Riverside South Block 167

- 955 Borbridge Avenue

Servicing and Stormwater Management Report

January 31, 2025

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1 Introduction

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 167 (955 Borbridge Avenue) of the Riverside South Phase 17-1B subdivision. The subject site is within the City of Ottawa, bound by Borbridge Avenue to the north, Ralph Hennessy Avenue to the east, Axis Way to the south, and Compass Street to the west (refer to **Figure 1.1** below).

Figure 1.1 Key Map of Riverside South Subdivision Phase 17-1B Block 167

The subject property is currently zoned R4Z (Residential Fourth Density) and occupies 1.45 ha of land. The site is currently undeveloped. The proposed development consists of ninety-three (93) stacked townhouse units as shown in the draft plan included in **Appendix E**.

Servicing and stormwater management constraints for the block were identified as part of the previously approved *Design Brief for the Riverside South Phase 17-1B 4775 & 4875 Spratt Road Riverside South Community* (IBI Group, 2022). 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.
- Design Brief for the Riverside South Phase 17-1B 4775 & 4875 Spratt Road Riverside South Community, IBI Group, March, 2022.
- Geotechnical Investigation: Proposed Residential Development 955 Borbridge Avenue, Ottawa, Ontario, Paterson Group, October 18, 2024 .
- Pre-Consultation: Meeting Feedback Proposed Site Plan Control Application – 955 Borbridge Avenue, City of Ottawa, September 27, 2024.

3 Potable Water Servicing

3.1 Background

The proposed development is located within Zone 2W2C of the City of Ottawa's water distribution system. The site will be fed by the 300mm diameter watermain on Borbridge Avenue and the 300mm diameter watermain on Ralph Hennessy Avenue to form a looped system.

3.2 Proposed Watermain Sizing and Layout

3.2.1 Connections to Existing Infrastructure

The proposed watermain alignment and sizing for the development is demonstrated on **Drawing SSP-1**. A 200mm diameter watermain is proposed to follow the alignment of the private roads within the subject property with a connection to the existing 300mm diameter watermain on Borbrdige Avenue and Ralph Hennessy Avenue at the two entrances to the 955 Borbridge site. **Figure 3.1** shows the location of the two (2) connection points to the existing watermain.

Figure 3.1 Proposed Watermain Layout and Pipe Diameters (mm)

3.2.2 Ground Elevations

Proposed ground elevations throughout the site range from approximately 97.28 m to 97.73 m at nodes in the watermain network.

Figure 3.2 Ground Elevations (m) at Nodes

3.2.3 Domestic Water Demands

The proposed site contains a total of ninety-three (93) stacked townhouse units, with an estimated total population of 251 persons. Refer to **Appendix A.1** 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 Residential Water Demands for 955 Borbridge

Unit Type	Units	Persons/Unit	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Townhouse Units	93	2.7	251	0.81	2.03	4.48

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.2** for detailed FUS calculations. The results of the fire flow calculations 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)
Two-bedroom Terrace	Two-storey building with twelve stacked units (worst case exposures: Block 3)	11,000	183

3.4 Hydraulic Analysis

Hydraulic modeling using PCSWMM was built by Stantec using the following boundary conditions:

1. Boundary conditions before and after the SUC Pressure Zone Reconfiguration at the Borbridge Avenue watermain across from the northern entrance to the site were provided by City of Ottawa staff.
2. Boundary condition before and after the SUC Pressure Zone Reconfiguration at the Ralph Hennessy Avenue watermain across from the eastern entrance to the site were provided by City of Ottawa staff.

The boundary conditions used for the hydraulic analysis are summarized in **Table 3.3**.

Table 3.3 Boundary Condtions for Connection Points for 955 Borbridge

Location	Before SUC Pressure Zone Reconfiguration			After SUC Pressure Zone Reconfiguration		
	Max. HGL (AVDY), Head (m)	PKHR, Head (m)	MXDY+FF (183 L/s), Head (m)	Max. HGL (AVDY), Head (m)	PKHR, Head (m)	MXDY+FF (183 L/s), Head (m)
1 – Borbridge Avenue (northern entrance to Block 167)	132.3	124.9	123.3	146.8	143.7	140.7
2 – Ralph Hennessey Street (eastern entrance to Block 167)	132.3	124.9	123.2	146.8	143.7	140.5

The anticipated pressures in this development were assessed to meet minimum 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 A3**.

3.4.1 Model Development

New watermains were added to 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 (**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 339-343 kPa (49.2-49.8 psi) prior to the SUC Pressure Zone Reconfiguration and 480-485 kPa (69.7-70.4 psi) after the SUC Pressure Zone Reconfiguration within the Block 167 site. Minimum pressures during PKHR conditions are anticipated to be approximately 265-270 kPa (38.5-39.3 psi) prior to the SUC Pressure Zone Reconfiguration and 450-455 kPa (65.3-66.0 psi) after the SUC Pressure Zone Reconfiguration for Block 167. Following the SUC Pressure Zone Reconfirguration, these pressures are below the maximum allowable pressure at the unit of 80 psi, therefore, pressure reducing valves (PRVs) are not required for the development.

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

Figure 3.3 Maximum Pressures in Block 167 (during AVDY Conditions after SUC Pressure Zone Reconfiguration)

Figure 3.4 Minimum Pressures (psi) in Block 167 During PKHR Conditions after SUC Pressure Zone Reconfiguration

3.4.1.2 Maximum Day Plus Fire flow

An analysis was carried out using the hydraulic model to determine if the proposed development, under maximum day demands, can achieve a fire flow of 11,000 L/min (183 L/s) while maintaining a residual pressure of 138 kPa (20 psi). This was accomplished using a steady-state maximum day demand scenario along with the automated fire flow simulation feature of PCSWMM. The available flows are shown in **Figure 3.5**.

Figure 3.5 Available Fire Flows (L/s) in Block 167 During MXDY Conditions after SUC Pressure Zone Reconfiguration

Using the proposed pipe layout and sizing, a fire flow of 11,000 L/min (183 L/s) can be achieved while maintaining at least 20 psi residual pressure at all locations upon development.

4 Wastewater Servicing

4.1 Background

As indicated in Design Brief for the Riverside South Phase 17-1B 4775 & 4875 Spratt Road Riverside South Community (IBI Group, 2022), the wastewater from the Riverside South Phase 17-1B development is conveyed to the existing 450mm diameter sanitary sewer on Ralph Hennessy Road via an extended 375mm gravity sewer. Wastewater from the Riverside South Phase 17-1B Development is ultimately conveyed to the River Road Pumping Station.

