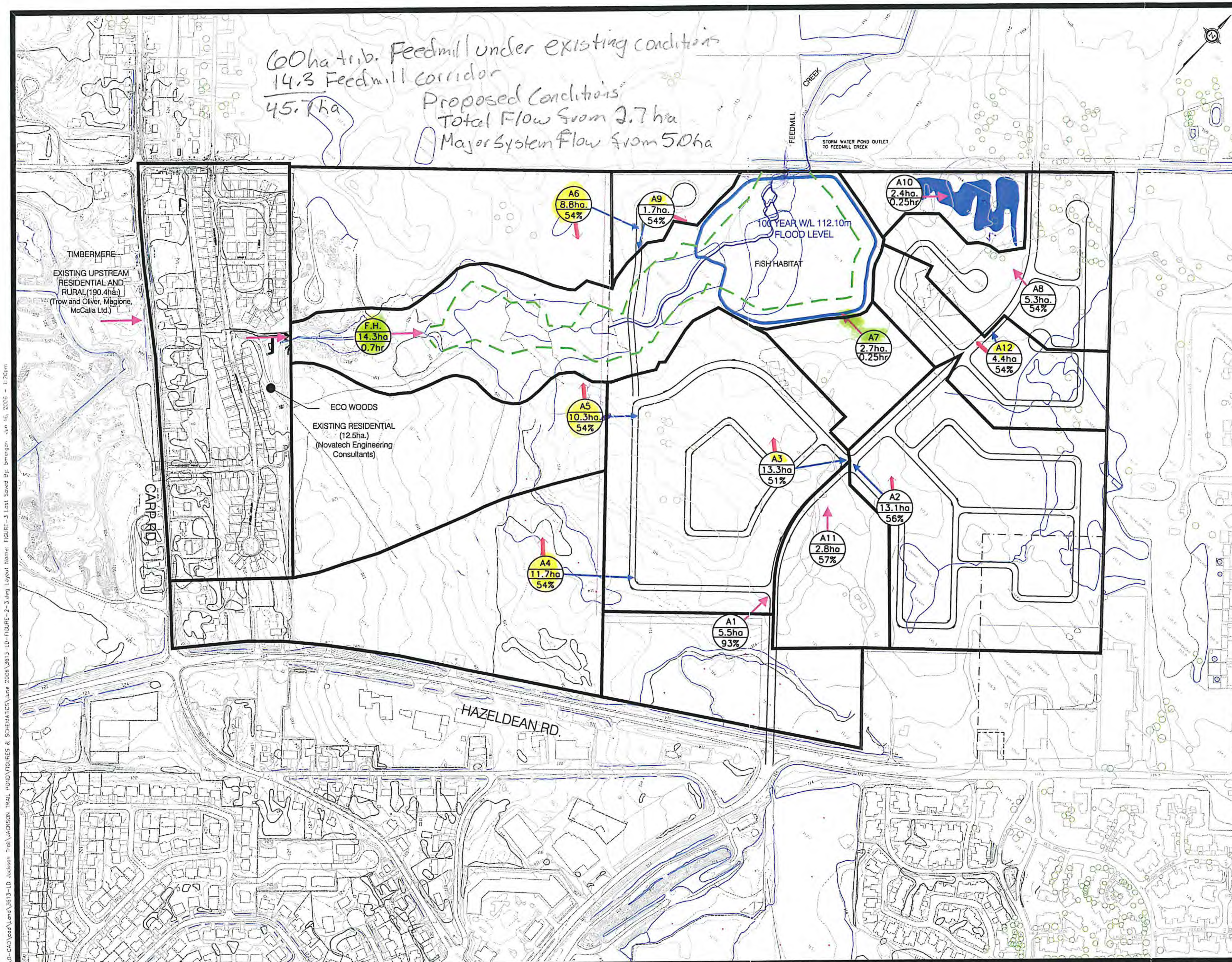
PRE-DEVELOPMENT CONDITIONS

DATE	SCALE	DWG. NO.
OCT. 2005	1:5500	FIGURE 2



NOTES:

MAJOR OVERFLOW	(red arrow)
TOTAL FLOW	(green arrow)
MINOR FLOW	(blue arrow)
DESIGNATED FISH HABITAT	(green dashed line)
ID No.	0
AREA	0.0 ha
COMPOSITE IMP OR TP	0%

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MASTER STORM DRAINAGE PLAN

DATE	SCALE	DWG. NO.
OCT. 2005	1:5500	FIGURE 3

Robinson Consultants

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Carp River Watershed/ Subwatershed Study Volume I - Main Report

Prepared For:

Ottawa

Prepared By:

Robinson Consultants Inc.
Aquafor Beech Ltd.
Lloyd Phillips and Associates
Daniel Brunton Consulting Services

Project No. 00056
December 2004

TARGETS

Groundwater Resources
- 262 mm/yr infiltration for high recharge areas
- 104 mm/yr infiltration for moderate recharge areas
- 73 mm/yr infiltration for low recharge areas
- maintain groundwater discharge to Feedmill Creek

Surface Water Resources
- Enhanced (80% long term suspended sediment removal) level water quality control
- 10 l/s (over 7 day period) low flow augmentation from each stormwater management facility
- area F5 requires 2 through 100 year post to pre control for flooding and 30% DRC control for erosion

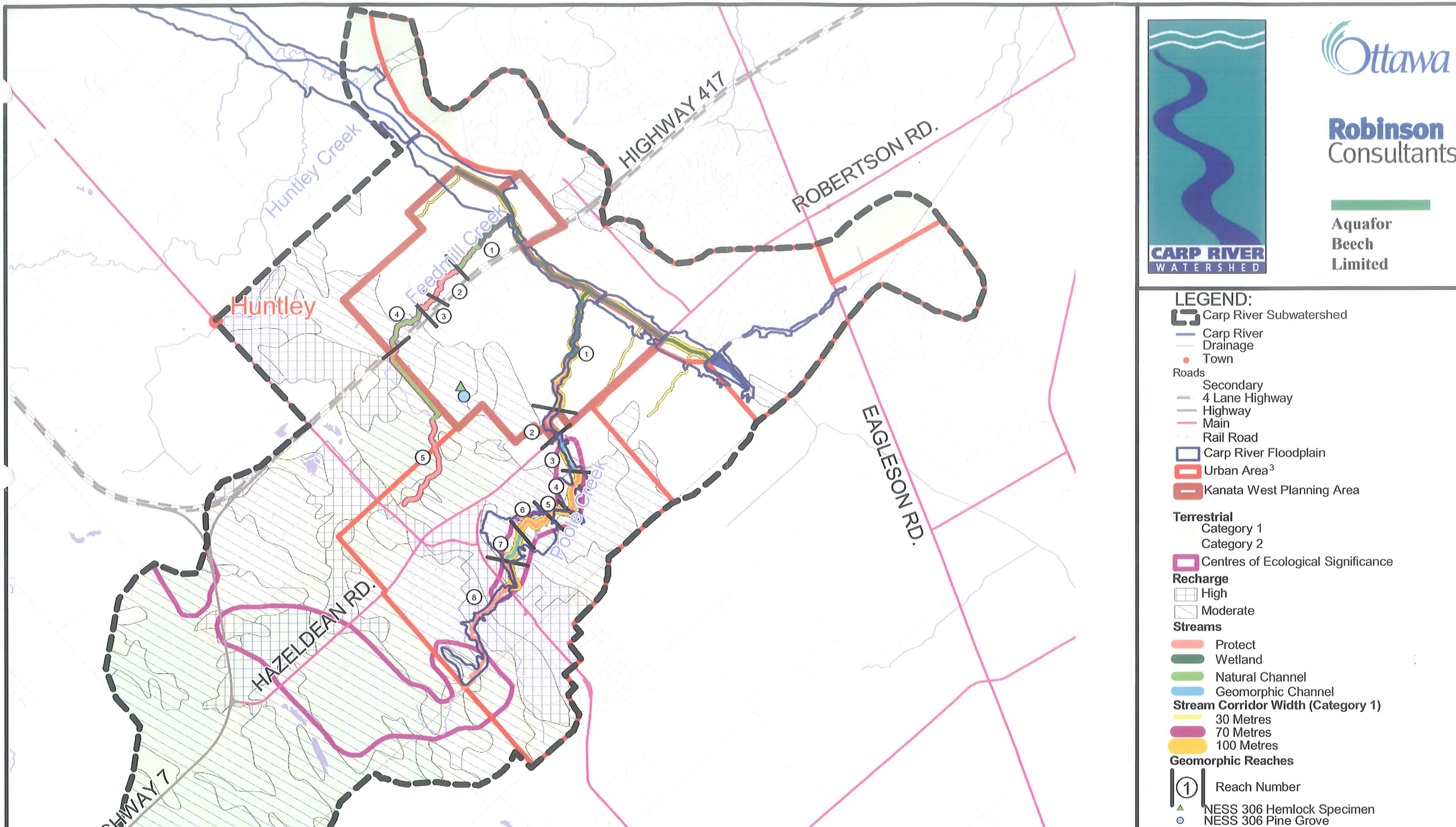
Stream Morphology
- Restoration of 1100 m of stream using natural channel design principles (see Appendix B for baseline conditions)

