Richcraft Kanata West Block 1

- 815 Roger Griffiths Avenue

Servicing and Stormwater Management Report

February 6, 2026

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Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
1	Servicing and SWM	Ziyi Wang/Warren Johnson	2025-07-29	Ana M. Paerez	2025-07-29	Karin Smadella	2025-07-31
2	Revised per City comments	Ziyi Wang/Warren Johnson	2026-01-28	Ana M. Paerez	2026-02-04	Sheridan Gillis	2026-02-05

Limitations and Sign-off

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1 Introduction

This updated Servicing and Stormwater Management (SWM) Report addresses comments on the initial engineering submission from July 2025, as well as minor updates to the site plan. The water and sanitary servicing systems have been revised to provide separate servicing infrastructure for the two apartment buildings on the west side of the site and the townhome blocks on the east side. The site stormwater model has also been updated to reflect the revised site plan, and the Richcraft Kanata West Subdivision SWM model has been rerun to evaluate the impacts of the proposed uncontrolled subcatchments on the subdivision infrastructure. The findings of the revised servicing analyses are summarized in this report and shown on the accompanying engineering drawings. **Appendix G** includes a summary of comments received from the City of Ottawa (City) and the Mississippi Valley Conservation Authority (MVCA), along with Stantec's responses.

Richcraft Homes Ltd. (Richcraft) has commissioned Stantec Consulting Ltd. (Stantec) to prepare the following Servicing and Stormwater Management Report in support of the Site Plan Application for Block 1 (815 Roger Griffiths Avenue) of the Richcraft Kanata West subdivision. The subject site is within the City of Ottawa, bound by Maple Grove Road to the northwest, Roger Griffiths Avenue to the southwest, Ploughshare Road to the southeast and the Kanata West Pump Station (1590 Maple Grove Road) to the northeast as shown in **Figure 1.1** below.



Figure 1.1 Key Map of Richcraft Kanata West Subdivision Block 1

The subject property was zoned as LC (Local Commerical Zone) during the subdivision registration and occupies 1.47 ha of land. Richcraft is proposing to develop the proposed Block 1 as a residental

development which consists of a utility building, two (2) amenity areas, two (2) three-storey apartment buildings with fifity (50) apartment units and underground parking, six (6) three-storey townhome blocks with sixty-three (63) stacked townhouse units, and associated access road and parking areas as shown in the site plan included in **Appendix E**.

Servicing constraints for the proposed block were identified in the approved *Richcraft Kanata West Development First Registration Phase – Servicing and Stormwater Management Report, Rev 4* (Stantec, 2020). Findings from the above noted report are referenced throughout this report.

1.1 Objective

This site servicing and stormwater management (SWM) report has been prepared to present an internal servicing scheme that is free of conflicts, uses existing/approved infrastructure, and meets all design criteria as identified in background documents and City of Ottawa design guidelines.

2 Reference Documents

The following documents were referenced in the preparation of this report:

- *City of Ottawa Sewer Design Guidelines, 2nd Edition, City of Ottawa*, October 2012.
- *City of Ottawa Design Guidelines – Water Distribution, 1st Edition*, Infrastructure Services Department, City of Ottawa, July 2010.
- *Technical Bulletin ISDTB-2014-02 Revision to Ottawa Design Guidelines – Water*, City of Ottawa, May 2014.
- *Technical Bulletin PIEDTB-2016-01 Revisions to Ottawa Design Guidelines – Sewer*, City of Ottawa, September 2016.
- *Technical Bulletin ISTB-2018-01 Revision to Ottawa Design Guidelines – Sewer*, City of Ottawa, March 2018.
- *Technical Bulletin ISTB-2018-02 Revision to Ottawa Design Guidelines – Water Distribution*, City of Ottawa, March 2018.
- *Richcraft Kanata West Development First Registration Phase*, *1620 Maple Grove Road (D07-16-04-0017) – Servicing and Stormwater Management Report*, *Rev 4,* Stantec, Feb 12, 2020
- *Richcraft Kanata West Development Second Registration Phase – Servicing and Stormwater Management Report*, *Rev 2*, Stantec, May 10, 2022
- *Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum*, Stantec, July 10, 2025
- *Ultimate Kanata West Pond 5 Design Brief – 1620 Maple Grove Road, Stantec, May 4, 2022 Geotechnical Investigation, Proposed Residential Development, Mapleton – Block 1, [Report PG3062-2]*, Paterson Group, April 7, 2025

3 Potable Water Servicing

3.1 Background

The proposed development is located within Zone 3W of the City of Ottawa's water distribution system. The site will be fed by the existing 200mm diameter watermain on Ploughshare Road with two separate connections as shown on **Drawing SSP-1**. Two independent on-site watermain networks are proposed to service the two apartment buildings on the east side of the site and the townhome blocks on the west side of the site separately.

3.2 Proposed Watermain Sizing and Layout

3.2.1 Connections to Existing Infrastructure

The proposed watermain alignment and sizing for the development is shown on Drawing SSP-1. A 200 mm diameter watermain is proposed to follow the alignment of the private roads within the eastern portion of the subject property to service the proposed townhome blocks. Looping for this eastern system will be provided through the amenity area, between the utility building and Block 6 with a connection to the existing 200 mm diameter watermain on Ploughshare Road at the eastern entrance to the site. A separate 200 mm diameter watermain is proposed to service the apartment buildings within the western portion of the subject property with a connection to the existing 200 mm diameter watermain on Ploughshare Road at the western entrance of the site.

Figure 3.1 shows the proposed watermain layout and the location of the two (2) connection points to the existing watermain on Ploughshare Road.

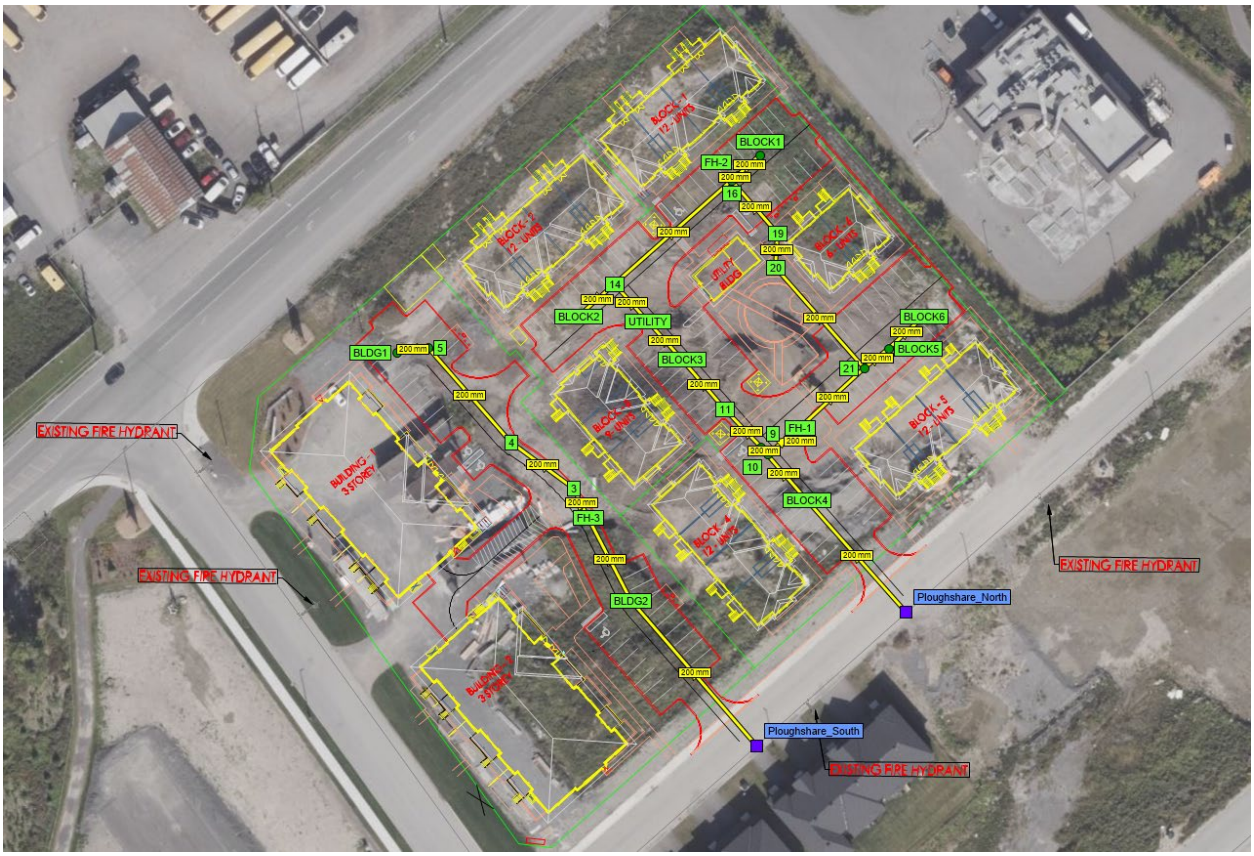


Figure 3.1 Proposed Watermain Layout

3.2.2 Ground Elevations

Proposed ground elevations throughout the site range from approximately 97.6 m to 98.1 m at nodes along the watermain network, as shown in **Figure 3.2**.

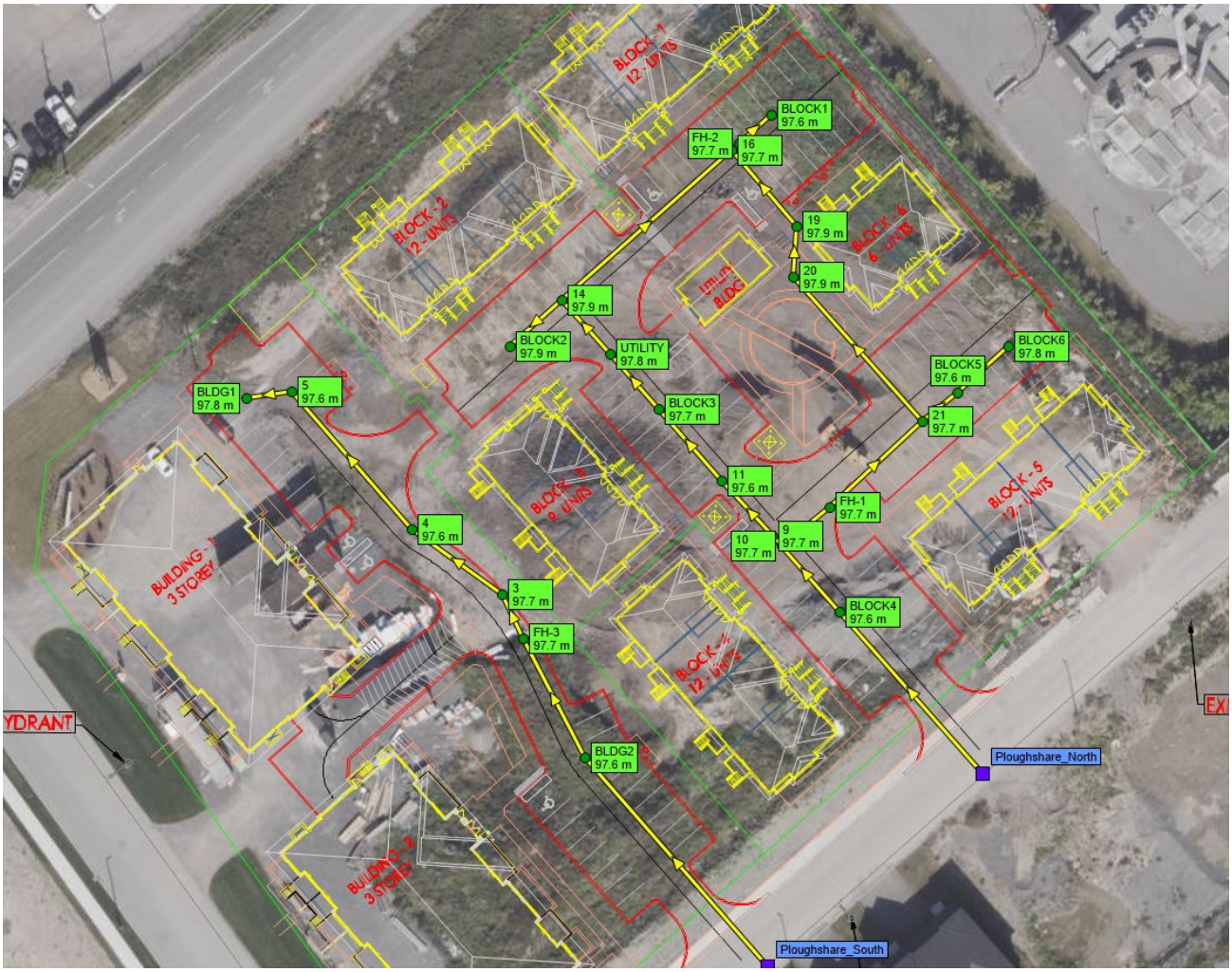


Figure 3.2 Ground Elevations (m) at Nodes

3.2.3 Domestic Water Demands

The proposed site contains a total of sixty-three (63) stacked townhouse units and fifty (50) apartment units, with an estimated total population of 260. Refer to **Appendix A.2** for detailed domestic water demand calculations.

Water demands for the development were estimated using the City of Ottawa's Water Distribution Design Guidelines. For residential developments, the average day (AVDY) per capita water demand is 280 L/cap/d. For maximum day (MXDY) demand, AVDY was multiplied by a factor of 2.5 and for peak hour (PKHR) demand, MXDY was multiplied by a factor of 2.2. The calculated residential water consumption is represented in **Table 3.1**.

Table 3.1 Domestic Water Demands for 815 Roger Griffiths

Unit Type	Units	Persons/Unit	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Townhouse Units	63	2.7	170	0.55	1.38	3.04
Apartment Units	50	1.8	90	0.29	0.73	1.60
Accessory/Utility Building	-	-	-	0.003	0.004	0.009
Site Total	**113**		**260**	**0.85**	**2.11**	**4.64**

**As per the City of Ottawa Water Design Guidelines and Technical Bulletin ISTB-2021-03, the persons per unit for Townhouse (row) units is 2.7 and for Apartment units is 1.8. The average daily rate of water demand for residential areas is 280 L/cap/day and for commerical area is 28,000 L/ha/day. The commercial demand rate was applied to the proposed 1-storey Accessory/Utility Building with an approximate 83 m^2 footprint area.*

3.3 Level of Service

3.3.1 Allowable Pressures

The City of Ottawa Water Distribution Design Guidelines state that the desired range of system pressures under normal demand conditions (i.e., basic day, maximum day, and peak hour) should be in the range of 350 to 552 kPa (50 to 80 psi) and no less than 275 kPa (40 psi) at the ground elevation on the streets (i.e., at hydrant level). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way is 552 kPa (80 psi). As per the Ontario Building Code (OBC) & Guide for Plumbing, if pressures greater than 552 kPa (80 psi) are anticipated, pressure relief measures are required. The maximum pressure at any point in the distribution system in unoccupied areas shall not exceed 689 kPa (100 psi). Under emergency fire flow conditions, the minimum pressure objective in the distribution system is 138 kPa (20 psi).

3.3.2 Fire Flow Demands

Fire flow calculations were completed using the Fire Underwriters Survey (FUS) methodology. Refer to **Appendix A.3** for detailed FUS calculations. The results of the fire flow calculations for the worst-case townhome blocks and apartment buildings are summarized in **Table 3.2.**

Table 3.2 Fire Flow Calculations Using FUS Methodology

Unit Type	Description	Required Fire Flow (L/min)	Required Fire Flow (L/s)
Terrace Flat Townhouse Units	Three-storey terrace flat townhouses with twelve (12) units (worst case exposures: Block 4) – Type V Woodframe Construction	14,000	233.3
Apartment Building Units	Three-storey Apartment Building with twenty-five (25) units (worst case exposures: Building 2) – Type III Ordinary Construction	12,000	200.0

3.4 Hydraulic Analysis

A hydraulic model of the proposed watermain network was built in PCSWMM using the boundary conditions at the existing 200 mm watermain along Ploughshare Road as obtained from the City of Ottawa staff, refer to **Appendix A.1** . The boundary conditions used for the hydraulic analysis are summarized in **Table 3.3**.

Table 3.3 Boundary Condition for Connection Points for Kanata West Block 1

Location	Max. HGL (AVDY), Head (m)	PKHR, Head (m)	MXDY+FF (233 L/s), Head (m)	MXDY+FF (300 L/s), Head (m)
1 – Western entrance to Block 1 at Ploughshare Road	160.9	155.9	140.6	130.6
2 – Eastern entrance to Block 1 at Ploughshare Road	160.9	155.9	135.2	122.0

The anticipated pressures across the proposed watermain network were assessed to meet servicing requirements (average day and peak hour demands). A fire flow analysis was also performed under maximum day conditions. Detailed results are shown in **Appendix A**.**3**.

3.4.1 Model Development

New watermains were included in the hydraulic model to simulate the proposed distribution system. Hazen-Williams coefficients ("C-Factors") were applied to the new watermain in accordance with the City of Ottawa's Water Distribution Design Guidelines, as shown in **Table 3.4**.

Table 3.4 C-Factors Applied Based on Watermain Diameter

Nominal Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120
Over 600	130

3.4.1.1 Average Day & Peak Hour

The hydraulic model results show that the maximum pressures (AVDY condition) are anticipated to be approximately 618.8-627.6 kPa (89.7-91.0 psi) within the Block 1 site. Minimum pressures during PKHR conditions are anticipated to be approximately 569.6- 578.5 kPa (82.6-83.9 psi) for Block 1. These pressures are above the maximum allowable pressure of 80 psi; therefore, pressure reducing valves (PRVs) will be required for the development at the townhouse units and apartment buildings.

Figure 3.3 and Figure 3.4 below identify the minimum (PKHR) and maximum pressure (AVDY) results for the simulation, respectively.

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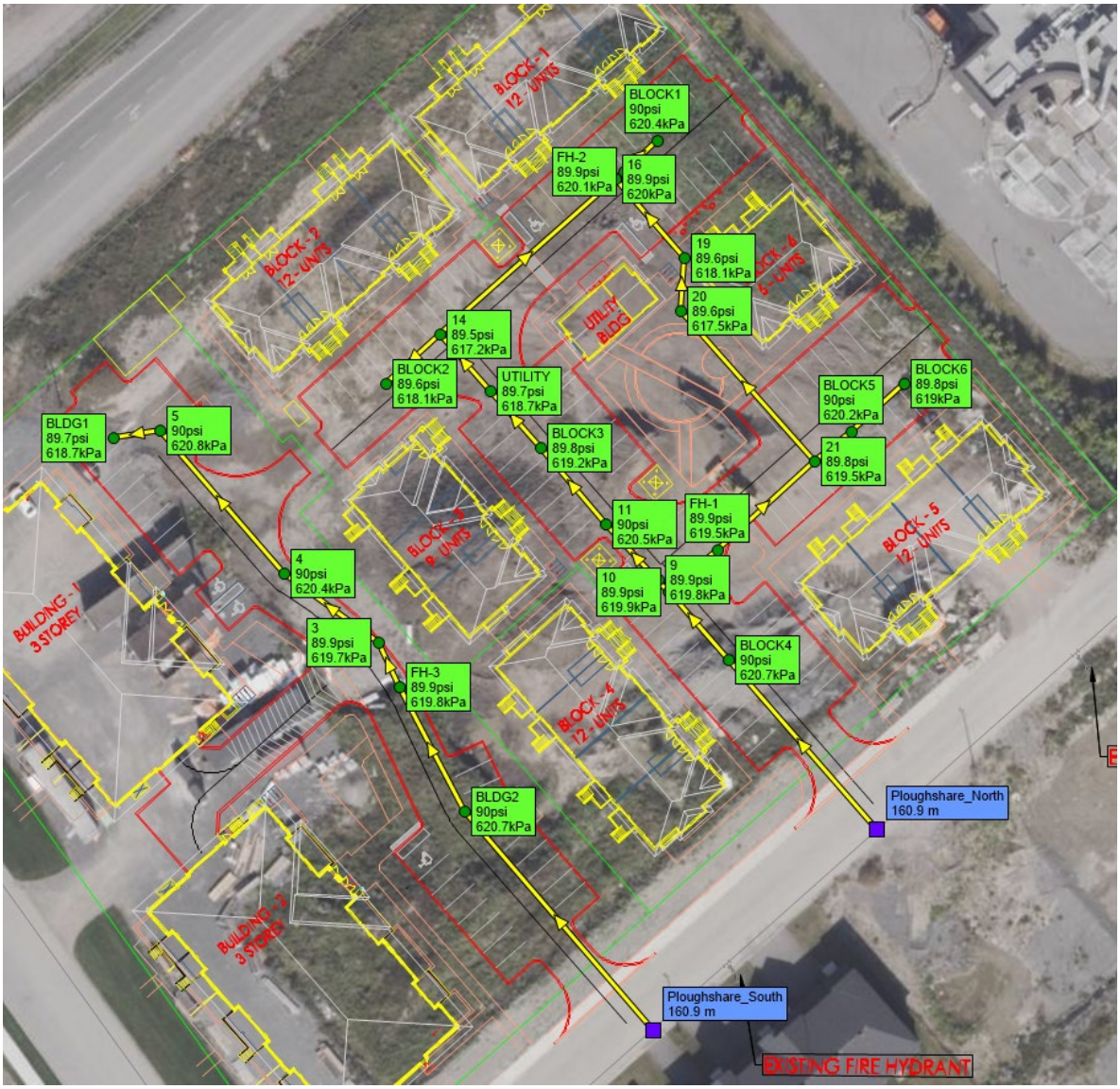


Figure 3.3 Maximum Pressures in Kanata West Block 1 during AVDY Condition

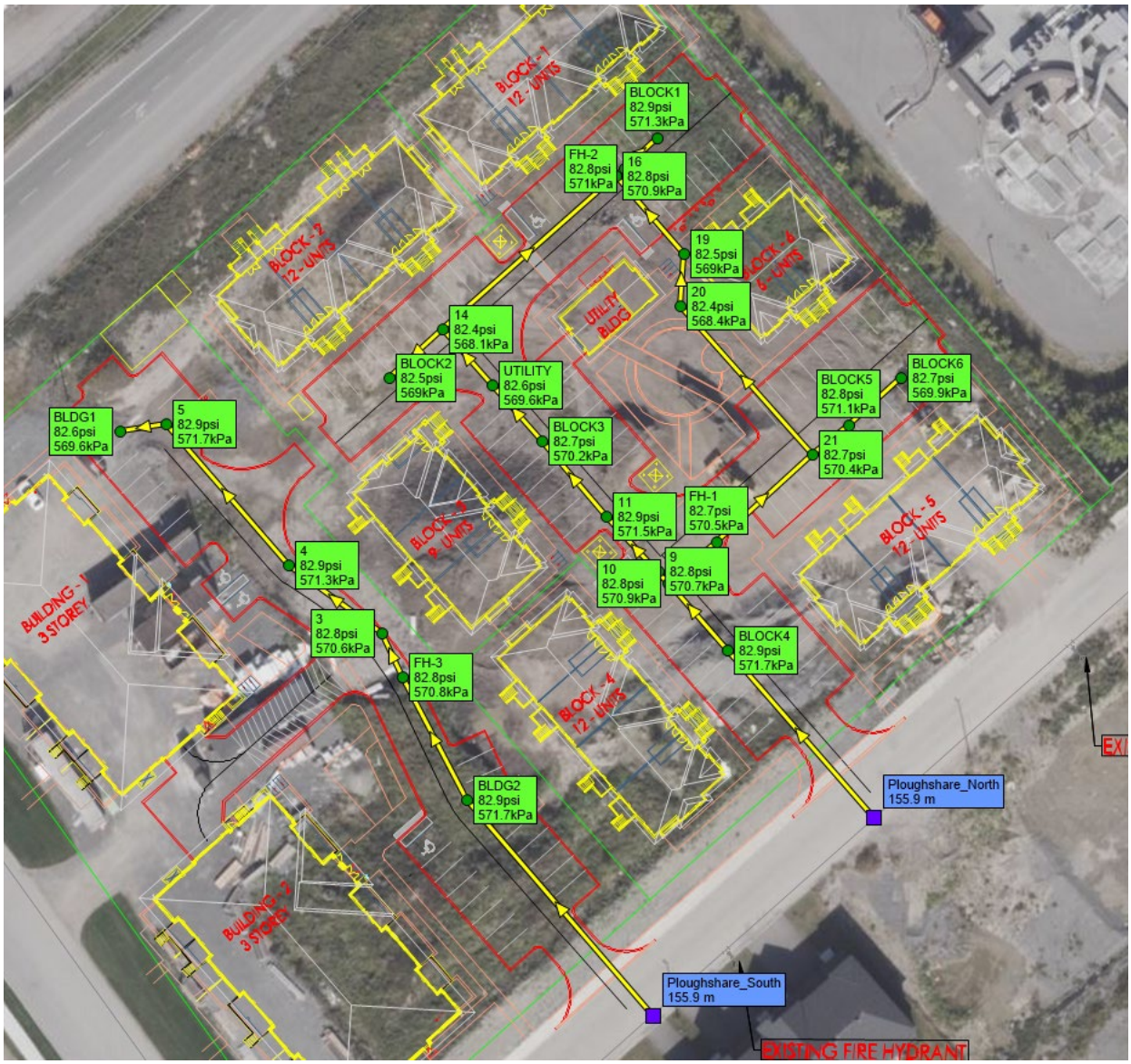


Figure 3.4 Minimum Pressures (psi) in Kanata West Block 1 During PKHR Conditions

3.4.1.2 Maximum Day Plus Fire flow

A fire flow analysis was carried out using the hydraulic model to determine if the proposed development, under maximum day demands, can achieve the fire flow requirements of 14,000 L/min (233 L/s) for the townhome blocks within the eastern portion of the site. This was accomplished using a steady-state maximum day demand scenario along with the automated fire flow simulation feature in PCSWMM. Using the proposed pipe layout and sizing, a fire flow of 14,000 L/min (233 L/s) can be achieved while maintaining at least 20 psi residual pressure at all locations across the proposed eastern watermain network. The available flows and residual pressures are shown in **Figure 3.5**.

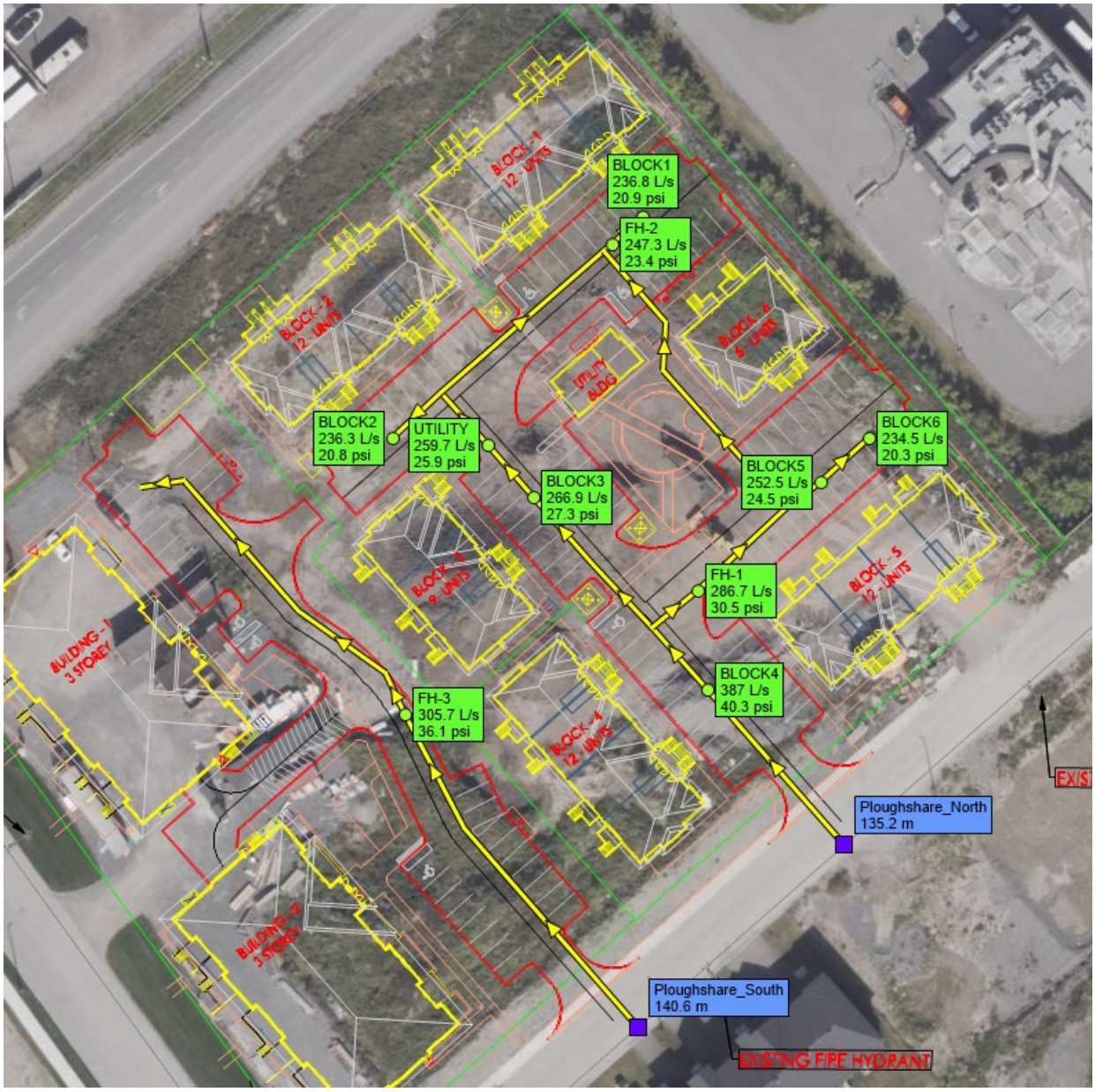


Figure 3.5 Available Fire Flows (L/s) for Townhouse Blocks During MXDY Conditions Plus 233 L/s Fire Flow

A separate fire flow analysis was generated in PCSWMM to assess the watermain network within the western portion of the site under 12,000 L/min (200 L/s) fire flow requirements for the proposed apartment

buildings. The fire flow simulation results under the 200 L/s fire flow requirements are shown in **Figure 3.6**.

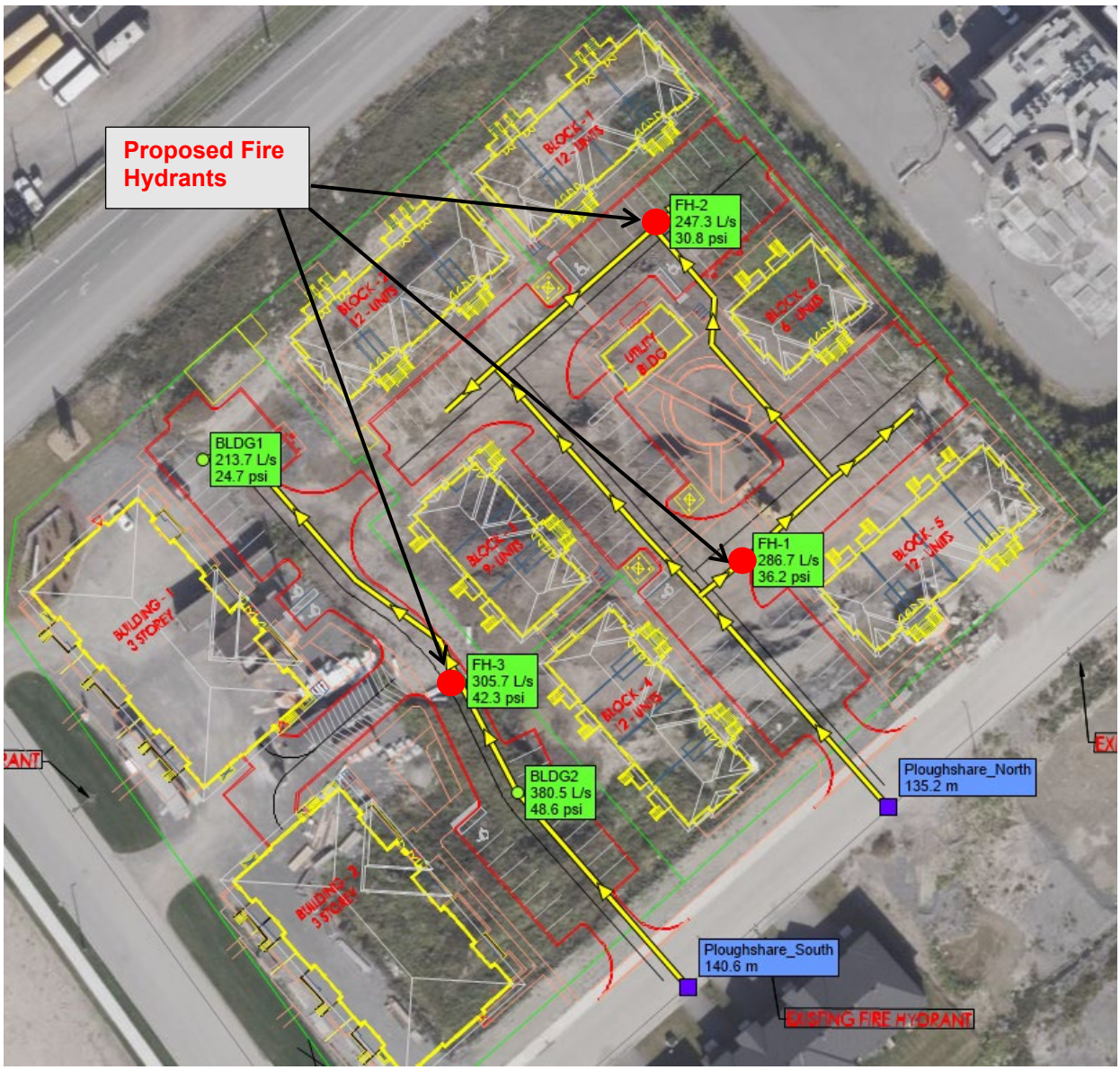


Figure 3.6 Residual Pressures for 200 L/s Fire Flow Requirements

The results show that the residual pressure in the proposed watermain network serving the apartment buildings exceeds the allowable pressure (20 psi), as shown in **Figure 3.6.** The three proposed on-site fire hydrants(FH-1, FH-2 and FH-3 in the above **Figure 3.6**) combined with the existing fire hydrants on Roger Griffiths Avenue and Ploughshare Road can provide a minimum fire flow of 14,000 L/min across the site based on the fire hydrant information obtained from the Ottawa Water Distribution Design Guidelines and the Technical Bulletin ISTB-2018-02 as summarized below in **Table 3.5**. The minimum fire flow available from the proposed fire hydrants on site and the existing fire hydrants in the vicinity of the

site is sufficient to supply the fire flow required for both the proposed apartment buidlings and townhome blocks.

Table 3.5 Fire Hydrant Maximum Flow

Hydrant Class	Distance to asset/structure/building (m)	Contribution to required fire flow (L/min)
AA	≤ 75	5,700
	> 75 and ≤ 150	3,800
A	≤ 75	3,800
	> 75 and ≤ 150	2,850
B	≤ 75	1,900
	> 75 and ≤ 150	1,500
C	≤ 75	800
	> 75 and ≤ 150	800

3.5 Water Age Analysis

Water age calculations for the two independent watermain networks proposed for the Kanata West Block 1 development have been completed. These two systems will service the two apartment buildings within the western portion of the site and the townhome blocks within the eastern portions of the site separately; each connecting to the existing 200 mm diameter watermain on Ploughshare Road.

The following parameters were used in the calculations:

- Average daily demand of 280 L/persons/day
- Residential population and daily water demand:
  - Apartment network: 50 units at 1.8 persons/unit, for a total population of 90 persons and a daily demand of 25.2 m^3/day.
  - Townhome Blocks: 63 units at 2.7 persons/unit, for a total population of 170 persons and a daily demand of 47.9 m^3/day.
- Watermain volumes:
  - Apartment network: 121 m of 200 mm diameter watermain pipes for a volume of 3.8 m^3.
  - Townhome network: 250 m of 200 mm diameter watermain pipes for a volume of 7.8 m^3.

Based on the above parameters, the turnover time of water within the pipe will be approximately 3.6 and 3.9 hours for the watermain networks supporting the apartment buildings and townhome blocks, respectively. Details of the water age calculations can be found in **Appendix A.5**

4 Wastewater Servicing

4.1 Background

As indicated in the *Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 4* (Stantec, 2020), wastewater servicing for the proposed Block 1 development is provided through two connections to the existing deep 200 mm diameter sanitary sewer on Ploughshare Road which discharges into the 1200 mm diameter sanitary trunk sewer on Maple Grove Road via the 450 mm deep sanitary sewer on Roger Griffiths Avenue, and ultimately discharges into the Kanata West Pump Station at the east of the subject site.

The previously approved design report for the Kanata West subdivision was based on the proposed Block 1 as a commercial block that measured 1.47 ha with a daily flow rate of 28,000 L/ha/day.

4.2 Design Criteria

As outlined in the City of Ottawa Sewer Design Guidelines, the following design parameters were used to calculate wastewater flow rates and to size on-site sanitary sewers:

- Minimum full flow velocity – 0.6 m/s
- Maximum full flow velocity – 3.0 m/s
- Manning's roughness coefficient for all smooth-walled pipes – 0.013
- Single family home persons per unit – 3.4
- Townhouse persons per unit – 2.7
- Apartment persons per unit – 1.8
- Extraneous flow allowance – 0.33 L/s/ha
- Residential average flows – 280 L/cap/day
- Commercial/mixed-use flows – 28,000 L/ha/day
- Maintenance hole spacing – 120 m for pipes under 450 mm diameter, 150 m for pipes 450 mm diameter and larger
- Minimum cover – 2.5 m
- Harmon correction factor – 0.8

In addition, a residential peak factor based on Harmon's Equation was used to determine the peak design flows, per the City of Ottawa Sewer Design Guidelines.

Refer to **Appendix B** for the sanitary sewer design sheet for the proposed site.

4.3 Sanitary Servicing Design

The Block 1 site has 1.47 ha of undeveloped land which previously was zoned as LC (Local Commercial) in the subdivision registration, Richcraft now is proposing to develop a residental development which consists of a utility building, two (2) three-storey apartment buildings with fifity (50) apartment units and underground parking, six (6) three-storey townhome blocks with sixty-three (63) stacked townhouse units, and associated amenity area, access road and parking areas as shown in the site plan included in **Appendix E**.

The proposed site will be serviced through a network of 200 mm diameter sanitary sewers. Two proposed SAN MH 1 and SAN MH 20 are to be installed to connect to the existing 200 mm deep sanitary sewer on Ploughshare Road. The proposed sanitary sewer layout for the subject site is shown on **Drawing SSP-1** and **Drawing SA-1**.

The sanitary peak flows generated from the proposed development have been estimated in order to compare them with the previous approved sanitary peak design flows dassumed for Block 1 during the subdivision registration stage. The population densities are based on the per unit population given by the City of Ottawa's Sewer Design Guidelines. For residential developments, the population density is 2.7 persons per unit for townhouse units and 1.8 persons per uniset for apartment units. The proposed peak flows from the Block 1 site are summarized in **Table 4.1** below. Calculation details are included in the sanitary sewer design sheet included in **Appendix B.1**.

Table 4.1 Sanitary Peak Flow at Proposed Connection (SAN MH 1 and SAN MH 20)

Connection MH ID	Total Area (ha)	Population	Peak Flow (L/s)	Sewer Diameter (mm)
SAN MH 1	0.59	90	1.2	200
SAN MH 20	0.87	170	2.2	200
Site Total	**1.47**	**260**	**3.4**	

The *Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 4* (Stantec, 2020) assumed a sanitary peak flow generation of 1.0 L/s from the Kanata West Block 1 site with commercial land use. Background information, including the sanitary sewer design sheet for the overall Richcraft Kanata West subdivision, and the sanitary flow calculation based on the expected population, is provided in **Appendix F**.

The above table shows a 2.4 L/s increase in the expected sanitary peak flows over the 1.0 L/s allotted to Block 1 as a result of the land use change from commercial to residential development. The residual capacity noted in the previously approved *Richcraft Kanata West Development First Registration Phase,*

1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 4 (Stantec, 2020) for the critical sewer run from SAN MH 3 to SAN MH 2 is about 12 L/s, which demonstrates that the downstream sewer system maintains sufficient capacity to accept the relatively small increase in the overall subdivision sanitary peak discharge into the trunk sewer.

4.4 Sanitary Hydraulic Grade Line (HGL)

As indicated in the *Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 4* (Stantec, 2020), the sanitary flow generated from the Richcraft Kanata West subdivision, including the proposed Block 1 site and the upstream developments, will eventually be conveyed into the Kanata West Pump Station.

To prepare for the worst-case scenario of a pump failure, a sanitary Hydraulic Grade Line (HGL) analysis was conducted in the previously approved report for the overall Richcraft Kanata West subdivision. Given that the peak flow increase from the proposed Block 1 is a very small fraction of the overall sanitary peak flow from the subdivision, it is expected that the sanitary HGL analysis results from the previously approved report remain applicable.

The previously completed HGL analysis calculated the backwater elevation based on the 100-year water level of the Kanata West SWM Pond 5 (95.0 m), which serves as the emergency outlet for the pump station, plus an additional 0.2 m head over the pump station emergency overflow required to convey the design wet weather peak flow of 1,250 L/s under the utilimate pump failure condition (scenario 1). Besides the pump failure condition, the sanitary HGL analysis also included the results for normal operating conditions and the resulting freeboard to the proposed Under Side of Footings (USFs) across the subdivision. **Table 4.2** shows the HGL in the receiving sanitary manholes on Ploughshare Road (SAN MH 14 and SAN MH 3) along with the minimum USF across the proposed townhome blocks within Block 1.

Table 4.2 Sanitary HGL analysis for Upstream and Downstream Manhole

Receiving MH ID	Minimum USF (m)	Catastrophic HGL and USF – HGL Clearance			
		Ultimate Pump Failure (Scenario 1)		Normal Operating Condition	
		HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
3	95.80	95.39	0.41	91.11	4.69
14	95.80	95.40	0.40	92.53	3.27

As outlined in the HGL analysis for the Kanata West Subdivision, the HGL in the receiving manholes during pump failure is 95.40 m, which results in 0.40 m clearance to the minimum proposed USF on site (Block 6). Since underground parking spaces are proposed for the two three-storey apartment buildings, the elevator mechanical room and some area without residential occupancy will be lower than the proposed sanitary sewer system. As a result, the sanitary services for the proposed apartment buildings

will be equiiped with sump pumps and backwater valves. Detailed HGL analysis for the Kanata West Subdivision is included in **Appendix F.**

5 Stormwater Management and Storm Servicing

The proposed development encompasses approximately 1.47 ha of land within Block 1 of the Kanata West subdivision. The entire development is residential containing stacked townhouse units and apartment blocks. As shown on **Drawing SD-1**, post-development minor system peak flows from the development will be discharged to an existing 1200 mm diameter storm sewer on Ploughshare Road. The majority of emergency overland flows during storm events above that of the 100-year design storm event will be directed to the Ploughshare Road Right-of-Way and ultimately discharge into the Kanata West Pond 5 located east of the site, with some small uncontrolled areas directed to the Maple Grove Road, Roger Griffiths Avenue, and Ploughshare Road Rights-of-Way. Stormwater quality control (80% TSS removal) is provided by the Kanata West Pond 5, as described in the Ultimate Kanata West Pond 5 Design Brief – 1620 Maple Grove Road (Stantec, 2022).

The site is currently undeveloped and sheet flows overland to the northwest towards Maple Grove Road as shown on **Drawing ESD-1**.

5.1 Background

Stantec completed the Servicing and SWM Design Brief for the first registration of the Kanata West Subdivision in February 2020, the second registration in May 2022, and an addendum in September 2025. The design of the storm drainage system and sewer network in the subdivision accounted for development within the proposed Block 1 development (previously referred to as Commercial Block 136 in the first registration design brief).

Based on the 2020 Stantec Design Brief, the minor system 100-year release rate for the site is to be restricted to 299 L/s. On-site quantity control storage is required to retain runoff from the development from design storms up to and including the 100-year storm.

Flows are to be ultimately conveyed to the Kanata West Pond 5 for quality and quantity control per the Ultimate Kanata West Pond 5 Design Brief – 1620 Maple Grove Road (Stantec, 2022)

Additional SWM criteria outlined in the background reports are listed in the subsequent sections.

5.2 Stormwater Management Design

5.2.1 Design Criteria and Constraints

The design methodology for the SWM component of the development is as follows:

General

- Application of the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997, as described in the City of Ottawa's Sewer Design Guidelines.

- Minimum time of concentration values applied for each subcatchment cannot be less than 10 minutes.
- Create a PCSWMM model that generates major and minor system hydrographs and assesses the minor system hydraulic grade line and the major system flow depths under worst-case conditions.
- Quality control has been provided for the site via the existing Kanata West Pond 5.

Storm Sewer & Inlet Controls

- Proposed site to discharge to the existing 1200 mm diameter storm sewer on Ploughshare Road, (Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 4, Stantec, February 12, 2020 and Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum, Stantec, September 30, 2025).
- Minor system discharge rate from the entirety of Block 1 not to exceed 299 L/s in the 100-year event (Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 4, Stantec, February 12, 2020 and Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum, Stantec, September 30, 2025).
- Size storm sewers to convey the 2-year storm event under free-flow conditions using 2012 City of Ottawa I-D-F parameters. (City of Ottawa).
- Ensure that the resulting 100-year hydraulic grade line does not encroach within 0.30 m of the proposed underside of footings (USF) for the proposed units.

Surface Storage & Overland Flow

- No surface ponding is permitted within the site during the 2-year storm event (City of Ottawa).
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35 m for design storm events (i.e., up to 100-year storm) (City of Ottawa).
- Minimum clearance depth of 0.15 m to be provided from spill elevations to building envelopes in proximity of overland flow routes or ponding areas (City of Ottawa).
- Dynamic flow must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (100-year storm + 20%) (City of Ottawa).
- Provide adequate emergency overflow conveyance off-site (City of Ottawa).
- Uncontrolled areas draining towards Maple Grove Road must be controlled to the pre-development release rates for all storm events up to the 100-year storm (City of Ottawa).

In keeping with the 2-year inlet restriction criterion, inlet control devices (ICDs) or orifice plates are specified for all catch basins to limit the inflow to the minor system. Restricted inlet rates to the sewer are necessary to prevent the hydraulic grade line from surcharging storm sewers into basements during major storms. **Drawing SD-1** outlines the proposed storm sewer alignment and drainage divides.

5.3 Post-Development Modeling

5.3.1 Allowable Release Rate

The allowable release rate from the Kanata West Block 1 development is not to exceed 299 L/s in the 100-year event (Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 4, Stantec, February 12, 2020 and Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum, Stantec, September 30, 2025).

5.3.2 Modeling Rationale

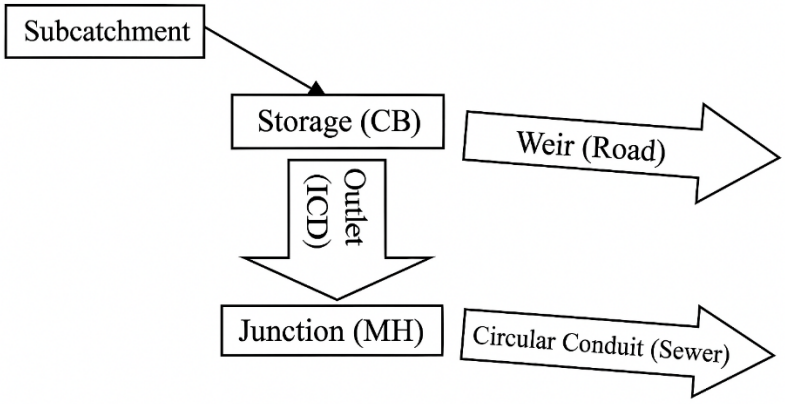
A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure and major system segments in the ultimate development condition. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems' response during various storm events. The following assumptions were applied to the detailed model:

- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n,' and depression storage values.
- 3-hour Chicago Storm distribution for the 2-year to determine inlet capture rates for the different catchments.
- Minor and major system response assessed for the 100-year using the 3-hour Chicago Storm Distribution with fixed water levels in the receiving sewers as per the Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 4, Stantec, February 12, 2020.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year storm at their specified time step.
- Percent imperviousness calculated based on actual soft and hard surfaces for representative catchments and converted to equivalent runoff coefficient using the relationship C = (Imp. x 0.7) + 0.2.
- Subcatchment areas are defined from high-point to high-point where sags occur.
- Width parameter was taken as twice the length of the street/swale segment for two-sided catchments and as the length of the street/swale segment for one-sided catchments.
- Catchbasin inflow restricted with inlet-control devices (ICDs) as per City guidelines.
- Surface ponding in sag storage calculated based on grading plans (**Drawing GP-1**).
- Inlet control devices (ICDs) to have a minimum orifice diameter of 83 mm.

5.3.3 SWMM Dual Drainage Methodology

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 5.1**), with: 1) circular conduits representing the sewers & storage nodes representing manholes; 2) weirs have been added at the spill grade elevation of each catchbasin to direct major system overflows to the next downstream catchbasin, while storage nodes have been used to represent catchbasins. The dual drainage systems are connected via orifice link objects from storage node (i.e., CB) to storage node (i.e., MH) and represent inlet control devices (ICDs). Subcatchments are linked to the storage node (CB) on the surface so that generated hydrographs are directed there firstly.

Figure 5.1: Schematic Representing Model Object Roles



For storage nodes representing low point catchbasins (CB's), the invert of the storage node represents the invert of the CB and the rim of the storage node represents the maximum allowable flow depth elevation above the storage node. Additional depth has been added to rim elevations to allow for dynamic routing from one surface storage to the next. Sag storage within irregular parking areas has been represented with a stage-area curve in the storage node as per **Drawing GP-1**. If the available storage volume in a storage node is exceeded, flows spill above the storage node and through a wide weir (representing the spill grade elevation) that directs overflows towards the downstream catchbasin and continue routing through the system until ultimately flows either re-enter the minor system or reach the outfall of the major system. Weirs representing high points are assigned an invert elevation equal to the spill elevation at the edge of pavement and a rim elevation equal to the maximum allowable flow depth elevation above the storage node. In this manner, storage will accumulate according to the actual ponding depths before spilling along the overflow weir, and to the next downstream catchbasin.

Inlet control devices, as represented by orifice links, use a user-specified diameter and a discharge coefficient of 0.61. A minimum orifice diameter of 83 mm has been specified.

5.3.4 Boundary Conditions

Static hydraulic grade lines (HGLs) were obtained from the second registration September 2025 Kanata West subdivision PCSWMM model to use as boundary conditions at the existing storm maintenance holes STM 200A and STM 100 on Ploughshare Road (STM 119 and STM 121 respectively in the Kanata West subdivision's September 2025 models). The HGL's from the latest 2025 model have been used for boundary conditions for the proposed site since this model captures all revisions made to the storm sewer system across the entire first and second registration phases of the subdivision and the ultimate condition of the receiving SWM Pond 5. The following table summarizes the high-water levels (HWL) used as boundary conditions for the different storm events.

Table 5.1: Stormwater Boundary Conditions

	September 2025 PCSWMM Model	
Storm Event	**STM 100 (121) HGL (m)**	**STM 200A (119) HGL (m)**
2-year, 3hr Chicago	94.72	94.56
100-year, 3hr Chicago	95.49	95.35
100-year, 3hr Chicago+20%	95.60	95.44

The detailed PCSWMM hydrology, and the proposed storm sewers within the proposed development were used to assess the peak inflows and hydraulic grade line (HGL) in the proposed development.

5.3.5 Hydrologic Parameters

Drawing SD-1 summarizes the discretized subcatchments used in the analysis of the proposed development and outlines the major overland flow paths.

Key parameters for the subject area are summarized below, while an example input file is provided for the 100-year, 3hr Chicago storm which indicates all other parameters (see **Appendix C.2**). For all other input files and results from storm scenarios, please examine the electronic modeling files included in the digital submission. **Table 5.2** presents the general subcatchment parameters used:

Table 5.2: General Subcatchment Parameters

Subcatchment Parameter	**Value**
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67

Subcatchment Parameter	Value
Zero Imperv (%)	0

Table 5.3 presents the individual parameters that vary for each of the proposed subcatchments.

Table 5.3: Proposed Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	Imperviousness (%)	Runoff Coefficient
F103A	0.03	62.0	2.0	85.71	0.80
L101A	0.19	54.0	3.0	71.43	0.70
L103A	0.19	66.0	2.5	71.43	0.70
L201A	0.10	36.0	4.0	85.71	0.80
L201B	0.08	69.0	4.0	71.43	0.70
L202A	0.14	62.0	3.0	85.71	0.80
L203A	0.08	27.0	1.0	85.71	0.80
L204A	0.18	73.0	2.0	85.71	0.80
L205A	0.14	38.0	3.0	85.71	0.80
UNC-1	0.10	122.0	3.0	57.14	0.60
UNC-2	0.07	53.0	20.0	68.57	0.68
UNC-3	0.05	37.0	3.0	64.29	0.65
UNC-4	0.06	101.0	5.0	42.86	0.50
UNC-5	0.05	60.0	5.0	64.29	0.65
UNC-6	0.03	106.0	33.0	10.00	0.27

Please note that runoff from areas UNC-1 to UNC-6 cannot be captured into the minor system due to grading constraints and have been modeled to sheet flow uncontrolled towards Ploughshare Road, Roger Griffiths Avenue, and Maple Grove Road. Area F103A represents the underground parking garage ramps that will be connected to the buildings' internal plumbing system and discharged uncontrolled (up to the 100-year storm) to the site storm system. **Table 5.4** summarizes the storage node parameters used in the model.

Table 5.4: Storage Node Parameters

Storage Node	Invert Elev. (m)	Rim Elev. (m)	Depth (m)
C101A-1	95.32	97.77	2.45
C103A-1	95.78	97.79	2.01
C201A-1	95.10	97.66	2.56
C201B-2	95.13	97.82	2.69
C202A-1	95.20	97.73	2.53
C203A-2	95.40	97.98	2.58

Storage Node	Invert Elev. (m)	Rim Elev. (m)	Depth (m)
C204A-1	95.53	97.76	2.23
C205A-2	95.34	97.90	2.56

* Rim elevations shown above are above the proposed grade elevation to allow for dynamic flow routing.

5.3.6 Hydraulic Parameters

As per the OSDG 2012, Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways.

Storm sewers were modeled to confirm conveyance capacities and assess hydraulic grade lines (HGLs). The detailed storm sewer design sheet is included in **Appendix C.1**.

The table below presents the parameters for the orifice link objects within the proposed development which represent ICDs. A coefficient of 0.61 was applied when using orifices.

Table 5.5: Orifice Parameters for Proposed Catchments

Orifice Name	CB ID	Tributary Area ID	Minor System Node	ICD Type	Inlet Elev. (m)	Discharge Coeff.
C101A-2IC	C101A-2	C101A	101	CIRCULAR (102mm ORIFICE)	95.23	0.61
C103A-2IC	C103A-2	C103A	103	CIRCULAR (83mm ORIFICE)	95.70	0.61
C201A-1IC	C201A-1	C201A	201	CIRCULAR (94mm ORIFICE)	95.10	0.61
C201B-1C	C201B-1	C201B	201	CIRCULAR (83mm ORIFICE)	95.00	0.61
C202A-1IC	C202A-1	C202A	202	CIRCULAR (83mm ORIFICE)	95.20	0.61
C203A-2IC	C203A-2	C203A	203	CIRCULAR (83mm ORIFICE)	95.40	0.61
C204A-2IC	C204A-2	C204A	204	CIRCULAR (83mm ORIFICE)	95.45	0.61
C205A-1IC	C205A-1	C205A	205	CIRCULAR (83mm ORIFICE)	95.25	0.61

5.4 Model Results and Discussion

The following sections summarize the key hydrologic and hydraulic model results for the proposed development. For detailed model results or inputs please refer to the example input file in **Appendix C.2** and the electronic model files included in the digital submission.

5.4.1 Proposed ICD Schedule

The site requires quantity control measures to meet the restrictive stormwater release criteria. The use of surface and subsurface storage is proposed to reduce site peak outflows to the allowable target release rate. It is proposed to detain stormwater on the surface in parking lot areas and underground in 900mm

dia. BOSS 2000 HDPE watertight stormwater storage pipes using inlet control devices (ICDs) in associated catchbasins. Underground storage pipes have been sized to ensure no ponding occurs within the 2-year event and no major system discharge occurs from the proposed development in the 100-year event as per City of Ottawa design criteria and criteria set out in the Kanata West subdivision model.

Table 5.6 summarizes the orifice link maximum flow rates and heads across the proposed development.

Table 5.6: Proposed Orifice Link Results

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	2yr Flow (L/s)	100yr Head (m)	100yr Flow (L/s)
C101A-2IC	C101A	CIRCULAR (102mm ORIFICE)	0.79	19.04	2.36	31.62
C103A-2IC	C103A	CIRCULAR (83mm ORIFICE)	1.36	16.79	2.02	20.55
C201A-1IC	C201A	CIRCULAR (94mm ORIFICE)	0.55	13.26	2.45	27.11
C201B-1C	C201B	CIRCULAR (83mm ORIFICE)	0.59	10.77	2.75	22.06
C202A-1IC	C202A	CIRCULAR (83mm ORIFICE)	1.46	17.41	2.47	21.45
C203A-2IC	C203A	CIRCULAR (83mm ORIFICE)	0.68	11.72	2.43	22.14
C204A-2IC	C204A	CIRCULAR (83mm ORIFICE)	1.57	18.06	2.26	21.50
C205A-1IC	C205A	CIRCULAR (83mm ORIFICE)	0.74	12.23	2.40	21.52

Table 5.7 summarizes the trench drain maximum flow rates across the proposed development.

Table 5.7: Proposed Trench Drain Results

Building	Tributary Area ID	2yr Flow (L/s)	100yr Flow (L/s)
Building 1 & 2	F103A	6.10	14.53

5.4.2 Hydraulic Grade Line Analysis

The hydraulic grade line (HGL) elevation across the proposed development was estimated using the hydraulic grade lines from the 2025 Kanata West subdivision PCSWMM models in STM 119 and STM 121 within Ploughshare Road as boundary conditions. The HGL's from the latest September 2025 model have been used for boundary conditions for the proposed site since this model captures all revisions made to the storm sewer system across the entire first and second registration of the subdivision and the ultimate condition of the SWM Pond 5.The 'climate change' scenario required by the City of Ottawa Sewer Design Guidelines (2012), where 100-year intensities are increased by 20% was also assessed. The storm sewer design sheet is included in **Appendix C.1**.

Table 5.8 below presents the clearance between the proposed storm sewer HGL and the proposed under side of footings (USFs). However, it should be noted that the parking garages, elevator pits, mechanical

rooms, and janitor's closets in the proposed apartment buildings are lower and will require sump pumps for footing drainage.

Table 5.8: Proposed Development Hydraulic Grade Line Results

Manhole ID	USF Elevation	Worst Case 100-year HGL (m)	Prop. USF – HGL Clearance	100-Year 3-hour Chicago +20%	Prop. USF – HGL Clearance
101	95.67	95.56	0.11	95.68	-0.01
102	N/A	95.57	-	95.69	-
102A	N/A	95.60	-	95.72	-
103	95.80	95.64	0.16	95.77	0.03
200	N/A	95.38	-	95.47	-
201	95.91	95.47	0.44	95.56	0.35
202	96.14	95.52	0.62	95.61	0.53
203	96.09	95.54	0.55	95.63	0.46
204	95.92	95.55	0.37	95.64	0.28
205	95.80	95.50	0.30	95.59	0.21

Although a gravity connection is provided from each building for the foundation drains, full port backwater valves will be required on the apartment buildings' storm services.

5.4.3 Overland Flow

Drawings SD-1 and GP-1 show the proposed emergency overland flow route from the site. The major system outlets for the site have been set above the 100-year flow depth on Ploughshare Road as obtained from the Kanata West subdivision PCSWMM model.

Table 5.9 presents the total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of the proposed street catchbasins for the 2-year storm, 100-year 3-hr Chicago storm, and the 'climate change' storm. Based on the model results, there is no surface ponding within the site during the 2-year storm event, and the total ponding depth (static + dynamic) does not exceed 0.35 m during the 100-year event or encroach on the lowest building opening during the 'climate change' event.

Table 5.9: Proposed Development – Maximum Static and Dynamic Surface Water Depths

Drainage Area ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	Max. 2 yr HGL (m)	Total Surface Ponding Depth (m)	Max. 100 yr HGL (m)	Total Surface Ponding Depth (m)	Max. 100 yr + 20% HGL (m)	Total Surface Ponding Depth (m)
L101A	97.41	98.00	96.02	0.00	97.59	0.18	97.69	0.28
L103A	97.47	98.00	97.06	0.00	97.71	0.24	97.74	0.27

Drainage Area ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	Max. 2 yr HGL (m)	Total Surface Ponding Depth (m)	Max. 100 yr HGL (m)	Total Surface Ponding Depth (m)	Max. 100 yr + 20% HGL (m)	Total Surface Ponding Depth (m)
L201A	97.40	98.07	95.65	0.00	97.55	0.15	97.63	0.23
L201B	97.65	98.02	95.59	0.00	97.75	0.10	97.76	0.11
L202A	97.38	98.30	96.66	0.00	97.67	0.29	97.71	0.33
L203A	97.70	98.25	96.08	0.00	97.83	0.13	97.90	0.20
L204A	97.45	97.90	97.02	0.00	97.70	0.25	97.73	0.28
L205A	97.50	97.95	95.99	0.00	97.65	0.15	97.72	0.22

5.4.4 Uncontrolled Areas

Due to grading constraints, six subcatchments cannot drain to the site's storm sewer system and will instead sheet-flow uncontrolled to surrounding areas.

- Area UNC-1 drains to the Roger Griffiths Avenue roadside ditch, which outlets to the Carp River.
- Area UNC-2 drains to the north end of the Roger Griffiths ROW and then to the Maple Grove Road roadside ditch.
- Area UNC-3 drains upstream of a pair of roadside catchbasins on Roger Griffiths Avenue, which overflow north toward Maple Grove Road.
- Areas UNC-4 and UNC-5 drain to the Ploughshare Road ROW, where there are two pairs of road catchbasins at sags with overflows directed east towards the Kanata West SWM Pond 5.
- Area UNC-6 drains west to a grassed swale on the Kanata West Pump Station property, which flows north to the Maple Grove Road roadside ditch.

The Kanata West subdivision PCSWMM model was updated to include peak flows from these uncontrolled areas and assess downstream impacts (see **Section 5.4.4.3**). A post- to pre-development analysis for areas draining to the Maple Grove Road ROW (UNC-1, UNC-2, and UNC-6) confirms that post-development uncontrolled flows are less than or equal to existing conditions, indicating no adverse impact on downstream stormwater infrastructure (see **Section 5.4.4.2** for details).

5.4.4.1 Post Development Runoff Coefficients

The proposed site will be developed with a mixture of amenity areas, apartment buildings, stacked townhouse blocks, and associated access roads and parking areas. Conservative runoff coefficients were assumed for the controlled subcatchments internal to the proposed site storm system to account for potential modifications during future applications (building permit, etc.). Actual runoff coefficients have been

calculated for the uncontrolled areas along the boundaries of the site to accurately compare the uncontrolled post to pre-development peak flows.

Table 5.10 tabulates the uncontrolled area runoff coefficients based on the actual pervious and impervious areas for each catchment.

Table 5.10: Uncontrolled Runoff Coefficients

Area ID	Total Area (m^2)	Hard Area (m^2)	Soft Area (m^2)	C-Value
UNC-1	1,030	594	436	0.60
UNC-2	665	457	208	0.68
UNC-3	462	294	168	0.65
UNC-4	613	261	352	0.50
UNC-5	500	319	181	0.65
UNC-6	340	32	308	0.27

1. Runoff Coefficient values of 0.90 were used for hard Areas and 0.20 for soft areas.

5.4.4.2 Maple Grove Road Post to Pre-development Peak Flow Comparison

The Modified Rational Method (MRM) was employed to assess the rate of runoff generated from the site areas under existing conditions and from uncontrolled subcatchments discharging to the Maple Grove Road ROW (UNC-1, UNC-2, and UNC-6) under post development conditions for the 2-year and 100-year events. **Drawings SD-1** and **ESD-1** outline the proposed and existing drainage divides respectively. A time of concentration of 10 minutes was used in the predevelopment condition calculations given the relatively small areas and the proximity to the drainage outlets for the site. Peak flow rates have been calculated using the rational method as follows:

$$\boldsymbol{Q} = \mathbf{2.78}\,(\boldsymbol{C})(\boldsymbol{I})(\boldsymbol{A})$$

Where:
$\boldsymbol{Q} = peak\ flow\ rate, L/s$
$\boldsymbol{C} = site\ runoff\ coefficient$
$\boldsymbol{I} = rainfall\ intensity, mm/hr\ (per\ City\ of\ Ottawa\ 2-year\ IDF\ curves)$
$\boldsymbol{A} = drainage\ area, ha$

Table 5.11 summarizes the 2 and 100-year uncontrolled release rates from the development (refer to **Appendix C.3** for detailed MRM calculations). An overall reduction in peak flows directed to the Maple Grove Road ROW roadside ditch under post-development conditions has been demonstrated so no negative impacts on the downstream system are anticipated.

Table 5.11: Peak Uncontrolled 2-year and 100-Year Release Rates

Storm Event	Post-Dev. Area ID	Post-Dev. Area (ha)	Post-Dev. Flow (L/s)	Pre-Dev. Area ID	Pre-Dev. Area (ha)	Pre-Dev. Flow (L/s)	Difference (L/s)
2-year	UNC-1	0.10	17.28	MG-1	1.22	83.36	-66.08
	UNC-2	0.07	13.71	RG-1	0.07	9.72	3.99
	UNC-6	0.03	2.33	KWPS-1	0.16	6.83	-4.50
	Total	**0.20**	**33.31**	**Total**	**1.45**	**99.91**	**-66.60**
100-year	UNC-1	0.10	37.23	MG-1	1.22	242.24	-205.01
	UNC-2	0.07	29.54	RG-1	0.07	28.23	1.31
	UNC-6	0.03	5.03	KWPS-1	0.16	19.86	-14.83
	Total	**0.20**	**71.79**	**Total**	**1.45**	**290.33**	**-218.54**

5.4.4.3 Impacts to the Kanata West Subdivision

The Kanata West subdivision PCSWMM model has been revised to reflect the minor system release rate and overland discharges from uncontrolled areas from the proposed development (areas UNC-3, UNC-4, and UNC-5) to assess impacts to ICD sizing, HGL levels and flow depths within the Kanata West Subdivision. Refer to **Appendix C.4** for an example input file from the Subdivision model during the 100-year, 3hr Chicago storm.

Table 5.12 below presents the clearance between the subdivision storm sewer HGL and the subdivision under side of footings (USFs) downstream of the proposed development to the outlet to Kanata West SWM Pond 5. The model results indicate that there is sufficient clearance between the worst case 100-year HGL and the under side of footings (USFs) within the Kanata West subdivision downstream of the proposed development. Refer to the subdivisions first registration February 2020 storm drainage plan **SD-1** in **Appendix C.5** for storm maintenance hole locations.

Table 5.12: Kanata West Subdivision Ultimate Condition Hydraulic Grade Line Results

STM MH	USF Elevation (m)	100-Year HGL		100-year + 20%	
		3-hr Chicago HGL (m)	USF – HGL Clearance (m)	3-hr Chicago HGL (m)	USF – HGL Clearance (m)
100D	N/A	95.10	-	95.14	-
101	95.74	95.19	0.55	95.23	0.51
119	95.70	95.34	0.36	95.40	0.30
121	96.20	95.47	0.73	95.55	0.65

Table 5.13 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate within the Kanata West Subdivision street catchbasins downstream of the proposed development for the 2-year 3-hr Chicago storm, the 100-year, 3-hr Chicago storm, and the ‘climate change’ storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed

the required 0.35 m maximum during the 100-year event. Since the flow depths are within acceptable limits, the Kanata West subdivision ICD's have not been adjusted. Refer to the subdivisions first registration February 2020 storm drainage plan **SD-1** in **Appendix C.5** for storm maintenance hole and drainage area ID's.

Table 5.13: Kanata West Subdivision Ultimate Maximum Static and Dynamic Surface Water Depths

Storage node ID	Structure ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	2-year, 3-hour Chicago		100-year, 3-hour Chicago		100-year, 3-hour Chicago+20%	
				Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)
121A-S(2)	CB 121 A-1 & 2	97.36	97.90	96.58	0.00	97.67	0.31	97.73	0.37
121AA-S	CB 121 AA-1 & 2	97.31	N/A	96.52	0.00	97.35	0.04	97.35	0.04
102A-S(1)	CB 102 A-1 & 2	97.14	97.79	96.96	0.00	97.32	0.18	97.46	0.32
114A-S	CB 114 A-1	97.07	N/A	95.91	0.00	97.28	0.21	97.31	0.24
119A-S	CB 119 A-1 & 2	97.22	97.82	97.23	0.01	97.45	0.23	97.54	0.32

5.4.5 Overall Release Rates

The allowable minor system release rate from the proposed development to the existing storm sewer on Ploughshare Road as obtained from the Kanata West subdivision first registration February 2020 PCSWMM model is 299 L/s in the 100-year storm. The uncontrolled areas discharging offsite towards Maple grove Road (UNC-1 (OF7), UNC-2 (OF6), and UNC-6 (OF5)) have not been considered when comparing the proposed release rate to the allowable release rate since these areas are not directed to the Ploughshare Road trunk sewer as assumed for the entirety of Block 1 in the Kanata West subdivision model. **Table 5.14** summarizes the overall site allowable release rates and the proposed development discharges.

Table 5.14: Proposed Development – Peak Outflows

Location	Contributing Drainage Area ID's	Discharge Location	System	Storm Event		
				2-Year 3hr Chicago (L/s)	100-Year 3hr Chicago (L/s)	100-Year, 3hr Chicago +20% (L/s)
100	L101A, L103A, F103A	Ploughshare Road	Minor	40.1	66.0	68.6
200A	L201A, L201B, L202A, L203A, L204A, L205A	Ploughshare Road	Minor	81.6	135.1	134.1
Total Minor System Release Rate from Site Areas:				**121.7**	**201.1**	**202.7**
OF1	L201A, L202A, L203A, L204A, L205A	Ploughshare Road	Major	0.0	0.0	56.4
OF2	L101A, L103A, F103A	Ploughshare Road	Major	0.0	0.0	9.5

Location	Contributing Drainage Area ID's	Discharge Location	System	Storm Event		
				2-Year 3hr Chicago (L/s)	100-Year 3hr Chicago (L/s)	100-Year, 3hr Chicago +20% (L/s)
OF3	UNC-3	Roger Griffihs Ave	Major	8.1	22.1	26.8
OF4	L201B, UNC-5	Ploughshare Road	Major	9.3	37.5	52.2
OF8	UNC-4	Ploughshare Road	Major	10.2	28.9	35.0
Total Major System Release Rate from Site Areas to Kanata West Subdivision:				**17.4**	**59.6**	**144.8**
Overall Release Rate from Site Areas to Kanata West Subdivision:				**139.1**	**260.7**	**347.5**
On-site 100-year Target Release Rate				**299.0**		

*Allowable release rates taken from Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report dated February 12, 2020 and associated PCSWMM model

As can be seen in the above table, the allowable release rates for both the major and minor systems up to the 100-year storm from site areas to Ploughshare Road have been met.

5.5 Water Balance – Infiltration Requirements

As per the Richcraft Kanata West Development First Registration Phase – Servicing and Stormwater Management Report (Stantec, 2020), the opportunities for infiltration within the subdivision's private blocks were limited to none. Infiltration requirements established in the Kanata West Master Servicing Study (Stantec, 2007) have been satisfied through the overall subdivision design, based on site configuration, imperviousness, and the feasibility of implementing infiltration measures. The proposed site is largely impervious, limiting opportunities for additional infiltration practices. As a result, infiltration requirements for the subdivision were achieved through infiltration measures implemented within the rear yards, school block, and park blocks and no infiltration requirements were placed on Block 1.

6 Geotechnical Considerations and Grading

6.1 Geotechnical Investigation

A geotechnical investigation report for Kanata West (Mapleton) Block 1 was completed by Paterson Group on April 7, 2025. Field testing consisting of the advancement of six (6) boreholes with a maximum depth of 6.7 m throughout the subject site was completed on March 21, 2025. The geotechnical investigation report is included in **Appendix D.1**.

The site currently has a temporary granular pad at the west portion with access facing Roger Griffiths Avenue for site trailer parking. The grade across the site is generally level at an elevation of approximately 97 m by the time of field investigation; this may have been raised from the historical data which was around 95 to 96 m due to the ongoing construction activity. The subsurface profile within the subject site 1.7 to 2.2 m fill consists of compact brown silty sand and silty clay with granular crushed stone around the granular pad, followed by compact and brown to grey sandy silt underlying the fill and followed by a firm, grey silty clay layer at an approximate depth of 4.5 m below the existing ground surface. From the geological mapping in this area, the bedrock in this site consists of interbedded limestone and dolomite at about 5 to 15 m depth.

Groundwater levels were taken during the borehole drilling and observed at the depth of 2.19 m to 2.84 m below the existing surface with elevation from 94.40 m to 94.98 m. The long-term groundwater table is anticipated to be at 2 to 3 m depth, subject to seasonal fluctuations.

The site is considered suitable for the proposed development from a geotechnical perspective. Conventional shallow foundations placed on undisturbed sandy silt, silt or silty clay can be used for the proposed buildings.

Due to the presence of the silty clay deposit, a permissible grade raise restriction of 2.0 m above the original site grade is recommended for grading at this site. If a grade raise of more than 2.0m is required, lightweight fill and other measures should be considered to prevent long-term post-construction settlement. Refer to drawing **GP-1** for on-site grading design.

6.1.1 Proposed Pavement Structure

Table 6.1 and **Table 6.2** summarize the recommended pavement structures for the development.

Table 6.1 Recommended Pavement Structure for Car-Only Parking

Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone Compacted to Min. 99% SPMDD
300	Subbase – OPSS Granular B Type II Compacted to Min. 99% SPMDD
-	Subgrade – fill in situ soil or OPSS Granular B Type I or II material placed over in situ soil

Table 6.2 Recommended Pavement Structure for Access Lanes and Truck Parking Areas

Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
50	Binder Course – HL-8 pr Superpave 19.0 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone Compacted to Min. 99% SPMDD
450	Subbase – OPSS Granular B Type II Compacted to Min. 99% SPMDD
-	Subgrade – OPSS Granular B Type II material placed over in situ soil or engineered fill

6.1.2 Sewer/Watermain Installation

The subsurface soils are considered to be Type 2 and 3 according to the Occupational Health and Safety Act and Regulations for Construction Projects. For excavations up to 3 m deep, 1H:1V slopes or shallower are recommended. A shallow slope should be used if the excavation is below the groundwater table. A trench box is required for all steep or vertical side slopes where workers are present.

At least 150mm of OPSS Granular A crushed stone compacted to 95% SPMDD is recommended as bedding for watermains and sewers, up to the springline of the pipes. OPSS Granular A crushed stone is to be used as cover material at least 300 mm above the obvert of the pipes and compacted to a minimum of 95% SPMDD.

If the excavation and filling operations are carried out in dry weather, the moist brown silty clay is expected to be suitable as backfill material (above the cover material). Wet silty clay materials will be difficult to reuse without an extensive drying period. The trench backfill material within the frost zone (about 1.8 m below finished grade) should match the existing soils at the trench walls. Clay seals are recommended at no more than 60 m intervals in the service trenches and at strategic locations to reduce long-term lowering of the groundwater level in the site.

A low to moderate volume of groundwater infiltration is expected during excavation, and it is anticipated to be sufficient in providing groundwater control by using open sumps and pumps. Contractor should be prepared to direct any water away from all bearing surfaces and subgrade to avoid disturbance to the founding medium. A temporary Permit to Take Water (PTTW) from the Ontario Ministry of the Environment, Conservation and Parks (MECP) may be required if more than 400,000 L/day of ground and/or surface water needs to be pumped during the construction phase (to be determined by the geotechnical consultant). The review/issuance of the permit may take upwards of 4 months. For typical ground/surface water pumping volumes (50,000 L/day to 400,000 L/day), registration on the Environmental Activity and Sector Registry (EASR) will be required. Two to four weeks should be allotted for the completion of this registration and the preparation of a Water Taking and Discharge Plan by a Qualified Person as required under O.Reg. 63/16.

The founding stratum should be protected from freezing temperatures if winter construction is anticipated. The trench excavations should also be completed in a manner that will avoid the introduction of frozen materials into the trenches.

6.2 Grading Plan

Proposed grading for the Kanata West Block 1 site is shown on **Drawing GP-1**. The proposed grading design for the subject site directs the controlled overland flow from most of the site toward Ploughshare Road. A small portion of the site along the west property line, containing mostly landscape and grassed area, drains uncontrolled towards Roger Griffiths Avenue. Another small section of the mainly landscaped area of the proposed townhomes' front yard, north of the site, drains uncontrolled towards Maple Grove Road. The proposed grading implements sags in the parking areas for surface stormwater detention.

The proposed grading has been developed to match the existing road grades along Maple Grove Road to the North, Roger Griffiths Avenue to the West and Ploughshare Road to the South. Terracing and a retaining wall are proposed to adjust the elevation difference between the proposed site and the neighbouring pump station property to match the existing grades along the property line.

All grading, infilling and backfilling works are to be completed as per the geotechnical recommendations made in Paterson’s geotechnical investigation report (summarized above in **Section 6**).

7 Utilities

Utility infrastructure for Bell, Rogers, Hydro Ottawa, and Enbridge exists within underground plant servicing urbanized rights-of-way adjacent to the subject site. Coordination regarding the exact size, location, and routing of utilities will begin following design circulation.

8 Approvals

The City of Ottawa will review most development applications as they relate to the provision of water supply, wastewater collection and disposal, and stormwater conveyance and treatment for Site Plan Approval.

An Environmental Compliance Approval (ECA) is not expected to be required from the Ontario Ministry of the Environment, Conservation and Parks (MECP) for the proposed servicing works within the proposed private block as all services are connecting into existing sewer infrastructure, and service a single property parcel of non-industrial nature.

Approval from the Mississippi Valley Conservation Authority (MVCA) under Section 28 of the Conservation Authorities Act (Ontario Regulation 153/06) will be required for any development (e.g., filling or construction) with the Regulation Limit, as defined on our regulation mapping, and/or alteration to any watercourse (e.g., watercourse crossings). MVCA should be circulated before receiving municipal approval.

An MECP Permit to Take Water (PTTW) or registration on the Environmental Activity and Sector Registry (EASR) may be required for the site. The geotechnical consultant shall confirm at the time of application whether a PTTW or EASR registration is required.

No other approval requirements from other regulatory agencies are anticipated.

9 Erosion Control

In order to protect downstream water quality and prevent sediment build up in catchbasins and storm sewers, erosion and sediment control measures must be implemented during construction. The following recommendations will be included in the contract documents and communicated to the Contractor.

- Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
- Limit the extent of the exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with geotextiles, geogrid, or synthetic mulches.
- Provide sediment traps and basins during dewatering works.
- Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
- Schedule the construction works at times which avoid flooding due to seasonal rains.

The Contractor will also be required to complete inspections and guarantee the proper performance of their erosion and sediment control measures at least after every rainfall. The inspections are to include:

- Verification that water is not flowing under silt barriers.
- Cleaning and changing the sediment traps placed on catch basins.

Refer to **Drawing EC/DS-1** for the proposed location of silt fences, straw bales, and other erosion control measures.

10 Conclusions and Recommendations

10.1 Potable Water Servicing

The proposed watermain network is capable of achieving the level of service required by the City of Ottawa based on the hydraulic analysis. The following conclusions were made:

- The proposed water distribution system in the Kanata West Block 1 (815 Roger Griffiths Avenue) is recommended to consist of 200 mm diameter watermain to service the apartment buildings and townhouse units with two independent watermain networks, by connecting to the existing 200mm diameter watermain on Ploughshare Road from two separate connection points.
- The proposed watermain network will operate above the maximum pressure objective of 552 kPa (80 psi) in the average day (AVDY) and peak hour (PKHR) conditions. Pressure-reducing valves (PRVs) will be required at the building connections.
- During maximum day domestic demands with a fire flow demand of 14,000 L/min (233 L/s) for the wood-frame townhome blocks and up to 12,000 L/min (200 L/s) for the apartment buildings in ordinary construction, the watermain network will provide sufficient fire flows while maintaining a residual pressure of 138 kPa (20 psi) in all areas within the development.

10.2 Wastewater Servicing

Wastewater from the proposed development will be conveyed to the existing sanitary sewer on Ploughshare Road, constructed as part of the existing Richcraft Kanata West Subdivision, which ultimately discharges to the Kanata West Pumping Station.

200mm diameter sanitary sewers are proposed throughout the site. The capacity of the existing sanitary sewers on Ploughshare Road and further downstream was verified with the estimated peak wastewater flows from the site and their relative increase from the estimates made in the *Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road (D07-16-04-0017) - Servicing and Stormwater Management Report, Rev 4* (Stantec, 2020). The analysis confirmed that there is sufficient capacity within the downstream sanitary sewer system to service the site with the proposed residential land use.

10.3 Stormwater Management and Servicing

The proposed stormwater management plan complies with the requirements outlined in the background documents, the City of Ottawa Sewer Design Guidelines, and the Ontario Ministry of the Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual.

Inlet control devices were defined for each subcatchment to restrict minor system peak flows rates to the storm sewers to 299 L/s for the Kanata West Block 1 site as per City of Ottawa and background report design criteria. Emergency overland peak flows from the site (i.e., for storm events above the 100-year

design storm) will be directed to the Ploughshare Road ROW. Due to grading constraints, a few uncontrolled areas will sheet drain to Maple Grove Road, Roger Griffiths Avenue, and the KWPS block (all of which ultimately discharge to the Maple Grove Road ROW roadside ditch). Under the post-development conditions there will be an overall reduction in peak flows directed to the Maple Grove Road ROW roadside ditch so no negative impacts on the downstream system are anticipated.

Minor system peak flows will be directed to the existing 1200 mm diameter storm sewer on Ploughshare Road. The Kanata West subdivision PCSWMM model has been revised to reflect the minor system release rate from site areas and overland discharges from uncontrolled areas from the proposed development. The model results indicate that there is sufficient clearance between the worst case HGL and the under side of footings (USFs) and that static and dynamic flow depths are within acceptable limits within the Kanata West subdivision downstream of the proposed development.

Quantity and quality control (80% TSS removal) of stormwater runoff will be provided at the downstream Kanata West Pond 5.

10.4 Grading

Proposed grading for the site directs emergency major system flows to the surrounding ROWs. The proposed grading implements sags in the parking areas for surface stormwater detention and has been designed to accommodate SWM requirements for the development.

All grading, infilling and backfilling works are to be completed as per the geotechnical recommendations made in the background geotechnical investigation report.

10.5 Approvals/Permits

An Environmental Compliance Approval (ECA) is not expected to be required from the Ontario Ministry of the Environment, Conservation and Parks (MECP) for the proposed servicing works within the proposed private block so long as part lot control is not pursued for this development (i.e., as long as the property will be held under single ownership) as all services are connecting into existing sewer infrastructure, and service a single property parcel of non-industrial nature. A Permit to Take Water or registration on the EASR may be required for dewatering works during sewer/watermain installation, pending confirmation by the geotechnical consultant. The Mississippi Valley Conservation Authority (MVCA) will need to be consulted to obtain municipal approval for site development. No other approval requirements from other regulatory agencies are anticipated.

10.6 Utilities

Utility infrastructure for Bell, Rogers, Hydro Ottawa, and Enbridge exists within underground plant servicing urbanized rights-of-way adjacent to the subject site. Coordination regarding the exact size, location, and routing of utilities will begin following design circulation.