The design brief identifies MH 907A on Borbridge Avenue as being used to service the proposed site. MH 907A lies within a sewer branch immediately upstream of the connection to the 375mm sewer on Ralph Hennessy Avenue. The brief identified an assumed site area of 1.45ha and a population of 188.5 persons (130 persons/ha) for the development.

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
- 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

200mm diameter sanitary sewers are proposed throughout the site. Proposed SAN MH 1 is to be installed into the existing 300 mm sewer main on Borbridge Avenue to suit the proposed site access and serve as the sanitary outlet for the site. Sanitary flows will then be directed eastwards from Borbridge Avenue to Ralph Hennessy Avenue per background reports. The proposed sanitary sewer layout for the subject site is shown in **Drawings SSP-1** and **SA-1**. The sanitary sewer design sheet is included in **Appendix B.1**.

The proposed peak flows from 995 Borbridge are summarized in **Table 4.1** below.

Table 4.1 Sanitary Peak Flow at Proposed SAN MH 1

MH ID	Total Area (ha)	Population	Peak Flow (L/s)	Sewer Diameter (mm)
SAN MH 1, Block 167 contribution	1.45	251	3.3	200

The Design Brief for the Riverside South Phase 17-1B 4775 & 4875 Spratt Road Riverside South Community (IBI Group, 2022) assumes a peak flow generation of 2.7L/s for the sewer segment with discharge from the proposed 955 Borbridge site, with approximately 2.3L/s allotted for the site itself. Background information, including the IBI design brief, sanitary sewer design sheet, and the sanitary flow calculation based on the expected population, are provided in **Appendix F**.

The above table shows a 1.0 L/s increase in the expected sanitary peak flows over the 2.3L/s allotted as a result of higher anticipated population density. The residual capacity noted in the IBI Design Brief for the critical sewer run MH 908A – MH 909A is 13.22L/s, which demonstrates that the downstream sewer system maintains sufficient capacity to accept the relatively small increase in expected site sanitary peak discharge.

5 Stormwater Management and Storm Servicing

The proposed development encompasses approximately 1.45 ha of land within Block 167 of the Riverside South Phase 17-1B subdivision. The entire development is residential containing stacked townhouse units. As shown on **Drawing SD-1**, post-development minor system peak flows from the development will be discharged to an existing 1,650 mm diameter storm sewer on Borbridge Avenue. Emergency overland flows during storm events above that of the 100-year design storm event will be directed to Ralph Hennesy Avenue Right-of-Way and Rockmelon Street Right-of-Way, and ultimately discharging to Riverside South Community Pond 5 located northeast of the site. Stormwater quality control (80% TSS removal) is provided by RSC Pond 5, as described in the Design Brief for the Riverside South Phase 17-1B 4775 & 4875 Spratt Road Riverside South Community (IBI Group, 2022). Refer to **Appendix F** for the storm drainage plan and storm sewer design sheet for the Riverside South Phase 17-1B Subdivision (IBI Group, 2022).

In the existing condition, site runoff sheet flows overland to the east towards Ralph Hennessy Avenue. The site is currently undeveloped.

5.1 Background

IBI Group completed the Design Brief of the Riverside South Subdivision Phase 17-1B in March 2022. The design of storm drainage system and sewer network in the site accounted for development within the 955 Borbridge site.

Based on the IBI brief, the site minor system release rate is to be restricted to that of the previously modeled 5-year flow for the area, determined to be 320L/s. On-site quantity control storage is required to retain all runoff from the development from design storms up to and including the 100-year storm.

Flows are to be ultimately conveyed to RSC Pond 5 for quality and quantity control per Stormwater Management Report for the Design Brief for the Riverside South Phase 17-1B, (IBI Group, 2022).

Additional SWM criteria from this report are listed in the proceeding 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 Ottawa's Sewer Design Guidelines.

- Minimum time of concentration values applied for each subcatchment cannot be less than 10 minutes.
- Use of the Modified Rational Method to identify required quantity storage based on restricted minor system release rates (City of Ottawa).
- Quality control has been provided for the site via the existing RSC Pond 5.

Storm Sewer & Inlet Controls

- Proposed site to discharge to the existing 1650 mm diameter storm sewer on Borbridge Avenue, (Design Brief for the Riverside South Phase 17-1B 4775 & 4875 Spratt Road Riverside South Community, IBI Group, 2022).
- Minor system discharge rate from the entirety of Block 167 not to exceed 320 L/s in the 100-year event (Design Brief for the Riverside South Phase 17-1B 4775 & 4875 Spratt Road Riverside South Community, IBI Group, 2022).
- 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)

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 0.35m for design storm events (i.e., up to 100-year storm) (City of Ottawa).
- Minimum clearance depth of 0.30m to be provided from spill elevations to building envelopes in proximity of overland flow routes or ponding areas (City of Ottawa).
- Provide adequate emergency overflow conveyance off-site (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 Modelling

5.3.1 Allowable Release Rate

The allowable release rate from the 955 Borbridge Avenue site is based on the Design Brief for the Riverside South Phase 17-1B 4775 & 4875 Spratt Road Riverside South Community (IBI Group, March 2022), and noted as 320L/s for storm events up to and including the 100-year event.

5.3.2 Modelling Rationale

The Modified Rational Method was employed to assess the rate of runoff generated during post-development conditions. A time of concentration for the post-development areas (10 minutes) was assigned based on the relatively small site and its proximity to the existing drainage outlet for the site. Surface storage estimates were based on the final grading plan design (see **Drawing GP-1**). Peak flow rates to sewers have been calculated using the rational method as follows:

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

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

5.3.3 Storage Requirements

The site requires quantity control measures to meet the restrictive stormwater release criteria. The use of controlled surface and subsurface storage within a proposed subdrain trench are proposed to reduce site peak outflow to the allowable target release rate. As per City of Ottawa criteria, no surface ponding is permitted within the site during the 2-year storm event. Refer to **Appendix C** for the Modified Rational Method calculations which demonstrate that no surface storage is required in the 2-year event.

It is proposed to detain stormwater on the surface in parking lot areas using inlet control devices (ICDs) in associated catch basins. Additional runoff from storms in excess of the 100-year storm event that exceed available on-site storage will be directed overland towards the Ralph Hennessy Avenue ROW at the east and Rockmelon Street ROW at the southwest boundary of the site.