Aquatic Resources
- Maintain Tolerant Coldwater Fish Community Type 1 (see **Table 9.2.1** for representative species and **Table 9.2.2** for specific targets)
- Maximum stream temperature = 25 C
- Minimum Dissolved Oxygen = 6 mg/l

Terrestrial Resources
- Protect Category 1 features located within Feedmill Creek Corridor and tableland woodlands/wetlands

Corridors
- Provide a minimum 60 m corridor along Feedmill Creek.

ENVIRONMENTAL STUDY REQUIREMENTS
- Restoration Plan and delineation of creek corridor widths for Feedmill Creek
- Floodplain mapping for Feedmill Creek
- Conceptual and Functional design of stormwater management facilities
- Preparation of water budget for subject area
- Groundwater study to identify flow patterns, recharge – discharge characteristics/linkages
- Preparation of Site EIS Report in Category 1 and 2 areas
- Development of an Environmental Monitoring Plan



Carp River Watershed Study

Recommended Subwatershed Plan

Figure 9.5

Appendix J – Manufacturers Information

Flexmat Specification Sheet (1 page)

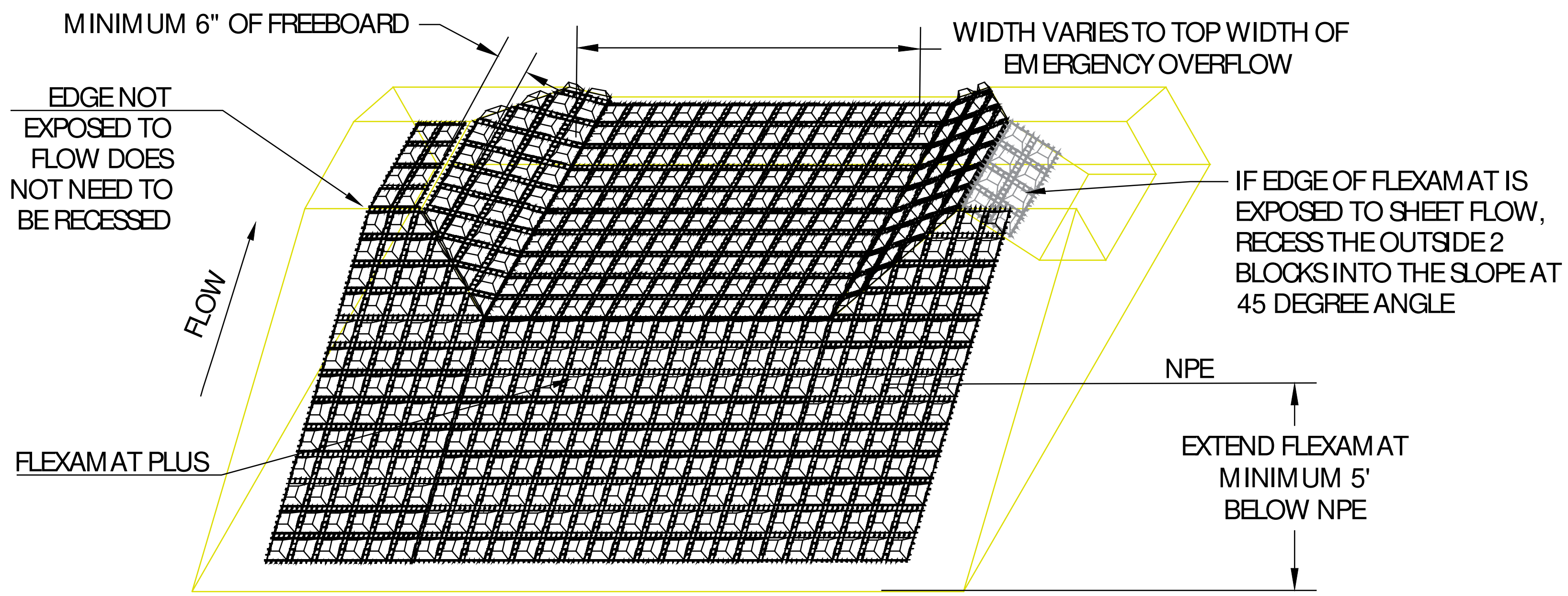
Flexmat – Data Sheet (1 page)

Flexmat – Brochure (4 pages)

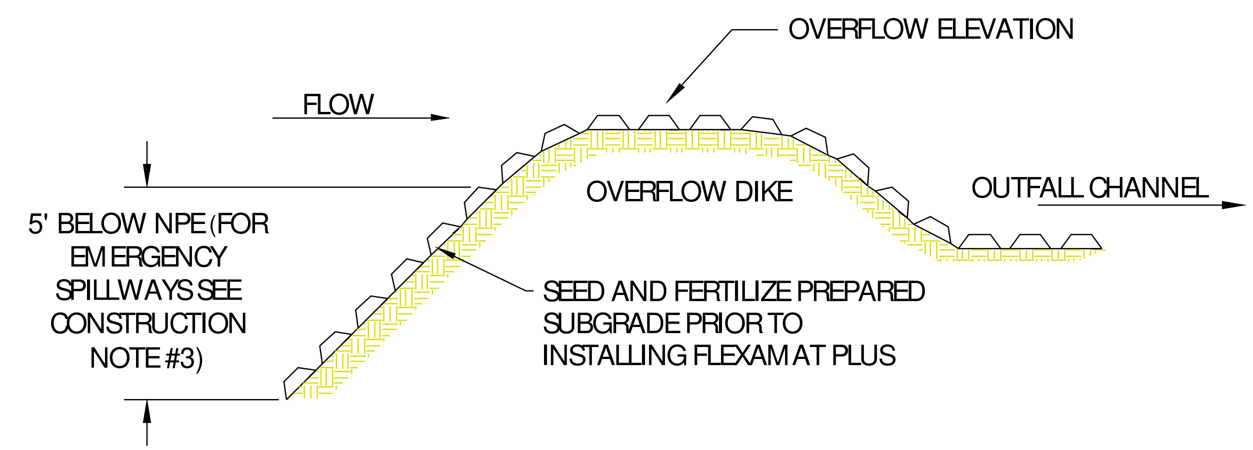
Watt Adjustable Accutrol Weir (1 page)