Appendices

Appendix A Potable Water Servicing

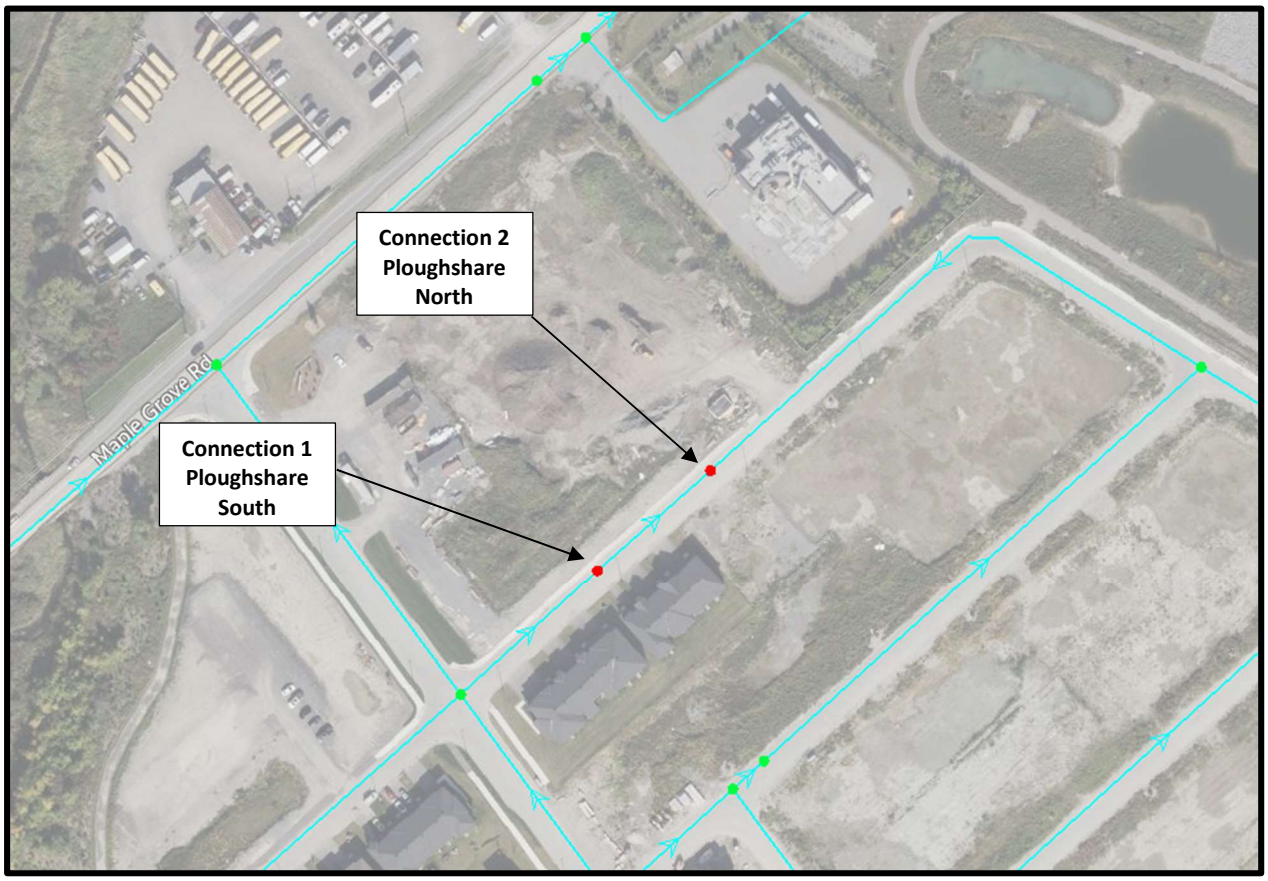
A.1 Boundary Condition Correspondence

Boundary Conditions
815 Roger Griffiths

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	51	0.85
Maximum Daily Demand	130	2.17
Peak Hour	282	4.70
Fire Flow Demand #1	14,000	233.33
Fire Flow Demand #2	18,000	300.00

Location



Results

Connection 1 – Ploughshare South

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.9	90.8
Peak Hour	155.9	83.7
Max Day plus Fire Flow #1	140.6	61.9
Max Day plus Fire Flow #2	130.6	47.6

[1] Ground Elevation = 97.1 m

Connection 2 – Ploughshare North

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.9	90.7
Maximum HGL	155.9	83.6
Max Day plus Fire Flow #1	135.2	54.1
Max Day plus Fire Flow #2	122.0	35.4

[1] Ground Elevation = 97.1 m

Notes

1. The IWSD has recently updated their water modelling software. Any significant difference between previously received BC results and newly received BC results could be attributed to this update.
2. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    - If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    - Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

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.

A.2 Domestic Water Demand Calculations

815 Roger Griffith Avenue - Block 1, Ottawa, ON - Domestic Water Demand Estimates

Site Plan Provided by M.David Blakely Architect Inc., Rev 15, Dated Jan 19, 2026
Project No. 160402165

Densities as per City Guidelines:		
Personns Per Units[1]		
Row	2.7	ppu
Apartment	1.8	ppu

Stantec

Type of Unit	No. of Units	Population	Daily Rate of Demand [2] (L/cap/day)	Avg Day Demand		Max Day Demand [3]		Max Hour Demand [3]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
SP-1a									
Building 1	25	45	280	8.8	0.15	21.9	0.36	48.1	0.80
Building 2	25	45	280	8.8	0.15	21.9	0.36	48.1	0.80
			Subtotal	**17.5**	**0.29**	**43.8**	**0.73**	**96.3**	**1.60**
Sp-1b									
Block 1	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Block 2	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Block 3	9	24	280	4.7	0.08	11.8	0.20	26.0	0.43
Block 4	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Block 5	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Block 6	6	16	280	3.2	0.05	7.9	0.13	17.3	0.29
	Area (m^2)		**Daily Rate of Demand [2] (L/ha/day)**						
Accessory Building	83		28000	0.2	0.003	0.2	0.004	0.4	0.009
			Subtotal	**33.2**	**0.55**	**82.9**	**1.38**	**182.3**	**3.04**
Total Site :	**113**	**260**		**50.7**	**0.85**	**126.7**	**2.11**	**278.6**	**4.64**

Notes:

1 As per Table 4-1 from the City of Ottawa Water Design Guidelines, the persons per unit for Townhouse (row) units is 2.7 and for Apartment is 1.8

2 As per Table 4-2 from the City of Ottawa Water Design Guidelines and Technical Bulletin ISTB-2021-03, the average daily rate of water demand for residential areas: 280 L/cap/day for commerical area:28,000 L/ha/day

3 As per Table 4.2 from the City of Ottawa Water Design Guidelines, the water demand criteria used to estimate peak demand rates for residential areas are as follows:

maximum daily demand rate = 2.5 x average day demand rate

maximum hour demand rate = 2.2 x maximum day demand rate

A.3 FUS Calculations

Stantec

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 2/4/2026
Fire Flow Calculation #: 1
Description: Building 1 - 3 storey(25 Unit) Apartment Building without sprinkler system

Notes: Site Plan Provided by M.David Blakely Architect Inc., Rev 15, Dated Jan 19, 2026

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type III - Ordinary Construction / Type IV-C - Mass Timber Construction										1	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		826	826	826								2478	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	11000
4	Determine Occupancy Charge	Limited Combustible										-15%	9350
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		North	> 30	24	3	61-80	Type V	NO				0%	2151
		East	20.1 to 30	40	3	> 100	Type V	NO				10%	
		South	10.1 to 20	22	3	61-80	Type V	NO				13%	
		West	> 30	40	3	> 100	Type V	NO				0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											12000
		Total Required Fire Flow in L/s											200.0
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1800

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 2/4/2026
Fire Flow Calculation #: 2
Description: Building 2 - 3 storey(25 Unit) Apartment Building without sprinkler system

Notes: Site Plan Provided by M.David Blakely Architect Inc., Rev 15, Dated Jan 19, 2026

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type III - Ordinary Construction / Type IV-C - Mass Timber Construction										1	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		826	826	826								2478	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	11000
4	Determine Occupancy Charge	Limited Combustible										-15%	9350
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		North	10.1 to 20	22	3	61-80	Type V	NO				13%	2712
		East	20.1 to 30	40	3	> 100	Type V	NO				10%	
		South	20.1 to 30	22	3	61-80	Type V	NO				6%	
		West	> 30	40	3	> 100	Type V	NO				0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											12000
		Total Required Fire Flow in L/s											200.0
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1800

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 2/4/2026
Fire Flow Calculation #: 3
Description: Block 1 - Three Level Terrace flat (12 Unit) townhouse without firewall

Notes: Site Plan Provided by M.David Blakely Architect Inc., Rev 15, Dated Jan 19, 2026

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		416	416	416								1248	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	12000
4	Determine Occupancy Charge	Limited Combustible										-15%	10200
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		North	> 30	34	0	0-20	Type V	NO				0%	2652
		East	> 30	13	3	21-49	Type V	NO				0%	
		South	20.1 to 30	34	3	> 100	Type V	NO				10%	
		West	3.1 to 10	13	3	21-49	Type V	NO				16%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											13000
		Total Required Fire Flow in L/s											216.7
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1950

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 2/4/2026
Fire Flow Calculation #: 4
Description: Block 2 - Three Level Terrace flat (12 Unit) townhouse without firewall

Notes: Site Plan Provided by M.David Blakely Architect Inc., Rev 15, Dated Jan 19, 2026

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		416	416	416								1248	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	12000
4	Determine Occupancy Charge	Limited Combustible										-15%	10200
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		North	> 30	34	3	> 100	Type V	NO				0%	3162
		East	3.1 to 10	13	3	21-49	Type V	NO				16%	
		South	10.1 to 20	34	3	> 100	Type V	NO				15%	
		West	> 30	13	3	21-49	Type V	NO				0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											13000
		Total Required Fire Flow in L/s											216.7
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1950

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 2/4/2026
Fire Flow Calculation #: 5
Description: Block 3 - Three Level Terrace flat (9 Unit) townhouse without firewall

Notes: Site Plan Provided by M.David Blakely Architect Inc., Rev 15, Dated Jan 19, 2026

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		313	313	313								939	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	10000
4	Determine Occupancy Charge	Limited Combustible										-15%	8500
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		North	10.1 to 20	13	3	21-49	Type V	NO				11%	3910
		East	10.1 to 20	26	3	61-80	Type V	NO				13%	
		South	3.1 to 10	13	3	21-49	Type V	NO				16%	
		West	20.1 to 30	26	3	61-80	Type V	NO				6%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											12000
		Total Required Fire Flow in L/s											200.0
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1800

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 2/4/2026
Fire Flow Calculation #: 6
Description: Block 4 - Three Level Terrace flat (12 Unit) townhouse without firewall

Notes: Site Plan Provided by M.David Blakely Architect Inc., Rev 15, Dated Jan 19, 2026

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		416	416	416								1248	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	12000
4	Determine Occupancy Charge	Limited Combustible										-15%	10200
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		North	3.1 to 10	13	3	21-49	Type V	NO				16%	3774
		East	20.1 to 30	34	3	> 100	Type V	NO				10%	
		South	10.1 to 20	13	2	21-49	Type V	NO				11%	
		West	> 30	34	3	> 100	Type V	NO				0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											14000
		Total Required Fire Flow in L/s											233.3
		Required Duration of Fire Flow (hrs)											3.00
		Required Volume of Fire Flow (m^3)											2520

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 2/4/2026
Fire Flow Calculation #: 7
Description: Block 5 - Three Level Terrace flat (12 Unit) townhouse withouth firewall

Notes: Site Plan Provided by M.David Blakely Architect Inc., Rev 15, Dated Jan 19, 2026

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		416	416	416								1248	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	12000
4	Determine Occupancy Charge	Limited Combustible										-15%	10200
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		North	20.1 to 30	34	3	> 100	Type V	NO				10%	2550
		East	20.1 to 30	13	3	21-49	Type I-II - Unprotected Openings	YES				0%	
		South	10.1 to 20	34	2	61-80	Type V	NO				13%	
		West	20.1 to 30	13	3	21-49	Type V	NO				2%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											13000
		Total Required Fire Flow in L/s											216.7
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1950

Stantec

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 2/4/2026
Fire Flow Calculation #: 8
Description: Block 6 - Three Level Terrace flat (6 Unit) townhouse without firewall

Notes: Site Plan Provided by M.David Blakely Architect Inc., Rev 15, Dated Jan 19, 2026

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		208	208	208								624	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	8000
4	Determine Occupancy Charge	Limited Combustible										-15%	6800
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		North	20.1 to 30	18	3	41-60	Type V	NO				4%	2176
		East	> 30	13	3	21-49	Type I-II - Unprotected Openings	YES				0%	
		South	10.1 to 20	18	3	41-60	Type V	NO				12%	
		West	3.1 to 10	13	3	21-49	Type V	NO				16%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											9000
		Total Required Fire Flow in L/s											150.0
		Required Duration of Fire Flow (hrs)											2.00
		Required Volume of Fire Flow (m^3)											1080

A.4 Watermain Hydraulic Analysis Results

PCSWMM Watermain Hydraulic Analysis Result
Junction Results - Basic Day

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
10	0.00	97.67	160.90	63.23	89.91	619.94
11	0.00	97.61	160.90	63.29	90.00	620.52
14	0.00	97.95	160.90	62.95	89.51	617.18
16	0.00	97.66	160.90	63.24	89.92	620.00
19	0.00	97.86	160.90	63.04	89.65	618.08
20	0.00	97.92	160.90	62.98	89.56	617.49
21	0.00	97.72	160.90	63.19	89.85	619.47
3	0.00	97.70	160.90	63.21	89.88	619.67
4	0.00	97.62	160.90	63.28	89.98	620.38
5	0.00	97.58	160.90	63.32	90.04	620.79
9	0.00	97.68	160.90	63.22	89.89	619.78
BLDG1	0.15	97.80	160.90	63.10	89.73	618.66
BLDG2	0.15	97.59	160.90	63.31	90.02	620.70
BLOCK1	0.11	97.62	160.90	63.28	89.98	620.40
BLOCK2	0.11	97.86	160.90	63.04	89.65	618.08
BLOCK3	0.08	97.74	160.90	63.16	89.81	619.25
BLOCK4	0.11	97.59	160.90	63.31	90.03	620.73
BLOCK5	0.11	97.64	160.90	63.26	89.95	620.19
BLOCK6	0.05	97.77	160.90	63.13	89.77	618.97
FH-1	0.00	97.71	160.90	63.19	89.85	619.51
FH-2	0.00	97.65	160.90	63.25	89.94	620.10
FH-3	0.00	97.68	160.90	63.22	89.90	619.81
UTILITY	0.00	97.79	160.90	63.11	89.73	618.70

Link Results - Basic Day

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	BLDG2	Ploughshare_South	38	200	110	-0.300	0.010
1001	FH-3	BLDG2	19	200	110	-0.150	0.005
1002	3	FH-3	6	200	110	-0.150	0.005
1003	4	3	16	200	110	-0.150	0.005
1004	5	4	25	200	110	-0.150	0.005
1005	BLDG1	5	6	200	110	-0.150	0.005
1006	BLOCK4	Ploughshare_North	30	200	110	-0.573	0.018
1007	9	BLOCK4	14	200	110	-0.463	0.015
1008	10	9	2	200	110	-0.463	0.015
1009	11	10	12	200	110	-0.225	0.007
1010	BLOCK3	11	13	200	110	-0.225	0.007
1011	UTILITY	BLOCK3	10	200	110	-0.145	0.005
1012	14	UTILITY	10	200	110	-0.142	0.005
1013	14	BLOCK2	10	200	110	0.110	0.004
1014	16	14	32	200	110	-0.032	0.001
1015	FH-2	16	2	200	110	-0.110	0.004
1016	BLOCK1	FH-2	6	200	110	-0.110	0.004
1017	19	16	14	200	110	0.078	0.002
1018	20	19	7	200	110	0.078	0.002
1019	21	20	27	200	110	0.078	0.002
1020	BLOCK5	BLOCK6	9	200	110	0.050	0.002
1021	21	BLOCK5	7	200	110	0.160	0.005
1022	FH-1	21	17	200	110	0.238	0.008
1023	10	FH-1	9	200	110	0.238	0.008

PCSWMM Watermain Hydraulic Analysis Result
Junction Results - Peak Hour

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
10	0.00	97.67	155.90	58.23	82.80	570.88
11	0.00	97.61	155.90	58.29	82.88	571.46
14	0.00	97.95	155.90	57.95	82.40	568.11
16	0.00	97.66	155.90	58.23	82.81	570.93
19	0.00	97.86	155.90	58.04	82.53	569.01
20	0.00	97.92	155.90	57.98	82.44	568.42
21	0.00	97.72	155.90	58.18	82.73	570.40
3	0.00	97.70	155.90	58.20	82.76	570.64
4	0.00	97.62	155.90	58.28	82.87	571.35
5	0.00	97.58	155.90	58.32	82.93	571.75
9	0.00	97.68	155.90	58.21	82.78	570.72
BLDG1	0.80	97.80	155.90	58.10	82.62	569.62
BLDG2	0.80	97.59	155.90	58.31	82.91	571.67
BLOCK1	0.58	97.62	155.90	58.27	82.86	571.33
BLOCK2	0.58	97.86	155.90	58.04	82.53	569.01
BLOCK3	0.43	97.74	155.90	58.16	82.70	570.19
BLOCK4	0.58	97.59	155.90	58.31	82.92	571.68
BLOCK5	0.58	97.64	155.90	58.25	82.83	571.12
BLOCK6	0.29	97.77	155.90	58.13	82.66	569.90
FH-1	0.00	97.71	155.90	58.19	82.74	570.45
FH-2	0.00	97.65	155.90	58.24	82.82	571.03
FH-3	0.00	97.68	155.90	58.22	82.78	570.78
UTILITY	0.01	97.79	155.90	58.10	82.62	569.63

Link Results - Basic Day

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	BLDG2	Ploughshare_South	38	200	110	-1.600	0.051
1001	FH-3	BLDG2	19	200	110	-0.800	0.025
1002	3	FH-3	6	200	110	-0.800	0.025
1003	4	3	16	200	110	-0.800	0.025
1004	5	4	25	200	110	-0.800	0.025
1005	BLDG1	5	6	200	110	-0.800	0.025
1006	BLOCK4	Ploughshare_North	30	200	110	-3.049	0.097
1007	9	BLOCK4	14	200	110	-2.469	0.079
1008	10	9	2	200	110	-2.469	0.079
1009	11	10	12	200	110	-1.198	0.038
1010	BLOCK3	11	13	200	110	-1.198	0.038
1011	UTILITY	BLOCK3	10	200	110	-0.768	0.024
1012	14	UTILITY	10	200	110	-0.759	0.024
1013	14	BLOCK2	10	200	110	0.580	0.018
1014	16	14	32	200	110	-0.179	0.006
1015	FH-2	16	2	200	110	-0.580	0.018
1016	BLOCK1	FH-2	6	200	110	-0.580	0.018
1017	19	16	14	200	110	0.401	0.013
1018	20	19	7	200	110	0.401	0.013
1019	21	20	27	200	110	0.401	0.013
1020	BLOCK5	BLOCK6	9	200	110	0.290	0.009
1021	21	BLOCK5	7	200	110	0.870	0.028
1022	FH-1	21	17	200	110	1.271	0.040
1023	10	FH-1	9	200	110	1.271	0.040

PCSWMM Watermain Hydraulic Analysis Result
Fire Flow Results - Max Day + 233 L/s

ID	Static Demand (L/s)	Static Pressure (m)	Static Pressure (psi)	Static Pressure (kPa)	Static Head (m)	Fire Flow Demand (L/s)	Residual Pressure (m)	Residual Pressure (psi)	Available Flow (L/s)	Available Pressure (psi)
10	0.00	37.53	53.37	367.95	135.20	0.00	23.35	33.20	306.59	20
11	0.00	37.59	53.45	368.54	135.20	0.00	20.98	29.83	281.84	20
14	0.00	37.25	52.97	365.20	135.20	0.00	17.43	24.78	254.04	20
16	0.00	37.54	53.38	368.05	135.20	0.00	16.94	24.09	250.45	20
19	0.00	37.34	53.10	366.09	135.20	0.00	16.95	24.10	250.68	20
20	0.00	37.28	53.01	365.50	135.20	0.00	17.13	24.36	251.96	20
21	0.00	37.48	53.30	367.46	135.20	0.00	19.18	27.27	266.70	20
3	0.00	42.90	61.00	420.60	140.60	0.00	23.44	33.33	288.61	20
4	0.00	42.98	61.12	421.38	140.60	0.00	18.73	26.63	256.63	20
5	0.00	43.02	61.17	421.77	140.60	0.00	11.13	15.83	221.43	20
9	0.00	37.52	53.35	367.85	135.20	0.00	23.95	34.06	314.05	20
BLDG1	0.36	42.80	60.86	419.62	140.60	0.00	8.99	12.78	213.68	20
BLDG2	0.36	43.01	61.16	421.68	140.60	0.00	31.28	44.48	380.53	20
BLOCK1	0.26	37.58	53.44	368.44	135.20	0.00	14.70	20.90	236.81	20
BLOCK2	0.26	37.34	53.10	366.09	135.20	0.00	14.61	20.77	236.34	20
BLOCK3	0.20	37.46	53.27	367.26	135.20	0.00	19.20	27.30	266.86	20
BLOCK4	0.26	37.61	53.48	368.73	135.20	0.00	28.35	40.31	387.02	20
BLOCK5	0.26	37.56	53.41	368.24	135.20	0.00	17.25	24.53	252.54	20
BLOCK6	0.13	37.43	53.22	366.97	135.20	0.00	14.28	20.31	234.50	20
FH-1	0.00	37.49	53.31	367.56	135.20	0.00	21.47	30.53	286.70	20
FH-2	0.00	37.55	53.39	368.15	135.20	0.00	16.46	23.41	247.32	20
FH-3	0.00	42.92	61.03	420.79	140.60	0.00	25.40	36.12	305.65	20
UTILITY	0.00	37.40	53.18	366.67	135.20	0.00	18.24	25.94	259.67	20

PCSWMM Watermain Hydraulic Analysis Result
Fire Flow Results - Max Day + 200 L/s

ID	Static Demand (L/s)	Static Pressure (m)	Static Pressure (psi)	Static Pressure (kPa)	Static Head (m)	Fire Flow Demand (L/s)	Residual Pressure (m)	Residual Pressure (psi)	Available Flow (L/s)	Available Pressure (psi)
10	0.00	37.53	53.37	367.95	135.20	0.00	26.85	38.18	306.59	20
11	0.00	37.59	53.45	368.54	135.20	0.00	25.09	35.68	281.84	20
14	0.00	37.25	52.97	365.20	135.20	0.00	22.33	31.75	254.04	20
16	0.00	37.54	53.38	368.05	135.20	0.00	22.03	31.33	250.45	20
19	0.00	37.34	53.10	366.09	135.20	0.00	21.99	31.27	250.68	20
20	0.00	37.28	53.01	365.50	135.20	0.00	22.11	31.44	251.96	20
21	0.00	37.48	53.30	367.46	135.20	0.00	23.70	33.70	266.70	20
3	0.00	42.90	61.00	420.60	140.60	0.00	28.26	40.18	288.61	20
4	0.00	42.98	61.12	421.38	140.60	0.00	24.74	35.18	256.63	20
5	0.00	43.02	61.17	421.77	140.60	0.00	19.03	27.06	221.43	20
9	0.00	37.52	53.35	367.85	135.20	0.00	27.30	38.82	314.05	20
BLDG1	0.36	42.80	60.86	419.62	140.60	0.00	17.37	24.70	213.68	20
BLDG2	0.36	43.01	61.16	421.68	140.60	0.00	34.19	48.62	380.53	20
BLOCK1	0.26	37.58	53.44	368.44	135.20	0.00	20.36	28.95	236.81	20
BLOCK2	0.26	37.34	53.10	366.09	135.20	0.00	20.23	28.77	236.34	20
BLOCK3	0.20	37.46	53.27	367.26	135.20	0.00	23.71	33.71	266.86	20
BLOCK4	0.26	37.61	53.48	368.73	135.20	0.00	30.64	43.57	387.02	20
BLOCK5	0.26	37.56	53.41	368.24	135.20	0.00	22.27	31.67	252.54	20
BLOCK6	0.13	37.43	53.22	366.97	135.20	0.00	20.01	28.45	234.50	20
FH-1	0.00	37.49	53.31	367.56	135.20	0.00	25.43	36.16	286.70	20
FH-2	0.00	37.55	53.39	368.15	135.20	0.00	21.67	30.81	247.32	20
FH-3	0.00	42.92	61.03	420.79	140.60	0.00	29.74	42.29	305.65	20
UTILITY	0.00	37.40	53.18	366.67	135.20	0.00	22.98	32.68	259.67	20

A.5 Water Age Analysis

Roger Griffith Avenue - Block 1, Ottawa, ON - Water Age Analysis

Project No.: 16042165
Date: 2/3/2026
Revision: 01

Watermain Pipe Volume			
	Dia. (mm)	Length (m)	Volume (m^3)
Apartment Blocks	200	121	3.8
Townhouse Blocks	200	250	7.8

Watermain Network	Area (m^2)	No. of Units	Population	Avg Day Demand		Daily Demand (m^3/day)	Age (hours)
				(L/min)	(L/s)		
Apartment Blocks		50	94	17.5	0.3	25.2	3.6
Townhouse Blocks		63	170	33.2	0.6	47.9	3.9
Total Site		**113**	**264**	**51**	**0.8**		

Appendix B Wastewater Servicing Calculations

B.1 Sanitary Sewer Design Sheet

Stantec

SUBDIVISION: **Kanata West - Block 1**

DATE: 2/4/2026
REVISION: 4
DESIGNED BY: ZW
CHECKED BY: WJ

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160402165

DESIGN PARAMETERS

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

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	SINGLE	UNITS TOWN	APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(l/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
R23A	23	22	0.10	0	9	0	24	0.10	24	3.69	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.10	0.10	0.0	0.3	21.5	200	PVC	SDR 35	0.65	27.0	**1.20%**	0.85	0.24
R24A	24	22	0.22	0	15	0	41	0.22	41	3.67	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.22	0.22	0.1	0.6	46.5	200	PVC	SDR 35	0.65	27.0	**2.06%**	0.85	0.28
R22A, UTILITY BLDG	22	21	0.17	0	12	0	32	0.49	97	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.003	0.18	0.50	0.2	1.3	40.7	200	PVC	SDR 35	0.40	21.1	**6.16%**	0.67	0.30
R25A	25	21	0.21	0	18	0	49	0.21	49	3.65	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.21	0.21	0.1	0.6	46.5	200	PVC	SDR 35	0.65	27.0	**2.39%**	0.85	0.29
R21A	21	20A	0.16	0	9	0	24	0.86	170	3.54	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.003	0.16	0.87	0.3	2.2	32.0	200	PVC	SDR 35	0.40	21.2	**10.59%**	0.67	0.36
	20A	20	0.00	0	0	0	0	0.86	170	3.54	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.003	0.00	0.87	0.3	2.2	11.4	200	PVC	SDR 35	0.40	21.2	**10.59%**	0.67	0.36
																												200							
R4A	4	3	0.30	0	0	25	45	0.30	45	3.66	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.30	0.30	0.1	0.6	31.8	200	PVC	SDR 35	0.40	21.1	**2.99%**	0.67	0.25
	3A	3	0.00	0	0	0	0	0.30	45	3.66	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.30	0.1	0.6	15.4	200	PVC	SDR 35	0.40	21.1	**2.99%**	0.67	0.25
R3A	3	2	0.29	0	0	25	45	0.59	90	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.29	0.59	0.2	1.2	25.1	200	PVC	SDR 35	0.40	21.1	**5.90%**	0.67	0.30
	2	1A	0.00	0	0	0	0	0.59	90	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.59	0.2	1.2	26.1	200	PVC	SDR 35	0.40	21.1	**5.90%**	0.67	0.30
	1A	1	0.00	0	0	0	0	0.59	90	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.59	0.2	1.2	11.3	200	PVC	SDR 35	0.40	21.1	**5.90%**	0.67	0.30
																												200							

Appendix C Stormwater Management

C.1 Storm Sewer Design Sheet

Stantec

Kanata West Block 1

DATE: 2026-01-28
REVISION: 3
DESIGNED BY: WJ
CHECKED BY: AMP

FILE NUMBER: 160401393

STORM SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

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

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013 BEDDING CLASS = B
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min

LOCATION			DRAINAGE AREA																						PIPE SELECTION										
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
L203A	203	202	0.08	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.061	0.061	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	12.9	24.2	300	300	CIRCULAR	PVC	SDR 35	0.40	60.8	**21.29%**	0.86	0.57	0.71
																				10.71																			
L204A	204	202	0.16	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.130	0.130	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	27.8	43.9	300	300	CIRCULAR	PVC	SDR 35	0.40	60.8	**45.73%**	0.86	0.72	1.02
																				11.02																			
L202A	202	201	0.14	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.109	0.300	0.000	0.000	0.000	0.000	0.000	0.000	11.02	73.10	99.10	116.14	169.74	0.0	0.0	61.0	37.7	375	375	CIRCULAR	PVC	SDR 35	0.40	104.3	**58.49%**	0.99	0.88	0.71
																				11.73																			
L205A	205	201	0.14	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.114	0.114	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	24.3	43.2	300	300	CIRCULAR	PVC	SDR 35	0.40	60.8	**39.89%**	0.86	0.69	1.05
																				11.05																			
L201A, L201B	201	200	0.17	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.126	0.540	0.000	0.000	0.000	0.000	0.000	0.000	11.73	70.74	95.86	112.32	164.14	0.0	0.0	106.2	34.5	450	450	CIRCULAR	CONCRETE	100-D	0.40	188.1	**56.43%**	1.15	1.02	0.57
	200	200A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.540	0.000	0.000	0.000	0.000	0.000	0.000	12.30	68.98	93.44	109.48	159.96	0.0	0.0	103.5	8.2	450	450	CIRCULAR	CONCRETE	100-D	0.40	188.1	**55.03%**	1.15	1.01	0.14
																				12.43									450	450									
F103A, L103A	103	102	0.16	0.00	0.00	0.04	0.00	0.70	0.00	0.00	0.80	0.111	0.111	0.000	0.000	0.000	0.000	0.028	0.028	10.00	76.81	104.19	122.14	178.56	0.0	0.0	37.7	30.0	300	300	CIRCULAR	PVC	SDR 35	0.40	60.8	**61.93%**	0.86	0.79	0.63
	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.111	0.000	0.000	0.000	0.000	0.000	0.028	10.63	74.46	100.97	118.34	172.98	0.0	0.0	36.5	15.7	300	300	CIRCULAR	PVC	SDR 35	0.40	60.8	**60.02%**	0.86	0.78	0.34
	102	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.111	0.000	0.000	0.000	0.000	0.000	0.028	10.97	73.28	99.34	116.43	170.17	0.0	0.0	35.9	24.7	375	375	CIRCULAR	PVC	SDR 35	0.40	104.3	**34.45%**	0.99	0.75	0.55
L101A	101	100	0.17	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.119	0.230	0.000	0.000	0.000	0.000	0.000	0.028	11.52	71.43	96.81	113.45	165.79	0.0	0.0	58.7	34.8	375	375	CIRCULAR	PVC	SDR 35	0.40	104.3	**56.28%**	0.99	0.88	0.66
																				12.18									375	375									

C.2 PCSWMM Input File Example

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           10/12/2022
START_TIME           00:00:00
REPORT_START_DATE    10/12/2022
REPORT_START_TIME    00:00:00
END_DATE             10/13/2022
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              8

[FILES]
;;Interfacing Files
USE HOTSTART "C:\Users\wajohnson\Desktop\PCSWMM\160402165\hotstart files\Block
1_100C_HSF.HSF"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO
```

```
[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES 100YRCHI

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width
%Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- -------- ----------------
F103A            RG1              103              0.029662 85.714   62       2
    0
L101A            RG1              C101A-1          0.188927 71.429   54       3
    0
L103A            RG1              C103A-1          0.185891 71.429   66       2.5
    0
L201A            RG1              C201A-1          0.095112 85.714   36       4
    0
L201B            RG1              C201B-2          0.076926 71.429   69       4
    0
L202A            RG1              C202A-1          0.13728  85.714   62       3
    0
L203A            RG1              C203A-2          0.075952 85.714   27       1
    0
L204A            RG1              C204A-1          0.176666 85.714   73       2
    0
L205A            RG1              C205A-2          0.139386 85.714   38       3
    0
UNC-1            RG1              OF6              0.102972 57.143   122      3
    0
UNC-2            RG1              OF7              0.066539 68.571   53       20
    0
UNC-3            RG1              OF3              0.04618  64.286   37       3
    0
UNC-4            RG1              OF8              0.061338 42.857   101      5
    0
UNC-5            RG1              OF4              0.049988 64.286   60       5
    0
UNC-6            RG1              OF5              0.034013 10       106      33
    0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ----------
----------
F103A            0.013      0.25       1.57       4.67       0          OUTLET
L101A            0.013      0.25       1.57       4.67       0          OUTLET
L103A            0.013      0.25       1.57       4.67       0          OUTLET
L201A            0.013      0.25       1.57       4.67       0          OUTLET
```

```
L201B            0.013      0.25       1.57       4.67       0          OUTLET
L202A            0.013      0.25       1.57       4.67       0          OUTLET
L203A            0.013      0.25       1.57       4.67       0          OUTLET
L204A            0.013      0.25       1.57       4.67       0          OUTLET
L205A            0.013      0.25       1.57       4.67       0          OUTLET
UNC-1            0.013      0.25       1.57       4.67       0          OUTLET
UNC-2            0.013      0.25       1.57       4.67       0          OUTLET
UNC-3            0.013      0.25       1.57       4.67       0          OUTLET
UNC-4            0.013      0.25       1.57       4.67       0          OUTLET
UNC-5            0.013      0.25       1.57       4.67       0          OUTLET
UNC-6            0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
F103A            76.2       13.2       4.14       7          0
L101A            76.2       13.2       4.14       7          0
L103A            76.2       13.2       4.14       7          0
L201A            76.2       13.2       4.14       7          0
L201B            76.2       13.2       4.14       7          0
L202A            76.2       13.2       4.14       7          0
L203A            76.2       13.2       4.14       7          0
L204A            76.2       13.2       4.14       7          0
L205A            76.2       13.2       4.14       7          0
UNC-1            76.2       13.2       4.14       7          0
UNC-2            76.2       13.2       4.14       7          0
UNC-3            76.2       13.2       4.14       7          0
UNC-4            76.2       13.2       4.14       7          0
UNC-5            76.2       13.2       4.14       7          0
UNC-6            76.2       13.2       4.14       7          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
100              94.765     FIXED      95.49            NO
200A             94.638     FIXED      95.35            NO
OF1              97.56      FREE                        NO
OF2              97.67      FREE                        NO
OF3              97.8       FREE                        NO
OF4              97.7       FREE                        NO
OF5              96.5       FREE                        NO
OF6              96         FREE                        NO
OF7              97         FREE                        NO
OF8              97.7       FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape       Curve Name/Params
      SurDepth Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- -----------
---------------------------- -------- -------- -------- -------- --------
101              94.904   2.632      0          FUNCTIONAL  0         0
1.13     0        0
102              95.029   2.723      0          FUNCTIONAL  0         0
1.13     0        0
102A             95.167   2.457      0          FUNCTIONAL  0         0
1.13     0        0
103              95.32    2.495      0          FUNCTIONAL  0         0
1.13     0        0
200              94.67    3.112      0          FUNCTIONAL  0         0
1.13     0        0
201              94.836   2.827      0          FUNCTIONAL  0         0
1.13     0        0
202              95.065   2.734      0          FUNCTIONAL  0         0
1.13     0        0
203              95.234   2.624      0          FUNCTIONAL  0         0
1.13     0        0
204              95.313   2.273      0          FUNCTIONAL  0         0
1.13     0        0
205              95.159   2.599      0          FUNCTIONAL  0         0
1.13     0        0
C101A-1          95.32    2.45       0          TABULAR     C101A
      0        0
C101A-2          95.23    2.74       0          FUNCTIONAL  0         0         0
      0        0
C103A-1          95.78    2.01       0          TABULAR     C103A
      0        0
C103A-2          95.7     2.3        0          FUNCTIONAL  0         0         0
      0        0
C201A-1          95.1     2.56       0          TABULAR     C201A
      0        0
C201A-2          95.18    2.8        0          FUNCTIONAL  0         0         0
      0        0
C201B-1          95       3.07       0          FUNCTIONAL  0         0         0
      0        0
C201B-2          95.13    2.69       0          TABULAR     C201B
      0        0
C202A-1          95.2     2.53       0          TABULAR     C202A
      0        0
C202A-2          95.28    2.68       0          FUNCTIONAL  0         0         0
      0        0
C203A-1          95.48    2.89       0          FUNCTIONAL  0         0         0
      0        0
C203A-2          95.4     2.58       0          TABULAR     C203A
      0        0
C204A-1          95.53    2.23       0          TABULAR     C204A
      0        0
C204A-2          95.45    2.64       0          FUNCTIONAL  0         0         0
      0        0
C205A-1          95.25    2.93       0          FUNCTIONAL  0         0         0
      0        0
C205A-2          95.34    2.56       0          TABULAR     C205A
      0        0
```

```
[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset
 OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ----------
---------- ---------- ---------- ----------
C1               C103A-1          C103A-2          14         0.013      95.78
 95.77      0          0
C2               C101A-1          C101A-2          16         0.013      95.32
 95.3       0          0
C3               C201A-2          C201A-1          12         0.013      95.18
 95.17      0          0
C4               C201B-2          C201B-1          6.5        0.013      95.13
 95.12      0          0
C5               C204A-1          C204A-2          15         0.013      95.53
 95.52      0          0
C6               C205A-2          C205A-1          10         0.013      95.34
 95.33      0          0
C7               C202A-2          C202A-1          10         0.013      95.28
 95.27      0          0
C8               C203A-1          C203A-2          5          0.013      95.48
 95.47      0          0
C9               C205A-2          C205A-1          10         0.013      95.34
 95.33      0          0
Pipe_12          101              100              34.814     0.013      94.904
 94.765     0          0
Pipe_13          102              101              24.677     0.013      95.029
 94.93      0          0
Pipe_15          102A             102              15.651     0.013      95.167
 95.104     0          0
Pipe_15_(1)      103              102A             30.025     0.013      95.32
 95.2       0          0
Pipe_17          201              200              34.548     0.013      94.836
 94.698     0          0
Pipe_17_(1)      200              200A             8.216      0.013      94.67
 94.638     0          0
Pipe_18          202              201              37.743     0.013      95.065
 94.914     0          0
Pipe_19          203              202              24.164     0.013      95.234
 95.137     0          0
Pipe_20          204              202              43.94      0.013      95.313
 95.137     0          0
Pipe_21          205              201              43.2       0.013      95.159
 94.986     0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff
   Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- ----------
C101A-2IC        C101A-2          101              SIDE         95.23      0.61
   NO       0
C103A-2IC        C103A-2          103              SIDE         95.7       0.61
   NO       0
C201A-1IC        C201A-1          201              SIDE         95.1       0.61
   NO       0
C201B-1C         C201B-1          201              SIDE         95         0.61
   NO       0
C202A-1IC        C202A-1          202              SIDE         95.2       0.61
   NO       0
C203A-2IC        C203A-2          203              SIDE         95.4       0.61
   NO       0
C204A-2IC        C204A-2          204              SIDE         95.45      0.61
   NO       0
C205A-1IC        C205A-1          205              SIDE         95.25      0.61
   NO       0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff
   Gated    EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- -------- ---------- ---------- ---------- ----------
----------------
W13              C205A-2            C201A-1          TRANSVERSE   97.8       1.67
   NO       0        0          YES
W15              C201A-1            OF1              TRANSVERSE   97.56      1.67
   NO       0        0          YES
W18              C202A-1            C201A-1          TRANSVERSE   97.63      1.67
   NO       0        0          YES
W2               C103A-1            C101A-1          TRANSVERSE   97.69      1.67
   NO       0        0          YES
W3               C201B-2            OF4              TRANSVERSE   97.72      1.67
   NO       0        0          YES
W4               C101A-1            OF2              TRANSVERSE   97.67      1.67
   NO       0        0          YES
W7               C203A-2            C202A-1          TRANSVERSE   97.88      1.67
   NO       0        0          YES
W8               C204A-1            C202A-1          TRANSVERSE   97.66      1.67
   NO       0        0          YES

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
C1               CIRCULAR     0.9              0          0          0          1

C2               CIRCULAR     0.9              0          0          0          1

C3               CIRCULAR     0.9              0          0          0          1

C4               CIRCULAR     0.9              0          0          0          1
```

```
C5              CIRCULAR    0.9             0         0         0         1

C6              CIRCULAR    0.9             0         0         0         1

C7              CIRCULAR    0.9             0         0         0         1

C8              CIRCULAR    0.9             0         0         0         1

C9              CIRCULAR    0.9             0         0         0         1

Pipe_12         CIRCULAR    0.375           0         0         0         1

Pipe_13         CIRCULAR    0.375           0         0         0         1

Pipe_15         CIRCULAR    0.3             0         0         0         1

Pipe_15_(1)     CIRCULAR    0.3             0         0         0         1

Pipe_17         CIRCULAR    0.45            0         0         0         1

Pipe_17_(1)     CIRCULAR    0.45            0         0         0         1

Pipe_18         CIRCULAR    0.375           0         0         0         1

Pipe_19         CIRCULAR    0.3             0         0         0         1

Pipe_20         CIRCULAR    0.3             0         0         0         1

Pipe_21         CIRCULAR    0.3             0         0         0         1

C101A-2IC       CIRCULAR    0.102           0         0         0
C103A-2IC       CIRCULAR    0.083           0         0         0
C201A-1IC       CIRCULAR    0.094           0         0         0
C201B-1C        CIRCULAR    0.083           0         0         0
C202A-1IC       CIRCULAR    0.083           0         0         0
C203A-2IC       CIRCULAR    0.083           0         0         0
C204A-2IC       CIRCULAR    0.083           0         0         0
C205A-1IC       CIRCULAR    0.083           0         0         0
W13             RECT_OPEN   0.1             2         0         0
W15             RECT_OPEN   0.24            2         0         0
W18             RECT_OPEN   0.17            2         0         0
W2              RECT_OPEN   0.18            2         0         0
W3              RECT_OPEN   0.33            2         0         0
W4              RECT_OPEN   0.16            2         0         0
W7              RECT_OPEN   0.22            2         0         0
W8              RECT_OPEN   0.19            2         0         0

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
```

```
Pipe_12         0          1.344      0          NO         0
Pipe_13         0          0.094      0          NO         0
Pipe_15         0          0.157      0          NO         0
Pipe_15_(1)     0          0.053      0          NO         0
Pipe_17         0          0.27       0          NO         0
Pipe_17_(1)     0          0.405      0          NO         0
Pipe_18         0          0.022      0          NO         0
Pipe_19         0          1.344      0          NO         0
Pipe_20         0          1.344      0          NO         0
Pipe_21         0          1.344      0          NO         0

[CURVES]
;;Name          Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
C101A           Storage    0          0
C101A                      2.05       0
C101A                      2.29       254

C103A           Storage    0          0
C103A                      1.69       0
C103A                      1.91       205

C201A           Storage    0          0
C201A                      2.3        0
C201A                      2.46       109

C201B           Storage    0          0
C201B                      2.36       0
C201B                      2.43       6

C202A           Storage    0          0
C202A                      2.18       0
C202A                      2.43       131

C203A           Storage    0          0
C203A                      2.3        0
C203A                      2.48       67

C204A           Storage    0          0
C204A                      1.92       0
C204A                      2.14       167

C205A           Storage    0          0
C205A                      2.16       0
C205A                      2.46       290

C206A           Storage    0          0
C206A                      2          0
C206A                      2.2        137

[TIMESERIES]
```

```
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
100YR+20CHI                 0:00       0
100YR+20CHI                 0:10       7.26
100YR+20CHI                 0:20       9.048
100YR+20CHI                 0:30       12.192
100YR+20CHI                 0:40       19.164
100YR+20CHI                 0:50       48.78
100YR+20CHI                 1:00       214.272
100YR+20CHI                 1:10       64.86
100YR+20CHI                 1:20       32.784
100YR+20CHI                 1:30       21.888
100YR+20CHI                 1:40       16.488
100YR+20CHI                 1:50       13.272
100YR+20CHI                 2:00       11.148
100YR+20CHI                 2:10       9.624
100YR+20CHI                 2:20       8.496
100YR+20CHI                 2:30       7.62
100YR+20CHI                 2:40       6.912
100YR+20CHI                 2:50       6.336
100YR+20CHI                 3:00       5.856

100YRCHI                    0:00       0
100YRCHI                    0:10       6.05
100YRCHI                    0:20       7.54
100YRCHI                    0:30       10.16
100YRCHI                    0:40       15.97
100YRCHI                    0:50       40.65
100YRCHI                    1:00       178.56
100YRCHI                    1:10       54.05
100YRCHI                    1:20       27.32
100YRCHI                    1:30       18.24
100YRCHI                    1:40       13.74
100YRCHI                    1:50       11.06
100YRCHI                    2:00       9.29
100YRCHI                    2:10       8.02
100YRCHI                    2:20       7.08
100YRCHI                    2:30       6.35
100YRCHI                    2:40       5.76
100YRCHI                    2:50       5.28
100YRCHI                    3:00       4.88

2YRCHI                      0:00       0
2YRCHI                      0:10       2.81
2YRCHI                      0:20       3.5
2YRCHI                      0:30       4.69
2YRCHI                      0:40       7.3
2YRCHI                      0:50       18.21
2YRCHI                      1:00       76.81
2YRCHI                      1:10       24.08
2YRCHI                      1:20       12.36
2YRCHI                      1:30       8.32
2YRCHI                      1:40       6.3
2YRCHI                      1:50       5.09
2YRCHI                      2:00       4.29
2YRCHI                      2:10       3.72
2YRCHI                      2:20       3.29
2YRCHI                      2:30       2.95
2YRCHI                      2:40       2.68
2YRCHI                      2:50       2.46
2YRCHI                      3:00       2.28

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Node       100             MN
Node       200A            MN
Node       101             MN
Node       102             MN
Node       102A            MN
Node       103             MN
Node       200             MN
Node       201             MN
Node       202             MN
Node       203             MN
Node       204             MN
Node       205             MN
Node       C101A-1         MJ
Node       C101A-2         UG
Node       C103A-1         MJ
Node       C103A-2         UG
Node       C201A-1         MJ
Node       C201A-2         UG
Node       C201B-1         UG
Node       C201B-2         MJ
Node       C202A-1         MJ
Node       C202A-2         UG
Node       C203A-1         UG
Node       C203A-2         MJ
Node       C204A-1         MJ
Node       C204A-2         UG
Node       C205A-1         UG
Node       C205A-2         MJ
Link       C1              UG
Link       C2              UG
Link       C3              UG
```

```
Link       C4              UG
Link       C5              UG
Link       C6              UG
Link       C7              UG
Link       C8              UG
Link       C9              UG
Link       W13             MJ
Link       W15             MJ
Link       W18             MJ
Link       W2              MJ
Link       W4              MJ
Link       W7              MJ
Link       W8              MJ

[MAP]
DIMENSIONS       350864.9038      5017129.2014     351047.5082      5017317.8426

UNITS            Meters

[COORDINATES]
;;Node            X-Coord            Y-Coord
;;--------------- ------------------ ------------------
100               350970.5           5017160
200A              351010.3           5017195
OF1               351000.918         5017200.248
OF2               350962.621         5017167.607
OF3               350898.527         5017176.264
OF4               351016.766         5017206.025
OF5               351012.832         5017263.934
OF6               350925.565         5017275.032
OF7               350873.204         5017210.828
OF8               350952.457         5017147.669
101               350947.3           5017185
102               350935.9           5017207
102A              350923.3           5017217
103               350903.3           5017239
200               351002.3           5017197
201               350979             5017223
202               350953.8           5017251
203               350935.8           5017235
204               350986.5           5017280
205               351011.1           5017252
C101A-1           350945.312         5017187.313
C101A-2           350958.239         5017170.322
C103A-1           350915.048         5017233.341
C103A-2           350926.107         5017222.886
C201A-1           350994.327         5017208.034
C201A-2           350985.658         5017219.496
C201B-1           350996.037         5017195.7
C201B-2           350976.26          5017176.921
C202A-1           350971.691         5017232.116
C202A-2           350963.543         5017241.635
C203A-1           350937.399         5017235.062
C203A-2           350942.321         5017239.307
C204A-1           350985.149         5017275.132
C204A-2           350972.281         5017264.602
C205A-1           350988.835         5017233.847
C205A-2           350998.191         5017242.491
```

C.3 Post to Pre-development Modified Rational Method Calculations

Stormwater Management Calculations

File No: **160402165**
Project: **Kanata West Block 1**
Date: **28-Jan-26**

SWM Approach:
Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Uncontrolled - Non-Tributary	KWPS-1	Hard	0.000		0.9	0.000		
Ultimate Outlet	Maple Grove Road	Soft	0.160		0.2	0.032		
	Subtotal			0.16			0.032	0.200
Uncontrolled - Non-Tributary	MG-1	Hard	0.209		0.9	0.188		
Ultimate Outlet	Maple Grove Road	Soft	1.011		0.2	0.202		
	Subtotal			1.22			0.3904	0.320
Uncontrolled - Non-Tributary	RG-2	Hard	0.000		0.9	0.000		
Ultimate Outlet	Roger Griffiths Ave	Soft	0.010		0.2	0.002		
	Subtotal			0.01			0.002	0.200
Uncontrolled - Non-Tributary	RG-1	Hard	0.045		0.9	0.041		
Ultimate Outlet	Maple Grove Road	Soft	0.025		0.2	0.005		
	Subtotal			0.07			0.0455	0.650
Total				**1.460**			**0.470**	
Overall Runoff Coefficient= C:								**0.32**

Total Roof Areas	**0.000 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.000 ha**
Total Tributary Area to Outlet	**0.000 ha**
Total Uncontrolled Areas (Non-Tributary)	**1.460 ha**
Total Site	**1.460 ha**

Stormwater Management Calculations

Project #160402165, Kanata West Block 1
Modified Rational Method Calculatons for Storage

2 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	732.951
b =	6.199
c =	0.81

t (min)	I (mm/hr)
10	76.81
20	52.03
30	40.04
40	32.86
50	28.04
60	24.56
70	21.91
80	19.83
90	18.14
100	16.75
110	15.57
120	14.56

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: KWPS-1
Area (ha): 0.16
C: 0.20

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	6.83	6.83		
20	52.03	4.63	4.63		
30	40.04	3.56	3.56		
40	32.86	2.92	2.92		
50	28.04	2.49	2.49		
60	24.56	2.18	2.18		
70	21.91	1.95	1.95		
80	19.83	1.76	1.76		
90	18.14	1.61	1.61		
100	16.75	1.49	1.49		
110	15.57	1.39	1.39		
120	14.56	1.30	1.30		

Subdrainage Area: MG-1
Area (ha): 1.22
C: 0.32

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	83.36	83.36		
20	52.03	56.47	56.47		
30	40.04	43.46	43.46		
40	32.86	35.67	35.67		
50	28.04	30.43	30.43		
60	24.56	26.65	26.65		
70	21.91	23.78	23.78		
80	19.83	21.52	21.52		
90	18.14	19.69	19.69		
100	16.75	18.17	18.17		
110	15.57	16.90	16.90		
120	14.56	15.80	15.80		

Subdrainage Area: RG-2
Area (ha): 0.01
C: 0.20

Uncontrolled - Non-Tributary
Ultimate Outlet Roger Griffiths Ave

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	0.43	0.43		
20	52.03	0.29	0.29		
30	40.04	0.22	0.22		
40	32.86	0.18	0.18		
50	28.04	0.16	0.16		
60	24.56	0.14	0.14		
70	21.91	0.12	0.12		
80	19.83	0.11	0.11		
90	18.14	0.10	0.10		
100	16.75	0.09	0.09		
110	15.57	0.09	0.09		
120	14.56	0.08	0.08		

Subdrainage Area: RG-1
Area (ha): 0.07
C: 0.65

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	9.72	9.72		
20	52.03	6.58	6.58		
30	40.04	5.07	5.07		
40	32.86	4.16	4.16		
50	28.04	3.55	3.55		
60	24.56	3.11	3.11		
70	21.91	2.77	2.77		
80	19.83	2.51	2.51		
90	18.14	2.29	2.29		
100	16.75	2.12	2.12		
110	15.57	1.97	1.97		
120	14.56	1.84	1.84		

SUMMARY TO OUTLET

Ultimate Outlet	Area ID	Area (ha)	2-year Flow (L/s)	Total Flow (L/s)
Maple Grove Road	RG-1	0.070	9.72	99.91
	MG-1	1.220	83.36	
	KWPS-1	0.160	6.83	
Roger Griffiths Ave	RG-2	0.010	0.43	0.43
Ploughshare Road	-	-	-	-
	Grand Total	**1.46**	**100.33**	

Project #160402165, Kanata West Block 1
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: KWPS-1
Area (ha): 0.16
C: 0.25

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	19.86	19.86		
20	119.95	13.34	13.34		
30	91.87	10.22	10.22		
40	75.15	8.36	8.36		
50	63.95	7.11	7.11		
60	55.89	6.22	6.22		
70	49.79	5.54	5.54		
80	44.99	5.00	5.00		
90	41.11	4.57	4.57		
100	37.90	4.21	4.21		
110	35.20	3.91	3.91		
120	32.89	3.66	3.66		

Subdrainage Area: MG-1
Area (ha): 1.22
C: 0.40

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	242.24	242.24		
20	119.95	162.73	162.73		
30	91.87	124.63	124.63		
40	75.15	101.95	101.95		
50	63.95	86.76	86.76		
60	55.89	75.83	75.83		
70	49.79	67.55	67.55		
80	44.99	61.04	61.04		
90	41.11	55.77	55.77		
100	37.90	51.42	51.42		
110	35.20	47.76	47.76		
120	32.89	44.63	44.63		

Subdrainage Area: RG-2
Area (ha): 0.01
C: 0.25

Uncontrolled - Non-Tributary
Ultimate Outlet Roger Griffiths Ave

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	1.24	1.24		
20	119.95	0.83	0.83		
30	91.87	0.64	0.64		
40	75.15	0.52	0.52		
50	63.95	0.44	0.44		
60	55.89	0.39	0.39		
70	49.79	0.35	0.35		
80	44.99	0.31	0.31		
90	41.11	0.29	0.29		
100	37.90	0.26	0.26		
110	35.20	0.24	0.24		
120	32.89	0.23	0.23		

Subdrainage Area: RG-1
Area (ha): 0.07
C: 0.81

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	28.23	28.23		
20	119.95	18.97	18.97		
30	91.87	14.53	14.53		
40	75.15	11.88	11.88		
50	63.95	10.11	10.11		
60	55.89	8.84	8.84		
70	49.79	7.87	7.87		
80	44.99	7.11	7.11		
90	41.11	6.50	6.50		
100	37.90	5.99	5.99		
110	35.20	5.57	5.57		
120	32.89	5.20	5.20		

SUMMARY TO OUTLET

Ultimate Outlet	Area ID	Area (ha)	100-year Flow (L/s)	Total Flow (L/s)
Maple Grove Road	RG-1	0.070	28.23	290.33
	MG-1	1.220	242.24	
	KWPS-1	0.160	19.86	
Roger Griffiths Ave	RG-2	0.010	1.24	1.24
Ploughshare Road	-	-	-	-
	Grand Total	**1.46**	**291.57**	

Stormwater Management Calculations

File No: **160402165**
Project: **Kanata West Block 1**
Date: **28-Jan-26**

SWM Approach:
Post-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Uncontrolled - Non-Tributary	UNC-6	Hard	0.003		0.9	0.003		
Ultimate Outlet	Maple Grove Road	Soft	0.027		0.2	0.005		
	Subtotal			0.03			0.0081	0.270
Uncontrolled - Non-Tributary	UNC-5	Hard	0.032		0.9	0.029		
Ultimate Outlet	Ploughshare Road	Soft	0.018		0.2	0.004		
	Subtotal			0.05			0.0325	0.650
Uncontrolled - Non-Tributary	UNC-4	Hard	0.026		0.9	0.023		
Ultimate Outlet	Ploughshare Road	Soft	0.034		0.2	0.007		
	Subtotal			0.06			0.03	0.500
Uncontrolled - Non-Tributary	UNC-3	Hard	0.032		0.9	0.029		
Ultimate Outlet	Roger Griffiths Ave	Soft	0.018		0.2	0.004		
	Subtotal			0.05			0.0325	0.650
Uncontrolled - Non-Tributary	UNC-2	Hard	0.048		0.9	0.043		
Ultimate Outlet	Maple Grove Road	Soft	0.022		0.2	0.004		
	Subtotal			0.07			0.0476	0.680
Uncontrolled - Non-Tributary	UNC-1	Hard	0.057		0.9	0.051		
Ultimate Outlet	Maple Grove Road	Soft	0.043		0.2	0.009		
	Subtotal			0.1			0.06	0.600
Total				**0.360**			**0.211**	
Overall Runoff Coefficient= C:								**0.59**

Total Roof Areas	**0.000 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.000 ha**
Total Tributary Area to Outlet	**0.000 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.360 ha**
Total Site	**0.360 ha**

Stormwater Management Calculations

Project #160402165, Kanata West Block 1
Modified Rational Method Calculatons for Storage

2 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	732.951
b =	6.199
c =	0.81

t (min)	I (mm/hr)
10	76.81
20	52.03
30	40.04
40	32.86
50	28.04
60	24.56
70	21.91
80	19.83
90	18.14
100	16.75
110	15.57
120	14.56

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC-6
Area (ha): 0.03
C: 0.27

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	103.57	2.33	2.33		
10	76.81	1.73	1.73		
15	61.77	1.39	1.39		
20	52.03	1.17	1.17		
25	45.17	1.02	1.02		
30	40.04	0.90	0.90		
35	36.06	0.81	0.81		
40	32.86	0.74	0.74		
45	30.24	0.68	0.68		
50	28.04	0.63	0.63		
55	26.17	0.59	0.59		
60	24.56	0.55	0.55		

Subdrainage Area: UNC-5
Area (ha): 0.05
C: 0.65

Uncontrolled - Non-Tributary
Ultimate Outlet Ploughshare Road

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	103.57	9.36	9.36		
10	76.81	6.94	6.94		
15	61.77	5.58	5.58		
20	52.03	4.70	4.70		
25	45.17	4.08	4.08		
30	40.04	3.62	3.62		
35	36.06	3.26	3.26		
40	32.86	2.97	2.97		
45	30.24	2.73	2.73		
50	28.04	2.53	2.53		
55	26.17	2.36	2.36		
60	24.56	2.22	2.22		

Subdrainage Area: UNC-4
Area (ha): 0.06
C: 0.50

Uncontrolled - Non-Tributary
Ultimate Outlet Ploughshare Road

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	103.57	8.64	8.64		
10	76.81	6.41	6.41		
15	61.77	5.15	5.15		
20	52.03	4.34	4.34		
25	45.17	3.77	3.77		
30	40.04	3.34	3.34		
35	36.06	3.01	3.01		
40	32.86	2.74	2.74		
45	30.24	2.52	2.52		
50	28.04	2.34	2.34		
55	26.17	2.18	2.18		
60	24.56	2.05	2.05		

Subdrainage Area: UNC-3
Area (ha): 0.05
C: 0.65

Uncontrolled - Non-Tributary
Ultimate Outlet Roger Griffiths Ave

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	103.57	9.36	9.36		
10	76.81	6.94	6.94		
15	61.77	5.58	5.58		
20	52.03	4.70	4.70		
25	45.17	4.08	4.08		
30	40.04	3.62	3.62		
35	36.06	3.26	3.26		
40	32.86	2.97	2.97		
45	30.24	2.73	2.73		
50	28.04	2.53	2.53		
55	26.17	2.36	2.36		
60	24.56	2.22	2.22		

Subdrainage Area: UNC-2
Area (ha): 0.07
C: 0.68

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	103.57	13.71	13.71		
10	76.81	10.16	10.16		
15	61.77	8.17	8.17		
20	52.03	6.89	6.89		
25	45.17	5.98	5.98		
30	40.04	5.30	5.30		
35	36.06	4.77	4.77		
40	32.86	4.35	4.35		
45	30.24	4.00	4.00		
50	28.04	3.71	3.71		
55	26.17	3.46	3.46		
60	24.56	3.25	3.25		

Subdrainage Area: UNC-1
Area (ha): 0.10
C: 0.60

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	103.57	17.28	17.28		
10	76.81	12.81	12.81		
15	61.77	10.30	10.30		
20	52.03	8.68	8.68		
25	45.17	7.53	7.53		
30	40.04	6.68	6.68		

Project #160402165, Kanata West Block 1
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC-6
Area (ha): 0.03
C: 0.34

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	5.03	5.03		
20	119.95	3.38	3.38		
30	91.87	2.59	2.59		
40	75.15	2.12	2.12		
50	63.95	1.80	1.80		
60	55.89	1.57	1.57		
70	49.79	1.40	1.40		
80	44.99	1.27	1.27		
90	41.11	1.16	1.16		
100	37.90	1.07	1.07		
110	35.20	0.99	0.99		
120	32.89	0.93	0.93		

Subdrainage Area: UNC-5
Area (ha): 0.05
C: 0.81

Uncontrolled - Non-Tributary
Ultimate Outlet Ploughshare Road

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	20.17	20.17		
20	119.95	13.55	13.55		
30	91.87	10.38	10.38		
40	75.15	8.49	8.49		
50	63.95	7.22	7.22		
60	55.89	6.31	6.31		
70	49.79	5.62	5.62		
80	44.99	5.08	5.08		
90	41.11	4.64	4.64		
100	37.90	4.28	4.28		
110	35.20	3.98	3.98		
120	32.89	3.72	3.72		

Subdrainage Area: UNC-4
Area (ha): 0.06
C: 0.63

Uncontrolled - Non-Tributary
Ultimate Outlet Ploughshare Road

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	18.61	18.61		
20	119.95	12.50	12.50		
30	91.87	9.58	9.58		
40	75.15	7.83	7.83		
50	63.95	6.67	6.67		
60	55.89	5.83	5.83		
70	49.79	5.19	5.19		
80	44.99	4.69	4.69		
90	41.11	4.29	4.29		
100	37.90	3.95	3.95		
110	35.20	3.67	3.67		
120	32.89	3.43	3.43		

Subdrainage Area: UNC-3
Area (ha): 0.05
C: 0.81

Uncontrolled - Non-Tributary
Ultimate Outlet Roger Griffiths Ave

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	20.17	20.17		
20	119.95	13.55	13.55		
30	91.87	10.38	10.38		
40	75.15	8.49	8.49		
50	63.95	7.22	7.22		
60	55.89	6.31	6.31		
70	49.79	5.62	5.62		
80	44.99	5.08	5.08		
90	41.11	4.64	4.64		
100	37.90	4.28	4.28		
110	35.20	3.98	3.98		
120	32.89	3.72	3.72		

Subdrainage Area: UNC-2
Area (ha): 0.07
C: 0.85

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	29.54	29.54		
20	119.95	19.84	19.84		
30	91.87	15.20	15.20		
40	75.15	12.43	12.43		
50	63.95	10.58	10.58		
60	55.89	9.25	9.25		
70	49.79	8.24	8.24		
80	44.99	7.44	7.44		
90	41.11	6.80	6.80		
100	37.90	6.27	6.27		
110	35.20	5.82	5.82		
120	32.89	5.44	5.44		

Subdrainage Area: UNC-1
Area (ha): 0.10
C: 0.75

Uncontrolled - Non-Tributary
Ultimate Outlet Maple Grove Road

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	37.23	37.23		
20	119.95	25.01	25.01		
30	91.87	19.15	19.15		
40	75.15	15.67	15.67		
50	63.95	13.33	13.33		
60	55.89	11.65	11.65		

Stormwater Management Calculations

Project #160402165, Kanata West Block 1
Modified Rational Method Calculatons for Storage

35	36.06	6.01	6.01
40	32.86	5.48	5.48
45	30.24	5.04	5.04
50	28.04	4.68	4.68
55	26.17	4.37	4.37
60	24.56	4.10	4.10

SUMMARY TO OUTLET

Ultimate Outlet	Area ID	Area (ha)	2-year Flow (L/s)	Total Flow (L/s)	Pre-dev. Flow (L/s)	Difference (L/s)
Maple Grove Road	UNC-1	0.10	17.28	33.31	99.91	-66.60
	UNC-2	0.07	13.71			
	UNC-6	0.03	2.33			
Roger Griffiths Ave	UNC-3	0.05	9.36	9.36	0.43	8.93
Ploughshare Road	UNC-4	0.06	8.64	18.00	0.00	18.00
	UNC-5	0.05	9.36			
	Grand Total	**0.36**	**60.67**	**60.67**	**100.34**	**-39.67**

Project #160402165, Kanata West Block 1
Modified Rational Method Calculatons for Storage

70	49.79	10.38	10.38
80	44.99	9.38	9.38
90	41.11	8.57	8.57
100	37.90	7.90	7.90
110	35.20	7.34	7.34
120	32.89	6.86	6.86

SUMMARY TO OUTLET

Ultimate Outlet	Area ID	Area (ha)	100-year Flow (L/s)	Total Flow (L/s)	Pre-dev. Flow (L/s)	Difference (L/s)
Maple Grove Road	UNC-1	0.10	37.23	71.79	290.33	-218.54
	UNC-2	0.07	29.54			
	UNC-6	0.03	5.03			
Roger Griffiths Ave	UNC-3	0.05	20.17	20.17	1.24	18.93
Ploughshare Road	UNC-4	0.06	18.61	38.78	0.00	38.78
	UNC-5	0.05	20.17			
	Grand Total	**0.36**	**130.74**	**130.74**	**291.57**	**-160.83**

C.4 Kanata West Subdivision PCSWMM Input File Example

```
[TITLE]
;;Project Title/Notes
Ultimate Kanata West Pond 5

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    NO

START_DATE           07/23/2009
START_TIME           00:00:00
REPORT_START_DATE    07/23/2009
REPORT_START_TIME    00:00:00
END_DATE             07/24/2009
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             01:00:00
ROUTING_STEP         5
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  D-W
VARIABLE_STEP        0
LENGTHENING_STEP     7
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[FILES]
;;Interfacing Files
USE HOTSTART "C:\Users\wajohnson\Desktop\PCSWMM\160402165\KW
Subdivision\Ana\Scenario1\160401393_100CHI_2026-01-23_ULT_FIXED_amp-r1_files\100ch
i-r1.HSF"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES Chicago100y_3h_10m_City

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width
%Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- -------- ----------------
;10yr
Arterial         RG1              Transitway-S     3.19     71.429   1314     1
    0
;0.60
B-1              RG1              B1-S             1.098331 57.143   186      1
    0
;0.70
B-2              RG1              B2-S             0.693403 71.429   186      1
    0
B2A              RG1              B2-S             0.102972 57.143   122      3
    0
B2B              RG1              B2-S             0.034013 10       106      33
    0
;0.69
C107A            RG1              107A-S(1)        0.185359 70       52       1
    0
;0.69
C109A            RG1              109A-S           0.43013  70       160      1
    0
;0.71
C109B            RG1              109B-S           0.378527 72.857   138      1
    0
;0.67
C110A            RG1              110A-S           0.118382 67.143   39       1
    0
;0.68
C121A            RG1              121A-S(2)        0.384285 68.571   95       1
    0
;0.65
C121AA           RG1              121AA-S          0.090818 64.286   37       1.5
    0
C121AB           RG1              121AA-S          0.04618  64.286   37       3
    0
C121B            RG1              121A-S(2)        0.061338 42.857   101      5
    0
;0.67
C123A            RG1              123A-S           0.199218 67.143   43.244   1
    0
```

```
C205A           RG1             205A-S(1)       0.262262 67.143   70.882   2.5
    0
;0.70
C206B           RG1             206B-S(1)       0.170307 71.429   68       3
    0
;0.68
C219A           RG1             219A-S(1)       0.089546 68.571   79.8     2
    0
C220A           RG1             220A-S          0.406575 75.714   131.8    2
    0
;0.69
C222A           RG1             222A-S          0.520835 70       257      4
    0
;0.71
C223A           RG1             223A-S          0.160134 72.857   59       3
    0
;2yr
Comm            RG1             Comm-S          1.9912   92.857   448      1
    0
;0.63
EXT1            RG1             EXT-1A-S(1)     0.124871 61.429   59       1.5
    0
EXT1A           RG1             EXT-1A-S(1)     0.066539 68.571   53       20
    0
;0.67
EXT2            RG1             EXT2-S          0.072046 67.143   29       2
    0
;0.54
EXT-4           RG1             EXT-4-S         0.128242 48.571   79.6     0.5
    0
;0.37
EXT5            RG1             EXT5-S          0.114323 24.286   77       4
    0
;0.48
EXT6            RG1             EXT6-S          0.115535 40       78.75    4
    0
;0.55
F101A-1A        RG1             F101A-S         0.692256 50       155      1
    0
;0.40
G234C           RG1             G234C-S         0.972065 28.571   218.103  1
    0
;10yr
Hazeldean       RG1             HZD-S           3.95     71.429   1764     1
    0
;0.61
L102A           RG1             102A-S(1)       0.227479 58.571   82.41    1
    0
;0.70
L103A           RG1             103A-S          0.388512 71.429   161.8    1
    0
;0.62
L103B           RG1             103B-S          0.203104 60       63.176   1
    0
;0.48
L103C           RG1             RY103C-S        0.63865  40       300      1
    0
;0.46
L103D           RG1             RY103D-S        0.552254 37.143   278      1
    0
;0.68
L104A           RG1             104A-S          0.333862 68.571   122.73   1
    0
;0.72
L105A           RG1             105A-S(1)       0.323559 74.286   153.18   1
    0
;0.73
L106A           RG1             106A-S(1)       0.243756 75.714   97.272   1
    0
;0.69
L106B           RG1             106B-S          0.073514 70       26.6     1
    0
;0.67
L112A           RG1             112A-S(1)       0.413699 67.143   167.73   1
    0
;0.69
L113A           RG1             113A-S(1)       0.328527 70       127      1
    0
;0.42
L113B           RG1             RY113B-S        0.494662 31.429   280      1
    0
;0.68
L114A           RG1             114A-S          0.057286 68.571   63.174   1
    0
;0.68
L115A           RG1             115A-S          0.165096 68.571   58.04    1
    0
;0.69
L116A           RG1             116A-S          0.222674 70       83.98    1
    0
;0.71
L117A           RG1             117A-S          0.424565 72.857   173.74   1
    0
;0.58
L117B           RG1             117B-S          0.145678 54.286   49.3     1
    0
;0.46
L117C           RG1             RY117C-S        0.662633 37.143   360      1
    0
;0.66
L118A           RG1             118A-S          0.443447 65.714   167.34   1
    0
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;0.69
L119A           RG1             119A-S          0.311731 70       89.76    1
    0
L119B           RG1             119A-S          0.049988 64.286   60       5
    0
;0.85
L121B           RG1             121B-S          1.105804 79.88    69.767   2.7
    0
;0.70
L123B           RG1             123B-S          0.740371 71.429   167      1
    0
;0.66
L124A           RG1             124A-S          0.232046 65.714   116.1    1
    0
;0.43
L124B           RG1             RY124B-S        0.398402 32.857   246      1
    0
;0.73
L126A           RG1             126A-S          0.031736 75.714   30       1
    0
;0.70
L126B           RG1             126B-S(1)       0.263339 71.429   85.365   1
    0
;0.25
L126C           RG1             126C-S          0.463032 7.143    104      1
    0
;0.66
L127A           RG1             127A-S(1)       0.382018 65.714   144.16   1
    0
;0.66
L128A           RG1             128A-S(1)       0.318529 65.714   72.1     1
    0
;0.69
L130A           RG1             130A-S          0.454243 70       170.7    1
    0
;0.46
L130B           RG1             RY130B-S        0.225263 40       200      1
    0
L202A           RG1             202A-S(1)       0.208064 55.714   76.7     2
    0
;0.55
L202B           RG1             RY202B-S        0.245154 50       152      3
    0
L204A           RG1             204A-S(1)       0.4192   75.714   174.7    3
    0
L204B           RG1             204BS(1)        0.347276 70       146.654  3
    0
L204C           RG1             RY204C-S        0.262904 38.571   168      3
    0
L205B           RG1             RY205B-S        0.485323 35.714   238.137  3
    0
```

```
;0.73
L206A           RG1             206A-S(1)       0.309319 75.714   127.2    3
    0
;0.63
L207A           RG1             207A-S(1)       0.581227 64.286   202.33   3
    0
L209A           RG1             209A-S          0.350096 70       153.4    2
    0
L209B           RG1             209B-S          0.148222 67.143   159      2
    0
L209C           RG1             RY209C-S        0.406932 38.571   200      3
    0
L210A           RG1             210A-S          0.342071 71.429   97.735   4
    0
;0.72
L211A           RG1             211A-S(1)       0.399505 74.286   177.158  3
    0
;0.60
L212A           RG1             L212A-S         0.098006 57.143   44       3
    0
L213A           RG1             213A-S          0.211658 70       75.003   2
    0
;0.71
L214A           RG1             214A-S(1)       0.550699 72.857   221      4
    0
;0.68
L217A           RG1             217A-S          0.401215 68.571   196      3
    0
;0.70
L218A           RG1             L218A-S         2.679261 71.429   664      1
    0
;0.45
L218B           RG1             RY218B-S        0.250341 35.714   166      3
    0
L219B           RG1             219B-S          0.359982 68.571   111.7    2
    0
L220A           RG1             RY220A-S        0.86664  34.286   480      2.5
    0
L225A           RG1             225A-S          0.273345 71.429   134.6    2.5
    0
L225B           RG1             L225B-S         1.790261 85.714   402.8    2
    0
L225C           RG1             225C-S          0.354866 71.429   170      2.5
    0
L228A           RG1             228A-S          0.483637 75.714   127.273  2.5
    0
L229A           RG1             229A-S          0.317271 75.714   102.345  3
    0
;0.68
L234A           RG1             234A-S          0.261524 68.571   78       5
    0
```

```
;0.69
L234B           RG1             234B-S          0.227552 70       81.14    4
    0
;0.57
L234D           RG1             RY234D-S        0.371868 52.857   210      3
    0
;0.69
L235A           RG1             235A-S          0.592903 70       232      4
    0
;0.80
L235B           RG1             L235B-S         0.983962 85.714   221.38   2
    0
L240A           RG1             240A-S          0.15961  78.571   100      5
    0
L241A           RG1             241A-S          0.19391  71.429   83       4
    0
L241B           RG1             241B-S          0.238701 78.571   136      5
    0
POND            RG1             POND-S1         2.558117 60       576      1
    0
;0.70
UNC-1           RG1             219B-S          0.061933 71.429   120      4
    0
;0.80
UNC-10          RG1             OF14            0.102763 85.714   102.75   33
    0
;0.80
UNC-11          RG1             OF14            0.119911 85.714   119.9    33
    0
;0.70
UNC-2           RG1             RY218B-S        0.065616 71.429   120      4
    0
;0.70
UNC-3           RG1             CREEK           0.071548 71.429   120      4
    0
;0.70
UNC-4           RG1             222A-S          0.070173 71.429   120      4
    0
;0.80
UNC-5           RG1             241A-S(1)       0.303489 85.714   177.9    3
    0
;0.80
UNC-6           RG1             225C-S(1)       0.105373 85.714   105.6    3
    0
;0.80
UNC-7           RG1             CREEK-1         0.157236 85.714   160      3
    0
;0.80
UNC-8           RG1             Transitway-S    0.072241 85.714   144.3    3
    0
;0.80
UNC-9           RG1             235A-S          0.117501 85.714   117.5    3
    0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ----------
----------
Arterial        0.013      0.25       1.57       4.67       0          OUTLET
B-1             0.013      0.25       1.57       4.67       0          PERVIOUS
30
B-2             0.013      0.25       1.57       4.67       0          OUTLET
B2A             0.013      0.25       1.57       4.67       0          OUTLET
B2B             0.013      0.25       1.57       4.67       0          OUTLET
C107A           0.013      0.25       1.57       4.67       0          OUTLET
C109A           0.013      0.25       1.57       4.67       0          OUTLET
C109B           0.013      0.25       1.57       4.67       0          OUTLET
C110A           0.013      0.25       1.57       4.67       0          OUTLET
C121A           0.013      0.25       1.57       4.67       0          OUTLET
C121AA          0.013      0.25       1.57       4.67       0          OUTLET
C121AB          0.013      0.25       1.57       4.67       0          OUTLET
C121B           0.013      0.25       1.57       4.67       0          OUTLET
C123A           0.013      0.25       1.57       4.67       0          OUTLET
C205A           0.013      0.25       1.57       4.67       0          OUTLET
C206B           0.013      0.25       1.57       4.67       0          OUTLET
C219A           0.013      0.25       1.57       4.67       0          OUTLET
C220A           0.013      0.25       1.57       4.67       0          OUTLET
C222A           0.013      0.25       1.57       4.67       0          OUTLET
C223A           0.013      0.25       1.57       4.67       0          OUTLET
Comm            0.013      0.25       1.57       4.67       0          OUTLET
EXT1            0.013      0.25       1.57       4.67       0          OUTLET
EXT1A           0.013      0.25       1.57       4.67       0          OUTLET
EXT2            0.013      0.25       1.57       4.67       0          OUTLET
EXT-4           0.013      0.25       1.57       4.67       0          OUTLET
EXT5            0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT6            0.013      0.25       1.57       4.67       0          PERVIOUS
100
F101A-1A        0.013      0.25       1.57       4.67       0          PERVIOUS
100
G234C           0.013      0.25       1.57       4.67       0          PERVIOUS
100
Hazeldean       0.013      0.25       1.57       4.67       0          OUTLET
L102A           0.013      0.25       1.57       4.67       0          OUTLET
L103A           0.013      0.25       1.57       4.67       0          OUTLET
L103B           0.013      0.25       1.57       4.67       0          OUTLET
L103C           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L103D           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L104A           0.013      0.25       1.57       4.67       0          OUTLET
```

```
L105A           0.013      0.25       1.57       4.67       0          OUTLET
L106A           0.013      0.25       1.57       4.67       0          OUTLET
L106B           0.013      0.25       1.57       4.67       0          OUTLET
L112A           0.013      0.25       1.57       4.67       0          OUTLET
L113A           0.013      0.25       1.57       4.67       0          OUTLET
L113B           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L114A           0.013      0.25       1.57       4.67       0          OUTLET
L115A           0.013      0.25       1.57       4.67       0          OUTLET
L116A           0.013      0.25       1.57       4.67       0          OUTLET
L117A           0.013      0.25       1.57       4.67       0          OUTLET
L117B           0.013      0.25       1.57       4.67       0          OUTLET
L117C           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L118A           0.013      0.25       1.57       4.67       0          OUTLET
L119A           0.013      0.25       1.57       4.67       0          OUTLET
L119B           0.013      0.25       1.57       4.67       0          OUTLET
L121B           0.013      0.25       1.57       4.67       0          OUTLET
L123B           0.013      0.25       1.57       4.67       0          PERVIOUS
30
L124A           0.013      0.25       1.57       4.67       0          OUTLET
L124B           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L126A           0.013      0.25       1.57       4.67       0          OUTLET
L126B           0.013      0.25       1.57       4.67       0          OUTLET
L126C           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L127A           0.013      0.25       1.57       4.67       0          OUTLET
L128A           0.013      0.25       1.57       4.67       0          OUTLET
L130A           0.013      0.25       1.57       4.67       0          OUTLET
L130B           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L202A           0.013      0.25       1.57       4.67       0          OUTLET
L202B           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L204A           0.013      0.25       1.57       4.67       0          OUTLET
L204B           0.013      0.25       1.57       4.67       0          OUTLET
L204C           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L205B           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L206A           0.013      0.25       1.57       4.67       0          OUTLET
L207A           0.013      0.25       1.57       4.67       0          OUTLET
L209A           0.013      0.25       1.57       4.67       0          OUTLET
L209B           0.013      0.25       1.57       4.67       0          OUTLET
L209C           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L210A           0.013      0.25       1.57       4.67       0          OUTLET
L211A           0.013      0.25       1.57       4.67       0          OUTLET
L212A           0.013      0.25       1.57       4.67       0          OUTLET
L213A           0.013      0.25       1.57       4.67       0          OUTLET
L214A           0.013      0.25       1.57       4.67       0          OUTLET
L217A           0.013      0.25       1.57       4.67       0          OUTLET
L218A           0.013      0.25       1.57       4.67       0          PERVIOUS
30
L218B           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L219B           0.013      0.25       1.57       4.67       0          OUTLET
L220A           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L225A           0.013      0.25       1.57       4.67       0          OUTLET
L225B           0.013      0.25       1.57       4.67       0          PERVIOUS
30
L225C           0.013      0.25       1.57       4.67       0          OUTLET
L228A           0.013      0.25       1.57       4.67       0          OUTLET
L229A           0.013      0.25       1.57       4.67       0          OUTLET
L234A           0.013      0.25       1.57       4.67       0          OUTLET
L234B           0.013      0.25       1.57       4.67       0          OUTLET
L234D           0.013      0.25       1.57       4.67       0          PERVIOUS
100
L235A           0.013      0.25       1.57       4.67       0          OUTLET
L235B           0.013      0.25       1.57       4.67       0          PERVIOUS
30
L240A           0.013      0.25       1.57       4.67       0          OUTLET
L241A           0.013      0.25       1.57       4.67       0          OUTLET
L241B           0.013      0.25       1.57       4.67       0          OUTLET
POND            0.013      0.25       1.57       4.67       0          PERVIOUS
60
UNC-1           0.013      0.25       1.57       4.67       0          OUTLET
UNC-10          0.013      0.25       1.57       4.67       0          OUTLET
UNC-11          0.013      0.25       1.57       4.67       0          OUTLET
UNC-2           0.013      0.25       1.57       4.67       0          OUTLET
UNC-3           0.013      0.25       1.57       4.67       0          OUTLET
UNC-4           0.013      0.25       1.57       4.67       0          OUTLET
UNC-5           0.013      0.25       1.57       4.67       0          OUTLET
UNC-6           0.013      0.25       1.57       4.67       0          OUTLET
UNC-7           0.013      0.25       1.57       4.67       0          OUTLET
UNC-8           0.013      0.25       1.57       4.67       0          OUTLET
UNC-9           0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
Arterial        76.2       13.2       4.14       7          0
B-1             76.2       13.2       4.14       7          0
B-2             76.2       13.2       4.14       7          0
B2A             76.2       13.2       4.14       7          0
B2B             76.2       13.2       4.14       7          0
C107A           76.2       13.2       4.14       7          0
C109A           76.2       13.2       4.14       7          0
C109B           76.2       13.2       4.14       7          0
C110A           76.2       13.2       4.14       7          0
```

C121A	76.2	13.2	4.14	7	0
C121AA	76.2	13.2	4.14	7	0
C121AB	76.2	13.2	4.14	7	0
C121B	76.2	13.2	4.14	7	0
C123A	76.2	13.2	4.14	7	0
C205A	76.2	13.2	4.14	7	0
C206B	76.2	13.2	4.14	7	0
C219A	76.2	13.2	4.14	7	0
C220A	76.2	13.2	4.14	7	0
C222A	76.2	13.2	4.14	7	0
C223A	76.2	13.2	4.14	7	0
Comm	76.2	13.2	4.14	7	0
EXT1	76.2	13.2	4.14	7	0
EXT1A	76.2	13.2	4.14	7	0
EXT2	76.2	13.2	4.14	7	0
EXT-4	76.2	13.2	4.14	7	0
EXT5	76.2	13.2	4.14	7	0
EXT6	76.2	13.2	4.14	7	0
F101A-1A	76.2	13.2	4.14	7	0
G234C	76.2	13.2	4.14	7	0
Hazeldean	76.2	13.2	4.14	7	0
L102A	76.2	13.2	4.14	7	0
L103A	76.2	13.2	4.14	7	0
L103B	76.2	13.2	4.14	7	0
L103C	76.2	13.2	4.14	7	0
L103D	76.2	13.2	4.14	7	0
L104A	76.2	13.2	4.14	7	0
L105A	76.2	13.2	4.14	7	0
L106A	76.2	13.2	4.14	7	0
L106B	76.2	13.2	4.14	7	0
L112A	76.2	13.2	4.14	7	0
L113A	76.2	13.2	4.14	7	0
L113B	76.2	13.2	4.14	7	0
L114A	76.2	13.2	4.14	7	0
L115A	76.2	13.2	4.14	7	0
L116A	76.2	13.2	4.14	7	0
L117A	76.2	13.2	4.14	7	0
L117B	76.2	13.2	4.14	7	0
L117C	76.2	13.2	4.14	7	0
L118A	76.2	13.2	4.14	7	0
L119A	76.2	13.2	4.14	7	0
L119B	76.2	13.2	4.14	7	0
L121B	76.2	13.2	4.14	7	0
L123B	76.2	13.2	4.14	7	0
L124A	76.2	13.2	4.14	7	0
L124B	76.2	13.2	4.14	7	0
L126A	76.2	13.2	4.14	7	0
L126B	76.2	13.2	4.14	7	0
L126C	76.2	13.2	4.14	7	0
L127A	76.2	13.2	4.14	7	0
L128A	76.2	13.2	4.14	7	0
L130A	76.2	13.2	4.14	7	0
L130B	76.2	13.2	4.14	7	0
L202A	76.2	13.2	4.14	7	0
L202B	76.2	13.2	4.14	7	0
L204A	76.2	13.2	4.14	7	0
L204B	76.2	13.2	4.14	7	0
L204C	76.2	13.2	4.14	7	0
L205B	76.2	13.2	4.14	7	0
L206A	76.2	13.2	4.14	7	0
L207A	76.2	13.2	4.14	7	0
L209A	76.2	13.2	4.14	7	0
L209B	76.2	13.2	4.14	7	0
L209C	76.2	13.2	4.14	7	0
L210A	76.2	13.2	4.14	7	0
L211A	76.2	13.2	4.14	7	0
L212A	76.2	13.2	4.14	7	0
L213A	76.2	13.2	4.14	7	0
L214A	76.2	13.2	4.14	7	0
L217A	76.2	13.2	4.14	7	0
L218A	76.2	13.2	4.14	7	0
L218B	76.2	13.2	4.14	7	0
L219B	76.2	13.2	4.14	7	0
L220A	76.2	13.2	4.14	7	0
L225A	76.2	13.2	4.14	7	0
L225B	76.2	13.2	4.14	7	0
L225C	76.2	13.2	4.14	7	0
L228A	76.2	13.2	4.14	7	0
L229A	76.2	13.2	4.14	7	0
L234A	76.2	13.2	4.14	7	0
L234B	76.2	13.2	4.14	7	0
L234D	76.2	13.2	4.14	7	0
L235A	76.2	13.2	4.14	7	0
L235B	76.2	13.2	4.14	7	0
L240A	76.2	13.2	4.14	7	0
L241A	76.2	13.2	4.14	7	0
L241B	76.2	13.2	4.14	7	0
POND	76.2	13.2	4.14	7	0
UNC-1	76.2	13.2	4.14	7	0
UNC-10	76.2	13.2	4.14	7	0
UNC-11	76.2	13.2	4.14	7	0
UNC-2	76.2	13.2	4.14	7	0
UNC-3	76.2	13.2	4.14	7	0
UNC-4	76.2	13.2	4.14	7	0
UNC-5	76.2	13.2	4.14	7	0
UNC-6	76.2	13.2	4.14	7	0
UNC-7	76.2	13.2	4.14	7	0
UNC-8	76.2	13.2	4.14	7	0
UNC-9	76.2	13.2	4.14	7	0

[JUNCTIONS]

;;Name	Elevation	MaxDepth	InitDepth	SurDepth	Aponded