The Modified Rational Method was employed to determine the peak volume stored in the catch basins and surface storage areas. The site was subdivided into subcatchments (subareas) as defined by the proposed grades and the location, nature, or presence/absence of inlet control devices (ICDs). Each subcatchment was assigned a runoff coefficient based on the proposed finished surface. Further details can be found in Appendix C, while Drawing SD-1 illustrates the proposed subcatchments. The inlet control devices were sized based on the available target release rate from the site during the 2-year storm event. Storage volume and controlled release rates from the on-site catch basins during the 2 and 100-year events are summarized in the table below.

Table 5.1 2-Year and 100-Year Peak Surface Volume and Controlled Discharge Summary

Area ID	ICD (Circular Orifice)	2-Year Event			100-Year Event		
		Release Rate (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)	Release Rate (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)
L103A	140 mm	43.4	0.0	49.6	52.4	44.2	49.6
L104A	102 mm	23.9	0.2	33.6	26.0	26.6	33.6
L106A	140 mm	45.2	0.0	83.5	52.8	47.1	83.5
L107A	108 mm	26.5	0.0	50.8	29.5	28.5	50.8
L107B	102 mm	15.0	0.0	19.8	22.0	13.0	19.8

L108A	102 mm	23.0	0.0	37.3	26.4	22.9	37.3
L108B	102 mm	3.5	0.0	2.1	7.4	0.0	2.1

5.3.4 Uncontrolled Areas

Due to grading restrictions, four subcatchment areas have been designed without a storage component. Areas UNC1-3 are located at the perimeter of the site where tie-ins to existing property line grades cannot permit capture of runoff to the minor system. Peak discharges from uncontrolled areas have been considered in the overall SWM plan and have been balanced through overcontrolling ICDs within the proposed site to meet target levels.

Table 5.3 summarizes the 2 and 100-year uncontrolled release rates from the proposed development.

Table 5.2 Peak Uncontrolled 2-Year and 100-Year Release Rates

Storm Return Period	Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
2-year	UNC-1	0.07	0.53	10	7.9
	UNC-2	0.16	0.57	10	19.5
	UNC-3	0.04	0.63	10	5.4
100-year	UNC-1	0.07	0.66	10	23.0
	UNC-2	0.16	0.71	10	56.6
	UNC-3	0.04	0.79	10	15.6

5.4 Results and Discussion

The following section summarizes the key analysis results. For detailed calculations please refer to the Modified Rational Method sheet in **Appendix C**.

Table 5.4 summarizes the minor system peak discharge rate from the proposed 955 Borbridge Avenue for the 2 and 100-year storm events.

Table 5.3 Storm Event Peak Discharge Rates

	2-Year Peak Discharge (L/s)	100-Year Peak Discharge (L/s)
Controlled Discharge	184.5	216.7
Uncontrolled Sheet Flow	32.8	95.2
Total	**217.3**	**311.9**
Target	**320**	

The total release rate from the proposed 955 Borbridge Avenue site is anticipated to be less than the allowable rate during all storm events up the 100-year storm event.

6 Geotechnical Considerations and Grading

6.1 Geotechnical Investigation

A geotechnical investigation report for 955 Borbridge Avenue was completed by Paterson Group on October 18, 2024. Field testing consisting of the advancement of four (4) boreholes with a maximum depth of 5.9m throughout the subject site was completed on September 20, 2024. Data from a previous investigation carried out by Paterson including a total of two (2) test pits and three (3) test boreholes with a maximum depth of 5.7m was also taken into consideration. The geotechnical investigation report is included in **Appendix D.1**.

The site is undeveloped with surface covered by gravel and grass. The grade across the site is generally level at an elevation of approximately 96 m. The subsurface profile within Block 167 consisted of 0.3 to 1.1m fill consists of compact brown silty sand, sandy silt and silty clay with gravel and organics, about 3.6 to 4.8m glacial till was encountered underlying the fill consists of compact to very dense brown silty sand to sandy silt with gravel, cobble and boulders.

Groundwater levels were taken at the four (4) boreholes advanced in 2020. The long-term groundwater table is anticipated to be at a 3 to 4 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 stiff to firm silty clay, compacted silty sand to sandy silt, or engineered compacted fill, can be used for the proposed buildings.

Since no clay deposit was found on site, there will be no permissible grade raise restriction or geotechnical tree planting setback required for the 955 Borbridge Development

6.1.1 Proposed Pavement Structure

Tables 6.1 and 6.2 summarize the recommended pavement structures for the development.

Table 6.1 Recommended Pavement Structure for Local Road

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 Compacted to Min. 99% SPMDD
450	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 Driveway and 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 Compacted to Min. 99% SPMDD
300	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 300mm 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 surface 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 need 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 Block 167 is shown on Drawing GP-1. The proposed grading design for the Block 167 site directs the controlled overland flow from east half of the site toward Ralph Hennessy Avenue ROW and the controlled overland flow from the west half of the site toward Rockmelon Street ROW, as the emergency spill out outlet during major storm event that exceeded the 100-year level. A small North, and West portion of the site containing mostly landscape and grassed area drains uncontrolled towards existing Borbridge Avenue ROW. Another small section of mainly landscape area of proposed townhomes front yard drains uncontrolled towards Rockmelon Street ROW. 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 Borbridge Avenue to the North, Ralph Hennessy Avenue to the East and Rockmelon Street to the South.

All grading, in-filling and backfilling works are to be completed as per the geotechnical recommendations made in Paterson's geotechnical investigation report (summarized above in Section 6.1).

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 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). The Rideau Valley Conservation Authority (RVCA) will be circulated on this submission.

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 catch basins 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 955 Borbridge site is recommended to consist of a 200mm diameter watermain connecting to the existing 300mm diameter watermain on Borbridge Avenue and Ralph Hennessy Avenue at two connection points to loop the system.
- The proposed watermain network operates below the maximum pressure objective of 552 kPa (80 psi) in both the average day (AVDY) and peak hour (PKHR) conditions both before and after the SUC Pressure Zone Reconfiguration.
- During maximum day domestic demands with a fire flow demand of 11,000 L/min (183 L/s), the proposed watermain network is capable of providing sufficient fire flow while maintaining a residual pressure of 138 kPa (20 psi) in all areas within the development both before and after the SUC Pressure Zone Reconfiguration.

10.2 Wastewater Servicing

Wastewater from the proposed development will be conveyed to the existing sanitary sewer on Borbridge Avenue constructed as part of the Riverside South Phase 17-1B Development. The wastewater will ultimately be directed to the River Road Pumping Station.