Tempest Inlet Control Devices Technical Manual (14 pages)

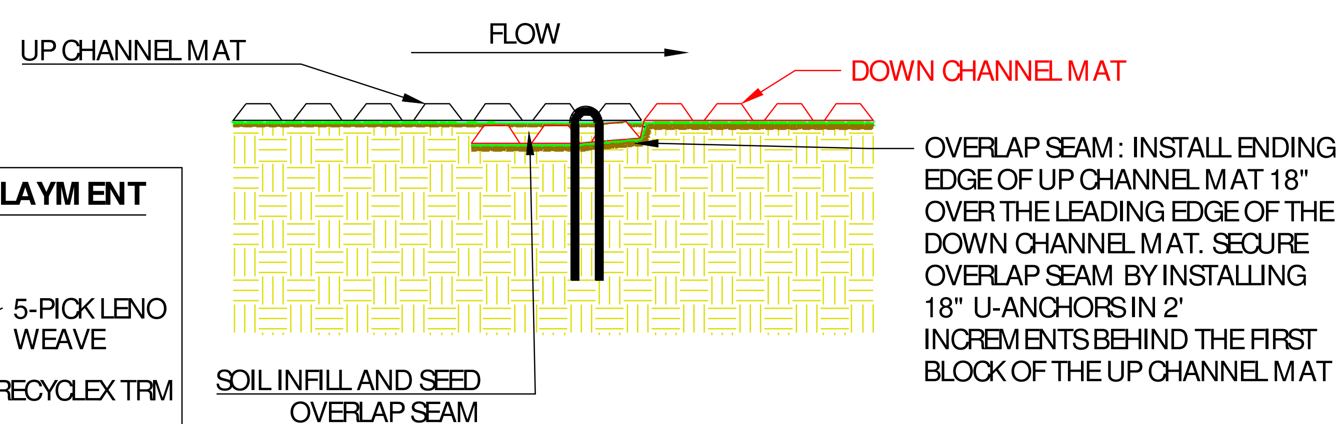
EMERGENCY SPILLWAY - ISOMETRIC VIEW



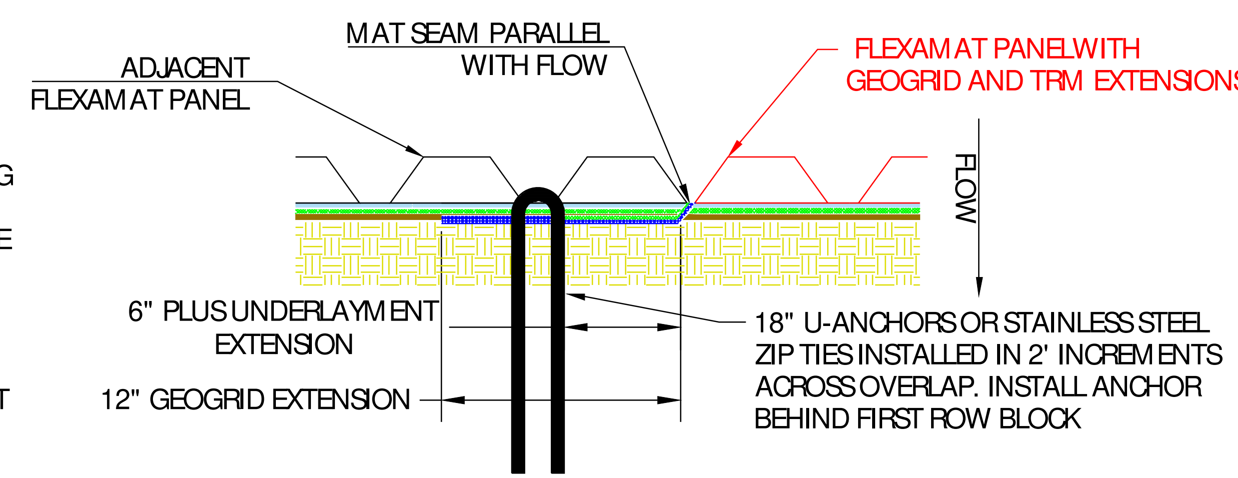
OVERFLOW DIKE - PROFILE VIEW



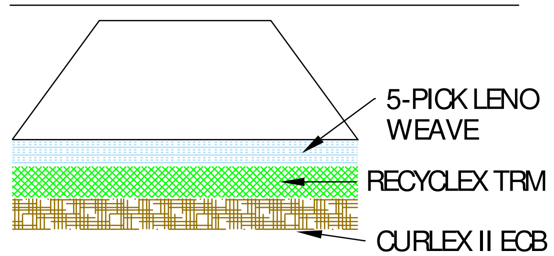
1. OVERLAP METHOD FOR SEAMS PERPENDICULAR TO FLOW



2. OVERLAP METHOD FOR SEAMS PARALLEL TO FLOW



FLEXAMAT PLUS UNDERLAYMENT



FLEXAMAT PLUS - OVERFLOW CHANNEL PARALLEL TO FLOW

CONSTRUCTION NOTES:

1. AN ENGINEER OR MANUFACTURERS REPRESENTATIVE SHALL BE ONSITE FOR THE START OF THE INSTALLATION.
2. ALL SUBGRADE SURFACES PREPARED FOR PLACEMENT OF MATS SHALL BE SMOOTH AND FREE OF ALL ROCKS, STICKS, ROOTS, OTHER PROTRUSIONS, OR DEBRIS OF ANY KIND. THE PREPARED SURFACE SHALL PROVIDE A FIRM UNYIELDING SUBGRADE FOR THE MATS.
3. PRIOR TO THE FLEXAMAT PLUS INSTALLATION SEED AND FERTILIZE SUBGRADE WITH SITE SPECIFIC SEED MIX IN ACCORDANCE WITH THE PROJECT PLANS AND SPECIFICATIONS.
4. MAT SHALL EXTEND 5' BELOW NORMAL POND ELEVATION. (FOR EMERGENCY OVERFLOW INSTALLATIONS EXTEND THE MAT 3' DOWN THE INSIDE FACE OF THE OVERFLOW DIKE.)
5. INSTALL FLEXAMAT PLUS ROLLS. MANUFACTURER RECOMMENDS INSTALLING THE WIDEST MAT POSSIBLE FOR SPILLWAY APPLICATIONS.
   - 5.1. FOR WIDTHS WIDER THAN 16', INSTALL 15.5' WIDE MATS WITH GEOGRID AND TRM UNDERLAYMENT EXTENSIONS. INSTALL ADJACENT MAT OVER THE 12" GEOGRID AND 6" TRM UNDERLAYMENT EXTENSIONS OF THE ADJACENT MATS. ENSURE THE GEOGRID AND TRM UNDERLAYMENT EXTENSIONS ARE LAYING FLAT ON THE SUBGRADE BEFORE INSTALLING ADJACENT MAT OVER THE EXTENSIONS. INSTALL #3 REBAR 18" U-ANCHORS IN 2' INCREMENTS ACROSS THE GEOGRID AND TRM EXTENSION OVERLAP. INSTALL ANCHORS PERPENDICULAR TO THE FLOW DIRECTLY BEHIND FIRST ROW OF BLOCKS ON THE ADJACENT MAT.
   - 5.2. FOR ADDITIONAL SECTIONS OF MAT, OVERLAP THE DOWNSTREAM SECTION 18" WITH UPSTREAM SECTION OF MAT. PRIOR TO INSTALLING OVERLAP, FLIP UPSTREAM MAT BACK 24". EXCAVATE 2.25" OF SOIL 18" FROM THE END OF THE UPSTREAM MAT. DOWNSTREAM SECTION IS THEN LAID IN THE SHALLOW TRENCH. RETURN AND TAMP SOIL OVER INITIAL EDGE AND SEED AREA. FLIP END OF UPSTREAM MAT OVER THE SOIL COVERED INITIAL LEADING EDGE. SEED AND FERTILIZE SOIL INFILL PRIOR TO FLIPPING END OF UPSTREAM MAT OVER THE SOIL COVERED INITIAL LEADING EDGE OF DOWNSTREAM MAT. SECURE PERPENDICULAR OVERLAP SEAMS BY INSTALLING #3 REBAR - 18" U ANCHORS PERPENDICULAR TO FLOW IN 2' INCREMENTS.
6. AT THE END OF THE ARMORED SPILLWAY, EMBED THE MAT 18" IN A TERMINATION TRENCH. FILL AND COMPACT TERMINATION TRENCH WITH SUITABLE FILL. (AS SPECIFIED BY EOR.)

MOTZ ENTERPRISES, INC.
Flexamat
(513)772-6689
Info@Flexamat.com
Flexamat.com

REV - 1

terrafix® Geosynthetics Inc.
455 Horner Avenue
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www.terrafixgeo.com

Product Data Sheet

Flexamat® is a tied concrete block mat used to control erosion in swales, slopes, ditches, channels, shorelines and any area where soil sediment may be lost due to water runoff.

Flexamat® should be considered in any application where consideration is being given to poured concrete, riprap, gabions, ACB's and other hard-armor systems.

Flexamat® consists of pyramidal concrete blocks that are interconnected utilizing a polypropylene geogrid. The completed mat yields a high strength, ultra-flexible hard armor system of Erosion Control. Flexamat's superior Percentage of Open Area (POA) affords an ideal zone for vegetation growth while remaining a permanent armor against long-term erosional forces.

General Composition of Materials

Blocks	34.5 MPa, Wet-cast Portland Cement
Interlocking Geogrid	30KN/M (MD), 30KN/M (CMD)
Underlayment Options	W 200 Erosion Control Blanket TRM Non-woven fabrics. More options available.

Manufacturing Values

Flexamat Properties	Values
Roll Width (m)	1.22, 1.67, 2.44, 3.05, 3.66, 4.88
Roll Length	9.14m, 12.2m, 15.2m / custom
Material Weight	48.8 kg/sqm
Block Size	165mm x 165mm x 60mm
Spacing Between Blocks	38mm

Performance Design Criteria

Percentage Open Area (POA)	30% min.
Geogrid Tensile Strength	30KN/M (MD), 30KN/M (CMD)
Shear Tolerance*	1149 Pa
Velocity Tolerance*	9.1 m/s

*ASTM D 6460

terrafix®

geosynthetics inc.



Flexamat – Tied Concrete Block Mat

terrafix®
geosynthetics inc.

FLEXAMAT

Flexamat® consists of concrete blocks, locked together and embedded with a high strength geogrid. There are openings around each concrete block that give Flexamat® the flexibility and enable it to be packaged in rolls. The openings also allow vegetation to grow through the mat. Eventually, vegetation will completely cover Flexamat®. It can be manufactured with various backings such as non-woven fabric to stop vegetation growth or a variety of erosion control blankets depending on the soil conditions and other factors.

There's a wide range of applications where Flexamat® is utilized, but it is most commonly used for erosion control. Flexamat® is used to control erosion in channels, outlet protection, on slopes, for shoreline protection and many other applications.

Flexamat® offers permanent, hard armour protection, with a natural vegetated appearance. Flexamat® may be mowed over with commercial mowing equipment or left to grow wild. Besides grass, there are many other types of native plant species that can be planted to grow within the mat. For example, Willow Saplings were planted through Flexamat® for a streambank re-vegetation project.

Flexamat® Stops Erosion

No more rock rip rap - No more poured concrete gutters

Un-vegetated capabilities:
Limiting Shear 1149Pa*
Limiting Velocity 5.8m/s*

Flexamat® is a permanent erosion control mat utilized for stabilizing slopes, channels, low water crossing, inlet/outlet protection, and shorelines. It consists of concrete blocks (165mm x 165mm with a 57mm profile) embedded into a high strength geogrid. There is 38mm spacing between the blocks that gives the mat flexibility and allows vegetation growth.

Flexamat® is packaged in rolls, making staging and installing the material very efficient. Standard construction equipment is used for installation.

Flexamat® weighs 48.8kg/m². The weight of the product performs as a "built-in" anchoring system. Standard widths are 1.22m, 1.67m, 2.44m, 3.05m, 3.66m, 4.88m. Rolls are available in custom lengths. 1.22m x 1.22m mats stacks on pallets are also available.

Wood Fibre Erosion Control Blanket

Turf Reinforcement Mat
(For Flexamat Plus version)

Polypropylene Netting

Concrete Blocks Embedded with High Strength Geogrid

Benefits for Ditch Applications:

- Easy and efficient Installation
- Multiple uses: erosion prevention, roadside, drainage, landfills, and more
- Ability to manufacture onsite for large projects, reducing costs - typically cheaper than rock
- Environmentally friendly - allows vegetation growth
- Capable of handling high flow water runoff
- Easy maintenance, mow right over Flexamat®!
- Cleanses the water of sediments and water runs clear

terrafix®
geosynthetics inc.

FLEXAMAT

- Permanent Solution - will not crack with freeze / thaw cycles.
- Easy Maintenance - can be mowed over with commercial mowing equipment without turf damage.
- Fast and Simple Installation - roll design makes installation efficient.
- Reduces Construction cost - low material cost, less labor, and shorter lain closure time.
- Reduces Runoff Velocities
- Natural and Aesthetic Solution - insulates from cold and heat, and allows pet and owner access.
- Improves Safety - no loose blocks that can be thrown or cause slippage.
- Accumulate LEED Credits - Materials & Resources (MR), Water Efficiency (WE), Sustainable Sites (SS)

1. New Construction and Major Renovations (NC)
2. Existing Buildings: Operations & Maintenance (EB)
3. Core & Shell (CS)
4. Schools (S)
5. Homes (H)