```
;;-------------- ---------- ---------- ---------- ---------- ----------
J6               94.56      0.54       0          0          0
J9               92.75      2.42       0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
CREEK            0          FREE                        NO
CREEK-1          0          FREE                        NO
OF10             95         FREE                        NO
OF11             100        FREE                        NO
OF13             97.7       FREE                        NO
OF14             97.7       FREE                        NO
OF2              93.01      FIXED      94.6             NO
OF3              95.9       FREE                        NO
OF4              96.91      FREE                        NO
OF5              98.35      FREE                        NO
OF6              97         FREE                        NO
OF7              99         FREE                        NO
OF8              92.6       FIXED      94.6             NO
OF9              95         FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape       Curve Name/Params
      SurDepth Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- -----------
---------------------------- -------- -------- -------- -------- --------
100A             91.49    4.8        0          FUNCTIONAL  0         0
1.13     0        0
100B             91.5     5.24       0          FUNCTIONAL  0         0
1.13     0        0
100C             92.9     3.72       0          FUNCTIONAL  0         0
1.13     0        0
100D             92.84    4.43       0          FUNCTIONAL  0         0
1.13     0        0
100E             93.5     3.62       0          FUNCTIONAL  0         0
1.13     0        0
101              92.982   4.416      0          FUNCTIONAL  0         0
1.13     0        0
102              93.123   4.028      0          FUNCTIONAL  0         0
1.13     0        0
102A             93.582   3.51       0          FUNCTIONAL  0         0         0
      0        0
102A-S           97.35    0.35       0          FUNCTIONAL  0         0         0
      0        0
102A-S(1)        95.76    1.73       0          FUNCTIONAL  0         0         0
      0        0
102A-S(2)        97.42    0.35       0          FUNCTIONAL  0         0         0
      0        0
103              93.68    3.897      0          FUNCTIONAL  0         0
1.13     0        0
103A-S           95.88    1.73       0          FUNCTIONAL  0         0         0
      0        0
103A-S(1)        97.45    0.35       0          FUNCTIONAL  0         0         0
      0        0
103B-S           95.64    1.73       0          FUNCTIONAL  0         0         0
      0        0
104              94.054   3.823      0          FUNCTIONAL  0         0
1.13     0        0
104A-S           96.08    1.73       0          FUNCTIONAL  0         0         0
      0        0
104A-S(1)        97.65    0.35       0          FUNCTIONAL  0         0         0
      0        0
105              94.513   3.442      0          FUNCTIONAL  0         0
1.13     0        0
105A-S           97.79    0.35       0          FUNCTIONAL  0         0         0
      0        0
105A-S(1)        96.11    1.73       0          FUNCTIONAL  0         0         0
      0        0
106              94.715   2.876      0          FUNCTIONAL  0         0
1.13     0        0
106A-S           97.88    0.35       0          FUNCTIONAL  0         0         0
      0        0
106A-S(1)        96.27    1.73       0          FUNCTIONAL  0         0         0
      0        0
106A-S(2)        97.71    0.35       0          FUNCTIONAL  0         0         0
      0        0
106B-S           95.14    2.73       0          FUNCTIONAL  0         0         0
      0        0
107              94.308   3.618      0          FUNCTIONAL  0         0
1.13     0        0
107A-S           97.8     0.35       0          FUNCTIONAL  0         0         0
      0        0
107A-S(1)        96.21    1.73       0          FUNCTIONAL  0         0         0
      0        0
108              94.468   3.313      0          FUNCTIONAL  0         0
1.13     0        0
109              94.952   2.837      0          FUNCTIONAL  0         0
1.13     0        0
109A-S           96.2     1.73       0          FUNCTIONAL  0         0         0
      0        0
109A-S(1)        97.79    0.35       0          FUNCTIONAL  0         0         0
      0        0
109B-S           96.21    1.73       0          FUNCTIONAL  0         0         0
      0        0
109B-S(1)        97.87    0.35       0          FUNCTIONAL  0         0         0
      0        0
109B-S(3)        98.01    0.35       0          FUNCTIONAL  0         0         0
      0        0
110              94.688   3.347      0          FUNCTIONAL  0         0
1.13     0        0
110A-S           96.37    1.73       0          FUNCTIONAL  0         0         0
```

```
      0       0
111             94.762   3.23       0          FUNCTIONAL  0         0
1.13     0       0
112             94.958   2.989      0          FUNCTIONAL  0         0
1.13     0       0
112A-S          98.09    0.35       0          FUNCTIONAL  0         0         0
      0       0
112A-S(1)       96.4     1.73       0          FUNCTIONAL  0         0         0
      0       0
113             95.302   2.756      0          FUNCTIONAL  0         0
1.13     0       0
113A-S          98.17    0.35       0          FUNCTIONAL  0         0         0
      0       0
113A-S(1)       96.47    1.73       0          FUNCTIONAL  0         0         0
      0       0
114             93.924   3.48       0          FUNCTIONAL  0         0
1.13     0       0
114A-S          95.69    1.93       0          FUNCTIONAL  0         0         0
      0       0
115             94.118   3.367      0          FUNCTIONAL  0         0
1.13     0       0
115A            94.192   3.046      0          FUNCTIONAL  0         0         0
      0       0
115A-S          95.79    1.73       0          FUNCTIONAL  0         0         0
      0       0
115A-S(1)       97.33    0.35       0          FUNCTIONAL  0         0         0
      0       0
116             94.798   2.634      0          FUNCTIONAL  0         0
1.13     0       0
116A-S          95.82    1.73       0          FUNCTIONAL  0         0         0
      0       0
116A-S(1)       97.41    0.35       0          FUNCTIONAL  0         0         0
      0       0
117             94.41    3.052      0          FUNCTIONAL  0         0
1.13     0       0
117A-S          95.88    1.73       0          FUNCTIONAL  0         0         0
      0       0
117A-S(1)       97.52    0.35       0          FUNCTIONAL  0         0         0
      0       0
117B-S          95.81    1.73       0          FUNCTIONAL  0         0         0
      0       0
118             94.952   2.674      0          FUNCTIONAL  0         0
1.13     0       0
118A-S          96       1.73       0          FUNCTIONAL  0         0         0
      0       0
118A-S(1)       97.57    0.35       0          FUNCTIONAL  0         0         0
      0       0
119             93.5     4.078      0          FUNCTIONAL  0         0
1.13     0       0
119A-S          95.84    1.73       0          FUNCTIONAL  0         0         0
      0       0
120A-S(1)       97.62    0.35       0          FUNCTIONAL  0         0         0
      0       0
121             94       3.834      0          FUNCTIONAL  0         0
1.13     0       0
121A            95.02    2.687      0          FUNCTIONAL  0         0
1.13     0       0
121AA-S         95.93    1.73       0          FUNCTIONAL  0         0         0
      0       0
121A-S          97.72    0.35       0          FUNCTIONAL  0         0         0
      0       0
121A-S(1)       98.05    0.35       0          FUNCTIONAL  0         0         0
      0       0
121A-S(2)       95.98    1.73       0          FUNCTIONAL  0         0         0
      0       0
121B-S          95.85    2.5        0          TABULAR     120AA-S
      0       0
123             94.712   3.472      0          FUNCTIONAL  0         0
1.13     0       0
123A-S          96.31    1.73       0          FUNCTIONAL  0         0         0
      0       0
123B-S          96       2.5        0          TABULAR     123AA-S
      0       0
124             95.572   3.009      0          FUNCTIONAL  0         0
1.13     0       0
124A-S          96.55    1.73       0          FUNCTIONAL  0         0         0
      0       0
124A-S(1)       98.1     0.35       0          FUNCTIONAL  0         0         0
      0       0
125             95.696   2.929      0          FUNCTIONAL  0         0
1.13     0       0
126             96.096   2.971      0          FUNCTIONAL  0         0
1.13     0       0
126A-S          97.53    1.73       0          FUNCTIONAL  0         0         0
      0       0
126B-S          99.05    0.35       0          FUNCTIONAL  0         0         0
      0       0
126B-S(1)       96.99    1.73       0          FUNCTIONAL  0         0         0
      0       0
126B-S(2)       98.57    0.35       0          FUNCTIONAL  0         0         0
      0       0
126C-S          96.49    3.13       0          FUNCTIONAL  0         0         0
      0       0
127             97.429   2.75       0          FUNCTIONAL  0         0
1.13     0       0
127A-S          100.62   0.35       0          FUNCTIONAL  0         0         0
      0       0
127A-S(1)       97.77    1.73       0          FUNCTIONAL  0         0         0
      0       0
128             96.445   2.727      0          FUNCTIONAL  0         0
1.13     0       0
128A-S(1)       97.49    1.73       0          FUNCTIONAL  0         0         0
```

0	0							
129		96.536	2.837	0	FUNCTIONAL	0	0	
1.13	0	0						
130		97.136	3.559	0	FUNCTIONAL	0	0	
1.13	0	0						
130A-S		97.94	1.73	0	FUNCTIONAL	0	0	0
0	0							
130A-S(1)		99.39	0.35	0	FUNCTIONAL	0	0	0
0	0							
131		97.308	3.238	0	FUNCTIONAL	0	0	
1.13	0	0						
132		97.561	2.636	0	FUNCTIONAL	0	0	
1.13	0	0						
201		91.46	6.067	0	FUNCTIONAL	0	0	
1.13	0	0						
202		91.578	6.019	0	FUNCTIONAL	0	0	
1.13	0	0						
202A-S		97.56	0.35	0	FUNCTIONAL	0	0	0
0	0							
202A-S(1)		95.89	1.73	0	FUNCTIONAL	0	0	0
0	0							
203A-S		97.61	0.35	0	FUNCTIONAL	0	0	0
0	0							
204		92.462	5.127	0	FUNCTIONAL	0	0	
1.13	0	0						
204A-S		97.66	0.35	0	FUNCTIONAL	0	0	0
0	0							
204A-S(1)		96.01	1.73	0	FUNCTIONAL	0	0	0
0	0							
204BS(1)		95.96	1.73	0	FUNCTIONAL	0	0	0
0	0							
205		92.775	5.089	0	FUNCTIONAL	0	0	
1.13	0	0						
205A-S		97.51	0.35	0	FUNCTIONAL	0	0	0
0	0							
205A-S(1)		96.07	1.73	0	FUNCTIONAL	0	0	0
0	0							
206		92.944	5.687	0	FUNCTIONAL	0	0	
1.13	0	0						
206A-S		98.88	0.35	0	FUNCTIONAL	0	0	0
0	0							
206A-S(1)		96.91	1.73	0	FUNCTIONAL	0	0	0
0	0							
206B-S		98.42	0.35	0	FUNCTIONAL	0	0	0
0	0							
206B-S(1)		96.39	1.73	0	FUNCTIONAL	0	0	0
0	0							
206B-Sl		97.9	0.35	0	FUNCTIONAL	0	0	0
0	0							
207		94.242	5.091	0	FUNCTIONAL	0	0	
1.13	0	0						
207A-S(1)		97.3	1.73	0	FUNCTIONAL	0	0	0
0	0							
209		94.7	5.408	0	FUNCTIONAL	0	0	
1.13	0	0						
209A-S		98.21	1.73	0	FUNCTIONAL	0	0	0
0	0							
209B-S		98.65	1.73	0	FUNCTIONAL	0	0	0
0	0							
209B-S(1)		100.44	0.35	0	FUNCTIONAL	0	0	0
0	0							
210		91.911	6.134	0	FUNCTIONAL	0	0	
1.13	0	0						
210A-S		95.99	1.73	0	FUNCTIONAL	0	0	0
0	0							
211		92.241	5.892	0	FUNCTIONAL	0	0	
1.13	0	0						
211A-S		98.01	0.35	0	FUNCTIONAL	0	0	0
0	0							
211A-S(1)		96.37	1.73	0	FUNCTIONAL	0	0	0
0	0							
211A-S(2)		98.21	0.35	0	FUNCTIONAL	0	0	0
0	0							
212		92.392	4.608	0	FUNCTIONAL	0	0	
1.13	0	0						
213		93	5.11	0	FUNCTIONAL	0	0	
1.13	0	0						
213A-S		96.44	1.73	0	FUNCTIONAL	0	0	0
0	0							
214		94.435	3.604	0	FUNCTIONAL	0	0	
1.13	0	0						
214A-S		98.02	0.35	0	FUNCTIONAL	0	0	0
0	0							
214A-S(1)		96.27	1.73	0	FUNCTIONAL	0	0	0
0	0							
214A-S(2)		98.26	0.35	0	FUNCTIONAL	0	0	0
0	0							
215		95.023	3.147	0	FUNCTIONAL	0	0	
1.13	0	0						
216		95.112	2.961	0	FUNCTIONAL	0	0	
1.13	0	0						
217		95.298	2.597	0	FUNCTIONAL	0	0	
1.13	0	0						
217A-S		96.43	1.73	0	FUNCTIONAL	0	0	0
0	0							
217A-S(1)		98.11	0.35	0	FUNCTIONAL	0	0	0
0	0							
217A-S(2)		98.11	0.35	0	FUNCTIONAL	0	0	0
0	0							
218		93.672	4.415	0	FUNCTIONAL	0	0	
1.13	0	0						
219		93.897	4.051	0	FUNCTIONAL	0	0	

```
1.13     0        0
219A-S             98.07    0.35       0          FUNCTIONAL  0         0         0
       0        0
219A-S(1)          96.44    1.73       0          FUNCTIONAL  0         0         0
       0        0
219A-S(2)          98.22    0.35       0          FUNCTIONAL  0         0         0
       0        0
219B-S             96.6     1.73       0          FUNCTIONAL  0         0         0
       0        0
219B-S(1)          98.32    0.35       0          FUNCTIONAL  0         0         0
       0        0
220                95.076   2.872      0          FUNCTIONAL  0         0
1.13     0        0
220A-S             96.3     1.73       0          FUNCTIONAL  0         0         0
       0        0
220A-S(1)          97.87    0.35       0          FUNCTIONAL  0         0         0
       0        0
221                94.48    3.483      0          FUNCTIONAL  0         0
1.13     0        0
222                94.955   3.408      0          FUNCTIONAL  0         0
1.13     0        0
222A-S             96.44    1.81       0          FUNCTIONAL  0         0         0
       0        0
222A-S(1)          98.22    0.35       0          FUNCTIONAL  0         0         0
       0        0
222A-S(2)          98.82    0.35       0          FUNCTIONAL  0         0         0
       0        0
223                95.278   3.904      0          FUNCTIONAL  0         0
1.13     0        0
223A-S             96.79    1.73       0          FUNCTIONAL  0         0         0
       0        0
224                95.344   3.801      0          FUNCTIONAL  0         0         0
       0        0
225                95.648   4.141      0          FUNCTIONAL  0         0         0
       0        0
;T/G=99.03
225A-S             97.65    1.73       0          FUNCTIONAL  0         0         0
       0        0
225A-S(1)          99.16    0.35       0          FUNCTIONAL  0         0         0
       0        0
;T/G=99.49
225C-S             98.11    1.73       0          FUNCTIONAL  0         0         0
       0        0
225C-S(1)          99.63    0.35       0          FUNCTIONAL  0         0         0
       0        0
226                96.136   4.112      0          FUNCTIONAL  0         0         0
       0        0
227                96.212   4.022      0          FUNCTIONAL  0         0         0
       0        0
228                96.471   3.959      0          FUNCTIONAL  0         0         0
       0        0
```

```
;T/G=99.99
228A-S             98.61    1.73       0          FUNCTIONAL  0         0         0
       0        0
228A-S(1)          100.2    0.35       0          FUNCTIONAL  0         0         0
       0        0
229                96.882   3.543      0          FUNCTIONAL  0         0         0
       0        0
;T/G=100.20
229A-S             98.82    1.73       0          FUNCTIONAL  0         0         0
       0        0
229A-S(1)          100.42   0.35       0          FUNCTIONAL  0         0         0
       0        0
230                97.164   3.375      0          FUNCTIONAL  0         0         0
       0        0
231                97.349   3.019      0          FUNCTIONAL  0         0         0
       0        0
232                97.578   2.579      0          FUNCTIONAL  0         0
1.13     0        0
233                92.392   5.031      0          FUNCTIONAL  0         0
1.13     0        0
234                92.927   4.604      0          FUNCTIONAL  0         0         0
       0        0
234A-S             95.97    1.73       0          FUNCTIONAL  0         0         0
       0        0
234A-S(1)          97.56    0.35       0          FUNCTIONAL  0         0         0
       0        0
234B-S             95.92    1.73       0          FUNCTIONAL  0         0         0
       0        0
234B-S(1)          97.49    0.35       0          FUNCTIONAL  0         0         0
       0        0
235                93.363   4.072      0          FUNCTIONAL  0         0         0
       0        0
235A-S             95.98    1.73       0          FUNCTIONAL  0         0         0
       0        0
235A-S(1)          97.6     0.35       0          FUNCTIONAL  0         0         0
       0        0
236                93.777   3.724      0          FUNCTIONAL  0         0         0
       0        0
237                94.02    3.875      0          FUNCTIONAL  0         0         0
       0        0
240                96.327   3.784      0          FUNCTIONAL  0         0         0
       0        0
;T/G=99.80
240A-S             98.42    1.73       0          FUNCTIONAL  0         0         0
       0        0
240A-S(1)          99.89    0.35       0          FUNCTIONAL  0         0         0
       0        0
241                96.729   3.486      0          FUNCTIONAL  0         0         0
       0        0
;T/G=100.14
241A-S             98.76    1.73       0          FUNCTIONAL  0         0         0
```

```
      0        0
241A-S(1)        100.26   0.35       0          FUNCTIONAL  0         0         0
      0        0
;T/G=99.90
241B-S           98.52    1.73       0          FUNCTIONAL  0         0         0
      0        0
241B-S(1)        100.05   0.35       0          FUNCTIONAL  0         0         0
      0        0
242              96.922   3.351      0          FUNCTIONAL  0         0         0
      0        0
B1-S             94.43    2.5        0          TABULAR     B1-S
      0        0
;10yr
B2-S             94.4     2.5        0          TABULAR     B2-S
      0        0
;2yr
Comm-S           97.4     2.5        0          TABULAR     StorCommE
      0        0
EXT-1A-S         97.92    0.35       0          FUNCTIONAL  0         0         0
      0        0
EXT-1A-S(1)      95.93    0.39       0          FUNCTIONAL  0         0         0
      0        0
EXT2-S           98.39    0.35       0          FUNCTIONAL  0         0         0
      0        0
EXT-4-S          98       0.35       0          FUNCTIONAL  0         0         0
      0        0
EXT5-S           98       0.35       0          FUNCTIONAL  0         0         0
      0        0
EXT6-S           99.6     0.35       0          FUNCTIONAL  0         0         0
      0        0
F101A(1)         94.2     2.2        0          FUNCTIONAL  0         0         0
      0        0
F101A(2)         94       2.2        0          FUNCTIONAL  0         0         0
      0        0
F101A-S          93.43    1.87       0          FUNCTIONAL  0         0         0
      0        0
;2yr
G234C-S          93.41    4.78       0          FUNCTIONAL  0         0         0
      0        0
HW7              93.65    2.35       0          FUNCTIONAL  0         0
1.13     0        0
HZD-S            98       2.5        0          TABULAR     Hazeldean-s
      0        0
J2               94.1     2.9        0          FUNCTIONAL  0         0
1.13     0        0
J3               93.7     2.59       0          FUNCTIONAL  0         0
1.13     0        0
J4               94.1     2.9        0          FUNCTIONAL  0         0
1.13     0        0
L212A-S          95.56    1.73       0          FUNCTIONAL  0         0         0
      0        0
```

```
;2yr
L218A-S          96       2.5        0          TABULAR     INST
      0        0
L225B-S          97.2     2.5        0          TABULAR     224AA-S
      0        0
L235B-S          95.55    2.5        0          TABULAR     235B-S
      0        0
POND-S1          90.7     4.6        0          TABULAR     PondStorageULT
      0        0
RY103C-S         96.24    1.8        0          FUNCTIONAL  0         0         0
      0        0
RY103D-S         96.2     1.8        0          FUNCTIONAL  0         0         0
      0        0
RY113B-S         96.66    1.8        0          FUNCTIONAL  0         0         0
      0        0
RY117C-S         96.17    1.8        0          FUNCTIONAL  0         0         0
      0        0
RY124B-S         96.91    1.8        0          FUNCTIONAL  0         0         0
      0        0
RY130B-S         98.38    1.6        0          FUNCTIONAL  0         0         0
      0        0
RY202B-S         95.5     2.6        0          FUNCTIONAL  0         0         0
      0        0
RY204C-S         95.36    2.6        0          FUNCTIONAL  0         0         0
      0        0
RY205B-S         95.46    2.6        0          FUNCTIONAL  0         0         0
      0        0
RY209C-S         97.41    2.6        0          FUNCTIONAL  0         0         0
      0        0
RY218B-S         96.29    2.6        0          FUNCTIONAL  0         0         0
      0        0
RY220A-S         95.88    2.43       0          FUNCTIONAL  0         0         0
      0        0
RY234D-S         95.49    2.6        0          FUNCTIONAL  0         0         0
      0        0
SU               97.2     0.35       0          FUNCTIONAL  0         0         0
      0        0
Transitway-S     97       2.5        0          TABULAR     transit-S
      0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset
 OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ----------
---------- ---------- ---------- ----------
C1               EXT-1A-S(1)      OF3              15.6       0.013      95.93
 95.9       0          0
C10              206B-Sl          109A-S(1)        14.6       0.013      97.9
 97.79      0          0
C100             118A-S           118A-S(1)        37.89      0.013      97.38
 97.57      0          0
```

C101	118A-S(1)	117A-S	52.21	0.013	97.57
97.26	0	0			
C102	117A-S	117A-S(1)	34.6	0.013	97.26
97.52	0	0			
C103	117A-S(1)	117B-S	31.1	0.013	97.52
97.19	0	0			
C104	117B-S	116A-S(1)	15.86	0.013	97.19
97.41	0	0			
C105	109A-S(1)	205A-S(1)	32.75	0.013	97.79
97.45	0	0			
C106	205A-S(1)	205A-S	13.25	0.013	97.45
97.51	0	0			
C107	205A-S	204A-S	30.53	0.013	97.51
97.66	0	0			
C108	204A-S	204A-S(1)	50.9	0.013	97.66
97.39	0	0			
C109	204A-S(1)	203A-S	37.4	0.013	97.39
97.61	0	0			
C11	220A-S	206B-Sl	28.7	0.013	97.68
97.9	0	0			
C110	203A-S	204BS(1)	38.8	0.013	97.61
97.34	0	0			
C111	204BS(1)	202A-S	35.3	0.013	97.34
97.56	0	0			
C112	202A-S	202A-S(1)	57.34	0.013	97.56
97.27	0	0			
C113	202A-S(1)	234B-S(1)	14.5	0.013	97.27
97.49	0	0			
C114	210A-S	202A-S	9.25	0.013	97.37
97.56	0	0			
C115	211A-S	210A-S	67.52	0.013	98.01
97.37	0	0			
C116	211A-S(1)	211A-S	40.6	0.013	97.75
98.01	0	0			
C117	211A-S(2)	211A-S(1)	48.5	0.013	98.21
97.75	0	0			
C118	211A-S(2)	217A-S(1)	47.6	0.013	98.21
98.11	0	0			
C119	217A-S(2)	217A-S	6.77	0.013	98.11
97.81	0	0			
C12	220A-S(1)	220A-S	38	0.013	97.87
97.68	0	0			
C120	217A-S(2)	L212A-S	16.5	0.013	98.11
96.94	0	0			
C121	219A-S(1)	220A-S(1)	8.8	0.013	97.82
97.87	0	0			
C122	219A-S(2)	219A-S(1)	42.15	0.013	98.22
98.82	0	0			
C123	219B-S	219A-S(2)	43	0.013	97.98
98.22	0	0			
C124	219B-S(1)	219B-S	69.7	0.013	98.32
97.98	0	0			
C125	219B-S(1)	214A-S	43.75	0.013	98.32
98.02	0	0			
C126	214A-S	213A-S	35.75	0.013	98.02
97.82	0	0			
C127	213A-S	211A-S	9.51	0.013	97.82
98.01	0	0			
C128	RY103C-S	103B-S	5	0.025	97.44
97.17	0	0			
C129	RY103D-S	103B-S	5	0.025	97.4
97.17	0	0			
C13	219A-S	220A-S(1)	39	0.013	98.07
97.87	0	0			
C130	RY117C-S	117B-S	5	0.025	97.37
97.19	0	0			
C131	RY204C-S	204BS(1)	5	0.025	97.62
97.37	0	0			
C132	RY205B-S	205A-S(1)	5	0.025	97.46
97.45	0	0			
C133	L218A-S	219B-S	50	0.025	98.15
97.98	0	0			
C134	RY218B-S	219B-S	5	0.025	98.29
97.98	0	0			
C135	EXT5-S	OF13	10	0.025	98
97.7	0	0			
C136	L212A-S	OF4	6	0.025	96.94
96.91	0	0			
C137	241B-S	241B-S(1)	30.2	0.013	99.9
100.05	0	0			
C138	G234C-S	234B-S	2	0.025	97.59
97.4	0	0			
C139	RY202B-S	202A-S(1)	5	0.013	97.5
97.27	0	0			
C14	222A-S	219A-S	45.9	0.013	97.82
98.07	0	0			
C140	241B-S(1)	240A-S	34.7	0.013	100.05
99.8	0	0			
C141	123B-S	124A-S	10	0.013	98.15
98	0	0			
C142	121B-S	119A-S	10	0.013	98
97.9	0	0			
C143	126C-S	126A-S	2	0.025	99.02
98.91	0	0			
C144	RY124B-S	124A-S	2	0.025	98.11
97.93	0	0			
C145	RY113B-S	113A-S(1)	5	0.025	97.86
97.85	0	0			
C146	RY130B-S	207A-S(1)	35	0.013	99.38
99	0	0			
C147	RY209C-S	207A-S(1)	30.5	0.013	99.41
99.09	0	0			

C148		RY220A-S	220A-S	5	0.013	97.71
97.68	0	0				
C149		240A-S(1)	225C-S	42.5	0.013	99.89
99.49	0	0				
C15		222A-S(1)	222A-S	65.36	0.013	98.22
97.82	0	0				
C150		240A-S	240A-S(1)	15.9	0.013	99.8
99.89	0	0				
C151		F101A-S	F101A(2)	25.19	0.025	94.7
94.5	0	0				
C152		EXT6-S	EXT2-S	6	0.025	99.6
98.39	0	0				
C153		EXT2-S	OF5	6	0.025	98.39
98.35	0	0				
C154		201	100B	15	0.013	91.76
91.74	0	0				
C155		100B	POND-S1	18	0.013	91.73
91.7	0	0				
C156		100B	100A	49.8	0.013	92.93
92.88	0	0				
C157		100A	POND-S1	28.1	0.013	91.79
91.76	0	0				
C158		101	100D	15.7	0.013	93.28
93.26	0	0				
C159		100D	100E	15.27	0.013	94.04
93.89	0	0				
C16		222A-S(2)	222A-S(1)	39.94	0.013	98.82
98.22	0	0				
C160		100E	POND-S1	15.8	0.013	93.86
93.46	0	0				
C161		100D	100C	26.4	0.013	93.21
93.17	0	0				
C162		100C	POND-S1	13.5	0.013	93.11
93.08	0	0				
C163		B1-S	OF9	10	0.025	96.58
95	0	0				
C164		B2-S	OF10	10	0.013	96.55
95	0	0				
C165		J6	OF8	70	0.013	94.56
92.6	0	0				
C166		114A-S	POND-S1	30.4	0.025	97.22
93.44	0	0				
C167		F101A(1)	F101A(2)	30.11	0.035	94.2
94	0	0				
C168		SU	114A-S	4.25	0.013	97.2
97.07	0	0				
C169		117	115A	94.9	0.013	94.71
94.52	0	0				
C17		222A-S(2)	EXT2-S	29.89	0.013	98.82
98.39	0	0				
C170		115A	115	11	0.013	94.49
94.47	0	0				
C171		103	102A	97.9	0.013	93.98
93.89	0	0				
C172		J4	J3	219	0.013	94.4
94.07	0	0				
C173		HW7	POND-S1	18.1	0.013	93.66
93.45	0	0				
C174		Comm-S	OF7	5	0.013	99.55
99	0	0				
C175		Transitway-S	OF6	238.7	0.013	99.15
97	0	0				
C176		F101A(2)	HW7	44.18	0.035	94
93.65	0	0				
C177		J2	J3	244	0.013	94.43
94.07	0	0				
C178		J3	F101A(2)	29.9	0.013	94.04
94	0	0				
C179		121A	121	54	0.013	95.32
95.18	0	0				
C18		127A-S	130A-S	91.45	0.013	100.62
99.32	0	0				
C180		121AA-S	EXT-1A-S(1)	58.2	0.013	97.31
95.93	0	0				
C181		HZD-S	OF11	30	0.013	100.15
100	0	0				
C182		102A	102	8.7	0.013	93.88
93.87	0	0				
C183		107	121	80.3	0.013	94.46
94.38	0	0				
C184		L225B-S	225A-S	10	0.013	99.35
99.25	0	0				
C19		130A-S	130A-S(1)	10.3	0.013	99.32
99.39	0	0				
C2		EXT-1A-S	121AA-S	36.5	0.013	97.92
97.31	0	0				
C20		130A-S(1)	128A-S(1)	40.4	0.013	99.39
98.87	0	0				
C21		128A-S(1)	126A-S	19.97	0.013	98.87
98.91	0	0				
C22		126A-S	126B-S	14.63	0.013	98.91
99.05	0	0				
C23		126B-S	126B-S(1)	45	0.013	99.05
98.37	0	0				
C24		126B-S(1)	126B-S(2)	40	0.013	98.37
98.57	0	0				
C25		126B-S(2)	124A-S	50	0.013	98.57
97.93	0	0				
C26		124A-S	124A-S(1)	35.1	0.013	97.93
98.1	0	0				
C27		124A-S(1)	123A-S	30	0.013	98.1
97.69	0	0				

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C28             123A-S          121A-S          8.32        0.013       97.69
 97.72      0          0
C29             113A-S(1)       113A-S          36.45       0.013       97.85
 98.17      0          0
C3              EXT-1A-S        121A-S          24.6        0.013       97.92
 97.72      0          0
C30             112A-S          113A-S(1)       34.9        0.013       98.09
 97.85      0          0
C31             112A-S          112A-S(1)       32.9        0.013       98.09
 97.78      0          0
C32             112A-S(1)       109B-S(3)       47.1        0.013       97.78
 98.01      0          0
C33             109B-S(3)       110A-S          26          0.013       98.01
 97.75      0          0
C34             110A-S          107A-S          8.5         0.013       97.75
 97.8       0          0
C35             127A-S(1)       126A-S          25.57       0.013       99.15
 98.91      0          0
C36             127A-S          127A-S(1)       140.1       0.013       100.62
 99.15      0          0
C37             127A-S          209B-S          66.17       0.013       100.62
 100.03     0          0
C38             209B-S(1)       209B-S          95.5        0.013       100.44
 100.03     0          0
C39             209B-S(1)       229A-S          40.5        0.013       100.44
 100.2      0          0
C4              121A-S(1)       121A-S          47.84       0.013       98.05
 97.72      0          0
C40             229A-S          229A-S(1)       44.3        0.013       100.2
 100.42     0          0
C41             229A-S(1)       228A-S          58.2        0.013       100.42
 99.99      0          0
C42             228A-S          228A-S(1)       41.9        0.013       99.99
 100.2      0          0
C43             228A-S(1)       225C-S          62.2        0.013       100.2
 99.49      0          0
C44             225C-S          225C-S(1)       23.1        0.013       99.49
 99.63      0          0
C45             225C-S(1)       225A-S          43.2        0.013       99.63
 99.03      0          0
C46             225A-S          225A-S(1)       26.9        0.013       99.03
 99.16      0          0
C47             225A-S(1)       223A-S          53.4        0.013       99.16
 98.17      0          0
C48             223A-S          222A-S(1)       6.6         0.013       98.17
 98.22      0          0
C49             209B-S          209A-S          20.75       0.013       100.03
 99.59      0          0
C5              121A-S(1)       107A-S          32.04       0.013       98.05
 97.8       0          0
C50             209A-S          207A-S(1)       62.5        0.013       99.59
 98.68      0          0
C51             207A-S(1)       206A-S          37.5        0.013       98.68
 98.88      0          0
C52             206A-S          206A-S(1)       39.3        0.013       98.88
 98.29      0          0
C53             206A-S(1)       206B-S          25.55       0.013       98.29
 98.42      0          0
C54             206B-S          113A-S          16.72       0.013       98.42
 98.17      0          0
C55             113A-S          206B-S(1)       35.75       0.013       98.17
 97.77      0          0
C56             206B-S(1)       109A-S(1)       10.49       0.013       97.77
 97.79      0          0
C57             214A-S(1)       214A-S          49.75       0.013       97.65
 98.02      0          0
;2023_rev_MJ
C58             214A-S(2)       214A-S(1)       57          0.013       98.26
 97.65      0          0
C59             214A-S(2)       217A-S          57          0.013       98.26
 97.81      0          0
C6              109B-S          107A-S          41.26       0.013       97.59
 97.8       0          0
C60             217A-S          217A-S(1)       9.54        0.013       97.81
 98.11      0          0
C61             105A-S(1)       105A-S          35.56       0.013       97.49
 97.79      0          0
C62             106A-S          105A-S(1)       39.57       0.013       97.88
 97.49      0          0
C63             106A-S(1)       106A-S          36.23       0.013       97.65
 97.88      0          0
C64             106A-S(2)       106A-S(1)       11.68       0.013       97.71
 97.65      0          0
C65             106A-S(2)       106B-S          9.7         0.013       97.71
 97.52      0          0
C66             106B-S          205A-S          12.6        0.013       97.52
 97.51      0          0
C67             121A-S          121A-S(2)       35.93       0.013       97.72
 97.36      0          0
C68             121A-S(2)       120A-S(1)       53.8        0.013       97.36
 97.62      0          0
C69             120A-S(1)       119A-S          57          0.013       97.62
 97.22      0          0
C7              109B-S(1)       109B-S          27.52       0.013       97.87
 97.59      0          0
C70             119A-S          102A-S(2)       33          0.013       97.22
 97.42      0          0
C71             102A-S(2)       102A-S(1)       57          0.013       97.42
 97.14      0          0
C72             102A-S(1)       102A-S          25          0.013       97.14
 97.35      0          0
C73             102A-S          114A-S          37.77       0.013       97.35
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	97.07	0	0			
C74		115A-S(1)	114A-S	26.34	0.013	97.33
	97.07	0	0			
C75		115A-S	115A-S(1)	33.89	0.013	97.17
	97.33	0	0			
C76		116A-S(1)	115A-S	24.62	0.013	97.41
	97.17	0	0			
C77		116A-S	116A-S(1)	30.68	0.013	97.2
	97.41	0	0			
C78		234B-S(1)	116A-S	53.39	0.013	97.49
	97.2	0	0			
C79		234B-S	234B-S(1)	32.51	0.013	97.3
	97.49	0	0			
C8		109B-S(1)	109A-S	38.48	0.013	97.87
	97.58	0	0			
C80		234A-S(1)	234B-S	48.8	0.013	97.56
	97.3	0	0			
C81		234A-S	234A-S(1)	30	0.013	97.35
	97.56	0	0			
C82		235A-S(1)	234A-S	50	0.013	97.6
	97.35	0	0			
C83		235A-S	235A-S(1)	44.1	0.013	97.36
	97.6	0	0			
C84		217A-S(1)	235A-S	87.3	0.013	98.11
	97.36	0	0			
C85		EXT-4-S	OF14	10	0.025	98
	97.7	0	0			
C86		209B-S(1)	241A-S	56	0.013	100.44
	100.14	0	0			
C87		241A-S	241A-S(1)	23.2	0.013	100.14
	100.26	0	0			
C88		L235B-S	235A-S	10	0.013	97.7
	97.36	0	0			
C89		RY234D-S	234A-S	33	0.013	97.49
	97.35	0	0			
C9		109A-S	109A-S(1)	41.52	0.013	97.58
	97.79	0	0			
C90		241A-S(1)	241B-S	39.9	0.013	100.26
	99.9	0	0			
C91		107A-S	107A-S(1)	12.24	0.013	97.8
	97.59	0	0			
C92		107A-S(1)	105A-S	34.01	0.013	97.59
	97.79	0	0			
C93		105A-S	104A-S	41.49	0.013	97.79
	97.46	0	0			
C94		104A-S	104A-S(1)	37.85	0.013	97.46
	97.65	0	0			
C95		104A-S(1)	103A-S	45.8	0.013	97.65
	97.26	0	0			
C96		103A-S	103A-S(1)	33.2	0.013	97.26
	97.45	0	0			
C97		103A-S(1)	103B-S	32.25	0.013	97.45
	97.02	0	0			
C98		103B-S	SU	6.12	0.013	97.02
	97.2	0	0			
C99		106A-S	118A-S	62	0.013	97.88
	97.38	0	0			
F101A-IC		F101A-S	101	16.3	0.013	93.43
	93.35	0	0			
outlet		J9	OF2	7.8	0.013	93.05
	93.01	0	0			
Pipe_-_(131)		240	225	76.696	0.013	96.627
	96.32	0	0			
Pipe_-_(132)		241	240	96.14	0.013	97.029
	96.644	0	0			
Pipe_-_(133)		242	241	10.616	0.013	97.222
	97.18	0	0			
Pipe_-_(134)		230	242	53.557	0.013	97.464
	97.25	0	0			
Pipe_-_(234)		108	107	18.945	0.013	94.766
	94.681	0	0			
Pipe_-_(234)_(1)		109	108	116.815	0.013	95.185
	94.777	0	0			
Pipe_-_(235)		107	104	51.748	0.013	95.59
	95.383	0	0			
Pipe_-_(238)		206	205	109.96	0.013	93.099
	92.93	0	0			
Pipe_-_(240)		207	206	99.158	0.013	94.55
	94.249	0	0			
Pipe_-_(241)_(1)		209	207	49.667	0.013	95
	94.86	0	0			
Pipe_-_(245)		127	126	110.836	0.013	97.731
	96.623	0	0			
Pipe_-_(253)		113	112	84.212	0.013	95.57
	95.238	0	0			
Pipe_-_(263)		202	201	74.953	0.013	91.878
	91.765	0	0			
Pipe_-_(264)		204	202	149.899	0.013	92.762
	92.538	0	0			
Pipe_-_(267)		205	204	108.144	0.013	92.929
	92.767	0	0			
Pipe_-_(329)		125	124	12.188	0.013	95.998
	95.949	0	0			
Pipe_-_(330)		126	125	92.464	0.013	96.398
	96.028	0	0			
Pipe_-_(331)		128	126	39.463	0.013	96.672
	96.473	0	0			
Pipe_-_(332)		129	128	12.261	0.013	96.838
	96.777	0	0			
Pipe_-_(333)		130	129	113.92	0.013	97.438
	96.868	0	0			
Pipe_-_(334)		131	130	19.451	0.013	97.61

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 97.513     0          0
Pipe_-_(335)     132             131             35.88      0.013      97.863
 97.629     0          0
Pipe_-_(337)     105             104             79.381     0.013      94.816
 94.658     0          0
Pipe_-_(338)     106             105             63.485     0.013      95.018
 94.891     0          0
Pipe_-_(344)     116             115             65.711     0.013      95.118
 94.789     0          0
Pipe_-_(345)     115             114             54.688     0.013      94.414
 94.305     0          0
Pipe_-_(346)     114             102             28.243     0.013      94.23
 94.173     0          0
Pipe_-_(347)     102             101             79.783     0.013      93.423
 93.344     0          0
Pipe_-_(349)     119             101             115.054    0.013      93.826
 93.654     0          0
Pipe_-_(350)     121             119             113.166    0.013      94
 93.831     0          0
Pipe_-_(351)     123             121             51.295     0.013      95.014
 94.886     0          0
Pipe_-_(352)     124             123             71.391     0.013      95.874
 95.589     0          0
Pipe_-_(354)     104             103             99.774     0.013      94.358
 94.208     0          0
Pipe_-_(360)     118             117             96.757     0.013      95.254
 95.012     0          0
Pipe_-_(366)     210             202             85.512     0.013      92.06
 91.94      0          0
Pipe_-_(367)     211             210             115.944    0.013      92.39
 92.21      0          0
Pipe_-_(368)     212             211             97.797     0.013      92.69
 92.55      0          0
Pipe_-_(4)       110             107             44.394     0.013      94.911
 94.756     0          0
Pipe_-_(43)      213             210             55.346     0.013      93.28
 93.17      0          0
Pipe_-_(44)      218             213             102.115    0.013      93.82
 93.62      0          0
Pipe_-_(45)      219             218             110.65     0.013      94.19
 93.97      0          0
Pipe_-_(47)      221             219             76.765     0.013      94.77
 94.49      0          0
Pipe_-_(48)      222             221             71.448     0.013      95.25
 95         0          0
Pipe_-_(49)      220             219             71.8       0.013      95.15
 94.79      0          0
Pipe_-_(5)       111             110             11.163     0.013      95.03
 94.986     0          0
Pipe_-_(50)      223             222             75.276     0.013      95.572
 95.309     0          0
Pipe_-_(51)      224             223             11.94      0.013      95.644
 95.602     0          0
Pipe_-_(52)      225             224             91.198     0.013      95.948
 95.674     0          0
Pipe_-_(52)_(1)  226             225             38.715     0.013      96.436
 96.32      0          0
Pipe_-_(53)      227             226             14.08      0.013      96.512
 96.47      0          0
Pipe_-_(54)      228             227             77.156     0.013      96.771
 96.54      0          0
Pipe_-_(54)_(1)  229             228             83.908     0.013      97.182
 96.846     0          0
Pipe_-_(56)      231             230             33.892     0.013      97.649
 97.48      0          0
Pipe_-_(57)      232             231             42.775     0.013      97.878
 97.664     0          0
Pipe_-_(58)      214             213             70.631     0.013      94.74
 94.51      0          0
Pipe_-_(58)_(1)  215             214             57.473     0.013      95.25
 94.96      0          0
Pipe_-_(59)      216             215             11.874     0.013      95.34
 95.28      0          0
Pipe_-_(6)       112             111             41.88      0.013      95.226
 95.06      0          0
Pipe_-_(60)      217             216             31.248     0.013      95.52
 95.37      0          0
Pipe_-_(73)      233             201             26.629     0.013      92.692
 92.586     0          0
Pipe_-_(77)      234             233             106.856    0.013      93.227
 92.853     0          0
Pipe_-_(84)      235             234             80.815     0.013      93.663
 93.38      0          0
Pipe_-_(85)      236             235             12.657     0.013      94.077
 94.033     0          0
Pipe_-_(87)      237             236             61.251     0.013      94.32
 94.106     0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff
   Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ----------
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C107A-IC(1)      107A-S(1)        107              SIDE         96.21      0.572
   NO       0
C107A-IC(2)      107A-S(1)        107              SIDE         96.21      0.572
   NO       0
C109A-IC(1)      109A-S           109              SIDE         96.2       0.572
   NO       0
C109A-IC(2)      109A-S           109              SIDE         96.2       0.572
   NO       0
C109B-IC(1)      109B-S           109              SIDE         96.21      0.572
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NO	0				
C109B-IC(2)	109B-S	109	SIDE	96.21	0.572
NO	0				
C110A-IC(1)	110A-S	110	SIDE	96.37	0.572
NO	0				
C121AA-IC(1)	121AA-S	121A	SIDE	95.93	0.572
NO	0				
C121AA-IC(2)	121AA-S	121A	SIDE	95.93	0.572
NO	0				
C121A-IC(1)	121A-S(2)	121	SIDE	95.98	0.572
NO	0				
C121A-IC(2)	121A-S(2)	121	SIDE	95.98	0.572
NO	0				
C123A-IC(1)	123A-S	123	SIDE	96.31	0.572
NO	0				
C123A-IC(2)	123A-S	123	SIDE	96.31	0.572
NO	0				
C205A-IC(1)	205A-S(1)	205	SIDE	96.07	0.572
NO	0				
C205A-IC(2)	205A-S(1)	205	SIDE	96.07	0.572
NO	0				
C219-IC	219A-S(1)	219	SIDE	96.44	0.572
NO	0				
C220A-IC(1)	220A-S	220	SIDE	96.3	0.572
NO	0				
C220A-IC(2)	220A-S	220	SIDE	96.3	0.572
NO	0				
C222A-IC(1)	222A-S	222	SIDE	96.44	0.572
NO	0				
C222A-IC(2)	222A-S	222	SIDE	96.44	0.572
NO	0				
C223A-IC(1)	223A-S	223	SIDE	96.79	0.572
NO	0				
G234C-IC	G234C-S	234	SIDE	93.41	0.572
NO	0				
L102A-IC(1)	102A-S(1)	102	SIDE	95.76	0.572
NO	0				
L102A-IC(2)	102A-S(1)	102	SIDE	95.76	0.572
NO	0				
L103A-IC(1)	103A-S	103	SIDE	95.88	0.572
NO	0				
L103A-IC(2)	103A-S	103	SIDE	95.88	0.572
NO	0				
L103B-IC(1)	103B-S	103	SIDE	95.64	0.572
NO	0				
L103B-IC(2)	103B-S	103	SIDE	95.64	0.572
NO	0				
L103C-IC	RY103C-S	103	SIDE	96.24	0.572
NO	0				
L103D-IC	RY103D-S	103	SIDE	96.2	0.572
NO	0				
L104A-IC(1)	104A-S	104	SIDE	96.08	0.572
NO	0				
L104A-IC(2)	104A-S	104	SIDE	96.08	0.572
NO	0				
L105A-IC(1)	105A-S(1)	105	SIDE	96.11	0.572
NO	0				
L105A-IC(2)	105A-S(1)	105	SIDE	96.11	0.572
NO	0				
L106A-IC(1)	106A-S(1)	106	SIDE	96.27	0.572
NO	0				
L106A-IC(2)	106A-S(1)	106	SIDE	96.27	0.572
NO	0				
L106B-IC(1)	106B-S	106	SIDE	95.14	0.572
NO	0				
L112A-IC(1)	112A-S(1)	112	SIDE	96.4	0.572
NO	0				
L112A-IC(2)	112A-S(1)	112	SIDE	96.4	0.572
NO	0				
L113A-IC(1)	113A-S(1)	113	SIDE	96.47	0.572
NO	0				
L113A-IC(2)	113A-S(1)	113	SIDE	96.47	0.572
NO	0				
L113B-IC	RY113B-S	113	SIDE	96.66	0.572
NO	0				
L114A-IC	114A-S	114	SIDE	95.69	0.572
NO	0				
L115A-IC(1)	115A-S	115	SIDE	95.79	0.572
NO	0				
L115A-IC(2)	115A-S	115	SIDE	95.79	0.572
NO	0				
L116A-IC(1)	116A-S	116	SIDE	95.82	0.572
NO	0				
L116A-IC(2)	116A-S	116	SIDE	95.82	0.572
NO	0				
L117A-IC(1)	117A-S	117	SIDE	95.88	0.572
NO	0				
L117A-IC(2)	117A-S	117	SIDE	95.88	0.572
NO	0				
L117B-IC(1)	117B-S	117	SIDE	95.81	0.572
NO	0				
L117B-IC(2)	117B-S	117	SIDE	95.81	0.572
NO	0				
L117C-IC	RY117C-S	117	SIDE	96.17	0.572
NO	0				
L118A-IC(1)	118A-S	118	SIDE	96	0.572
NO	0				
L118A-IC(2)	118A-S	118	SIDE	96	0.572
NO	0				
L119A-IC(1)	119A-S	119	SIDE	95.84	0.572
NO	0				
L119A-IC(2)	119A-S	119	SIDE	95.84	0.572

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   NO       0
L124A-IC(1)      124A-S          124             SIDE         96.55      0.572
   NO       0
L124A-IC(2)      124A-S          124             SIDE         96.55      0.572
   NO       0
L124B-IC         RY124B-S        124             SIDE         96.91      0.572
   NO       0
L126A-IC(1)      126A-S          126             SIDE         97.53      0.572
   NO       0
L126B-IC(1)      126B-S(1)       126             SIDE         96.99      0.572
   NO       0
L126B-IC(2)      126B-S(1)       126             SIDE         96.99      0.572
   NO       0
L126C-IC         126C-S          126             SIDE         96.49      0.572
   NO       0
L127A-IC(1)      127A-S(1)       127             SIDE         97.77      0.572
   NO       0
L127A-IC(2)      127A-S(1)       127             SIDE         97.77      0.572
   NO       0
L128A-IC(1)      128A-S(1)       128             SIDE         97.49      0.572
   NO       0
L128A-IC(2)      128A-S(1)       128             SIDE         97.49      0.572
   NO       0
L130A-IC(1)      130A-S          130             SIDE         97.94      0.572
   NO       0
L130A-IC(2)      130A-S          130             SIDE         97.94      0.572
   NO       0
L130B-IC         RY130B-S        130             SIDE         98.38      0.572
   NO       0
L202A-IC(1)      202A-S(1)       202             SIDE         95.89      0.572
   NO       0
L202A-IC(2)      202A-S(1)       202             SIDE         95.89      0.572
   NO       0
;2023_rev
L202B-IC         RY202B-S        202             SIDE         95.5       0.572
   NO       0
L204A-IC(1)      204A-S(1)       204             SIDE         96.01      0.572
   NO       0
L204A-IC(2)      204A-S(1)       204             SIDE         96.01      0.572
   NO       0
L204B-IC(1)      204BS(1)        204             SIDE         95.96      0.572
   NO       0
L204B-IC(2)      204BS(1)        204             SIDE         95.96      0.572
   NO       0
L204C-IC         RY204C-S        202             SIDE         95.36      0.572
   NO       0
L205B-IC         RY205B-S        205             SIDE         95.46      0.572
   NO       0
L206A-IC(1)      206A-S(1)       206             SIDE         96.91      0.572
   NO       0
L206A-IC(2)      206A-S(1)       206             SIDE         96.91      0.572
   NO       0
L206B-IC(1)      206B-S(1)       206             SIDE         96.39      0.572
   NO       0
L207A-IC(1)      207A-S(1)       207             SIDE         97.3       0.572
   NO       0
L207A-IC(2)      207A-S(1)       207             SIDE         97.3       0.572
   NO       0
L209A-IC(1)      209A-S          209             SIDE         98.21      0.572
   NO       0
L209A-IC(2)      209A-S          209             SIDE         98.21      0.572
   NO       0
L209B-IC         209B-S          209             SIDE         98.65      0.572
   NO       0
L209C-IC         RY209C-S        209             SIDE         97.41      0.572
   NO       0
L210A-IC(1)      210A-S          210             SIDE         95.99      0.572
   NO       0
L210A-IC(2)      210A-S          210             SIDE         95.99      0.572
   NO       0
L211A-IC(1)      211A-S(1)       211             SIDE         96.37      0.572
   NO       0
L211A-IC(2)      211A-S(1)       211             SIDE         96.37      0.572
   NO       0
L212A-IC1        L212A-S         212             SIDE         95.56      0.572
   NO       0
L212A-IC2        L212A-S         212             SIDE         95.56      0.572
   NO       0
L213A-IC(1)      213A-S          213             SIDE         96.44      0.572
   NO       0
L213A-IC(2)      213A-S          213             SIDE         96.44      0.572
   NO       0
L214A-IC(1)      214A-S(1)       214             SIDE         96.27      0.572
   NO       0
L214A-IC(2)      214A-S(1)       214             SIDE         96.27      0.572
   NO       0
L217A-IC(1)      217A-S          217             SIDE         96.43      0.572
   NO       0
L217A-IC(2)      217A-S          217             SIDE         96.43      0.572
   NO       0
L218B-IC         RY218B-S        218             SIDE         96.29      0.572
   NO       0
L219B-IC(1)      219B-S          219             SIDE         96.6       0.572
   NO       0
L219B-IC(2)      219B-S          219             SIDE         96.6       0.572
   NO       0
L220A-S          RY220A-S        220             SIDE         95.88      0.572
   NO       0
L225A-IC(1)      225A-S          225             SIDE         97.65      0.572
   NO       0
L225A-IC_(2)     225A-S          225             SIDE         97.65      0.572
   NO       0
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L225C-IC(1)      225C-S          225             SIDE         98.11      0.572
   NO       0
L225C-IC(2)      225C-S          225             SIDE         98.11      0.572
   NO       0
L228A-IC(1)      228A-S          228             SIDE         98.61      0.572
   NO       0
L228A-IC(2)      228A-S          228             SIDE         98.61      0.572
   NO       0
L229A-IC(1)      229A-S          229             SIDE         98.82      0.572
   NO       0
L229A-IC(2)      229A-S          229             SIDE         98.82      0.572
   NO       0
L234A-IC1        234A-S          234             SIDE         95.97      0.572
   NO       0
L234A-IC2        234A-S          234             SIDE         95.97      0.572
   NO       0
L234B-IC1        234B-S          234             SIDE         95.92      0.572
   NO       0
L234B-IC2        234B-S          234             SIDE         95.92      0.572
   NO       0
L234D-IC         RY234D-S        234             SIDE         95.49      0.572
   NO       0
L235A-IC1        235A-S          235             SIDE         95.98      0.572
   NO       0
L235A-IC2        235A-S          235             SIDE         95.98      0.572
   NO       0
L240A-IC(1)      240A-S          240             SIDE         98.42      0.572
   NO       0
L240A-IC(2)      240A-S          240             SIDE         98.42      0.572
   NO       0
L241A-IC(1)      241A-S          241             SIDE         98.76      0.572
   NO       0
L241A-IC(2)      241A-S          241             SIDE         98.76      0.572
   NO       0
L241B-IC(1)      241B-S          241             SIDE         98.52      0.572
   NO       0
L241B-IC(2)      241B-S          241             SIDE         98.52      0.572
   NO       0
OR1              POND-S1         J9              SIDE         93.44      0.61
   NO       0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff
   Gated    EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- -------- ---------- ---------- ---------- ----------
----------------
Spillway         POND-S1          J6              TRANSVERSE   94.6       1.76
   NO       0        0          YES
W2               POND-S1          J9              TRANSVERSE   93.85      1.74
   NO       0        0          YES
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[OUTLETS]
;;Name           From Node        To Node          Offset     Type
QTable/Qcoeff    Qexpon     Gated
;;-------------- ---------------- ---------------- ---------- ----------------
---------------- ---------- --------
ART-IC           Transitway-S     209              97         TABULAR/HEAD
Transit                     NO
B1-IC            B1-S             J2               94.43      TABULAR/DEPTH    B1
                          NO
B2-IC            B2-S             J4               94.4       TABULAR/DEPTH    B2
                          NO
COMM-IC          Comm-S           209              97.4       TABULAR/HEAD
CommE                       NO
HZD-IC           HZD-S            209              98         TABULAR/HEAD
Hazeldean                   NO
L121B-IC         121B-S           121              95.85      TABULAR/HEAD
L121BIC                     NO
L123B-IC         123B-S           123              96         TABULAR/HEAD
L123BIC                     NO
L218A-IC         L218A-S          218              96         TABULAR/HEAD
L218AAIC                    NO
L225BIC          L225B-S          225              97.2       TABULAR/HEAD
L225BIC                     NO
L235B-IC         L235B-S          235              95.55      TABULAR/HEAD
L235BIC                     NO

[XSECTIONS]
;;Link            Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
C1               IRREGULAR    24mROW           0          0          0          1

C10              IRREGULAR    24mROW           0          0          0          1

C100             IRREGULAR    18mROW           0          0          0          1

C101             IRREGULAR    18mROW           0          0          0          1

C102             IRREGULAR    18mROW           0          0          0          1

C103             IRREGULAR    18mROW           0          0          0          1

C104             IRREGULAR    18mROW           0          0          0          1

C105             IRREGULAR    18mROW           0          0          0          1

C106             IRREGULAR    18mROW           0          0          0          1

C107             IRREGULAR    18mROW           0          0          0          1
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C108	IRREGULAR	18mROW	0	0	0	1
C109	IRREGULAR	18mROW	0	0	0	1
C11	IRREGULAR	24mROW	0	0	0	1
C110	IRREGULAR	18mROW	0	0	0	1
C111	IRREGULAR	18mROW	0	0	0	1
C112	IRREGULAR	18mROW	0	0	0	1
C113	IRREGULAR	18mROW	0	0	0	1
C114	IRREGULAR	20mROW	0	0	0	1
C115	IRREGULAR	20mROW	0	0	0	1
C116	IRREGULAR	20mROW	0	0	0	1
C117	IRREGULAR	20mROW	0	0	0	1
C118	IRREGULAR	20mROW	0	0	0	1
C119	IRREGULAR	20mROW	0	0	0	1
C12	IRREGULAR	24mROW	0	0	0	1
C120	IRREGULAR	20mROW	0	0	0	1
C121	IRREGULAR	18mROW	0	0	0	1
C122	IRREGULAR	18mROW	0	0	0	1
C123	IRREGULAR	18mROW	0	0	0	1
C124	IRREGULAR	18mROW	0	0	0	1
C125	IRREGULAR	18mROW	0	0	0	1
C126	IRREGULAR	18mROW	0	0	0	1
C127	IRREGULAR	18mROW	0	0	0	1
C128	TRIANGULAR	0.6	3.6	0	0	1
C129	TRIANGULAR	0.6	3.6	0	0	1
C13	IRREGULAR	24mROW	0	0	0	1
C130	TRIANGULAR	0.6	3.6	0	0	1
C131	TRIANGULAR	0.6	3.6	0	0	1
C132	TRIANGULAR	0.6	3.6	0	0	1
C133	IRREGULAR	8.5mROW	0	0	0	1
C134	TRIANGULAR	0.6	3.5	0	0	1
C135	TRIANGULAR	0.6	3.6	0	0	1
C136	TRAPEZOIDAL	0.15	2	44	44	1
C137	IRREGULAR	18mROW	0	0	0	1
C138	TRIANGULAR	0.6	3.6	0	0	1
C139	TRIANGULAR	0.6	3.6	0	0	1
C14	IRREGULAR	24mROW	0	0	0	1
C140	IRREGULAR	18mROW	0	0	0	1
C141	IRREGULAR	18mROW	0	0	0	1
C142	IRREGULAR	18mROW	0	0	0	1
C143	TRIANGULAR	0.6	3.6	0	0	1
C144	TRIANGULAR	0.6	3.6	0	0	1
C145	TRIANGULAR	0.6	3.6	0	0	1
C146	TRAPEZOIDAL	0.6	3	5	5	1
C147	IRREGULAR	Block88&149	0	0	0	1
C148	TRIANGULAR	0.6	3.6	0	0	1
C149	IRREGULAR	18mROW	0	0	0	1
C15	IRREGULAR	24mROW	0	0	0	1
C150	IRREGULAR	18mROW	0	0	0	1
C151	TRIANGULAR	0.6	3.6	0	0	1
C152	TRIANGULAR	0.6	3.6	0	0	1
C153	TRAPEZOIDAL	0.15	2	41	41	1

C154	RECT_CLOSED	1.8	3	0	0	1
C155	CIRCULAR	1.8	0	0	0	1
C156	CIRCULAR	2.4	0	0	0	1
C157	CIRCULAR	2.4	0	0	0	1
C158	CIRCULAR	1.5	0	0	0	1
C159	CIRCULAR	1.35	0	0	0	1
C16	IRREGULAR	24mROW	0	0	0	1
C160	CIRCULAR	1.35	0	0	0	1
C161	CIRCULAR	1.05	0	0	0	1
C162	CIRCULAR	1.05	0	0	0	1
C163	TRIANGULAR	0.6	3.6	0	0	1
C164	IRREGULAR	24mROW	0	0	0	1
C165	TRAPEZOIDAL	0.5	20	3	3	1
C166	TRAPEZOIDAL	0.4	3	10	10	1
C167	TRAPEZOIDAL	2.2	2.4	3	3	1
C168	IRREGULAR	18mROW_half	0	0	0	1
C169	CIRCULAR	0.675	0	0	0	1
C17	IRREGULAR	24mROW	0	0	0	1
C170	CIRCULAR	0.675	0	0	0	1
C171	CIRCULAR	1.05	0	0	0	1
C172	CIRCULAR	0.6	0	0	0	1
C173	CIRCULAR	0.9	0	0	0	1
C174	IRREGULAR	8.5mROW	0	0	0	1
C175	IRREGULAR	24mROW	0	0	0	1
C176	TRAPEZOIDAL	2.2	2.4	3	3	1
C177	CIRCULAR	0.6	0	0	0	1
C178	CIRCULAR	0.75	0	0	0	1
C179	CIRCULAR	0.375	0	0	0	1
C18	IRREGULAR	18mROW	0	0	0	1
C180	IRREGULAR	24mROW	0	0	0	1
C181	IRREGULAR	24mROW	0	0	0	1
C182	CIRCULAR	1.05	0	0	0	1
C183	CIRCULAR	0.825	0	0	0	1
C184	IRREGULAR	8.5mROW	0	0	0	1
C19	IRREGULAR	18mROW	0	0	0	1
C2	IRREGULAR	24mROW	0	0	0	1
C20	IRREGULAR	18mROW	0	0	0	1
C21	IRREGULAR	18mROW	0	0	0	1
C22	IRREGULAR	18mROW	0	0	0	1
C23	IRREGULAR	18mROW	0	0	0	1
C24	IRREGULAR	18mROW	0	0	0	1
C25	IRREGULAR	18mROW	0	0	0	1
C26	IRREGULAR	18mROW	0	0	0	1
C27	IRREGULAR	18mROW	0	0	0	1
C28	IRREGULAR	18mROW	0	0	0	1
C29	IRREGULAR	18mROW	0	0	0	1
C3	IRREGULAR	24mROW	0	0	0	1
C30	IRREGULAR	18mROW	0	0	0	1
C31	IRREGULAR	18mROW	0	0	0	1
C32	IRREGULAR	18mROW	0	0	0	1
C33	IRREGULAR	18mROW	0	0	0	1

C34	IRREGULAR	18mROW	0	0	0	1
C35	IRREGULAR	18mROW	0	0	0	1
C36	IRREGULAR	18mROW	0	0	0	1
C37	IRREGULAR	18mROW	0	0	0	1
C38	IRREGULAR	18mROW	0	0	0	1
C39	IRREGULAR	18mROW	0	0	0	1
C4	IRREGULAR	24mROW	0	0	0	1
C40	IRREGULAR	18mROW	0	0	0	1
C41	IRREGULAR	18mROW	0	0	0	1
C42	IRREGULAR	18mROW	0	0	0	1
C43	IRREGULAR	18mROW	0	0	0	1
C44	IRREGULAR	18mROW	0	0	0	1
C45	IRREGULAR	18mROW	0	0	0	1
C46	IRREGULAR	18mROW	0	0	0	1
C47	IRREGULAR	18mROW	0	0	0	1
C48	IRREGULAR	18mROW	0	0	0	1
C49	IRREGULAR	18mROW	0	0	0	1
C5	IRREGULAR	24mROW	0	0	0	1
C50	IRREGULAR	18mROW	0	0	0	1
C51	IRREGULAR	18mROW	0	0	0	1
C52	IRREGULAR	18mROW	0	0	0	1
C53	IRREGULAR	18mROW	0	0	0	1
C54	IRREGULAR	18mROW	0	0	0	1
C55	IRREGULAR	18mROW	0	0	0	1
C56	IRREGULAR	18mROW	0	0	0	1
C57	IRREGULAR	18mROW	0	0	0	1
C58	IRREGULAR	18mROW	0	0	0	1
C59	IRREGULAR	18mROW	0	0	0	1
C6	IRREGULAR	24mROW	0	0	0	1
C60	IRREGULAR	18mROW	0	0	0	1
C61	IRREGULAR	18mROW	0	0	0	1
C62	IRREGULAR	18mROW	0	0	0	1
C63	IRREGULAR	18mROW	0	0	0	1
C64	IRREGULAR	18mROW	0	0	0	1
C65	IRREGULAR	18mROW	0	0	0	1
C66	IRREGULAR	18mROW	0	0	0	1
C67	IRREGULAR	18mROW	0	0	0	1
C68	IRREGULAR	18mROW	0	0	0	1
C69	IRREGULAR	18mROW	0	0	0	1
C7	IRREGULAR	24mROW	0	0	0	1
C70	IRREGULAR	18mROW	0	0	0	1
C71	IRREGULAR	18mROW	0	0	0	1
C72	IRREGULAR	18mROW	0	0	0	1
C73	IRREGULAR	18mROW	0	0	0	1
C74	IRREGULAR	18mROW	0	0	0	1
C75	IRREGULAR	18mROW	0	0	0	1
C76	IRREGULAR	18mROW	0	0	0	1
C77	IRREGULAR	18mROW	0	0	0	1
C78	IRREGULAR	18mROW	0	0	0	1
C79	IRREGULAR	18mROW	0	0	0	1
C8	IRREGULAR	24mROW	0	0	0	1

C80	IRREGULAR	18mROW	0	0	0	1
C81	IRREGULAR	18mROW	0	0	0	1
C82	IRREGULAR	18mROW	0	0	0	1
C83	IRREGULAR	18mROW	0	0	0	1
C84	IRREGULAR	18mROW	0	0	0	1
C85	TRIANGULAR	0.6	3.6	0	0	1
C86	IRREGULAR	18mROW	0	0	0	1
C87	IRREGULAR	18mROW	0	0	0	1
C88	IRREGULAR	8.5mROW	0	0	0	1
C89	IRREGULAR	Block88&149	0	0	0	1
C9	IRREGULAR	24mROW	0	0	0	1
C90	IRREGULAR	18mROW	0	0	0	1
C91	IRREGULAR	18mROW	0	0	0	1
C92	IRREGULAR	18mROW	0	0	0	1
C93	IRREGULAR	18mROW	0	0	0	1
C94	IRREGULAR	18mROW	0	0	0	1
C95	IRREGULAR	18mROW	0	0	0	1
C96	IRREGULAR	18mROW	0	0	0	1
C97	IRREGULAR	18mROW	0	0	0	1
C98	IRREGULAR	18mROW	0	0	0	1
C99	IRREGULAR	18mROW	0	0	0	1
F101A-IC	CIRCULAR	0.6	0	0	0	1
outlet	RECT_CLOSED	1.5	1.8	0	0	1
Pipe_-_(131)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(132)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(133)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(134)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(234)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(234)_(1)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(235)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(238)	CIRCULAR	2.1	0	0	0	1
Pipe_-_(240)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(241)_(1)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(245)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(253)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(263)	Rect_Closed	1.8	3	0	0	1
Pipe_-_(264)	CIRCULAR	2.1	0	0	0	1
Pipe_-_(267)	CIRCULAR	2.1	0	0	0	1
Pipe_-_(329)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(330)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(331)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(332)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(333)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(334)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(335)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(337)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(338)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(344)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(345)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(346)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(347)	CIRCULAR	1.5	0	0	0	1

Pipe_-_(349)	CIRCULAR	1.2	0	0	0	1
Pipe_-_(350)	CIRCULAR	1.2	0	0	0	1
Pipe_-_(351)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(352)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(354)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(360)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(366)	CIRCULAR	1.95	0	0	0	1
Pipe_-_(367)	CIRCULAR	1.8	0	0	0	1
Pipe_-_(368)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(4)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(43)	CIRCULAR	1.5	0	0	0	1
Pipe_-_(44)	CIRCULAR	1.5	0	0	0	1
Pipe_-_(45)	CIRCULAR	1.35	0	0	0	1
Pipe_-_(47)	CIRCULAR	1.05	0	0	0	1
Pipe_-_(48)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(49)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(5)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(50)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(51)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(52)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(52)_(1)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(53)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(54)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(54)_(1)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(56)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(57)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(58)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(58)_(1)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(59)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(6)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(60)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(73)	CIRCULAR	0.975	0	0	0	1
Pipe_-_(77)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(84)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(85)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(87)	CIRCULAR	0.3	0	0	0	1
C107A-IC(1)	CIRCULAR	0.095	0	0	0	
C107A-IC(2)	CIRCULAR	0.095	0	0	0	
C109A-IC(1)	CIRCULAR	0.165	0	0	0	
C109A-IC(2)	CIRCULAR	0.165	0	0	0	
C109B-IC(1)	CIRCULAR	0.178	0	0	0	
C109B-IC(2)	CIRCULAR	0.178	0	0	0	
C110A-IC(1)	CIRCULAR	0.108	0	0	0	
C121AA-IC(1)	CIRCULAR	0.083	0	0	0	
C121AA-IC(2)	CIRCULAR	0.083	0	0	0	
C121A-IC(1)	CIRCULAR	0.152	0	0	0	
C121A-IC(2)	CIRCULAR	0.152	0	0	0	
C123A-IC(1)	CIRCULAR	0.102	0	0	0	
C123A-IC(2)	CIRCULAR	0.102	0	0	0	
C205A-IC(1)	CIRCULAR	0.127	0	0	0	
C205A-IC(2)	CIRCULAR	0.152	0	0	0	
C219-IC	CIRCULAR	0.102	0	0	0	
C220A-IC(1)	CIRCULAR	0.191	0	0	0	
C220A-IC(2)	CIRCULAR	0.191	0	0	0	
C222A-IC(1)	CIRCULAR	0.203	0	0	0	
C222A-IC(2)	CIRCULAR	0.203	0	0	0	
C223A-IC(1)	CIRCULAR	0.152	0	0	0	
G234C-IC	CIRCULAR	0.102	0	0	0	
L102A-IC(1)	CIRCULAR	0.083	0	0	0	
L102A-IC(2)	CIRCULAR	0.083	0	0	0	
L103A-IC(1)	CIRCULAR	0.127	0	0	0	
L103A-IC(2)	CIRCULAR	0.127	0	0	0	
L103B-IC(1)	CIRCULAR	0.083	0	0	0	
L103B-IC(2)	CIRCULAR	0.083	0	0	0	
L103C-IC	CIRCULAR	0.14	0	0	0	

```
L103D-IC        CIRCULAR    0.127       0       0       0
L104A-IC(1)     CIRCULAR    0.108       0       0       0
L104A-IC(2)     CIRCULAR    0.108       0       0       0
L105A-IC(1)     CIRCULAR    0.108       0       0       0
L105A-IC(2)     CIRCULAR    0.108       0       0       0
L106A-IC(1)     CIRCULAR    0.102       0       0       0
L106A-IC(2)     CIRCULAR    0.102       0       0       0
L106B-IC(1)     CIRCULAR    0.083       0       0       0
L112A-IC(1)     CIRCULAR    0.127       0       0       0
L112A-IC(2)     CIRCULAR    0.127       0       0       0
L113A-IC(1)     CIRCULAR    0.108       0       0       0
L113A-IC(2)     CIRCULAR    0.108       0       0       0
L113B-IC        CIRCULAR    0.108       0       0       0
L114A-IC        CIRCULAR    0.108       0       0       0
L115A-IC(1)     CIRCULAR    0.083       0       0       0
L115A-IC(2)     CIRCULAR    0.083       0       0       0
L116A-IC(1)     CIRCULAR    0.095       0       0       0
L116A-IC(2)     CIRCULAR    0.095       0       0       0
L117A-IC(1)     CIRCULAR    0.127       0       0       0
L117A-IC(2)     CIRCULAR    0.127       0       0       0
L117B-IC(1)     CIRCULAR    0.083       0       0       0
L117B-IC(2)     CIRCULAR    0.083       0       0       0
L117C-IC        CIRCULAR    0.14        0       0       0
L118A-IC(1)     CIRCULAR    0.127       0       0       0
L118A-IC(2)     CIRCULAR    0.127       0       0       0
L119A-IC(1)     CIRCULAR    0.108       0       0       0
L119A-IC(2)     CIRCULAR    0.108       0       0       0
L124A-IC(1)     CIRCULAR    0.095       0       0       0
L124A-IC(2)     CIRCULAR    0.095       0       0       0
L124B-IC        CIRCULAR    0.095       0       0       0
L126A-IC(1)     CIRCULAR    0.083       0       0       0
L126B-IC(1)     CIRCULAR    0.102       0       0       0
L126B-IC(2)     CIRCULAR    0.102       0       0       0
L126C-IC        CIRCULAR    0.083       0       0       0
L127A-IC(1)     CIRCULAR    0.127       0       0       0
L127A-IC(2)     CIRCULAR    0.127       0       0       0
L128A-IC(1)     CIRCULAR    0.102       0       0       0
L128A-IC(2)     CIRCULAR    0.102       0       0       0
L130A-IC(1)     CIRCULAR    0.127       0       0       0
L130A-IC(2)     CIRCULAR    0.127       0       0       0
L130B-IC        CIRCULAR    0.108       0       0       0
L202A-IC(1)     CIRCULAR    0.083       0       0       0
L202A-IC(2)     CIRCULAR    0.083       0       0       0
L202B-IC        CIRCULAR    0.108       0       0       0
L204A-IC(1)     CIRCULAR    0.127       0       0       0
L204A-IC(2)     CIRCULAR    0.127       0       0       0
L204B-IC(1)     CIRCULAR    0.127       0       0       0
L204B-IC(2)     CIRCULAR    0.127       0       0       0
L204C-IC        CIRCULAR    0.108       0       0       0
L205B-IC        CIRCULAR    0.127       0       0       0
L206A-IC(1)     CIRCULAR    0.108       0       0       0
L206A-IC(2)     CIRCULAR    0.108       0       0       0
L206B-IC(1)     CIRCULAR    0.14        0       0       0
L207A-IC(1)     CIRCULAR    0.152       0       0       0
L207A-IC(2)     CIRCULAR    0.152       0       0       0
L209A-IC(1)     CIRCULAR    0.127       0       0       0
L209A-IC(2)     CIRCULAR    0.127       0       0       0
L209B-IC        CIRCULAR    0.102       0       0       0
L209C-IC        CIRCULAR    0.108       0       0       0
L210A-IC(1)     CIRCULAR    0.108       0       0       0
L210A-IC(2)     CIRCULAR    0.127       0       0       0
L211A-IC(1)     CIRCULAR    0.127       0       0       0
L211A-IC(2)     CIRCULAR    0.127       0       0       0
L212A-IC1       CIRCULAR    0.083       0       0       0
L212A-IC2       CIRCULAR    0.083       0       0       0
L213A-IC(1)     CIRCULAR    0.095       0       0       0
L213A-IC(2)     CIRCULAR    0.095       0       0       0
L214A-IC(1)     CIRCULAR    0.152       0       0       0
L214A-IC(2)     CIRCULAR    0.152       0       0       0
L217A-IC(1)     CIRCULAR    0.127       0       0       0
L217A-IC(2)     CIRCULAR    0.127       0       0       0
L218B-IC        CIRCULAR    0.095       0       0       0
L219B-IC(1)     CIRCULAR    0.127       0       0       0
L219B-IC(2)     CIRCULAR    0.152       0       0       0
L220A-S         CIRCULAR    0.178       0       0       0
L225A-IC(1)     CIRCULAR    0.108       0       0       0
L225A-IC_(2)    CIRCULAR    0.108       0       0       0
L225C-IC(1)     CIRCULAR    0.127       0       0       0
L225C-IC(2)     CIRCULAR    0.108       0       0       0
L228A-IC(1)     CIRCULAR    0.127       0       0       0
L228A-IC(2)     CIRCULAR    0.152       0       0       0
L229A-IC(1)     CIRCULAR    0.108       0       0       0
L229A-IC(2)     CIRCULAR    0.108       0       0       0
L234A-IC1       CIRCULAR    0.095       0       0       0
L234A-IC2       CIRCULAR    0.095       0       0       0
L234B-IC1       CIRCULAR    0.095       0       0       0
L234B-IC2       CIRCULAR    0.095       0       0       0
L234D-IC        CIRCULAR    0.152       0       0       0
L235A-IC1       CIRCULAR    0.178       0       0       0
L235A-IC2       CIRCULAR    0.178       0       0       0
L240A-IC(1)     CIRCULAR    0.083       0       0       0
L240A-IC(2)     CIRCULAR    0.083       0       0       0
L241A-IC(1)     CIRCULAR    0.108       0       0       0
L241A-IC(2)     CIRCULAR    0.108       0       0       0
L241B-IC(1)     CIRCULAR    0.127       0       0       0
L241B-IC(2)     CIRCULAR    0.127       0       0       0
OR1             CIRCULAR    0.45        0       0       0
Spillway        RECT_OPEN   0.6         20      10      10
W2              RECT_OPEN   0.8         2       0       0

[TRANSECTS]
;;Transect Data in HEC-2 format
```

```
;
;Full street, width = 10m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.014
X1 10mROW            7        4        14       0.0      0.0      0.0      0.0
 0.0
GR 0.23     0        0.15     4        0        4        0.1      9        0
 14
GR 0.15     14       0.23     18
;
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.013
X1 16.5mROW          7        4        12.5     0.0      0.0      0.0      0.0
 0.0
GR 0.23     0        0.15     4        0        4        0.13     8.25     0
 12.5
GR 0.15     12.5     0.23     16.5
;
;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.013
X1 16.5mROW_half     4        0.0      4.25     0.0      0.0      0.0      0.0
 0.0
GR 0.13     0        0        4.25     0.15     4.25     0.23     8.25
;
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.245m.
NC 0.025    0.025    0.013
X1 18mROW            7        10       18.5     0.0      0.0      0.0      0.0
 0.0
GR 0.35     0        0.15     10       0        10       0.13     14.25    0
 18.5
GR 0.15     18.5     0.35     28.5
;
;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.245m.
NC 0.02     0.02     0.013
X1 18mROW_half       4        0.0      4.25     0.0      0.0      0.0      0.0
 0.0
GR 0.13     0        0        4.25     0.15     4.25     0.25     9
;
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.27m.
NC 0.025    0.025    0.013
X1 20mROW            7        10       18.5     0.0      0.0      0.0      0.0
 0.0
GR 0.35     0        0.15     10       0        10       0.13     14.25    0
 18.5
GR 0.15     18.5     0.35     28.5
;
```

```
;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.27m.
NC 0.02     0.02     0.013
X1 20mROW_half       4        0.0      4.25     0.0      0.0      0.0      0.0
 0.0
GR 0.13     0        0        4.25     0.15     4.25     0.27     10
;
;Full street, width = 24m, curb = 0.15m , cross-slope = 0.016m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.025    0.025    0.014
X1 24mROW            7        10       21       0.0      0.0      0.0      0.0
 0.0
GR 0.35     0        0.15     10       0        10       0.165    15.5     0
 21
GR 0.15     21       0.35     31
;
;Half street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.28m.
NC 0.02     0.02     0.013
X1 24mROW_half       4        0.0      5.5      0.0      0.0      0.0      0.0
 0.0
GR 0.17     0        0        5.5      0.15     5.5      0.28     12
;
;Full street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.025    0.025    0.013
X1 8.5mROW           7        10       15.5     0.0      0.0      0.0      0.0
 0.0
GR 0.35     0        0.15     10       0        10       0.13     12.75    0
 15.5
GR 0.15     15.5     0.35     25.5
;
;Half street, width = 2.75m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.18m.
NC 0.02     0.02     0.013
X1 8.5mROW_half      4        0.0      2.75     0.0      0.0      0.0      0.0
 0.0
GR 0.08     0        0        2.75     0.15     2.75     0.18     4.25
;
NC 0.025    0.025    0.013
X1 Block88&149       6        3        6        0.0      0.0      0.0      0.0
 0.0
GR 0.15     0        0        1.5      0        3        0        6        0
 7.5
GR 0.15     9
;
NC 0.25     0.25     0.25
X1 RYswale           3        0        2        0.0      0.0      0.0      0.0
 0.0
GR 0.3      0        0        1        0.3      2
```