200mm diameter sanitary sewers are proposed throughout the site. The capacity of the existing sanitary sewers on Ralph Hennessy Avenue and further downstream was verified with the estimated peak wastewater flows from the site and their relative increase from the estimates made in the Design Brief for the Riverside South Phase 17-1B 4775 & 4875 Spratt Road Riverside South Community (IBI Group, 2022). The analysis confirmed that there is sufficient capacity within the downstream sanitary sewer system to service the site.

10.3 Stormwater Management and Servicing

The proposed stormwater management plan is in compliance 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 inflow rates to the storm sewers to that of the 2-year runoff for the 955 Borbridge Avenue site as per City of Ottawa and background report design criteria. Emergency major system peak flows from the site for storm events above that of the 100-year design storm will be directed to Ralph Hennessy Avenue ROW and Rockmelon Street ROW, except for small uncontrolled areas to the north which will drain to Borbridge Avenue as per existing conditions.

Minor system peak flows will be directed to the existing 1650 mm diameter storm sewer on Borbridge Avenue. Quantity and quality control (80% TSS removal) of stormwater runoff will be provided at the downstream RSC Pond 5.

10.4 Grading

Proposed grading for the site directs emergency major system flows from events above that of the 100-year design storm event 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, in-filling and backfilling works are to be completed as per the geotechnical recommendations made in the background geotechnical investigation report (summarized above).

10.5 Approvals/Permits

An MECP Environmental Compliance Approval (ECA) may be required for the installation of the proposed storm and sanitary sewers within the private site should part lot control be pursued to sever the property into separate parcels at a later date. 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 Rideau Valley Conservation Authority (RVCA) will need to be consulted in order 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 Domestic Water Demand Calculations

Riverside South Phase 17 - Block 167, Ottawa, ON - Domestic Water Demand Estimates

Site Plan provided by M.David Blakely Architect Inc. Rev 7
Project No. 160402058

Densities as per City Guidelines:		
Townhouse Row Units[1]		
Row	2.7	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)
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	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
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	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Block 7	9	24	280	4.7	0.08	11.8	0.20	26.0	0.43
Block 8	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Total Site :	**93**	**251**		**48.8**	**0.81**	**122.1**	**2.03**	**268.5**	**4.48**

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

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

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.2 FUS Calculation Sheets

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402058
Project Name: Riverside South Block Ph 17 - Block 167
Date: 11/11/2024
Fire Flow Calculation #: 1
Description: Block 1 (2-storey residential townhouses c/w basement)

Notes: Site Plan provided by M.David Blakely Architect Inc.

<table>
<tr><th>Step</th><th>Task</th><th colspan="10">Notes</th><th>Value Used</th><th>Req'd Fire Flow (L/min)</th></tr>
<tr><td>1</td><td>Determine Type of Construction</td><td colspan="10">Type V - Wood Frame / Type IV-D - Mass Timber Construction</td><td>1.5</td><td>-</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Determine Effective Floor Area</td><td colspan="5">Sum of All Floor Areas</td><td colspan="5"></td><td>-</td><td>-</td></tr>
<tr><td>313</td><td>313</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>625</td><td>-</td></tr>
<tr><td>3</td><td>Determine Required Fire Flow</td><td colspan="10">(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min</td><td>-</td><td>8000</td></tr>
<tr><td>4</td><td>Determine Occupancy Charge</td><td colspan="10">Limited Combustible</td><td>-15%</td><td>6800</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Determine Sprinkler Reduction</td><td colspan="10">None</td><td>0%</td><td rowspan="4">0</td></tr>
<tr><td colspan="10">Non-Standard Water Supply or N/A</td><td>0%</td></tr>
<tr><td colspan="10">Not Fully Supervised or N/A</td><td>0%</td></tr>
<tr><td colspan="10">% Coverage of Sprinkler System</td><td>0%</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Determine Increase for Exposures (Max. 75%)</td><td>Direction</td><td>Exposure Distance (m)</td><td>Exposed Length (m)</td><td>Exposed Height (Stories)</td><td>Length-Height Factor (m x stories)</td><td colspan="2">Construction of Adjacent Wall</td><td colspan="3">Firewall / Sprinklered ?</td><td>-</td><td>-</td></tr>
<tr><td>North</td><td>20.1 to 30</td><td>13</td><td>2</td><td>21-49</td><td colspan="2">Type V</td><td colspan="3">NO</td><td>2%</td><td rowspan="4">1360</td></tr>
<tr><td>East</td><td>> 30</td><td>0</td><td>0</td><td>0-20</td><td colspan="2">Type V</td><td colspan="3">NO</td><td>0%</td></tr>
<tr><td>South</td><td>20.1 to 30</td><td>33</td><td>2</td><td>61-80</td><td colspan="2">Type V</td><td colspan="3">NO</td><td>6%</td></tr>
<tr><td>West</td><td>10.1 to 20</td><td>25</td><td>2</td><td>41-60</td><td colspan="2">Type V</td><td colspan="3">NO</td><td>12%</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Determine Final Required Fire Flow</td><td colspan="11">Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min</td><td>8000</td></tr>
<tr><td colspan="11">Total Required Fire Flow in L/s</td><td>133.3</td></tr>
<tr><td colspan="11">Required Duration of Fire Flow (hrs)</td><td>2.00</td></tr>
<tr><td colspan="11">Required Volume of Fire Flow (m^3)</td><td>960</td></tr>
</table>

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec

Stantec Project #: 160402058
Project Name: Riverside South Block Ph 17 - Block 167
Date: 11/11/2024
Fire Flow Calculation #: 2
Description: Block 2 (2-storey residential townhouses c/w basement)

Notes: Site Plan provided by M.David Blakely Architect Inc.

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										-	-
		412	412									824	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min										-	9000
4	Determine Occupancy Charge	Limited Combustible										-15%	7650
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	26	2	41-60	Type V		NO			4%	3060
		East	10.1 to 20	13	0	0-20	Type V		NO			10%	
		South	10.1 to 20	33	2	61-80	Type V		NO			13%	
		West	10.1 to 20	31	2	61-80	Type V		NO			13%	
7	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**											**11000**
		Total Required Fire Flow in L/s											**183.3**
		Required Duration of Fire Flow (hrs)											**2.00**
		Required Volume of Fire Flow (m^3)											**1320**

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402058
Project Name: Riverside South Block Ph 17 - Block 167
Date: 11/11/2024
Fire Flow Calculation #: 3
Description: Block 3 (2-storey residential townhouses c/w basement)

Notes: Site Plan provided by M.David Blakely Architect Inc.