Mat Width & Length	Manufactured in standard widths of 1.22m, 1.67m, 2.44m, 3.05m, 3.66m, 4.88m. Lengths can be cut to order per project requirements. Stocked lengths are 9.14m, 12.2m, 15.24m. 1.22m x 1.22m mats stacked on pallets are also available.
Underlayment Options	Standard Flexamat® is manufactured with wood erosion control blanket underlayment backing. It may also be manufactured with a TRM or non-woven filter fabrics. Onsite conditions and project requirements determine the appropriate underlayment material.
Weight per Square Foot	48.8kg/m²
Block Size	The concrete blocks are 165mm x 165mm x 57mm. There is 38mm spacing between the blocks.
Limiting Shear	1149Pa (non vegetated)*
Limiting Velocity	5.8m/s (non vegetated)*

* ASTM D 6460

terrafixgeo.com • (416) 674 0363 • 455 Horner Avenue, Toronto, ON M8W4W9

April 2020

WATTS®	Adjustable Accutrol Weir Tag: ____________	Adjustable Flow Control for Roof Drains

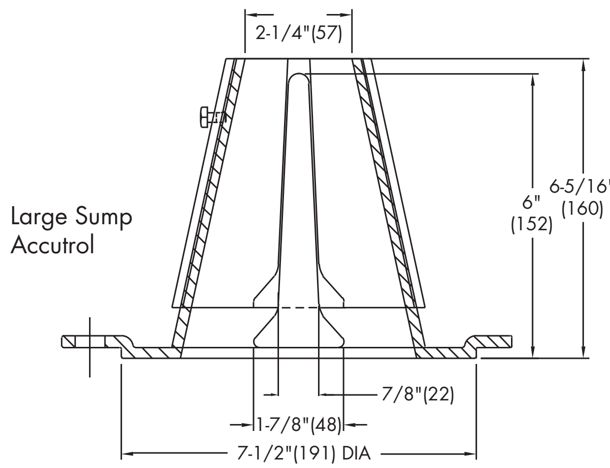
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

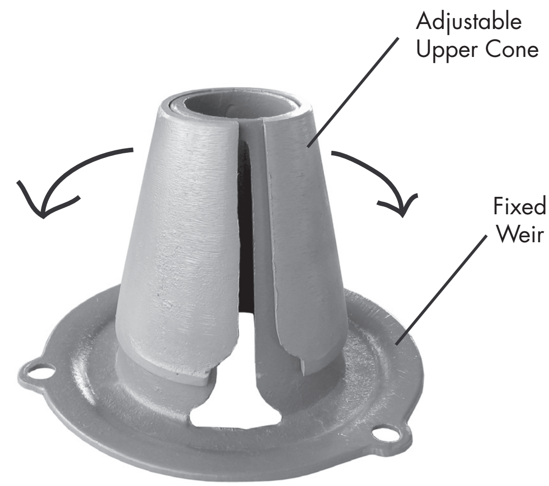
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2"of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3"of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm (per inch of head) x 2 inches of head] + 2-1/2 gpm (for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	5	5	5	5	5

Job Name ____________ Contractor ____________

Job Location ____________ Contractor's P.O. No. ____________

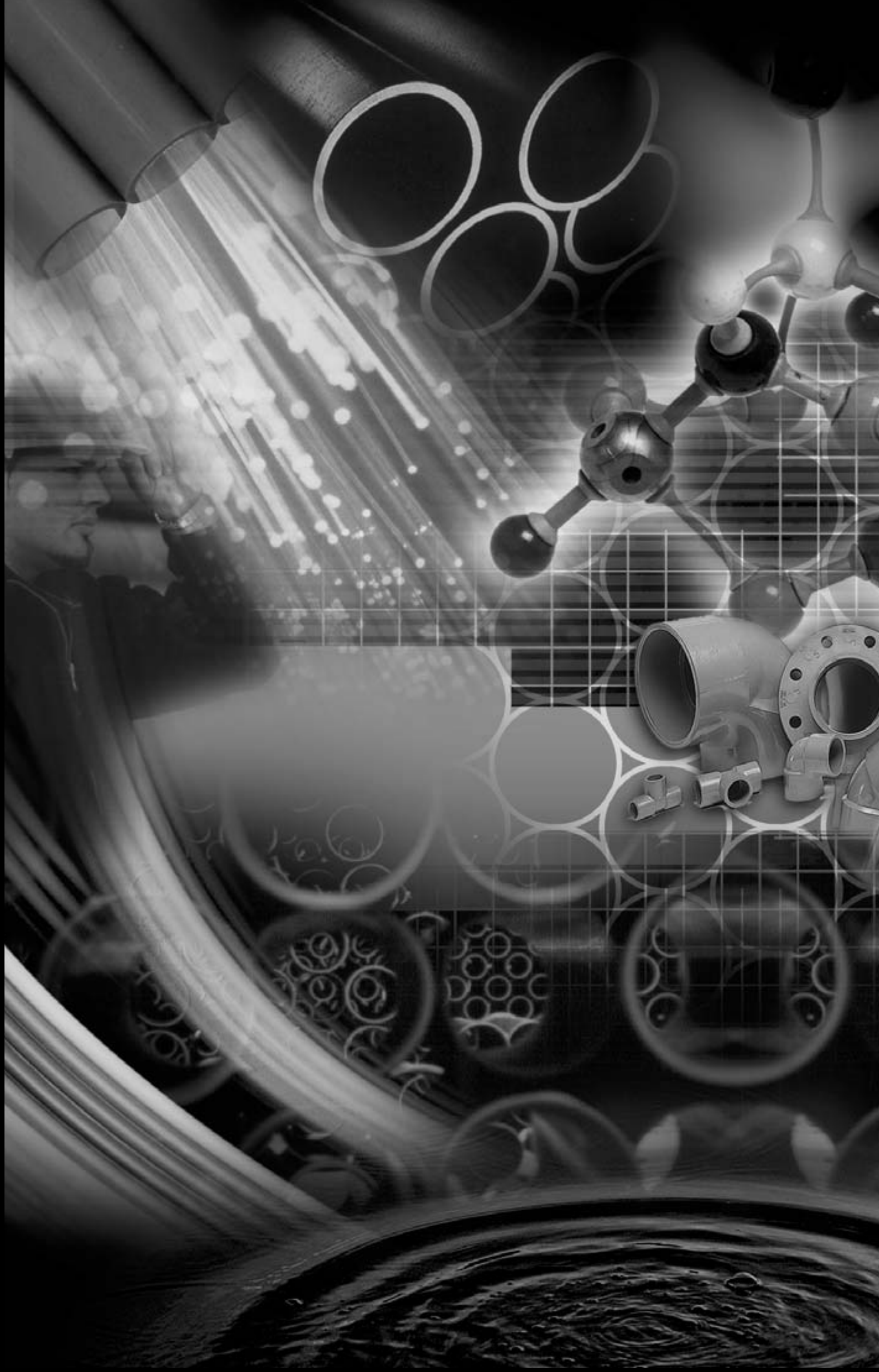
Engineer ____________ Representative ____________

WATTS®
A Watts Water Technologies Company

USA: Tel: (800) 338-2581 • Fax: (828) 248-3929 • Watts.com
Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • Watts.ca
Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