```
[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
C152             0          0.64       0          NO         0
C154             0          0.39       0          NO         0
C156             0          0.06       0          NO         0
C158             0          1.344      0          NO         0
C159             0          0.64       0          NO         0
C161             0          1.344      0          NO         0
C169             0          0.06       0          NO         0
C170             0          1.344      0          NO         0
C171             0          0.06       0          NO         0
C172             0          1.32       0          NO         0
C177             0          1.32       0          NO         0
C178             0          0.216      0          NO         0
C179             0          1.344      0          NO         0
C182             0          1.344      0          NO         0
C183             0          1.32       0          NO         0
F101A-IC         0          1.323      0          NO         0
Pipe_-_(131)     0          1.344      0          NO         0
Pipe_-_(132)     0          0.06       0          NO         0
Pipe_-_(133)     0          0.64       0          NO         0
Pipe_-_(134)     0          0.64       0          NO         0
Pipe_-_(234)     0          1.32       0          NO         0
Pipe_-_(234)_(1) 0          0.06       0          NO         0
Pipe_-_(235)     0          0.06       0          NO         0
Pipe_-_(238)     0          0.06       0          NO         0
Pipe_-_(240)     0          0.06       0          NO         0
Pipe_-_(241)_(1) 0          0.14       0          NO         0
Pipe_-_(245)     0          1.32       0          NO         0
Pipe_-_(253)     0          0.06       0          NO         0
Pipe_-_(263)     0          0.06       0          NO         0
Pipe_-_(264)     0          0.06       0          NO         0
Pipe_-_(267)     0          0.06       0          NO         0
Pipe_-_(329)     0          0.405      0          NO         0
Pipe_-_(330)     0          0.39       0          NO         0
Pipe_-_(331)     0          0.06       0          NO         0
Pipe_-_(332)     0          0.39       0          NO         0
Pipe_-_(333)     0          0.405      0          NO         0
Pipe_-_(334)     0          1.32       0          NO         0
Pipe_-_(335)     0          0.14       0          NO         0
Pipe_-_(337)     0          1.32       0          NO         0
Pipe_-_(338)     0          0.06       0          NO         0
Pipe_-_(344)     0          0.06       0          NO         0
Pipe_-_(345)     0          0.06       0          NO         0
Pipe_-_(346)     0          0.06       0          NO         0
Pipe_-_(347)     0          1.344      0          NO         0
Pipe_-_(349)     0          0.14       0          NO         0
Pipe_-_(350)     0          0.06       0          NO         0
Pipe_-_(351)     0          0.06       0          NO         0
Pipe_-_(352)     0          0.06       0          NO         0
Pipe_-_(354)     0          0.06       0          NO         0
Pipe_-_(360)     0          0.06       0          NO         0
Pipe_-_(366)     0          1.32       0          NO         0
Pipe_-_(367)     0          0.06       0          NO         0
Pipe_-_(368)     0          0.06       0          NO         0
Pipe_-_(4)       0          1.32       0          NO         0
Pipe_-_(43)      0          1.344      0          NO         0
Pipe_-_(44)      0          0.06       0          NO         0
Pipe_-_(45)      0          0.06       0          NO         0
Pipe_-_(47)      0          1.32       0          NO         0
Pipe_-_(48)      0          0.06       0          NO         0
Pipe_-_(49)      0          1.32       0          NO         0
Pipe_-_(5)       0          0.39       0          NO         0
Pipe_-_(50)      0          1.32       0          NO         0
Pipe_-_(51)      0          0.64       0          NO         0
Pipe_-_(52)      0          0.64       0          NO         0
Pipe_-_(52)_(1)  0          0.06       0          NO         0
Pipe_-_(53)      0          0.64       0          NO         0
Pipe_-_(54)      0          0.39       0          NO         0
Pipe_-_(54)_(1)  0          0.06       0          NO         0
Pipe_-_(56)      0          0.06       0          NO         0
Pipe_-_(57)      0          0.14       0          NO         0
Pipe_-_(58)      0          1.32       0          NO         0
Pipe_-_(58)_(1)  0          0.06       0          NO         0
Pipe_-_(59)      0          0.39       0          NO         0
Pipe_-_(6)       0          0.64       0          NO         0
Pipe_-_(60)      0          0.64       0          NO         0
Pipe_-_(73)      0          1.32       0          NO         0
Pipe_-_(77)      0          0.02       0          NO         0
Pipe_-_(84)      0          0.021      0          NO         0
Pipe_-_(85)      0          0.39       0          NO         0
Pipe_-_(87)      0          0.39       0          NO         0

[INFLOWS]
;;Node           Constituent      Time Series      Type     Mfactor  Sfactor
Baseline Pattern
;;-------------- ---------------- ---------------- -------- -------- --------
-------- --------
209              FLOW             Fairwinds_100CHI_mod FLOW     1.0      1
0
212              FLOW             Trinity_100CHI   FLOW     1.0      1        0


[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL
```

```
[TAGS]
Subcatch   Arterial        Arterial
Subcatch   B-1             Residential
Subcatch   B-2             Arterial
Subcatch   C107A           Road
Subcatch   C109A           Road
Subcatch   C109B           Road
Subcatch   C110A           Road
Subcatch   C121A           Road
Subcatch   C121AA          Road
Subcatch   C123A           Road
Subcatch   C205A           Road_rev_2025
Subcatch   C206B           Road
Subcatch   C219A           Road
Subcatch   C220A           Road_rev_2025
Subcatch   C222A           Road
Subcatch   C223A           Road
Subcatch   Comm            Commercial
Subcatch   EXT1            Road
Subcatch   EXT2            Road
Subcatch   EXT-4           2023_rev
Subcatch   EXT5            RY
Subcatch   EXT6            RY
Subcatch   F101A-1A        KWPumpStation
Subcatch   G234C           Park_2023_rev
Subcatch   Hazeldean       Arterial
Subcatch   L102A           Road
Subcatch   L103A           Road
Subcatch   L103B           Road
Subcatch   L103C           RY
Subcatch   L103D           RY
Subcatch   L104A           Road
Subcatch   L105A           Road
Subcatch   L106A           Road
Subcatch   L106B           Road
Subcatch   L112A           Road
Subcatch   L113A           Road
Subcatch   L113B           RY
Subcatch   L114A           Road
Subcatch   L115A           Road
Subcatch   L116A           Road
Subcatch   L117A           Road
Subcatch   L117B           Road
Subcatch   L117C           RY
Subcatch   L118A           Road
Subcatch   L119A           Road
Subcatch   L121B           Residential
Subcatch   L123B           Residential
Subcatch   L124A           Road
Subcatch   L124B           RY
Subcatch   L126A           Road
Subcatch   L126B           Road
Subcatch   L126C           Park
Subcatch   L127A           Road
Subcatch   L128A           Road
Subcatch   L130A           Road
Subcatch   L130B           RY
Subcatch   L202A           Road_rev_2025
Subcatch   L202B           RY
Subcatch   L204A           Road_rev_2025
Subcatch   L204B           Road_rev_2025
Subcatch   L204C           RY-rev_2025
Subcatch   L205B           RY-rev_2025
Subcatch   L206A           Road
Subcatch   L207A           Road
Subcatch   L209A           Road_rev_2025
Subcatch   L209B           Road_rev_2025
Subcatch   L209C           RY_rev_2025
Subcatch   L210A           Road_rev_2025
Subcatch   L211A           Road
Subcatch   L212A           Road
Subcatch   L213A           Road_rev_2025
Subcatch   L214A           Road
Subcatch   L217A           Road
Subcatch   L218A           School
Subcatch   L218B           RY
Subcatch   L219B           Road_rev_2025
Subcatch   L220A           RY_rev_2025
Subcatch   L225A           Road_rev_2025
Subcatch   L225B           Med-Dens_rev_2025
Subcatch   L225C           Road_rev_2025
Subcatch   L228A           Road_rev_2025
Subcatch   L229A           Road_rev_2025
Subcatch   L234A           Road_2023_rev
Subcatch   L234B           Road
Subcatch   L234D           RY_2023_rev
Subcatch   L235A           Road_2023_rev
Subcatch   L235B           Med_Dens_2023_rev
Subcatch   L240A           Road_rev_2025
Subcatch   L241A           Road_rev_2025
Subcatch   L241B           Road_rev_2025
Subcatch   POND            Ult_pond5
Subcatch   UNC-1           UNC-SCHOOL
Subcatch   UNC-10          Unc-235B_2023_rev
Subcatch   UNC-11          Unc-235B_2023_rev
Subcatch   UNC-2           UNC-SCHOOL
Subcatch   UNC-3           UNC-SCHOOL
Subcatch   UNC-4           UNC-SCHOOL
Subcatch   UNC-5           Unc225B_rev_2025
Subcatch   UNC-6           Unc225B_rev_2025
Subcatch   UNC-7           UNC-RES
Subcatch   UNC-8           Unc225B_rev_2025
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Subcatch	UNC-9	Unc235B_2023_rev
Node	100A	MH
Node	100B	MH
Node	100C	MH
Node	100D	MH
Node	100E	MH
Node	101	MH-REV
Node	102	MH-REV
Node	102A	MH-NEW
Node	103	MH-REV
Node	104	MH-REV
Node	105	MH-REV
Node	106	MH-REV
Node	107	MH-REV
Node	108	MH-REV
Node	109	MH-REV
Node	110	MH-REV
Node	111	MH-REV
Node	112	MH-REV
Node	113	MH-REV
Node	114	MH-REV
Node	115	MH-REV
Node	115A	MH-NEW
Node	116	MH-REV
Node	117	MH-REV
Node	118	MH-REV
Node	119	MH-REV
Node	121	MH-REV
Node	121A	MH-NEW
Node	121B-S	COMMERCIAL
Node	123	MH-REV
Node	123B-S	MED.RESIDENTIAL
Node	124	MH-REV
Node	125	MH-REV
Node	126	MH-REV
Node	126C-S	UN
Node	127	MH-REV
Node	128	MH-REV
Node	129	MH-REV
Node	130	MH-REV
Node	131	MH-REV
Node	132	MH-REV
Node	201	MH-REV
Node	202	MH-REV
Node	203A-S	MJ-REV-2025
Node	204	MH-REV
Node	204A-S(1)	MJ-REV-2025
Node	204BS(1)	MJ-REV-2025
Node	205	MH-REV
Node	206	MH-REV
Node	206B-Sl	2023_rev_MJ
Node	207	MH-REV
Node	209	MH-REV
Node	209B-S(1)	MJ-REV-2025
Node	210	MH-REV
Node	211	MH-REV
Node	212	MH-REV
Node	213	MH-REV
Node	214	MH-REV
Node	214A-S(1)	2023_rev_MJ
Node	215	MH-REV
Node	216	MH-REV
Node	217	MH-REV
Node	218	MH-REV
Node	219	MH-REV
Node	219B-S	2023_rev_MJ
Node	220	MH-REV
Node	220A-S	2023_rev_MJ
Node	221	MH-REV
Node	222	MH-REV
Node	223	MH-REV-2025
Node	224	MH-REV-2025
Node	225	MH-REV-2025
Node	225A-S	MJ-REV-2025
Node	225C-S	MJ-REV-2025
Node	225C-S(1)	MJ-REV-2025
Node	226	MH-REV-2025
Node	227	MH-REV-2025
Node	228	MH-REV-2025
Node	228A-S	MJ-REV-2025
Node	228A-S(1)	MJ-REV-2025
Node	229	MH-REV-2025
Node	229A-S	MJ-REV-2025
Node	229A-S(1)	MJ-REV-2025
Node	230	MH-REV-2025
Node	231	MH-REV-2025
Node	232	MH-REV
Node	233	MH-REV
Node	234	2023_rev
Node	234A-S	2023_rev_MJ
Node	235	2023_rev
Node	235A-S	2023_rev_MJ
Node	235A-S(1)	2023_rev_MJ
Node	236	2023_rev
Node	237	2023_rev
Node	240	MH-REV-2025
Node	240A-S	MJ-REV-2025
Node	240A-S(1)	MJ-REV-2025
Node	241	MH-REV-2025
Node	241A-S	MJ-REV-2025
Node	241A-S(1)	MJ-REV-2025
Node	241B-S	MJ-REV-2025

Node	241B-S(1)	MJ-REV-2025
Node	242	MH-REV-2025
Node	Comm-S	COMMERCIAL
Node	EXT-4-S	2023_rev_MJ
Node	F101A(2)	Channel
Node	F101A-S	PUMP
Node	G234C-S	PARK
Node	HW7	MH
Node	J2	MH
Node	J3	MH
Node	J4	MH
Node	L218A-S	SCHOOL
Node	L225B-S	MJ-REV-2025
Node	L235B-S	2023_rev_MJ
Node	POND-S1	POND
Node	RY103C-S	RY
Node	RY103D-S	RY
Node	RY113B-S	RY
Node	RY117C-S	RY
Node	RY124B-S	RY
Node	RY130B-S	RY
Node	RY202B-S	2023_rev_RY
Node	RY204C-S	RY-REV-2025
Node	RY205B-S	RY
Node	RY209C-S	2023_rev_RY
Node	RY218B-S	RY
Node	RY220A-S	2023_rev_RY
Node	RY234D-S	2023_rev_RY
Link	C1	MJ
Link	C10	MJ
Link	C100	MJ
Link	C101	MJ
Link	C102	MJ
Link	C103	MJ
Link	C104	MJ
Link	C105	MJ
Link	C106	MJ
Link	C107	MJ
Link	C108	MJ-REV-2025
Link	C109	MJ-REV-2025
Link	C11	2023_rev_MJ
Link	C110	MJ-REV-2025
Link	C111	MJ-REV-2025
Link	C112	MJ
Link	C113	MJ
Link	C114	MJ
Link	C115	MJ
Link	C116	2023_rev_MJ
Link	C117	2023_rev_MJ
Link	C118	MJ
Link	C119	MJ
Link	C12	2023_rev_MJ
Link	C120	MJ
Link	C121	MJ
Link	C122	MJ
Link	C123	2023_rev_MJ
Link	C124	2023_rev_MJ
Link	C125	MJ
Link	C126	MJ
Link	C127	MJ
Link	C128	MJ
Link	C129	MJ
Link	C13	MJ
Link	C130	MJ
Link	C131	MJ-REV-2025
Link	C132	MJ
Link	C133	2023_rev_MJ
Link	C134	2023_rev_MJ
Link	C135	MJ
Link	C136	MJ
Link	C137	MJ-REV-2025
Link	C138	MJ
Link	C139	MJ
Link	C14	2023_rev_MJ
Link	C140	MJ-REV-2025
Link	C141	MJ
Link	C142	MJ
Link	C143	MJ
Link	C144	MJ
Link	C145	MJ
Link	C146	MJ
Link	C147	2023_rev_MJ
Link	C148	2023_rev_MJ
Link	C149	MJ-REV-2025
Link	C15	MJ
Link	C150	MJ-REV-2025
Link	C151	MJ
Link	C152	MJ
Link	C153	MJ
Link	C16	MJ
Link	C163	MJ
Link	C164	MJ
Link	C165	MJ
Link	C166	MJ
Link	C167	MJ
Link	C168	MJ
Link	C17	MJ
Link	C174	MJ
Link	C175	MJ
Link	C176	MJ
Link	C18	MJ
Link	C180	MJ

Link	C181	MJ
Link	C184	MJ-REV-2025
Link	C19	MJ
Link	C2	MJ
Link	C20	MJ
Link	C21	MJ
Link	C22	MJ
Link	C23	MJ
Link	C24	MJ
Link	C25	MJ
Link	C26	MJ
Link	C27	MJ
Link	C28	MJ
Link	C29	MJ
Link	C3	MJ
Link	C30	MJ
Link	C31	MJ
Link	C32	MJ
Link	C33	MJ
Link	C34	MJ
Link	C35	MJ
Link	C36	MJ
Link	C37	MJ
Link	C38	MJ-REV-2025
Link	C39	MJ-REV-2025
Link	C4	MJ
Link	C40	MJ-REV-2025
Link	C41	MJ-REV-2025
Link	C42	MJ-REV-2025
Link	C43	MJ-REV-2025
Link	C44	MJ-REV-2025
Link	C45	MJ-REV-2025
Link	C46	MJ-REV-2025
Link	C47	2023_rev_MJ
Link	C48	MJ
Link	C49	MJ
Link	C5	MJ
Link	C50	MJ
Link	C51	MJ
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Link	C85	2023_rev_MJ
Link	C86	MJ-REV-2025
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Link	C88	2023_rev_MJ
Link	C89	2023_rev_MJ
Link	C9	MJ
Link	C90	MJ-REV-2025
Link	C91	MJ
Link	C92	MJ
Link	C93	MJ
Link	C94	MJ
Link	C95	MJ
Link	C96	MJ
Link	C97	MJ
Link	C98	MJ
Link	C99	MJ
Link	Pipe_-_(131)	PIPE_REV_2025
Link	Pipe_-_(132)	PIPE_REV_2025
Link	Pipe_-_(133)	PIPE_REV_2025
Link	Pipe_-_(134)	PIPE_REV_2025
Link	Pipe_-_(234)	PIPE-REV
Link	Pipe_-_(234)_(1)	PIPE-REV
Link	Pipe_-_(235)	PIPE-REV
Link	Pipe_-_(238)	PIPE-REV
Link	Pipe_-_(240)	PIPE-REV
Link	Pipe_-_(241)_(1)	PIPE-REV
Link	Pipe_-_(245)	PIPE-REV

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Link       Pipe_-_(253)     PIPE-REV
Link       Pipe_-_(263)     PIPE-REV
Link       Pipe_-_(264)     PIPE-REV
Link       Pipe_-_(267)     PIPE-REV
Link       Pipe_-_(329)     PIPE-REV
Link       Pipe_-_(330)     PIPE-REV
Link       Pipe_-_(331)     PIPE-REV
Link       Pipe_-_(332)     PIPE-REV
Link       Pipe_-_(333)     PIPE-REV
Link       Pipe_-_(334)     PIPE-REV
Link       Pipe_-_(335)     PIPE-REV
Link       Pipe_-_(337)     PIPE-REV
Link       Pipe_-_(338)     PIPE-REV
Link       Pipe_-_(344)     PIPE-REV
Link       Pipe_-_(345)     PIPE-REV
Link       Pipe_-_(346)     PIPE-REV
Link       Pipe_-_(347)     PIPE-REV
Link       Pipe_-_(349)     PIPE-REV
Link       Pipe_-_(350)     PIPE-REV
Link       Pipe_-_(351)     PIPE-REV
Link       Pipe_-_(352)     PIPE-REV
Link       Pipe_-_(354)     PIPE-REV
Link       Pipe_-_(360)     PIPE-REV
Link       Pipe_-_(366)     PIPE-REV
Link       Pipe_-_(367)     PIPE-REV
Link       Pipe_-_(368)     PIPE-REV
Link       Pipe_-_(4)       PIPE-REV
Link       Pipe_-_(43)      PIPE-REV
Link       Pipe_-_(44)      PIPE-REV
Link       Pipe_-_(45)      PIPE-REV
Link       Pipe_-_(47)      PIPE-REV
Link       Pipe_-_(48)      PIPE-REV
Link       Pipe_-_(49)      PIPE-REV
Link       Pipe_-_(5)       PIPE-REV
Link       Pipe_-_(50)      PIPE-REV
Link       Pipe_-_(51)      PIPE_REV_2025
Link       Pipe_-_(52)      PIPE_REV_2025
Link       Pipe_-_(52)_(1)  PIPE_REV_2025
Link       Pipe_-_(53)      PIPE_REV_2025
Link       Pipe_-_(54)      PIPE_REV_2025
Link       Pipe_-_(54)_(1)  PIPE_REV_2025
Link       Pipe_-_(56)      PIPE_REV_2025
Link       Pipe_-_(57)      PIPE_REV_2025
Link       Pipe_-_(58)      PIPE-REV
Link       Pipe_-_(58)_(1)  PIPE-REV
Link       Pipe_-_(59)      PIPE-REV
Link       Pipe_-_(6)       PIPE-REV
Link       Pipe_-_(60)      PIPE-REV
Link       Pipe_-_(73)      PIPE-REV
Link       Pipe_-_(77)      2023_rev
Link       Pipe_-_(84)      2023_rev
Link       Pipe_-_(85)      2023_rev
Link       Pipe_-_(87)      2023_rev
Link       C205A-IC(1)      OR-REV-2025
Link       C220A-IC(1)      2023_rev
Link       C220A-IC(2)      2023_rev
Link       C223A-IC(1)      OR-REV-2025
Link       G234C-IC         2023_rev
Link       L204B-IC(1)      OR-REV-2025
Link       L204B-IC(2)      OR-REV-2025
Link       L204C-IC         OR-REV-2025
Link       L210A-IC(1)      OR-REV-2025
Link       L210A-IC(2)      OR-REV-2025
Link       L214A-IC(1)      2023_rev
Link       L214A-IC(2)      2023_rev
Link       L219B-IC(2)      OR-REV-2025
Link       L220A-S          2023_rev
Link       L225A-IC(1)      OR-REV-2025
Link       L225A-IC_(2)     OR-REV-2025
Link       L225C-IC(1)      OR-REV-2025
Link       L225C-IC(2)      OR-REV-2025
Link       L228A-IC(1)      OR-REV-2025
Link       L228A-IC(2)      OR-REV-2025
Link       L229A-IC(1)      OR-REV-2025
Link       L229A-IC(2)      OR-REV-2025
Link       L234A-IC1        2023_rev
Link       L234A-IC2        2023_rev
Link       L234B-IC1        2023_rev
Link       L234B-IC2        2023_rev
Link       L234D-IC         2023_rev
Link       L235A-IC1        2023_rev
Link       L235A-IC2        2023_rev
Link       L240A-IC(1)      OR-REV-2025
Link       L240A-IC(2)      OR-REV-2025
Link       L241A-IC(1)      OR-REV-2025
Link       L241A-IC(2)      OR-REV-2025
Link       L241B-IC(1)      OR-REV-2025
Link       L241B-IC(2)      OR-REV-2025
Link       L225BIC          OT-REV-2025
Link       L235B-IC         2023_rev

[MAP]
DIMENSIONS       350602.35485     5015790.15005    351623.42215     5017517.10495

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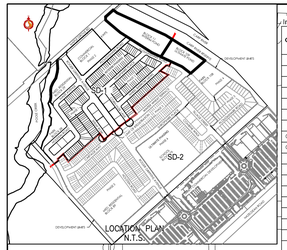
[COORDINATES]
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J6               351254.472         5017274.23
J9               351223.8           5017289
CREEK            351312.702         5016769.271
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CREEK-1	351138.69	5016626.426
OF10	350846.432	5017242.938
OF11	350829.75	5016452.324
OF13	351421.819	5016873.5
OF14	351473.769	5016922.469
OF2	351231.602	5017303.162
OF3	350852.271	5017225.82
OF4	351434.596	5016870.158
OF5	351260.329	5016712.105
OF6	350708.269	5016912.465
OF7	351100.314	5016586.167
OF8	351268.448	5017294.577
OF9	350870.859	5017383.863
100A	351283.5	5017191
100B	351323.8	5017162
100C	351081.9	5017299
100D	351104.3	5017285
100E	351117.3	5017277
101	351096.3	5017272
102	351166.1	5017228
102A	351159.3	5017222
102A-S	351130.255	5017241.892
102A-S(1)	351103.736	5017259.04
102A-S(2)	351070.638	5017239.699
103	351077.2	5017148
103A-S	351116.609	5017175.661
103A-S(1)	351137.816	5017195.285
103B-S	351161.871	5017216.808
104	351012.5	5017090
104A-S	351048.971	5017115.923
104A-S(1)	351076.886	5017141.477
105	351059.4	5017026
105A-S	351017.524	5017090.59
105A-S(1)	351034.319	5017066.244
106	351097	5016974
106A-S	351064.045	5017026.379
106A-S(1)	351084.231	5016997.257
106A-S(2)	351090.431	5016988.355
106B-S	351098.076	5016979.625
107	350974	5017055
107A-S	350980.482	5017055.096
107A-S(1)	350993.326	5017065.83
108	350983.9	5017039
109	351053	5016945
109A-S	351040.468	5016971.27
109A-S(1)	351065.846	5016938.101
109B-S	350996.866	5017029.811
109B-S(1)	351019.656	5017001.615
109B-S(3)	350948.557	5017026.226
110	350941.8	5017026
110A-S	350968.895	5017043.996
111	350940	5017014
112	350964.8	5016981
112A-S	350981.955	5016963.925
112A-S(1)	350961.188	5016991.543
113	351014.6	5016913
113A-S	351025.424	5016900.257
113A-S(1)	351005.576	5016933.417
114	351186.7	5017215
114A-S	351164.962	5017234.333
115	351241.5	5017189
115A	351232.6	5017181
115A-S	351220.223	5017194.316
115A-S(1)	351186.992	5017209.558
116	351294	5017164
116A-S	351268.076	5017172.516
116A-S(1)	351241.846	5017186.695
117	351152.5	5017109
117A-S	351173.926	5017118.366
117A-S(1)	351206.207	5017149.965
117B-S	351227.865	5017170.826
118	351089.8	5017053
118A-S	351122.299	5017072.423
118A-S(1)	351144.724	5017092.332
119	351011.706	5017191.906
119A-S	351050.699	5017220.159
120A-S(1)	351004.241	5017179.882
121	350926	5017120
121A	350894.5	5017163
121AA-S	350887.553	5017173.809
121A-S	350933.835	5017116.806
121A-S(1)	350958.269	5017085.48
121A-S(2)	350958.78	5017137.81
121B-S	350916.27	5017213.829
123	350887.8	5017085
123A-S	350922.185	5017108.245
123B-S	350858.733	5017116.382
124	350834.7	5017038
124A-S	350862.274	5017056.877
124A-S(1)	350897.007	5017088.239
125	350833.8	5017026
126	350888.5	5016951
126A-S	350893.41	5016953.016
126B-S	350884.754	5016964.256
126B-S(1)	350855.17	5017006.635
126B-S(2)	350838.264	5017032.374
126C-S	350827.583	5016950.192
127	350806	5016877
127A-S	350826.859	5016832.77
127A-S(1)	350868.25	5016930.18
128	350911.3	5016919
128A-S(1)	350905.549	5016933.233

129	350910.7	5016907
130	350826.3	5016830
130A-S	350885.879	5016889.733
130A-S(1)	350903.008	5016904.903
131	350838.7	5016815
132	350854.4	5016786
201	351314.6	5017150
202	351258.5	5017099
202A-S	351258.568	5017095.415
202A-S(1)	351304.099	5017136.271
203A-S	351198.458	5017040.192
204	351142.4	5016996
204A-S	351130.529	5016983.014
204A-S(1)	351165.952	5017011.434
204BS(1)	351225.625	5017067.006
205	351060.5	5016936
205A-S	351105.487	5016965.178
205A-S(1)	351093.403	5016956.36
206	350971.2	5016855
206A-S	350965.837	5016844.808
206A-S(1)	350988.843	5016863.397
206B-S	351013.69	5016888.244
206B-S(1)	351054.918	5016923.03
206B-Sl	351084.931	5016910.429
207	350917.2	5016807
207A-S(1)	350929.578	5016812.599
209	350859.4	5016775
209A-S	350887.152	5016783.599
209B-S	350865.679	5016775.046
209B-S(1)	350917.412	5016690.386
210	351314.2	5017040
210A-S	351270.224	5017081.18
211	351396.3	5016952
211A-S	351315.959	5017032.174
211A-S(1)	351360.684	5016985.516
211A-S(2)	351373.225	5016970.024
212	351462.2	5016880
213	351274.4	5017004
213A-S	351307.235	5017025.763
214	351326.1	5016949
214A-S	351272.948	5016995.5
214A-S(1)	351308.036	5016955.539
214A-S(2)	351348.319	5016915.537
215	351364.7	5016908
216	351377.5	5016907
217	351399.7	5016927
217A-S	351403.199	5016921.432
217A-S(1)	351410.009	5016929.161
217A-S(2)	351422.309	5016916.712
218	351196.8	5016935
219	351109.5	5016870
219A-S	351135.703	5016839.69
219A-S(1)	351127.551	5016879.144
219A-S(2)	351160.089	5016902.065
219B-S	351186.304	5016920.903
219B-S(1)	351246.242	5016973.333
220	351067.6	5016927
220A-S	351097.633	5016892.913
220A-S(1)	351113.636	5016869.687
221	351157.2	5016805
222	351199.5	5016748
222A-S	351157.75	5016810.507
222A-S(1)	351202.86	5016750.38
222A-S(2)	351225.016	5016718.921
223	351145.2	5016699
223A-S	351197.212	5016737.13
224	351132	5016701
225	351078.1	5016775
225A-S	351133.955	5016692.759
225A-S(1)	351160.693	5016706.201
225C-S	351083.4	5016761.332
225C-S(1)	351098.344	5016737.803
226	351055.2	5016806
227	351041.2	5016806
228	350983.7	5016755
228A-S	351021.555	5016782.811
228A-S(1)	351050.281	5016801.805
229	350921.2	5016699
229A-S	350945.083	5016713.823
229A-S(1)	350979.505	5016742.455
230	350903.1	5016700
231	350882.8	5016727
232	350864.8	5016766
233	351335	5017133
234	351408.1	5017055
234A-S	351382.833	5017075.478
234A-S(1)	351371.049	5017089.659
234B-S	351334.628	5017128.916
234B-S(1)	351314.567	5017146.739
235	351463.4	5016996
235A-S	351457.617	5016996.502
235A-S(1)	351422.457	5017033.508
236	351462.7	5016984
237	351417.1	5016943
240	351021	5016723
240A-S	351040.379	5016747.12
240A-S(1)	351058.172	5016763.673
241	350949.4	5016659
241A-S	350952.296	5016669.867
241A-S(1)	350969.465	5016683.857
241B-S	351000.619	5016713.105
241B-S(1)	351020.322	5016732.527

242	350938.8	5016660
B1-S	350885.514	5017329.608
B2-S	350889.968	5017261.356
Comm-S	351113.403	5016517.83
EXT-1A-S	350912.011	5017145.573
EXT-1A-S(1)	350858.956	5017212.087
EXT2-S	351243.257	5016695.865
EXT-4-S	351460.435	5016937.255
EXT5-S	351404.825	5016888.372
EXT6-S	351192.415	5016697.094
F101A(1)	350998.904	5017314.587
F101A(2)	351015.682	5017317.948
F101A-S	351075.898	5017283.963
G234C-S	351405.93	5017128.445
HW7	351069.502	5017308.324
HZD-S	351041.851	5016203.011
J2	350907.437	5017344.775
J3	350990.684	5017338.185
J4	350910.671	5017275.476
L212A-S	351450.154	5016882.168
L218A-S	351246.374	5016850.716
L225B-S	351062.299	5016653.952
L235B-S	351492.111	5017044.256
POND-S1	351210.554	5017256.575
RY103C-S	351105.565	5017212.589
RY103D-S	351182.547	5017170.807
RY113B-S	350997.237	5016918.36
RY117C-S	351234.856	5017148.107
RY124B-S	350868.704	5017037.885
RY130B-S	350879.573	5016820.709
RY202B-S	351294.651	5017116.089
RY204C-S	351240.206	5017059.237
RY205B-S	351105.22	5016940.054
RY209C-S	350916.675	5016763.976
RY218B-S	351258.658	5016968.754
RY220A-S	351068.605	5016898.813
RY234D-S	351349.827	5017053.793
SU	351158.989	5017226.661
Transitway-S	350798.414	5016782.763

C.5 Kanata West Subdivision First Registration Storm Drainage Plan



Interim Drawings ICD Schedule

Catchbasin ID	Tributary Area ID	Minor System Node	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
C107A-IC(1)	C107A	107	IPEX TEMPEST HF (95"mm ORIFICE)	0.66	1.59	14.1	22.3
C107A-IC(2)	C107A	107	IPEX TEMPEST HF (95"mm ORIFICE)	0.66	1.59	14.1	22.3
C109A-IC(1)	C109A	109	IPEX TEMPEST HF (165"mm ORIFICE)	0.46	1.55	33.4	65.5
C109A-IC(2)	C109A	109	IPEX TEMPEST HF (165"mm ORIFICE)	0.46	1.55	33.4	65.5
C109B-IC(1)	C109B	109	IPEX TEMPEST HF (178"mm ORIFICE)	0.32	1.47	30.5	74.1
C109B-IC(2)	C109B	109	IPEX TEMPEST HF (178"mm ORIFICE)	0.32	1.47	30.5	74.1
C110A-IC(1)	C110A	110	IPEX TEMPEST HF (108"mm ORIFICE)	0.61	1.51	17.3	28.0
C121AA-IC(1)	C121AA	SU15	IPEX TEMPEST HF (83"mm ORIFICE)	0.27	1.43	6.5	16.1
C121AA-IC(2)	C121AA	SU15	IPEX TEMPEST HF (83"mm ORIFICE)	0.27	1.43	6.5	16.1
C121A-IC(1)	C121A	121	IPEX TEMPEST HF (152"mm ORIFICE)	0.47	1.67	28.8	58.1
C121A-IC(2)	C121A	121	IPEX TEMPEST HF (152"mm ORIFICE)	0.47	1.67	28.8	58.1
C123A-IC(1)	C123A	123	IPEX TEMPEST HF (102"mm ORIFICE)	0.54	1.53	14.5	25.2
C123A-IC(2)	C123A	123	IPEX TEMPEST HF (102"mm ORIFICE)	0.54	1.53	14.5	25.2
L102A-IC(1)	L102A	102	IPEX TEMPEST HF (83"mm ORIFICE)	1.17	1.55	14.6	16.9
L102A-IC(2)	L102A	102	IPEX TEMPEST HF (83"mm ORIFICE)	1.17	1.55	14.6	16.9
L103A-IC(1)	L103A	103	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.59	30.7	39.7
L103A-IC(2)	L103A	103	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.59	30.7	39.7
L103B-IC(1)	L103B	103	IPEX TEMPEST HF (83"mm ORIFICE)	1.07	1.69	13.9	17.6
L103B-IC(2)	L103B	103	IPEX TEMPEST HF (83"mm ORIFICE)	1.07	1.69	13.9	17.6
L103C-IC	L103C	103	IPEX TEMPEST HF (140"mm ORIFICE)	1.26	1.39	42.5	44.9
L103D-IC	L103D	103	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.39	35.0	37.0
L104A-IC(1)	L104A	104	IPEX TEMPEST HF (108"mm ORIFICE)	1.22	1.59	25.1	28.7
L104A-IC(2)	L104A	104	IPEX TEMPEST HF (108"mm ORIFICE)	1.22	1.59	25.1	28.7
L105A-IC(1)	L105A	105	IPEX TEMPEST HF (108"mm ORIFICE)	1.35	1.61	26.5	28.9
L105A-IC(2)	L105A	105	IPEX TEMPEST HF (108"mm ORIFICE)	1.35	1.61	26.5	28.9
L106A-IC(1)	L106A	106	IPEX TEMPEST HF (102"mm ORIFICE)	1	1.51	20.2	25.0
L106A-IC(2)	L106A	106	IPEX TEMPEST HF (102"mm ORIFICE)	1	1.51	20.2	25.0
L106B-IC(1)	L106B	106	IPEX TEMPEST HF (83"mm ORIFICE)	0.69	1.59	11.0	17.1
L112A-IC(1)	L112A	112	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.68	30.7	40.8
L112A-IC(2)	L112A	112	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.68	30.7	40.8
L113A-IC(1)	L113A	113	IPEX TEMPEST HF (108"mm ORIFICE)	1.24	1.71	25.2	29.9
L113A-IC(2)	L113A	113	IPEX TEMPEST HF (108"mm ORIFICE)	1.24	1.71	25.2	29.9
L113B-IC	L113B	113	IPEX TEMPEST HF (108"mm ORIFICE)	1.28	1.52	25.8	28.1
L114A-IC	L114A	114	IPEX TEMPEST HF (108"mm ORIFICE)	0.21	1.59	9.1	28.7
L115A-IC(1)	L115A	115	IPEX TEMPEST HF (83"mm ORIFICE)	0.85	1.6	12.3	17.1
L115A-IC(2)	L115A	115	IPEX TEMPEST HF (83"mm ORIFICE)	0.85	1.6	12.3	17.1
L117A-IC(1)	L117A	117	IPEX TEMPEST HF (127"mm ORIFICE)	1.19	1.62	34.1	40.0
L117A-IC(2)	L117A	117	IPEX TEMPEST HF (127"mm ORIFICE)	1.19	1.62	34.1	40.0
L117B-IC(1)	L117B	117	IPEX TEMPEST HF (83"mm ORIFICE)	0.53	1.67	9.5	17.5
L117B-IC(2)	L117B	117	IPEX TEMPEST HF (83"mm ORIFICE)	0.53	1.67	9.5	17.5
L117C-IC	L117C	117	IPEX TEMPEST HF (140"mm ORIFICE)	1.26	1.42	42.6	45.3
L118A-IC(1)	L118A	118	IPEX TEMPEST HF (127"mm ORIFICE)	1.07	1.59	32.2	39.6
L118A-IC(2)	L118A	118	IPEX TEMPEST HF (127"mm ORIFICE)	1.07	1.59	32.2	39.6
L119A-IC(1)	L119A	119	IPEX TEMPEST HF (108"mm ORIFICE)	1.1	1.57	23.8	28.6
L119A-IC(2)	L119A	119	IPEX TEMPEST HF (108"mm ORIFICE)	1.1	1.57	23.8	28.6
L124A-IC(1)	L124A	124	IPEX TEMPEST HF (95"mm ORIFICE)	0.93	1.65	16.9	22.8
L124A-IC(2)	L124A	124	IPEX TEMPEST HF (95"mm ORIFICE)	0.93	1.65	16.9	22.8
L124B-IC	L124B	124	IPEX TEMPEST HF (95"mm ORIFICE)	1.25	1.36	19.7	20.6
L126A-IC(1)	L126A	126	IPEX TEMPEST HF (83"mm ORIFICE)	0.2	1.6	5.4	17.1
L126B-IC(1)	L126B	126	IPEX TEMPEST HF (102"mm ORIFICE)	1.03	1.63	20.5	26.1
L126B-IC(2)	L126B	126	IPEX TEMPEST HF (102"mm ORIFICE)	1.03	1.63	20.5	26.1
L126C-IC	L126C	126	IPEX TEMPEST HF (83"mm ORIFICE)	0.36	2.64	4.3	21.0
L127A-IC(1)	L127A	127	IPEX TEMPEST HF (127"mm ORIFICE)	0.88	1.44	27.8	36.6
L127A-IC(2)	L127A	127	IPEX TEMPEST HF (127"mm ORIFICE)	0.88	1.44	27.8	36.6
L128A-IC(1)	L128A	128	IPEX TEMPEST HF (102"mm ORIFICE)	1.24	1.64	22.6	26.1
L128A-IC(2)	L128A	128	IPEX TEMPEST HF (102"mm ORIFICE)	1.24	1.64	22.6	26.1
L130A-IC(1)	L130A	130	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.53	35.0	38.9
L130A-IC(2)	L130A	130	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.53	35.0	38.9
L130B-IC	L130B	130	IPEX TEMPEST HF (108"mm ORIFICE)	1	1.03	22.6	23.0

Storm Drainage Area	Block ID/Location	Description	MH Outlet	Maximum Minor System Capture (L/s)	100-Year Major System Overflows (L/s)
Arterial	Block 99	Arterial	209	953	N/A - Overflow to Poole Creek as per KWMSS
B-1	North of Maple Grove	Residential	J2	116	100-year On-Site Storage as per KWMSS
B-2	Maple Grove ROW	Arterial	J4	199	N/A - Overflow to Poole Creek/Carp River as per KWMSS
Comm	North of Hazeldean	Commercial	209	398.88	100-year On-Site Storage
Hazeldean	Hazeldean ROW	Arterial	209	1187	N/A - Overflow to Carp River as per KWMSS
L121B	Block 136	Commercial	121	299	100-year On-Site Storage
L123B	Block 115	Residential	123	111	480 L/s to Maize Street
L218A	Block 76	School	218	443	565 L/s to Shropshire Place
L225B	Block 89	Residential	225	389	799 L/s to Holstein Road

Stantec

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Legend

- PROPOSED STORM SEWER
- PROPOSED DRAINAGE BOUNDARY
- PROPOSED CATCHBASIN
- ST101A / 0.38 / 0.70 — STORM DRAINAGE AREA ID# / C-COEFFICIENT VALUE / DRAINAGE AREA (HA)

DRAINAGE AREA PREFIX

- L — LOCAL ROAD, 2-YEAR DESIGN EVENT
- C — COLLECTOR ROAD, 5-YEAR DESIGN EVENT
- F — FULL CAPTURE AREA, 100-YEAR DESIGN EVENT
- EXT — EXTERNAL DRAINAGE AREA
- DIRECTION OF OVERLAND FLOW
- EXTERNAL DRAINAGE
- CIRCULAR ORIFICE (SEE DWG SD-1)
- SERVICE LATERAL LOCATION
- PROPOSED BIOSWALE (SEE NOTE 5)

NOTES:
1. PROPOSED IPEX TEMPEST HF ICDS ARE TO HAVE CIRCULAR ORIFICES AS SPECIFIED AND ARE REQUIRED TO BE VERTICAL SLIDING TYPE WITH FLOATABLE TRAP.

Revision	By	Appd.	YY.MM.DD
9 ISSUED FOR ECA APPROVAL	WAJ	SGG	20.02.12
8 REVISED AS PER CITY COMMENTS	WAJ	SGG	20.01.31
7 ISSUED FOR TENDER	WAJ	KJH	20.01.09
6 REVISED AS PER CITY COMMENTS	WAJ	SGG	19.11.18
5 REVISED CROSSING DESIGN	WAJ	SGG	19.09.23
4 REVISED AS PER CITY COMMENTS	WAJ	SGG	19.08.30
3 REVISED AS PER CITY COMMENTS	WAJ	SGG	19.05.10
2 REVISED AS PER CITY COMMENTS	WAJ	SGG	18.12.10
1 ISSUED FOR FIRST SUBMISSION	WAJ	SGG	18.03.02

File Name: 106401393-DB	WAJ	SGG	WAJ	17.12.20
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project
RICHCRAFT HOMES
1st REGISTRATION

RICHCRAFT KANATA WEST
1620 MAPLE GROVE ROAD
OTTAWA, ON

Title
ULTIMATE CONDITION
STORM DRAINAGE AREA PLAN

Project No.	Scale	Revision
160401393	1:1000 (0 10 30 50m)	9
Drawing No.	Sheet	
SD-1	40 of 44	

CITY FILE No. D07-16-04-0017 CITY PLAN No. 17529

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Nov 20, 2019 - 2:13 PM By: GBB - SWM-SD

ORIGINAL SHEET - ARCH D

Appendix D Geotechnical Information

D.1 Geotechnical Investigation Report Excerpts

PATERSON GROUP

Geotechnical Investigation

Proposed Residential Development

Mapleton – Block 1
Ottawa, Ontario

Prepared for Richcraft

Report PG3062-2 dated April 7, 2025

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Appendices

Appendix 1 Soil Profile and Test Data Sheets
Symbols and Terms
Grain Size Distribution Testing Results
Atterberg Limits Testing Results
Analytical Testing Results

Appendix 2 Figure 1 – Key Plan
Drawing PG3062-9 – Test Hole Location Plan

1.0 Introduction

Paterson Group (Paterson) was commissioned by Richcraft to conduct a geotechnical investigation for the proposed Mapleton - Block 1 residential development to be located along Maple Grove Road in the City of Ottawa (reference should be made to Figure 1 – Key Plan in Appendix 2 of this report for the general site location).

The objectives of the geotechnical investigation were to:

- Determine the subsoil and groundwater conditions at this site by means of boreholes.
- Provide geotechnical recommendations pertaining to the design of the proposed development including construction considerations which may affect the design.

This report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Development

Based on the available conceptual plan, it is understood that the proposed development will consist of two 3-storey residential buildings with one underground parking level each, six townhouse blocks with at-grade parking, and an accessory building.

Further, it is understood that the remainder of the site will generally be occupied by asphalt-paved access lanes and landscaped areas. It is also expected that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on March 21, 2025, and consisted of advancing a total of 6 boreholes to a maximum depth of 6.7 m below the existing ground surface. A previous geotechnical investigation by Paterson also included borehole BH 14 and test pit TP-8 within Block 1.

The test hole locations were determined in the field by Paterson personnel and distributed in a manner to provide general coverage of the subject site, taking into consideration existing site features and underground utilities. The test hole locations are presented on Drawing PG3062-9 – Test Hole Location Plan included in Appendix 2.

The boreholes were advanced with a low-clearance track-mounted drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from the geotechnical division. The drilling procedure consisted of augering to the required depth at the selected location, sampling, and testing the overburden.

Sampling and In Situ Testing

Soil samples were recovered from the boreholes using a 50 mm diameter split-spoon sampler or from the auger flights. The split spoon, and auger samples were classified on site and placed in sealed plastic bags. All soil samples were transported to our laboratory for further review. The depths at which the split spoon, and auger samples were recovered from the boreholes are shown as SS, and AU, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as “N” values on the Soil Profile and Test Data sheets. The “N” value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing was carried out in cohesive soils using a field vane apparatus in all boreholes.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) at borehole BH 4-25, completed during the current field program. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment. Due to the low resistance exerted by the silty clay in some boreholes, the cone was often pushed using the hydraulic head of the drill rig until resistance to penetration was encountered. The hammer was then used to further advance the cone to practical refusal.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations.

Groundwater

Boreholes BH 1-25, BH 2-25, BH 4-25 and BH 5-25 were fitted with a flexible polyethylene standpipe to allow groundwater level monitoring. The groundwater level readings were obtained after a suitable stabilization period subsequent to the completion of the field investigation.

The groundwater observations are discussed in Section 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

All samples from the current investigation will be stored in the laboratory for a period of 1 month after the issuance of this report. They will then be discarded unless directed otherwise.

3.2 Field Survey

The borehole locations and ground surface elevation at each borehole location were surveyed by Paterson using a high-precision handheld GPS and referenced to a geodetic datum. The locations of the boreholes, and the ground surface elevation at each borehole location, are presented on Drawing PG3062-9 – Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the test holes were examined in our laboratory to review the results of the field logging. From the current boreholes, two samples were submitted for Atterberg Limits testing, one sample was submitted for grain size distribution testing and one sample was submitted for shrinkage testing.

The results of the Atterberg Limits testing, grain size distribution testing, and shrinkage testing are presented in Appendix 1 and are further discussed in Sections 4.2.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Section 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by site trailers along the western portion of the subject site, which were placed on a temporary granular pad facing Roger Griffith Avenue. The eastern part of the site is covered with several soil stockpiles.

The site is bordered by Roger Griffith Avenue to the west, Ploughshare Road to the south, an industrial building to the east, and Maple Grove Road to the north. The ground surface elevation across the subject site is currently relatively level at approximate geodetic elevation 97 m, although the older test holes indicate the site grade was previously around geodetic elevation 95 to 96 m.

4.2 Subsurface Profile

Generally, the subsurface profile encountered at the borehole locations consists of an approximate 1.7 to 2.2 m thickness of fill, which was generally observed to consist of compact, brown silty sand to silty clay. However, where the granular pad is present, the fill was observed to consist of granular crushed stone.

The fill was generally underlain by a loose to compact, brown sandy silt, turning grey with depth. A layer of firm, grey silty clay was encountered beneath the sandy silt layer at an approximate depth of 4.5 m below the existing ground surface.

A DCPT was conducted at borehole BH 4-25. Practical refusal to the DCPT was encountered at the borehole location at 15.8 m below ground surface.

Specific details of the soil profile at each test hole location are presented on the Soil Profile and Test Data sheets in Appendix 1.

Bedrock

Based on available geological mapping, the bedrock in the subject area is part of the Verulam formation, which consists of interbedded limestone and dolomite with an overburden drift thickness ranging between 5 to 15 m.

Atterberg Limits Testing

Atterberg limits testing was completed on the recovered silty clay samples at select borehole locations. The results of the Atterberg limits test are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1.

Table 1 – Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	Classification
BH 1-25 SS4	2.30	21	15	6	CL
BH 4-25 SS6	3.80	35	18	17	CL

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index.
CL: Inorganic Clay of Low Plasticity, CH: Inorganic Clays of High Plasticity

Grain Size Distribution and Hydrometer Testing

Grain size distribution analysis was completed on 1 selected recovered sandy silt deposit sample from the current investigation. The results of the grain size distribution analysis is presented in Table 2 and on the Grain Size Distribution sheets in Appendix 1.

Table 2 – Grain Size Distribution Results

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 2-25 SS4	2.30	0.0	31.9	63.3	4.8

Shrinkage Testing

Linear shrinkage testing was completed on one sample recovered at a depth of 2.30 m from BH 5-25. The shrinkage limit and shrinkage ratio of the tested sandy silt sample were found to be 19.38% and 1.806, respectively. The results of the linear shrinkage testing are presented in Appendix 1.

4.3 Groundwater

Groundwater levels were recorded at each borehole location and are presented in Table 3 below. The groundwater level readings are also presented in the Soil Profile and Test Data sheets in Appendix 1.

Table 3 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 1-25	97.24	2.84	94.40	March 31, 2025
BH 2-25	96.99	2.19	94.80	

Table 3 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 4-25	97.40	2.87	94.53	
BH 5-25	97.10	Blocked	-	

Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS using a geodetic datum.

It should be noted that surface water can become trapped within a backfilled borehole that can lead to higher than typical groundwater level observations. The long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples.

Based on these observations, the long-term groundwater table can be expected at a depth of approximately **2 to 3 m** below the existing ground surface.

However, groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. The proposed buildings are recommended to be founded on conventional spread footings placed on the undisturbed sandy silt, silt, and/or silty clay.

Due to the presence of the silty clay deposit, the subject site is subject to grade raise restrictions. The permissible grade raise recommendations are discussed in Section 5.3.

The above and other considerations are further discussed in the following sections.

5.2 Grading and Preparation

Stripping Depth

Asphalt, topsoil, construction debris, and deleterious fill, such as those containing organic materials, should be removed from within the perimeters of the proposed buildings and from under paved areas, pipe bedding or other settlement sensitive structures.

Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the placement of additional suitable fill material.

Fill Placement

Fill placed for grading beneath the proposed buildings should consist, unless otherwise specified, of clean imported granular fill such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the proposed building should be compacted to a minimum of 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified site-excavated soil could be placed as general landscaping fill and beneath paved areas. In landscaped areas, these materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. In areas to be paved, the site-excavated soils should be compacted to a minimum of 98% of the material's standard Proctor maximum dry density (SPMDD).

Vibration Considerations

Construction operations could cause vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain a cooperative environment with the residents.

The following construction equipment could be the source of vibrations: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the source of detrimental vibrations on the nearby buildings and structures. Therefore, all vibrations are recommended to be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline for construction activities, the peak particle velocity should be less than 19 mm/s between frequencies of 4 to 15 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 15 and 40 Hz).

5.3 Foundation Design

Conventional Spread Footings

Footings placed on the undisturbed sandy silt, silt, or silty clay can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **150 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed, in the dry, prior to the placement of concrete for footings.

Footings designed using the bearing resistance values at SLS given above will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

Permissible Grade Raise Recommendations

Due to the presence of the silty clay deposit, a permissible grade raise restriction of **2.0 m** above the **original site grade** is recommended for grading at the subject site. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

Lateral Support

The bearing medium under footing- and raft-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the in-situ bearing medium soils when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

5.4 Design for Earthquakes

The seismic site designation is **Class X_D** as referenced the Ontario Building Code (OBC) 2024. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code (OBC) 2024 for a full discussion of the earthquake design requirements.

5.5 Basement Slab

With the removal of all topsoil and deleterious materials within the footprint of the proposed building, a compact fill or native soil subgrade, approved by Paterson, is considered an acceptable subgrade surface on which to commence backfilling for the floor slab construction.

For the buildings with underground parking, the recommended pavement structure noted in Section 5.8 will be applicable. Further, it is recommended underslab drainage be provided for the proposed buildings with underground parking. This is discussed further in Section 6.1.

For the townhouses, the upper 200 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone.

For the accessory building, which is anticipated to have a slab-on-grade, it is recommended that the sub-slab fill consist of a 200 mm thickness of OPSS Granular A.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m^3.

The total earth pressure (P_{AE}) includes the static earth pressure component (P_o) and the seismic component (ΔP_{AE}).

Lateral Earth Pressures

The static horizontal earth pressure (P_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil (0.5)
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}).

The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45-a_{max}/g)\ a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the area of the subject site, is 0.353 g according to the OBC 2024. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$$

The earth pressures calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per the OBC 2024.

5.7 Pavement Design

Flexible Pavement Structure for Surface Parking

For design purposes, the following pavement structures, presented below, are recommended for the design of car only parking areas, access lanes, and heavy truck parking areas at the subject site.

Table 4 – Recommended Pavement Structure - Car-Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil.	

Table 5 – Recommended Pavement Structure - Access Lanes and Heavy Truck Parking Areas	
Thickness (mm)	**Material Description**
40	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material.

The pavement granular (base and subbase) should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable compaction equipment.

Rigid Pavement Structure for Underground Parking

For design purposes, it is recommended that the rigid pavement structure for the underground parking consist of Category C2, 32 MPa concrete at 28 days with air entrainment of 5 to 8%. The recommended rigid pavement structure is presented below in Table 6.

Table 6 – Recommended Rigid Pavement Structure – Lower Parking Level	
Thickness (mm)	**Material Description**
125	**Exposure Class C2 - 32 MPa Concrete** (5 to 8% Air Entrainment)
300	**Base** – OPSS Granular A Crushed Stone
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil.	

To control cracking due to shrinking of the concrete floor slab, it is recommended that strategically located saw cuts be used to create control joints within the concrete floor slab of the lower underground parking level.

The control joints are generally recommended to be located at the center of the column lines and spaced at approximately 24 to 36 times the slab thickness (for example; a 0.15 m thick slab should have control joints spaced between 3.6 and 5.4 m). The joints should be cut between 25 and 30% of the thickness of the concrete floor slab and completed as early as 4 hours after the concrete has been poured during warm temperatures, and up to 12 hours during cooler temperatures.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 100 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, and which is placed at the footing level around the exterior perimeter of the structure. The clear crushed stone should be wrapped in a non-woven geotextile. The pipe should have a positive outlet, such as a gravity connection to the storm sewer or sump pump pit.

Underslab Drainage

For the 3-storey apartment buildings with underground parking, underslab drainage will be required to control water infiltration. For design purposes, we recommend that 100 mm diameter perforated pipes be placed at 6 m centers below the lowest level floor slab. The spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining, non-frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover alone, or a combination of soil cover in conjunction with foundation insulation, should be provided in this regard.

Other exterior unheated footings (such as those for isolated exterior piers, or underground parking garage access ramp footings) or footings adjacent to garage

bay doors which may be open to exterior conditions for extended periods of time (such as the entrance to the underground parking garage), are more prone to deleterious movement associated with frost action than the exterior walls of the proper structure. These footings should be provided with a minimum 2.1 m thick soil cover, or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The temporary excavation side slopes anticipated should either be excavated to acceptable slopes or retained by shoring systems from the beginning of the excavation until the structure is backfilled. It is anticipated that sufficient space will be available from property lines such that the excavations can be sloped.

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level.

The subsurface soil is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should maintain a safe working distance from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent material specifications and standard detail drawings from the department of public works and services, infrastructure services branch of the City of Ottawa.

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on a soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm

above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding layer should be increased to a minimum thickness of 300 mm where the subgrade consists of grey silty clay. The bedding and cover materials should be placed in maximum 300 mm thick lifts and compacted to 98% of the SPMDD.

It should generally be possible to re-use the moist (not wet) site-generated fill above the cover material if the excavation and filling operations are carried out in dry weather conditions. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

To reduce long-term lowering of the groundwater level, clay seals should be provided in the service trenches. The seals should be a minimum of 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry impervious material placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at a maximum of 60 m intervals in the service trenches.

6.5 Groundwater Control

Groundwater Control for Building Construction

Based on our observations, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps.

The contractor should be prepared to direct water away from all subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

A temporary Ministry of Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required if more than 400,000 L/day of ground and/or

surface water are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Persons as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Impacts on Neighboring Properties

The excavation for the proposed buildings is not expected to extend significantly below the groundwater level. Therefore, impacts to adjacent properties are not expected as a result of minor, localized dewatering which may occur at this site.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

Precaution must be taken where excavations are carried in proximity of existing structures which may be adversely affected due to the freezing conditions. In particular, it should be recognized that where a shoring system is used, the soil behind the shoring system will be subjected to freezing conditions and could result in heaving of the structure(s) placed within or above frozen soil. Provisions should be made in the contract document to protect the walls of the excavations from freezing, if applicable.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (GU – General Use cement) would be appropriate for this site. The chloride content and pH of the sample indicate that they are not a significant factor in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of low to slightly aggressive corrosive environment.

6.8 Tree Planting Restrictions

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Based on the results of our review, a low to medium sensitivity soil was encountered, and the modified plasticity index does not exceed 40%. Therefore, the following tree planting setbacks are recommended for the low to medium sensitivity area as per City Guidelines.

Large trees (mature height over 14 m) can be planted within these areas provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g. in a park or other green space). Tree planting setback limits may be **reduced to 4.5 m** for small (mature height up to 7.5 m) and medium size trees (mature height 7.5 to 14 m), provided that the conditions noted below are met.

- The underside of footing (USF) is 2.1 m or greater below the lowest finished grade. This footing level must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan.

- A small tree must be provided with a minimum 25 m^3 of available soil volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

- ❒ The tree species must be small (mature height up to 7.5 m) to medium size (mature height 7.5 m to 14 m) as confirmed by the Landscape Architect.

- ❒ The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall) to provide ductility.

- ❒ Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree).

6.9 Corrosion Potential and Sulphate

The analytical test results of the soil sample indicate that the sulphate content is less than 0.1%. These results along with the chloride and pH value are indicative that Type 10 Portland cement (Type GU) would be appropriate for this site. The chloride content and the pH of the sample indicate they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a moderately corrosive environment.

7.0 Recommendations

It is recommended that the following be carried out by Paterson once preliminary and/or detailed designs of the proposed development have been prepared:

- ❑ Review detailed grading, servicing, landscaping, and structural plan(s) from a geotechnical perspective.

In addition, it is a requirement for the foundation design data provided herein to be applicable that a material testing and observation program be performed by the geotechnical consultant. The following aspects of the program should be performed by Paterson:

- ❑ Review and inspection of the installation of the foundation drainage systems.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

All excess soils, with the exception of engineered crushed stone fill, generated by construction activities that will be transported on-site or off-site should be handled ***Ontario Regulation 406/19: On-Site and Excess Soil Management*.**

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Richcraft, or their agents, is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.



Puneet Bandi, M.Eng.





Scott. S. Dennis, P.Eng.

Report Distribution:

- ❑ Richcraft Homes (Email Copy)
- ❑ Paterson Group (1 Copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMIT TESTING RESULTS

GRAIN SIZE TESTING RESULTS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 351006.65 **NORTHING:** 5017215.98 **ELEVATION:** 97.24

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

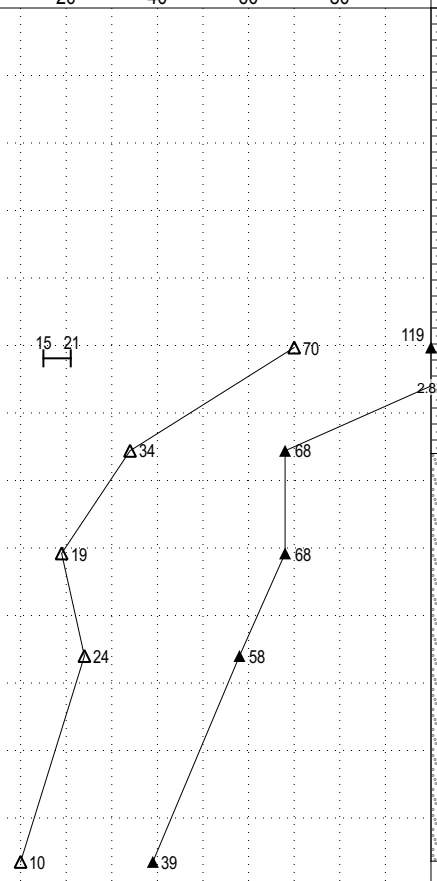
REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 1-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											97.24
FILL: Compact, course granular, crushed stone 0.10m [97.14m]		0	AU 1								97
FILL: Compact, brown silty fine sand, some gravel 0.69m [96.55m]											
FILL: Compact, brown sandy slit, trace clay and gravel 1.68m [95.56m]		1	SS 2	50	6-5-11-9 16						96
Very stiff brown **SILTY CLAY** trace gravel 2.21m [95.03m]		2	SS 3	67	2-3-3-4 6						95
Compact, brown **SILT**, some clay, trace sand - Clay content increasing with depth 4.50m [92.74m]		3	SS 4	71	P						94
		4	SS 5	75	P						93
			SS 6	83	P						
Compact, grey **SANDY SILT** 5.31m [91.93m]		5	SS 7	67	P						92
Firm, grey **SILTY CLAY** 6.71m [90.53m]		6	SS 8	100	P						91
			SS 9	100	P						
End of Borehole (GWL at 2.84 m depth - March 31, 2025)		7									90
		8									89
		9									88
		10									



DISCLAIMER: THE DATA PRESENTED IN THIS SHEET IS THE PROPERTY OF PATERSON GROUP AND THE CLIENT FOR WHOM IT WAS PRODUCED. THIS SHEET SHOULD BE READ IN CONJUNCTION WITH ITS CORRESPONDING REPORT. PATERSON GROUP IS NOT RESPONSIBLE FOR THE UNAUTHORIZED USE OF THIS DATA.

P:/AutoCAD Drawings/Test Hole Data Files/PG30xx/PG3062/data.sqlite 2025-04-02, 14:59 Paterson_Template MR

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350949.57 **NORTHING:** 5017222.10 **ELEVATION:** 96.98

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 2-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, brown silty clay, trace gravel, crushed stone			AU 1						
0.69m [96.30m]									
FILL: Compact, brown silty fine sand, trace gravel and clay		1	SS 2	85	4-15-50-50 65/0.08				96
1.02m [95.97m]									
FILL: weather shale			SS 3	42	31-50-/-/ 50/0.28				
1.83m [95.16m]									
Compact, brown **SANDY SILT**, trace clay and sand		2	SS 4	79	3-2-2-5 4				95
		3	SS 5	83	2-2-2-2 4				94
- Grey by 3.81 m depth		4	SS 6	83	2-2-2-2 4				93
4.50m [92.48m]									
Firm, grey **SILTY CLAY**		5	SS 7	92	1-2-1-1 3				92
		6	SS 8	100	P		▲34 △5 ▲34		91
6.55m [90.44m]									
End of Borehole		7							90
(GWL at 2.19 m depth - March 31, 2025)		8							89
		9							88
		10							87

2.19 m 2025-03-31

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350897.73 **NORTHING:** 5017214.37 **ELEVATION:** 97.21

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 3-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											
FILL: Compacted granular, crushed stone 0.05m [97.16m]											97
FILL: Compact, brown silty sand with gravel, crushed stone 0.71m [96.50m]			AU 1								96
End of Borehole		1									95
Practical refusal to augering at 0.71 m depth		2									94
		3									93
		4									92
		5									91
		6									90
		7									89
		8									88
		9									
		10									

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350897.73 **NORTHING:** 5017214.37 **ELEVATION:** 97.21

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 3A-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											
FILL: Compacted granular, crushed stone 0.05m [97.16m]											97
FILL: Compact, brown silty sand with gravel, crushed stone, trace clay 0.89m [96.32m]		1	AU 1 SS 2	78	50-/-/-/ 50/0.13						96
End of Borehole Practical refusal to augering at 0.89 m depth		2									95
		3									94
		4									93
		5									92
		6									91
		7									90
		8									89
		9									88
		10									

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350934.73 **NORTHING:** 5017162.09 **ELEVATION:** 97.40

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 4-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									97
FILL: Compact granular, crushed stone			AU 1						
0.08m [97.32m]									
FILL: Firm, brown silty clay with gravel, crushed stone									
0.69m [96.71m]									
Compact, brown **SANDY SILT**, trace clay and sand		1	SS 2		3-4-6-5 10				96
		2	SS 3	75	4-5-4-4 9				95
			SS 4	75	1-1-1-1 2				
		3	SS 5	75	1-1-4-3 5				94
3.51m [93.89m]									
Compact, brown **SILTY SAND**									93
3.73m [93.67m]		4	SS 6	100	1-1-1-1 2		18 35 / △5 ▲36 ▲27 △10 ▲39		
Firm, grey **SILTY CLAY**		5							92
		6							91
6.55m [90.85m]									
Dynamic Cone Penetration Test commenced at 6.55 m depth		7							90
		8							89
		9							88
		10							

2.87 m 2025-03-31

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350934.73 **NORTHING:** 5017162.09 **ELEVATION:** 97.40

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 4-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
15.80m [81.60m]		10									87
End of Borehole		11									86
Cone pushed form 6.55 to 14.02 m depth		12									85
Practical refusal to DCPT at 15.8 m depth		13									84
(GWL at 2.87 m depth - March 31, 2025)		14					47				83
							44				
		15					56				82
							60				
		16					66				81
							100				
		17									80
		18									79
		19									78
		20									

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350888.40 **NORTHING:** 5017218.34 **ELEVATION:** 97.10

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : **PG3062**

HOLE NO. : **BH 5-25**

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) △ / UNDRAINED SHEAR STRENGTH (kPa) ▲ 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									97
FILL: Compact granular, crushed stone 0.05m [97.05m]			AU 1						
FILL: Compact, brown silty sand with gravel, crushed stone, weatherd shale, trace clay		1	SS 2	100	19-50-/-/ 50/0.13				96
2.21m [94.89m]		2	SS 3	4	5-6-5-6 11				95
Compact, brown **SANDY SILT**, trace clay and sand			SS 4	67	2-2-1-1 3				94
3.43m [93.67m]		3	SS 5	79	1-1-2-3 3				
Compact, brown **SANDY SILT** 3.73m [93.37m]									93
Firm, grey **SILTY CLAY**		4	SS 6	100	P		△5 ▲34 ▲34 △5 ▲39		92
6.55m [90.55m]		5							91
End of Borehole		6							90
		7							89
		8							88
		9							
		10							

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JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Engineers
28 Concourse Gate, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Preliminary Geotechnical Investigation
Proposed Development, Hazeldean Road
Ottawa (Kanata), Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Limited.

FILE NO. G8886

REMARKS

HOLE NO. TP 8

BORINGS BY Hydraulic Excavator DATE 27 MAR 03

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	95.24		
TOPSOIL 0.23									
Compact, brown SANDY SILT		G	1			1	94.24		
2.59						2	93.24		
Soft to firm, grey SILTY CLAY						3	92.24		
3.66									
End of Test Pit									
(Open hole GWL @ 3.7m depth)									

Water Content % scale: 20 40 60 80

Shear Strength (kPa) scale: 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup

Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Proposed Kanata West Subdivision
Ottawa (Kanata), Ontario

DATUM Geodetic

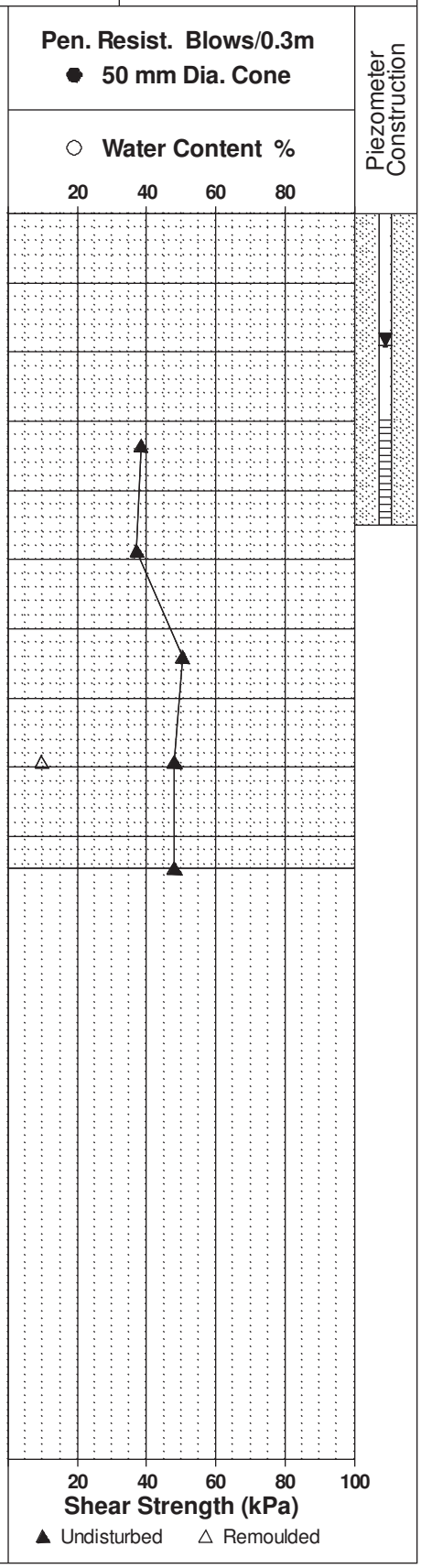
FILE NO. G9012

REMARKS

HOLE NO. BH14

BORINGS BY CME 75 Power Auger **DATE** Aug 6, 03

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	95.24
TOPSOIL	0.15							
Loose, brown **SILTY** fine **SAND**			SS	30	96	6	1	94.24
	1.45							
Very loose, greyish brown **SANDY SILT** with clay	2.13		SS	31	100	2	2	93.24
Firm, brown **SILTY CLAY**							3	92.24
- grey by 3.0m depth							4	91.24
							5	90.24
							6	89.24
							7	88.24
							8	87.24
							9	86.24
	9.45							
End of Borehole								
(GWL @ 1.90m-Aug. 18/03)								



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called "mechanical breaks") are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

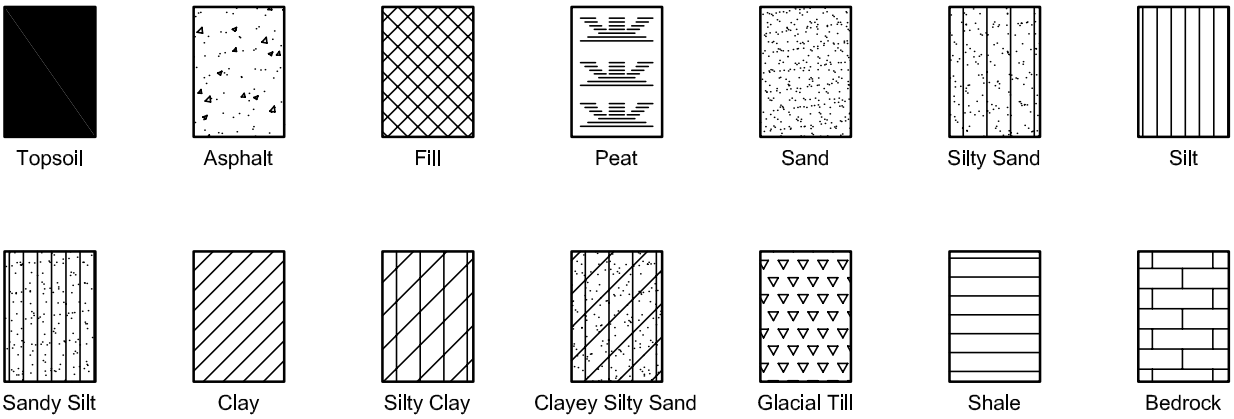
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

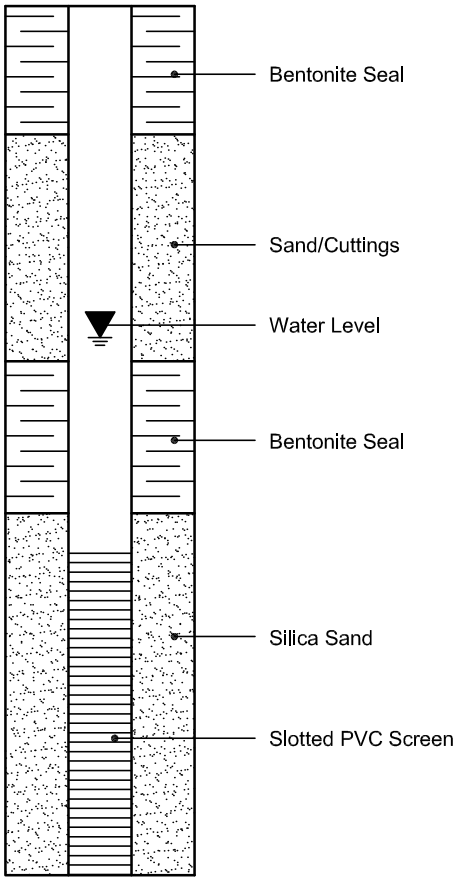
SYMBOLS AND TERMS (continued)

STRATA PLOT

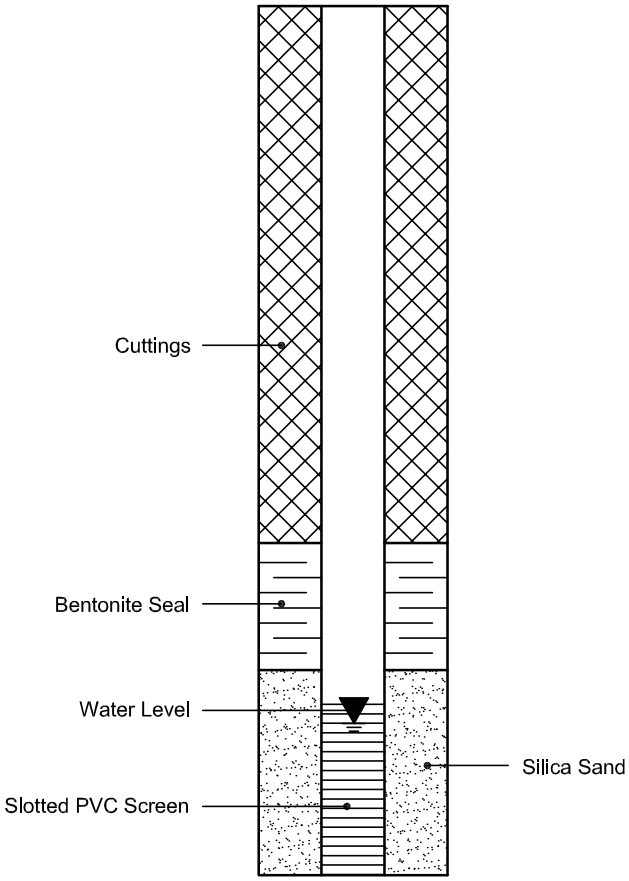


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



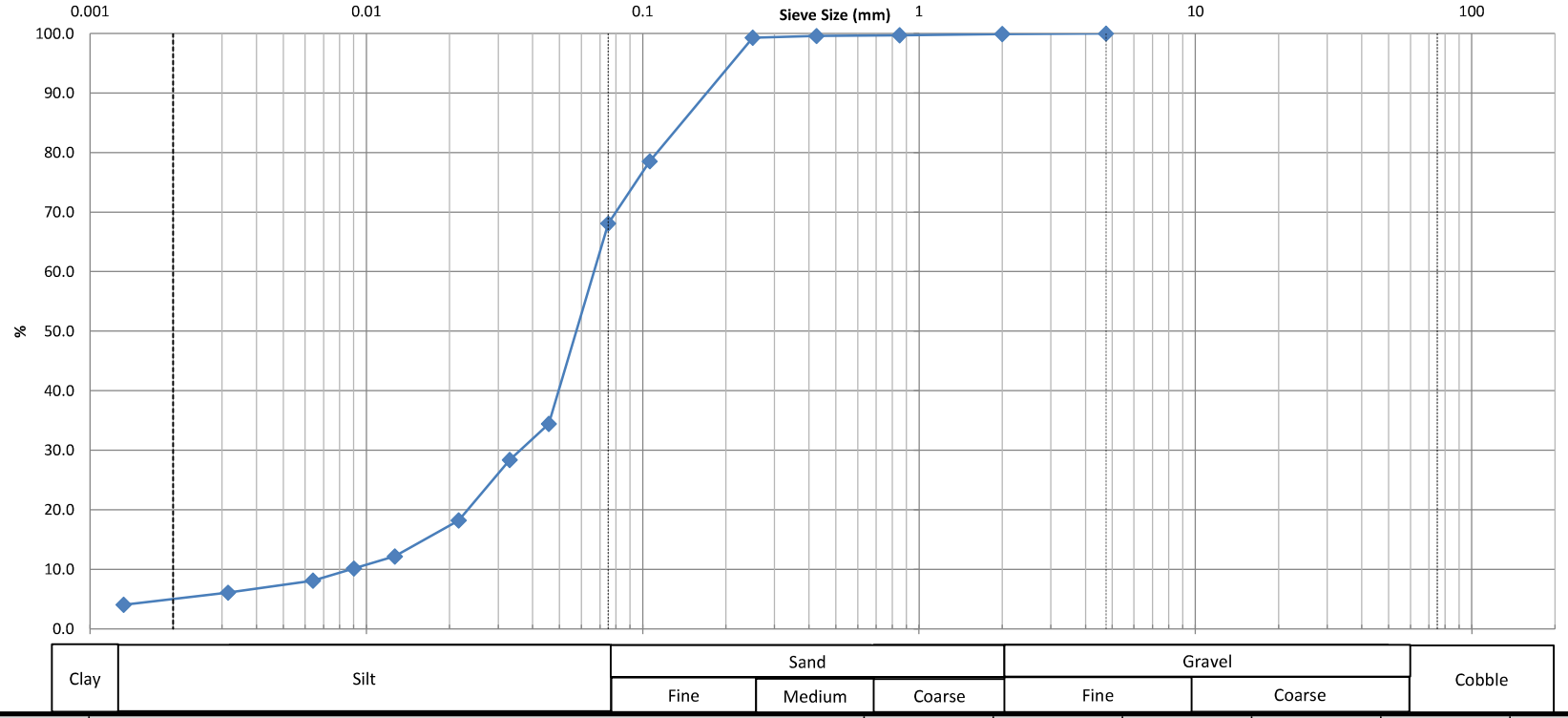
PIEZOMETER CONSTRUCTION



PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

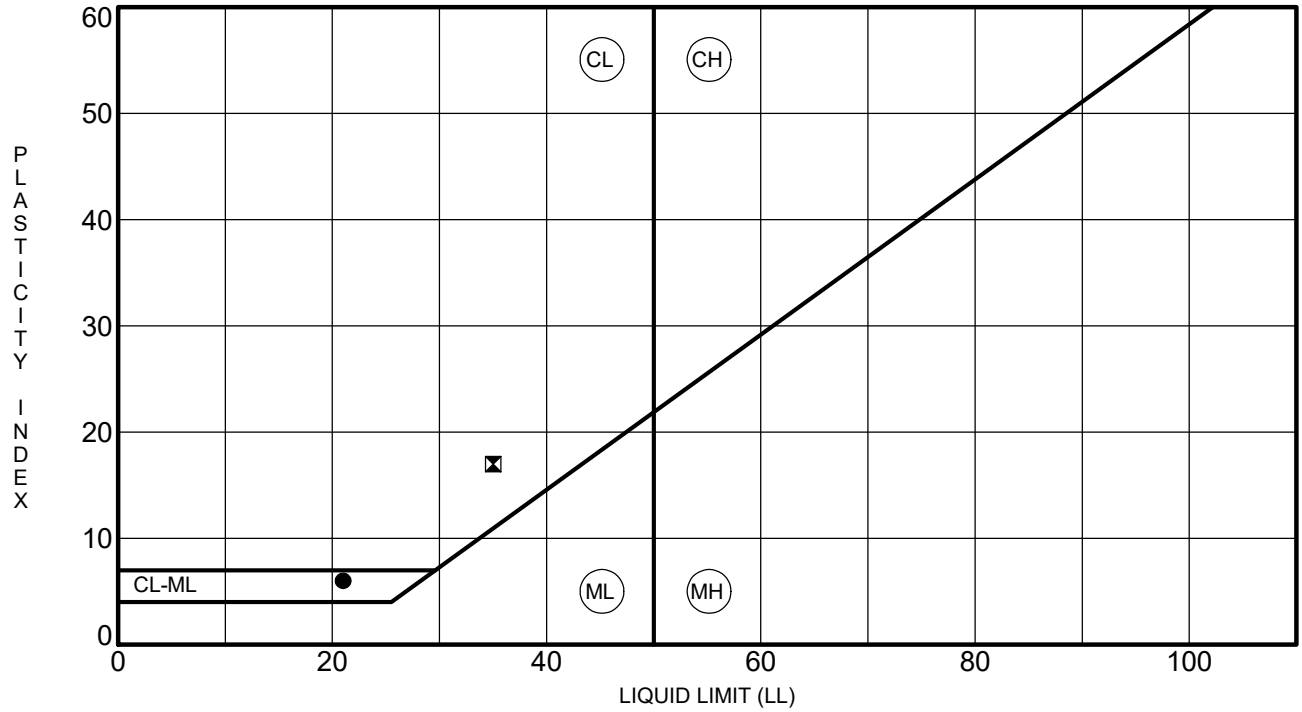
CLIENT:	Richcraft	DEPTH:	BH2-25 SS4	FILE NO:	PG3062
CONTRACT NO.:		BH OR TP No.:	2.3m - 2.9m	LAB NO:	59116
PROJECT:	Maple Grove			DATE RECEIVED:	24-Mar-25
				DATE TESTED:	24-Mar-25
DATE SAMPLED:	21-Mar-25			DATE REPORTED:	31-Mar-25
SAMPLED BY:	M.R.			TESTED BY:	D.K



Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
						23.3%					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
					0.0	31.9		63.3		4.8	

Comments:

REVIEWED BY:	Curtis Beadow	Joe Forsyth, P. Eng.



Specimen Identification		LL	PL	PI	Fines	Classification
● BH 1-25	SS4	21	15	6		CL-ML Inorganic silts-clays of low plasticity
⊠ BH 4-25	SS6	35	18	17		CL Inorganic clays of low plasticity

CLIENT **Richcraft Group of Companies**

PROJECT **Geotechnical Investigation - Mapleton - Block 1, Ottawa, Ontario**

FILE NO. **PG3062**

DATE **31 Mar 25**

PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

ATTERBERG LIMITS' RESULTS

PARACEL LABORATORIES LTD.