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										-	-
		412	412									824	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min										-	9000
4	Determine Occupancy Charge	Limited Combustible										-15%	7650
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	33	2	61-80	Type V		NO			13%	3137
		East	10.1 to 20	13	2	21-49	Type V		NO			11%	
		South	20.1 to 30	33	2	61-80	Type V		NO			6%	
		West	10.1 to 20	13	2	21-49	Type V		NO			11%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											11000
		Total Required Fire Flow in L/s											183.3
		Required Duration of Fire Flow (hrs)											2.00
		Required Volume of Fire Flow (m^3)											1320

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402058
Project Name: Riverside South Block Ph 17 - Block 167
Date: 11/11/2024
Fire Flow Calculation #: 4
Description: Block 4 (2-storey residential townhouses c/w basement)

Notes: Site Plan provided by M.David Blakely Architect Inc.

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										-	-
		412	412									824	-
3	Determine Required Fire Flow	$(F = 220 \times C \times A^{1/2})$. Round to nearest 1000 L/min										-	9000
4	Determine Occupancy Charge	Limited Combustible										-15%	7650
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	33	2	61-80	Type V		NO			6%	1683
		East	> 30	33	2	61-80	Type V		NO			0%	
		South	> 30	33	2	61-80	Type V		NO			0%	
		West	3.1 to 10	13	2	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**

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec

Stantec Project #: 160402058
Project Name: Riverside South Block Ph 17 - Block 167
Date: 11/11/2024
Fire Flow Calculation #: 5
Description: Block 5 (2-storey residential townhouses c/w basement)

Notes: Site Plan provided by M.David Blakely Architect Inc.

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										-	-
		412	412									824	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	9000
4	Determine Occupancy Charge	Limited Combustible										-15%	7650
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	33	2	61-80	Type V		NO			0%	2219
		East	3.1 to 10	13	2	21-49	Type V		NO			16%	
		South	20.1 to 30	13	2	21-49	Type V		NO			2%	
		West	10.1 to 20	13	2	21-49	Type V		NO			11%	
7	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**											**10000**
		Total Required Fire Flow in L/s											**166.7**
		Required Duration of Fire Flow (hrs)											**2.00**
		Required Volume of Fire Flow (m^3)											**1200**

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402058
Project Name: Riverside South Block Ph 17 - Block 167
Date: 11/11/2024
Fire Flow Calculation #: 6
Description: Block 6 (2-storey residential townhouses c/w basement)

Notes: Site Plan provided by M.David Blakely Architect Inc.

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										-	-
		412	412									824	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	9000
4	Determine Occupancy Charge	Limited Combustible										-15%	7650
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	33	2	61-80	Type V		NO			0%	1377
		East	> 30	13	2	21-49	Type V		NO			0%	
		South	20.1 to 30	13	2	21-49	Type V		NO			2%	
		West	3.1 to 10	13	2	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

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402058
Project Name: Riverside South Block Ph 17 - Block 167
Date: 11/11/2024
Fire Flow Calculation #: 7
Description: Block 7 (2-storey residential townhouses c/w basement)

Notes: Site Plan provided by M.David Blakely Architect Inc.

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										-	-
		412	412									824	-
3	Determine Required Fire Flow	$(F = 220 \times C \times A^{1/2})$. Round to nearest 1000 L/min										-	9000
4	Determine Occupancy Charge	Limited Combustible										-15%	7650
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	33	2	61-80	Type V		NO			6%	2142
		East	> 30	0	0	0-20	Type V		NO			0%	
		South	3.1 to 10	13	2	21-49	Type V		NO			16%	
		West	20.1 to 30	33	2	61-80	Type V		NO			6%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											10000
		Total Required Fire Flow in L/s											166.7
		Required Duration of Fire Flow (hrs)											2.00
		Required Volume of Fire Flow (m^3)											1200

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec

Stantec Project #: 160402058
Project Name: Riverside South Block Ph 17 - Block 167
Date: 11/11/2024
Fire Flow Calculation #: 8
Description: Block 8 (2-storey residential townhouses c/w basement)

Notes: Site Plan provided by M.David Blakely Architect Inc.

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										-	-
		412	412									824	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min										-	9000
4	Determine Occupancy Charge	Limited Combustible										-15%	7650
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	33	2	61-80	Type V		NO			6%	2907
		East	20.1 to 30	33	0	0-20	Type V		NO			0%	
		South	3.1 to 10	13	2	21-49	Type V		NO			16%	
		West	3.1 to 10	11	2	21-49	Type V		NO			16%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											11000
		Total Required Fire Flow in L/s											183.3
		Required Duration of Fire Flow (hrs)											2.00
		Required Volume of Fire Flow (m^3)											1320

A.3 Watermain Hydraulic Analysis Results

Pre-SUC Reconfiguration PCSWMM Watermain Hydraulic Analysis Result
Junction Results - Basic Day

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
0	0.00	97.44	132.30	34.86	49.56	341.73
1	0.00	97.32	132.30	34.98	49.74	342.97
2	0.00	97.29	132.30	35.02	49.79	343.29
3	0.00	97.38	132.30	34.92	49.66	342.40
4	0.00	97.48	132.30	34.82	49.51	341.34
6	0.19	97.48	132.30	34.82	49.51	341.37
7	0.11	97.50	132.30	34.81	49.49	341.23
8	0.00	97.59	132.30	34.71	49.36	340.29
9	0.00	97.54	132.30	34.76	49.43	340.80
10	0.11	97.53	132.30	34.77	49.44	340.86
11	0.00	97.50	132.30	34.81	49.49	341.23
12	0.00	97.72	132.30	34.58	49.17	339.03
13	0.00	97.60	132.30	34.70	49.35	340.24
14	0.22	97.52	132.30	34.78	49.45	340.95
16	0.00	97.73	132.30	34.57	49.16	338.96
17	0.00	97.75	132.30	34.55	49.13	338.71
18	0.00	97.78	132.30	34.53	49.09	338.49
19	0.11	97.60	132.30	34.70	49.35	340.23
20	0.00	97.61	132.30	34.69	49.32	340.08
22	0.00	97.53	132.30	34.77	49.44	340.91
23	0.11	97.53	132.30	34.77	49.44	340.87