Volume III: TEMPEST™ INLET CONTROL DEVICES

Municipal Technical Manual Series



SECOND EDITION

LMF (Low to Medium Flow) ICD

HF (High Flow) ICD

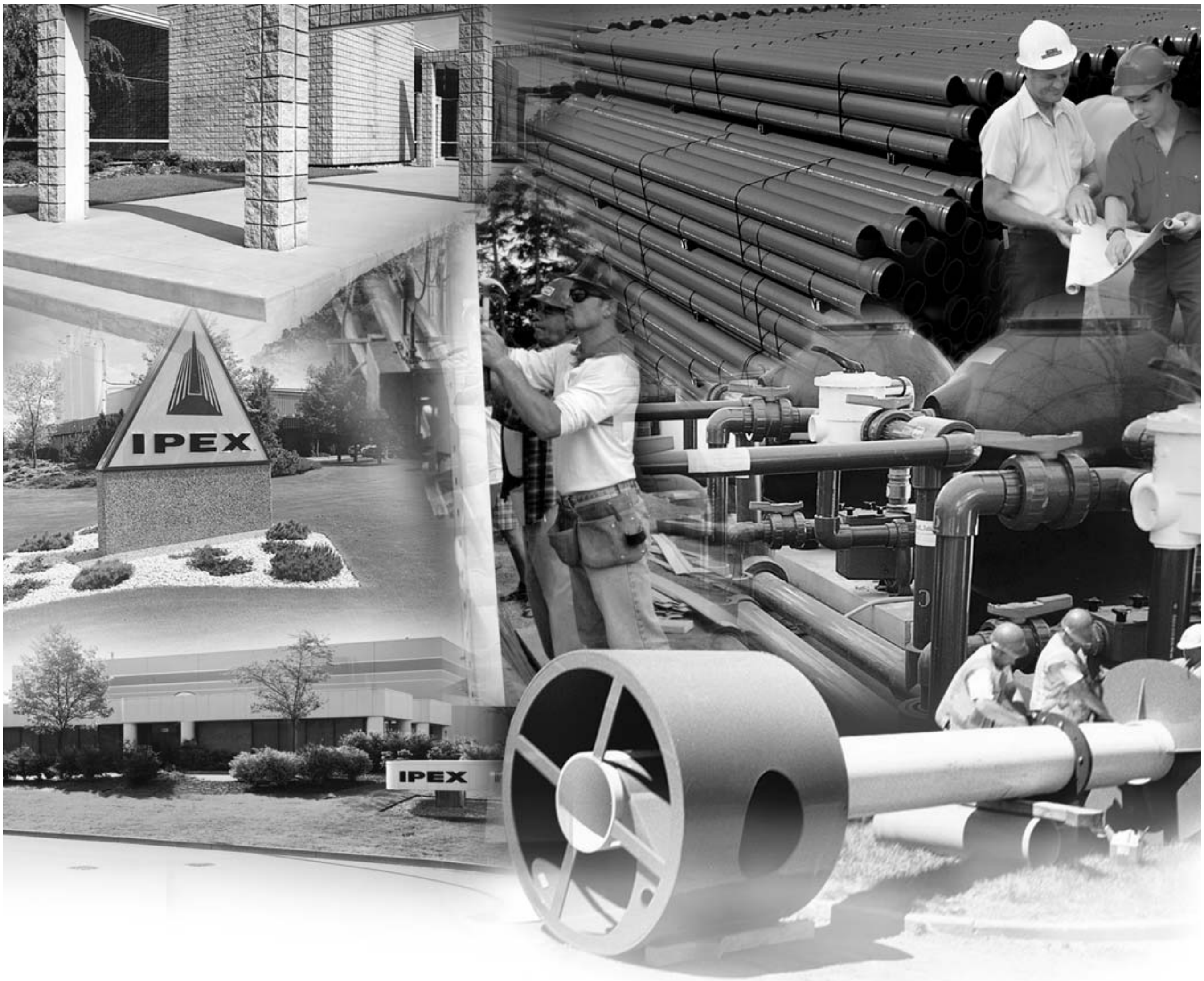
MHF (Medium to High Flow) ICD

IPEX

IPEX Tempest™ Inlet Control Devices

Municipal Technical Manual Series

Vol. I, 2nd Edition



About IPEX

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

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

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

CONTENTS

TEMPEST INLET CONTROL DEVICES Technical Manual

NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

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

Purpose

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

Product Description

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

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

Product Function

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

Product Construction

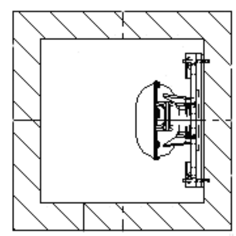
Constructed from durable PVC, the LMF ICD is light weight 8.9 Kg (19.7 lbs).

Product Applications

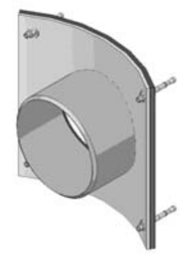
Will accommodate both square and round applications:

Square Application

Universal
Mounting Plate



Round Application

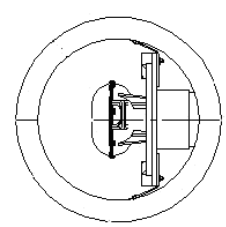


+

Spigot CB
Wall Plate

=

Universal
Mounting
Plate Hub
Adapter



NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

Chart 1: LMF 14 Preset Flow Curves

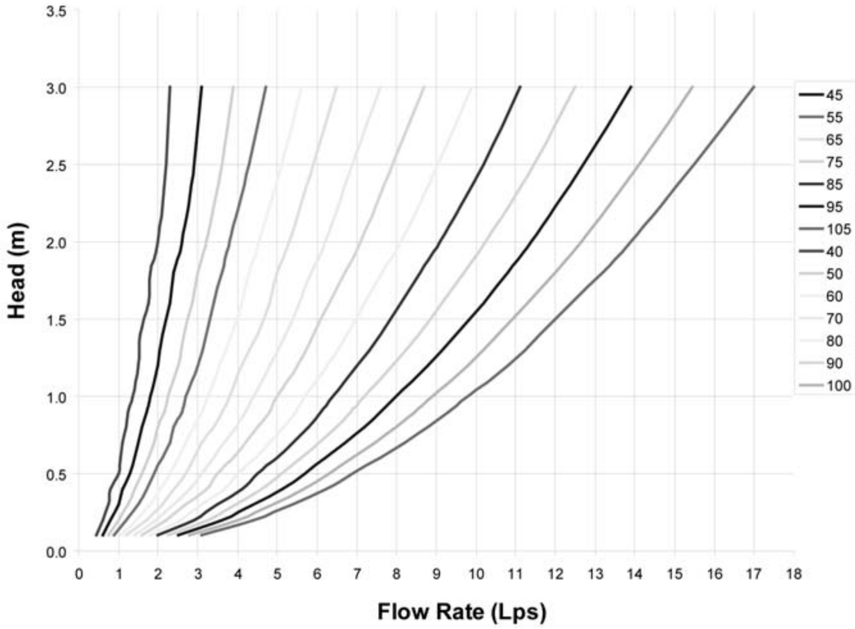
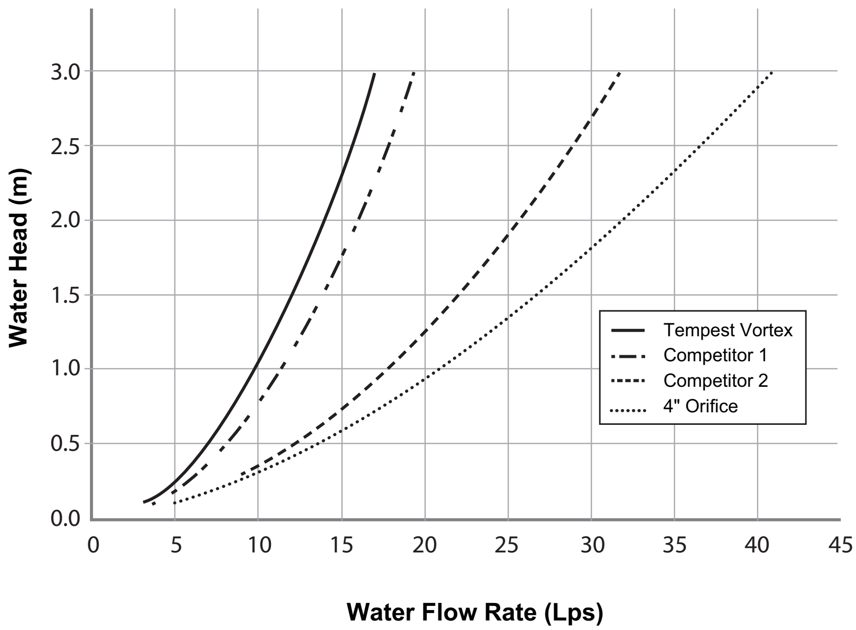