Order #: 2513087

Certificate of Analysis

Report Date: 27-Mar-2025

Client: Paterson Group Consulting Engineers (Ottawa)

Order Date: 24-Mar-2025

Client PO: 62672

Project Description: PG3062

	Client ID:	PG3062-BH2-25-SS 4	-	-	-		
	Sample Date:	21-Mar-25 09:00	-	-	-	-	-
	Sample ID:	2513087-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	80.0	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.19	-	-	-	-	-
Resistivity	0.1 Ohm.m	55.7	-	-	-	-	-
Anions							
Chloride	10 ug/g	11	-	-	-	-	-
Sulphate	10 ug/g	42	-	-	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG3062-9 – TEST HOLE LOCATION PLAN

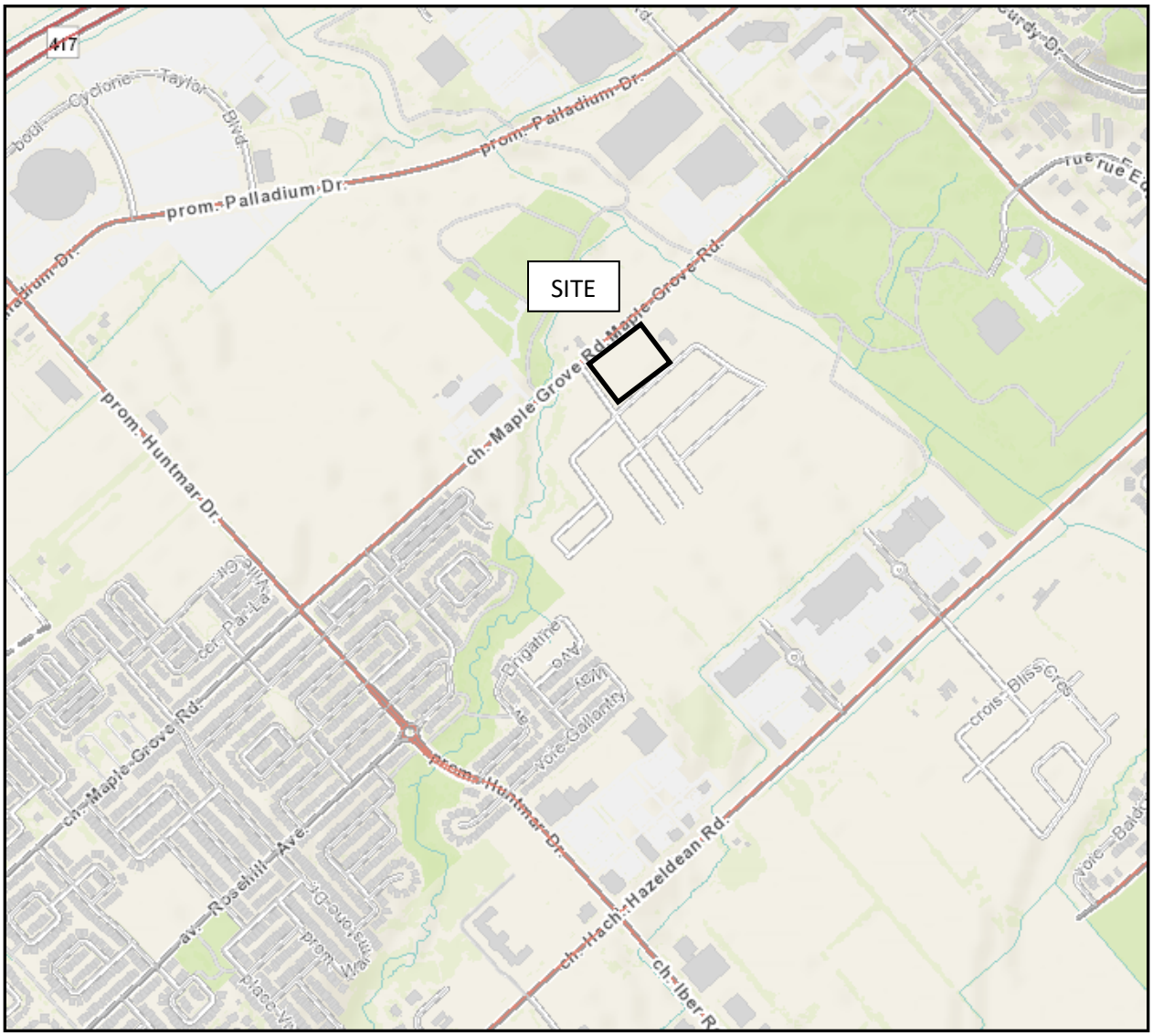
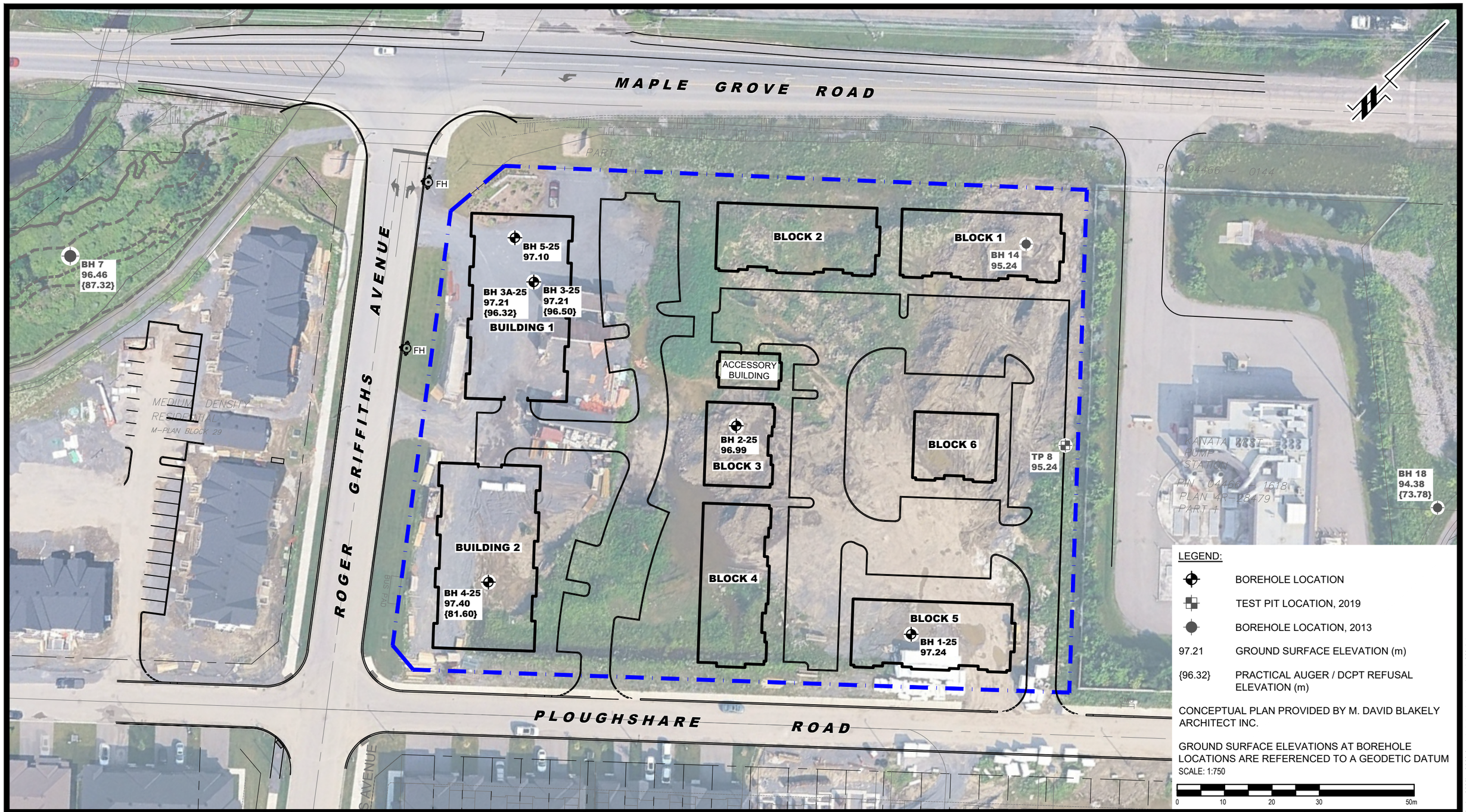


FIGURE 1

KEY PLAN

PATERSON GROUP



LEGEND:

- BOREHOLE LOCATION
- TEST PIT LOCATION, 2019
- BOREHOLE LOCATION, 2013
- 97.21 GROUND SURFACE ELEVATION (m)
- {96.32} PRACTICAL AUGER / DCPT REFUSAL ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY M. DAVID BLAKELY ARCHITECT INC.

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM

SCALE: 1:750

0 10 20 30 50m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

RICHCRAFT HOMES
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
MAPLETON - BLOCK 1
OTTAWA, ONTARIO

Title:

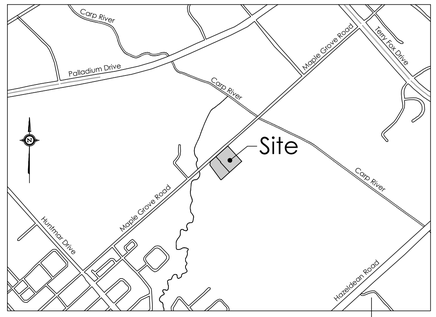
TEST HOLE LOCATION PLAN

Scale: 1:750	Date: 03/2025
Drawn by: YA	Report No.: PG3062-2
Checked by: PB	Dwg. No.: PG3062-9
Approved by: SD	Revision No.:

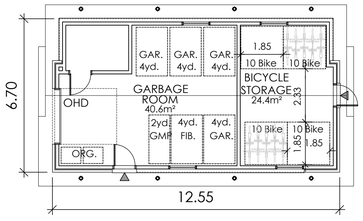
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p:\autocad drawings\geotechnical\pg30xx\pg3062\pg3062-9-test hole location plan (march 2025).dwg

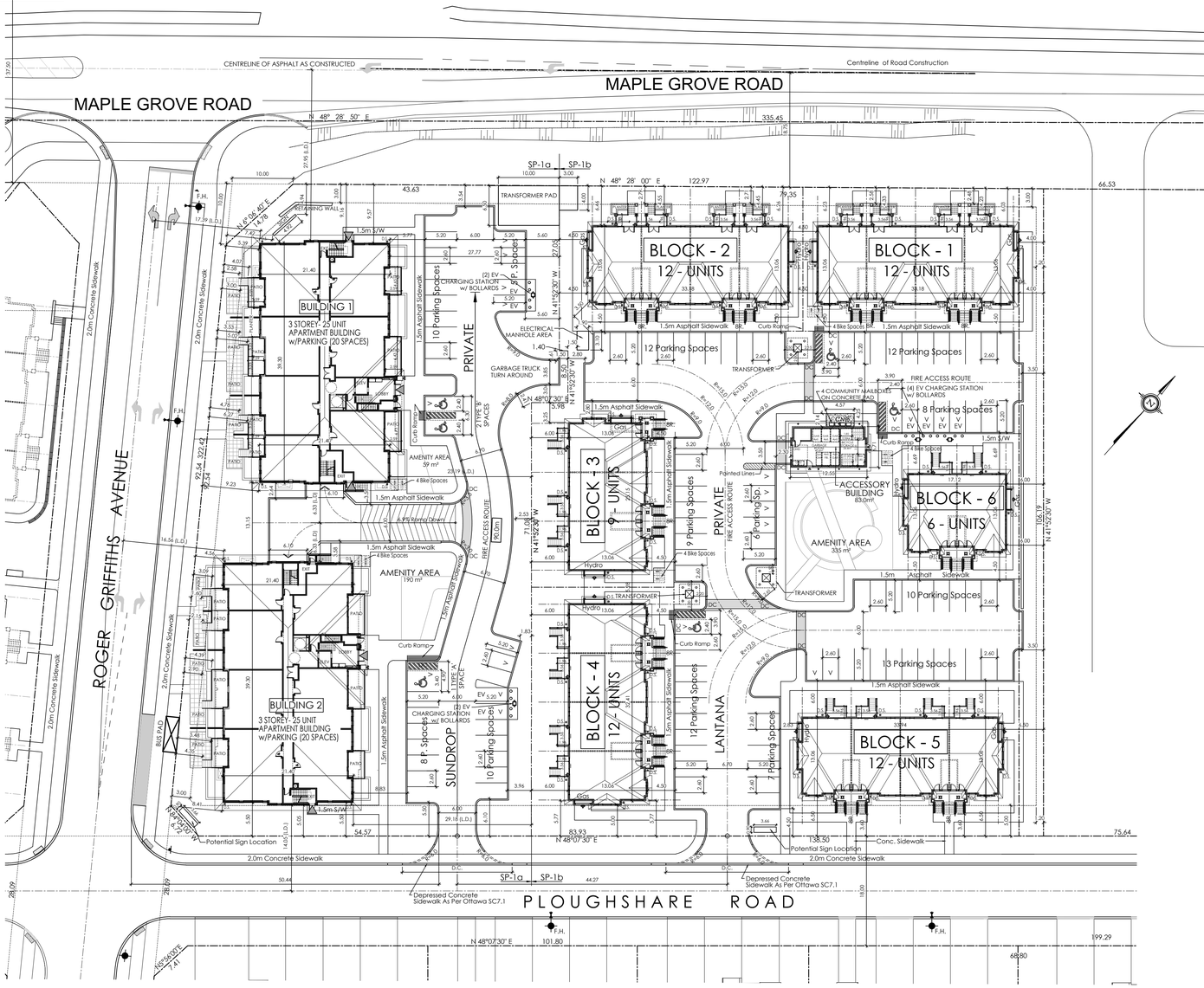
Appendix E Proposed Site Plan



KEY PLAN NOT TO SCALE



ACCESSORY BUILDING - 83.0m²
40 BICYCLE PARKING SPACES


MAPLE GROVE ROAD
CENTRELINE OF ASPHALT AS CONSTRUCTED
Centreline of Road Construction
N 48° 28' 50" E
335.45
122.97
66.53
79.35
43.63
SP-1a
SP-1b
TRANSFORMER PAD
BLOCK - 2
12 - UNITS
BLOCK - 1
12 - UNITS
BUILDING 1
3 STOREY- 25 UNIT APARTMENT BUILDING w/PARKING (20 SPACES)
(2) EV CHARGING STATION w/ BOLLARDS
10 Parking Spaces
PRIVATE
ELECTRICAL MANHOLE AREA
GARBAGE TRUCK TURN AROUND
12 Parking Spaces
TRANSFORMER
FIRE ACCESS ROUTE
(4) EV CHARGING STATION w/ BOLLARDS
4 COMMUNITY MAILBOXES ON CONCRETE PAD
8 Parking Spaces
AMENITY AREA 59 m²
4 Bike Spaces
1.5m Asphalt Sidewalk
6.7% Ramp Down
BLOCK - 3
9 - UNITS
9 Parking Spaces
6 Parking Spaces
ACCESSORY BUILDING 83.0m²
BLOCK - 6
6 - UNITS
AMENITY AREA 335 m²
Hydro
TRANSFORMER
10 Parking Spaces
AMENITY AREA 190 m²
BUILDING 2
3 STOREY- 25 UNIT APARTMENT BUILDING w/PARKING (20 SPACES)
BLOCK - 4
12 - UNITS
12 Parking Spaces
8 P. Spaces w/ BOLLARDS
10 Parking Spaces
SUNDROP
LANTANA
13 Parking Spaces
7 Parking Spaces
BLOCK - 5
12 - UNITS
ROGER GRIFFITHS AVENUE
2.0m Concrete Sidewalk
BUS PAD
Potential Sign Location
Conc. Sidewalk
Depressed Concrete Sidewalk As Per Ottawa SC7.1
PLOUGHSHARE ROAD
N 48°07'30" E
101.80
199.29
68.80
N 48°07'30" E
83.93
75.64
N 48°30' 30" E
15.98
N 41°29'30" W
71.00
N 41°29'30" W
125.70
N 41°29'30" W
97.84
N 41°29'30" W
97.42
N 41°29'30" W
54.57
N 41°30'00" E
7.41
138.50
44.27
50.44
28.09
28.69
37.50
27.95 (L.D.)
17.59 (L.D.)
16.54 (L.D.)
29.18 (L.D.)
14.60 (L.D.)
9.23
6.33 (L.D.)
18.0
6.0 D.C.
90.0m
FIRE ACCESS ROUTE
F.H.
Curb Ramp
Pointed Lines
Ramp
Gas
Hydro
Conc. Sidewalk
Retaining Wall
1.5m S/W
2.0m Concrete Sidewalk
1.5m Asphalt Sidewalk
4 Bike Spaces
10 Bike
1.85
2.53
2.40
2.60
3.20
4.00
4.50
5.20
6.00
6.70
7.00
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
15.0
16.0
17.0
17.5
18.0
21.40
33.18
39.30
40.20
40.30
40.40
40.50
40.60
40.70
40.80
40.90
41.00
41.10
41.20
41.30
41.40
41.50
41.60
41.70
41.80
41.90
42.00
42.10
42.20
42.30
42.40
42.50
42.60
42.70
42.80
42.90
43.00
43.10
43.20
43.30
43.40
43.50
43.60
43.70
43.80
43.90
44.00
44.10

Appendix F Background Report Excerpts

F.1 Richcraft Kanata West Development First Registration Phase – Servicing and Stormwater Management Report, Rev 4, Stantec, February 12, 2020

Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road (D07-16-04-0017) - Servicing and Stormwater Management Report

Job #160401393/83

Prepared for:
Richcraft Homes

Prepared by:
Stantec Consulting Ltd.
1331 Clyde Avenue
Ottawa, Ontario
K2C 3G4

February 12, 2020

Revision	Description	Prepared by		Checked by
0	Site Servicing and Stormwater Management Report	Ana Paerez	March 1, 2018	Karin Smadella
1	Site Servicing and Stormwater Management Report	Ana Paerez	December 11, 2018	Sheridan Gillis
2	First Registration Phase Site Servicing and Stormwater Management Report	Ana Paerez/Thakshika Rathnasooriya	August 28, 2019	Dustin Thiffault
3	First Registration Phase Site Servicing and Stormwater Management Report	Ana Paerez/Thakshika Rathnasooriya	November 19, 2019	Sheridan Gillis
4	First Registration Phase Site Servicing and Stormwater Management Report	Ana Paerez/Thakshika Rathnasooriya	February 12, 2020	Sheridan Gillis

3.0 STORM DRAINAGE

The following sections describe the stormwater management (SWM) design for the Richcraft Kanata West Development in the context of the background documents and governing criteria.

3.1 PROPOSED CONDITIONS

The initial 15.9 ha phase of the overall 36.5 ha development comprises a mixture of townhomes and back to back units, a park, a commercial block, and a medium density residential block. The commercial block and medium density residential private block will be developed as separate site plan applications.

The Kanata West Pond 5 is to be constructed in two stages, interim and ultimate conditions. In the interim development condition, it is proposed to construct an interim KW SWM Pond 5 to provide quality and quantity control for runoff from the proposed first registration phase of the Richcraft Kanata West Development, as well as runoff from the Kanata West Pumping Station (KWPS) for a total interim drainage area to the interim KW SWM Pond 5 of 15.5 ha at 61% imperviousness as shown on **Figure 1.3**. The interim pond will eventually become part of the ultimate KW SWM Pond 5 in the future. The KW Pond 5 will be designed to provide 'Normal' level of quality control of stormwater runoff which corresponds to 70% TSS removal prior to discharging into the Carp River. The *Interim Kanata West Pond 5 (with Ultimate Carp River) Design Brief* (Stantec, April 2019) has been submitted under separate cover and should be read in conjunction with this report.

Site storm sewers for the proposed interim phase will be directed to the interim Kanata West Pond 5 through the west forebay, while a future trunk sewer along Cartage Way and Winter Wheat Terrace will direct runoff from the future phase of the Richcraft Kanata West Development to the east forebay of the ultimate Kanata West Pond 5 which will also service the existing Mattamy and Trinity developments, as well as an existing section of Hazeldean Road once their respective interim SWM facilities are decommissioned. In addition, the ultimate condition KW Pond 5 and future site trunk sewers will service the future transitway/arterial road, and a future commercial block as shown on **Figure 1.4**.

The ultimate development condition with the ultimate KW Pond 5 configuration and the inclusion of runoff from external areas results in the worst-case scenario for the proposed first registration phase of the Richcraft Kanata West Development and as such, the results of the SWM analyses presented in this report correspond to the ultimate development conditions.

The overall approach for storm servicing and stormwater management for the Richcraft Kanata West Development was initially outlined in the Kanata West Master Servicing Study (KWMSS) prepared by Stantec in 2006. In accordance with this document, inlet control devices have been used at road low points to restrict inflow rates to the storm sewers and to provide

attenuating surface storage. The major overland system comprising of swales, roadway sags, streets, etc. has been designed to handle peak flows beyond the storm sewer capacity up to the 100-year storm and to be directed to the KW Pond 5.

3.2 STORMWATER BACKGROUND AND DESIGN CRITERIA

3.2.1 Kanata West Master Servicing Study SWM Criteria

The KWMSS established the SWM criteria for the Kanata West community, the SWM pond locations and their respective outlet locations. The following summarizes the design requirements outlined in the KWMSS for the future developments as shown in the report excerpts included in **Appendix D.2**.

- Width parameter: Twice the street length to be used for arterial roadways, and 225 m/ha to be used for residential and mixed-use developments where no street layout is available.
- Major system storage: major system storage of 40 m^3/ha and 50 m^3/ha was assumed for arterial roads and residential/non-residential lands respectively.
- Inlet control devices to be used to restrict runoff to 85 L/s/ha on average for residential and non-residential lands.
- The capture rates for arterial roadways to be equal to the10-year storm design.
- Sizing of local storm sewers to use inlet times of 15 minutes for typical split-lot drainage in residential developments.
- All sewer hydraulic analysis is to use a static boundary condition equal to the MVC 1983 flood limit of 94.60 m.
- Pond 5 is proposed upstream of the confluence of Poole Creek and the Carp River along the south-west bank of the Carp River. Pond 5 will service residential and retail developments between Poole Creek, the Carp River and Hazeldean Road. Normal and 100-year water levels in the pond are 93.44 m and 94.94 m, respectively.
- The Carp River Watershed/Subwatershed Study (Robinson Consultants, November 2004) proposed target infiltration rates of 104 mm/year and 73 mm/year for areas of moderate and low recharge respectively within the KW Community. Post development infiltration rates are to be increased by 25% above the pre-development rate. This rate of infiltration was established to compensate for those areas (i.e. Roadway corridors) that can not provide infiltration. The Richcraft Kanata West subdivision is identified as having an estimated infiltration rate between 50-70 mm/yr.

3.2.2 Proposed Deviations from the Kanata West Master Servicing Study

The proposed SWM design for the Richcraft Kanata West Development contains deviations from the KWMSS. Firstly, an interim pond has been introduced to support the development of the first registration phase of the Richcraft Development which will be serviced through the proposed west forebay trunk sewer, prior to constructing a second forebay to the east and corresponding

trunk sewer which will service the second registration phase of the Richcraft Development, the existing Fairwinds and Trinity developments, the existing section of Hazeldean Road, as well as future development areas.

The size of the ultimate conditions KW SWM Pond 5 has been increased to reflect the latest City of Ottawa Sewer Design Guidelines minor system capture rates which correspond to the 2-year runoff for local streets, the 5-year runoff for collector roads and the 10-year runoff for arterial roads (see excerpts from the technical bulletin included in **Appendix D.2**). These minor system capture rates are generally higher than the 85 L/s/ha capture rate used in the KWMSS. Similarly, storm sewers have been sized assuming free flow conditions with an inlet time of 10 minutes, instead of the varying inlet times used in the KWMSS which ranged from 15 minutes to 23 minutes. Excerpts from the KWMSS SWM section highlighting the SWM criteria as well as excerpts from the City of Ottawa Technical Bulletin with the new minor system sizing criteria have been provided in **Appendix D.2**.

The ultimate condition drainage area to the KW Pond 5 has been reduced given that the proposed development on 5731 Hazeldean Road which was originally included to go to the KW Pond 5 will now discharge directly into Poole Creek (see **Figure 1.4**).

Minor system peak flows from a medium density residential area north of Maple Grove Road as well as the section of Maple Grove Road between Poole Creek and the Carp River were originally intended to be conveyed through the site storm sewers to the KW Pond 5 in the KWMSS. However, upon further investigation of the existing grades in these areas as well as the expected grade raise restrictions, it was concluded that in order to service these areas through the site storm sewers, grade raises in excess of 2.0 m would be required for the residential area and/or the site storm sewers would need to be lowered by approximately 1.5 m which would cause submerged sewers across most of the site area tributary to the west forebay. As a result, an alternative approach has been proposed to service these areas. Emergency overflows from the Kanata West Pump Station (KWPS) will be directed to the SWM pond through a grassed channel and a storm sewer as shown on **Drawing OSSP-2.** It is proposed to use this channel as an outlet for the future storm sewer from Maple Grove Road.

3.2.3 City of Ottawa Sewer Design Guidelines and Technical Bulletins

The City of Ottawa published Technical Bulletin PIEDTB-2016-01 to revise the storm sewer and stormwater management elements of the Ottawa Design Guidelines – Sewer. The following is a summary of the design criteria obtained from the City Sewer Guidelines and subsequent technical bulletins.

- Use of the dual drainage principle.
- Size storm sewers to fully capture 2-year storm event under free-flow conditions (i.e. no ponding during 2-year storm event) using 2012 City of Ottawa Sewer Design Guidelines I-

D-F parameters for local streets, the 5-year storm event for collector streets, and the 10-year storm event for arterial roads.

- Assess impact of 2-year storm, 5-year storm, the worst case 100-year storm event, and the climate change scenario (worst case 100-year storm event with a 20% increase of rainfall intensity) on the major & minor drainage systems.
- Separation of at least 0.3 m between the 100-year hydraulic grade line (HGL) and building under side of footing (USF) must be provided.
- Maximum 'climate change' HGL to be lower than proposed basement elevations.
- No rear-yard ponding volumes to be accounted for in SWM model preparation. However, the effect of flow routing can be accounted for by assuming a constant slope ditch/swale draining to the street with a minimum slope of 1.5% and a minimum depth of 150 mm. The maximum allowable depth of a swale /ditch shall be 600 mm. The maximum side slopes of swales/ditches shall be 3 horizontal to 1 vertical.
- Depth of flow may extend adjacent to the right-of-way provided that the water level does not touch any part of the building envelope and remains below the lowest building opening during the stress test event (100-year increased by 20%).
- Total maximum depth of flow under static and dynamic conditions shall be less than 0.35 m during the 100-year event.
- There must be at least 15 cm of vertical clearance between the spill elevation on the street and the ground elevation at the building envelope that is in the proximity of the flow route or ponding area.
- There must be at least 30 cm of vertical clearance between the spill elevation on rear yard swales and the ground elevation at the building envelope that is in the proximity of the flow route or ponding area.
- Minimum swale grades at 1.5% (subgrade provided for grades < 1.5%).
- Minimum roadway profile grades at 0.5%.
- Minimum roadway slope of 0.1% from crest-to-crest for overland flow route.
- Provide adequate emergency overflow conveyance off-site.

3.3 DESIGN METHODOLOGY

The design methodology for the SWM component of the development is as follows:

- Create a PCSWMM model that generates major and minor system hydrographs and assesses the minor system hydraulic grade line and the major system flow depths under worst-case conditions (full build-out).

- Ensure that the resulting 100-year hydraulic grade line does not encroach within 0.30 m of the proposed underside of footings (USF) for the proposed units.
- Ensure that total dynamic and static surface ponding depths do not exceed 0.35 m during the 100-year storm scenario.
- Confirm that climate change storm simulation does not result in flooding of properties.
- Design bioswales along the proposed rear yards as appropriate to match the infiltration targets outlined in the KWMSS (make assumptions for future phases and future development blocks as required).

The site is designed using the "dual drainage" principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 2-year design storm for local streets, the 5-year for collector roads, and the 10-year storm for arterial roads, while runoff from larger events is conveyed by both minor (pipe) and major (overland) channels, such as roadways and walkways, safely to the KW Pond 5 without impacting the proposed units.

Inlet Control Devices (ICDs) or orifice plates have been specified for all street and rear-yard catchbasins to limit the inflow to the minor system. Restricted inlet rates to the sewer are necessary to prevent the hydraulic grade line from surcharging storm sewers into basements during major storms. Rear-yard catchbasins will have inlet controls placed at the downstream-most structure before entering the storm sewer. Solid covers will be installed on all manholes located in ponding areas to limit inflows to the minor system to that of the ICD.

The minor and major system for the site are directed to the KW Pond 5. Design assumptions have been made for future phases of the Richcraft KW Development. For instance, minor system peak flows from the future development blocks (i.e. medium density residential, school and commercial block) will be restricted to the 2-year storm. The school block within the future phase will provide 100 m^3/ha of on-site storage, while the medium density residential blocks will provide 50 m^3/ha of on-site storage and major system overflows from the commercial block during the 100-year storm will be stored on site. Quality and quantity control of runoff will be provided in the future ultimate KW Pond 5.

Drawings SD-1, and **SD-2** outline the proposed storm sewer alignment, proposed ICD locations, drainage divides, KW Pond 5 location and storm assumptions for the second registration phase areas. **Drawings PD-1** to **PD-6** show the proposed grading and ponding areas. The storm sewer design sheet is included in **Appendix B.1**.

3.4 MODELING RATIONALE

A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure and major

system segments in the ultimate development condition. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems' response during various storm events. The following assumptions were applied to the detailed model:

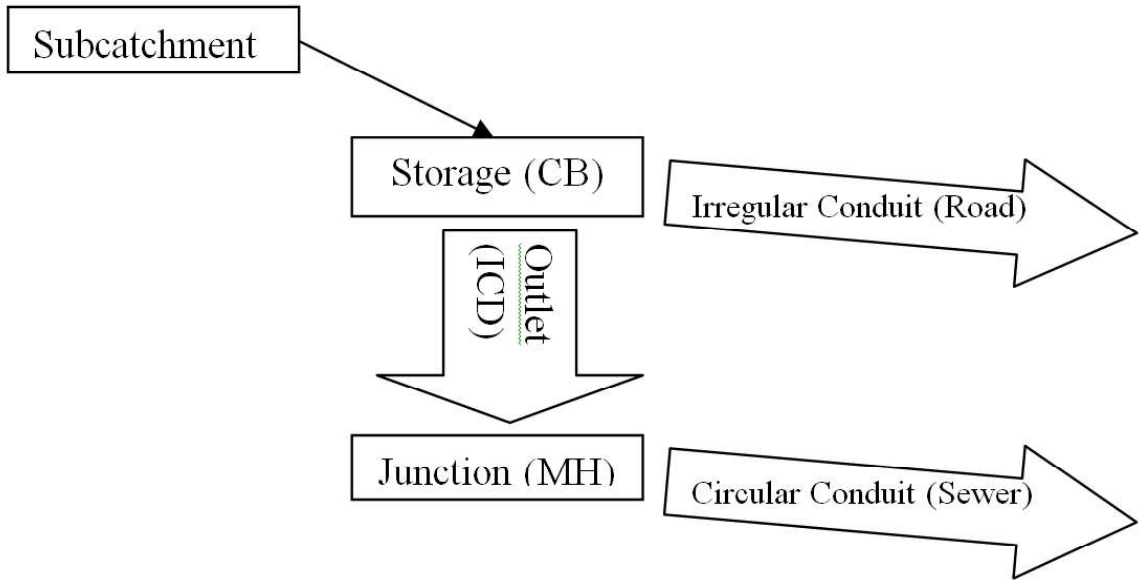
- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values.
- 3-hour Chicago Storm distribution for the 2-year, 5-year, and 10-year to determine inlet capture rates for the different catchments.
- Minor and major system response assessed for the 100-year using the 3-hour Chicago Storm Distribution and the 12-hour SCS Type II distribution with a fixed water level in the Carp River of 94.60 m.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year storms at their specified time step.
- Assess the minor and major systems response during the July 1, 1979 historical with a fixed water level in the Carp River of 94.60 m.
- Percent imperviousness calculated based on actual soft and hard surfaces for representative catchments and converted to equivalent runoff coefficient using the relationship C = (Imp. x 0.7) + 0.2.
- Runoff coefficients for future medium density residential and school blocks of 0.70, and 0.85 for commercial blocks.
- Subcatchment areas are defined from high-point to high-point where sags occur, and detailed grading is available.
- Width parameter was taken as twice the length of the street/swale segment for two-sided catchments and as the length of the street/swale segment for one-sided catchments.
- Where detailed grading was not available, subcatchment areas were defined by the limits of the future development blocks and the width of the subcatchment was defined as 225 m/ha as per the City of Ottawa Sewer Design Guidelines.
- Catchbasin inflow restricted with inlet-control devices (ICDs) as per City guidelines.
- Surface ponding in sag storage calculated based on grading plans (**Drawings PD-1** - **PD-6**).
- Different segment cross-section types defined, accounting for varying right-of-way widths with 3% cross slope, swales, and spillways.
- Future school block (area L218A) to restrict minor system peak flows up to the 100-year storm to 443 L/s and to restrict 100-year overflows to Shropshire Place to 565 L/s.

- Future medium density residential blocks, areas L123B and L225B, to limit minor system peak flows up to the 100-year storm to 111 L/s and to 389 L/s and to restrict 100-year overflows to Maize Street and Holstein Road to 480 L/s and 799 L/s respectively.
- Future commercial block, area L121B, to restrict minor system peak flows up to the 100-year storm to 299 L/s and to provide on-site storage for 100-year overflows.
- Inlet control devices (ICDs) to have a minimum orifice diameter of 83 mm.

3.4.1 SWMM Dual Drainage Methodology

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 3.1**), with: 1) circular conduits representing the sewers & storage nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the saw-toothed overland road network from high-point to low-point and storage nodes representing catchbasins and high points. The dual drainage systems are connected via orifice link objects from storage node (i.e. CB) to junction (i.e. MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there firstly.

Figure 3.1: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins as well as major system junctions. For storage nodes representing catchbasins (CBs), the invert of the storage node represents the invert of the CB and the rim of the storage node represents the maximum allowable flow depth elevation above the storage node (equal to the top of the CB plus an additional 0.35 m or

higher). The additional depth has been added to rim elevations to allow routing from one surface storage to the next. Storage nodes that represent catchbasins at sags, are surrounded by two transects that represent the road segments forming the sag. The storage value assigned to the storage node represents only the volume available within the structure. If the available storage volume in a storage node is exceeded, flows spill above the storage node and into the sag in the irregular conduits (representing roads). The volume stored within the road sags is represented as flood volume in the model and includes the total static volume and the ponded depth above the node representing the dynamic flow depth. Flow storage volumes exceeding the sag storage available in the transect (roadway) will spill at the downstream highpoint into the next sag and continue routing through the system until ultimately flows either re-enter the minor system or reach the outfall of the major system. Storage nodes representing high points are assigned an invert elevation equal to the transect invert (spill elevation at edge of pavement) and a rim elevation equal to the maximum allowable flow depth elevation above the storage node (equal to the spill elevation at edge of pavement plus an additional 0.35 m). A Storage value of 0 has been assigned to these nodes to disable linear volume calculations. No storage has been accounted for within storage nodes at high points. In this manner, storage will accumulate according to the actual ponding depths before spilling along the roadway conduit, and to the next downstream road conduit.

Inlet control devices, as represented by orifice links, use a user-specified diameter and discharge coefficient taken from manufacturer's specifications for the chosen ICD model (IPEX Tempest HF model with circular opening and floatable and odour control). A minimum orifice diameter of 83 mm has been specified.

3.4.2 Boundary Conditions

The worst case scenario for the proposed first registration phase of the Richcraft Kanata West Development will occur under the ultimate development conditions, once the ultimate KW Pond 5 is built and runoff from the external areas is conveyed through the ultimate development storm sewer system to the east forebay of the ultimate KW Pond 5. The following table summarizes the interim and conceptual ultimate KW Pond 5 water levels that drive the hydraulic grade line (HGL) elevations across the proposed development.

Table 3.1: Interim and Ultimate Pond 5 Water Levels

Boundary Condition	Storm Event	Interim Pond Water Level (m)	Conceptual Ultimate Pond Water Level (m)
Carp Model Time Series	2yr12hrSCS	93.87	94.40
Carp Model Time Series	5yr12hrSCS	94.01	94.64
Carp Model Time Series	10yr12hrSCS	94.11	94.73
Carp Model Time Series	25yr12hrSCS	94.24	94.84
Carp Model Time Series	100yr12hrSCS	94.45	94.97
Fixed = 94.60 m	100yr3hrChicago	94.78	95.05

The detailed PCSWMM hydrology, the proposed storm sewers within the proposed first phase, and the preliminary storm sewers for the future phases were used to assess the peak inflows and hydraulic grade line (HGL) in the proposed development. The conceptual design of the ultimate KW Pond 5 as depicted in the *Interim Kanata West Pond 5 (with Ultimate Carp River) Design Brief – D07-16-04 (*Stantec, July 2019) was included in the PCSWMM model. Static backwater elevations corresponding to the 2-year (93.52 m), 5-year (93.73 m), and 25-year (94.01 m) water levels as obtained from the post restoration Ultimate Development Conditions Carp River model have been used as boundary conditions downstream of the ultimate condition SWM Pond for the 2-year, 5-year, and 25-year (25% sediment-filled pipe) models respectively, while a static backwater elevation of 94.60 m as per the MVC 1983 100-year flood elevation for the Carp River has been used for the 100 year, 100 year +20% and historical 1979 storm models.

3.4.3 Hydrologic Parameters

Drawings SD-1, and **SD-2** summarize the discretized subcatchments used in the analysis of the proposed development and outline the major overland flow paths. All parameters were assigned as per applicable OSDG, MECP and background report requirements.

Key parameters for the subject area are summarized below; an example input file is provided for the 100-year, 3hr Chicago storm which indicates all other parameters (see **Appendix B.3**). For all other input files and results of storm scenarios, please examine the electronic model files located on the CD provided with this report. This analysis was performed using PCSWMM, which is a front-end GUI to the EPA-SWMM engine. Model files can be examined in any program which can read EPA-SWMM files version 5.1.012.

Table 3.2 presents the general subcatchment parameters used:

Table 3.2: General Subcatchment Parameters

Subcatchment Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67
Zero Imperv (%)	0

Table 3.3 presents the individual parameters that vary for each of the proposed subcatchments. Subcatchment parameters for future development areas are summarized in **Appendix B.3**.

Table 3.3: Proposed Phase Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
C107A	0.19	52.0	1.0	70.0%	0.69
C109A	0.43	160.0	1.0	70.0%	0.69
C109B	0.38	138.0	1.0	72.9%	0.71
C110A	0.12	39.0	1.0	67.1%	0.67
C121A	0.38	95.0	1.0	68.6%	0.68
C121AA	0.09	37.0	1.5	64.3%	0.65
C123A	0.20	43.2	1.0	67.1%	0.67
EXT1	0.12	59.0	1.5	61.4%	0.63
F101A-1A	0.69	155.0	1.0	50.0%	0.55
L102A	0.23	82.4	1.0	58.6%	0.61
L103A	0.39	161.8	1.0	71.4%	0.70
L103B	0.20	63.2	1.0	60.0%	0.62
L103C	0.64	300.0	1.0	40.0%	0.48
L103D	0.55	278.0	1.0	37.1%	0.46
L104A	0.33	122.7	1.0	68.6%	0.68
L105A	0.32	153.2	1.0	74.3%	0.72
L106A	0.24	97.3	1.0	75.7%	0.73
L106B	0.07	26.6	1.0	70.0%	0.69
L112A	0.41	167.7	1.0	67.1%	0.67
L113A	0.33	127.0	1.0	70.0%	0.69
L113B	0.49	280.0	1.0	31.4%	0.42
L114A	0.06	63.2	1.0	68.6%	0.68
L115A	0.17	58.0	1.0	68.6%	0.68
L117A	0.42	173.7	1.0	72.9%	0.71
L117B	0.15	49.3	1.0	54.3%	0.58
L117C	0.66	360.0	1.0	37.1%	0.46
L118A	0.44	167.3	1.0	65.7%	0.66
L119A	0.31	89.8	1.0	70.0%	0.69
L121B	1.47	331.0	1.0	92.9%	0.85
L123B	0.74	167.0	1.0	71.4%	0.70
L124A	0.23	116.1	1.0	65.7%	0.66
L124B	0.40	246.0	1.0	32.9%	0.43
L126A	0.03	30.0	1.0	75.7%	0.73
L126B	0.26	85.4	1.0	71.4%	0.70
L126C	0.46	104.0	1.0	7.1%	0.25
L127A	0.38	144.2	1.0	65.7%	0.66
L128A	0.32	72.1	1.0	65.7%	0.66
L130A	0.45	170.7	1.0	70.0%	0.69
L130B	0.23	200.0	1.0	40.0%	0.48

The subcatchment layer of PSWMM includes a 'subarea routing' parameter to choose internal routing of runoff between pervious and impervious areas, as well as a 'percent routed' parameter which allocates the percent of runoff routed between subareas. Pervious 'subarea

routing' has been used for all rear yard catchments, future residential blocks, future school block, and park areas to simulate runoff from the impervious portion of the catchment being routed through the pervious portion of the catchment (not directly connected imperviousness). 100% routing has been used for rearyard and park catchments to account for 0% directly connected imperviousness, while 30% routing has been used for future residential and school blocks.

Table 3.4 summarizes the storage node parameters used in the model. No surface storage was assumed within the rear-yard areas for modeling purposes. Static ponding depths, areas, and volumes within the proposed development area are as per **Drawings PD-1** to **PD-6**, but are not explicitly included in the PCSWMM model as per methodology presented in **Section 3.4.1**. Approximately 617 m^3 of surface storage have been provided within the proposed initial phase of the development (not including private blocks), which corresponds to approximately 39 m^3/ha, while approximately 52 m^3/ha will be provided for the overall Richcraft Kanata west Development. Storage node parameters for future development areas are summarized in **Appendix B.3**.

Table 3.4: Storage Node Parameters

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
107A-S(1)	96.21	97.94	1.73
109A-S	96.20	97.93	1.73
109B-S	96.21	97.94	1.73
110A-S	96.37	98.10	1.73
121A-S(2)	95.98	97.71	1.73
121AA-S	95.93	97.66	1.73
123A-S	96.31	98.04	1.73
EXT-1A-S(1)	95.97	96.32	0.35
F101A-S	93.45	95.30	1.85
102A-S(1)	95.76	97.49	1.73
103A-S	95.88	97.61	1.73
103B-S	95.64	97.37	1.73
RY103C-S	96.24	98.04	1.80
RY103D-S	96.20	98.00	1.80
104A-S	96.08	97.81	1.73
105A-S(1)	96.11	97.84	1.73
106A-S(1)	96.27	98.00	1.73
106B-S	96.14	97.87	1.73
112A-S(1)	96.40	98.13	1.73
113A-S(1)	96.47	98.20	1.73
RY113B-S	96.66	98.46	1.80
114A-S	95.69	97.62	1.93
115A-S	95.79	97.52	1.73
117A-S	95.88	97.61	1.73

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
117B-S	95.81	97.54	1.73
RY117C-S	96.17	97.97	1.80
118A-S	96.00	97.73	1.73
119A-S	95.84	97.57	1.73
121B-S	95.85	98.35	2.50
123B-S	96.00	98.50	2.50
124A-S	96.55	98.28	1.73
RY124B-S	96.91	98.71	1.80
126A-S	97.53	99.26	1.73
126B-S(1)	96.99	98.72	1.73
126C-S	96.49	99.62	3.13
127A-S(1)	97.77	99.50	1.73
128A-S(1)	97.49	99.22	1.73
130A-S	97.94	99.67	1.73
RY130B-S	98.38	99.98	1.60

3.4.4 Hydraulic Parameters

As per the OSDG 2012, Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways. Any grassed swales were modeled using Manning's roughness values of 0.025.

Storm sewers were modeled to confirm flow capacities and assess hydraulic grade lines (HGLs). The detailed storm sewer design sheet is included in **Appendix B.1**.

The tables below present the parameters for the orifice link objects within the proposed phase, the orifice link objects used for future phase areas, and the outlet link objects used for future development areas in the model, which represent ICDs. A coefficient of 0.572 was applied when using orifices to conform to head/discharge curves as supplied by the manufacturer for IPEX Tempest HF model ICDs with circular openings and floatable and odour control.

Table 3.5: Orifice Parameters for Proposed Catchments

Orifice Name	Tributary Area ID	Minor System Node	ICD Type
C107A-IC(1)	C107A	107	IPEX TEMPEST HF (95"mm ORIFICE)
C107A-IC(2)	C107A	107	IPEX TEMPEST HF (95"mm ORIFICE)
C109A-IC(1)	C109A	109	IPEX TEMPEST HF (165"mm ORIFICE)
C109A-IC(2)	C109A	109	IPEX TEMPEST HF (165"mm ORIFICE)
C109B-IC(1)	C109B	109	IPEX TEMPEST HF (178"mm ORIFICE)
C109B-IC(2)	C109B	109	IPEX TEMPEST HF (178"mm ORIFICE)
C110A-IC(1)	C110A	110	IPEX TEMPEST HF (108"mm ORIFICE)

Orifice Name	Tributary Area ID	Minor System Node	ICD Type
C121AA-IC(1)	C121AA	SU15	IPEX TEMPEST HF (83"mm ORIFICE)
C121AA-IC(2)	C121AA	SU15	IPEX TEMPEST HF (83"mm ORIFICE)
C121A-IC(1)	C121A	121	IPEX TEMPEST HF (152"mm ORIFICE)
C121A-IC(2)	C121A	121	IPEX TEMPEST HF (152"mm ORIFICE)
C123A-IC(1)	C123A	123	IPEX TEMPEST HF (102"mm ORIFICE)
C123A-IC(2)	C123A	123	IPEX TEMPEST HF (102"mm ORIFICE)
L102A-IC(1)	L102A	102	IPEX TEMPEST HF (83"mm ORIFICE)
L102A-IC(2)	L102A	102	IPEX TEMPEST HF (83"mm ORIFICE)
L103A-IC(1)	L103A	103	IPEX TEMPEST HF (127"mm ORIFICE)
L103A-IC(2)	L103A	103	IPEX TEMPEST HF (127"mm ORIFICE)
L103B-IC(1)	L103B	103	IPEX TEMPEST HF (83"mm ORIFICE)
L103B-IC(2)	L103B	103	IPEX TEMPEST HF (83"mm ORIFICE)
L103C-IC	L103C	103	IPEX TEMPEST HF (140"mm ORIFICE)
L103D-IC	L103D	103	IPEX TEMPEST HF (127"mm ORIFICE)
L104A-IC(1)	L104A	104	IPEX TEMPEST HF (108"mm ORIFICE)
L104A-IC(2)	L104A	104	IPEX TEMPEST HF (108"mm ORIFICE)
L105A-IC(1)	L105A	105	IPEX TEMPEST HF (108"mm ORIFICE)
L105A-IC(2)	L105A	105	IPEX TEMPEST HF (108"mm ORIFICE)
L106A-IC(1)	L106A	106	IPEX TEMPEST HF (102"mm ORIFICE)
L106A-IC(2)	L106A	106	IPEX TEMPEST HF (102"mm ORIFICE)
L106B-IC(1)	L106B	106	IPEX TEMPEST HF (83"mm ORIFICE)
L112A-IC(1)	L112A	112	IPEX TEMPEST HF (127"mm ORIFICE)
L112A-IC(2)	L112A	112	IPEX TEMPEST HF (127"mm ORIFICE)
L113A-IC(1)	L113A	113	IPEX TEMPEST HF (108"mm ORIFICE)
L113A-IC(2)	L113A	113	IPEX TEMPEST HF (108"mm ORIFICE)
L113B-IC	L113B	113	IPEX TEMPEST HF (108"mm ORIFICE)
L114A-IC	L114A	114	IPEX TEMPEST HF (108"mm ORIFICE)
L115A-IC(1)	L115A	115	IPEX TEMPEST HF (83"mm ORIFICE)
L115A-IC(2)	L115A	115	IPEX TEMPEST HF (83"mm ORIFICE)
L117A-IC(1)	L117A	117	IPEX TEMPEST HF (127"mm ORIFICE)
L117A-IC(2)	L117A	117	IPEX TEMPEST HF (127"mm ORIFICE)
L117B-IC(1)	L117B	117	IPEX TEMPEST HF (83"mm ORIFICE)
L117B-IC(2)	L117B	117	IPEX TEMPEST HF (83"mm ORIFICE)
L117C-IC	L117C	117	IPEX TEMPEST HF (140"mm ORIFICE)
L118A-IC(1)	L118A	118	IPEX TEMPEST HF (127"mm ORIFICE)
L118A-IC(2)	L118A	118	IPEX TEMPEST HF (127"mm ORIFICE)
L119A-IC(1)	L119A	119	IPEX TEMPEST HF (108"mm ORIFICE)
L119A-IC(2)	L119A	119	IPEX TEMPEST HF (108"mm ORIFICE)
L124A-IC(1)	L124A	124	IPEX TEMPEST HF (95"mm ORIFICE)
L124A-IC(2)	L124A	124	IPEX TEMPEST HF (95"mm ORIFICE)
L124B-IC	L124B	124	IPEX TEMPEST HF (95"mm ORIFICE)
L126A-IC(1)	L126A	126	IPEX TEMPEST HF (83"mm ORIFICE)
L126B-IC(1)	L126B	126	IPEX TEMPEST HF (102"mm ORIFICE)
L126B-IC(2)	L126B	126	IPEX TEMPEST HF (102"mm ORIFICE)

Orifice Name	Tributary Area ID	Minor System Node	ICD Type
L126C-IC	L126C	126	IPEX TEMPEST HF (83"mm ORIFICE)
L127A-IC(1)	L127A	127	IPEX TEMPEST HF (127"mm ORIFICE)
L127A-IC(2)	L127A	127	IPEX TEMPEST HF (127"mm ORIFICE)
L128A-IC(1)	L128A	128	IPEX TEMPEST HF (102"mm ORIFICE)
L128A-IC(2)	L128A	128	IPEX TEMPEST HF (102"mm ORIFICE)
L130A-IC(1)	L130A	130	IPEX TEMPEST HF (127"mm ORIFICE)
L130A-IC(2)	L130A	130	IPEX TEMPEST HF (127"mm ORIFICE)
L130B-IC	L130B	130	IPEX TEMPEST HF (108"mm ORIFICE)

Table 3.6: Orifice Parameters for Future Phase Catchments

Orifice Name	Tributary Area ID	Minor System Node	ICD Type
C205A-IC(1)	C205A	205	IPEX TEMPEST HF (127"mm ORIFICE)
C205A-IC(2)	C205A	205	IPEX TEMPEST HF (127"mm ORIFICE)
C219-IC	C219A	219	IPEX TEMPEST HF (102"mm ORIFICE)
C220A-IC(1)	C220A	220	IPEX TEMPEST HF (191"mm ORIFICE)
C220A-IC(2)	C220A	220	IPEX TEMPEST HF (191"mm ORIFICE)
C222A-IC(1)	C222A	222	IPEX TEMPEST HF (203"mm ORIFICE)
C222A-IC(2)	C222A	222	IPEX TEMPEST HF (203"mm ORIFICE)
C223A-IC(1)	C223A	223	IPEX TEMPEST HF (178"mm ORIFICE)
G234A-IC	G234A	234	IPEX TEMPEST HF (83"mm ORIFICE)
L116A-IC(1)	L116A	116	IPEX TEMPEST HF (95"mm ORIFICE)
L116A-IC(2)	L116A	116	IPEX TEMPEST HF (95"mm ORIFICE)
L202A-IC(1)	L202A	202	IPEX TEMPEST HF (83"mm ORIFICE)
L202A-IC(2)	L202A	202	IPEX TEMPEST HF (83"mm ORIFICE)
L202B-IC	L202B	202	IPEX TEMPEST HF (108"mm ORIFICE)
L204A-IC(1)	L204A	204	IPEX TEMPEST HF (127"mm ORIFICE)
L204A-IC(2)	L204A	204	IPEX TEMPEST HF (127"mm ORIFICE)
L204B-IC(1)	L204B	204	IPEX TEMPEST HF (127"mm ORIFICE)
L204B-IC(2)	L204B	204	IPEX TEMPEST HF (127"mm ORIFICE)
L205B-IC	L205B	205	IPEX TEMPEST HF (127"mm ORIFICE)
L206A-IC(1)	L206A	206	IPEX TEMPEST HF (108"mm ORIFICE)
L206A-IC(2)	L206A	206	IPEX TEMPEST HF (108"mm ORIFICE)
L206B-IC(1)	C206B	206	IPEX TEMPEST HF (140"mm ORIFICE)
L207A-IC(1)	L207A	207	IPEX TEMPEST HF (152"mm ORIFICE)
L207A-IC(2)	L207A	207	IPEX TEMPEST HF (152"mm ORIFICE)
L209A-IC(1)	L209A	209	IPEX TEMPEST HF (127"mm ORIFICE)
L209A-IC(2)	L209A	209	IPEX TEMPEST HF (127"mm ORIFICE)
L209B-IC	L209B	209	IPEX TEMPEST HF (102"mm ORIFICE)
L209C-IC	L209C	209	IPEX TEMPEST HF (108"mm ORIFICE)
L210A-IC(1)	L210A	210	IPEX TEMPEST HF (102"mm ORIFICE)
L210A-IC(2)	L210A	210	IPEX TEMPEST HF (102"mm ORIFICE)

Orifice Name	Tributary Area ID	Minor System Node	ICD Type
L210B-IC	L210B	210	IPEX TEMPEST HF (108"mm ORIFICE)
L211A-IC(1)	L211A	211	IPEX TEMPEST HF (127"mm ORIFICE)
L211A-IC(2)	L211A	211	IPEX TEMPEST HF (127"mm ORIFICE)
L213A-IC(1)	L213A	213	IPEX TEMPEST HF (95"mm ORIFICE)
L213A-IC(2)	L213A	213	IPEX TEMPEST HF (95"mm ORIFICE)
L214A-IC(1)	L214A	214	IPEX TEMPEST HF (152"mm ORIFICE)
L214A-IC(2)	L214A	214	IPEX TEMPEST HF (152"mm ORIFICE)
L217A-IC(1)	L217A	217	IPEX TEMPEST HF (127"mm ORIFICE)
L217A-IC(2)	L217A	217	IPEX TEMPEST HF (127"mm ORIFICE)
L218B-IC	L218B	218	IPEX TEMPEST HF (95"mm ORIFICE)
L219B-IC(1)	L219B	219	IPEX TEMPEST HF (127"mm ORIFICE)
L219B-IC(2)	L219B	219	IPEX TEMPEST HF (127"mm ORIFICE)
L220A-S	L220A	220	IPEX TEMPEST HF (178"mm ORIFICE)
L225A-IC(1)	L225A	225	IPEX TEMPEST HF (102"mm ORIFICE)
L225A-IC(2)	L225A	225	IPEX TEMPEST HF (102"mm ORIFICE)
L226A-IC(1)	L226A	226	IPEX TEMPEST HF (102"mm ORIFICE)
L226A-IC(2)	L226A	226	IPEX TEMPEST HF (102"mm ORIFICE)
L226B-IC	L226B	226	IPEX TEMPEST HF (127"mm ORIFICE)
L228A-IC(1)	L228A	228	IPEX TEMPEST HF (127"mm ORIFICE)
L228A-IC(2)	L228A	228	IPEX TEMPEST HF (127"mm ORIFICE)
L229A-IC(1)	L229A	229	IPEX TEMPEST HF (127"mm ORIFICE)
L229A-IC(2)	L229A	229	IPEX TEMPEST HF (127"mm ORIFICE)
L234A-IC(1)	L234A	234	IPEX TEMPEST HF (108"mm ORIFICE)
L234A-IC(2)	L234A	234	IPEX TEMPEST HF (108"mm ORIFICE)
L234B-IC(1)	L234B	234	IPEX TEMPEST HF (95"mm ORIFICE)
L234B-IC(2)	L234B	234	IPEX TEMPEST HF (95"mm ORIFICE)
L237A-IC(1)	L237A	237	IPEX TEMPEST HF (102"mm ORIFICE)
L237A-IC(2)	L237A	237	IPEX TEMPEST HF (102"mm ORIFICE)
L238A-IC	L238A	238	IPEX TEMPEST HF (203"mm ORIFICE)
L240A-IC(1)	L240A	240	IPEX TEMPEST HF (102"mm ORIFICE)
L240A-IC(2)	L240A	240	IPEX TEMPEST HF (102"mm ORIFICE)
L240B-IC(1)	L240B	240	IPEX TEMPEST HF (127"mm ORIFICE)
L240B-IC(2)	L240B	240	IPEX TEMPEST HF (127"mm ORIFICE)
L241A-IC(1)	L241A	241	IPEX TEMPEST HF (108"mm ORIFICE)
L241A-IC(2)	L241A	241	IPEX TEMPEST HF (108"mm ORIFICE)

Table 3.7 below presents the parameters for the outlet link objects in the model, which represent the minor system capture rate for the future private blocks within the Richcraft KW Development and the future external areas.

Table 3.7: SWM Criteria for Future Areas

Storm Drainage Area	Block ID/Location	Description	MH Outlet	Maximum Minor System Capture (L/s)	100-Year Major System Overflows (L/s)
Arterial	Block 99	Arterial	209	953	N/A - Overflow to Poole Creek as per KWMSS
B-1	North of Maple Grove	Residential	J2	116	100-year On-Site Storage as per KWMSS
B-2	Maple Grove ROW	Arterial	J4	199	N/A - Overflow to Poole Creek/Carp River as per KWMSS
Comm	North of Hazeldean	Commercial	209	399	100-year On-Site Storage
Hazeldean	Hazeldean ROW	Arterial	209	1,187	N/A - Overflow to Carp River as per KWMSS
L121B	Block 136	Commercial	121	299	100-year On-Site Storage
L123B	Block 115	Residential	123	111	480 L/s to Maize Street
L218A	Block 76	School	218	443	565 L/s to Shropshire Place
L225B	Block 89	Residential	225	389	799 L/s to Holstein Road

3.5 MODEL RESULTS AND DISCUSSION

The following section summarizes the key hydrologic and hydraulic model results for the proposed development area based on ultimate conditions. For detailed model results or inputs please refer to the example input file in **Appendix B.3** and the electronic model files on the enclosed CD.

3.5.1 Hydrology

Table 3.8 summarizes the orifice/outlet link maximum flow rates and heads across the proposed development.

Table 3.8: Proposed Phase Orifice Link Results

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
C107A-IC(1)	C107A	IPEX TEMPEST HF (95"mm ORIFICE)	0.66	1.59	14.1	22.3
C107A-IC(2)	C107A	IPEX TEMPEST HF (95"mm ORIFICE)	0.66	1.59	14.1	22.3
C109A-IC(1)	C109A	IPEX TEMPEST HF (165"mm ORIFICE)	0.46	1.55	33.4	65.5
C109A-IC(2)	C109A	IPEX TEMPEST HF (165"mm ORIFICE)	0.46	1.55	33.4	65.5
C109B-IC(1)	C109B	IPEX TEMPEST HF (178"mm ORIFICE)	0.32	1.47	30.5	74.1
C109B-IC(2)	C109B	IPEX TEMPEST HF (178"mm ORIFICE)	0.32	1.47	30.5	74.1
C110A-IC(1)	C110A	IPEX TEMPEST HF (108"mm ORIFICE)	0.61	1.51	17.3	28.0
C121AA-IC(1)	C121AA	IPEX TEMPEST HF (83"mm ORIFICE)	0.27	1.43	6.5	16.1

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
C121AA-IC(2)	C121AA	IPEX TEMPEST HF (83"mm ORIFICE)	0.27	1.43	6.5	16.1
C121A-IC(1)	C121A	IPEX TEMPEST HF (152"mm ORIFICE)	0.47	1.67	28.8	58.1
C121A-IC(2)	C121A	IPEX TEMPEST HF (152"mm ORIFICE)	0.47	1.67	28.8	58.1
C123A-IC(1)	C123A	IPEX TEMPEST HF (102"mm ORIFICE)	0.54	1.53	14.5	25.2
C123A-IC(2)	C123A	IPEX TEMPEST HF (102"mm ORIFICE)	0.54	1.53	14.5	25.2
L102A-IC(1)	L102A	IPEX TEMPEST HF (83"mm ORIFICE)	1.17	1.55	14.6	16.9
L102A-IC(2)	L102A	IPEX TEMPEST HF (83"mm ORIFICE)	1.17	1.55	14.6	16.9
L103A-IC(1)	L103A	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.59	30.7	39.7
L103A-IC(2)	L103A	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.59	30.7	39.7
L103B-IC(1)	L103B	IPEX TEMPEST HF (83"mm ORIFICE)	1.07	1.69	13.9	17.6
L103B-IC(2)	L103B	IPEX TEMPEST HF (83"mm ORIFICE)	1.07	1.69	13.9	17.6
L103C-IC	L103C	IPEX TEMPEST HF (140"mm ORIFICE)	1.26	1.39	42.5	44.9
L103D-IC	L103D	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.39	35.0	37.0
L104A-IC(1)	L104A	IPEX TEMPEST HF (108"mm ORIFICE)	1.22	1.59	25.1	28.7
L104A-IC(2)	L104A	IPEX TEMPEST HF (108"mm ORIFICE)	1.22	1.59	25.1	28.7
L105A-IC(1)	L105A	IPEX TEMPEST HF (108"mm ORIFICE)	1.35	1.61	26.5	28.9
L105A-IC(2)	L105A	IPEX TEMPEST HF (108"mm ORIFICE)	1.35	1.61	26.5	28.9
L106A-IC(1)	L106A	IPEX TEMPEST HF (102"mm ORIFICE)	1.00	1.51	20.2	25.0
L106A-IC(2)	L106A	IPEX TEMPEST HF (102"mm ORIFICE)	1.00	1.51	20.2	25.0
L106B-IC(1)	L106B	IPEX TEMPEST HF (83"mm ORIFICE)	0.69	1.59	11.0	17.1
L112A-IC(1)	L112A	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.68	30.7	40.8
L112A-IC(2)	L112A	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.68	30.7	40.8
L113A-IC(1)	L113A	IPEX TEMPEST HF (108"mm ORIFICE)	1.24	1.71	25.2	29.9
L113A-IC(2)	L113A	IPEX TEMPEST HF (108"mm ORIFICE)	1.24	1.71	25.2	29.9
L113B-IC	L113B	IPEX TEMPEST HF (108"mm ORIFICE)	1.28	1.52	25.8	28.1
L114A-IC	L114A	IPEX TEMPEST HF (108"mm ORIFICE)	0.21	1.59	9.1	28.7
L115A-IC(1)	L115A	IPEX TEMPEST HF (83"mm ORIFICE)	0.85	1.60	12.3	17.1
L115A-IC(2)	L115A	IPEX TEMPEST HF (83"mm ORIFICE)	0.85	1.60	12.3	17.1
L117A-IC(1)	L117A	IPEX TEMPEST HF (127"mm ORIFICE)	1.19	1.62	34.1	40.0
L117A-IC(2)	L117A	IPEX TEMPEST HF (127"mm ORIFICE)	1.19	1.62	34.1	40.0
L117B-IC(1)	L117B	IPEX TEMPEST HF (83"mm ORIFICE)	0.53	1.67	9.5	17.5
L117B-IC(2)	L117B	IPEX TEMPEST HF (83"mm ORIFICE)	0.53	1.67	9.5	17.5
L117C-IC	L117C	IPEX TEMPEST HF (140"mm ORIFICE)	1.26	1.42	42.6	45.3
L118A-IC(1)	L118A	IPEX TEMPEST HF (127"mm ORIFICE)	1.07	1.59	32.2	39.6
L118A-IC(2)	L118A	IPEX TEMPEST HF (127"mm ORIFICE)	1.07	1.59	32.2	39.6
L119A-IC(1)	L119A	IPEX TEMPEST HF (108"mm ORIFICE)	1.10	1.57	23.8	28.6
L119A-IC(2)	L119A	IPEX TEMPEST HF (108"mm ORIFICE)	1.10	1.57	23.8	28.6
L124A-IC(1)	L124A	IPEX TEMPEST HF (95"mm ORIFICE)	0.93	1.65	16.9	22.8
L124A-IC(2)	L124A	IPEX TEMPEST HF (95"mm ORIFICE)	0.93	1.65	16.9	22.8
L124B-IC	L124B	IPEX TEMPEST HF (95"mm ORIFICE)	1.25	1.36	19.7	20.6
L126A-IC(1)	L126A	IPEX TEMPEST HF (83"mm ORIFICE)	0.20	1.60	5.4	17.1
L126B-IC(1)	L126B	IPEX TEMPEST HF (102"mm ORIFICE)	1.03	1.63	20.5	26.1
L126B-IC(2)	L126B	IPEX TEMPEST HF (102"mm ORIFICE)	1.03	1.63	20.5	26.1
L126C-IC	L126C	IPEX TEMPEST HF (83"mm ORIFICE)	0.36	2.64	4.3	21.0
L127A-IC(1)	L127A	IPEX TEMPEST HF (127"mm ORIFICE)	0.88	1.44	27.8	36.6
L127A-IC(2)	L127A	IPEX TEMPEST HF (127"mm ORIFICE)	0.88	1.44	27.8	36.6
L128A-IC(1)	L128A	IPEX TEMPEST HF (102"mm ORIFICE)	1.24	1.64	22.6	26.1
L128A-IC(2)	L128A	IPEX TEMPEST HF (102"mm ORIFICE)	1.24	1.64	22.6	26.1

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
L130A-IC(1)	L130A	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.53	35.0	38.9
L130A-IC(2)	L130A	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.53	35.0	38.9
L130B-IC	L130B	IPEX TEMPEST HF (108"mm ORIFICE)	1.00	1.03	22.6	23.0

3.5.2 Proposed Development Hydraulic Grade Line Analysis

As mentioned previously, the worst-case HGL across the site occurs in the ultimate development conditions as outlined in the *Interim Kanata West Pond 5 (with Ultimate Carp River) Design Brief – D07-16-04 (*Stantec, April 2019) once the runoff from existing and future development areas is routed through the proposed site minor system to the ultimate KW Pond 5 through the trunk sewer along Cartage Way and Winter Wheat Terrace to the east forebay.

As shown in **Figure 1.4**, a portion of the proposed storm sewer system will be partially submerged. Specifically, approximately 138 m of storm sewer tributary to the west forebay (proposed first registration phase) and approximately 1,025 m of storm sewer tributary to the east forebay (future ultimate condition) will be partially submerged. Figure 5.5 from the KWMSS has been included in **Appendix D,** which shows the extent of submerged sewers. As can be seen, the extent of submerged sewers obtained in the KWMSS is comparable if not more than in the Kanata West Development, which is to be expected given that the pond bottom and permanent pool elevation have remained as per the KWMSS.

As per the above, the worst case 100-year hydraulic grade line (HGL) elevation across the proposed development was estimated using the conceptual ultimate KW Pond 5 PCSWMM model for the 100-year, 3-hour Chicago and 12-hour SCS Type II storms with a static backwater elevation of 94.60 m as per the MVC 1983 100-year flood elevation for the Carp River. **Table 3.9** below presents the clearance between the trunk sewer worst case HGL and the proposed under side of footing (USF) within the proposed first registration phase of the development. The storm sewer design sheet is included in **Appendix B.1**. The 'climate change' scenarios required by the City of Ottawa Sewer Design Guidelines (2012), where 100-year intensities are increased by 20% were also assessed. 100-Year HGL profiles from PCSWMM have been included in **Appendix B.4**.

Table 3.9: Proposed Phase - Ultimate Condition Hydraulic Grade Line Results

STM MH	Prop. USF Elevation (m)	100-Year HGL				100-year + 20%			
		12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR HGL (m)	USF – HGL Clearance (m)	12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR+20% HGL (m)	USF –HGL Clearance (m)
100C	N/A	95.06	95.06	95.06	-	95.09	95.10	95.10	-
100D	N/A	95.07	95.07	95.07	-	95.11	95.12	95.12	-
100E	N/A	95.05	95.05	95.05	-	95.09	95.10	95.10	-

STM MH	Prop. USF Elevation (m)	100-Year HGL				100-year + 20%			
		12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR HGL (m)	USF – HGL Clearance (m)	12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR+20% HGL (m)	USF –HGL Clearance (m)
101	95.74	95.14	95.14	95.14	0.60	95.19	95.20	95.20	0.54
102	95.63	95.15	95.16	95.16	0.47	95.20	95.22	95.22	0.41
103	95.69	95.17	95.18	95.18	0.51	95.22	95.25	95.25	0.44
104	95.75	95.19	95.19	95.19	0.56	95.23	95.27	95.27	0.48
105	96.00	95.25	95.23	95.25	0.75	95.30	95.36	95.36	0.64
106	96.00	95.29	95.27	95.29	0.71	95.33	95.39	95.39	0.61
107	96.10	95.49	95.54	95.54	0.56	95.63	95.71	95.71	0.39
108	96.10	95.53	95.58	95.58	0.52	95.69	95.82	95.82	0.28
+50	96.25	95.56	95.62	95.62	0.63	95.76	95.93	95.93	0.32
+86	96.33	95.58	95.65	95.65	0.68	95.82	96.01	96.01	0.32
109	96.23	95.60	95.68	95.68	0.55	95.86	96.08	96.08	0.15
110	96.54	95.61	95.68	95.68	0.86	95.78	95.86	95.86	0.68
111	96.30	95.67	95.74	95.74	0.56	95.84	95.92	95.92	0.38
112	96.30	95.84	95.92	95.92	0.38	96.02	96.10	96.10	0.20
+51	96.34	95.88	95.96	95.96	0.38	96.07	96.15	96.15	0.19
113	96.37	95.90	95.99	95.99	0.38	96.10	96.18	96.18	0.19
114	95.63	95.17	95.18	95.18	0.45	95.21	95.24	95.24	0.39
115	95.63	95.21	95.23	95.23	0.40	95.27	95.30	95.30	0.33
116	95.71	95.33	95.35	95.35	0.36	95.40	95.45	95.45	0.26
117	95.70	95.27	95.30	95.30	0.40	95.34	95.38	95.38	0.32
118	95.90	95.54	95.54	95.54	0.36	95.54	95.55	95.55	0.35
119	95.70	95.28	95.30	95.30	0.40	95.35	95.39	95.39	0.31
+51	95.79	95.33	95.36	95.36	0.43	95.42	95.46	95.46	0.33
121	96.20	95.40	95.43	95.43	0.77	95.50	95.55	95.55	0.65
121A	N/A	95.46	95.50	95.50	-	95.51	95.55	95.55	-
123	96.40	95.64	95.64	95.64	0.76	95.70	95.74	95.74	0.66
124	96.64	96.34	96.34	96.34	0.30	96.34	96.35	96.35	0.29
125	96.99	96.48	96.49	96.49	0.50	96.49	96.49	96.49	0.50
+69	97.15	96.84	96.85	96.85	0.30	96.86	96.86	96.86	0.29
126	97.44	96.96	96.97	96.97	0.47	96.98	96.98	96.98	0.46
+41	97.69	97.32	97.33	97.33	0.36	97.33	97.33	97.33	0.36
+71	98.00	97.58	97.59	97.59	0.41	97.59	97.59	97.59	0.41
127	98.35	97.92	97.93	97.93	0.42	97.93	97.93	97.93	0.42
128	97.44	97.05	97.07	97.07	0.37	97.07	97.08	97.08	0.36
129	97.49	97.13	97.14	97.14	0.35	97.14	97.14	97.14	0.35
+31	97.67	97.29	97.29	97.29	0.38	97.29	97.29	97.29	0.38
+65	98.17	97.46	97.46	97.46	0.71	97.46	97.46	97.46	0.71
130	98.35	97.70	97.70	97.70	0.65	97.70	97.70	97.70	0.65
131	98.39	97.70	97.70	97.70	0.69	97.70	97.70	97.70	0.69
132	98.39	97.56	97.56	97.56	0.83	97.56	97.56	97.56	0.83

The model results indicate that there is sufficient clearance between the worst case 100-year HGL and the proposed under side of footings (USFs).

An additional sensitivity test has also been undertaken to assess the hydraulic grade line (HGL) elevation across the proposed storm sewer network under ultimate development conditions, during the 25-year, 12-hour SCS with accumulation of sediment in the portions of the proposed storm sewer pipes submerged by the permanent pool of the SWM pond (93.44 m). Storm sewer pipes partially submerged by the permanent pool of the ultimate KW SWM Pond 5 were modelled as smaller diameter pipes, in order to replicate the impact of sediment accumulation (assumed to be 25% of submerged area) in the submerged portions of the pipes. The pipe parameters used in the sediment accumulation HGL analysis for the ultimate condition development are summarized in **Appendix B.5.**

Table 3.10 shows the results of the sediment accumulation HGL analysis for the Ultimate condition development during the 25-year, 12-hour SCS storm.

Table 3.10: Proposed Phase - Ultimate Development Sediment Accumulation HGL Results

STM MH	Prop. USF (m)	25-Year, 12 HR SCS HGL (m)	USF - HGL Clearance (m)
100C	N/A	94.88	N/A
100D	N/A	94.88	N/A
100E	N/A	94.87	N/A
101	95.74	94.90	0.84
102	95.63	94.90	0.73
103	95.69	94.91	0.78
104	95.75	94.91	0.84
105	96.00	95.15	0.85
106	96.00	95.24	0.76
107	96.10	95.13	0.97
108	96.10	95.17	0.93
109	96.10	95.45	0.65
110	96.54	95.31	1.23
111	96.30	95.39	0.91
112	96.30	95.59	0.71
113	96.30	95.79	0.51
114	95.63	94.91	0.72
115	95.63	94.93	0.70

STM MH	Prop. USF (m)	25-Year, 12 HR SCS HGL (m)	USF - HGL Clearance (m)
117	95.70	95.09	0.61
118	95.90	95.53	0.37
119	95.70	94.95	0.75
121	95.70	95.04	0.66
121A	N/A	N/A	N/A
123	96.40	95.59	0.81
124	96.64	96.33	0.31
125	96.99	96.47	0.52
+69	97.15	96.81	0.34
126	97.44	96.93	0.51
+41	97.69	97.30	0.39
+71	98.00	97.56	0.44
127	98.35	97.92	0.43
128	97.44	97.01	0.43
129	97.49	97.11	0.38
+31	97.67	97.27	0.40
+65	98.17	97.45	0.72
130	98.35	97.70	0.65
131	98.39	97.70	0.69
132	98.39	97.56	0.83

The results show that sufficient clearance is provided between the proposed USFs and the 25-year HGL assuming 25% of the submerged section of pipe is filled with sediment.

3.5.3 Overland Flow

Major system peak flows from the proposed development will be directed to the interim KW Pond 5. **Drawings SD-1** and **SD-2** show the proposed overland flow route.

The proposed ICDs have been sized to capture the 2-year runoff from local street catchments (areas named L-), and the 5-year runoff from collector road catchments (areas named C-), while still meeting the 0.3 m required 100-year HGL clearance to the USFs. A summary table showing the total surface water depths for the 2-year and 5-year design storms for the proposed and future phase areas of the Richcraft Kanata West Development has been included in **Appendix B.3.** The following table shows the target capture rate based on the 2-year or the 5-year runoff from the catchment as explained above and the 2 and 5-year ICD capture rate along with the capture difference for the proposed phase catchments.

Table 3.11: Proposed Phase - Minor System Capture Rate Comparison

Tributary Area ID	ICD Type	2yr ICD Capture (L/s)	5yr ICD Capture (L/s)	Target Capture Rate (L/s)	2/5yr Runoff - ICD Capture Difference (L/s)
C107A	IPEX TEMPEST HF (95"mm ORIFICE)	14.1	20.5	42.3	-1.2
C107A	IPEX TEMPEST HF (95"mm ORIFICE)	14.1	20.5		
C109A	IPEX TEMPEST HF (165"mm ORIFICE)	33.4	49.8	100.5	-0.8
C109A	IPEX TEMPEST HF (165"mm ORIFICE)	33.4	49.8		
C109B	IPEX TEMPEST HF (178"mm ORIFICE)	30.5	45.3	91.0	-0.5
C109B	IPEX TEMPEST HF (178"mm ORIFICE)	30.5	45.3		
C110A	IPEX TEMPEST HF (108"mm ORIFICE)	17.3	25.3	26.5	-1.2
C121AA	IPEX TEMPEST HF (83"mm ORIFICE)	6.5	9.9	20.5	-0.6
C121AA	IPEX TEMPEST HF (83"mm ORIFICE)	6.5	9.9		
C121A	IPEX TEMPEST HF (152"mm ORIFICE)	28.8	42.2	85.2	-0.8
C121A	IPEX TEMPEST HF (152"mm ORIFICE)	28.8	42.2		
C123A	IPEX TEMPEST HF (102"mm ORIFICE)	14.5	21.0	42.9	-0.9
C123A	IPEX TEMPEST HF (102"mm ORIFICE)	14.5	21.0		
L102A	IPEX TEMPEST HF (83"mm ORIFICE)	14.6	16.2	29.9	-0.8
L102A	IPEX TEMPEST HF (83"mm ORIFICE)	14.6	16.2		
L103A	IPEX TEMPEST HF (127"mm ORIFICE)	30.7	37.7	62.0	-0.7
L103A	IPEX TEMPEST HF (127"mm ORIFICE)	30.7	37.7		
L103B	IPEX TEMPEST HF (83"mm ORIFICE)	13.9	17.1	27.1	0.7
L103B	IPEX TEMPEST HF (83"mm ORIFICE)	13.9	17.1		
L103C	IPEX TEMPEST HF (140"mm ORIFICE)	42.5	43.6	49.1	-6.6
L103D	IPEX TEMPEST HF (127"mm ORIFICE)	35.0	35.9	41.8	-6.8
L104A	IPEX TEMPEST HF (108"mm ORIFICE)	25.1	27.6	51.4	-1.2
L104A	IPEX TEMPEST HF (108"mm ORIFICE)	25.1	27.6		
L105A	IPEX TEMPEST HF (108"mm ORIFICE)	26.5	27.7	53.8	-0.9
L105A	IPEX TEMPEST HF (108"mm ORIFICE)	26.5	27.7		
L106A	IPEX TEMPEST HF (102"mm ORIFICE)	20.2	24.5	41.0	-0.6
L106A	IPEX TEMPEST HF (102"mm ORIFICE)	20.2	24.5		
L106B	IPEX TEMPEST HF (83"mm ORIFICE)	11.0	15.7	11.4	-0.4
L112A	IPEX TEMPEST HF (127"mm ORIFICE)	30.7	37.8	62.2	-0.7
L112A	IPEX TEMPEST HF (127"mm ORIFICE)	30.7	37.8		
L113A	IPEX TEMPEST HF (108"mm ORIFICE)	25.2	28.1	51.3	-0.8
L113A	IPEX TEMPEST HF (108"mm ORIFICE)	25.2	28.1		
L113B	IPEX TEMPEST HF (108"mm ORIFICE)	25.8	26.6	31.1	-5.3
L114A	IPEX TEMPEST HF (108"mm ORIFICE)	9.1	24.8	9.4	-0.3
L115A	IPEX TEMPEST HF (83"mm ORIFICE)	12.3	16.1	25.2	-0.5
L115A	IPEX TEMPEST HF (83"mm ORIFICE)	12.3	16.1		
L117A	IPEX TEMPEST HF (127"mm ORIFICE)	34.1	38.0	68.9	-0.8
L117A	IPEX TEMPEST HF (127"mm ORIFICE)	34.1	38.0		
L117B	IPEX TEMPEST HF (83"mm ORIFICE)	9.5	16.8	17.8	1.3
L117B	IPEX TEMPEST HF (83"mm ORIFICE)	9.5	16.8		
L117C	IPEX TEMPEST HF (140"mm ORIFICE)	42.6	43.9	52.2	-9.6
L118A	IPEX TEMPEST HF (127"mm ORIFICE)	32.2	37.8	65.1	-0.7
L118A	IPEX TEMPEST HF (127"mm ORIFICE)	32.2	37.8		
L119A	IPEX TEMPEST HF (108"mm ORIFICE)	23.8	27.4	48.1	-0.6

Tributary Area ID	ICD Type	2yr ICD Capture (L/s)	5yr ICD Capture (L/s)	Target Capture Rate (L/s)	2/5yr Runoff - ICD Capture Difference (L/s)
L119A	IPEX TEMPEST HF (108"mm ORIFICE)	23.8	27.4		
L124A	IPEX TEMPEST HF (95"mm ORIFICE)	16.9	21.5	34.5	-0.7
L124A	IPEX TEMPEST HF (95"mm ORIFICE)	16.9	21.5		
L124B	IPEX TEMPEST HF (95"mm ORIFICE)	19.7	20.1	29.0	-9.2
L126A	IPEX TEMPEST HF (83"mm ORIFICE)	5.4	15.4	5.6	-0.1
L126B	IPEX TEMPEST HF (102"mm ORIFICE)	20.5	24.4	41.6	-0.6
L126B	IPEX TEMPEST HF (102"mm ORIFICE)	20.5	24.4		
L126C	IPEX TEMPEST HF (83"mm ORIFICE)	4.3	16.1	3.8	0.6
L127A	IPEX TEMPEST HF (127"mm ORIFICE)	27.8	35.9	56.1	-0.6
L127A	IPEX TEMPEST HF (127"mm ORIFICE)	27.8	35.9		
L128A	IPEX TEMPEST HF (102"mm ORIFICE)	22.6	24.5	45.9	-0.7
L128A	IPEX TEMPEST HF (102"mm ORIFICE)	22.6	24.5		
L130A	IPEX TEMPEST HF (127"mm ORIFICE)	35.0	38.0	70.8	-0.8
L130A	IPEX TEMPEST HF (127"mm ORIFICE)	35.0	38.0		
L130B	IPEX TEMPEST HF (108"mm ORIFICE)	22.6	22.8	25.4	-2.8

Table 3.12 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of the proposed catchbasins for the 100-year, 3-hr Chicago storm and the 'climate change' storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed the required 0.35 m maximum during the 100-year event.

Table 3.12: Proposed Phase – Ultimate Maximum Static and Dynamic Surface Water Depths

Storage node ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	100-year, 3-hour Chicago		100-year, 3-hour Chicago+20%	
			Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)
107A-S(1)	97.59	98.26	97.80	0.21	97.87	0.28
109A-S	97.58	98.23	97.75	0.17	97.90	0.32
109B-S	97.59	98.25	97.68	0.09	97.76	0.17
110A-S	97.75	98.45	97.88	0.13	97.92	0.17
121A-S(2)	97.36	97.90	97.65	0.29	97.72	0.36
121AA-S	97.31	N/A	97.36	0.05	97.37	0.06
123A-S	97.69	98.51	97.84	0.15	97.87	0.18
F101A-S	94.70	N/A	95.07	0.37	95.11	0.41
102A-S(1)	97.14	97.79	97.31	0.17	97.43	0.29
103A-S	97.26	97.80	97.47	0.21	97.50	0.24
103B-S	97.02	97.74	97.33	0.31	97.36	0.34
RY103C-S	97.44	N/A	97.63	0.19	97.65	0.21
RY103D-S	97.40	N/A	97.59	0.19	97.61	0.21

Storage node ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	100-year, 3-hour Chicago		100-year, 3-hour Chicago+20%	
			Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)
104A-S	97.46	97.85	97.67	0.21	97.70	0.24
105A-S(1)	97.49	98.01	97.72	0.23	97.82	0.33
106A-S(1)	97.65	98.11	97.78	0.13	97.80	0.15
106B-S	97.52	98.11	97.73	0.21	97.80	0.28
112A-S(1)	97.78	98.43	98.08	0.30	98.12	0.34
113A-S(1)	97.85	98.50	98.18	0.33	98.21	0.36
RY113B-S	97.86	N/A	98.18	0.32	98.21	0.35
114A-S	97.07	N/A	97.28	0.21	97.30	0.23
115A-S	97.17	97.78	97.39	0.22	97.46	0.29
117A-S	97.26	97.81	97.50	0.24	97.55	0.29
117B-S	97.19	97.81	97.48	0.29	97.52	0.33
RY117C-S	97.37	N/A	97.59	0.22	97.62	0.25
118A-S	97.38	97.99	97.59	0.21	97.62	0.24
119A-S	97.22	97.82	97.41	0.19	97.52	0.30
124A-S	97.93	98.51	98.20	0.27	98.24	0.31
RY124B-S	98.11	N/A	98.27	0.16	98.29	0.18
126A-S	98.91	N/A	99.13	0.22	99.16	0.25
126B-S(1)	98.37	98.90	98.62	0.25	98.66	0.29
126C-S	99.02	N/A	99.13	0.11	99.16	0.14
127A-S(1)	99.15	99.86	99.21	0.06	99.22	0.07
128A-S(1)	98.87	99.55	99.13	0.26	99.16	0.29
130A-S	99.32	99.80	99.47	0.15	99.49	0.17
RY130B-S	99.38	N/A	99.41	0.03	99.42	0.04

As requested by the City, the 100-yr, 3hr Chicago PCSWMM model was modified to use capture curves representing the proposed curb inlets within area L209A to confirm the flow depth on the street segments downstream does not exceed the allowable 35 cm, considering that the curb inlet capture curve used generates inlet capture rates that are less than the orifice capture rates used as a conservative approach to assess the HGL across the subdivision. The results of the analysis indicate that the total flow depth in the downstream segments increases up to 2cm, but results in total flow depths less than the allowable 35 cm across the site. Digital files of the additional PCSWMM model are included in the enclosed CD while the results are summarized in **Appendix B.3.**

3.6 WATER BALANCE – INFILTRATION REQUIREMENTS

As per the KWMSS, all developments in the Kanata West Community are required to provide infiltration measures to meet pre-development infiltration rates. Detailed geotechnical work

completed for the Kanata West MSS and the existing Fairwinds Subdivision outlined the target infiltration rates for the Kanata West Development as 50-100 mm/yr. The Richcraft Kanata West Development is identified as having an estimated infiltration rate between 50-70 mm/yr. It is noted that infiltration requirements were established to provide base flow to the Carp River in post-development conditions. The KWMSS recommends the pre-development infiltration is increased by 25% in order to account for future right of ways with no opportunity for infiltration.

Based on a target infiltration rate of 50 mm/yr for the overall 36.53 ha Richcraft Kanata West site, on-site infiltration measures are required to infiltrate approximately 22,831 m^3/year (Pre-development infiltration increased by 25%). Detailed water balance calculations are included in **Appendix B.6**.

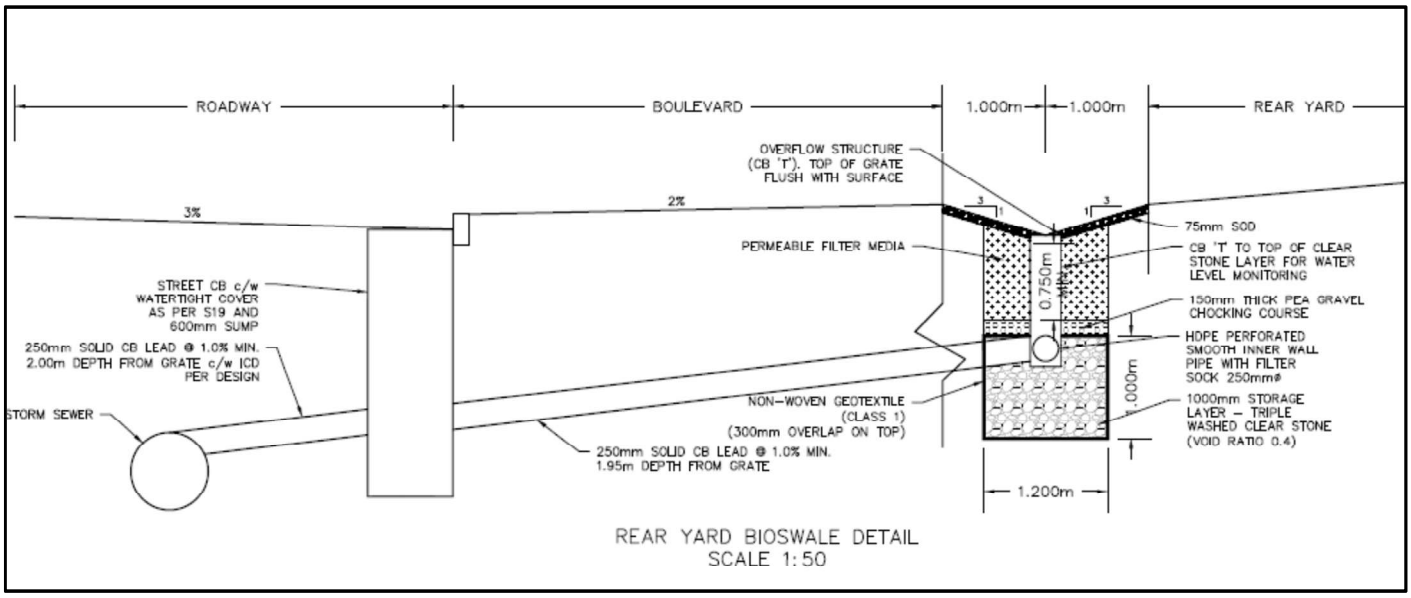
Of the total site area, 22.50 ha (61.6%) will be converted to impervious area with no infiltration. The remaining 14.03 ha (38.4%) is covered with urban lawns with an average annual infiltration of approximately 7,014 m^3/year. Rear-yard bioswales within the proposed and future residential developments are required to provide the additional 15,817 m^3/year.