Link Results - Basic Day

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	1	0	19.73	204	110	0.122	0.004
1001	2	1	11.00	204	110	0.122	0.004
1002	3	2	44.75	204	110	0.122	0.004
1003	4	3	42.80	204	110	0.358	0.011
1004	Ralph_Hennessy	4	6.00	204	110	0.358	0.011
1005	6	3	38.03	204	110	-0.236	0.007
1006	7	6	3.00	204	110	-0.046	0.001
1007	9	8	3.00	204	110	-0.174	0.005
1008	10	9	33.09	204	110	-0.174	0.005
1009	7	10	20.20	204	110	-0.064	0.002
1010	11	7	23.35	204	110	0.000	0.000
1011	13	12	18.55	204	110	-0.272	0.008
1012	8	13	6.34	204	110	-0.272	0.008
1013	0	8	30.65	204	110	-0.098	0.003
1014	14	0	44.32	204	110	-0.220	0.007
1015	16	Borbridge_Ave	11.05	204	110	-0.492	0.015
1016	17	16	9.00	204	110	-0.492	0.015
1017	12	17	2.89	204	110	-0.492	0.015
1018	18	12	13.44	204	110	-0.220	0.007
1019	19	18	18.17	204	110	-0.220	0.007
1020	20	19	16.05	204	110	0.000	0.000
1022	22	19	8.65	204	110	-0.110	0.003
1023	23	22	34.40	204	110	-0.110	0.003

Pre-SUC Reconfiguration PCSWMM Watermain Hydraulic Analysis Result
Junction Results - Peak Hour

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
0	0.00	97.44	124.90	27.45	39.04	269.16
1	0.00	97.32	124.90	27.58	39.22	270.40
2	0.00	97.29	124.90	27.61	39.26	270.72
3	0.00	97.38	124.90	27.52	39.14	269.83
4	0.00	97.48	124.90	27.42	38.98	268.79
6	1.01	97.48	124.90	27.42	38.99	268.80
7	0.58	97.50	124.90	27.40	38.97	268.66
8	0.00	97.59	124.90	27.31	38.83	267.72
9	0.00	97.54	124.90	27.36	38.90	268.23
10	0.58	97.53	124.90	27.37	38.91	268.29
11	0.00	97.50	124.90	27.40	38.97	268.66
12	0.00	97.72	124.90	27.18	38.65	266.46
13	0.00	97.60	124.90	27.30	38.82	267.67
14	1.16	97.52	124.90	27.37	38.92	268.37
16	0.00	97.73	124.90	27.17	38.64	266.40
17	0.00	97.75	124.90	27.15	38.60	266.15
18	0.00	97.78	124.90	27.12	38.57	265.92
19	0.58	97.60	124.90	27.30	38.82	267.66
20	0.00	97.61	124.90	27.29	38.80	267.51
22	0.00	97.53	124.90	27.37	38.92	268.34
23	0.58	97.53	124.90	27.37	38.91	268.30

Link Results - Peak Hour

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	1	0	19.727	204	110	0.642	0.020
1001	2	1	11.000	204	110	0.642	0.020
1002	3	2	44.746	204	110	0.642	0.020
1003	4	3	42.797	204	110	1.892	0.058
1004	Ralph_Henmessy	4	6.000	204	110	1.892	0.058
1005	6	3	38.034	204	110	-1.251	0.038
1006	7	6	3.000	204	110	-0.241	0.007
1007	9	8	3.000	204	110	-0.919	0.028
1008	10	9	33.089	204	110	-0.919	0.028
1009	7	10	20.199	204	110	-0.339	0.010
1010	11	7	23.351	204	110	0.000	0.000
1011	13	12	18.546	204	110	-1.438	0.044
1012	8	13	6.339	204	110	-1.438	0.044
1013	0	8	30.653	204	110	-0.518	0.016
1014	14	0	44.323	204	110	-1.160	0.035
1015	16	Borbridge_Ave	11.046	204	110	-2.598	0.079
1016	17	16	9.003	204	110	-2.598	0.079
1017	12	17	2.892	204	110	-2.598	0.079
1018	18	12	13.442	204	110	-1.160	0.035
1019	19	18	18.171	204	110	-1.160	0.035
1020	20	19	16.053	204	110	0.000	0.000
1022	22	19	8.650	204	110	-0.580	0.018
1023	23	22	34.396	204	110	-0.580	0.018

Pre-SUC Reconfiguration PCSWMM Watermain Hydraulic Analysis Result
Fire Flow Results - Max Day + 150 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)
0	0.00	25.80	36.69	252.99	123.25	183.33	21.15	30.07	302.77	20
1	0.00	25.93	36.87	254.18	123.24	183.33	20.94	29.78	293.31	20
2	0.00	25.96	36.91	254.49	123.24	183.33	21.02	29.89	295.13	20
3	0.00	25.86	36.77	253.51	123.23	183.33	22.90	32.56	387.64	20
4	0.00	25.72	36.57	252.16	123.20	183.33	24.97	35.51	803.56	20
6	0.46	25.76	36.63	252.54	123.24	183.33	21.06	29.95	300.58	20
7	0.26	25.746	36.61	252.42	123.24	183.33	21.01	29.88	299.01	20
8	0.00	25.664	36.49	251.61	123.26	183.33	22.71	32.29	385.06	20
9	0.00	25.715	36.57	252.11	123.25	183.33	22.52	32.02	370.00	20
10	0.26	25.713	36.56	252.09	123.25	183.33	21.05	29.93	301.13	20
11	0.00	25.746	36.61	252.42	123.24	183.33	16.9	24.03	213.04	20
12	0.00	25.557	36.34	250.56	123.28	183.33	23.48	33.39	464.98	20
13	0.00	25.665	36.49	251.62	123.26	183.33	22.85	32.49	395.41	20
16	0.00	25.562	36.35	250.61	123.29	183.33	24.31	34.57	612.78	20
17	0.00	25.528	36.30	250.28	123.28	183.33	23.62	33.59	486.49	20
18	0.00	25.502	36.26	250.03	123.28	183.33	21.05	29.93	305.86	20
19	0.26	25.68	36.52	251.77	123.28	183.33	18.01	25.61	229.61	20
20	0.00	25.664	36.49	251.61	123.28	183.33	15.17	21.57	193.52	20
22	0.00	25.749	36.61	252.45	123.28	183.33	16.55	23.53	208.73	20

Post-SUC Reconfiguration PCSWMM Watermain Hydraulic Analysis Result
Junction Results - Basic Day