Chart 2: LMF Flow vs. ICD Alternatives



PRODUCT INSTALLATION

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

STEPS:

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

WARNING

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

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

STEPS:

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

WARNING

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

PRODUCT TECHNICAL SPECIFICATION

General

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

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

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

ICD's shall have no moving parts.

Materials

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

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

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

All hardware will be made from 304 stainless steel.

Dimensioning

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

Installation

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

PRODUCT INFORMATION: TEMPEST HF & MHF ICD

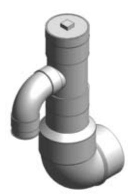
Product Description

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

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

Product Function

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



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

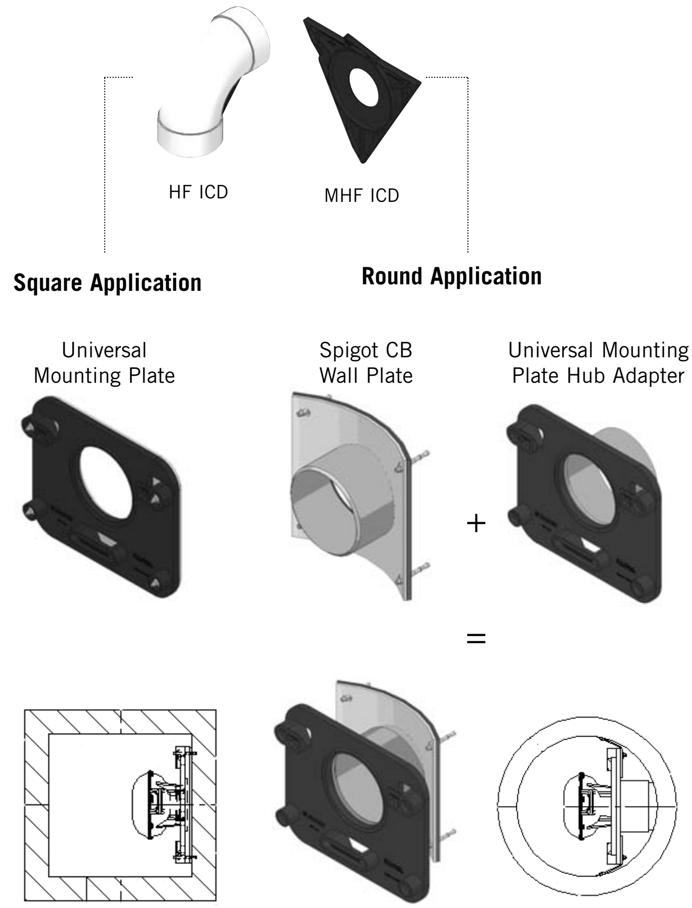
TEMPEST MHF (Medium to High Flow): The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

Product Construction

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

Product Applications

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



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

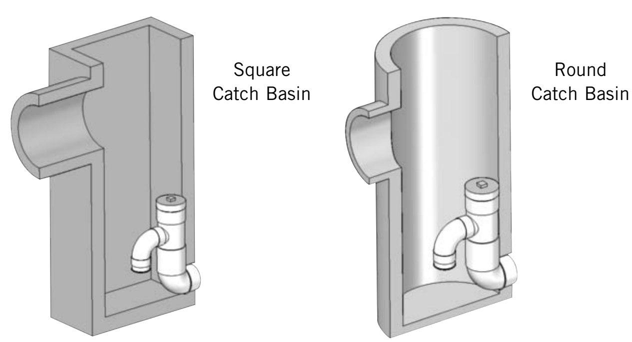
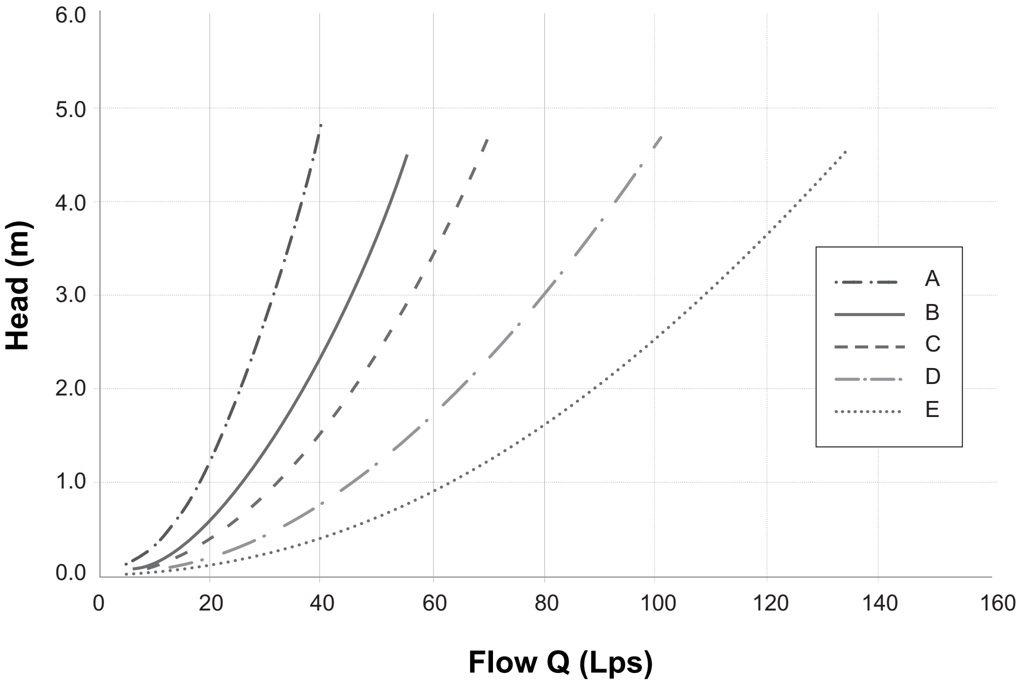


Chart 3: HF & MHF Preset Flow Curves



PRODUCT INSTALLATION

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

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

WARNING

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

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

STEPS:

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

WARNING

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

PRODUCT TECHNICAL SPECIFICATION

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

STEPS:

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

WARNING

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

General

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

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

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

ICD's shall have no moving parts.

Materials

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

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

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

All hardware will be made from 304 stainless steel.

Dimensioning

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

Installation

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

SALES AND CUSTOMER SERVICE

Canadian Customers call IPEX Inc.