Based on average precipitation data available, approximately 35 rainfall events/yr have a rainfall depth that ranges between 6 mm and 25 mm, for an average depth of 12 mm. Based on the roof area feeding the proposed bioswales in the proposed and future phase rear yards (25,234 m^2), the annual volume of runoff from the proposed roofs to the bioswales is approximately 10,615 m^3 (based on an average rainfall depth of 12 mm).

The remaining 5,202 m^3/yr required to infiltrate can be provided within the future residential blocks (89 and 115). Assuming 38 units/ha and 100 m^2/half roof directed to rear yard bioswales results in 28 units within Block 89 and 105 units within Block 115 for a total roof area directed to the bioswales of 13,262 m^2 and an annual volume of runoff from roof to bioswales of 5,579 m^3/yr (based on an average rainfall depth of 12 mm). Detailed water balance calculations are included in **Appendix B.6**.

The following figure shows the typical cross section of the bioswales as per Low Impact Development Stormwater Management and Design Guidelines from Credit Valley Conservation.

Figure 3.2: Typical Bioswale Cross Section



The minimum required footprint area of the bioswales was estimated for each bioswale based on MECP guidelines (Equation 4.3) for a retention time of 24 hours and an average infiltration rate of the native soil equal to 19 mm/hr as recommended by Paterson in their technical memo PG4624-MEMO.07 dated June 28, 2019 (see **Appendix D**). However, for conservatism, the proposed infiltration measures have not been included in the PCSWMM model for the proposed development. **Table 3.13** summarizes the design characteristics of the proposed bioswales. A table summarizing the bioswale assumptions for future phase rear yard areas has been included in **Appendix B.6**.

Table 3.13: Proposed Bioswale Characteristics

Drainage Area ID	Drainage Area (ha)	Imperviousness (%)	Required Volume for 25mm Event (m^3)[1]	Bioswale Length (m)	Bioswale Width (m)	Storage Layer Depth (m)	Maximum Storage Available (m)
L103C	0.64	40%	64	159	1.2	1	62
L124B	0.40	33%	33	130	1.2	1	50
L113B	0.49	31%	39	98	1.2	1	38
L103D	0.55	37%	51	167	1.2	1	65
L117C	0.66	37%	61	210	1.2	1	82

3.7 EXTERNAL DRAINAGE MANAGEMENT IN THE INTERIM CONDITION

In the proposed interim condition (first registration phase), only the streets north of Cartage Way and Winter Wheat Terrace will be built as shown on **Drawing OSSP-1**. As such, the lands south of the proposed development will remain undeveloped. These lands currently sheet drain in a north-east direction so an interim ditch will be provided along the southern boundary of the proposed first registration phase to capture rural runoff and convey it to a temporary sedimentation basin that will be located within Block 144 (designated for the ultimate KW SWM Pond 5). Discharge from the sedimentation basin will be directed to the Carp River in the interim condition as shown on **Drawing EC-1**.

The proposed interim sedimentation basin has been sized to provide 'Enhanced' quality treatment of runoff prior to discharging into the Carp River assuming the tributary drainage area.

Table 3.14: MECP Quality Volumetric Requirements for Interim Sedimentation Basin

Drainage Area (ha)	Actual % Imp.	Total Unit Volume Required (m^3/ha)	Water Quality Volume Requirements		Water Quality Volume Provided	
			Permanent Pool (m^3)	Extended Detention (m^3)	Permanent Pool (m^3)	Extended Detention (m^3)
24.13	85.0	250	5,067	965	6,082	1,477

The proposed interim outlet structure will consist of a Hicken bottom riser outlet with a 120mm diameter orifice cut at the permanent pool elevation (93.44m). The emergency spillway will be set at the extended detention elevation of 93.74 m which will provide 30 hours of detention time (see **Drawings EC-1** and **EC-3** for details). Detailed calculations have been provided in **Appendix B.7**.

4.0 WASTEWATER

The proposed first registration phase of the Richcraft Kanata West Development will be serviced through the existing 1200 mm diameter sanitary sewer on Maple Grove Road. The proposed sanitary trunk sewers have been sized for the ultimate development condition which includes sewage peak flows from the future phases (second registration phase) of the Richcraft Kanata West Development and the existing Trinity Development to the south.

4.1 BACKGROUND

The Kanata West Master Servicing Study (Stantec, 2006) outlined the servicing requirements for the subject property. As outlined in the KWMSS, sewage peak flows from the entire Richcraft Kanata West Development and the existing Trinity development to the south will be conveyed via the existing 1200 mm diameter sanitary trunk sewer on Maple Grove Road to the Kanata West Pump Station (KWPS) as shown on **Drawing OSSP-2**.

Modelling of the proposed sanitary sewer system is required as per the KWMSS to assess maximum HGLs during critical failure of the KWPS. In addition, as outlined in the City's "Technical Bulletin ISTB-2018-01", a sanitary HGL analysis is required to assess the maximum HGL in the sanitary sewer system under normal pumping station conditions. The HGL across the proposed site has been assessed under the worst-case scenario which occurs during full build-out of the Richcraft Kanata West Development, and once a sanitary connection has been provided for the existing Trinity Development through the proposed site.

4.2 PROPOSED DEVIATIONS FROM THE KANATA WEST MASTER SERVICING STUDY

The following table shows a comparison of the sanitary sewer design criteria outlined in the 2006 KWMSS and the revised design criteria used for the proposed development as per the latest City of Ottawa design guidelines and technical bulletins. Relevant excerpts from the KWMSS and the City of Ottawa guidelines are included in **Appendix D.3**.

Table 4.1: KWMSS and Proposed Design Criteria Comparison

Design Parameter	2006 KWMSS	Revised Criteria as per City Guidelines
Residential Average Daily Flow Rate (L/p/day)	350	280
Harmon Correction Factor	1.0	0.8
Employment Area Flow Rate (L/ha/day)	50,000	28,000
Business Park/Employment Peak Factor	1.5	1.5/1[1]
Infiltration Rate (L/s/ha)	0.28	0.33

Design Parameter	2006 KWMSS	Revised Criteria as per City Guidelines
Manhole Spacing	120 m maximum	120m for pipes under 450mm dia., 150m for pipes over 450mm dia.

1. ICI Peak Factor= 1.5 if ICI in contributing area is >20%; ICI Peak Factor =1.0 if ICI in contributing area <20%

4.3 DESIGN CRITERIA

The following design guidelines were obtained from the City's "Technical Bulletin ISTB-2018-01" and were used to estimate wastewater flow rates from the proposed development and to size the sanitary sewers.

- Minimum Full Flow Velocity – 0.6 m/s
- Maximum Full Flow Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Single Family Persons per unit – 3.4
- Townhouse unit – 2.7
- Per Capita Residential Average Daily Flow – 280 L/p/day
- Commercial and Institutional Average Daily Flow - 28,000 L/ha/day
- Peaking Factor for Commercial and Institutional Areas – 1.5 if ICI in contributing area is >20%; ICI Peak Factor =1.0 if ICI in contributing area <20%
- Extraneous Flow Allowance – 0.33 L/s/ha
- Manhole Spacing – 120m for pipes under 450mm dia., 150m for pipes over 450mm dia.
- Minimum Cover – 2.5 m

In addition, a unit density of 38 units/ha was used for the medium density residential blocks, and a residential peak factor based on Harmon's Equation with a correction factor of 0.8 was used to determine the residential peak design flows.

4.4 PROPOSED SANITARY SEWERS

The proposed sanitary sewer system has been designed as a network of gravity sewers which will direct wastewater flows from the future phases of the Richcraft Kanata West Subdivision and the existing Trinity Development (approximately **48.1 L/s** including **12.0 L/s** from the existing Trinity commercial site) to the Maple Grove trunk sewer and ultimately to the Kanata West Pump Station (KWPS). The overall drainage areas, wastewater peak flows and sanitary sewers within the proposed and future development areas used in the proposed design are shown on **Drawings SA-1** and **SA-2** and in the sanitary sewer design sheet included in **Appendix C.1.**

The existing sanitary sewer stub at the Trinity Development has an invert elevation of 92.30 m, which is roughly 5.6 m below the proposed grades of the Richcraft Kanata West Development.

Every effort has been made to raise the sanitary sewer system within the future and proposed phases of the Richcraft KW Development, while avoiding conflicts with the future and proposed storm sewers and while still providing a gravity outlet for the existing Trinity Development. However, the proposed sanitary sewer depth along sections of Ploughshare Road, Tillage Street, Winter Wheat Terrace and Roger Griffiths Avenue range between 4.4 m and 6.6 m. As a result, separate local sanitary sewers have been provided between the proposed sanitary manholes 17B to 17A, 3C to 3A, and 22B to 22A to service the proposed units and avoid deep service connections to the main trunk sewer which exceeds 4 m depth. Similarly, it is expected that local sanitary sewers will be required within the future phases of the development between sanitary manholes 54D to 54A and 54G to 54E. The proposed drainage pattern is in accordance with the KWMSS and is detailed on **Drawings SA-1** and **SA-2.** The sanitary sewer design sheet is included in **Appendix C**.

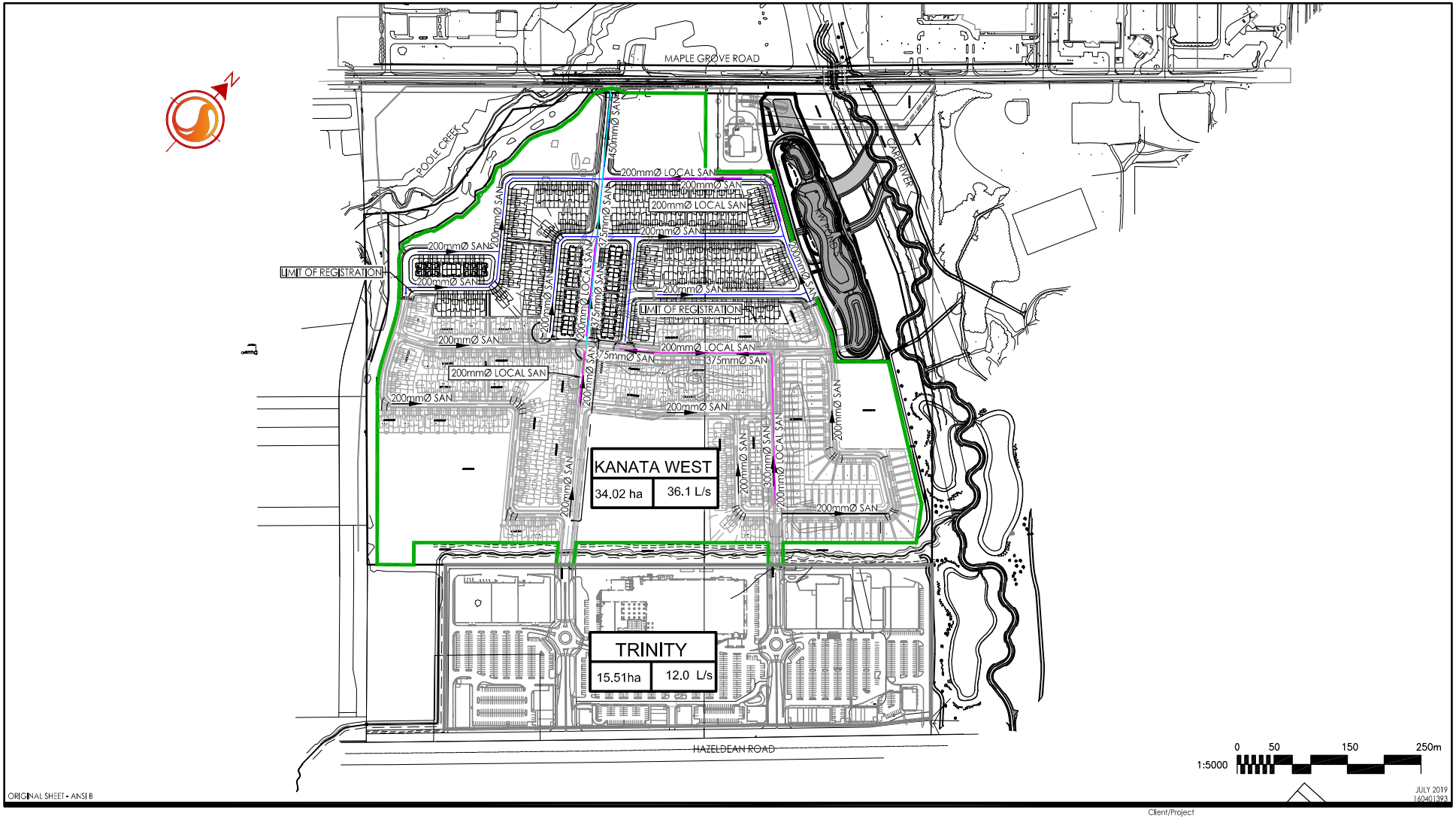
Modified Right of Way (ROW) cross-sections as shown on **Drawing DS-1** have been proposed and reviewed and approved by the City. The modified cross-sections accommodate a high-level sanitary sewer by laying the deep sanitary sewer closer to the watermain which allows the sanitary sewers to be offset, while ensuring that the elevation of the crown of the sewer is at least 0.5 m below the invert of the watermain in accordance with MOE F-6-1 Procedures to Govern Separation of Sewers and Watermain. In addition, consideration has been given to the separation proposed between the storm and the local/high-level sanitary sewer as the minimum distance, depending on the size of the storm sewer, shall be as per standard S7.

The potential total and differential settlements for the proposed underground services will be within the tolerable levels provided that the current and future settlement surcharge program are successfully completed.
The recommendations for deep underground services are provided in Subsection 6.3 - Excavation Side Slopes and Subsection 6.4 - Pipe Bedding and Backfill in the latest Geotechnical Report PG3062-1 Revision 4 dated May 24, 2019. For safety purposes, all deep excavation should be supported by temporary shoring, such as stacked trench boxes designed by a structural engineer.

Given the depth of the proposed sanitary sewer which will be below the ground water level in some areas, it is recommended that controlled settlement joints be used on each building service connection as per City Standard S11 and that clay seals be installed as per City standard drawing No. S8. In addition, the proposed sanitary sewers have been sized to include an infiltration peak flow rate equal to 0.33 L/s/ha as per City of Ottawa guidelines.

The proposed sanitary sewer consists in its majority of PVC SDR 35 pipes and a 49.3 m segment of 450 mm diameter concrete pipe, Class 140-D. As per Paterson memo PG3062-MEMO.09, It is expected that site servicing for the proposed development will be considered conventional for the Ottawa area using conventional open-cut methods and do not require SDR26 or SDR16 PVC sewers to mitigate the potential for pipe warping. As per technical information provided by the pipe manufacturer, IPEX's Ring-Tite piping systems SDR-35 meet the requirements of CSA B182.2,

with additional requirement that gasket joints shall withstand 345 kPa (50psi) hydrostatic pressure, and negative vacuum pressure of -75kPa (-11psi) or 22' of mercury, in compliance with CSA B182.2 and ASTM D3034. The depth of the proposed 450 mm diameter concrete pipe (140-D) will range from 8.1 to 11.2 m, which is acceptable for the proposed pipe as shown in the Height of Fill Table (OPSD 807.010) included in **Appendix C.1**.



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ORIGINAL SHEET - ANSI B

JULY 2019
160401393

Stantec
Stantec Consulting Ltd.
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

Legend

- EXISTING SANITARY DRAINAGE BOUNDARY
- PROPOSED OVERALL SANITARY DRAINAGE BOUNDARY
- Catchment 1 | 4.00 ha | 50L/s — SITE ID / AREA (HA) / QPEAK (L/s)
- PROPOSED SANITARY SEWER
- PROPOSED DEEP TRUNK SANITARY SEWER (DEEPER THAN 6.0m)
- PROPOSED HIGH LEVEL LOCAL SANITARY SEWER

Notes

Client/Project
RICHCRAFT HOMES
RICHCRAFT KANATA WEST

Figure No.
4.1

Title
PROPOSED SANITARY SEWER NETWORK AND EXTERNAL DRAINAGE EXTENT

4.5 SANITARY HGL ANALYSIS

This section summarizes the results of the sanitary hydraulic grade line (HGL) analysis for the proposed first registration phase of the Richcraft Kanata West Development. The worst-case HGL occurs at full build-out of the Richcraft KW Development and as such, the HGL analysis includes the proposed and future sanitary sewers within the entire Richcraft KW Development, external wastewater flows from the existing Trinity Development, as well as the existing 1200 mm diameter sanitary trunk sewer on Maple Grove Road from the subdivision outlet to the Kanata West Pumping Station (KWPS) located at the southwest intersection of Maple Grove Road and Terry Fox Drive.

The sanitary HGL across the proposed Richcraft subdivision has been assessed assuming ultimate development conditions for the KWPS catchment area under both catastrophic failure and normal operating conditions of the KWPS. The sanitary HGL analysis was prepared based on the following background documents provided by the City of Ottawa (see **Appendix C.3**).

- *Alternative 2: Divert Stittsville Trunk Sewer Only Design Sheet Long Term Flows (2031)*, J.L Richard and Associates, December 2014.
- *Fernbank Community – Kizell Lands, Sanitary Drainage Area Plan*, Novatech, February 2018.
- *Fernbank Community – Kizell Lands, Sanitary Sewer Design Sheet*, Novatech, February 2018.
- *Kanata West Master Servicing Study, Sanitary Sewer Design Sheet*, Stantec Consulting Ltd., CCL and IBI, April 2005.
- *Kanata West Concept Plan Master Servicing Study, Preferred Waste-Water Option*, Stantec Consulting Ltd., CCL and IBI, October 2005.
- *Reconstruction of Maple Grove Road, Sanitary Drainage Plan*, DSEL on behalf of the City of Ottawa, July 2011.
- *Reconstruction of Maple Grove Road, Sanitary Sewer Calculation Sheet,* DSEL on behalf of the City of Ottawa, May 2012.
- *Kanata West Serviceability Study, N-S Interceptor Sewer Sanitary Design Sheet*, IBI, June 2016.
- *Maple Grove Expansion Area Excel Sheet*, City of Ottawa.
- *Hazeldean Sanitary Sewer Analysis*, Atrel Engineering Ltd., November 29th, 2017.
- *Kanata West Pumping Station and Forcemains Preliminary Design Report*, Stantec Consulting Ltd., April 13, 2015
- *Kanata West Pumping station and Forcemains – Preliminary Design Report*, Stantec Consulting Ltd., April 2015.

4.5.1 Sanitary HGL Analysis Criteria

As per the City of Ottawa's Technical bulletin from March 2018, a sanitary HGL analysis must be performed assuming both catastrophic failure and normal operating conditions of the KWPS.

Annual flow parameters are to be used to assess the HGL in the sanitary system assuming a catastrophic failure of the pump station with wet weather peak flows being discharged through

the emergency overflow into the ultimate condition Kanata West Pond 5 under 100-year water level. The HGL under this scenario cannot touch the proposed under side of footing (USF).

As per the KWPS overflow weir design calculations, a 20 cm head over the overflow weir crest is required to convey the design wet weather peak flow of 1,250 L/s to the KW Pond 5. The 20 cm head has been used to estimate the boundary conditions in the Catastrophic event scenarios for conservatism.

Additional scenarios have been run assuming catastrophic failure of the KWPS as described below.

- Scenario 1 assumes a conservative design peak flow of 583 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5 (100-year water level plus 20 cm head over the KWPS overflow weir).
- Scenario 2 assumes the ultimate condition IMP peak flow of 360 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5.
- Scenario 3 assumes the interim condition IMP peak flow of 465 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5.
- Scenario 4 assumes a conservative design peak flow of 583 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.06 m at the ultimate KW Pond 5 (25-year water level plus 20 cm head over the PS overflow weir).

Rare flow parameters are to be used to assess the maximum HGL in the sanitary system under normal pumping station conditions. Under this scenario, the HGL must be at least 0.3 m below the USF.

4.5.2 Design Parameters and Assumptions

The following table summarizes the design annual and rare flow parameters as obtained from the City's "Technical Bulletin ISTB-2018-01 Revision to Ottawa Design Guidelines - Sewer".

Table 4.2: Wastewater Annual and Rare Flow Parameters

Parameters	Annual	Rare
Res. Per Capita	200	200
Commercial	17,000	17,000
Institutional	17,000	17,000
Industrial	10,000	10,000
I/I Dry	0.02	0.02
I/I Wet	0.28	0.53
Total I/I	0.30	0.55
Harmon – Correction Factor	0.6	0.6
ICI Peak Factor	1	1

Sanitary inflows from the proposed and future phases of the KW Development were obtained from the detailed sanitary drainage plans included in **Appendix G**, while sanitary inflows from all external areas under ultimate development conditions were obtained from background documents provided by the City of Ottawa as shown in **Appendix C.3**. **Appendix C.2** includes the rare and annual sewage inflow calculations as well as a figure identifying each of the subareas used. **Table 4.3** summarizes the populations and areas obtained from the background documents as well as the assumptions made for any other areas.

Table 4.3: Wastewater Population and Area Assumptions

Segment	Population	Residential Area (ha)	Commercial /Industrial/I nstitutional Area (ha)	Annual Peak Inflows (L/s)	Rare Peak Inflows (L/s)	Additional Assumptions
Stittsville Trunk	28,031	526.60	76.0 ha Commercial and 40.5 ha Industrial	583.0 Scenario 1 360.0 Scenario 2 465.0 Scenario 3 583.0 Scenario 4	503.0	The peak design flow of 583 L/s was used in the catastrophic event Scenario 1 for conservatism, the ultimate condition IMP model peak flow of 360 L/s was used for the catastrophic event scenario 2, while the interim condition IMP model peak flow of 465 L/s was used for the catastrophic event scenario 3. A peak flow estimated using rare event parameters of 503 L/s was used for the normal operating condition analysis.
Kizell Lands	3,585	52.56	11.82	41.8	57.9	-
Huntmar and Hazeldean	6,357	111.52	65.44	103.9	151.6	Population and areas as obtained from Huntmar/Hazeldean Design Sheet based on KWMSS assumptions for areas 16, 20, 17, 21, 19A, 23, 24 and 19
Additional Hazeldean	296	13.62	5.39	8.7	13.5	-
Maple Grove Sewer	10,501	137.54	-	93.8	128.2	-

Segment	Population	Residential Area (ha)	Commercial /Industrial/I nstitutional Area (ha)	Annual Peak Inflows (L/s)	Rare Peak Inflows (L/s)	Additional Assumptions
Maple Grove Expansion	3,549	84.43	-	42.9	61.9	Number of units and gross area based on spreadsheet provided by the City, with 90% of gross area contributing to I/I and 198 employees generating 83L/emp/day added to total flow
Future North-South Collector	4,936	28.44	165.28	147.5	195.9	Population and areas were obtained based on IBI Design Sheet areas A to F and 21.13 ha of area G. A 30L/s fixed flow was added to the total peak flow.
North of Richcraft Kanata Site	113	1.10	-	1.1	1.4	Assumed medium density residential area to have 38 units/ha and 2.7person/unit.
Richcraft Kanata West Development / Existing Trinity	2,313	28.14	18.65	34.5	46.8	-

Based on the above assumptions plus the peak flows estimated for the detailed sanitary catchments across the Richcraft KW Development as shown in **Appendix C.2**, the worst-case peak annual flow is 1,057 L/s (Scenario 1) and the peak rare flow is 1,160 L/s were obtained.

4.5.3 Boundary Conditions

The catastrophic HGL scenarios 1 through 3 which use annual flow parameters to calculate peak inflows into the sanitary system were assessed assuming a fixed backwater of 95.2 m based on a 100-year water level in the ultimate KW Pond 5 equal to 95.0 m plus an additional 0.2 m head over the KWPS emergency overflow weir (head required to convey the design wet weather peak flow of 1,250 L/s as obtained from the KWPS design brief). An additional catastrophic HGL scenario (Scenario 4) was assessed assuming a fixed backwater of 95.06 m based on a 25-year water level in the ultimate KW Pond 5 equal to 94.86 m plus an additional 0.2 m head over the KWPS emergency overflow weir.

The normal operating condition HGL analysis which uses rare flow parameters to calculate peak inflows into the sanitary system was done assuming startup and shutoff elevations in the KWPS of 84.25 m and 82.90 m respectively. The minimum and maximum wet well volumes assumed for

the ultimate condition were 281 m^3 and 810 m^3 respectively, while the wet weather peak flow of 1,250 L/s was used as the pumping rate.

4.5.4 Sanitary HGL Analysis Results

The following tables summarize the HGL results from the catastrophic failure (annual parameters) scenarios and the normal operating conditions (rare parameters) scenario across the proposed first registration phase of the Richcraft KW Development. Table summarizing the HGL results across the entire Richcarft KW site have been included in **Appendix C.2**.

Table 4.4: Catastrophic Pump Station Failure Sanitary HGL – Annual Parameters

MH ID	Road Grade (m)	USF (m)	Catastrophic HGL and USF – HGL Clearance							
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
			HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
1A	96.20	N/A	95.35	-	95.29	-	95.32	-	95.21	-
1B	96.60	N/A	95.31	-	95.27	-	95.28	-	95.17	-
1C	95.30	N/A	95.24	-	95.22	-	95.23	-	95.10	-
2	97.45	N/A	95.36	-	95.30	-	95.33	-	95.22	-
3	97.89	95.79	95.39	0.40	95.33	0.46	95.36	0.43	95.25	0.54
4	98.19	96.40	95.40	1.00	95.34	1.06	95.36	1.04	95.26	1.14
5	98.63	96.64	95.43	1.21	95.43	1.21	95.43	1.21	95.43	1.21
6	98.67	96.99	95.52	1.47	95.52	1.47	95.52	1.47	95.52	1.47
7	99.11	96.99	96.01	0.98	96.01	0.98	96.01	0.98	96.01	0.98
8	100.21	97.69	97.15	0.54	97.15	0.54	97.15	0.54	97.15	0.54
9	99.23	97.44	96.21	1.23	96.21	1.23	96.21	1.23	96.21	1.23
10	99.43	97.67	96.31	1.36	96.31	1.36	96.31	1.36	96.31	1.36
11	100.75	97.67	96.90	0.77	96.90	0.77	96.90	0.77	96.90	0.77
12	100.60	98.39	97.03	1.36	97.03	1.36	97.03	1.36	97.03	1.36
3A	97.75	95.71	95.39	0.32	95.33	0.38	95.36	0.35	95.25	0.46
3B	97.66	95.71	95.39	0.32	95.33	0.38	95.36	0.35	95.25	0.46
3C	97.53	95.71	95.39	0.32	95.33	0.38	95.36	0.35	95.25	0.46
14	97.61	N/A	95.40	-	95.34	-	95.37	-	95.26	-
16	97.35	95.71	95.41	0.30	95.35	0.36	95.38	0.33	95.27	0.44
17	97.29	N/A	95.41	-	95.35	-	95.38	-	95.27	-
17A	97.32	95.63	95.41	0.22	95.35	0.28	95.38	0.25	95.27	0.36
17B	97.37	95.63	95.41	0.22	95.35	0.28	95.38	0.25	95.27	0.36

MH ID	Road Grade (m)	USF (m)	Catastrophic HGL and USF – HGL Clearance							
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
			HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
18	97.17	95.63	95.42	0.21	95.36	0.27	95.38	0.25	95.28	0.35
18A	97.65	95.69	95.42	0.27	95.36	0.33	95.38	0.31	95.28	0.41
19	97.43	95.63	95.42	0.21	95.36	0.27	95.39	0.24	95.28	0.35
20	97.50	95.63	95.43	0.20	95.37	0.26	95.40	0.23	95.29	0.34
22	97.96	96.15	95.41	0.74	95.35	0.80	95.38	0.77	95.27	0.88
22A	97.83	96.10	95.41	0.69	95.35	0.75	95.38	0.72	95.27	0.83
22B	97.84	96.10	95.41	0.69	95.35	0.75	95.38	0.72	95.27	0.83
23	98.10	96.54	95.41	1.13	95.35	1.19	95.38	1.16	95.27	1.27
24	98.05	96.30	95.41	0.89	95.35	0.95	95.38	0.92	95.27	1.03
25	98.00	96.30	95.41	0.89	95.35	0.95	95.38	0.92	95.27	1.03
26	98.10	96.30	95.41	0.89	95.35	0.95	95.38	0.92	95.27	1.03
27	97.92	95.75	95.41	0.34	95.35	0.40	95.38	0.37	95.27	0.48
30	98.01	95.90	95.41	0.49	95.35	0.55	95.38	0.52	95.27	0.63
31	97.52	95.70	95.43	0.27	95.37	0.33	95.40	0.30	95.29	0.41
32	97.68	95.90	95.43	0.47	95.37	0.53	95.40	0.50	95.29	0.61
33	97.62	96.00	95.41	0.59	95.35	0.65	95.38	0.62	95.27	0.73
35	97.96	96.04	95.43	0.61	95.37	0.67	95.40	0.64	95.29	0.75
35A	97.94	N/A	95.42	-	95.36	-	95.39	-	95.28	-

As can be seen in the above table, the worst-case annual HGL (Scenario 1) remains below the proposed USF elevations across the proposed development.

Table 4.5: Normal Operating Conditions Sanitary HGL

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
1A	96.20	N/A	88.79	-
1B	96.60	N/A	88.61	-
1C	95.30	N/A	87.66	-
2	97.45	N/A	89.01	-
3	97.89	95.79	91.11	4.68
4	98.19	96.40	94.10	2.30

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
5	98.63	96.64	95.44	1.20
6	98.67	96.99	95.53	1.46
7	99.11	96.99	96.02	0.97
8	100.21	97.69	97.15	0.54
9	99.23	97.44	96.21	1.23
10	99.43	97.67	96.32	1.35
11	100.75	97.67	96.90	0.77
12	100.60	98.39	97.03	1.36
3A	97.75	95.71	94.19	1.52
3B	97.66	95.71	94.57	1.14
3C	97.53	95.71	94.85	0.86
14	97.61	N/A	92.53	-
16	97.35	95.71	92.87	2.84
17	97.29	N/A	92.95	-
17A	97.32	95.63	94.32	1.31
17B	97.37	95.63	94.68	0.95
18	97.17	95.63	93.21	2.42
18A	97.65	95.69	93.58	2.11
19	97.43	95.63	93.35	2.28
20	97.50	95.63	93.54	2.09
22	97.96	96.15	91.18	4.97
22A	97.83	96.10	94.36	1.74
22B	97.84	96.10	94.85	1.25
23	98.10	96.54	94.40	2.14
24	98.05	96.30	94.47	1.83
25	98.00	96.30	94.67	1.63
26	98.10	96.30	95.00	1.30
27	97.92	95.75	93.88	1.87
30	98.01	95.90	94.33	-
31	97.52	95.70	94.49	1.21
32	97.68	95.90	94.88	1.02
33	97.62	96.00	94.59	1.41
35	97.96	96.04	91.38	4.66
35A	97.94	N/A	91.28	-

The above table shows that the 0.3 m required clearance to the normal operating condition HGL is achieved across the proposed development.

9.0 CONCLUSIONS

9.1 WATER SERVICING

Based on the findings of the report, the proposed network is capable of servicing the development area and with the use of pressure reducing valves will meet all servicing requirements as per City of Ottawa standards under typical demand conditions (peak hour and average day conditions) as well as under emergency fire demand conditions (maximum day + fire flow) during the first construction phase, proposed first registration phase and ultimate development conditions.

One fire hydrant will be provided at the end of each of the temporary turning circles on Sheaf Row and on Corn Husk Lane during interim conditions and will be relocated once Winter Wheat Terrace and Cartage Way are constructed.

A temporary 200 mm diameter watermain will be installed adjacent to the future alignment of Roger Griffiths Avenue from Cartage Way to Holstein Road during the first construction phase to connect the proposed watermain network to the existing watermain within the Trinity development to the south. In the ultimate development condition (during the second registration phase), a 300 mm diameter watermain will be installed along Roger Griffiths Avenue and the temporary 200 mm diameter watermain will be decommissioned.

A portion of back-to back units (Blocks 41 to 45, and 66) on Sheaf Row, Corn Husk Lane and Holstein Road will be built with 2hr fire separation walls. The blocks with a total of 10 units will be equipped with firewalls to separate the blocks into 6 and 4 units in order to reduce the maximum required fire flow to 11,000 L/min (183 L/s). Similarly, the blocks with a total of 8 units are proposed to have a firewall to separate the units into two sets of 4 units, this will decrease the maximum fire flow down to 10,000 L/min (167L/s).

9.2 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified in the background reports and the 2012 City of Ottawa Sewer Guidelines. Inlet control devices are proposed to limit inflow from the site area into the minor system to the 2-year for local streets and to the 5-year storm for collector roads based on City of Ottawa IDF curves. Detailed grading of the proposed site will be done to ensure the storm sewer hydraulic grade line is maintained at least 0.30 m below the proposed underside of footings in the subdivision during the 100-year design storm events. All dynamic surface water depths are less than 0.35 m during the 100-year storm event. Quality control and further quantity control of runoff from the proposed development will be provided in the interim KW Pond 5.

9.3 SANITARY SERVICING

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage of the site and external tributary areas. The proposed network connects to the existing Maple Grove Trunk sanitary sewer which will ultimately outlet to the Kanata West Pump Station (KWPS). The proposed drainage pattern is in accordance with the KWMSS.

The worst-case annual HGL remains below the proposed USF elevations across the proposed development.
Given the depth of the proposed sanitary sewer which will be below the ground water level in some areas, it is recommended that controlled settlement joints be used on each building service connection as per City Standard S11. and that clay seals be installed as per City standard drawing No. S8.

9.4 GRADING

Grading for the site has been designed to provide an overland flow route as per City standards and in its majority, it reflects the grade raise restrictions recommended in Paterson's geotechnical investigation for the site (Paterson, November 2015). Areas where grades are expected to exceed the maximum permissible grade raise are currently under a pre-loading/surcharge program.

The final detailed grading plans will be provided to the geotechnical consultant for review and sign off.

Appendix B STORMWATER MANAGEMENT CALCULATIONS

B.1 Storm Sewer Design Sheet

B.2 Runoff Coefficient Sample Calculations

B.3 PCSWMM Model Input

B.4 PCSWMM – 100-Year HGL Profiles

B.5 Sediment Accumulation HGL Parameters

B.6 Infiltration Calculations

B.7 Interim Sedimentation Basin Calculations

B.1 STORM SEWER DESIGN SHEET

Stantec

Richcraft Kanata West

DATE: 2019-05-17
REVISION: 5
DESIGNED BY: WAJ
CHECKED BY: AMP

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401393

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

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min
BEDDING CLASS = B

LOCATION			DRAINAGE AREA																					PIPE SELECTION													
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
Pond Outlet Pipe (Sized for 100-year Ultimate Pond Outflows)	100	HW6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	3829.7	3829.7	3829.7	7.8	1800	1500	RECTANGULAR	CONCRETE	-	0.50	8093.2	**47.32%**	3.00	2.51	0.05
																				10.05									1800	1500								
Interim Kanata West Pond 5 Tributary Storm Sewers																																							
L116A (Ploughshare Road, L)	116	115	0.22	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.154	0.154	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	32.8	65.7	300	300	CIRCULAR	PVC	-	0.50	68.0	**48.21%**	0.97	0.82	1.34
																				11.34																		
L115A (Wheel Barrow Mews, L)	118	117	0.44	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.293	0.293	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	62.4	96.8	375	375	CIRCULAR	PVC	-	0.25	82.4	**75.76%**	0.78	0.76	2.13
L117A, L117B, L117C (Wheel Barrow Mews, L)	117	115A	1.23	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.691	0.983	0.000	0.000	0.000	0.000	0.000	0.000	12.13	69.49	94.14	110.90	161.17	0.0	0.0	189.8	94.9	675	675	CIRCULAR	CONCRETE	-	0.20	392.2	**48.40%**	1.06	0.90	1.76
(Wheel Barrow Mews, L)	115A	115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.983	0.000	0.000	0.000	0.000	0.000	0.000	13.89	64.51	87.32	102.28	149.39	0.0	0.0	176.2	11.0	675	675	CIRCULAR	CONCRETE	-	0.20	392.2	**44.94%**	1.06	0.88	0.21
																				14.10																		
L115A (Ploughshare Road, L)	115	114	0.17	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.112	1.249	0.000	0.000	0.000	0.000	0.000	0.000	14.10	63.98	86.58	101.41	148.12	0.0	0.0	222.0	54.7	675	675	CIRCULAR	CONCRETE	-	0.20	392.2	**56.61%**	1.06	0.94	0.97
L114A (Ploughshare Road, L)	114	102	0.06	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.039	1.288	0.000	0.000	0.000	0.000	0.000	0.000	15.07	61.61	83.34	97.59	142.51	0.0	0.0	220.5	28.2	750	750	CIRCULAR	CONCRETE	-	0.20	519.4	**42.45%**	1.14	0.93	0.51
																				15.58																		
C107A (Hampshire Place, L)	107	104	0.00	0.19	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.000	0.000	0.128	0.128	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	37.0	51.7	300	300	CIRCULAR	PVC	-	0.40	60.8	**60.87%**	0.86	0.78	1.10
																				11.10																		
L106A, L106B (Corn Husk Lane, L)	106	105	0.32	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.229	0.229	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	48.8	63.5	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**36.68%**	0.81	0.63	1.68
L105A (Corn Husk Lane, L)	105	104	0.32	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.233	0.462	0.000	0.000	0.000	0.000	0.000	0.000	11.68	70.91	96.09	112.60	164.54	0.0	0.0	90.9	79.4	525	525	CIRCULAR	CONCRETE	-	0.20	200.6	**45.32%**	0.90	0.75	1.77
																				13.45																		
L104A (Hampshire Place, L)	104	103	0.33	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.227	0.689	0.000	0.128	0.000	0.000	0.000	0.000	13.45	65.68	88.91	104.15	152.14	0.0	0.0	157.2	99.8	825	825	CIRCULAR	CONCRETE	-	0.15	580.0	**27.11%**	1.05	0.75	2.23
L103C, L103A, L103B, L103D (Hampshire Place, L)	103	102A	1.78	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.958	1.647	0.000	0.128	0.000	0.000	0.000	0.000	15.68	60.21	81.42	95.34	139.21	0.0	0.0	304.4	97.9	1050	1050	CIRCULAR	CONCRETE	-	0.10	900.9	**33.79%**	1.01	0.77	2.13
(Hampshire Place, L)	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.647	0.000	0.128	0.000	0.000	0.000	0.000	17.81	55.84	75.45	88.32	128.91	0.0	0.0	282.3	8.7	1050	1050	CIRCULAR	CONCRETE	-	0.10	900.9	**31.34%**	1.01	0.75	0.19
																				18.01																		
L102A (Ploughshare Road, L)	102	101	0.23	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.139	3.074	0.000	0.128	0.000	0.000	0.000	0.000	18.01	55.48	74.95	87.74	128.06	0.0	0.0	500.4	79.8	1500	1500	CIRCULAR	CONCRETE	-	0.10	2332.0	**21.46%**	1.28	0.84	1.58
																				19.58																		
L127A (Holstein Road, L)	127	126	0.38	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.252	0.252	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	53.8	110.8	300	300	CIRCULAR	PVC	-	1.00	96.2	**55.94%**	1.37	1.21	1.53
																				11.53																		
(Holstein Road, L)	132	131	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	35.9	300	300	CIRCULAR	PVC	-	0.65	77.5	**0.00%**	1.10	0.00	0.00
(Holstein Road, L)	131	130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	19.5	300	300	CIRCULAR	PVC	-	0.50	68.0	**0.00%**	0.97	0.00	0.00
L130A, L130B (Maize Street, L)	130	129	0.68	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.419	0.419	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	89.4	113.9	375	375	CIRCULAR	PVC	-	0.50	116.6	**76.72%**	1.11	1.08	1.76
(Maize Street, L)	129	128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.419	0.000	0.000	0.000	0.000	0.000	0.000	11.76	70.64	95.72	112.16	163.90	0.0	0.0	82.2	12.3	375	375	CIRCULAR	PVC	-	0.50	116.6	**70.56%**	1.11	1.05	0.19
L128A (Maize Street, L)	128	126	0.32	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.210	0.629	0.000	0.000	0.000	0.000	0.000	0.000	11.96	70.02	94.87	111.17	162.44	0.0	0.0	122.4	39.5	450	450	CIRCULAR	CONCRETE	-	0.50	211.2	**57.97%**	1.29	1.15	0.57
																				12.53																		
L126C, L126B, L126A (Maize Street, L)	126	125	0.76	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.323	1.205	0.000	0.000	0.000	0.000	0.000	0.000	12.53	68.28	92.49	108.36	158.32	0.0	0.0	228.5	92.5	525	525	CIRCULAR	CONCRETE	-	0.40	283.8	**80.53%**	1.27	1.25	1.23
(Maize Street, L)	125	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.205	0.000	0.000	0.000	0.000	0.000	0.000	13.76	64.85	87.78	102.82	150.18	0.0	0.0	217.0	12.2	525	525	CIRCULAR	CONCRETE	-	0.40	283.8	**76.48%**	1.27	1.24	0.16
L124B, L124A (Maize Street, L)	124	123	0.53	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.324	1.529	0.000	0.000	0.000	0.000	0.000	0.000	13.93	64.42	87.19	102.13	149.17	0.0	0.0	273.7	71.4	600	600	CIRCULAR	CONCRETE	-	0.40	405.1	**67.55%**	1.39	1.30	0.92
C123A, L123B (Maize Street, L)	123	121	0.74	0.20	0.00	0.00	0.00	0.70	0.67	0.00	0.00	0.518	2.047	0.133	0.133	0.000	0.000	0.000	0.000	14.84	62.14	84.07	98.45	143.78	0.0	0.0	384.6	51.3	675	675	CIRCULAR	CONCRETE	-	0.25	438.5	**87.71%**	1.19	1.20	0.71
																				15.55																		
C121AA (Roger Griffiths Avenue, C)	121A	121	0.00	0.09	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	0.000	0.059	0.059	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	17.1	54.0	375	375	CIRCULAR	PVC	-	0.25	82.4	**20.73%**	0.78	0.52	1.75
																				11.75																		
C109A, C109B (Roger Griffiths Avenue, C)	109	108	0.00	0.81	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.000	0.000	0.566	0.566	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	163.7	116.8	600	600	CIRCULAR	CONCRETE	-	0.35	379.0	**43.19%**	1.30	1.07	1.82
(Roger Griffiths Avenue, C)	108	107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.566	0.000	0.000	0.000	0.000	11.82	70.44	95.45	111.85	163.44	0.0	0.0	150.0	18.9	600	600	CIRCULAR	CONCRETE	-	0.45	429.7	**34.90%**	1.47	1.13	0.28
																				12.10																		
L113A, L113B (Sheaf Road, L)	113	112	0.82	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.434	0.434	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	92.7	84.2	450	450	CIRCULAR	CONCRETE	-	0.40	187.0	**49.59%**	1.14	0.97	1.44
L112A (Sheaf Road, L)	112	111	0.41	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.277	0.712	0.000	0.000	0.000	0.000	0.000	0.000	11.44	71.68	97.15	113.85	166.38	0.0	0.0	141.7	41.9	450	450	CIRCULAR	CONCRETE	-	0.40	187.0	**75.79%**	1.14	1.10	0.63
(Sheaf Road, L)	111	110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.712	0.000	0.000	0.000	0.000	0.000	0.000	12.07	69.66	94.38	110.58	161.58	0.0	0.0	137.7	11.2	450	450	CIRCULAR	CONCRETE	-	0.40	187.0	**73.65%**	1.14	1.10	0.17
C110A (Sheaf Road, L)	110	107	0.00	0.12	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.000	0.712	0.079	0.079	0.000	0.000	0.000	0.000	12.24	69.14	93.66	109.74	160.35	0.0	0.0	157.3	44.4	525	525	CIRCULAR	CONCRETE	-	0.35	265.4	**59.27%**	1.19	1.07	0.69
																				12.94																		
(Roger Griffiths Avenue, C)	107	121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.712	0.000	0.645	0.000	0.000	0.000	0.000	12.94	67.11	90.88	106.47	155.54	0.0	0.0	295.5	80.3	825	825	CIRCULAR	CONCRETE	-	0.10	473.6	**62.39%**	0.86	0.79	1.70
																				14.64																		
L121B, C121A (Ploughshare Road, L)	121	119	1.47	0.38	0.00	0.00	0.00	0.85	0.68	0.00	0.00	1.247	4.006	0.261	1.099	0.000	0.000	0.000	0.000	15.55	60.49	81.81	95.79	139.87	0.0	0.0	922.8	113.2	1200	1200	CIRCULAR	CONCRETE	-	0.15	1575.3	**58.58%**	1.35	1.21	1.56
L119A (Ploughshare Road, L)	119	101	0.31	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.215	4.221	0.000	1.099	0.000	0.000	0.000	0.000	17.12	57.18	77.28	90.48	132.07	0.0	0.0	906.3	115.1	1200	1200	CIRCULAR	CONCRETE	-	0.15	1575.3	**57.54%**	1.35	1.21	1.59
																				18.71																		
F101A-A1 (Kanata West Pump Station)	101A-1	101	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.00	0.55	0.000	0.000	0.000	0.000	0.000	0.000	0.381	0.381	10.00	76.81	104.19	122.14	178.56	0.0	0.0	188.8	16.3	600	600	CIRCULAR	CONCRETE	-	0.50	453.0	**41.69%**	1.55	1.25	0.22
																				10.22																		
	101	100D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	7.295	0.000	1.227	0.000	0.000	0.000	0.381	19.58	52.71	71.18	83.30	121.55	0.0	0.0	1439.2	15.7	1500	1500	CIRCULAR	CONCRETE	-	0.15	2826.0	**50.93%**	1.55	1.34	0.20
West Forebay Inlet (Sized for 25mm)	100D	100C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	19.78	52.39	70.74	82.78	120.79	1103.1	1103.1	1103.1	26.4	1050	1050	CIRCULAR	CONCRETE	-	0.16	1139.6	**96.80%**	1.27	1.33	0.33
	100C	HW2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	20.11	51.85	70.01	81.93	119.53	0.0	1103.1	1103.1	13.5	1050	1050	CIRCULAR	CONCRETE	-	0.18	1223.4	**90.16%**	1.37	1.40	0.16
																				20.27									1050	1050								
Bypass sewer to Maincell (Sized for difference between upstream flows and forebay inlet)	100D	100E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	7.295	0.000	1.227	0.000	0.000	0.000	0.381	19.78	52.39	70.74	82.78	120.79	0.0	0.0	327.3	15.3	1350	1350	CIRCULAR	CONCRETE	-	1.00	5568.4	**5.88%**	3.77	1.71	0.15
	100E	HW4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	7.295	0.000	1.227	0.000	0.000	0.000	0.381	19.93	52.15	70.41	82.40	120.22	0.0	0.0	320.7	15.8	1350	1350	CIRCULAR	CONCRETE	-	2.55	8887.6	**3.61%**	6.02	2.38	0.11
																				20.04									1350	1350								
			11.64	1.79	0.00	0.69	0.00					7.30		1.23		0.00		0.38																				
B-1, B-2, (KW Pump Station Overflow)	HW7	HW8	1.10	0.00	0.69	0.00	0.00	0.60	0.00	0.70	0.00	0.660	0.660	0.000	0.000	0.483	0.483	0.000	0.000	10.00	76.81	104.19	122.14	178.56	1200.0	1200.0	1504.7	18.1	900	900	CIRCULAR	CONCRETE	-	1.19	2057.3	**73.14%**	3.13	3.01	0.10
																				10.10									900	900								

Stantec

Richcraft Kanata West

DATE: 2019-05-17
REVISION: 5
DESIGNED BY: WAJ
CHECKED BY: AMP

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401393

DESIGN PARAMETERS

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

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min
BEDDING CLASS = B

LOCATION			DRAINAGE AREA																				PIPE SELECTION											
AREA ID / NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM (2-YEAR) (ha)	A x C (5-YEAR) (ha)	ACCUM. (5-YEAR) (ha)	A x C (10-YEAR) (ha)	ACCUM. (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
Future Storm Sewers to East Forebay of Ultimate KW Pond 5																																			
L206B, L209A, L209C, EXT9-Fairwinds/Mattamy/Commercial (Cartage Way, L)	209	207	0,92	23,31	7,14	0,00	0,00	0,59	0,59	0,70	0,00	0,539	0,539	13,844	13,844	4,998	4,998	0,000	0,000	15,00	61,77	83,56	97,85	142,89	0,0	0,0	4664,2	49,7	1650	1650	CIRCULAR	CONCRETE	-	0,30	5208,1	**89,56%**	2,36	2,40	0,35
L207A (Cartage Way, L)	207	206	0,58	0,00	0,00	0,00	0,00	0,63	0,00	0,00	0,00	0,365	0,904	0,000	13,844	0,000	4,998	0,000	0,000	15,35	60,96	82,46	96,56	141,00	0,0	0,0	4664,7	99,2	1650	1650	CIRCULAR	CONCRETE	-	0,30	5208,0	**89,57%**	2,36	2,40	0,69
L205A, C206B (Cartage Way, L)	206	205	0,31	0,17	0,00	0,00	0,00	0,73	0,70	0,00	0,00	0,226	1,130	0,119	13,963	0,000	4,998	0,000	0,000	16,03	59,43	80,36	94,09	137,37	0,0	0,0	4609,6	110,0	2100	2100	CIRCULAR	CONCRETE	-	0,15	7005,7	**65,80%**	1,96	1,82	1,01
L205B, C205A (Cartage Way, L)	205	204	0,48	0,26	0,00	0,00	0,00	0,45	0,67	0,00	0,00	0,216	1,347	0,176	14,139	0,000	4,998	0,000	0,000	17,04	57,34	77,50	90,72	132,44	0,0	0,0	4517,7	108,1	2100	2100	CIRCULAR	CONCRETE	-	0,15	7007,1	**64,47%**	1,96	1,81	1,00
L204A, L204B (Cartage Way, L)	204	202	0,61	0,00	0,00	0,00	0,00	0,71	0,00	0,00	0,00	0,574	1,921	0,000	14,139	0,000	4,998	0,000	0,000	18,04	55,42	74,87	87,64	127,92	0,0	0,0	4453,3	149,9	2100	2100	CIRCULAR	CONCRETE	-	0,15	7005,8	**63,57%**	1,96	1,81	1,38
																				19,42																	
EXT9 - Trinity/Hazeldean (Tillage Street, L)	212	211	0,00	12,31	4,54	0,00	2,54	0,00	0,86	0,76	0,00	0,000	0,000	10,587	10,587	3,450	3,450	0,000	0,000	21,58	49,62	66,96	78,35	114,29	76,4	76,4	2796,5	97,8	1650	1650	CIRCULAR	CONCRETE	-	0,15	3682,7	**75,94%**	1,67	1,61	1,01
L211A (Tillage Street, L)	211	210	0,40	0,00	0,00	0,00	0,00	0,72	0,00	0,00	0,00	0,288	0,288	0,000	10,587	0,000	3,450	0,000	0,000	22,59	48,21	65,04	76,09	110,97	0,0	76,4	2756,7	115,9	1650	1650	CIRCULAR	CONCRETE	-	0,16	3744,9	**73,61%**	1,70	1,63	1,18
																				23,77																	
(Holstein Road, L)	232	231	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	10,00	76,81	104,19	122,14	178,56	0,0	0,0	0,0	42,8	300	300	CIRCULAR	CONCRETE	-	0,50	68,0	**0,00%**	0,97	0,00	0,00
(Holstein Road, L)	231	230	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	10,00	76,81	104,19	122,14	178,56	0,0	0,0	0,0	37,4	300	300	CIRCULAR	CONCRETE	-	0,50	68,0	**0,00%**	0,97	0,00	0,00
(Holstein Road, L)	230	229	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	10,00	76,81	104,19	122,14	178,56	0,0	0,0	0,0	12,1	300	300	CIRCULAR	CONCRETE	-	0,50	68,0	**0,00%**	0,97	0,00	0,00
L229A (Holstein Road, L)	229	228	0,36	0,00	0,00	0,00	0,00	0,70	0,00	0,00	0,00	0,255	0,255	0,000	0,000	0,000	0,000	0,000	0,000	10,00	76,81	104,19	122,14	178,56	0,0	0,0	54,4	88,9	450	450	CIRCULAR	CONCRETE	-	0,40	188,1	**28,94%**	1,15	0,83	1,79
L228A (Holstein Road, L)	228	227	0,49	0,00	0,00	0,00	0,00	0,70	0,00	0,00	0,00	0,345	0,601	0,000	0,000	0,000	0,000	0,000	0,000	11,79	70,54	95,58	112,00	163,66	0,0	0,0	117,7	77,2	450	450	CIRCULAR	CONCRETE	-	0,30	162,9	**72,24%**	0,99	0,95	1,36
(Holstein Road, L)	227	226	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,601	0,000	0,000	0,000	0,000	0,000	0,000	13,15	66,51	90,05	105,49	154,10	0,0	0,0	111,0	14,1	450	450	CIRCULAR	CONCRETE	-	0,30	162,9	**68,11%**	0,99	0,93	0,25
L226B, L226A (Holstein Road, L)	226	225	0,56	0,00	0,00	0,00	0,00	0,59	0,00	0,00	0,00	0,326	0,926	0,000	0,000	0,000	0,000	0,000	0,000	13,40	65,81	89,10	104,37	152,46	0,0	0,0	169,3	62,2	525	525	CIRCULAR	CONCRETE	-	0,30	245,7	**68,90%**	1,10	1,04	1,00
L225A, L225B (Holstein Road, L)	225	224	3,03	0,00	0,00	0,00	0,00	0,70	0,00	0,00	0,00	2,113	3,040	0,000	0,000	0,000	0,000	0,000	0,000	14,40	63,21	85,53	100,18	146,31	0,0	0,0	533,7	67,7	825	825	CIRCULAR	CONCRETE	-	0,30	820,2	**65,07%**	1,49	1,37	0,82
(Holstein Road, L)	224	223	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	3,040	0,000	0,000	0,000	0,000	0,000	0,000	15,23	61,24	82,83	97,00	141,64	0,0	0,0	517,1	11,9	825	825	CIRCULAR	CONCRETE	-	0,35	886,0	**58,36%**	1,61	1,44	0,14
C223A (Holstein Road, L)	223	222	0,00	0,16	0,00	0,00	0,00	0,00	0,71	0,00	0,00	0,000	3,040	0,114	0,114	0,000	0,000	0,000	0,000	15,37	60,92	82,40	96,49	140,89	0,0	0,0	540,4	75,3	825	825	CIRCULAR	CONCRETE	-	0,35	885,9	**61,00%**	1,61	1,46	0,86
C222A (Roger Griffiths Avenue, C)	222	221	0,00	0,52	0,00	0,00	0,00	0,00	0,69	0,00	0,00	0,000	3,040	0,359	0,473	0,000	0,000	0,000	0,000	16,23	59,02	79,80	93,43	136,40	0,0	0,0	603,2	71,4	825	825	CIRCULAR	CONCRETE	-	0,35	885,9	**68,08%**	1,61	1,50	0,79
(Roger Griffiths Avenue, C)	221	219	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	3,040	0,000	0,473	0,000	0,000	0,000	0,000	17,02	57,38	77,56	90,80	132,54	0,0	0,0	586,4	76,8	1050	1050	CIRCULAR	CONCRETE	-	0,37	1728,6	**33,92%**	1,93	1,47	0,87
																				17,89																	
C220A, L220A (Roger Griffiths Avenue, C)	220	219	0,87	0,41	0,00	0,00	0,00	0,44	0,73	0,00	0,00	0,381	0,381	0,297	0,297	0,000	0,000	0,000	0,000	10,00	76,81	104,19	122,14	178,56	0,0	0,0	167,3	74,8	600	600	CIRCULAR	CONCRETE	-	0,47	440,7	**37,95%**	1,51	1,19	1,05
																				11,05																	
C219A, L219B (Shropshire Place, L)	219	218	0,36	0,09	0,00	0,00	0,00	0,68	0,68	0,00	0,00	0,246	3,667	0,061	0,831	0,000	0,000	0,000	0,000	17,89	55,69	75,25	88,09	128,57	0,0	0,0	740,9	110,7	1350	1350	CIRCULAR	CONCRETE	-	0,20	2475,0	**29,94%**	1,68	1,22	1,51
L218A, L218B (Shropshire Place, L)	218	213	3,20	0,00	0,00	0,00	0,00	0,68	0,00	0,00	0,00	2,177	5,843	0,000	0,831	0,000	0,000	0,000	0,000	19,40	53,02	71,60	83,80	122,28	0,0	0,0	1025,9	102,1	1350	1350	CIRCULAR	CONCRETE	-	0,20	2494,9	**41,12%**	1,69	1,36	1,25
																				20,65																	
L217A (Combine Walk, L)	217	216	0,40	0,00	0,00	0,00	0,00	0,68	0,00	0,00	0,00	0,273	0,273	0,000	0,000	0,000	0,000	0,000	0,000	10,00	76,81	104,19	122,14	178,56	0,0	0,0	58,2	31,2	375	375	CIRCULAR	PVC	-	0,50	116,6	**49,94%**	1,11	0,95	0,55
(Combine Walk, L)	216	215	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,273	0,000	0,000	0,000	0,000	0,000	0,000	10,55	74,75	101,37	118,82	173,67	0,0	0,0	56,7	11,9	375	375	CIRCULAR	PVC	-	0,50	116,6	**48,60%**	1,11	0,94	0,21
(Combine Walk, L)	215	214	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,273	0,000	0,000	0,000	0,000	0,000	0,000	10,76	74,00	100,33	117,59	171,98	0,0	0,0	56,1	57,5	375	375	CIRCULAR	PVC	-	0,50	116,6	**48,11%**	1,11	0,94	1,02
L214A (Combine Walk, L)	214	213	0,55	0,00	0,00	0,00	0,00	0,71	0,00	0,00	0,00	0,391	0,664	0,000	0,000	0,000	0,000	0,000	0,000	11,79	70,57	95,62	112,05	163,73	0,0	0,0	130,1	70,6	600	600	CIRCULAR	CONCRETE	-	0,32	360,5	**36,10%**	1,24	0,96	1,23
																				13,01																	
L213A (Shropshire Place, L)	213	210	0,26	0,00	0,00	0,00	0,00	0,69	0,00	0,00	0,00	0,182	6,689	0,000	0,831	0,000	0,000	0,000	0,000	20,85	51,01	68,86	80,57	117,55	0,0	0,0	1106,7	55,3	1500	1500	CIRCULAR	CONCRETE	-	0,20	3295,3	**33,58%**	1,81	1,37	0,67
																				21,32																	
L210A, L210B (Tillage Street, L)	210	202	0,51	0,00	0,00	0,00	0,00	0,57	0,00	0,00	0,00	0,291	7,268	0,000	11,417	0,000	3,450	0,000	0,000	23,77	46,66	62,93	73,61	107,34	0,0	76,4	3719,5	85,5	1800	1800	CIRCULAR	CONCRETE	-	0,14	4556,4	**81,63%**	1,73	1,72	0,83
																				24,60																	
L202B, L202A (Winter Wheat Terrace, L)	202	201	0,45	0,00	0,00	0,00	0,00	0,57	0,00	0,00	0,00	0,258	9,446	0,000	25,557	0,000	8,448	0,000	0,000	24,60	45,64	61,54	71,98	104,95	0,0	76,4	7331,6	75,0	2400	1800	RECTANGULAR	CONCRETE	-	0,15	8261,6	**88,74%**	1,91	1,94	0,64
																				25,25																	
L241A (Ploughshare Road, L)	241	240	0,31	0,00	0,00	0,00	0,00	0,69	0,00	0,00	0,00	0,213	0,213	0,000	0,000	0,000	0,000	0,000	0,000	10,00	76,81	104,19	122,14	178,56	0,0	0,0	45,5	77,3	375	375	CIRCULAR	PVC	-	0,35	97,5	**46,61%**	0,92	0,78	1,66
L240A, L240B (Ploughshare Road, L)	240	239	0,80	0,00	0,00	0,00	0,00	0,71	0,00	0,00	0,00	0,431	0,644	0,000	0,000	0,000	0,000	0,000	0,000	11,66	70,97	96,17	112,70	164,69	0,0	0,0	126,9	64,5	525	525	CIRCULAR	CONCRETE	-	0,35	265,4	**47,80%**	1,19	1,01	1,07
(Ploughshare Road, L)	239	238	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,644	0,000	0,000	0,000	0,000	0,000	0,000	12,73	67,70	91,69	107,42	156,94	0,0	0,0	121,0	12,8	525	525	CIRCULAR	CONCRETE	-	0,35	265,4	**45,60%**	1,19	0,99	0,22
L238A (Ploughshare Road, L)	238	237	0,65	0,00	0,00	0,00	0,00	0,57	0,00	0,00	0,00	0,372	1,016	0,000	0,000	0,000	0,000	0,000	0,000	12,95	67,08	90,84	106,42	155,47	0,0	0,0	189,3	68,1	675	675	CIRCULAR	CONCRETE	-	0,35	518,8	**36,49%**	1,40	1,09	1,04
L237A (Ploughshare Road, L)	237	236	0,27	0,00	0,00	0,00	0,00	0,66	0,00	0,00	0,00	0,175	1,191	0,000	0,000	0,000	0,000	0,000	0,000	13,98	64,27	86,99	101,89	148,82	0,0	0,0	212,7	9,1	675	675	CIRCULAR	CONCRETE	-	0,35	518,8	**41,00%**	1,40	1,13	0,13
(Ploughshare Road, L)	236	235	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	1,191	0,000	0,000	0,000	0,000	0,000	0,000	14,12	63,93	86,52	101,33	148,00	0,0	0,0	211,5	50,7	675	675	CIRCULAR	CONCRETE	-	0,35	518,8	**40,78%**	1,40	1,13	0,75
(Ploughshare Road, L)	235	234	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	1,191	0,000	0,000	0,000	0,000	0,000	0,000	14,87	62,08	83,99	98,36	143,64	0,0	0,0	205,4	11,2	750	750	CIRCULAR	CONCRETE	-	0,35	687,1	**29,90%**	1,51	1,10	0,17
L234B, 923AA, L234A (Ploughshare Road, L)	234	233	1,53	0,00	0,00	0,00	0,00	0,41	0,00	0,00	0,00	0,626	1,817	0,000	0,000	0,000	0,000	0,000	0,000	15,04	61,68	83,44	97,71	142,69	0,0	0,0	311,3	106,9	975	975	CIRCULAR	CONCRETE	-	0,35	1383,1	**22,51%**	1,79	1,20	1,48
(Ploughshare Road, L)	233	201	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	1,817	0,000	0,000	0,000	0,000	0,000	0,000	16,52	58,40	78,95	92,44	134,95	0,0	0,0	294,8	26,6	975	975	CIRCULAR	CONCRETE	-	0,40	1478,6	**19,94%**	1,92	1,24	0,36
																				16,87																	
	201	100B	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	11,263	0,000	25,557	0,000	8,448	0,000	0,000	25,25	44,89	60,51	70,77	103,18	0,0	76,4	7436,7	15,0	2400	1800	RECTANGULAR	CONCRETE	-	0,15	8260,8	**90,02%**	1,91	1,95	0,13
Forebay Inlet (Sized for 25mm)	100B	HW1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	25,37	44,73	60,31	70,53	102,93	4747,6	4824,0	4824,0	18,2	2400	1800	RECTANGULAR	CONCRETE	-	0,18	8892,2	**53,65%**	2,08	1,81	0,17
																				25,54										2400	1800						
Bypass sewer to Maincell (Sized for difference between upstream flows and forebay inlet)	100B	100A	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	11,263	0,000	25,557	0,000	8,448	0,000	0,000	25,37	44,73	60,31	70,53	102,83	0,0	0,0	2588,2	49,8	2400	1500	RECTANGULAR	CONCRETE	-	0,10	5131,5	**50,44%**	1,43	1,22	0,68
	100A	HW3	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	11,263	0,000	25,557	0,000	8,448	0,000	0,000	26,05	43,97	59,26	69,31	101,04	0,0	0,0	2461,6	26,3	2400	1500	RECTANGULAR	CONCRETE	-	0,11	5088,3	**44,05%**	1,55	1,28	0,34
																				26,40										2400	1500						
			17,90	37,23	11,68	0,00	2,54					11,26		25,98		8,45		0,00																			
	100F-1	100F	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	10,00	76,81	104,19	122,14	178,56	0,0	0,0	0,0	16,1	300	300	CIRCULAR	PVC	-	3,40	177,3	**0,00%**	2,52	0,00	0,00
	100F	100F-2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	10,00	76,81	104,19	122,14	178,56	0,0	0,0	0,0	22,4	300	300	CIRCULAR	PVC	-	2,90	163,7	**0,00%**	2,33	0,00	0,00
																				10,00										300	300						

Notes:

1. The proposed streets are all classified as local streets with the exception of Roger Griffiths Avenue which is classified as a collector road.
2. Storm sewers witin local streets have been sized for a 2-year storm with the exception of catchments at the intersection with Roger Griffiths Avenue for which storm sewers have been sized for the 5-year capture to avoid 5-year ponding on collector roads,
3. Existing residential and commercial developments (Fairwinds and Trinity), areas EXT-8 & EXT-9 have been included in the proposed storm sewer sizing for the 5-year storm as per previous City of Ottawa guidelines.
4. The proposed development includes two residential block areas L123B & L225B (Block 115 & Block 89) , one commercial block area L121B (Block 136), a school block area L218A (Block 76) and two park block areas G234A & L126C (Block 138 & Block 112) .

Appendix C WASTEWATER CALCULATIONS

C.1 Sanitary Sewer Design Sheet

C.2 Sanitary HGL Analysis Peak Inflows and Figure

C.3 External Areas Background Information

C.4 City Correspondence

Appendix C Wastewater Calculations
February 12, 2020

C.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:
Richcraft Kanata West Subdivision - First Registration Phase

DATE: 8/27/2019
REVISION: 3
DESIGNED BY: WAJ
CHECKED BY: AMP

FILE NUMBER: 160401393

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 L/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 L/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 L/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 L/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 L/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 L/s/ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8	Medium Denisty Residential Blocks	38 units/ha		

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	SINGLE	UNITS TOWN	APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
FUTURE PHASES																																		
R64A, EXT-1	64	63	0.17	0	0	0	0	0.17	0	3.80	0.0	13.19	13.19	0.00	0.00	0.00	0.00	1.04	1.04	1.28	1.28	6.9	15.68	15.68	5.2	12.1	93.8	300	PVC	SDR 35	0.19	41.9	28.9%	0.59	0.43
	63	55	0.00	0	0	0	0	0.17	0	3.80	0.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	1.04	0.00	1.28	6.9	0.00	15.68	5.2	12.1	120.0	300	PVC	SDR 35	0.19	41.7	29.0%	0.59	0.43
R58A	58	57	0.36	0	8	0	22	0.36	22	3.70	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.36	0.36	0.1	0.4	60.6	200	PVC	SDR 35	0.65	27.0	1.4%	0.85	0.26
I57B, R57A	57	56	0.51	0	15	0	41	0.87	62	3.64	0.7	0.00	0.00	0.00	0.00	0.00	0.00	2.95	2.95	0.00	0.00	1.4	3.46	3.82	1.3	3.4	105.5	200	PVC	SDR 35	0.40	21.1	16.2%	0.67	0.40
R62A	62	61	0.17	0	5	0	14	0.17	14	3.72	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.17	0.1	0.2	30.8	200	PVC	SDR 35	0.65	27.0	0.8%	0.85	0.21
R61A	61	60	0.17	0	3	0	8	0.35	22	3.70	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.35	0.1	0.4	11.9	200	PVC	SDR 35	0.50	23.6	1.6%	0.74	0.23
R60A	60	59	0.80	0	34	0	92	1.15	113	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.80	1.15	0.4	1.7	117.1	200	PVC	SDR 35	0.50	23.6	7.2%	0.74	0.36
	59	56	0.00	0	0	0	0	1.15	113	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.15	0.4	1.7	11.6	200	PVC	SDR 35	0.40	21.1	8.0%	0.67	0.33
R56A	56	55	0.22	0	6	0	16	2.23	192	3.52	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.00	0.00	1.4	0.22	5.18	1.7	5.3	49.8	200	PVC	SDR 35	0.40	21.1	25.2%	0.67	0.46
	55	54	0.00	0	0	0	0	2.41	192	3.52	2.2	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	20.87	6.9	17.4	79.5	375	PVC	SDR 35	0.14	61.3	28.4%	0.58	0.42
R65A	65	54	0.21	0	4	0	11	0.21	11	3.73	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.21	0.21	0.1	0.2	27.3	200	PVC	SDR 35	1.00	33.4	0.6%	1.05	0.26
R54GA	54G	54F	0.80	12	16	0	84	0.80	84	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.80	0.80	0.3	1.2	119.4	200	PVC	SDR 35	0.35	19.8	6.3%	0.62	0.29
R54FA	54F	54E	0.39	8	0	0	27	1.19	111	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.39	1.19	0.4	1.7	79.3	200	PVC	SDR 35	0.35	19.8	8.5%	0.62	0.32
	54E	54	0.00	0	0	0	0	1.19	111	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.19	0.4	1.7	5.8	200	PVC	SDR 35	0.35	19.8	8.5%	0.62	0.32
R54DA	54D	54C	0.40	0	10	0	27	0.40	27	3.69	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.40	0.40	0.1	0.5	57.9	200	PVC	SDR 35	0.65	27.0	1.7%	0.85	0.26
	54C	54B	0.00	0	0	0	0	0.40	27	3.69	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.40	0.1	0.5	76.0	200	PVC	SDR 35	0.35	19.8	2.3%	0.62	0.21
R54BA	54B	54A	0.60	0	22	0	59	1.00	86	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.60	1.00	0.3	1.3	70.2	200	PVC	SDR 35	0.35	19.8	6.8%	0.62	0.29
R54AA	54A	54	0.54	0	19	0	51	1.54	138	3.56	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.54	1.54	0.5	2.1	2.5	200	PVC	SDR 35	0.35	19.8	10.6%	0.62	0.33
	54	53	0.00	0	0	0	0	5.35	451	3.40	5.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	23.80	7.9	21.2	70.7	375	PVC	SDR 35	0.14	60.7	34.9%	0.58	0.44
	53	52	0.00	0	0	0	0	5.35	451	3.40	5.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	23.80	7.9	21.2	76.0	375	PVC	SDR 35	0.14	60.7	34.9%	0.58	0.44
	52	35	0.00	0	0	0	0	5.35	451	3.40	5.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	23.80	7.9	21.2	104.6	375	PVC	SDR 35	0.14	60.7	34.9%	0.58	0.44
R51A	51	50	0.18	0	4	0	11	0.18	11	3.73	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.18	0.18	0.1	0.2	39.8	200	PVC	SDR 35	0.65	27.0	0.7%	0.85	0.21
R50A	50	49	0.19	0	5	0	14	0.37	24	3.69	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.37	0.1	0.4	36.9	200	PVC	SDR 35	0.40	21.1	1.9%	0.67	0.22
R49A	49	48	0.08	0	2	0	5	0.45	30	3.68	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.45	0.1	0.5	12.1	200	PVC	SDR 35	0.40	21.1	2.4%	0.67	0.23
R48A	48	47	0.59	0	20	0	54	1.03	84	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.59	1.03	0.3	1.3	85.9	200	PVC	SDR 35	0.40	21.1	6.2%	0.67	0.31
R47A	47	46	0.66	0	22	0	59	1.69	143	3.56	1.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.66	1.69	0.6	2.2	80.2	200	PVC	SDR 35	0.40	21.1	10.4%	0.67	0.36
R46A	46	45	0.22	0	4	0	11	1.91	154	3.55	1.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.22	1.91	0.6	2.4	14.3	200	PVC	SDR 35	0.40	21.1	11.4%	0.67	0.36
R45A	45	44	0.33	0	10	0	27	2.24	181	3.53	2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.33	2.24	0.7	2.8	62.2	200	PVC	SDR 35	0.40	21.1	13.3%	0.67	0.38
R44A, R44B	44	43	3.07	0	9	0	307	5.31	488	3.38	5.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3.07	5.31	1.8	7.1	67.7	200	PVC	SDR 35	0.40	21.1	33.6%	0.67	0.51
R43A	43	42	0.09	0	2	0	5	5.39	494	3.38	5.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.09	5.39	1.8	7.2	11.7	200	PVC	SDR 35	0.40	21.1	34.0%	0.67	0.51
R42A	42	41	0.31	0	9	0	24	5.70	518	3.37	5.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.31	5.70	1.9	7.5	75.4	200	PVC	SDR 35	0.40	21.1	35.7%	0.67	0.51
R41A, R41B	41	40	0.53	0	9	0	24	6.23	542	3.36	5.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.53	6.23	2.1	8.0	71.3	200	PVC	SDR 35	0.40	21.1	37.7%	0.67	0.52
R40A	40	39	0.43	0	12	0	32	6.66	575	3.35	6.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.43	6.66	2.2	8.4	77.3	200	PVC	SDR 35	0.40	21.1	39.9%	0.67	0.53
R39BA	39B	39A	0.49	0	13	0	35	0.49	35	3.67	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.49	0.49	0.2	0.6	68.2	200	PVC	SDR 35	0.35	19.8	2.9%	0.62	0.24
	39A	39	0.00	0	0	0	0	0.49	35	3.67	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.49	0.2	0.6	3.4	200	PVC	SDR 35	0.35	19.8	2.9%	0.62	0.24
	39	35	0.00	0	0	0	0	7.15	610	3.34	6.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	7.15	2.4	9.0	79.5	200	PVC	SDR 35	0.40	21.1	42.4%	0.67	0.54
R38A	38	37	0.08	0	2	0	5	0.08	5	3.75	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.08	0.0	0.1	12.6	200	PVC	SDR 35	0.65	27.0	0.3%	0.85	0.16
R37A	37	36	0.78	0	27	0	73	0.86	78	3.62	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.78	0.86	0.3	1.2	99.3	200	PVC	SDR 35	0.40	21.1	5.7%	0.67	0.30
R36A	36	35	0.63	0	21	0	57	1.49	135	3.56	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.63	1.49	0.5	2.1	110.3	200	PVC	SDR 35	0.40	21.2	9.7%	0.67	0.35
R74A	74	73	0.52	12	0	0	41	0.52	41	3.67	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.52	0.52	0.2	0.7	80.3	200	PVC	SDR 35	0.65	27.0	2.4%	0.85	0.29
R73A	73	72	0.51	11	0	0	37	1.03	78	3.62	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.51	1.03	0.3	1.3	61.5	200	PVC	SDR 35	0.32	18.9	6.6%	0.60	0.28
R72A	72	71	0.20	3	0	0	10	1.23	88	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.20	1.23	0.4	1.4	12.3	200	PVC	SDR 35	0.32	18.9	7.6%	0.60	0.30
R71A	71	70	0.31	6	0	0	20	1.54	109	3.59	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.31	1.54	0.5	1.8	65.1	200	PVC	SDR 35	0.32	18.9	9.4%	0.60	0.31
R70A	70	69	0.07	1	0	0	3	1.60	112	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.07	1.60	0.5	1.8	9.6	200	PVC	SDR 35	0.32	18.9	9.7%	0.60	0.31
R69A	69	68	0.27	5	0	0	17	1.88	129	3.57	1.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.27	1.88	0.6	2.1	50.7	200	PVC	SDR 35	0.32	18.9	11.2%	0.60	0.33
R68A	68	67	0.16	2	0	0	7	2.03	136	3.56	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.16	2.03	0.7	2.2	11.2	200	PVC	SDR 35	0.32	18.9	11.9%	0.60	0.33
R67A, G67A	67	66	0.58	11	0	0	37	2.61	173	3.54	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.97	0.0	1.55	3.58	1.2	3.2	106.9	200	PVC	SDR 35	0.32	18.9	16.8%	0.60	0.37
R66A	66	21	0.13	1	0	0	3	2.74	177	3.53	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.13	3.71	1.2	3.2	50.9	200	PVC	SDR 35	0.32	18.9	17.2%	0.60	0.37
R21A	21	20	0.31	0	7	0	19	3.05	196	3.52	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.31	4.02	1.3	3.6	62.2	200	PVC	SDR 35	0.32	18.9	18.8%	0.60	0.38

Stantec

SUBDIVISION:
Richcraft Kanata West Subdivision - First Registration Phase

DATE: 8/27/2019
REVISION: 3
DESIGNED BY: WAJ
CHECKED BY: AMP

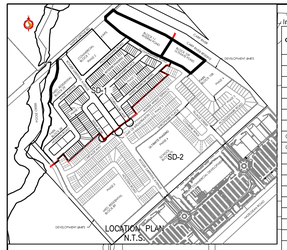
FILE NUMBER: 160401393

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 L/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 L/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 L/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 L/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 L/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 L/s/ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8	Medium Denisty Residential Blocks	38 units/ha		

LOCATION			RESIDENTIAL AREA AND POPULATION								COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	SINGLE	UNITS TOWN	APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
PROPOSED FIRST REGISTRATION PHASE																																			
R8A	8	7	0.42	0	14	0	38	0.42	38	3.67	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.42	0.42	0.1	0.6	110.7	200	PVC	SDR 35	1.00	33.4	1.8%	1.05	0.34
FUT R13A	*13*	*12*	*0.28*	*0*	*5*	*0*	*14*	*0.28*	*14*	*3.72*	*0.2*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.0*	*0.28*	*0.28*	*0.1*	*0.3*	*38.9*	*200*	*PVC*	*SDR 35*	*0.65*	*27.0*	*0.9%*	*0.85*	*0.23*
R12A	12	11	0.10	0	1	0	3	0.38	16	3.71	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.10	0.38	0.1	0.3	16.8	200	PVC	SDR 35	0.50	23.6	1.4%	0.74	0.21
R11A	11	10	0.58	0	24	0	65	0.96	81	3.61	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.58	0.96	0.3	1.3	112.4	200	PVC	SDR 35	0.50	23.6	5.4%	0.74	0.33
R10A	10	9	0.22	0	4	0	11	1.18	92	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.22	1.18	0.4	1.5	15.3	200	PVC	SDR 35	0.50	23.6	6.2%	0.74	0.34
R9A	9	7	0.19	0	6	0	16	1.37	108	3.59	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	1.37	0.5	1.7	37.9	200	PVC	SDR 35	0.50	23.6	7.2%	0.74	0.36
G7A, R7A	7	6	0.45	0	12	0	32	2.24	178	3.53	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.49	0.0	0.93	2.73	0.9	2.9	92.3	200	PVC	SDR 35	0.50	23.6	12.4%	0.74	0.42
R6A	6	5	0.03	0	0	0	0	2.27	178	3.53	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.0	0.03	2.76	0.9	3.0	12.1	200	PVC	SDR 35	0.50	23.6	12.5%	0.74	0.42
R5A	5	4	0.25	0	6	0	16	2.53	194	3.52	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.0	0.25	3.01	1.0	3.2	71.2	200	PVC	SDR 35	0.50	23.6	13.6%	0.74	0.43
R4A, R4B	4	3	0.94	0	5	0	90	3.47	284	3.47	3.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.0	0.94	3.95	1.3	4.5	51.6	200	PVC	SDR 35	0.50	23.7	19.0%	0.74	0.48
R33A	33	30	0.41	0	16	0	43	0.41	43	3.66	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.41	0.41	0.1	0.6	63.6	200	PVC	SDR 35	0.40	21.1	3.1%	0.67	0.25
R30A	30	27	0.42	0	17	0	46	0.83	89	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.42	0.83	0.3	1.3	79.4	200	PVC	SDR 35	0.40	21.1	6.2%	0.67	0.31
R27A	27	22	0.20	0	5	0	14	1.02	103	3.59	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.20	1.02	0.3	1.5	51.7	200	PVC	SDR 35	0.40	21.1	7.2%	0.67	0.32
	35	35A	0.00	0	0	0	0	13.99	1196	3.20	12.4	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	32.44	10.7	31.5	68.7	375	PVC	SDR 35	0.14	60.1	52.4%	0.57	0.49
	35A	22	0.00	0	0	0	0	13.99	1196	3.20	12.4	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	32.44	10.7	31.5	81.6	375	PVC	SDR 35	0.14	60.7	51.8%	0.58	0.50
R26A	26	25	0.50	0	21	0	57	0.50	57	3.64	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.50	0.50	0.2	0.8	81.2	200	PVC	SDR 35	0.40	21.1	3.9%	0.67	0.27
R25A	25	24	0.32	0	11	0	30	0.82	86	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.32	0.82	0.3	1.3	41.9	200	PVC	SDR 35	0.40	21.2	6.0%	0.67	0.30
R24A	24	23	0.15	0	3	0	8	0.97	95	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.15	0.97	0.3	1.4	11.4	200	PVC	SDR 35	0.40	21.1	6.7%	0.67	0.31
R23A	23	22	0.19	0	5	0	14	1.16	108	3.59	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	1.16	0.4	1.6	44.3	200	PVC	SDR 35	0.40	21.1	7.7%	0.67	0.33
R22BA	22B	22A	0.71	0	35	0	95	0.71	95	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.71	0.71	0.2	1.3	120.0	200	PVC	SDR 35	0.40	21.1	6.3%	0.67	0.31
R22AA	22A	22	0.02	0	0	0	0	0.73	95	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.02	0.73	0.2	1.3	15.9	200	PVC	SDR 35	0.40	21.1	6.4%	0.67	0.31
R22A	22	3	0.16	0	0	0	0	17.06	1501	3.14	15.3	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.16	35.52	11.7	35.4	78.4	375	PVC	SDR 35	0.14	61.3	57.7%	0.58	0.52
R32A	32	31	0.82	0	27	0	73	0.82	73	3.62	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.82	0.82	0.3	1.1	96.8	200	PVC	SDR 35	0.40	21.1	5.3%	0.67	0.29
R31A	31	20A	0.57	0	17	0	46	1.39	119	3.58	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.57	1.39	0.5	1.8	97.9	200	PVC	SDR 35	0.40	21.1	8.7%	0.67	0.34
	20A	20	0.00	0	0	0	0	1.39	119	3.58	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.39	0.5	1.8	8.7	200	PVC	SDR 35	0.40	21.1	8.7%	0.67	0.34
R20A	20	19	0.23	0	5	0	14	4.67	328	3.45	3.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.23	5.64	1.9	5.5	58.4	200	PVC	SDR 35	0.32	18.9	29.2%	0.60	0.43
R19A	19	18	0.11	0	2	0	5	4.78	333	3.45	3.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.11	5.75	1.9	5.6	24.5	200	PVC	SDR 35	0.32	18.9	29.7%	0.60	0.43
R27B	27	18A	0.65	0	22	0	59	0.65	59	3.64	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.65	0.65	0.2	0.9	96.4	200	PVC	SDR 35	0.32	18.9	4.8%	0.60	0.25
R18AA	18A	18B	0.58	0	18	0	49	1.24	108	3.59	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.58	1.24	0.4	1.7	101.4	200	PVC	SDR 35	0.32	18.9	8.8%	0.60	0.30
	18B	18	0.00	0	0	0	0	1.24	108	3.59	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.24	0.4	1.7	4.3	200	PVC	SDR 35	0.32	18.9	8.8%	0.60	0.30
	18	17	0.00	0	0	0	0	6.02	441	3.40	4.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.00	6.99	2.3	7.2	73.1	200	PVC	SDR 35	0.32	18.9	37.9%	0.60	0.47
R17BA	17B	17A	0.33	0	8	0	22	0.33	22	3.70	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.33	0.33	0.1	0.4	51.0	200	PVC	SDR 35	0.65	27.0	1.4%	0.85	0.24
	17A	17	0.00	0	0	0	0	0.33	22	3.70	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.33	0.1	0.4	2.1	200	PVC	SDR 35	0.35	19.8	1.9%	0.62	0.20
R17A	17	16	0.02	0	0	0	0	6.36	463	3.39	5.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.02	7.33	2.4	7.5	9.6	200	PVC	SDR 35	0.32	18.9	39.7%	0.60	0.47
	16	14	0.00	0	0	0	0	6.36	463	3.39	5.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.00	7.33	2.4	7.5	109.6	200	PVC	SDR 35	0.32	18.9	39.7%	0.60	0.47
C14B	14	3	0.00	0	0	0	0	6.36	463	3.39	5.1	1.47	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.5	1.47	8.80	2.9	8.5	109.5	200	PVC	SDR 35	0.32	18.9	44.8%	0.60	0.49
R3CA	3C	3B	0.45	0	10	0	27	0.45	27	3.69	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.45	0.45	0.1	0.5	80.8	200	PVC	SDR 35	0.35	19.8	2.4%	0.62	0.21
R3BA	3B	3A	0.50	0	14	0	38	0.95	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.50	0.95	0.3	1.1	103.3	200	PVC	SDR 35	0.35	19.8	5.4%	0.62	0.27
	3A	3	0.00	0	0	0	0	0.95	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.95	0.3	1.1	4.9	200	PVC	SDR 35	0.35	19.8	5.4%	0.62	0.27
R3A	3	2	0.16	0	0	0	0	28.00	2313	3.03	22.7	0.00	14.66	0.00	0.00	0.00	0.00	0.00	3.99	0.00	2.74	9.1	0.16	49.39	16.3	48.1	71.0	375	PVC	SDR 35	0.14	60.1	80.0%	0.57	0.56
R2A	2	1A	0.14	0	0	0	0	28.14	2313	3.03	22.7	0.00	14.66	0.00	0.00	0.00	0.00	0.00	3.99	0.00	2.74	9.1	0.14	49.52	16.3	48.1	49.3	450	PVC	SDR 35	1.00	300.3	16.0%	1.83	1.11
	1A	1	0.00	0	0	0	0	28.14	2313	3.03	22.7	0.00	14.66	0.00	0.00	0.00	0.00	0.00	3.99	0.00	2.74	9.1	0.00	49.52	16.3	48.1	4.8	450	PVC	SDR 35	1.00	300.1	16.0%	1.83	1.11
																												450							