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
0	0.00	97.44	146.80	49.36	70.18	483.89
1	0.00	97.32	146.80	49.48	70.36	485.13
2	0.00	97.29	146.80	49.52	70.41	485.45
3	0.00	97.38	146.80	49.42	70.28	484.56
4	0.00	97.48	146.80	49.32	70.13	483.50
6	0.19	97.48	146.80	49.32	70.13	483.53
7	0.11	97.50	146.80	49.31	70.11	483.39
8	0.00	97.59	146.80	49.21	69.97	482.45
9	0.00	97.54	146.80	49.26	70.05	482.96
10	0.11	97.53	146.80	49.27	70.06	483.02
11	0.00	97.50	146.80	49.31	70.11	483.39
12	0.00	97.72	146.80	49.08	69.79	481.19
13	0.00	97.60	146.80	49.20	69.97	482.40
14	0.22	97.52	146.80	49.28	70.07	483.11
16	0.00	97.73	146.80	49.07	69.78	481.12
17	0.00	97.75	146.80	49.05	69.74	480.87
18	0.00	97.78	146.80	49.03	69.71	480.65
19	0.11	97.60	146.80	49.20	69.97	482.39
20	0.00	97.61	146.80	49.19	69.94	482.24
22	0.00	97.53	146.80	49.27	70.06	483.07
23	0.11	97.53	146.80	49.27	70.06	483.03

Link Results - Basic Day

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	1	0	19.73	204	110	0.122	0.004
1001	2	1	11.00	204	110	0.122	0.004
1002	3	2	44.75	204	110	0.122	0.004
1003	4	3	42.80	204	110	0.358	0.011
1004	Ralph_Hennessy	4	6.00	204	110	0.358	0.011
1005	6	3	38.03	204	110	-0.236	0.007
1006	7	6	3.00	204	110	-0.046	0.001
1007	9	8	3.00	204	110	-0.174	0.005
1008	10	9	33.09	204	110	-0.174	0.005
1009	7	10	20.20	204	110	-0.064	0.002
1010	11	7	23.35	204	110	0.000	0.000
1011	13	12	18.55	204	110	-0.272	0.008
1012	8	13	6.34	204	110	-0.272	0.008
1013	0	8	30.65	204	110	-0.098	0.003
1014	14	0	44.32	204	110	-0.220	0.007
1015	16	Borbridge_Ave	11.05	204	110	-0.492	0.015
1016	17	16	9.00	204	110	-0.492	0.015
1017	12	17	2.89	204	110	-0.492	0.015
1018	18	12	13.44	204	110	-0.220	0.007
1019	19	18	18.17	204	110	-0.220	0.007
1020	20	19	16.05	204	110	0.000	0.000
1022	22	19	8.65	204	110	-0.110	0.003
1023	23	22	34.40	204	110	-0.110	0.003

Post-SUC Reconfiguration PCSWMM Watermain Hydraulic Analysis Result
Junction Results - Peak Hour

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
0	0.00	97.44	143.70	46.25	65.77	453.48
1	0.00	97.32	143.70	46.38	65.95	454.72
2	0.00	97.29	143.70	46.41	66.00	455.04
3	0.00	97.38	143.70	46.32	65.87	454.15
4	0.00	97.48	143.70	46.22	65.72	453.11
6	1.01	97.48	143.70	46.22	65.72	453.12
7	0.58	97.50	143.70	46.20	65.70	452.98
8	0.00	97.59	143.70	46.11	65.56	452.04
9	0.00	97.54	143.70	46.16	65.64	452.55
10	0.58	97.53	143.70	46.17	65.65	452.61
11	0.00	97.50	143.70	46.20	65.70	452.98
12	0.00	97.72	143.70	45.98	65.38	450.77
13	0.00	97.60	143.70	46.10	65.56	451.99
14	1.16	97.52	143.70	46.17	65.66	452.69
16	0.00	97.73	143.70	45.97	65.37	450.72
17	0.00	97.75	143.70	45.95	65.34	450.47
18	0.00	97.78	143.70	45.92	65.30	450.24
19	0.58	97.60	143.70	46.10	65.55	451.98
20	0.00	97.61	143.70	46.09	65.53	451.82
22	0.00	97.53	143.70	46.17	65.65	452.66
23	0.58	97.53	143.70	46.17	65.65	452.62

Link Results - Peak Hour

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	1	0	19.727	204	110	0.020	0.005
1001	2	1	11.000	204	110	0.020	0.005
1002	3	2	44.746	204	110	0.020	0.005
1003	4	3	42.797	204	110	0.058	0.037
1004	Ralph_Hennessy	4	6.000	204	110	0.058	0.037
1005	6	3	38.034	204	110	0.038	0.017
1006	7	6	3.000	204	110	0.007	0.000
1007	9	8	3.000	204	110	0.028	0.009
1008	10	9	33.089	204	110	0.028	0.010
1009	7	10	20.199	204	110	0.010	0.001
1010	11	7	23.351	204	110	0.000	0.000
1011	13	12	18.546	204	110	0.044	0.022
1012	8	13	6.339	204	110	0.044	0.022
1013	0	8	30.653	204	110	0.016	0.003
1014	14	0	44.323	204	110	0.035	0.015
1015	16	Borbridge	11.046	204	110	0.079	0.067
1016	17	16	9.003	204	110	0.079	0.066
1017	12	17	2.892	204	110	0.079	0.068
1018	18	12	13.442	204	110	0.035	0.015
1019	19	18	18.171	204	110	0.035	0.015
1020	20	19	16.053	204	110	0.000	0.000
1022	22	19	8.650	204	110	0.018	0.004
1023	23	22	34.396	204	110	0.018	0.004

Post-SUC Reconfiguration PCSWMM Watermain Hydraulic Analysis Result
Fire Flow Results - Max Day (Dead end pipe upgraded to 200mm dia.)