Toll free: (866) 473-9462

www.ipexinc.com

U.S. Customers call IPEX USA LLC

Toll free: (800) 463-9572

www.ipexamerica.com

About the IPEX Group of Companies

As leading suppliers of thermoplastic piping systems, the IPEX Group of Companies provides our customers with some of the largest and most comprehensive product lines. All IPEX products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have established a reputation for product innovation, quality, end-user focus and performance.

Markets served by IPEX group products are:

- Electrical systems
- Telecommunications and utility piping systems
- PVC, CPVC, PP, ABS, PEX, FR-PVDF and PE pipe and fittings (1/4" to 48")
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems

Products manufactured by IPEX Inc. and distributed in the United States by IPEX USA LLC.

Tempest™ is a trademark of IPEX Branding Inc.

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IPEX

Appendix K – Checklist

	GENERAL CONTENT	RESPONSE
☐	Executive Summary (for larger reports only).	Not included
☒	Date and revision number of the report.	Date of report provided
☒	Location map and plan showing municipal address, boundary, and layout of proposed development.	Page 1 and Appendix K
☒	Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Various Sections of report
☒	Summary of Pre-consultation Meetings with City and other approval agencies.	Section 4
☒	Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	Included
☒	Statement of objectives and servicing criteria.	Included
☒	Identification of existing and proposed infrastructure available in the immediate area.	Sections 2 & 3 of report
☐	Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	Not applicable
☒	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Section 8, Appendix K
☐	Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	Not applicable
☐	Proposed phasing of the development, if applicable.	Not applicable
☐	Reference to geotechnical studies and recommendations concerning servicing.	Not applicable
☒	All preliminary and formal site plan submissions should have the following information: Metric scale North arrow (including construction North) Key plan name and contact information of applicant and property owner Property limits including bearings and dimensions Existing and proposed structures and parking areas Easements, road widening and rights-of-way Adjacent street names	Civil and Architectural Plans provided separately
	DEVELOPMENT SERVICING REPORT: WATER	**RESPONSE**
☐	Confirm consistency with Master Servicing Study, if available Availability of public infrastructure to service proposed development Identification of system constraints	Not applicable
☒	Identify boundary conditions	Section 6
☒	Confirmation of adequate domestic supply and pressure	Section 6
☒	Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Section 6
☒	Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Section 6
☐	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design	Not applicable
☐	Address reliability requirements such as appropriate location of shut-off valves Check on the necessity of a pressure zone boundary modification.	Not applicable
☒	Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range	Section 6
☒	Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Section 6

☐	Description of off-site required feeder mains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	Not applicable
☒	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Section 6
☐	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Not applicable
DEVELOPMENT SERVICING REPORT: WASTEWATER		**RESPONSE**
☒	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Section 7
☐	Confirm consistency with Master Servicing Study and/or justifications for deviations.	Not applicable
☒	Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	Section 7
☒	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 7
☒	Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Section 7
☒	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Appendix D
☒	Description of proposed sewer network including sewers, pumping stations, and forcemains.	Section 7
☐	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	Not applicable
☐	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	Not applicable
☐	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	Not applicable
☐	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	Not applicable
☐	Special considerations such as contamination, corrosive environment etc.	Not applicable
DEVELOPMENT SERVICING REPORT: STORMWATER CHECKLIST		**RESPONSE**
☒	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 8
☐	Analysis of available capacity in existing public infrastructure.	Not applicable
☒	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Appendix A, Drawings provided separately
☐	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Not Applicable
☐	Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Not Applicable
☒	Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Section 8
☐	Set-back from private sewage disposal systems. Watercourse and hazard lands setbacks.	Not Applicable
☒	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	Not Applicable.
☐	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	Section 8
☒	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Section 8

☐	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	Not Applicable
☒	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Pre-Dev not calculated. Post-Dev Flows Calculated
☐	Any proposed diversion of drainage catchment areas from one outlet to another.	Not Applicable
☒	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Section 8
☐	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	Not Applicable
☐	Identification of potential impacts to receiving watercourses Identification of municipal drains and related approval requirements.	Not Applicable
☒	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Section 8
☒	100-year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Section 8
☒	Inclusion of hydraulic analysis including hydraulic grade line elevations.	Section 8
☒	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 8
☐	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	Not Applicable
☐	Identification of fill constraints related to floodplain and geotechnical investigation.	Not applicable
☒	The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:	Section 4
☐	Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in theAct.	Not Applicable
☒	Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	To be prepared
☐	Changes to Municipal Drains.	Not Applicable
☐	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	Not Applicable
CONCLUSION CHECKLIST		**RESPONSE**
☒	Clearly stated conclusions and recommendations	In Section 10
☒	Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	Response letter provided
☒	All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario	Signed and stamped

Appendix L – Drawings

Site Plan & Survey Drawings

- Site Plan, A100, dated March 25, 2022
- Topographic Plan, dated January 14, 2020
- Draft Plan, signed April 04, 2022

Engineering Drawings (provided separately)

- Cover Sheet
- C001 - Legends and Notes (Revision 3)
- C002 – Tables – Rev 1 (Revision 3)
- C100 – Servicing Plan – Plan 1 (Revision 6)
- C101 – Servicing Plan – Plan 2 (Revision 6)
- C200 – Grading Plan – Plan 1 (Revision 5)
- C201 – Grading Plan – Plan 2 (Revision 5)
- C300 – Plan and Profile, Street 1, STA 1+000 to STA 1+125 (Revision 3)
- C301 – Plan and Profile, Street 2, STA 0+000 to STA 0+150 (Revision 3)
- C302 – Plan and Profile, Street 2, STA 0+150 to STA 0+300 (Revision 3)
- C303 – Plan and Profile, Street 2, STA 0+300 to STA 0+550 (Revision 3)
- C304 – Plan and Profile, Street 2, STA 0+550 to STA 0+700 (Revision 3)
- C305 – Plan and Profile, Street 2, STA 0+700 to STA 0+810 (Revision 3)
- C306 – Plan and Profile, Street 4, STA 4+000 to STA 4+150 (Revision 3)
- C307 – Plan and Profile, Street 5, STA 5+000 to STA 5+200 (Revision 3)
- C308 – Plan and Profile, Samantha Eastop, STA 7+000 to STA 7+075 (Revision 3)
- C309 – Plan and Profile, Sanitary Conn. To Exist. 2, STA 0+000 to STA 0+125 (Revision 3)
- C310 – Plan and Profile, Storm Conn. To Exist. 2, STA 0+000 to STA 0+125 (Revision 3)
- C400 – Post Development Storm Drainage Plan (Revision 4)
- C401 – Post Development Ponding Plan (Revision 3)
- C500 – Sanitary Drainage Plan (Revision 4)
- C600 – Erosion and Sediment Control Plan (Revision 4)
- C700 – Detail Sheet 1 – Roadway Sections and Serving Details (Revision 3)
- C701 – Detail Sheet 2 – Typical Sections (Revision 3)
- C702 – Detail Sheet 3 – Low Impact Development Details (Revision 3)
- C703 – Detail Sheet 4 – Stormwater Management Facility (Revision 3)
- C704 – Detail Sheet 5 – Stormwater Management Facility Details 1 (Revision 3)
- C800 – Pavement Markings, Signage and Geometry Plan (Revision 1)
- C801 – Pavement Markings, Signage and Geometry Plan (Revision 1)