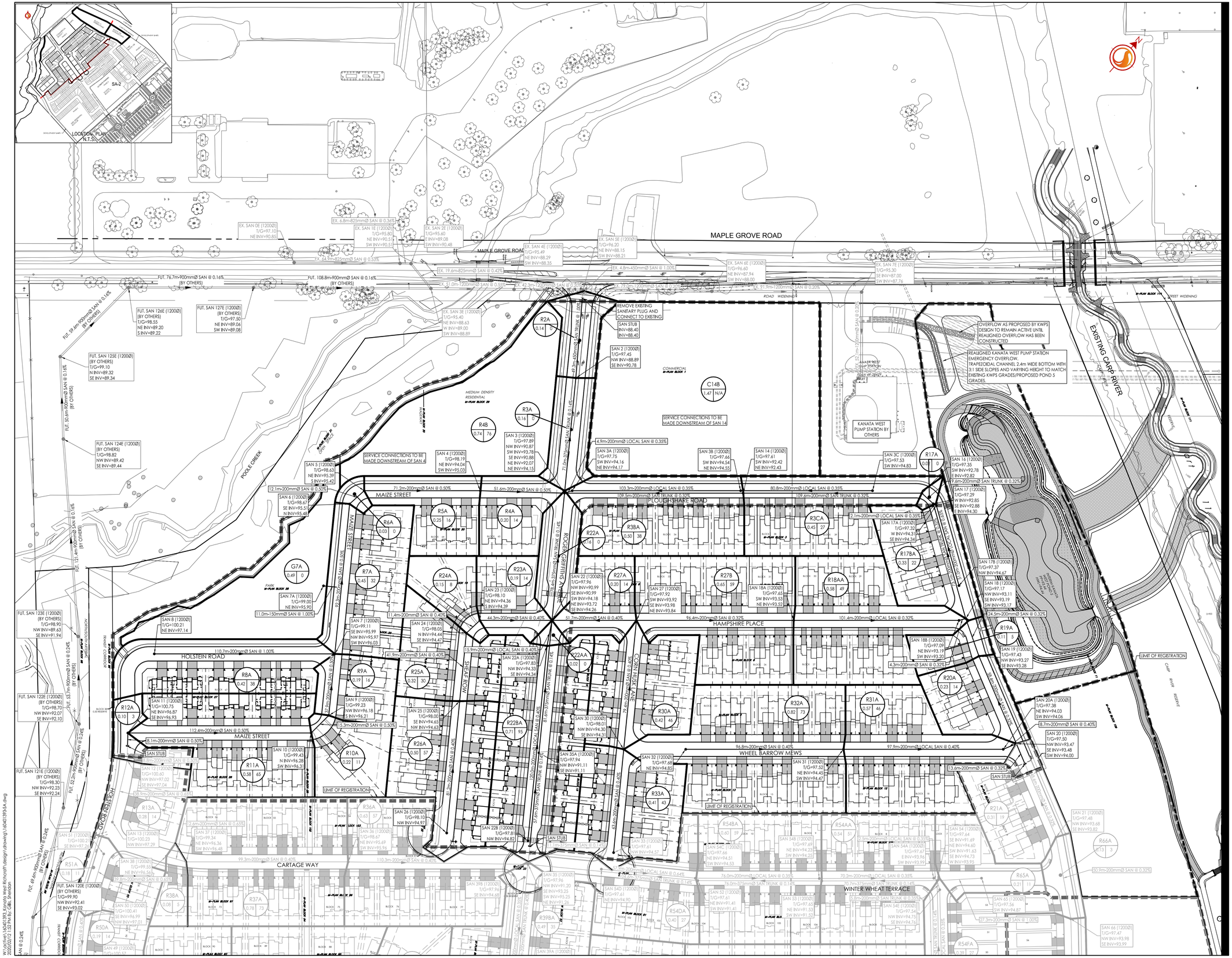


Interim Drawings ICD Schedule

Catchbasin ID	Tributary Area ID	Minor System Node	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
C107A-IC(1)	C107A	107	IPEX TEMPEST HF (95"mm ORIFICE)	0.66	1.59	14.1	22.3
C107A-IC(2)	C107A	107	IPEX TEMPEST HF (95"mm ORIFICE)	0.66	1.59	14.1	22.3
C109A-IC(1)	C109A	109	IPEX TEMPEST HF (165"mm ORIFICE)	0.46	1.55	33.4	65.5
C109A-IC(2)	C109A	109	IPEX TEMPEST HF (165"mm ORIFICE)	0.46	1.55	33.4	65.5
C109B-IC(1)	C109B	109	IPEX TEMPEST HF (178"mm ORIFICE)	0.32	1.47	30.5	74.1
C109B-IC(2)	C109B	109	IPEX TEMPEST HF (178"mm ORIFICE)	0.32	1.47	30.5	74.1
C110A-IC(1)	C110A	110	IPEX TEMPEST HF (108"mm ORIFICE)	0.61	1.51	17.3	28.0
C121AA-IC(1)	C121AA	SU15	IPEX TEMPEST HF (83"mm ORIFICE)	0.27	1.43	6.5	16.1
C121AA-IC(2)	C121AA	SU15	IPEX TEMPEST HF (83"mm ORIFICE)	0.27	1.43	6.5	16.1
C121A-IC(1)	C121A	121	IPEX TEMPEST HF (152"mm ORIFICE)	0.47	1.67	28.8	58.1
C121A-IC(2)	C121A	121	IPEX TEMPEST HF (152"mm ORIFICE)	0.47	1.67	28.8	58.1
C123A-IC(1)	C123A	123	IPEX TEMPEST HF (102"mm ORIFICE)	0.54	1.53	14.5	25.2
C123A-IC(2)	C123A	123	IPEX TEMPEST HF (102"mm ORIFICE)	0.54	1.53	14.5	25.2
L102A-IC(1)	L102A	102	IPEX TEMPEST HF (83"mm ORIFICE)	1.17	1.55	14.6	16.9
L102A-IC(2)	L102A	102	IPEX TEMPEST HF (83"mm ORIFICE)	1.17	1.55	14.6	16.9
L103A-IC(1)	L103A	103	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.59	30.7	39.7
L103A-IC(2)	L103A	103	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.59	30.7	39.7
L103B-IC(1)	L103B	103	IPEX TEMPEST HF (83"mm ORIFICE)	1.07	1.69	13.9	17.6
L103B-IC(2)	L103B	103	IPEX TEMPEST HF (83"mm ORIFICE)	1.07	1.69	13.9	17.6
L103C-IC	L103C	103	IPEX TEMPEST HF (140"mm ORIFICE)	1.26	1.39	42.5	44.9
L103D-IC	L103D	103	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.39	35.0	37.0
L104A-IC(1)	L104A	104	IPEX TEMPEST HF (108"mm ORIFICE)	1.22	1.59	25.1	28.7
L104A-IC(2)	L104A	104	IPEX TEMPEST HF (108"mm ORIFICE)	1.22	1.59	25.1	28.7
L105A-IC(1)	L105A	105	IPEX TEMPEST HF (108"mm ORIFICE)	1.35	1.61	26.5	28.9
L105A-IC(2)	L105A	105	IPEX TEMPEST HF (108"mm ORIFICE)	1.35	1.61	26.5	28.9
L106A-IC(1)	L106A	106	IPEX TEMPEST HF (102"mm ORIFICE)	1	1.51	20.2	25.0
L106A-IC(2)	L106A	106	IPEX TEMPEST HF (102"mm ORIFICE)	1	1.51	20.2	25.0
L106B-IC(1)	L106B	106	IPEX TEMPEST HF (83"mm ORIFICE)	0.69	1.59	11.0	17.1
L112A-IC(1)	L112A	112	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.68	30.7	40.8
L112A-IC(2)	L112A	112	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.68	30.7	40.8
L113A-IC(1)	L113A	113	IPEX TEMPEST HF (108"mm ORIFICE)	1.24	1.71	25.2	29.9
L113A-IC(2)	L113A	113	IPEX TEMPEST HF (108"mm ORIFICE)	1.24	1.71	25.2	29.9
L113B-IC	L113B	113	IPEX TEMPEST HF (108"mm ORIFICE)	1.28	1.52	25.8	28.1
L114A-IC	L114A	114	IPEX TEMPEST HF (108"mm ORIFICE)	0.21	1.59	9.1	28.7
L115A-IC(1)	L115A	115	IPEX TEMPEST HF (83"mm ORIFICE)	0.85	1.6	12.3	17.1
L115A-IC(2)	L115A	115	IPEX TEMPEST HF (83"mm ORIFICE)	0.85	1.6	12.3	17.1
L117A-IC(1)	L117A	117	IPEX TEMPEST HF (127"mm ORIFICE)	1.19	1.62	34.1	40.0
L117A-IC(2)	L117A	117	IPEX TEMPEST HF (127"mm ORIFICE)	1.19	1.62	34.1	40.0
L117B-IC(1)	L117B	117	IPEX TEMPEST HF (83"mm ORIFICE)	0.53	1.67	9.5	17.5
L117B-IC(2)	L117B	117	IPEX TEMPEST HF (83"mm ORIFICE)	0.53	1.67	9.5	17.5
L117C-IC	L117C	117	IPEX TEMPEST HF (140"mm ORIFICE)	1.26	1.42	42.6	45.3
L118A-IC(1)	L118A	118	IPEX TEMPEST HF (127"mm ORIFICE)	1.07	1.59	32.2	39.6
L118A-IC(2)	L118A	118	IPEX TEMPEST HF (127"mm ORIFICE)	1.07	1.59	32.2	39.6
L119A-IC(1)	L119A	119	IPEX TEMPEST HF (108"mm ORIFICE)	1.1	1.57	23.8	28.6
L119A-IC(2)	L119A	119	IPEX TEMPEST HF (108"mm ORIFICE)	1.1	1.57	23.8	28.6
L124A-IC(1)	L124A	124	IPEX TEMPEST HF (95"mm ORIFICE)	0.93	1.65	16.9	22.8
L124A-IC(2)	L124A	124	IPEX TEMPEST HF (95"mm ORIFICE)	0.93	1.65	16.9	22.8
L124B-IC	L124B	124	IPEX TEMPEST HF (95"mm ORIFICE)	1.25	1.36	19.7	20.6
L126A-IC(1)	L126A	126	IPEX TEMPEST HF (83"mm ORIFICE)	0.2	1.6	5.4	17.1
L126B-IC(1)	L126B	126	IPEX TEMPEST HF (102"mm ORIFICE)	1.03	1.63	20.5	26.1
L126B-IC(2)	L126B	126	IPEX TEMPEST HF (102"mm ORIFICE)	1.03	1.63	20.5	26.1
L126C-IC	L126C	126	IPEX TEMPEST HF (83"mm ORIFICE)	0.36	2.64	4.3	21.0
L127A-IC(1)	L127A	127	IPEX TEMPEST HF (127"mm ORIFICE)	0.88	1.44	27.8	36.6
L127A-IC(2)	L127A	127	IPEX TEMPEST HF (127"mm ORIFICE)	0.88	1.44	27.8	36.6
L128A-IC(1)	L128A	128	IPEX TEMPEST HF (102"mm ORIFICE)	1.24	1.64	22.6	26.1
L128A-IC(2)	L128A	128	IPEX TEMPEST HF (102"mm ORIFICE)	1.24	1.64	22.6	26.1
L130A-IC(1)	L130A	130	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.53	35.0	38.9
L130A-IC(2)	L130A	130	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.53	35.0	38.9
L130B-IC	L130B	130	IPEX TEMPEST HF (108"mm ORIFICE)	1	1.03	22.6	23.0

Storm Drainage Area	Block ID/Location	Description	MH Outlet	Maximum Minor System Capture (L/s)	100-Year Major System Overflows (L/s)
Arterial	Block 99	Arterial	209	953	N/A - Overflow to Poole Creek as per KWMSS
B-1	North of Maple Grove	Residential	J2	116	100-year On-Site Storage as per KWMSS
B-2	Maple Grove ROW	Arterial	J4	199	N/A - Overflow to Poole Creek/Carp River as per KWMSS
Comm	North of Hazeldean	Commercial	209	398.88	100-year On-Site Storage
Hazeldean	Hazeldean ROW	Arterial	209	1187	N/A - Overflow to Carp River as per KWMSS
L121B	Block 136	Commercial	121	299	100-year On-Site Storage
L123B	Block 115	Residential	123	111	480 L/s to Maize Street
L218A	Block 76	School	218	443	565 L/s to Shropshire Place
L225B	Block 89	Residential	225	389	799 L/s to Holstein Road

MAPLE GROVE ROAD
REALIGNED CARP RIVER
EXISTING CARP RIVER
INTERIM PHASING
KANATA WEST PUMP STATION EMERGENCY OVERFLOW SEE DWG POND-1 FOR DETAILS
SEDIMENT MANAGEMENT AREA
SERVICE CONNECTIONS TO BE MADE DOWNSTREAM OF STM 123
SERVICE CONNECTIONS TO BE MADE DOWNSTREAM OF STM 121
TRUNK STORM SEWERS ON PLOUGHSHARE ROAD TO BE INSTALLED DURING PHASE 1
EXTEND EX. CULVERT WITH 14.6m-500mmØ CSP CULVERT 2.0mm TH. @ 1.2%
EX. 12.0m-500mmØ CSP CULVERT @ 1.2%
PLOUGHSHARE ROAD
MAIZE STREET
HOLSTEIN ROAD
HAMPSHIRE PLACE
WHEEL BARROW MEWS
WINTER WHEAT TERRACE
CARTAGE WAY
ROGER GRIFFITHS AVENUE
SHEAF ROW
POOLE CREEK
TRANSIT CONNECTION
PARK
LIMIT OF REGISTRATION
FUTURE TRUNK SEWER BY OTHERS
REFER TO FIGURE 1.4 IN THE SERVICING AND SWM REPORT FOR A DETAILED BREAKDOWN OF THE EXTERNAL AREAS
EXT8 ARTERIAL A=7.14 ha C= 0.7 COMMERCIAL A=1.99 ha C= 0.85 Tc= 18 min. RESIDENTIAL A=21.32 ha C= 0.57 Tc= 15 min.
B-1 1.10 0.60
B-2 0.49 0.70
EXT1 0.12 0.65
C121AA 0.09 0.65
L123B 0.74 0.70
L1218 1.47 0.85
L101A-1A 0.69 0.55
STM 121A (1200Ø) T/G=97.71 SE INV=95.32
STM 124 (1500Ø) T/G=98.58 S INV=95.95 NE INV=95.87
STM 123 (1500Ø) T/G=98.19 NE INV=95.01 SW INV=95.59
STM 121 (2400Ø) T/G=97.83 NW INV=95.19 SE INV=94.38 SW INV=94.89 NE INV=94.00
STM 119 (2400Ø) T/G=97.58 NE INV=93.83 SW INV=93.83
STM 101 (3000Ø) T/G=97.40 SE INV=93.34 SW INV=93.65 NE INV=93.28
STM 100C (2400Ø) T/G=96.62 NE INV=93.11 SE INV=93.17
STM 100D (3000Ø) T/G=97.27 NW INV=93.21 SW INV=93.26 SE INV=94.04
STM 100E (2400Ø) T/G=97.12 E INV=93.86 NW INV=93.89
STM 100F 1219mm x 1219mm T/G=95.07 SW INV=91.45 S INV=91.35
STM 100 2438mm x 4270mm T/G=95.17 NE INV=93.30
STM 102 (3000Ø) T/G=97.16 SE INV=94.17 NW INV=93.42 SW INV=93.87
STM 114 (1500Ø) T/G=97.40 SE INV=94.30 NW INV=94.23
STM 115 (1800Ø) T/G=97.44 SE INV=94.79 NW INV=94.41 SW INV=94.47
STM 116 (1200Ø) T/G=97.43 NW INV=95.12
STM 117 (1500Ø) T/G=97.46 NE INV=94.71 SW INV=95.01
STM 118 (1200Ø) T/G=97.63 NE INV=95.25
STM 201 2438mm x 3810mm T/G=97.52 SW INV=91.76 NE INV=91.76 SE INV=92.59
STM 202 2438mm x 3810mm T/G=97.60 NE INV=91.88 SW INV=92.54 SE INV=92.60
STM 233 (1800Ø) T/G=97.42 NW INV=92.69 SE INV=92.70
STM 100A 3810mm x 3810mm T/G=97.00 SE INV=93.18 N INV=93.13
STM 100B 3810mm x 3810mm T/G=97.00 NW INV=93.23 SW INV=91.74 NE INV=91.73
STM 105 (1200Ø) T/G=97.96 NW INV=94.82 SE INV=94.89
STM 106 (1200Ø) T/G=97.92 NW INV=95.00
STM 107 (1800Ø) T/G=97.93 SE INV=94.68 NE INV=95.59 SW INV=94.76 NW INV=94.46
STM 108 (1200Ø) T/G=97.78 NW INV=94.77 SE INV=94.78
STM 109 (1200Ø) T/G=97.77 NW INV=95.10
STM 110 (1200Ø) T/G=98.04 NE INV=94.91 S INV=94.99
STM 111 (1200Ø) T/G=97.99 N INV=95.03 SE INV=95.06
STM 112 (1200Ø) T/G=97.95 SE INV=95.24 NW INV=95.23
STM 113 (1200Ø) T/G=98.06 NW INV=95.57
STM 126 (1200Ø) T/G=99.07 SW INV=96.62 NW INV=96.40 SE INV=96.47
STM 127 (1200Ø) T/G=100.18 NE INV=97.73
STM 128 (1200Ø) T/G=99.17 NW INV=96.67 S INV=96.78
STM 129 (1200Ø) T/G=99.37 N INV=96.84 SW INV=96.87
STM 130 (1200Ø) T/G=100.70 NE INV=97.44 SE INV=97.51
STM 131 (1200Ø) T/G=100.63 NW INV=97.46 SE INV=97.46
STM 132 (1200Ø) T/G=100.20 NW INV=97.86 SW INV=97.86
STM 207 (3000Ø) T/G=99.33 NE INV=94.55 SW INV=94.86
STM 208 (3600Ø) T/G=98.63 NE INV=93.10 SW INV=94.25
STM 209 (3000Ø) T/G=100.11 NE INV=95.00
STM 204 (3600Ø) T/G=97.58 SW INV=92.77 NE INV=92.76
STM 205 (3600Ø) T/G=97.86 SW INV=92.93 NE INV=92.92
STM 220 (1200Ø) T/G=97.90 SE INV=95.30
STM 227 (1200Ø)
STM 230 (1200Ø)
STM 231 (1200Ø) T/G=100.36 SE INV=97.66 NW INV=97.66
STM 232 (1200Ø) T/G=100.16 SE INV=97.96
STM 104 (1800Ø) T/G=97.88 SW INV=95.38 SE INV=94.66 NE INV=94.36
STM 103 (1800Ø) T/G=97.58 NE INV=93.98 SW INV=94.21
STM 118 (1200Ø) T/G=97.63 NE INV=95.25
STM 124A 0.23 0.66
STM 123A 0.20 0.67
STM 121A 0.38 0.68
STM 119A 0.31 0.69
STM 102A 0.23 0.61
STM 126B 0.26 0.70
STM 124B 0.40 0.45
STM 103C 0.64 0.46
STM 107A 0.19 0.69
STM 110A 0.12 0.67
STM 114A 0.06 0.67
STM 126C 0.46 0.25
STM 126A 0.03 0.70
STM 104A 0.33 0.68
STM 103A 0.39 0.70
STM 103B 0.20 0.62
STM 127A 0.38 0.46
STM 128A 0.32 0.66
STM 103D 0.55 0.46
STM 112A 0.41 0.67
STM 109B 0.38 0.71
STM 105A 0.32 0.72
STM 115A 0.17 0.66
STM 130A 0.45 0.69
STM 113B 0.49 0.42
STM 113A 0.33 0.69
STM 118A 0.44 0.66
STM 117A 0.42 0.71
STM 117B 0.15 0.58
STM 130B 0.23 0.46
STM 106A 0.24 0.73
STM 109A 0.43 0.69
STM 117C 0.66 0.46
STM 106B 0.07 0.69
STM 204A 0.42 0.67
STM 202A 0.21 0.59
STM 205A 0.26 0.67
STM 204B 0.39 0.73
STM 210A 0.25 0.67
STM 205B 0.48 0.45
STM 210B 0.26 0.47
STM 209A 0.35 0.66
STM 207A 0.58 0.63
STM 206A 0.31 0.73
STM 206B 0.17 0.70
STM 209B 0.16 0.64
STM 209C 0.41 0.47
STM 220A 0.87 0.44
12.2m-525mmØ STM @ 0.40%
71.4m-600mmØ STM @ 0.40%
53.3m-675mmØ STM @ 0.25%
113.2m-1200mmØ STM @ 0.15%
115.1m-1200mmØ STM @ 0.15%
10.6m-300mmØ STM @ 1.00%
110.8m-300mmØ STM @ 1.00%
41.9m-450mmØ STM @ 0.40%
44.4m-525mmØ STM @ 0.35%
18.9m-600mmØ STM @ 0.45%
116.8m-600mmØ STM @ 0.35%
51.7m-300mmØ STM @ 0.40%
97.8m-825mmØ STM @ 0.15%
97.9m-1050mmØ STM @ 0.10%
8.7m-1050mmØ STM @ 0.10%
15.3m-1350mmØ STM @ 1.00%
15.8m-1350mmØ STM @ 2.55%
28.2m-750mmØ STM @ 0.20%
87.8m-1800mm X 1500mm STM @ 0.30%
22.4m-300mmØ STM @ 2.90%
16.1m-300mmØ STM @ 3.40%
13.5m-1050mmØ STM @ 0.18%
26.4m-1050mmØ STM @ 0.16%
15.7m-1500mmØ STM @ 0.15%
18.1m-1200mmØ STM @ 1.19%
9.5m-300mmØ STM @ 0.50%
12.9m-300mmØ STM @ 0.50%
113.9m-375mmØ STM @ 0.50%
12.3m-375mmØ STM @ 0.50%
26.8m-375mmØ STM @ 0.25%
94.9m-675mmØ STM @ 0.20%
11.0m-675mmØ STM @ 0.20%
15.7m-300mmØ STM @ 0.50%
STM STUB
99.2m-1650mmØ STM @ 0.30%
110.0m-2100mmØ STM @ 0.30%
99.9m-2100mmØ STM @ 0.15%
175.0m-2400mm X 1800mm STM @ 0.15%
26.3m-2400mm X 1500mm STM @ 0.11%
49.8m-2400mm X 1500mm STM @ 0.10%
15.0m-2400mm X 1800mm STM @ 0.15%
18.2m-2400mm X 1800mm STM @ 0.10%
26.6m-975mmØ STM @ 0.40%
HW1 SW INV=91.70
HW2 SW INV=93.08
HW3 S INV=93.10
HW4 W INV=93.46
HW5 SW INV=91.45
HW6 SW INV=93.26
HW7 E INV=93.66
HW8 W INV=93.45
HW9 SW INV=93.44
HW10 W INV=93.42
HW11 W INV=93.42
HW12 W INV=93.42
HW13 W INV=93.42
HW14 W INV=93.42
HW15 W INV=93.42
HW16 W INV=93.42
HW17 W INV=93.42
HW18 W INV=93.42
HW19 W INV=93.42
HW20 W INV=93.42
HW21 W INV=93.42
HW22 W INV=93.42


LOCATION PLAN
N.T.S.
SA-2
MAPLE GROVE ROAD
EX. SAN 0E (1200Ø)
T/G=97.10
NE INV=90.85
EX. SAN 1E (1200Ø)
T/G=95.80
NE INV=90.51
SW INV=90.51
EX. SAN 2E (1200Ø)
T/G=95.60
INV=89.08
SW INV=90.48
EX. SAN 4E (1200Ø)
T/G=95.49
NE INV=88.29
SW INV=88.35
EX. SAN 5E (1200Ø)
T/G=96.20
NE INV=88.15
SW INV=88.21
EX. SAN 6E (1200Ø)
T/G=96.60
NE INV=87.94
SW INV=88.00
EX. SAN 7E (1200Ø)
T/G=95.30
SE INV=87.00
SW INV=87.76
EX. 6.8m-825mmØ SAN @ 0.36%
EX. 64.9m-825mmØ SAN @ 0.53%
EX. 19.6m-825mmØ SAN @ 0.42%
EX. 5.1m-1200mmØ SAN @ 0.58%
EX. 42.3m-1200mmØ SAN @ 0.53%
EX. 72.0m-1200mmØ SAN @ 0.07%
EX. 21.9m-1200mmØ SAN @ 0.20%
EX. 4.8m-450mmØ SAN @ 1.00%
FUT. 76.7m-900mmØ SAN @ 0.16% (BY OTHERS)
FUT. 108.8m-900mmØ SAN @ 0.16% (BY OTHERS)
FUT. 59.4m-900mmØ SAN @ 0.16% (BY OTHERS)
FUT. 50.6m-900mmØ SAN @ 0.16% (BY OTHERS)
FUT. SAN 126E (1200Ø) (BY OTHERS) T/G=98.55 NE INV=89.20 S INV=89.22
FUT. SAN 127E (1200Ø) (BY OTHERS) T/G=97.50 NE INV=89.06 SW INV=89.08
FUT. SAN 125E (1200Ø) (BY OTHERS) T/G=99.10 N INV=89.32 SE INV=89.34
FUT. SAN 124E (1200Ø) (BY OTHERS) T/G=98.82 NW INV=89.42 SE INV=89.44
FUT. SAN 123E (1200Ø) (BY OTHERS) T/G=98.90 NW INV=89.63 SE INV=91.94
FUT. SAN 122E (1200Ø) (BY OTHERS) T/G=98.70 NW INV=92.07 SE INV=92.10
FUT. SAN 121E (1200Ø) (BY OTHERS) T/G=98.30 NW INV=92.23 SE INV=92.24
FUT. 124.4m-900mmØ SAN @ 0.16% (BY OTHERS)
FUT. 49.6m-900mmØ SAN @ 0.24% (BY OTHERS)
FUT. 52.2m-900mmØ SAN @ 0.24% (BY OTHERS)
FUT. 53.7m-900mmØ SAN @ 0.24% (BY OTHERS)
FUT. 122.4m-900mmØ SAN @ 0.24% (BY OTHERS)
REMOVE EXISTING SANITARY PLUG AND CONNECT TO EXISTING
SAN STUB INV=88.40
SAN 2 (1200Ø) T/G=97.45 NW INV=88.89 SE INV=90.78
42.9m-450mmØ SAN TRUNK @ 1.00%
71.0m-375mmØ SAN TRUNK @ 0.16%
SAN 3 (1200Ø) T/G=97.89 NW INV=90.87 SW INV=93.78 SE INV=90.88 NE INV=92.07 NE INV=94.15
4.9m-200mmØ LOCAL SAN @ 0.35%
SAN 3A (1200Ø) T/G=97.75 SW INV=94.16 NE INV=94.17
SAN 3B (1200Ø) T/G=97.66 SW INV=94.54 NE INV=94.55
SAN 14 (1200Ø) T/G=97.61 SW INV=92.42 NE INV=92.43
SAN 3C (1200Ø) T/G=97.53 SW INV=94.83
SERVICE CONNECTIONS TO BE MADE DOWNSTREAM OF SAN 14
SERVICE CONNECTIONS TO BE MADE DOWNSTREAM OF SAN 4
SAN 4 (1200Ø) T/G=98.19 NE INV=94.04 SW INV=95.03
OVERFLOW AS PROPOSED BY KWPS DESIGN TO REMAIN ACTIVE UNTIL REALIGNED OVERFLOW HAS BEEN CONSTRUCTED
REALIGNED KANATA WEST PUMP STATION EMERGENCY OVERFLOW. TRAPEZOIDAL CHANNEL 2.4m WIDE BOTTOM WITH 5:1 SIDE SLOPES AND VARYING HEIGHT TO MATCH EXISTING KWPS GRADES/PROPOSED POND 5 GRADES.
KANATA WEST PUMP STATION
KANATA WEST PUMP STATION BY OTHERS
EXISTING CARP RIVER
POOLE CREEK
MAIZE STREET
PLOUGHSHARE ROAD
HAMPSHIRE PLACE
WHEAT BARROW MEWS
WINTER WHEAT TERRACE
CARTAGE WAY
HOLSTEIN ROAD
SHEAF ROW
CROOKED WINDMILL AVENUE
MARKET CRESCENT
MEDIUM DENSITY RESIDENTIAL
COMMERCIAL
ROAD WIDENING
LIMIT OF REGISTRATION
R2A 0.14 0
R3A 0.16 0
R4B 0.74 76
C14B 1.47 N/A
R5A 0.25 16
R6A 0.03 0
R4A 0.20 14
R3CA 0.45 27
R22A 0.16 0
R38A 0.50 38
R7A 0.45 32
R24A 0.15 8
R23A 0.19 14
R27A 0.20 14
R27B 0.65 59
R18AA 0.58 49
R17A 0.08 0
R17BA 0.33 22
R19A 0.11 5
R20A 0.23 14
R22AA 0.02 0
R9A 0.19 16
R25A 0.32 30
R22BA 0.71 95
R26A 0.50 57
R10A 0.22 11
R11A 0.58 65
R12A 0.16 3
R30A 0.42 46
R32A 0.82 73
R31A 0.57 46
R33A 0.41 43
R13A 0.28 14
R36A 0.63 57
R8A 0.42 38
G7A 0.49 0
R21A 0.31 19
R66A 0.13 3
R54BA 0.60 59
R54AA 0.54 51
R65A 0.21 11
R51A 0.18 11
R37A 0.78 73
R38A 0.08 5
R50A 0.19 14
R54DA 0.40 57
R54FA 0.39 27
R39BA 0.49 35
SAN 5 (1200Ø) T/G=98.63 NE INV=95.39 S INV=95.42
SAN 6 (1200Ø) T/G=98.67 SE INV=95.51 N INV=95.48
SAN 7 (1200Ø) T/G=99.11 SE INV=95.99 NW INV=95.97 SW INV=96.03
SAN 7A (1200Ø) T/G=99.00 NE INV=95.90
SAN 8 (1200Ø) T/G=100.21 NE INV=97.14
SAN 9 (1200Ø) T/G=99.23 NW INV=96.18 S INV=96.21
SAN 10 (1200Ø) T/G=99.45 N INV=96.28 SW INV=96.31
SAN 11 (1200Ø) T/G=100.75 NE INV=96.87 SE INV=96.93
SAN 12 (1200Ø) T/G=100.60 NW INV=97.02 SE INV=97.04
SAN 13 (1200Ø) T/G=100.23 NW INV=97.29
SAN 22 (1200Ø) T/G=97.96 NW INV=90.99 SE INV=90.99 SW INV=94.18 NE INV=93.72 SE INV=94.26
SAN 23 (1200Ø) T/G=98.10 NE INV=94.36 S INV=94.39
SAN 24 (1200Ø) T/G=98.05 N INV=94.44 SE INV=94.42
SAN 22A (1200Ø) T/G=97.83 NW INV=94.33 SE INV=94.34
SAN 25 (1200Ø) T/G=98.00 SE INV=94.65 NW INV=94.63
SAN 26 (1200Ø) T/G=98.10 NW INV=94.92
SAN 27 (1200Ø) T/G=97.92 SW INV=93.92 SE INV=93.98 NE INV=93.84
SAN 28 (1200Ø) T/G=97.81 NW INV=94.82
SAN 30 (1200Ø) T/G=98.01 NW INV=94.30 SE INV=94.31
SAN 31 (1200Ø) T/G=97.52 NE INV=94.45 SW INV=94.47
SAN 32 (1200Ø) T/G=97.68 NE INV=94.85
SAN 33 (1200Ø) T/G=97.61 NW INV=94.57
SAN 35 (1200Ø) T/G=97.99 SW INV=91.20 SE INV=95.25 NW INV=95.26
SAN 35A (1200Ø) T/G=97.94 NW INV=91.11 SE INV=91.11
SAN 36 (1200Ø) T/G=98.67 NE INV=95.69 SW INV=95.96
SAN 37 (1200Ø) T/G=99.34 NE INV=96.36 SW INV=96.48
SAN 38 (1200Ø) T/G=99.50 NE INV=96.56
SAN 39 (1200Ø) T/G=100.00 NW INV=97.00
SAN 39A (1200Ø) T/G=100.41 NW INV=96.99 SW INV=97.01
SAN 39B (1200Ø) T/G=97.94 SE INV=97.68
SAN 40 (1200Ø) T/G=100.41
SAN 48 (1200Ø) T/G=97.69 NE INV=94.23 SW INV=94.25
SAN 54C (1200Ø) T/G=97.66 NE INV=94.51 SW INV=94.53
SAN 54B (1200Ø) T/G=97.69 NE INV=94.60 SW INV=94.63
SAN 54A (1200Ø) T/G=97.67 SE INV=93.96 SW INV=93.99
SAN 54 (1200Ø) T/G=97.64 SE INV=91.69 NE INV=94.60 SW INV=94.63 SE INV=94.73 NW INV=93.95
SAN 16 (1200Ø) T/G=97.35 SW INV=92.78 E INV=92.82
SAN 17 (1200Ø) T/G=97.29 W INV=92.85 SE INV=92.88 E INV=94.30
SAN 17A (1200Ø) T/G=97.32 W INV=94.31 SE INV=94.34
SAN 17B (1200Ø) T/G=97.37 NW INV=94.67
SAN 18 (1200Ø) T/G=97.17 NW INV=93.11 SE INV=93.19 SW INV=93.17
SAN 19 (1200Ø) T/G=97.43 NW INV=93.27 SE INV=93.28
SAN 188 (1200Ø) T/G=97.09 NE INV=93.19 SW INV=93.20
SAN 20 (1200Ø) T/G=97.50 NW INV=93.47 SE INV=93.48 SW INV=94.00
SAN 20A (1200Ø) T/G=97.38 NE INV=94.03 SW INV=94.06
SAN 21 (1200Ø) T/G=97.48 NW INV=93.68 SE INV=93.82
SAN 54E (1200Ø) T/G=97.54 NW INV=94.75 SE INV=94.76
SAN 66 (1200Ø) T/G=97.47 NW INV=93.98 SE INV=93.99
SAN 1 (1200Ø) T/G=97.10 NE INV=89.85
SAN 10 (1200Ø) T/G=99.45 N INV=96.28 SW INV=96.31
SAN 12 (1200Ø) T/G=100.60 NW INV=97.02 SE INV=97.04
SAN 13 (1200Ø) T/G=100.23 NW INV=97.29
SAN 31 (1200Ø) T/G=100.21 SE INV=97.04
SAN 38 (1200Ø) T/G=99.50 NE INV=96.56
SAN 39 (1200Ø) T/G=100.00 NW INV=97.00
SAN 39A (1200Ø) T/G=100.41 NW INV=96.99 SW INV=97.01
SAN 39B (1200Ø) T/G=97.94 SE INV=97.68
SAN 40 (1200Ø) T/G=100.41
SAN 50 (1200Ø) T/G=100.41 NW INV=97.01
SAN 49 (1200Ø) T/G=100.41
SAN 54D (1200Ø) T/G=97.61 NE INV=94.90
SAN 52 (1200Ø) T/G=97.61 NE INV=91.41 SW INV=91.41
SAN 53 (1200Ø) T/G=97.65 NE INV=91.53 SW INV=91.52
SAN 54E (1200Ø) T/G=97.54 NW INV=94.75 SE INV=94.76
12.1m-200mmØ SAN @ 0.50%
71.2m-200mmØ SAN @ 0.50%
51.6m-200mmØ SAN @ 0.50%
103.3m-200mmØ LOCAL SAN @ 0.35%
80.8m-200mmØ LOCAL SAN @ 0.35%
109.5m-200mmØ SAN TRUNK @ 0.32%
109.6m-200mmØ SAN TRUNK @ 0.32%
12.1m-200mmØ LOCAL SAN @ 0.35%
9.6m-200mmØ SAN TRUNK @ 0.32%
92.3m-200mmØ SAN @ 0.50%
11.0m-150mmØ SAN @ 1.00%
11.4m-200mmØ SAN @ 0.40%
44.3m-200mmØ SAN @ 0.40%
51.7m-200mmØ SAN @ 0.40%
96.4m-200mmØ SAN @ 0.32%
101.4m-200mmØ LOCAL SAN @ 0.32%
24.5m-200mmØ SAN @ 0.32%
110.7m-200mmØ SAN @ 1.00%
41.9m-200mmØ SAN @ 0.40%
15.9m-200mmØ SAN @ 0.40%
15.3m-200mmØ SAN @ 0.50%
112.4m-200mmØ SAN @ 0.50%
8.1m-200mmØ SAN @ 0.50%
4.3m-200mmØ SAN @ 0.32%
8.7m-200mmØ SAN @ 0.40%
96.8m-200mmØ SAN @ 0.40%
97.9m-200mmØ LOCAL SAN @ 0.40%
13.6m-200mmØ SAN @ 0.32%
99.3m-200mmØ SAN @ 0.40%
110.3m-200mmØ SAN @ 0.40%
12.6m-200mmØ SAN @ 0.65%
38.9m-200mmØ SAN @ 0.40%
76.0m-200mmØ LOCAL SAN @ 0.35%
70.2m-200mmØ LOCAL SAN @ 0.35%
76.0m-375mmØ SAN TRUNK @ 0.14%
70.7m-375mmØ SAN TRUNK @ 0.14%
9.9m-200mmØ SAN TRUNK @ 0.32%
50.9m-200mmØ SAN @ 0.32%
27.3m-200mmØ SAN @ 1.00%
200mmØ LOCAL SAN @ 0.40%
200mmØ SAN TRUNK @ 0.40%
200mmØ SAN TRUNK @ 0.40%
200mmØ SAN TRUNK

F.2 Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum, Stantec, September 30, 2025

Stantec Consulting Ltd.
300-1331 Clyde Avenue, Ottawa ON K2C 3G4

September 30, 2025
File: 160401393

Attention: Ms. Rubina Rasool
City of Ottawa
Development Review – East Branch
110 Laurier Avenue West
Ottawa, ON K1P 1J1

Dear Ms. Rasool,

Reference: Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum

This Servicing and Stormwater Management (SWM) letter report addendum has been prepared to reflect draft plan changes to the approved second registration phase of the Richcraft Kanata West Development. Specifically, a new public right-of-way has been added in the south-western corner of the site (north and east of Holstein Road) by reducing the size of the medium density residential block (Block 60). Additionally, lot configuration for a few townhouses along Winter Wheat Terrace and Tillage Street has been modified. Results from the revised water hydraulic analysis for ultimate development conditions, sanitary sewer design sheet and sanitary hydraulic grade line (HGL) analysis, as well as the revised storm sewer design sheet and stormwater management (SWM) dual drainage PCSWMM model are summarized in this letter report, and reflected on the revised engineering drawings included in **Appendix E**.

This letter report should be read in conjunction with the approved "*Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report*" prepared by Stantec on May 10, 2022, and a subsequent letter report addendum dated December 21, 2023.

POTABLE WATER

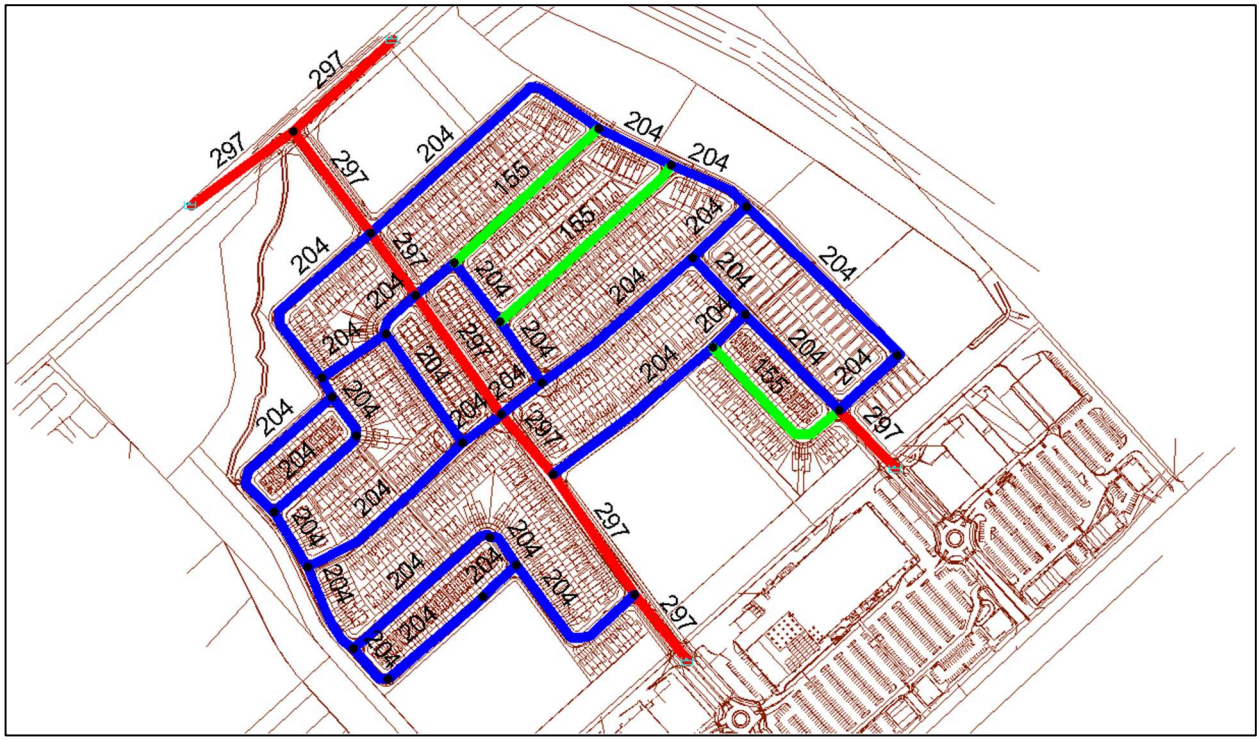
A detailed potable water servicing analysis has been completed and is included in **Appendix A.** The analysis was created to assess the proposed potable water distribution network in the ultimate development conditions of the Richcraft Kanata West Development, since it is the only scenario impacted by the proposed draft plan change. The models include both the approved First Registration Phase of the Richcraft KW Development as well as the proposed phase under ultimate development conditions.

Please refer to the "*Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report" and "Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum"* prepared by Stantec on May 10, 2022 and Dec 21, 2023 respectively, for background information and further details and results on the hydraulic analysis scenarios for all construction phases of the development.

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

For the purpose of modelling the proposed watermain network, the specific connection points provided in the boundary conditions by the City were used in the analysis as shown in **Figure 1**.

Figure 1: Ultimate Development Potable Water Distribution Network



Proposed ground elevations of the site vary from approximately 100.8 m to 97.2 m. Boundary conditions for the ultimate condition scenario were obtained from the City of Ottawa as included in **Appendix A** and summarized in **Table 1**.

Table 1: Ultimate Condition Hydraulic Analysis Boundary Conditions

Connection	Maximum HGL (m)	Peak Hour HGL (m)	Max. Day plus Fire HGL (m) 167 L/s (10,000 L/min)	Max. Day plus Fire HGL (m) 250 L/s (15,000 L/min)	Max. Day plus Fire HGL (m) 267 L/s (16,000 L/min)	Max. Day plus Fire HGL (m) 283 L/s (17,000 L/min)	Ground Elevation (m)
Maple Grove Road East (Connection #1)	162.1	157.7	154.7	151.7	151.1	150.5	96.88

Connection	Maximum HGL (m)	Peak Hour HGL (m)	Max. Day plus Fire HGL (m) 167 L/s (10,000 L/min)	Max. Day plus Fire HGL (m) 250 L/s (15,000 L/min)	Max. Day plus Fire HGL (m) 267 L/s (16,000 L/min)	Max. Day plus Fire HGL (m) 283 L/s (17,000 L/min)	Ground Elevation (m)
Maple Grove Road West (Connection #2)	161.0	157.4	153.9	143.2	141.1	138.9	100.90
Hazeldean and Kincardine Dr. (Connection#3)	161.5	157.9	158.8	158.2	158.0	157.9	97.49
Hazeldean Road (Connection #4)	161.4	158.0	158.7	158.1	157.9	157.8	99.90

1. Boundary conditions for Max. Day plus Fire flow of 267 L/s and 250 L/s were interpolated between the values obtained from the City for 167 L/s and 283 L/s

WATER DEMANDS

Water demands for the entire KW Development for each phase of construction were estimated using the City of Ottawa Water Distribution Design Guidelines. A daily rate of 28,000 L/ha/d was used for the proposed school and the commercial block. The population for the medium density residential block MD1 (Block 29) within the approved First Registration Phase was estimated based on a density of 38 units/ha and 2.7 persons per unit. The medium density residential block MD2 (Previous Block 75, now Block 60) within the Second Registration Phase was based on the concept site plan prepared by M. David Blakely Architect Inc. in February 2020 (see **Appendix C.3**), which results in a unit density of 93 unit/ha. The unit count for the medium density residential block MD3 (Block 117) located at the south-eastern corner of the site has been estimated based on a unit density of 93 units/ha and 2.7 persons per unit. See **Appendix A** for detailed domestic water demand estimates.

In the ultimate development condition, the average day demand (AVDY) was determined to be 13.2 L/s. The maximum day demand (MXDY) was determined to be 31.6 L/s, which was calculated as 1.5 times the AVDY for school and commercial blocks and 2.5 times the AVDY for all other residential areas. The peak hour demand (PKHR) totaled 68.7 L/s and was calculated as 1.8 times the MXDY for school and commercial blocks, and 2.2 times the MXDY for all other residential areas.

The calculated residential, institutional and commercial water consumption for the ultimate development scenario is shown in **Table 2** and **Table 3**.

Table 2: Ultimate Development Residential Water Demands

Unit Type	Units	Area (ha)	Person/Unit	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Singles	45	-	3.4	153	0.62	1.55	3.41
Townhomes (Including both B2B and Row townhouses)	646	-	2.7	1745	7.07	17.66	38.86
MD1 (Block 29)	28	0.74	2.7	76	0.31	0.77	1.68
MD2 (Block 60)	224	2.42	2.7	605	2.45	6.13	13.48
MD3 (Block 117)	122	1.32	2.7	330	1.33	3.34	7.34
Total	**1,065**	**-**	**-**	**2909**	**11.8**	**29.5**	**64.8**

Table 3: Ultimate Development Institutional and Commercial Water Demands

	Area (ha)	Demand (L/day)	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Commercial	1.47	28,000	0.48	0.71	1.29
School	2.95	28,000	0.98	1.47	2.65

Fire Flow Requirements

The fire flow requirement for residential properties is capped at 10,000 L/min (167 L/s) as per the City of Ottawa Technical Bulletin ISDTB-2014-02 (May 2014) provided that firewalls with a minimum two-hour fire-resistance rating that comply with OBC Div. B, Subsection 3.1.10, are constructed to separate townhouse blocks to the lesser of seven dwelling units and 600 m^2 of building area, and that a minimum 10 m separation exists between rear yards. For the purposes of this analysis, required fire flows for private residential development blocks, as well as for the majority of proposed townhome blocks and single-family dwellings were assumed at the cap of 10,000 L/min (167 L/s). As part of the approved Servicing and SWM Report for the Second Registration Phase (Stantec, May 2022), a maximum worst-case fire flow of 16,000 L/min (267 L/s) was estimated using FUS calculations (see detailed calculations in **Appendix A.3**) for back-to-back units, and 15,000 L/min (250 L/s) for townhome blocks that did not meet the 10 m separation between backs/sides of adjacent units. Please refer to the approved Second Registration Phase Servicing and SWM Report for hydrant spacing analysis and firewall configuration requirements.

Note that in previous submissions from the First Registration Phase, the worst-case fire flow for a 10-unit back-to-back townhome block was established to be 283 L/s (based on wood frame back-to-back townhome blocks designed without firewalls). Given that the 10-unit back-to-back townhome blocks were eventually designed with firewalls, the worst-case fire flow of 283 L/s no longer applies. The worst-case fire flow demand scenario has now been replaced with a fire flow of 267 L/s based on an 8-unit back-to-back townhome block and a 10-unit back-to-back townhome block with more exposure distance from the adjacent building which are designed without firewalls.

HYDRAULIC MODEL

Level of Service

The City of Ottawa Water Distribution Design Guidelines state that the desired range of system pressures under normal demand conditions (i.e., basic day, maximum day and peak hour) should be in the range of 350 to 480 kPa (50 to 70 psi) and no less than 275 kPa (40 psi) at the ground elevation on the streets (i.e., at hydrant level). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way is 552 kPa (80 psi). As per the Ontario Building Code (OBC) & Guide for Plumbing, if pressures greater than 552 kPa (80 psi) are anticipated, pressure relief measures are required. The maximum pressure at any point in the distribution system in unoccupied areas shall not exceed 689 kPa (100 psi). Under emergency fire flow conditions, the minimum pressure objective in the distribution system is 138 kPa (20 psi).

Model Development

The hydraulic model used to simulate the approved First Registration Phase of the Richcraft KW Development which included the proposed Second Registration Phase distribution system has been modified to represent the ultimate development conditions based on the revised draft plan. Hazen-William's coefficients ("C-Factors") were applied to the new watermain in accordance with the City of Ottawa's Water Distribution Design Guidelines (Table 4).

Table 4: Proposed Watermain C-Factors

Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120
> 600	130

HYDRAULIC MODEL RESULTS

A hydraulic model was created to simulate the ultimate development condition based on boundary conditions provided by the City of Ottawa. The hydraulic analysis was completed with H2OMAP Water Software and assessed the internal network and connections to the surrounding infrastructure. The model was tested under peak hour, average day, and maximum day plus fire flow conditions.

In the ultimate development condition, the maximum pressure modeled was approximately 92.8 psi (640 kPa) and the minimum pressure during the peak hour scenario was approximately 80.5 psi (596kPa) as shown in **Figure 2** and **Figure** 3 respectively. These pressures are above the serviceable limit of 50 to 80 psi (345 to 552 kPa) and therefore all units will require pressure reducing valves.

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Figure 2: AVDY Pressure Results for Ultimate Condition Scenario (psi)

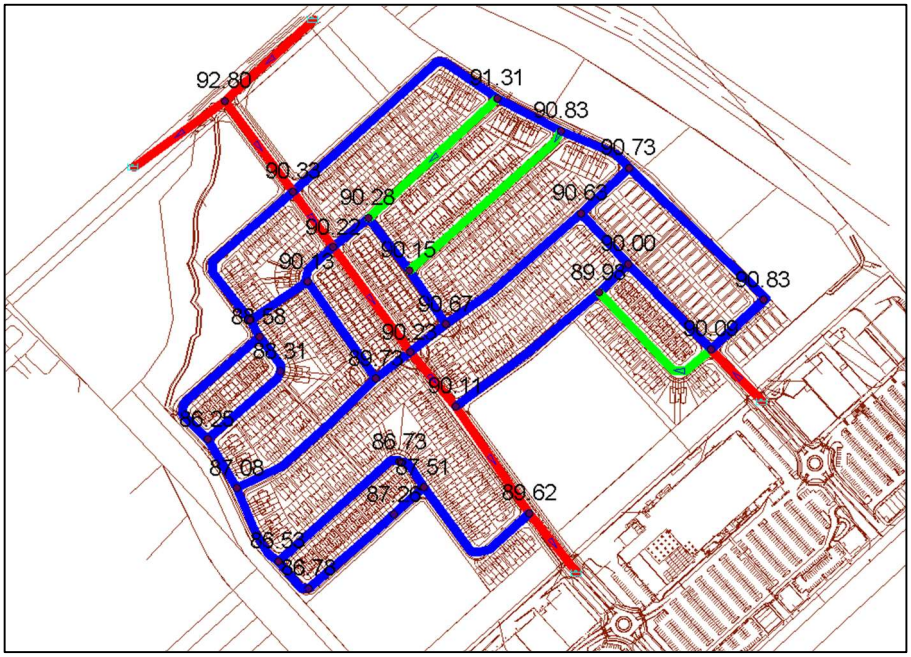
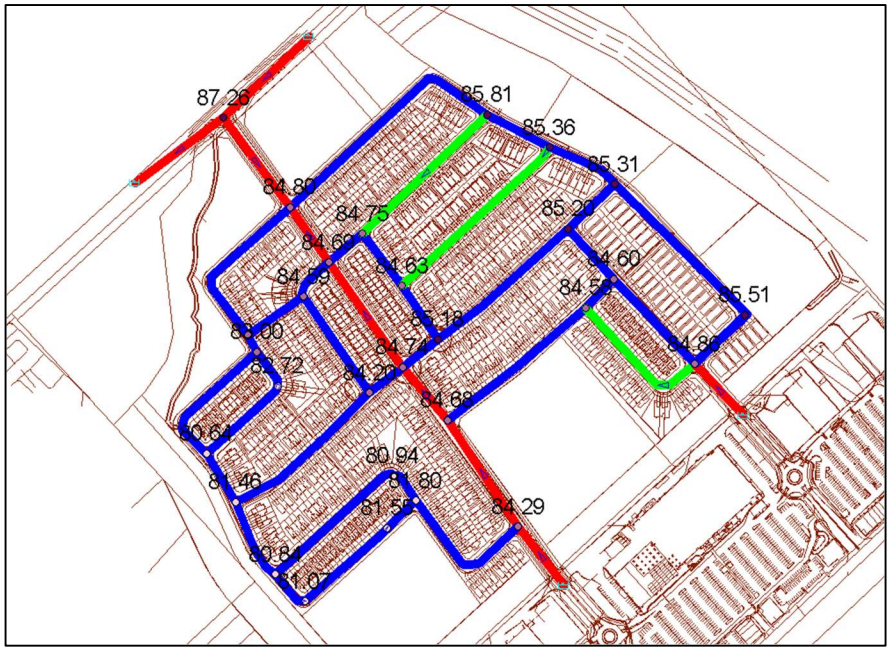


Figure 3: PKHR Pressure Results for Ultimate Condition Scenario (psi)

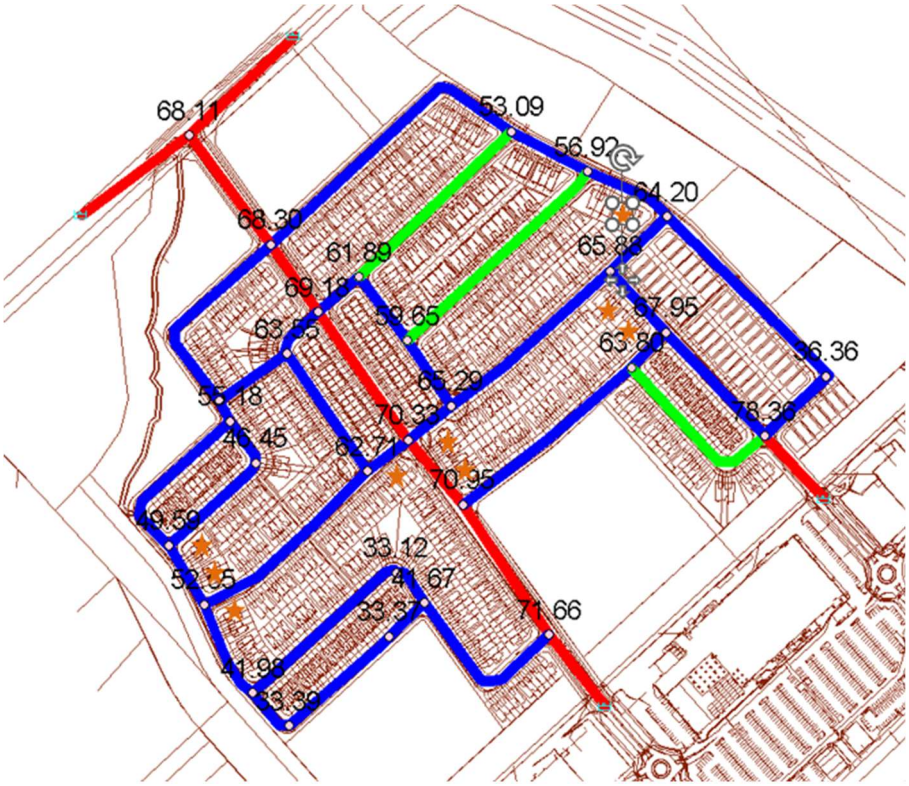


Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

A fire flow analysis was carried out in the hydraulic model to determine the anticipated amount of flow that could be provided for the proposed development under maximum day demands and a fire flow requirement of 267 L/s as per the worst-case for back to back units that do not meet the technical bulletin's 10,000 L/min fire flow cap conditions based on rear yard to side yard separation. Given that all nodes within the ultimate construction phase had residual pressures above 20 psi when modeling the fire flows of 267 L/s, an additional hydraulic model was not needed to represent lower fire flows.

Results of the ultimate condition modeling analysis indicate that flows in excess of 16,000 L/min (267 L/s) can be delivered for all proposed units while still maintaining a residual pressure of 140 kPa (20 psi). The residual pressures for the fire flow analysis are shown in Figure 4. Results of the hydraulic modeling are included for reference in **Appendix A**.

Figure 4: MXDY + 267 L/s Fire Flow Results for Ultimate Condition Scenario (Residual Pressure (psi))



★ Represent the Blocks that do not meet a rear yard to side yard separation of 10m.

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

STORM DRAINAGE

The following sections describe the stormwater management (SWM) design for the Richcraft Kanata West Development in the context of the approved background documents and governing criteria, revised to reflect the proposed draft plan changes.

PROPOSED DRAINAGE CONDITIONS

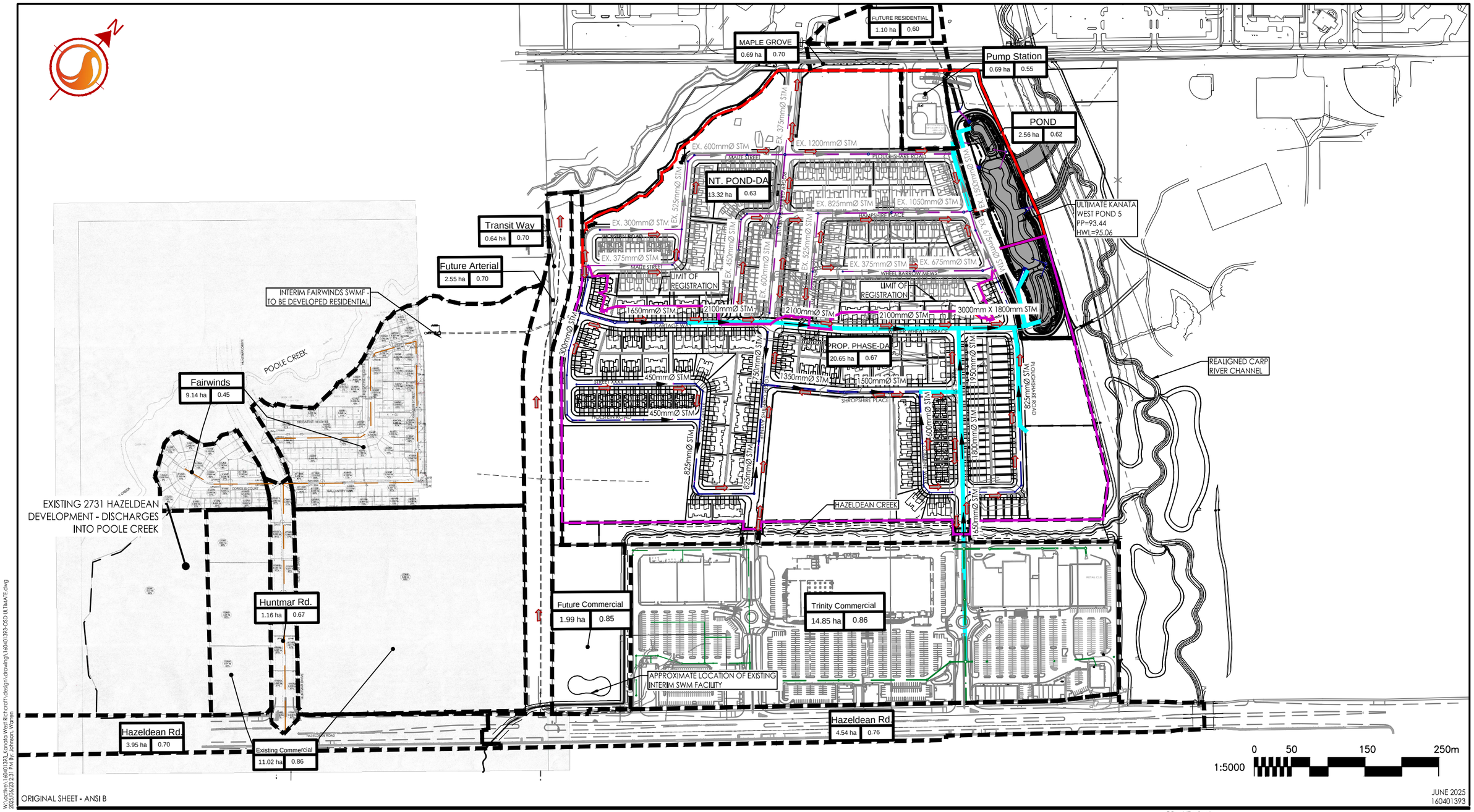
The Second Registration Phase of the KW Development comprises approximately 20.7 ha of land and consists of a mixture of single homes, townhomes and back-to-back units, a park, a school block, and two medium density residential blocks. The school block and medium density residential private blocks will be developed as separate site plan applications.

The ultimate KW SWM Pond 5, as well as the storm trunk sewer along Cartage Way and Winter Wheat Terrace have been constructed to service the Mattamy Fairwinds Subdivision to the south. SWM Pond 5 was designed to provide quantity control and 'Normal' level of quality control of stormwater runoff which corresponds to 70% Total Suspended Solids (TSS) removal prior to discharging into the Carp River. Please refer to the *Ultimate Kanata West Pond 5 Design Brief* (Stantec, May 2022) for details on SWM Pond 5 design. The approved SWM model for the Kanata West Subdivision was subsequently revised to reflect changes to the draft plan within the south-eastern corner of the site which replaced part of the subdivision with a medium density residential private block (Block 117). **Figure 5** shows the overall drainage area to the ultimate SWM Pond 5.

The overall approach for storm servicing and stormwater management for the Richcraft Kanata West Development was initially outlined in the Kanata West Master Servicing Study (KWMSS) prepared by Stantec in 2006. In accordance with this document, the approved SWM plan for the Richcraft Kanata West Development consisted of inlet control devices designed at road low points to restrict inflow rates to the storm sewers and to provide attenuating surface storage. The major overland system comprising of swales, roadway sags, streets, etc. was designed to handle peak flows beyond the storm sewer capacity up to the 100-year storm and to be directed to the ultimate KW Pond 5.

The SWM approach in this letter report consists of sizing inlet control devices (ICDs) for the proposed catchbasins to meet City of Ottawa guidelines, and establishing minor and major system target peak flows for the proposed medium density residential blocks (Blocks 60 and 117), school block (Block 120), and park block (Block 116) in order to restrict peak flows to the previously approved minor and major system peak flows. Please refer to **Drawings SD-1** and **SD-2** for drainage areas, storm sewer information and ICD schedule.

Figure 5: Overall Drainage Areas to ultimate Kanata West Pond 5



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Stantec

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Legend

- ULTIMATE KW SWM POND 5 DRAINAGE AREA BOUNDARY
- EXISTING INTERIM KW POND 5 DRAINAGE AREA (APPROVED FIRST REGISTRATION PHASE)
- PROPOSED SECOND REGISTRATION PHASE OF RICHCRAFT KANATA WEST DEVELOPMENT DRAINAGE AREA BOUNDARY
- Catchment 1 / 4.00 ha / 0.99 — SITE ID / AREA (HA) / RUNOFF COEFFICIENT
- PROPOSED STORM SEWER
- EXISTING STORM SEWER (TRINITY COMMERCIAL)
- EXISTING STORM SEWER (FAIRWINDS)
- EXISTING STORM SEWER (KANATA WEST)
- EXTENT OF SUBMERGED SEWERS
- DIRECTION OF OVERLAND FLOW

Client/Project
RICHCRAFT HOMES
ULTIMATE KANATA WEST POND 5

Figure No.
5

Title
OVERALL DRAINAGE AREAS TO ULTIMATE KW POND 5

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

STORMWATER BACKGROUND AND DESIGN CRITERIA

The approved SWM criteria for the Richcraft Kanata West Development was established in the "*Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report"* prepared by Stantec on May 10, 2022, and is summarized below.

- Width parameter: Twice the street length to be used for arterial roadways, and 225 m/ha to be used for residential and mixed-use developments where no street layout is available.
- Major system storage: major system storage of 40 m^3/ha and 50 m^3/ha was assumed for arterial roads and residential/non-residential lands, respectively.
- The capture rates for arterial roadways to be equal to the 10-year storm design.
- All sewer hydraulic analysis is to use a static boundary condition equal to the MVC 1983 flood limit of 94.60 m.
- The Carp River Watershed/Subwatershed Study (Robinson Consultants, November 2004) proposed target infiltration rates of 104 mm/year and 73 mm/year for areas of moderate and low recharge respectively within the KW Community. Post development infiltration rates are to be increased by 25% above the pre-development rate. This rate of infiltration was established to compensate for those areas (i.e., roadway corridors) that can not provide infiltration. The Richcraft Kanata West subdivision is identified as having an estimated infiltration rate between 50-70 mm/yr.
- Use of the dual drainage principle.
- Size storm sewers to fully capture 2-year storm event under free-flow conditions (i.e., no ponding during 2-year storm event) using 2012 City of Ottawa Sewer Design Guidelines I-D-F parameters for local streets, the 5-year storm event for collector streets, and the 10-year storm event for arterial roads.
- Assess impact of 2-year storm, 5-year storm, the worst case 100-year storm event, and the climate change scenario (worst case 100-year storm event with a 20% increase of rainfall intensity) on the major & minor drainage systems.
- Separation of at least 0.3 m between the 100-year hydraulic grade line (HGL) and building under side of footing (USF) must be provided.
- Maximum 'climate change' HGL to be lower than proposed basement elevations.
- No rear-yard ponding volumes to be accounted for in SWM model preparation. However, the effect of flow routing can be accounted for by assuming a constant slope ditch/swale draining to the street with a minimum slope of 1.5% and a minimum depth of 150 mm. The maximum allowable depth of a swale /ditch shall be 600 mm. The maximum side slopes of swales/ditches shall be 3 horizontal to 1 vertical.
- Depth of flow may extend adjacent to the right-of-way provided that the water level does not touch any part of the building envelope and remains below the lowest building opening during the stress test event (100-year increased by 20%).
- Total maximum depth of flow under static and dynamic conditions shall be less than 0.35 m during the 100-year event.

- There must be at least 15 cm of vertical clearance between the spill elevation on the street and the ground elevation at the building envelope that is in the proximity of the flow route or ponding area.
- There must be at least 30 cm of vertical clearance between the spill elevation on rear yard swales and the ground elevation at the building envelope that is in the proximity of the flow route or ponding area.
- Minimum swale grades at 1.5% (subgrade provided for grades < 1.5%).
- Minimum roadway profile grades at 0.5%.
- Minimum roadway slope of 0.1% from crest-to-crest for overland flow route.
- Provide adequate emergency overflow conveyance off-site.
- The SWM Model was revised in December 2023 to reflect draft plan changes to the south-easter corner of the site. Minor system target peak outflows for the medium density residential block (Block 117) were established in the 2023 SWM revision to restrict 100-year minor system peak flows in the storm sewer from MH233 to MH201 to 504 L/s as per the previously approved SWM model to minimize changes to the hydraulic grade line (HGL) across the site.
- Similarly, the December 2023 SWM Model was revised to establish on-site storage requirements for the medium density residential block (Block 117) to restrict the 100-year major system peak flow along Ploughshare Road east of the intersection with Winter Wheat Terrace to 145 L/s and thus minimize negative impacts to total flow depths downstream.

SWM DESIGN METHODOLOGY

A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure and major system segments in the ultimate development condition. The approved PCSWMM model for the Richcraft Kanata West Development was revised to reflect the proposed draft plan changes within the site. The vast majority of the model and its parameters remained as per the approved PCSWMM model. The following assumptions were applied as per the approved PCSWMM model:

- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values.
- 3-hour Chicago Storm distribution for the 2-year, 5-year, and 10-year to determine inlet capture rates for the different catchments.
- Minor and major system response assessed for the 100-year using the 3-hour Chicago Storm Distribution and the 12-hour SCS Type II distribution with a fixed water level in the Carp River of 94.60 m.
- To 'stress test' the system, a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year storms at their specified time step.
- Assess the minor and major systems response during the July 1, 1979, historical storm with a fixed water level in the Carp River of 94.60 m.

- Percent imperviousness calculated based on actual soft and hard surfaces for representative catchments and converted to equivalent runoff coefficient using the relationship C = (Imp. x 0.7) + 0.2.
- Runoff coefficients for future medium density residential blocks (Block 60 and Block 117) of 0.80, 0.70 for the school block, and 0.85 for commercial blocks.
- Subcatchment areas are defined from high-point to high-point where sags occur, and detailed grading is available.
- Width parameter was taken as twice the length of the street/swale segment for two-sided catchments and as the length of the street/swale segment for one-sided catchments.
- Where detailed grading was not available, subcatchment areas were defined by the limits of the future development blocks with some assumed uncontrolled areas and the width of the subcatchment was defined as 225 m/ha as per the City of Ottawa Sewer Design Guidelines.
- Catchbasin inflow restricted with inlet-control devices (ICDs) as per City guidelines.
- Surface ponding in sag storage calculated based on grading plans (**Drawings PD-1** - **PD-4**).
- Different segment cross-section types defined, accounting for varying right-of-way widths with 3% cross slope, swales, and spillways.
- Minor system discharge rate from the Fairwinds Subdivision up to the 100-year storm to be restricted to 4.794 m^3/s.
- Minor system discharge rate from the Trinity Commercial Site up to the 100-year storm to be restricted to 2.118 m^3/s.
- Future school block (area L218A) to restrict minor system peak flows up to the 100-year storm to 443 L/s and to restrict 100-year overflows to Shropshire Place to 376 L/s.
- Future medium density residential blocks, areas L123B, L225B, and L235B to limit minor system peak flows up to the 100-year storm to 111 L/s, 434 L/s and 130 L/s respectively and to restrict 100-year overflows to Maize Street, Grazier Row, and Ploughshare Road to 443 L/s, 437 L/s and 350 L/s respectively.
- Commercial block, area L121B, to restrict minor system peak flows up to the 100-year storm to 299 L/s and to provide on-site storage for 100-year overflows.
- Inlet control devices (ICDs) to have a minimum orifice diameter of 83 mm.

- Inlet control devices, as represented by orifice links, use a user-specified diameter and discharge coefficient taken from manufacturer's specifications for the chosen ICD model (IPEX Tempest HF model with circular opening and floatable and odour control).

Boundary Conditions

The worst-case scenario for the second registration phase of the Richcraft Kanata West Development will occur under the ultimate development conditions once the full drainage area to the ultimate KW Pond 5 is built-out. The following table summarizes the approved ultimate KW Pond 5 water levels that drive the hydraulic grade line (HGL) elevations across the proposed development.

Table 5: Ultimate KW Pond 5 Water Levels

Boundary Condition	Storm Event	Ultimate Pond Water Level (m)
Carp Model Time Series	2yr, 12hrSCS	94.39
Carp Model Time Series	5yr, 12hrSCS	94.60
Carp Model Time Series	10yr, 12hrSCS	94.73
Carp Model Time Series	25yr, 12hrSCS	94.84
Carp Model Time Series	100yr, 12hrSCS	94.97
Fixed = 94.60 m	100yr, 3hrChicago	95.06

The detailed PCSWMM hydrology, the approved storm sewers and ICDs within the first and second registration phase, design assumptions and hydrology for external areas, and the proposed storm sewers and ICDs for the revised south-eastern corner within the second registration phase were used to assess the peak inflows and hydraulic grade line (HGL) in the overall development. The detailed design of the ultimate KW Pond 5 as depicted in the Ultimate Kanata West Pond 5 Design Brief *(*Stantec, June 2021) was included in the PCSWMM model. Static backwater elevations at the Carp River outlet corresponding to the 2-year (93.52 m), 5-year (93.73 m), and 25-year (94.02 m) water levels as obtained from the post restoration Ultimate Development Conditions Carp River model have been used as boundary conditions downstream of the ultimate condition SWM Pond for the 2-year, 5-year, and 25-year (25% sediment-filled pipe) models respectively, while a static backwater elevation of 94.60 m as per the MVC 1983 100-year flood elevation for the Carp River has been used for the 100 year, 100 year +20% and historical 1979 storm models.

SWM Modeling Parameters

Key parameters for the subject area are summarized below; an example input file is provided for the 100-year, 3hr Chicago storm which indicates all other parameters (see **Appendix B.3**). For all other input files and results of storm scenarios, please examine the electronic model files included in the digital submission. This analysis was performed using PCSWMM, which is a front-end GUI to the EPA-SWMM engine. Model files can be examined in any program which can read EPA-SWMM files version 5.1.015.

Table 6: General Subcatchment Parameters

Subcatchment Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67

Table 7 presents the individual parameters that vary for each of the proposed subcatchments. Subcatchment parameters for external areas and approved development areas are summarized in **Appendix B.3**.

Table 7: Proposed Phase Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
C205A	0.26	70.9	2.5	67.1%	0.67
C206B	0.17	68.0	3.0	71.4%	0.70
C219A	0.09	79.8	2.0	68.6%	0.68
C220A	0.41	131.8	2.0	75.7%	0.73
C222A	0.52	257.0	4.0	70.0%	0.69
C223A	0.16	59.0	3.0	72.9%	0.71
EXT2	0.07	29.0	2.0	67.1%	0.67
EXT-4	0.13	79.6	0.5	48.6%	0.54
EXT5	0.11	77.0	4.0	24.3%	0.37
EXT6	0.12	78.8	4.0	40.0%	0.48
G234C	0.97	218.1	1.0	28.6%	0.40
L116A	0.22	84.0	1.0	70.0%	0.69
L202A	0.21	76.7	2.0	55.7%	0.59
L202B	0.25	152.0	3.0	50.0%	0.55
L204A	0.42	174.7	3.0	75.7%	0.73
L204B	0.39	146.7	3.0	70.0%	0.69
L202A	0.21	76.7	2.0	55.7%	0.59
L202B	0.25	152.0	3.0	50.0%	0.55
L204A	0.42	174.7	3.0	75.7%	0.73
L204B	0.35	146.7	3.0	70.0%	0.69
L204C	0.26	168.0	3.0	38.6%	0.47
L205B	0.49	238.1	3.0	35.7%	0.45
L206A	0.31	127.2	3.0	75.7%	0.73

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
L207A	0.58	202.3	3.0	64.3%	0.65
L209A	0.35	153.4	2.0	70.0%	0.69
L209B	0.15	159.0	2.0	67.1%	0.67
L209C	0.41	200.0	3.0	38.6%	0.47
L210A	0.34	97.7	4.0	71.4%	0.70
L211A	0.40	177.2	3.0	74.3%	0.72
L212A	0.10	44.0	3.0	57.1%	0.60
L213A	0.21	75.0	2.0	70.0%	0.69
L214A	0.55	221.0	4.0	72.9%	0.71
L217A	0.40	196.0	3.0	68.6%	0.68
L218A	2.68	664.0	1.0	71.4%	0.70
L218B	0.25	166.0	3.0	35.7%	0.45
L219B	0.36	111.7	2.0	68.6%	0.68
L220A	0.87	480.0	2.5	34.3%	0.44
L225A	0.27	134.6	2.5	71.4%	0.70
L225B	1.79	402.8	2.0	85.7%	0.80
L225C	0.35	170.0	2.5	71.4%	0.70
L228A	0.48	127.3	2.5	75.7%	0.73
L229A	0.32	102.3	3.0	75.7%	0.73
L234A	0.26	78.0	5.0	68.6%	0.68
L234B	0.23	81.1	4.0	70.0%	0.69
L234D	0.37	210.0	3.0	52.9%	0.57
L235A	0.59	232.0	4.0	70.0%	0.69
L235B	0.98	221.4	2.0	85.7%	0.80
L240A	0.16	100.0	5.0	78.6%	0.75
L241A	0.19	83.0	4.0	71.4%	0.70
L241B	0.24	136.0	5.0	78.6%	0.75
POND	2.56	576.0	1.0	60.0%	0.62
UNC-1	0.06	120.0	4.0	71.4%	0.70
UNC-10	0.10	102.8	33.0	85.7%	0.80
UNC-11	0.12	119.9	33.0	85.7%	0.80
UNC-2	0.07	120.0	4.0	71.4%	0.70
UNC-3	0.07	120.0	4.0	71.4%	0.70
UNC-4	0.07	120.0	4.0	71.4%	0.70
UNC-5	0.30	177.9	3.0	85.7%	0.80
UNC-6	0.11	105.6	3.0	85.7%	0.80
UNC-7	0.16	160.0	3.0	85.7%	0.80
UNC-8	0.07	144.3	3.0	85.7%	0.80
UNC-9	0.12	117.5	3.0	85.7%	0.80

Table 8 below presents the parameters for the outlet link objects in the model, which represent the minor system capture rate for the future private blocks within the Richcraft KW Development and the future external areas.

Table 8: SWM Criteria for Future Areas

Storm Drainage Area	Block ID/Location	Description	MH Outlet	Maximum Minor System Capture (L/s)	100-Year Major System Overflows (L/s)
Arterial	Block 79 & 80	Arterial	209	953	N/A - Overflow to Poole Creek as per KWMSS
B-1	North of Maple Grove	Residential	J2	116	100-year On-Site Storage as per KWMSS
B-2	Maple Grove ROW	Arterial	J4	199	N/A - Overflow to Poole Creek/Carp River as per KWMSS
Comm	North of Hazeldean	Commercial	209	399	100-year On-Site Storage
Hazeldean	Hazeldean ROW	Arterial	209	1,187	N/A - Overflow to Carp River/Poole Creek as per KWMSS
L121B	Block 1	Commercial	121	299	100-year On-Site Storage
L123B	Block 29	Residential	123	111	443 L/s to Maize Street
L218A	Block 70	School	218	443	376 L/s to Shropshire Place
L225B	Block 75	Residential	225	434	437 L/s to Grazier Row
G234A	Block 116	Park	234	34	185 L/s to Ploughshare Road
L235B	Block 117	Med-Density-New	235	130	350 L/s to Holstein Road

1. School block area L218A to provide 671 m^3/year of infiltration.
2. Residential block area L225B to provide 490 m^3/year of infiltration.
3. Residential block area L235B to provide 268 m^3/year of infiltration.

The following section summarizes the key hydrologic and hydraulic model results for the second registration phase of the development area based on ultimate conditions. For detailed model results or inputs, please refer to the example input file in **Appendix B.3** and the electronic model files included in the digital submission.

Table 9 summarizes the revised ICD schedule.

Table 9: Second Registration Phase Inlet Control Device Results

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
C205A-IC(1)	C205A	IPEX TEMPEST HF (127mm ORIFICE)	0.31	1.65	15.8	40.4
C205A-IC(2)	C205A	IPEX TEMPEST HF (152mm ORIFICE)	0.31	1.65	22.1	57.7
C219-IC	C219A	IPEX TEMPEST HF (102mm ORIFICE)	0.46	1.52	13.3	25.1
C220A-IC(1)	C220A	IPEX TEMPEST HF (191mm ORIFICE)	0.30	1.66	33.2	90.7
C220A-IC(2)	C220A	IPEX TEMPEST HF (191mm ORIFICE)	0.30	1.66	33.2	90.7
C222A-IC(1)	C222A	IPEX TEMPEST HF (203mm ORIFICE)	0.41	1.66	45.4	102.3

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
C222A-IC(2)	C222A	IPEX TEMPEST HF (203mm ORIFICE)	0.41	1.66	45.4	102.3
C223A-IC(1)	C223A	IPEX TEMPEST HF (152mm ORIFICE)	0.38	1.58	25.1	56.4
G234C-IC	G234C	IPEX TEMPEST HF (102mm ORIFICE)	1.58	4.35	18.3	34.3
L116A-IC(1)	L116A	IPEX TEMPEST HF (95mm ORIFICE)	0.91	1.66	16.7	22.8
L116A-IC(2)	L116A	IPEX TEMPEST HF (95mm ORIFICE)	0.91	1.66	16.7	22.8
L202A-IC(1)	L202A	IPEX TEMPEST HF (83mm ORIFICE)	0.86	1.67	12.4	17.5
L202A-IC(2)	L202A	IPEX TEMPEST HF (83mm ORIFICE)	0.86	1.67	12.4	17.5
L202B-IC	L202B	IPEX TEMPEST HF (108mm ORIFICE)	1.82	2.11	30.9	33.3
L204A-IC(1)	L204A	IPEX TEMPEST HF (127mm ORIFICE)	1.20	1.63	34.2	40.2
L204A-IC(2)	L204A	IPEX TEMPEST HF (127mm ORIFICE)	1.20	1.63	34.2	40.2
L204B-IC(1)	L204B	IPEX TEMPEST HF (127mm ORIFICE)	0.73	1.63	26.2	40.2
L204B-IC(2)	L204B	IPEX TEMPEST HF (127mm ORIFICE)	0.73	1.63	26.2	40.2
L204C-IC	L204C	IPEX TEMPEST HF (108mm ORIFICE)	1.15	2.40	24.3	35.5
L205B-IC	L205B	IPEX TEMPEST HF (127mm ORIFICE)	1.32	2.26	35.9	47.4
L206A-IC(1)	L206A	IPEX TEMPEST HF (108mm ORIFICE)	1.23	1.63	25.2	29.2
L206A-IC(2)	L206A	IPEX TEMPEST HF (108mm ORIFICE)	1.23	1.63	25.2	29.2
L206B-IC(1)	C206B	IPEX TEMPEST HF (140mm ORIFICE)	0.52	1.51	26.2	46.7
L207A-IC(1)	L207A	IPEX TEMPEST HF (152mm ORIFICE)	0.85	1.69	40.3	58.5
L207A-IC(2)	L207A	IPEX TEMPEST HF (152mm ORIFICE)	0.85	1.69	40.3	58.5
L209A-IC(1)	L209A	IPEX TEMPEST HF (127mm ORIFICE)	0.74	1.45	26.4	37.7
L209A-IC(2)	L209A	IPEX TEMPEST HF (127mm ORIFICE)	0.74	1.45	26.4	37.7
L209B-IC	L209B	IPEX TEMPEST HF (102mm ORIFICE)	1.12	1.42	21.4	24.2
L209C-IC	L209C	IPEX TEMPEST HF (108mm ORIFICE)	1.92	2.04	31.7	32.7
L210A-IC(1)	L210A	IPEX TEMPEST HF (108mm ORIFICE)	0.96	1.58	22.1	28.7
L210A-IC(2)	L210A	IPEX TEMPEST HF (127mm ORIFICE)	0.96	1.58	30.4	39.6
L211A-IC(1)	L211A	IPEX TEMPEST HF (127mm ORIFICE)	1.06	1.61	32.0	39.9
L211A-IC(2)	L211A	IPEX TEMPEST HF (127mm ORIFICE)	1.06	1.61	32.0	39.9
L212A-IC1	L212A	IPEX TEMPEST HF (83mm ORIFICE)	0.24	1.41	6.1	16.0
L212A-IC2	L212A	IPEX TEMPEST HF (83mm ORIFICE)	0.24	1.41	6.1	16.0
L213A-IC(1)	L213A	IPEX TEMPEST HF (95mm ORIFICE)	0.83	1.56	15.9	22.1
L213A-IC(2)	L213A	IPEX TEMPEST HF (95mm ORIFICE)	0.83	1.56	15.9	22.1
L214A-IC(1)	L214A	IPEX TEMPEST HF (152mm ORIFICE)	0.97	1.61	43.4	57.0
L214A-IC(2)	L214A	IPEX TEMPEST HF (152mm ORIFICE)	0.97	1.61	43.4	57.0
L217A-IC(1)	L217A	IPEX TEMPEST HF (127mm ORIFICE)	0.92	1.57	29.7	39.5
L217A-IC(2)	L217A	IPEX TEMPEST HF (127mm ORIFICE)	0.92	1.57	29.7	39.5
L218B-IC	L218B	IPEX TEMPEST HF (95mm ORIFICE)	2.04	2.15	25.4	26.1
L219B-IC(1)	L219B	IPEX TEMPEST HF (127mm ORIFICE)	0.72	1.69	26.1	40.9
L219B-IC(2)	L219B	IPEX TEMPEST HF (152mm ORIFICE)	0.72	1.69	37.0	58.4
L220A-S	L220A	IPEX TEMPEST HF (178mm ORIFICE)	1.14	2.09	64.7	89.2
L225A-IC(1)	L225A	IPEX TEMPEST HF (108mm ORIFICE)	1.38	1.66	26.8	29.5
L225A-IC_(2)	L225A	IPEX TEMPEST HF (108mm ORIFICE)	1.38	1.66	26.8	29.5
L225C-IC(1)	L225C	IPEX TEMPEST HF (127mm ORIFICE)	1.32	1.59	36.0	39.6
L225C-IC(2)	L225C	IPEX TEMPEST HF (108mm ORIFICE)	1.32	1.59	26.1	28.7
L228A-IC(1)	L228A	IPEX TEMPEST HF (127mm ORIFICE)	1.08	1.60	32.4	39.8
L228A-IC(2)	L228A	IPEX TEMPEST HF (152mm ORIFICE)	1.08	1.60	46.1	56.8
L229A-IC(1)	L229A	IPEX TEMPEST HF (108mm ORIFICE)	1.29	1.59	25.8	28.8

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
L229A-IC(2)	L229A	IPEX TEMPEST HF (108mm ORIFICE)	1.29	1.59	25.8	28.8
L234A-IC1	L234A	IPEX TEMPEST HF (95mm ORIFICE)	1.20	1.63	19.3	22.6
L234A-IC2	L234A	IPEX TEMPEST HF (95mm ORIFICE)	1.20	1.63	19.3	22.6
L234B-IC1	L234B	IPEX TEMPEST HF (95mm ORIFICE)	0.96	1.65	17.1	22.7
L234B-IC2	L234B	IPEX TEMPEST HF (95mm ORIFICE)	0.96	1.65	17.1	22.7
L234D-IC	L234D	IPEX TEMPEST HF (152mm ORIFICE)	1.39	2.12	52.8	65.7
L235A-IC1	L235A	IPEX TEMPEST HF (178mm ORIFICE)	0.88	1.69	55.9	79.9
L235A-IC2	L235A	IPEX TEMPEST HF (178mm ORIFICE)	0.88	1.69	55.9	79.9
L240A-IC(1)	L240A	IPEX TEMPEST HF (83mm ORIFICE)	1.01	1.55	13.5	16.8
L240A-IC(2)	L240A	IPEX TEMPEST HF (83mm ORIFICE)	1.01	1.55	13.5	16.8
L241A-IC(1)	L241A	IPEX TEMPEST HF (108mm ORIFICE)	1.38	1.58	26.7	28.6
L241A-IC(2)	L241A	IPEX TEMPEST HF (108mm ORIFICE)	1.38	1.58	26.7	28.6
L241B-IC(1)	L241B	IPEX TEMPEST HF (127mm ORIFICE)	1.34	1.61	36.3	39.9
L241B-IC(2)	L241B	IPEX TEMPEST HF (127mm ORIFICE)	1.34	1.61	36.3	39.9

Proposed Development Storm Hydraulic Grade Line Analysis

As mentioned previously, the worst-case HGL across the site occurs in the ultimate development conditions once runoff from approved, proposed and external development areas is routed through the proposed site minor system to the ultimate KW SWM Pond 5.

As shown in

Figure 5, a portion of the proposed storm sewer system will be partially submerged. Specifically, approximately 112 m of storm sewer tributary to the west forebay (approved first registration phase) and approximately 1,123 m of storm sewer tributary to the east forebay (proposed ultimate condition) will be partially submerged.

As per the above, the worst case 100-year hydraulic grade line (HGL) elevation across the proposed development was estimated using the proposed ultimate KW Pond 5 PCSWMM model for the 100-year, 3-hour Chicago and 12-hour SCS Type II storms with a static backwater elevation of 94.60 m as per the MVC 1983 100-year flood elevation for the Carp River. **Table 10** below presents the clearance between the trunk sewer worst case HGL and the proposed and approved under side of footings (USF) within the Richcraft Kanata West development. The storm sewer design sheet is included in **Appendix B.1**. The 'climate change' scenarios required by the City of Ottawa Sewer Design Guidelines (2012), where 100-year intensities are increased by 20% were also assessed. 100-Year HGL profiles from PCSWMM have been included in **Appendix B.4**.

Table 10: Ultimate Condition Hydraulic Grade Line Results

STM MH	Prop/App. USF Elevation (m)	100-Year HGL				100-year + 20%			
		12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR HGL (m)	USF – HGL Clearance (m)	12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR+ 20% HGL (m)	USF –HGL Clearance (m)
100A	N/A	95.08	95.08	95.08	-	95.11	95.13	95.13	-
100B	N/A	95.10	95.10	95.10	-	95.14	95.16	95.16	-
100C	N/A	95.07	95.07	95.07	-	95.10	95.12	95.12	-
100D	N/A	95.10	95.10	95.10	-	95.14	95.16	95.16	-
100E	N/A	95.07	95.07	95.07	-	95.10	95.12	95.12	-
101	95.74	95.19	95.19	95.19	0.55	95.24	95.26	95.26	0.48
102	95.63	95.21	95.21	95.21	0.42	95.26	95.28	95.28	0.35
103	95.69	95.24	95.24	95.24	0.45	95.30	95.32	95.32	0.37
104	95.75	95.26	95.26	95.26	0.49	95.31	95.35	95.35	0.40
105	96.00	95.35	95.34	95.35	0.65	95.41	95.44	95.44	0.56
106	96.00	95.37	95.36	95.37	0.63	95.44	95.48	95.48	0.52
107	96.10	95.58	95.61	95.61	0.49	95.69	95.75	95.75	0.35
108	96.10	95.62	95.67	95.67	0.43	95.77	95.86	95.86	0.24
+50	96.25	95.65	95.76	95.76	0.49	95.85	95.97	95.97	0.28
+86	96.33	95.68	95.83	95.83	0.50	95.91	96.05	96.05	0.28
109	96.23	95.70	95.89	95.89	0.34	95.96	96.12	96.12	0.11
110	96.54	95.71	95.75	95.75	0.79	95.84	95.90	95.90	0.64
111	96.30	95.77	95.81	95.81	0.49	95.90	95.96	95.96	0.34
112	96.30	95.94	96.00	96.00	0.30	96.08	96.14	96.14	0.16
+51	96.34	95.99	96.04	96.04	0.30	96.13	96.19	96.19	0.15
113	96.37	96.02	96.07	96.07	0.30	96.16	96.22	96.22	0.15
114	95.63	95.24	95.24	95.24	0.39	95.29	95.31	95.31	0.32
115	95.71	95.31	95.32	95.32	0.39	95.37	95.39	95.39	0.32
116	95.78	95.46	95.47	95.47	0.31	95.52	95.55	95.55	0.23

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

STM MH	Prop/App. USF Elevation (m)	100-Year HGL				100-year + 20%			
		12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR HGL (m)	USF – HGL Clearance (m)	12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR+ 20% HGL (m)	USF –HGL Clearance (m)
117	95.77	95.42	95.43	95.43	0.34	95.48	95.51	95.51	0.26
118	95.90	95.58	95.60	95.60	0.30	95.68	95.71	95.71	0.19
119	95.70	95.34	95.35	95.35	0.35	95.41	95.44	95.44	0.26
+51	95.79	95.40	95.41	95.41	0.38	95.48	95.51	95.51	0.28
121	96.20	95.48	95.49	95.49	0.71	95.56	95.60	95.60	0.60
121A	N/A	95.49	95.50	95.50	-	95.56	95.60	95.60	-
123	96.40	95.68	95.66	95.68	0.72	95.78	95.80	95.80	0.60
124	96.64	96.34	96.34	96.34	0.30	96.34	96.34	96.34	0.30
125	96.99	96.48	96.48	96.48	0.51	96.49	96.48	96.49	0.50
+69	97.15	96.84	96.83	96.84	0.31	96.86	96.84	96.86	0.29
126	97.44	96.96	96.95	96.96	0.48	96.98	96.96	96.98	0.46
+41	97.69	97.32	97.31	97.32	0.37	97.33	97.32	97.33	0.36
+71	98.00	97.58	97.58	97.58	0.42	97.59	97.58	97.59	0.41
127	98.35	97.92	97.93	97.93	0.42	97.93	97.93	97.93	0.42
128	97.44	97.05	97.04	97.05	0.39	97.07	97.06	97.07	0.37
129	97.49	97.13	97.12	97.13	0.36	97.14	97.13	97.14	0.35
+31	97.67	97.29	97.28	97.29	0.38	97.29	97.29	97.29	0.38
+65	98.17	97.46	97.45	97.46	0.71	97.46	97.46	97.46	0.71
130	98.35	97.70	97.70	97.70	0.65	97.70	97.70	97.70	0.65
131	98.50	97.70	97.70	97.70	0.80	97.70	97.70	97.70	0.80
132	98.46	97.56	97.56	97.56	0.90	97.56	97.56	97.56	0.90
201	N/A	95.21	95.22	95.22	-	95.27	95.29	95.29	-
210	95.87	95.54	95.57	95.57	0.30	95.63	95.69	95.69	0.18
+32	95.84	95.41	95.44	95.44	0.40	95.50	95.53	95.53	0.31
202	95.76	95.33	95.36	95.36	0.40	95.42	95.44	95.44	0.32
+46	95.77	95.40	95.45	95.45	0.32	95.51	95.53	95.53	0.24
204	95.94	95.56	95.64	95.64	0.30	95.71	95.74	95.74	0.20
+7	95.95	95.57	95.65	95.65	0.30	95.72	95.75	95.75	0.20
205	96.14	95.72	95.84	95.84	0.30	95.92	95.96	95.96	0.18
+82	96.74	95.85	95.99	95.99	0.75	96.07	96.15	96.15	0.59
206	97.12	95.89	96.04	96.04	1.08	96.12	96.21	96.21	0.91
207	97.12	96.39	96.72	96.72	0.40	96.76	97.00	97.00	0.12
209	97.79	96.70	97.13	97.13	0.66	97.14	97.47	97.47	0.32
211	95.92	95.58	95.62	95.62	0.30	95.68	95.74	95.74	0.18
212	96.11	95.64	95.67	95.67	0.44	95.75	95.81	95.81	0.30
213	96.32	95.67	95.71	95.71	0.61	95.78	95.84	95.84	0.48
214	96.14	95.76	95.81	95.81	0.33	95.88	95.94	95.94	0.20
+25	96.19	95.81	95.86	95.86	0.33	95.93	95.99	95.99	0.20
215	96.28	95.87	95.93	95.93	0.35	95.99	96.06	96.06	0.22
216	96.39	95.90	95.96	95.96	0.43	96.02	96.10	96.10	0.29
217	96.59	95.98	96.04	96.04	0.55	96.10	96.18	96.18	0.41

STM MH	Prop/App. USF Elevation (m)	100-Year HGL				100-year + 20%			
		12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR HGL (m)	USF – HGL Clearance (m)	12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR+ 20% HGL (m)	USF –HGL Clearance (m)
218	96.38	95.74	95.79	95.79	0.59	95.86	95.92	95.92	0.46
220	96.25	95.86	95.95	95.95	0.30	96.01	96.07	96.07	0.18
+43	96.22	95.84	95.92	95.92	0.30	95.98	96.04	96.04	0.18
219	96.26	95.80	95.88	95.88	0.38	95.94	96.00	96.00	0.26
+30	96.36	95.87	95.96	95.96	0.40	96.02	96.08	96.08	0.28
221	96.39	95.98	96.09	96.09	0.30	96.15	96.21	96.21	0.18
222	96.80	96.31	96.48	96.48	0.32	96.55	96.60	96.60	0.20
+54	97.19	96.62	96.78	96.78	0.41	96.86	96.90	96.90	0.29
223	97.48	96.74	96.90	96.90	0.58	96.98	97.02	97.02	0.46
224	97.48	96.86	97.01	97.01	0.47	97.09	97.13	97.13	0.35
225	97.66	97.23	97.36	97.36	0.30	97.45	97.48	97.48	0.18
226	98.34	97.33	97.47	97.47	0.87	97.56	97.59	97.59	0.75
227	98.29	97.39	97.54	97.54	0.75	97.63	97.66	97.66	0.63
228	98.14	97.61	97.78	97.78	0.36	97.87	97.91	97.91	0.23
229	98.35	97.70	97.87	97.87	0.48	97.96	98.00	98.00	0.35
230	N/A	97.73	97.87	97.87	-	97.98	98.00	98.00	-
231	98.55	97.73	97.88	97.88	0.67	97.98	98.00	98.00	0.55
232	98.48	97.58	97.58	97.58	0.90	97.98	98.00	98.00	0.48
233	95.60	95.25	95.25	95.25	0.35	95.31	95.33	95.33	0.27
234	95.70	95.37	95.37	95.37	0.33	95.43	95.45	95.45	0.25
235	95.85	95.46	95.47	95.47	0.38	95.53	95.55	95.55	0.30
236	95.80	95.46	95.47	95.47	0.33	95.53	95.55	95.55	0.25
237	95.80	95.46	95.47	95.47	0.33	95.53	95.55	95.55	0.25
240	98.14	97.52	97.66	97.66	0.48	97.76	97.78	97.78	0.36
241	98.35	97.72	97.87	97.87	0.48	97.97	97.99	97.99	0.36
242	N/A	97.72	97.87	97.87	-	97.97	98.00	98.00	-

1. HGL values have been interpolated between proposed manholes where the worst-case HGL did not meet the 0.3m clearance to the lowest USF between manholes.

The model results indicate that there is sufficient clearance between the worst case 100-year HGL and the proposed and approved under side of footings (USFs).

An additional sensitivity test has also been undertaken to assess the hydraulic grade line (HGL) elevation across the proposed storm sewer network under ultimate development conditions, during the 25-year, 3-hour Chicago storm with accumulation of sediment in the portions of the proposed storm sewer pipes submerged by the permanent pool of the SWM pond (93.44 m). Storm sewer pipes partially submerged by the permanent pool of the ultimate KW SWM Pond 5 were modelled as smaller diameter pipes, in order to replicate the impact of sediment accumulation (assumed to be 25% of submerged area) in the submerged portions of the pipes. The pipe parameters used in the sediment accumulation HGL analysis for the ultimate condition development are summarized in **Appendix B.5**

Table 11 shows the results of the sediment accumulation HGL analysis for the Ultimate condition development during the 25-year, 3-hour Chicago storm.

Table 11: Ultimate Development Sediment Accumulation HGL Results

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
100A	N/A	94.77	N/A
100B	N/A	94.77	N/A
100C	N/A	94.77	N/A
100D	N/A	94.78	N/A
100E	N/A	94.75	N/A
101	95.74	94.85	0.89
102	95.63	94.87	0.76
103	95.69	94.89	0.80
104	95.75	94.90	0.85
105	96.00	95.18	0.82
106	96.00	95.26	0.74
107	96.10	95.18	0.92
108	96.10	95.27	0.83
+50	96.25	95.39	0.86
+86	96.33	95.48	0.85
109	96.23	95.56	0.67
110	96.54	95.34	1.20
111	96.30	95.41	0.89
112	96.30	95.61	0.69
+51	96.34	95.72	0.62
113	96.37	95.79	0.58
114	95.63	94.89	0.74
115	95.71	94.96	0.75
116	95.78	95.29	0.49
117	95.77	95.11	0.66
118	95.90	95.54	0.36
119	95.70	94.93	0.77

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
+51	95.79	94.97	0.82
121	96.20	95.02	1.18
121A	N/A	95.49	N/A
123	96.40	95.61	0.79
124	96.64	96.34	0.30
125	96.99	96.48	0.51
+69	97.15	96.84	0.31
126	97.44	96.96	0.48
+41	97.69	97.32	0.37
+71	98.00	97.58	0.42
127	98.35	97.93	0.42
128	97.44	97.04	0.40
129	97.49	97.12	0.37
+31	97.67	97.28	0.39
+65	98.17	97.45	0.72
130	98.35	97.70	0.65
131	98.50	97.70	0.80
132	98.46	97.56	0.90
201	N/A	94.79	N/A
210	95.87	95.06	0.81
+32	95.84	94.91	0.93
202	95.76	94.82	0.94
+46	95.77	94.82	0.95
204	95.94	94.83	1.11
+7	95.95	94.83	1.12
205	96.14	94.83	1.31
+82	96.74	94.84	1.90
206	97.12	94.84	2.28
207	97.12	95.42	1.70
209	97.79	95.87	1.92

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
211	95.92	95.10	0.82
212	96.11	95.15	0.96
213	96.32	95.18	1.14
214	96.14	95.27	0.87
+25	96.19	95.36	0.83
215	96.28	95.47	0.81
216	96.39	95.57	0.82
217	96.59	95.76	0.83
218	96.38	95.24	1.14
220	96.25	95.49	0.76
+43	96.22	95.36	0.86
219	96.26	95.28	0.98
+30	96.36	95.39	0.97
221	96.39	95.55	0.84
222	96.80	96.06	0.74
+54	97.19	96.40	0.79
223	97.48	96.53	0.95
224	97.48	96.65	0.83
225	97.66	97.06	0.60
226	98.34	97.17	1.17
227	98.29	97.23	1.06
228	98.14	97.46	0.68
229	98.35	97.54	0.81
230	N/A	97.59	N/A
231	98.55	97.35	1.20
232	98.48	97.58	0.90
233	95.60	94.84	0.76
234	95.70	94.97	0.73
235	95.85	95.07	0.78
236	95.80	95.07	0.73

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
237	95.80	95.07	0.73
240	98.14	97.38	0.76
241	98.35	97.59	0.76
242	N/A	97.59	N/A

The results show that sufficient clearance is provided between the proposed and approved USFs and the 25-year HGL assuming 25% of the submerged section of pipe is filled with sediment.

Overland Flow

Major system peak flows from the proposed development will be directed to the KW Pond 5. **Drawings SD-1** and **SD-2** show the proposed overland flow route.

The proposed ICDs have been sized to capture the 2-year runoff from local street catchments (areas named L-), and the 5-year runoff from collector road catchments (areas named C-), while still meeting the 0.3 m required 100-year HGL clearance to the USFs.

Table 12 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of the proposed street catchbasins for the 100-year, 3-hr Chicago storm and the 'climate change' storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed the required 0.35 m maximum during the 100-year event. A summary table showing the total surface water depths for the 5-year design storms for the proposed phase areas of the Richcraft Kanata West Development has been included in **Appendix B.3**

Table 12: Proposed Phase – Ultimate Maximum Static and Dynamic Surface Water Depths

Storage node ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	2-year, 3-hour Chicago		100-year, 3-hour Chicago		100-year, 3-hour Chicago+20%	
			Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)
205A-S(1)	97.45	98.25	96.38	0.00	97.72	0.27	97.78	0.33
206B-S(1)	97.77	98.49	96.91	0.00	97.90	0.13	97.93	0.16
219A-S(1)	97.82	N/A	96.90	0.00	97.96	0.14	98.00	0.18
220A-S	97.68	98.33	96.60	0.00	97.96	0.28	98.00	0.32
222A-S	97.82	98.50	96.85	0.00	98.10	0.28	98.19	0.37
223A-S	98.17	99.16	97.17	0.00	98.37	0.20	98.40	0.23
G234C-S	97.59	N/A	94.99	0.00	97.76	0.17	97.78	0.19
116A-S	97.20	97.88	96.73	0.00	97.48	0.28	97.54	0.34
202A-S(1)	97.27	97.87	96.75	0.00	97.56	0.29	97.62	0.35

Storage node ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	2-year, 3-hour Chicago		100-year, 3-hour Chicago		100-year, 3-hour Chicago+20%	
			Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)
204A-S(1)	97.39	98.05	97.21	0.00	97.64	0.25	97.71	0.32
204BS(1)	97.34	97.87	96.69	0.00	97.59	0.25	97.65	0.31
206A-S(1)	98.29	98.85	98.14	0.00	98.54	0.25	98.58	0.29
207A-S(1)	98.68	99.37	98.15	0.00	98.99	0.31	99.03	0.35
209A-S	99.59	100.25	98.95	0.00	99.66	0.07	99.66	0.07
209B-S	100.03	N/A	99.77	0.00	100.07	0.04	100.08	0.05
210A-S	97.37	97.94	96.95	0.00	97.57	0.20	97.64	0.27
211A-S(1)	97.75	98.27	97.43	0.00	97.98	0.23	98.02	0.27
L212A-S	96.94	N/A	95.80	0.00	96.97	0.03	96.97	0.03
213A-S	97.82	98.53	97.27	0.00	98.00	0.18	98.03	0.21
214A-S(1)	97.65	98.31	97.24	0.00	97.88	0.23	97.94	0.29
217A-S	97.81	98.56	97.35	0.00	98.00	0.19	98.05	0.24
219B-S	97.98	98.49	97.32	0.00	98.29	0.31	98.37	0.39
225A-S	99.03	99.59	99.03	0.00	99.31	0.28	99.35	0.32
225C-S	99.49	99.85	99.43	0.00	99.70	0.21	99.73	0.24
228A-S	99.99	100.40	99.69	0.00	100.21	0.22	100.24	0.25
229A-S	100.20	100.62	100.11	0.00	100.41	0.21	100.44	0.24
234A-S	97.35	97.95	97.17	0.00	97.60	0.25	97.66	0.31
234B-S	97.30	97.77	96.88	0.00	97.57	0.27	97.63	0.33
235A-S	97.36	97.90	96.86	0.00	97.67	0.31	97.71	0.35
240A-S	99.80	100.40	99.43	0.00	99.97	0.17	100.00	0.20
241B-S	99.90	100.47	99.86	0.00	100.13	0.23	100.16	0.26
241A-S	100.14	100.65	100.14	0.00	100.34	0.20	100.35	0.21

WATER BALANCE – INFILTRATION REQUIREMENTS

Based on a target infiltration rate of 50 mm/yr for the overall 36.53 ha Richcraft Kanata West site, on-site infiltration measures are required to infiltrate approximately 22,831 m^3/year (Pre-development infiltration increased by 25%). Infiltration, evapotranspiration, and runoff values were established based on results of previous hydrogeologic and geotechnical investigations for areas in the City's west end that maintain similar subsurface soils conditions. Detailed water balance calculations are attached.

As the development will receive an extensive soils pre-loading and/or surcharge program to permit proposed grading at or near permissible grade raise recommendations, it is proposed that the upper 20 cm layer of soil within the proposed front and back landscaped areas (Second Registration Phase), and within landscaped areas in the proposed park (Second Registration Phase) be constructed with amended soils to promote infiltration and evapotranspiration. It is also recommended that the underlying soils below the proposed amended topsoil layer be scarified to a depth of 45 cm to promote additional infiltration.

Other practices for groundwater infiltration include:

- Direct roof leaders to rear yard areas
- Bioswales underlying drainage swales in proposed rear yard areas
- The use of amended planting topsoil in parks and residential backyards
- Infiltration of runoff captured by rear yard catch basins

Per the above, proposed roof eaves troughs will be directed to rear yard pervious areas, and rear yards will maintain perforated pipe subdrains and bioswales as per the approved cross-section for the First Registration Phase (see **Figure 6**).

Of the total site area, 21.88 ha will be converted to impervious area with no infiltration, which excludes the proposed ultimate SWM pond footprint of 2.56 ha that will not provide infiltration either. Approximately 12.09 ha will consist of parks, lawns and open space areas. The inclusion of amended planting topsoil in proposed residential landscaped areas and the proposed park area (total of 2.84 ha) is expected to provide additional infiltrative capacity to surficial soils in order to increase post development infiltration rate from pervious areas to 13,409 m^3/year (9,423 m^3/year to be infiltrated elsewhere). The practice of applying a deeper layer of organic topsoil has the potential to absorb runoff and increase infiltration, as well as to promote evapotranspiration, thus reducing runoff volumes overall. Due to the impervious nature of the native clay soils, it is expected that the addition of amended soils to the rear yard landscaped areas within the proposed phase as well as within the proposed park landscaped areas will promote shallow groundwater movement to the Carp River and Hazeldean Creek.

The recommended minimum topsoil depth and quality standards as per the Toronto and Region Conservation Authority is as follows.

Table 13: Amended Planting Soil Minimum Depth and Quality Standards

Planting Area Type	Subsoil Scarifying Depth (cm)	Topsoil Organic Matter (%dry wt.)	Topsoil PH	Planting Soil Depth (cm)	Total Uncompacted Soil Depth (cm)
Turf Area	45	5 to 10	6.0 to 8.0	20	65
Planting Bed of Tree Pit	45	10 to 15	6.0 to 8.0	20	65

Rear-yard bioswales within the approved and proposed phases of the development are required to provide the additional 9,423 m^3/year.

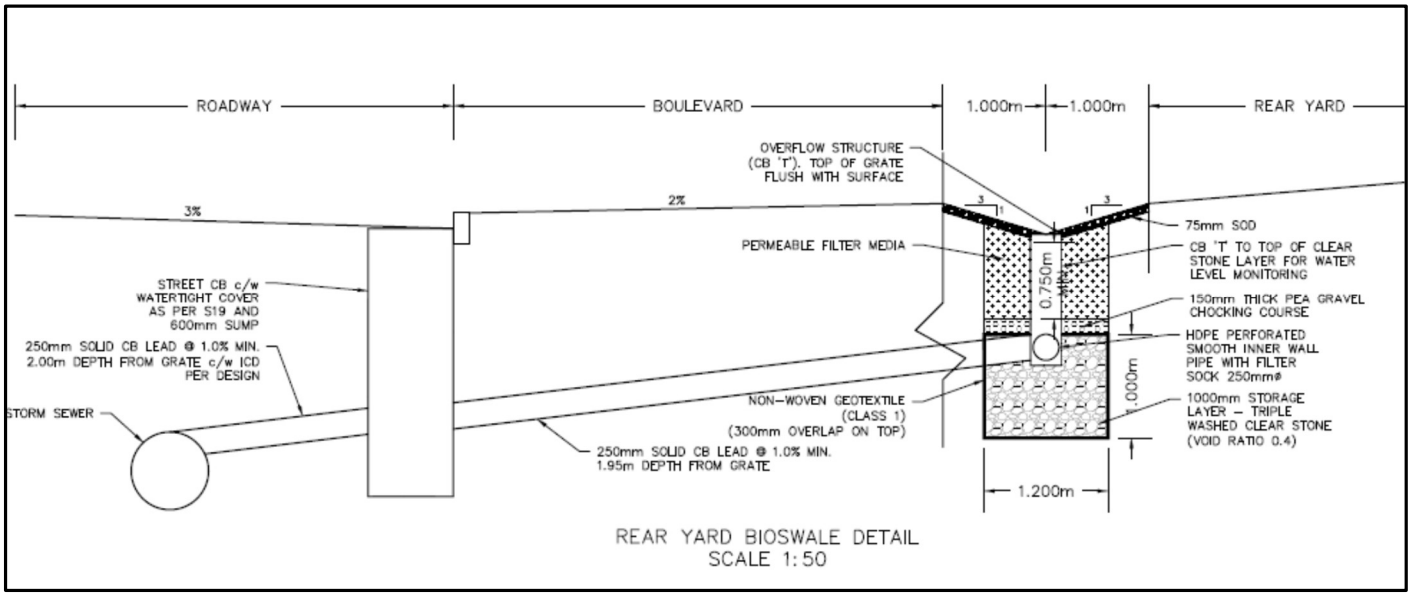
Based on average precipitation data available (2000-2011), approximately 31 rainfall events/yr have a rainfall depth that ranges between 6 mm and 25 mm, for an average depth of 12.2 mm. Based on the roof area tributary to the rear yard bioswales in the approved and proposed phases (21,324 m^2 based on half roofs directed to rear yards), the annual volume of runoff from the roofs to the bioswales is approximately 7,992 m^3 (1,431 m^3/year to be infiltrated elsewhere).

As per the approved SWM plan for the second registration phase of the development, the school block (Block 70) is required to in filtrate 671 m^3/yr and as such, the remainder 759 m^3/yr are required to be infiltrated within the two proposed medium density residential blocks (Block 60 and Block 117).

Given that the total area for the two medium density residential blocks is 2.77 ha, an infiltration target of 274 m^3/year has been established for each block (refer to **Table 8** for future block SWM criteria). Detailed water balance calculations are included in **Appendix B.6**.

The following figure shows the typical cross section of the bioswales as agreed upon with the City of Ottawa during the detailed design stage of the First Registration Phase of the KW Development.

Figure 6: Typical Bioswale Cross Section



The minimum required footprint area of the bioswales was estimated for each bioswale based on MECP guidelines (Equation 4.3) for a retention time of 24 hours and an average infiltration rate of the native soil equal to 19 mm/hr as recommended by Paterson in their technical memo PG4624-MEMO.07 dated June 28, 2019. However, for conservatism, the proposed infiltration measures have not been included in the PCSWMM models for the proposed development.

Table 14 summarizes the design characteristics of the proposed bioswales.

Table 14: Proposed Bioswale Characteristics

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Drainage Area ID	Drainage Area (ha)	Impervious-ness (%)	Required Volume for 25mm Event (m^3)	Bioswale Length (m)	Bioswale Width (m)	Storage Layer Depth (m)	Maximum Storage Available (m)
L209C	0.41	39%	40	105	1.2	0.75	41
L205B	0.49	36%	44	130	1.2	0.75	51
L204C	0.26	39%	25	44	1.2	0.75	17
L202B	0.25	50%	31	75	1.2	0.75	29
L234D	0.37	53%	49	90	1.2	0.75	35
L218B	0.25	36%	22	131	1.2	0.75	51
L220A	0.87	34%	75	192	1.2	0.75	75

WASTEWATER

The second registration phase of the Richcraft Kanata West Development was previously approved in 2022 and an addendum letter was subsequently approved in 2023. However, the draft plan has been revised to replace single family homes in the south-eastern corner of the site by a medium density residential block (Block 117), a new public right-of-way has been added in the south-western corner of the site (north and east of Holstein Road) and lot configuration for a few townhouses along Winter Wheat Terrace and Tillage Street has been modified. As such, the sanitary sewer design sheet and HGL analysis across the entire site have been revised to reflect the revised draft plan changes.

The second registration phase of the Richcraft Kanata West Development will be serviced through the approved sanitary sewers within the first registration phase that ultimately discharge into the existing 1200 mm diameter sanitary sewer on Maple Grove Road and the Kanata West Pump Station (KWPS) as shown on **Drawing OSSP-2**. The proposed sanitary trunk sewers have been sized for the ultimate development condition which includes sewage peak flows from the existing Trinity Development to the south.

Modelling of the proposed sanitary sewer system is required as per the Kanata West Master Servicing Study (Stantec, 2006) to assess maximum HGLs during critical failure of the KWPS. In addition, as outlined in the City's "Technical Bulletin ISTB-2018-01", a sanitary HGL analysis is required to assess the maximum HGL in the sanitary sewer system under normal pumping station conditions. The HGL across the proposed site has been assessed under the worst-case scenario which occurs during full build-out of the Richcraft Kanata West Development, and once a sanitary connection has been provided for the existing Trinity Development through the proposed site.

DESIGN CRITERIA

The following design guidelines were obtained from the City's "Technical Bulletin ISTB-2018-01" and were used to estimate wastewater flow rates from the proposed development and to size the sanitary sewers.

- Minimum Full Flow Velocity – 0.6 m/s
- Maximum Full Flow Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Single Family Persons per unit – 3.4
- Townhouse unit – 2.7
- Per Capita Residential Average Daily Flow – 280 L/p/day
- Commercial and Institutional Average Daily Flow - 28,000 L/ha/day
- Peaking Factor for Commercial and Institutional Areas – 1.5 if ICI in contributing area is >20%; ICI Peak Factor =1.0 if ICI in contributing area <20%
- Extraneous Flow Allowance – 0.33 L/s/ha
- Manhole Spacing – 120m for pipes under 450mm dia., 150m for pipes over 450mm dia.
- Minimum Cover – 2.5 m

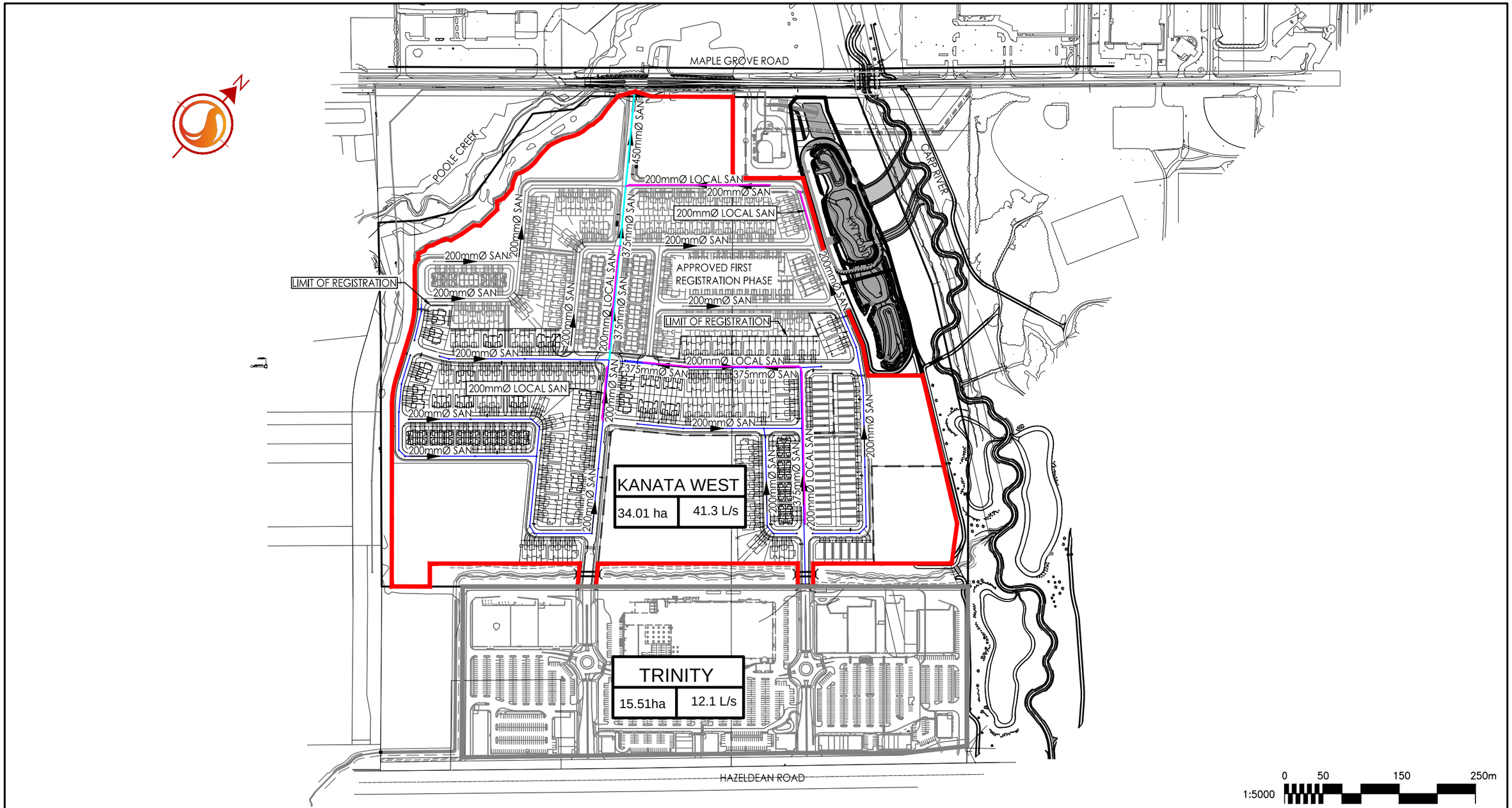
In the approved First Registration phase of the development, a unit density of 38 units/ha was used for the medium density residential block (Block 29). The unit density for the medium density residential block (previously Block 75) within the Second Registration Phase of the development is based on the concept

plan, included in **Appendix C.3.** Based on the concept plan, the unit density for medium density residential blocks within the Second Registration Phase has been revised to approximately 93 units/hectare. This unit density was used for both medium density residential blocks (Block 60 and Block 117) within the Second Registration Phase**.** A residential peak factor based on Harmon's Equation with a correction factor of 0.8 was used to determine the residential peak design flows.

PROPOSED SANITARY SEWERS

The proposed sanitary sewer system has been designed as a network of gravity sewers which will direct wastewater flows from the approved and proposed phases of the Richcraft Kanata West Subdivision and the existing Trinity Development (approximately **53.4 L/s** which includes **12.1 L/s** from the existing Trinity commercial site) to the Maple Grove trunk sewer and ultimately to the Kanata West Pump Station (KWPS). The overall external drainage extent is shown on **Figure 7**, while the overall drainage areas, wastewater peak flows and sanitary sewers within the approved and proposed development areas are shown on **Drawings SA-1** and **SA-2** and in the sanitary sewer design sheet included in **Appendix C.1.**

Figure 7: Proposed Sanitary Sewer Network and External Drainage Extent



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Legend

- EXISTING SANITARY DRAINAGE BOUNDARY
- PROPOSED OVERALL SANITARY DRAINAGE BOUNDARY
- Catchment 1 (4.00 ha | 50L/s) — SITE ID / AREA (HA) / QPEAK (L/s)
- PROPOSED SANITARY SEWER
- APPROVED FIRST REGISTRATION PHASE SANITARY SEWER
- PROPOSED DEEP TRUNK SANITARY SEWER (DEEPER THAN 6.0m)
- PROPOSED HIGH LEVEL LOCAL SANITARY SEWER

Client/Project
RICHCRAFT HOMES
RICHCRAFT KANATA WEST

Figure No.
7

Title
PROPOSED SANITARY SEWER NETWORK AND EXTERNAL DRAINAGE EXTENT

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

SANITARY HGL ANALYSIS

This section summarizes the results of the sanitary hydraulic grade line (HGL) analysis for the proposed second registration phase of the Richcraft Kanata West Development, which has been revised to replace the single family homes in the south-eastern corner of the site with a medium density residential block (Block 117), and to add a new public right-of-way in the south-western corner of the site, and adjust lotting configuration for a few townhouses. The worst-case HGL occurs at full build-out of the Richcraft KW Development and as such, the HGL analysis includes the approved and proposed sanitary sewers within the entire Richcraft KW Development, external wastewater flows from the existing Trinity Development, as well as the existing 1200 mm diameter sanitary trunk sewer on Maple Grove Road from the subdivision outlet to the Kanata West Pumping Station (KWPS) located at the southwest intersection of Maple Grove Road and Terry Fox Drive.

The sanitary HGL across the proposed Richcraft subdivision has been assessed assuming ultimate development conditions for the KWPS catchment area under both catastrophic failure and normal operating conditions of the KWPS. The sanitary HGL analysis was prepared based on the following background documents provided by the City of Ottawa (see **Appendix C.3**).

- *Alternative 2: Divert Stittsville Trunk Sewer Only Design Sheet Long Term Flows (2031)*, J.L Richard and Associates, December 2014.
- *Fernbank Community – Kizell Lands, Sanitary Drainage Area Plan*, Novatech, February 2018.
- *Fernbank Community – Kizell Lands, Sanitary Sewer Design Sheet*, Novatech, February 2018.
- *Kanata West Master Servicing Study, Sanitary Sewer Design Sheet*, Stantec Consulting Ltd., CCL and IBI, April 2005.
- *Kanata West Concept Plan Master Servicing Study, Preferred Waste-Water Option*, Stantec Consulting Ltd., CCL and IBI, October 2005.
- *Reconstruction of Maple Grove Road, Sanitary Drainage Plan*, DSEL on behalf of the City of Ottawa, July 2011.
- *Reconstruction of Maple Grove Road, Sanitary Sewer Calculation Sheet,* DSEL on behalf of the City of Ottawa, May 2012.
- *Kanata West Serviceability Study, N-S Interceptor Sewer Sanitary Design Sheet*, IBI, June 2016.
- *Maple Grove Expansion Area Excel Sheet*, City of Ottawa.
- *Hazeldean Sanitary Sewer Analysis*, Atrel Engineering Ltd., November 29th, 2017.
- *Kanata West Pumping Station and Forcemains Preliminary Design Report*, Stantec Consulting Ltd., April 13, 2015
- *Kanata West Pumping station and Forcemains – Preliminary Design Report*, Stantec Consulting Ltd., April 2015.

Sanitary HGL Analysis Criteria

As per the City of Ottawa's Technical Bulletin from March 2018, a sanitary HGL analysis must be performed assuming both catastrophic failure and normal operating conditions of the KWPS.

Annual flow parameters are to be used to assess the HGL in the sanitary system assuming a catastrophic failure of the pump station with wet weather peak flows being discharged through the emergency overflow

into the ultimate condition Kanata West Pond 5 under 100-year water level. The HGL under this scenario cannot touch the proposed under side of footing (USF).

As per the KWPS overflow weir design calculations, a 20 cm head over the overflow weir crest is required to convey the design wet weather peak flow of 1,250 L/s to the KW Pond 5. The 20 cm head has been used to estimate the boundary conditions in the Catastrophic event scenarios for conservatism.

Additional scenarios have been run assuming catastrophic failure of the KWPS as described below.

- Scenario 1 assumes a conservative design peak flow of 583 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5 (100-year water level plus 20 cm head over the KWPS overflow weir).
- Scenario 2 assumes the ultimate condition IMP peak flow of 360 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5.
- Scenario 3 assumes the interim condition IMP peak flow of 465 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5.
- Scenario 4 assumes a conservative design peak flow of 583 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.06 m at the ultimate KW Pond 5 (25-year water level plus 20 cm head over the PS overflow weir).

Rare flow parameters are to be used to assess the maximum HGL in the sanitary system under normal pumping station conditions. Under this scenario, the HGL must be at least 0.3 m below the USF.

Design Parameters and Assumptions

The following table summarizes the design annual and rare flow parameters as obtained from the City's "Technical Bulletin ISTB-2018-01 Revision to Ottawa Design Guidelines - Sewer".

Table 15: Wastewater Annual and Rare Flow Parameters

Parameters	Annual	Rare
Res. Per Capita	200	200
Commercial	17,000	17,000
Institutional	17,000	17,000
Industrial	10,000	10,000
I/I Dry	0.02	0.02
I/I Wet	0.28	0.53
Total I/I	0.30	0.55
Harmon – Correction Factor	0.6	0.6
ICI Peak Factor	1	1

Sanitary inflows from the proposed and approved phases of the KW Development were obtained from the detailed sanitary drainage plans included in **Appendix E**, while sanitary inflows from all external areas under ultimate development conditions were obtained from background documents provided by the City of Ottawa as shown in **Appendix C.3**. **Appendix C.2** includes the rare and annual sewage inflow calculations

as well as a figure identifying each of the subareas used. **Table 16** summarizes the populations and areas obtained from the background documents as well as the assumptions made for any other areas.

Table 16: Wastewater Population and Area Assumptions

Segment	Population	Residential Area (ha)	Commercial/ Industrial/Institutional Area (ha)	Annual Peak Inflows (L/s)	Rare Peak Inflows (L/s)	Additional Assumptions
Stittsville Trunk	28,031	526.60	76.0 ha Commercial and 40.5 ha Industrial	583.0 Scenario 1 360.0 Scenario 2 465.0 Scenario 3 583.0 Scenario 4	503.0	The peak design flow of 583 L/s was used in the catastrophic event Scenario 1 for conservatism, the ultimate condition IMP model peak flow of 360 L/s was used for the catastrophic event scenario 2, while the interim condition IMP model peak flow of 465 L/s was used for the catastrophic event scenario 3. A peak flow estimated using rare event parameters of 503 L/s was used for the normal operating condition analysis.
Kizell Lands	3,585	52.56	11.82	41.8	57.9	-
Huntmar and Hazeldean	6,357	111.52	65.44	103.9	151.6	Population and areas as obtained from Huntmar/Hazeldean Design Sheet based on KWMSS assumptions for areas 16, 20, 17, 21, 19A, 23, 24 and 19
Additional Hazeldean	296	13.62	5.39	8.7	13.5	-
Maple Grove Sewer	10,501	137.54	-	93.8	128.2	-
Maple Grove Expansion	3,549	84.43	-	42.9	61.9	Number of units and gross area based on spreadsheet provided by the City, with 90% of gross area contributing to I/I and 198 employees generating 83L/emp/day added to total flow

Segment	Population	Residential Area (ha)	Commercial/ Industrial/Institutional Area (ha)	Annual Peak Inflows (L/s)	Rare Peak Inflows (L/s)	Additional Assumptions
Future North-South Collector	4,936	28.44	165.28	147.5	195.9	Population and areas were obtained based on IBI Design Sheet areas A to F and 21.13 ha of area G. A 30L/s fixed flow was added to the total peak flow.
North of Richcraft Kanata Site	113	1.10	-	1.1	1.4	Assumed medium density residential area to have 38 units/ha and 2.7person/unit.
Richcraft Kanata West Development / Existing Trinity	2,911	28.14	18.65	38.2	50.6	-

Based on the above assumptions plus the peak flows estimated for the detailed sanitary catchments across the Richcraft KW Development as shown in **Appendix C.2**, the worst-case peak annual flow is 1,061 L/s (Scenario 1) and the peak rare flow is 1,164 L/s were obtained.

Boundary Conditions

The catastrophic HGL scenarios 1 through 3 which use annual flow parameters to calculate peak inflows into the sanitary system were assessed assuming a fixed backwater of 95.2 m based on a 100-year water level in the ultimate KW Pond 5 equal to 95.0 m plus an additional 0.2 m head over the KWPS emergency overflow weir (head required to convey the design wet weather peak flow of 1,250 L/s as obtained from the KWPS design brief). An additional catastrophic HGL scenario (Scenario 4) was assessed assuming a fixed backwater of 95.06 m based on a 25-year water level in the ultimate KW Pond 5 equal to 94.86 m plus an additional 0.2 m head over the KWPS emergency overflow weir.

The normal operating condition HGL analysis which uses rare flow parameters to calculate peak inflows into the sanitary system was done assuming startup and shutoff elevations in the KWPS of 84.25 m and 82.90 m respectively. The minimum and maximum wet well volumes assumed for the ultimate condition were 281 m^3 and 810 m^3 respectively, while the wet weather peak flow of 1,250 L/s was used as the pumping rate.

Sanitary HGL Analysis Results

The following tables summarize the HGL results from the catastrophic failure (annual parameters) scenarios and the normal operating conditions (rare parameters) scenario across the Richcraft KW Development.

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Table 17: Catastrophic Pump Station Failure Sanitary HGL – Annual Parameters

MH ID	Road Grade (m)	USF (m)	Catastrophic HGL and USF – HGL Clearance							
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
			HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
10	99.43	97.51	96.32	1.19	96.32	1.19	96.32	1.19	96.32	1.19
11	100.75	97.69	96.90	0.79	96.9	0.79	96.9	0.79	96.9	0.79
12	100.60	98.50	97.04	1.46	97.04	1.46	97.04	1.46	97.04	1.46
13	100.23	98.46	97.30	1.16	97.3	1.16	97.3	1.16	97.3	1.16
14	97.61	N/A	95.42	-	95.36	-	95.39	-	95.28	-
16	97.35	N/A	95.44	-	95.38	-	95.4	-	95.3	-
17	97.29	N/A	95.44	-	95.38	-	95.4	-	95.3	-
17A	97.32	N/A	95.44	-	95.38	-	95.4	-	95.3	-
17B	97.37	95.68	95.44	0.24	95.38	0.30	95.4	0.28	95.3	0.38
18	97.17	N/A	95.45	-	95.38	-	95.41	-	95.31	-
18A	97.65	95.69	95.44	0.25	95.38	0.31	95.41	0.28	95.3	0.39
18B	97.09	N/A	95.44	-	95.38	-	95.41	-	95.3	-
19	97.43	95.63	95.45	0.18	95.39	0.24	95.42	0.21	95.31	0.32
1A	96.22	N/A	95.35	-	95.29	-	95.32	-	95.21	-
1B	96.60	N/A	95.31	-	95.27	-	95.29	-	95.17	-
1C	95.30	N/A	95.24	-	95.22	-	95.23	-	95.1	-
2	97.46	N/A	95.37	-	95.31	-	95.33	-	95.23	-
20	97.50	95.63	95.47	0.16	95.41	0.22	95.44	0.19	95.33	0.30
20A	97.37	N/A	95.47	-	95.41	-	95.44	-	95.33	-
21	97.48	95.78	95.48	0.30	95.42	0.36	95.44	0.34	95.34	0.44
22	97.96	N/A	95.42	-	95.36	-	95.39	-	95.28	-
22A	97.83	96.10	95.42	0.68	95.36	0.74	95.39	0.71	95.28	0.82
22B	97.81	96.10	95.43	0.67	95.37	0.73	95.39	0.71	95.29	0.81
23	98.10	96.54	95.43	1.11	95.37	1.17	95.39	1.15	95.29	1.25
24	98.05	96.62	95.43	1.19	95.37	1.25	95.39	1.23	95.29	1.33
25	98.00	96.30	95.43	0.87	95.37	0.93	95.39	0.91	95.29	1.01

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

MH ID	Road Grade (m)	USF (m)	Catastrophic HGL and USF – HGL Clearance							
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
			HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
26	98.10	96.34	95.43	0.91	95.37	0.97	95.39	0.95	95.29	1.05
27	97.92	95.75	95.43	0.32	95.37	0.38	95.4	0.35	95.29	0.46
3	97.89	N/A	95.40	-	95.34	-	95.37	-	95.26	-
30	98.01	95.90	95.43	0.47	95.37	0.53	95.4	0.50	95.29	0.61
31	97.52	95.77	95.47	0.30	95.41	0.36	95.44	0.33	95.33	0.44
32	97.68	95.90	95.47	0.43	95.41	0.49	95.44	0.46	95.33	0.57
33	97.62	96.00	95.43	0.57	95.37	0.63	95.4	0.60	95.29	0.71
35	97.97	N/A	95.45	-	95.39	-	95.42	-	95.31	-
35A	97.94	96.10	95.44	0.66	95.38	0.72	95.41	0.69	95.3	0.80
36	98.67	96.52	95.73	0.79	95.73	0.79	95.73	0.79	95.73	0.79
37	99.34	97.12	96.39	0.73	96.39	0.73	96.39	0.73	96.39	0.73
38	99.55	97.79	96.57	1.22	96.57	1.22	96.57	1.22	96.57	1.22
39	98.03	N/A	95.51	-	95.45	-	95.48	-	95.37	-
39A	97.97	96.36	95.51	0.85	95.45	0.91	95.48	0.88	95.37	0.99
39B	98.01	96.22	95.51	0.71	95.45	0.77	95.48	0.74	95.37	0.85
3A	97.75	N/A	95.40	-	95.34	-	95.37	-	95.26	-
3B	97.66	95.79	95.40	0.39	95.34	0.45	95.37	0.42	95.26	0.53
3C	97.53	95.74	95.40	0.34	95.34	0.40	95.37	0.37	95.26	0.48
4	98.19	96.40	95.41	0.99	95.35	1.05	95.37	1.03	95.27	1.13
40	98.10	96.36	95.56	0.80	95.5	0.86	95.53	0.83	95.42	0.94
41	98.38	96.39	95.61	0.78	95.55	0.84	95.57	0.82	95.47	0.92
42	99.25	97.19	95.65	1.54	95.59	1.60	95.62	1.57	95.51	1.68
43	99.19	97.48	95.66	1.82	95.6	1.88	95.63	1.85	95.52	1.96
44	99.85	97.66	95.71	1.95	95.7	1.96	95.7	1.96	95.7	1.96
45	100.27	98.34	95.97	2.37	95.97	2.37	95.97	2.37	95.97	2.37
46	100.27	98.29	96.06	2.23	96.06	2.23	96.06	2.23	96.06	2.23
47	100.49	98.14	96.41	1.73	96.41	1.73	96.41	1.73	96.41	1.73

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

MH ID	Road Grade (m)	USF (m)	Catastrophic HGL and USF – HGL Clearance							
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
			HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
48	100.46	98.35	96.73	1.62	96.73	1.62	96.73	1.62	96.73	1.62
49	100.59	N/A	96.71	-	96.71	-	96.71	-	96.71	-
5	98.63	96.68	95.43	1.25	95.43	1.25	95.43	1.25	95.43	1.25
50	100.41	98.55	96.96	1.59	96.96	1.59	96.96	1.59	96.96	1.59
51	100.21	98.48	97.23	1.25	97.23	1.25	97.23	1.25	97.23	1.25
52	97.61	N/A	95.46	-	95.4	-	95.43	-	95.32	-
53	97.65	N/A	95.46	-	95.4	-	95.43	-	95.32	-
54	97.63	N/A	95.47	-	95.41	-	95.44	-	95.33	-
54A	97.67	95.77	95.47	0.30	95.41	0.36	95.44	0.33	95.33	0.44
54B	97.70	95.77	95.47	0.30	95.41	0.36	95.44	0.33	95.33	0.44
54C	97.66	95.94	95.47	0.47	95.41	0.53	95.44	0.50	95.33	0.61
54D	97.69	95.95	95.47	0.48	95.41	0.54	95.44	0.51	95.33	0.62
54E	97.54	N/A	95.47	-	95.41	-	95.44	-	95.33	-
54F	98.10	95.84	95.47	0.37	95.41	0.43	95.44	0.40	95.33	0.51
54G	98.17	95.95	95.50	0.45	95.5	0.45	95.5	0.45	95.5	0.45
55	98.09	N/A	95.47	-	95.41	-	95.44	-	95.33	-
56	98.16	96.32	95.48	0.84	95.42	0.90	95.44	0.88	95.34	0.98
57	98.13	96.38	95.48	0.90	95.42	0.96	95.45	0.93	95.34	1.04
58	98.24	96.26	95.55	0.71	95.55	0.71	95.55	0.71	95.55	0.71
59	97.99	N/A	95.48	-	95.42	-	95.44	-	95.34	-
6	98.67	N/A	95.52	-	95.52	-	95.52	-	95.52	-
60	98.23	96.14	95.48	0.66	95.42	0.72	95.45	0.69	95.34	0.80
61	98.13	96.39	95.48	0.91	95.42	0.97	95.45	0.94	95.34	1.05
62	97.95	96.59	95.48	1.11	95.42	1.17	95.45	1.14	95.34	1.25
63	98.15	N/A	95.48	-	95.42	-	95.45	-	95.34	-
64	97.29	N/A	95.49	-	95.43	-	95.45	-	95.35	-
65	97.56	95.77	95.47	0.30	95.41	0.36	95.44	0.33	95.33	0.44

MH ID	Road Grade (m)	USF (m)	Catastrophic HGL and USF – HGL Clearance							
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
			HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
66	97.47	95.60	95.49	0.11	95.43	0.17	95.45	0.15	95.35	0.25
67	97.58	95.60	95.50	0.10	95.44	0.16	95.47	0.13	95.36	0.24
68	97.49	95.85	95.51	0.34	95.45	0.40	95.47	0.38	95.37	0.48
69	97.56	95.80	95.51	0.29	95.45	0.35	95.47	0.33	95.37	0.43
7	99.11	96.99	96.01	0.98	96.01	0.98	96.01	0.98	96.01	0.98
70	97.95	95.80	95.51	0.29	95.45	0.35	95.47	0.33	95.37	0.43
8	100.21	97.69	97.18	0.51	97.18	0.51	97.18	0.51	97.18	0.51
80	100.15	98.14	96.08	2.06	96.08	2.06	96.08	2.06	96.08	2.06
81	100.28	98.35	96.45	1.90	96.45	1.90	96.45	1.90	96.45	1.90
82	100.35	N/A	96.47	-	96.47	-	96.47	-	96.47	-
9	99.23	97.44	96.21	1.23	96.21	1.23	96.21	1.23	96.21	1.23

As can be seen in the above table, the worst-case annual HGL (Scenario 1) remains below the proposed USF elevations across the proposed development.

Table 18: Normal Operating Conditions Sanitary HGL

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
10	99.43	97.51	96.33	1.18
11	100.75	97.69	96.90	0.79
12	100.60	98.50	97.04	1.46
13	100.23	98.46	97.30	1.16
14	97.61	N/A	92.54	-
16	97.35	N/A	92.88	-
17	97.29	N/A	92.96	-
17A	97.32	N/A	94.32	-
17B	97.37	95.68	94.68	1.00

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
18	97.17	N/A	93.19	-
18A	97.65	95.69	93.57	2.12
18B	97.09	N/A	93.19	-
19	97.43	95.63	93.30	2.33
1A	96.22	N/A	88.79	-
1B	96.60	N/A	88.62	-
1C	95.30	N/A	87.66	-
2	97.46	N/A	89.01	-
20	97.50	95.63	93.52	2.11
20A	97.37	N/A	94.01	-
21	97.48	95.78	93.70	2.08
22	97.96	N/A	91.18	-
22A	97.83	96.10	94.33	1.77
22B	97.81	96.10	94.87	1.23
23	98.10	96.54	94.40	2.14
24	98.05	96.62	94.47	2.15
25	98.00	96.30	94.69	1.61
26	98.10	96.34	95.01	1.33
27	97.92	95.75	93.89	1.86
3	97.89	N/A	91.12	-
30	98.01	95.90	94.30	1.60
31	97.52	95.77	94.45	1.32
32	97.68	95.90	94.85	1.05
33	97.62	96.00	94.62	1.38
35	97.97	N/A	91.43	-
35A	97.94	96.10	91.29	4.81
36	98.67	96.52	95.73	0.79
37	99.34	97.12	96.39	0.73
38	99.55	97.79	96.57	1.22
39	98.03	N/A	93.67	-
39A	97.97	96.36	94.43	1.93
39B	98.01	96.22	94.69	1.53
3A	97.75	N/A	94.19	-

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
3B	97.66	95.79	94.57	1.22
3C	97.53	95.74	94.85	0.89
4	98.19	96.40	94.10	2.30
40	98.10	96.36	93.94	2.42
41	98.38	96.39	94.73	1.66
42	99.25	97.19	95.10	2.09
43	99.19	97.48	95.17	2.31
44	99.85	97.66	95.71	1.95
45	100.27	98.34	95.98	2.36
46	100.27	98.29	96.06	2.23
47	100.49	98.14	96.41	1.73
48	100.46	98.35	96.73	1.62
49	100.59	N/A	96.71	-
5	98.63	96.68	95.44	1.24
50	100.41	98.55	96.96	1.59
51	100.21	98.48	97.23	1.25
52	97.61	N/A	91.65	-
53	97.65	N/A	91.74	-
54	97.63	N/A	91.84	-
54A	97.67	95.77	94.00	1.77
54B	97.70	95.77	94.28	1.49
54C	97.66	95.94	94.55	1.39
54D	97.69	95.95	95.08	0.87
54E	97.54	N/A	94.79	-
54F	98.10	95.84	95.08	0.76
54G	98.17	95.95	95.50	0.45
55	98.09	N/A	92.02	-
56	98.16	96.32	92.71	3.61
57	98.13	96.38	95.18	1.20
58	98.24	96.26	95.56	0.70
59	97.99	N/A	92.78	-
6	98.67	N/A	95.53	-
60	98.23	96.14	94.58	1.56

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
61	98.13	96.39	94.66	1.73
62	97.95	96.59	94.88	1.71
63	98.15	N/A	92.23	-
64	97.29	N/A	92.40	-
65	97.56	95.77	94.88	0.89
66	97.47	95.60	94.05	1.55
67	97.58	95.60	94.40	1.20
68	97.49	95.85	94.67	1.18
69	97.56	95.80	94.70	1.10
7	99.11	96.99	96.02	0.97
70	97.95	95.80	94.93	0.87
8	100.21	97.69	97.18	0.51
80	100.15	98.14	96.08	2.06
81	100.28	98.35	96.45	1.90
82	100.35	N/A	96.48	-
9	99.23	97.44	96.22	1.22

The above table shows that the 0.3 m required clearance to the normal operating condition HGL is achieved across the proposed development.

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

CONCLUSIONS

POTABLE WATER

Based on the findings of the report, the proposed change to the draft plan does not impact the overall potable water results. The proposed network can service the development area and with the use of pressure reducing valves will meet all servicing requirements as per City of Ottawa standards under typical demand conditions (peak hour and average day conditions), as well as under emergency fire demand conditions (maximum day + fire flow) during the ultimate development conditions.

STORMWATER MANAGEMENT

The proposed stormwater management plan is in compliance with the goals specified in the background reports and the 2012 City of Ottawa Sewer Guidelines. Inlet control devices are proposed to limit inflow from the site area into the minor system to the 2-year for local streets and to the 5-year storm for collector roads based on City of Ottawa IDF curves. The worst-case 100-year HGL remains 0.3 m below proposed USFs across the site. All dynamic surface water depths are less than 0.35 m during the 100-year storm event. Quality control and further quantity control of runoff from the proposed development will be provided in the ultimate KW Pond 5.

The proposed draft plan changes do not impact the previously approved SWM design.

SANITARY SERVICING

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage for the site and external tributary areas. The proposed network connects to the approved sanitary sewer system within the first registration phase of the development that discharges into the existing Maple Grove Trunk sanitary sewer which will ultimately outlets to the Kanata West Pump Station (KWPS). The proposed drainage pattern is in accordance with the KWMSS.

The worst-case annual HGL remains below the proposed USF elevations across the proposed development.

Regards,

Stantec Consulting Ltd.

Ana Paerez P.Eng.
Senior Water Resources Engineer
Phone: 506 857 8607
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Dustin Thiffault P.Eng.
Project Engineer
Phone: 613 724 4385
Dustin.Thiffault@stantec.com

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Attachment: Appendix A: Potable Water Calculations and Background, Appendix B: SWM Calculations and Background, Appendix C: Sanitary Calculations and Background, Appendix D: Draft 4M-Plan, Appendix E: Drawings

wz document1

Appendix G Summary of Comments and Responses

Stantec Consulting Ltd.
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

February 04, 2026

Project/File: 160402165

John Bernier, MCIP, RPP
Development Review West,
City of Ottawa,
110 Laurier Ave. West,
Ottawa, ON

Dear John,

Reference: Complex Site Plan Control – 815 Roger Griffiths Avenue– Formal Review Comments

Please see below response to the engineering comments received on November 7, 2025 and stormwater comments received December 2, 2025.

November 7, 2025 City engineering comments:

3. The Phase I Environmental Site Assessment Update is dated June 02, 2025 however, the engineer's stamp is dated 2019.

   R/ Please refer to Phase 1 ESA (dated 2 June 2025); date of engineer's stamp has been updated.

4. The Servicing and Stormwater Management report must be stamped by a Professional Engineer, licensed in Ontario.

   R/ Noted. The report has been stamped for this submission.

5. Considering the proposed watermain dead-ends, please include a water age analysis in the servicing and stormwater management report.

   R/ Water Age Analysis is included in Appendix A and referenced in the water section of the report. Water age within the development has been calculated below 4 hrs and is therefore not expected to present any concerns.

6. Through internal coordination, it's been confirmed that City standard W3 will be re-integrated in the City's standard drawings. The City requires DMA chambers to be installed as per standard W3. Additionally, as the private system will be looped, only one DMA chamber is required for the development. The water valve must be installed within the chamber. The second watermain (without DMA chamber) must have its isolation valve at the property line. Please revise the servicing plan accordingly.

R/ The watermain loop between SP1-a and SP1-b has been removed. DMA chambers as per W3 have been included for both proposed connections.

7. The water meters must be in a common room near the water service entry for access purposes

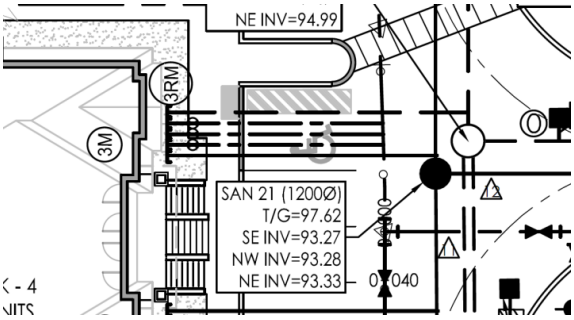
   R/ Terrace Flats: meters will be installed in a concealed closet in the lower level unit with all three meters in the same closet; this has been an acceptable approach approved by BCS for this product.

   Apartments: service is entering the mechanical room which is a common area.

8. The dead-end mains must include means to provide adequate flushing as per the City of Ottawa Water Distribution Guidelines. Flushing hydrants are the City's standard to meet this requirement. Any other alternative must be shown on the plan including relevant details for review.

   R/ Watermain dead end's have been revised to utilize Ottawa Std. Detail W37.2 to minimize water age.

9. There is not much separation between the sanitary service and maintenance hole. Could the maintenance hole be repaired/replaced without impacting the sewer lateral?



   R/ The sanitary service has been shifted to provide more clearance from the maintenance hole.

10. The maintenance holes within proposed ponding areas must be equipped with watertight lids. Please include a note on the servicing plan or notes and legend

    R/ The note has been included on drawing NL-1 Storm and Sanitary sewers note 18.

11. SAN 20 and 1 require drop pipes

    R/ Sanitary sewer inverts have been revised to reduce the drop to less than 0.6m so drop pipes are not required.

12. The uncontrolled areas draining towards Maple Grove must be controlled to the pre-development release rates for all storm events. Please add this to the stormwater management criteria

    R/ The stormwater management criteria has been updated accordingly. A comparison of post to pre-development peak flows from site areas discharging to Maple Grove Road has

been added to section 5.4.4 of the report to show that the uncontrolled peak flows discharging to Maple Grove under post-development conditions are less than pre-development rates.

13. Please demonstrate that the existing ICDs within Roger Griffiths and Ploughshare Rd are still adequately sized to collect uncontrolled discharge from the property. What's the impact to the required ponding depths within the ROW?

    R/ The Kanata West subdivision model has been updated to reflect the uncontrolled areas being directed to Roger Griffiths Avenue and Ploughshare Road and the results for the stormwater system downstream of the proposed development have been included in the report. Surface ponding depths are within acceptable limits so ICD's have not been modified within the subdivision.

14. Demonstrate that the existing ditch and culvert within Maple Grove Road has capacity for the proposed discharge

    R/ Please see response to Comment #12. Post development release rates from site areas to Maple Grove are less than pre-development values so no negative impacts are anticipated on the downstream infrastructure.

15. The stormwater modelling files are being reviewed separately by the Infrastructures and Water services. Any further comment will be shared as soon as received.

    R/ Noted.

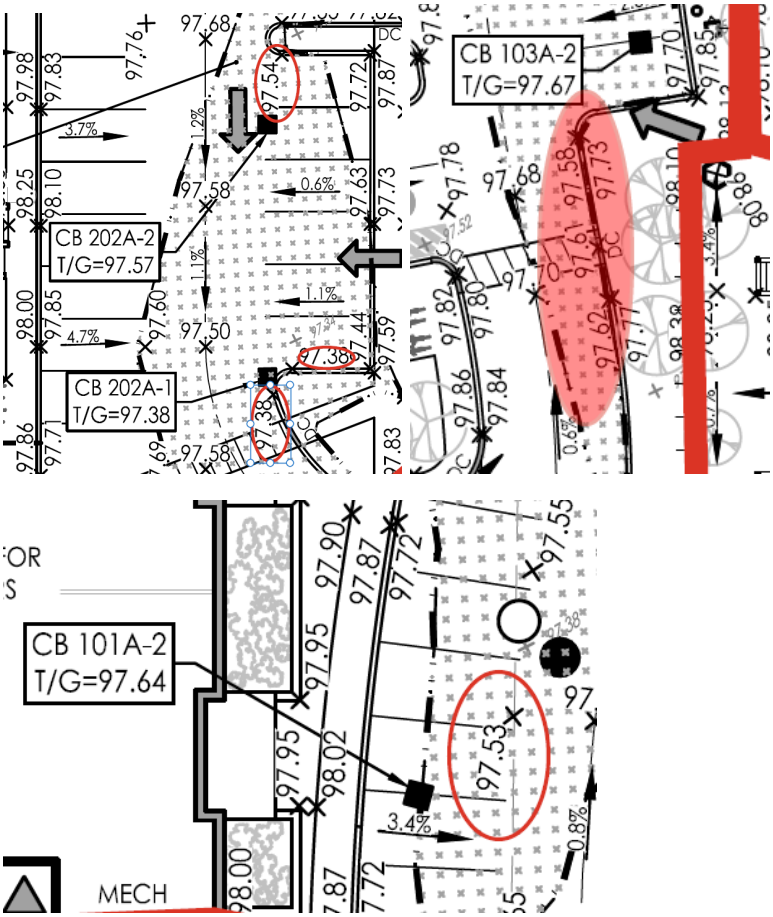
16. Please show the roof downspouts locations on the Grading Plan

    R/ Approximate downspout locations have been added to the grading plan as confirmed by the architect. Refer to the architectural plans for additional details.

17. Please raise the elevations below to allow for positive drainage towards the catch basins.

    R/ Elevations have been revised to provide positive drainage to the low point catch basin flagged for review (CB 202A-1). Please note that catch basins CB 202A-2, CB 103A-2 and CB 101A-2 are not intended as structures for surface drainage capture. These structures are for access and maintenance to the underground stormwater storage pipes.

Reference: **temp**

18. 

19. Retaining walls higher than 1.0m must be designed and stamped by geotechnical and structural professional engineers. The design must confirm that the proposed retaining walls will have a factor of safety of at least 1.5 against global instability and provide sufficient details to support that conclusion. Refer to the City of Ottawa Slope Stability Guidelines for reference. All portions for the wall, including the footings must remain within private property.

    R/ Noted. Structural design for walls higher than 1.0m will be provided under separate submission.

20. The proposed landscape plan shows pavers within the amenity area. Has that been accounted for in the stormwater management design?

    R/ Yes, the stormwater management design has accounted for the hard surface (pavers) within the amenity area through the use of conservative runoff coefficients throughout the proposed site.

21. Please ensure all detail drawing are up to date. There is a July 2025 version of standard SC1.4

    R/ Details have been updated to the latest revision.

22. Please update all drawings with the plan number 19383 and the application number (D07-12-25-0108)

    R/ Revised.

Feel free to contact Abi Dieme, Infrastructure Project Manager

November 3, 2025 MCVA comments:

Comment -- Overall

The Site Plan Control application indicates uncontrolled runoff from the site that discharges, both directly and indirectly, into the Maple Grove Road right-of-way (ROW) ditch system. This runoff ultimately discharges through the roadside ditch to the Carp River, bypassing the Kanata West SWM Pond 5. Although the volume of runoff from this site is relatively small, it still contributes to the overall flow and volume in the Carp River. Uncontrolled discharges from this and similar developments throughout the watershed, both existing and future, have a cumulative effect on flooding and erosion within the Carp River system, impacts that have become increasingly evident over time.

While this site may contribute less than 120 L/s during a 100-year storm event, the cumulative effect of multiple sites releasing uncontrolled flows of similar magnitude (e.g., ten sites) would result in an additional 1.2 m^3/s to the Carp River. Therefore, we do not support the proposal to discharge uncontrolled flow to the Carp River. We request that measures be implemented to capture and manage the uncontrolled runoff currently proposed to be directed, directly or indirectly, to Maple Grove Road.

R/ A comparison of post to pre-development peak flows from site areas discharging to Maple Grove Road has been added to section 5.4.4 of the report to show that the uncontrolled peak flows discharging to Maple Grove under post-development conditions are less than pre-development rates.

Comments – Detailed

1. It understood that the storm servicing for the Kanata West subdivision and Kanata West SWM Pond 5 was determined and documented in other reports. Appendix F of the Servicing and Stormwater Management Report provides an excerpt from the Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road - Servicing and Stormwater Management Report (Stantec, May 2022). This is the second registration of the subdivision, and it is understood the servicing details of this site (Block 1) is documented in the first registration. It is unclear from the supporting documentation whether Block 1 was assumed to be fully contained and captured in the subdivision and SWM Pond 5 catchment or if uncontrolled flow from Block 1 was assumed at that stage. Please provide additional information such as drainage area plans, PCSWMM schematics, and appropriate report excerpts, etc., that link this site design with the overall subdivision design and any uncontrolled off-site drainage assumptions.

   R/ The Kanata West subdivision model has been updated to reflect the uncontrolled areas being directed to Roger Griffiths Avenue and Ploughshare Road and the results for the stormwater system downstream of the proposed development have been included in the

report. Surface ponding depths and HGL's are within acceptable limits no negative impacts are anticipated within the subdivision downstream of the proposed development.

2. Those areas of the site, if it has been clearly demonstrated cannot be captured by the internal grading or minor storm system, are still proposed to sheet flow into the Maple Grove Road ROW, into the lands containing the Kanata West Pump Station, Ploughshare Road ROW and Roger Griffiths Avenue ROW.

    a. Please clearly state in the report where each uncontrolled area is discharging and provide it on a plan (drainage plan and provide the PCSWMM model schematic).

    R/ The table has been revised to indicate the discharge locations. Please refer to drawing SD-1 for a plan view of the drainage areas.

    b. Demonstrate that the receiving storm system accounted for this uncontrolled flow from the May 2022 report or the first registration of the subdivision.

    R/ Refer to response to MVCA comment #1.

    c. As noted in Comment – Overall, we do not support the proposal for uncontrolled flow, directly or indirectly, to Maple Grove Road unless it can be demonstrated that the uncontrolled flow originally proposed in previous servicing studies.

    R/ A comparison of post to pre-development peak flows from site areas discharging to Maple Grove Road has been added to section 5.4.4 of the report to show that the uncontrolled peak flows discharging to Maple Grove under post-development conditions are less than pre-development rates.

    d. It is noted in Section 5.4 of the Site Servicing and Stormwater Report that the "areas discharging off-site are small, mostly landscaped areas with a short distance to the outlet of the Carp River, it is anticipated that they will have a negligible impact on existing downstream infrastructure." Please demonstrate the conclusions to this statement. As noted previously, MVCA has concerns with uncontrolled flow, previously unaccounted for, bypassing infrastructure it was intended to be serviced by and the cumulative impact of those flows on the recipient watercourse.

    R/ A comparison of post to pre-development peak flows from site areas discharging to Maple Grove Road has been added to section 5.4.4 of the report to show that the uncontrolled peak flows discharging to Maple Grove under post-development conditions are less than pre-development rates.

3. Please provide additional arrows on the Drawing EX-1 Existing Conditions Plan that indicate the current surface flow direction within the site and where it currently outlets.

R/ An existing conditions storm drainage plan (ESD-1) has been added to the drawing set.

4. Drawing ECDS-1 Erosion Control Plan and Detail Sheet within the notes, please provide a frequency of inspection of ESC measures as it relates to storm events, weekly and storm events) and timelines for repairs to be made along with requirement for material to be on-site or available for any ESC repairs. It should also be noted that the ESC plan is a living document which may be adjusted as construction and site conditions require.

   R/ The Erosion Control Plan serves as a guidance document intended to inform the contractor in the preparation of the site-specific erosion and sediment control plan. Drawing ECDS-1 identifies the requirements for daily inspection of erosion and sediment control measures, outlines the need for timely repairs as required, and specifies that additional details are to be provided by the contractor in their finalized Erosion Control Plan, in accordance with the notes included on drawing NL-1. The following note has been added to Drawing ECDS-1.

   The Contractor will also be required to complete inspections and guarantee the proper performance of their erosion and sediment control measures at least after every rainfall. The inspections are to include:

   - **Verification that water is not flowing under silt barriers.**
   - **Cleaning and changing the sediment traps placed on catchbasins**

5. Review and comments related to water quality are deferred to the municipality since they are outside of MVCA's review mandate.

   R/ Noted.

<u>December 2, 2026 City SWM comments:</u>

Richcraft Kanata West Block 1 – 815 Roger Griffiths Avenue, July 30, 2025

1. Section 5.2.1 – The storm criteria in the 2022 report requires a maximum minor system capture rate of 299 L/s, and that 100-year major system flows be controlled via on-site storage (no overflows). Please address the major system flows in this report compared to the criteria set by the 2022 report. Furthermore, Section 5.4.3 states "The SWM design for the Kanata West subdivision assumed that major system peak flows from the proposed site would discharge to Ploughshare Road." Table 5.10 shows major flows from the site. Are there adjustments that are needed to be made to the icd's on Ploughshare and Robert Grant. Robert Grant is an arterial road are the design criteria for arterial roads maintained with the additional flow?

   R/ The Kanata West subdivision model has been updated to reflect the uncontrolled areas being directed to Roger Griffiths Avenue and Ploughshare Road and the results for the stormwater system downstream of the proposed development have been included in the report. Surface ponding depths are within acceptable limits so ICD's have not been modified within the subdivision.

2. Section 5.3.3 and Figure 5.1 - The report text states that flows exceed node storage volumes overflow into road sags represented by irregular conduits. Roads have not been modelled in the model via irregular conduits. Please update.

R/ The report has been revised to reflect that weirs have been used in the model to represent the overland road network.

3. The model and drawings include 900 mm storm sewer pipes between CB pairs. Please include text addressing these pipes in the report.

   R/ Refer to section 5.4.1 of the report which has been revised to include additional text describing the underground storage pipes. Please specify what is required if further information is needed.

4. Section 5.4.4 – The 2022 report and 2025 addendum both included the 1.47 ha area for Block 1 (L121B) for the analysis that resulted in the 299 L/s release rate. The report states that the Kanata West subdivision model did not encompass areas discharging to OF5, OF6, OF7. Please clarify why flows from these areas are not being considered if they are included in the subdivision model.

   R/ These areas have been considered in the post to pre-development comparison for the uncontrolled drainage directed to Maple Grove Road, however, they are not considered against the target release rate for the site as they are not being directed to the Ploughshare Road trunk sewer as assumed in the Kanata West subdivision model.

5. Section 5.5 - Even though no infiltration requirements were placed on Block 1, please provide text on practices that will promote infiltration on this site where the opportunity exists. As per the KWMSS, all developments in the Kanata West Community are required to provide infiltration measures to meet pre-development infiltration rates.

   R/ Infiltration requirements established in the Kanata West Master Servicing Study have been satisfied through the overall subdivision design, based on site configuration, imperviousness, and the feasibility of implementing infiltration measures. The proposed site is largely impervious, limiting opportunities for additional infiltration practices. Furthermore, roof runoff is conveyed directly to the storm sewer system via laterals, restricting the ability to implement best management practices such as directing roof drainage to landscaped areas.

6. Section 5.3.2. The modeling rationale states that percent imperviousness was calculated based on soft and hard surfaces, please show sample calculations. Furthermore, We disagree with the statement that most of the uncontrolled areas to Robert Grant are pervious. It is predominantly roof and hard patios and walkways.

   R/ Conservative runoff coefficients were assumed for the controlled subcatchments internal to the proposed site to account for potential modifications during future applications (building permit, etc.). Actual runoff coefficients have been calculated for the uncontrolled areas along the boundaries of the site and have been provided in section 5.4.4 of the report.

7. There are some discrepancies between the invert elevations in Table 5.4 and the drawings.

   R/ The table has been reviewed and updated as required. Please note, where low point storage nodes are at the upstream end of a storage pipe, the upstream storage pipe invert has been assigned to the storage node to eliminate negative offset errors in PCSWMM.

8. The USF elevation for the MH 203 row in Table 5.8 does not appear to be accurate.

R/ The invert has been updated to match the drawings.

9. Are the Limitations and Sign-Off page incomplete for signatures? The reviewed by and approved names are not signed, and there is a signature box left on the page.

   R/ Revised per Comment

10. Please verify and include in the report that the outlet elevations from the site are at least 15 cm higher than the major flow depths on Ploughshare Road.

    R/ The major system outlets for the sites have been set at or above the 100 year flow depth on Ploughshare Road. Confirmation has been added to section 5.4.3 the report.

11. Revise table 5.9 to include a column which will identify where these are on the storm drainage drawing. Same comment applies for 5.10 that refers to OF1 to OF7. The reader should not have to refer to the model to find out where these areas are

    R/ Associated drainage areas have been added to both tables for reference. Refer to drawing SD-1 for the location of the drainage areas.

12. Section 8, the fact that it is private property is not a reason to be exempt from an ECA. The rational whether an ECA is required or not needs to be expanded.

    R/ The report has been updated to indicate that the proposed services are connecting into existing sewer infrastructure, and service a single property parcel of non-industrial nature.

13. Section 10.3 fails to mention uncontrolled flow on the east side of the site. Also, in this section this statement is confusing. “Small uncontrolled areas will drain to the Maple Grove Road and Roger Griffiths Avenue Rights-of-way as per existing conditions.” Did the plans for this area assume these uncontrolled areas to flow here?
    R/ The text has been updated to refer to the post to pre-development peak flows comparison which demonstrates a reduction in flow under the post-development conditions.

PCSWMM Model, July 2025

14. The average surface slope of 33% for UNC-2 seems a bit high for this subcatchment based on the grading plan. Please review and confirm if this is representative of the catchment.

    R/ The slope for UNC-2 has been revised to 20% to more accurately reflect the proposed grading.

15. Why is the zero impervious% parameter set as 0? Consider assigning values to this parameter to better represent areas such as sloped rooftop that have zero depression storage.

    R/ The impervious depression storage parameter is as per typical values in 5.4.5.4 of the OSDG. The depression storage parameter is a term that has been calibrated through prior iterations of the design guidelines at a high level and is consistent with modeled approaches at the draft plan / master servicing level.

16. Should there be a fixed stage for the major system outfall on Ploughshare Road to ensure that the major system ponding on Ploughshare Road worse case scenario doesn't exceed the allowable ponding depth on the road?

    R/ As shown on the grading plan, the spill elevation for the site is at or above the 100-year major system elevation on Ploughshare so having a fixed stage would not impact the results.

Drawings, July 2025

17. GP-1: 100-year ponding limits near Building 2 overtop the parking lot curbs and are shown to pond over the curb ramp, sidewalk area, and bike space area. The ponding limits south of the utility building also overtops the curb. Please revise grading so that ponding does not overtop onto pedestrian walkways.

    R/ Ponding within pedestrian walkways has been minimized to the extent possible while adhering to the site grading constraints. Only a minimal area (+-10 m2) remains adjacent to the CICB 101A-1 low point due to accessibility sloping constraints at the depressed curb.

18. NL-1: Text overlaps for "Best Management Practices" title.
    R/ Revised.

Sincerely,

Stantec Consulting Ltd.

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Attachment: [Attachment]

c.