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)
0	0.00	43.156	61.37	423.11	140.60	183.33	38.50	54.75	494.91	20
1	0.00	43.274	61.53	424.26	140.59	183.33	38.29	54.45	477.72	20
2	0.00	43.303	61.58	424.55	140.59	183.33	38.37	54.56	480.25	20
3	0.00	43.194	61.42	423.48	140.57	183.33	40.24	57.22	632.41	20
4	0.00	43.025	61.18	421.82	140.51	183.33	42.29	60.14	1313.96	20
6	0.46	43.104	61.29	422.60	140.59	183.33	38.41	54.62	491.93	20
7	0.26	43.091	61.27	422.47	140.59	183.33	38.36	54.55	489.56	20
8	0.00	43.023	61.18	421.80	140.61	183.33	40.06	56.96	631.97	20
9	0.00	43.074	61.25	422.30	140.61	183.33	39.87	56.69	606.37	20
10	0.26	43.063	61.23	422.20	140.60	183.33	38.40	54.60	493.49	20
11	0.00	43.091	61.27	422.47	140.59	183.33	34.24	48.69	348.66	20
12	0.00	42.938	61.06	420.97	140.66	183.33	40.85	58.09	765.62	20
13	0.00	43.029	61.19	421.86	140.63	183.33	40.21	57.18	648.98	20
16	0.00	42.953	61.08	421.12	140.68	183.33	41.69	59.28	1008.69	20
17	0.00	42.911	61.02	420.71	140.66	183.33	40.99	58.29	801.67	20
18	0.00	42.882	60.98	420.42	140.66	183.33	38.42	54.63	504.40	20
19	0.26	43.06	61.23	422.17	140.66	183.33	35.38	50.31	376.78	20
20	0.00	43.044	61.21	422.01	140.66	183.33	32.54	46.27	317.66	20
22	0.00	43.129	61.33	422.84	140.66	183.33	33.92	48.23	341.86	20

Appendix B Wastewater Servicing Calculations

B.1 Sanitary Sewer Design Sheet

Stantec

SUBDIVISION:

Riverside South Block 167

DATE: 11/8/2024
REVISION: 1
DESIGNED BY: MJS
CHECKED BY: -

FILE NUMBER: 160402058

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				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
R5A	5	4	0.42	0	24	0	65	0.42	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	0.42	0.42	0.1	0.9	42.7	200	PVC	SDR 35	0.65	27.0	**3.34%**	0.85	0.32
G4A	4	3	0.00	0	0	0	0	0.42	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.0	0.09	0.51	0.2	0.9	39.8	200	PVC	SDR 35	0.40	21.1	**4.40%**	0.67	0.27
R8A	8	7	0.22	0	21	0	57	0.22	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	0.22	0.22	0.1	0.7	37.3	200	PVC	SDR 35	0.40	21.1	**3.51%**	0.67	0.26
R9A	9	7	0.12	0	9	0	24	0.12	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	0.12	0.12	0.0	0.3	23.2	200	PVC	SDR 35	1.40	39.6	**0.83%**	1.24	0.33
R7A	7	6	0.07	0	3	0	8	0.40	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	0.07	0.40	0.1	1.2	21.8	200	PVC	SDR 35	0.40	21.1	**5.55%**	0.67	0.29
R6A	6	3	0.15	0	12	0	32	0.56	122	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	0.15	0.56	0.2	1.6	41.0	200	PVC	SDR 35	0.40	21.1	**7.52%**	0.67	0.32
	3	2	0.00	0	0	0	0	0.97	186	3.53	2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.0	0.00	1.06	0.4	2.5	26.4	200	PVC	SDR 35	0.40	21.1	**11.73%**	0.67	0.37
R10A	10	11	0.16	0	9	0	24	0.16	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	0.16	0.16	0.1	0.3	27.1	200	PVC	SDR 35	0.65	27.0	**1.28%**	0.85	0.24
R12A	12	11	0.13	0	12	0	32	0.13	32	3.68	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.13	0.13	0.0	0.4	42.7	200	PVC	SDR 35	0.40	21.1	**2.03%**	0.67	0.22
R11A	11	2	0.10	0	3	0	8	0.39	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	0.10	0.39	0.1	0.9	21.7	200	PVC	SDR 35	0.40	21.1	**4.22%**	0.67	0.27
	2	1	0.00	0	0	0	0	1.36	251	3.49	2.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.0	0.00	1.45	0.5	3.3	21.2	200	PVC	SDR 35	0.40	21.1	**15.69%**	0.67	0.40
																												200							

Appendix C Stormwater Management

C.1 Storm Sewer Design Sheet

Stantec	Riverside South Block 167		STORM SEWER DESIGN SHEET (City of Ottawa)	DESIGN PARAMETERS
	DATE:	2024-11-08		$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)
	REVISION:	1		
	DESIGNED BY:	MJS	FILE NUMBER: 160402058	
	CHECKED BY:	-		

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

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)
L108A	108	103	0.13	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.106	0.106	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.88
L103A	103A	103	0.30	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.203	0.203	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.29
L103B	103	102	0.08	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.048	0.358	0.000	0.000	0.000	0.000	0.000	0.000	10.88
																				11.66
L106A	106	105	0.27	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.211	0.211	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.80
	109	105	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
																				10.00
	105	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.211	0.000	0.000	0.000	0.000	0.000	0.000	10.80
L104A	104	102	0.14	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.113	0.325	0.000	0.000	0.000	0.000	0.000	0.000	11.24
																				11.89
	102	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.683	0.000	0.000	0.000	0.000	0.000	0.000	11.89
																				12.21
L107A	107	101	0.16	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.124	0.124	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.90
	101	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.807	0.000	0.000	0.000	0.000	0.000	0.000	12.21
																				12.60

DRAINAGE AREA (continued) / PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR 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)
L108A	108	103	76.81	104.19	122.14	178.56	0.0	0.0	22.6	39.7	250	250	CIRCULAR	PVC	-	0.50	42.7	**52.88%**	0.86	0.75	0.88
L103A	103A	103	76.81	104.19	122.14	178.56	0.0	0.0	43.4	25.5	250	250	CIRCULAR	PVC	-	2.00	85.4	**50.82%**	1.72	1.48	0.29
L103B	103	102	73.57	99.75	116.91	170.87	0.0	0.0	73.1	43.6	375	375	CIRCULAR	PVC	-	0.40	104.3	**70.14%**	0.99	0.94	0.77
L106A	106	105	76.81	104.19	122.14	178.56	0.0	0.0	45.1	40.1	300	300	CIRCULAR	PVC	-	0.40	60.8	**74.20%**	0.86	0.83	0.80
	109	105	76.81	104.19	122.14	178.56	0.0	0.0	0.0	20.4	250	250	CIRCULAR	PVC	-	0.50	42.7	**0.00%**	0.86	0.00	0.00
	105	104	73.85	100.13	117.36	171.53	0.0	0.0	43.4	21.5	300	300	CIRCULAR	PVC	-	0.40	60.8	**71.35%**	0.86	0.82	0.44
L104A	104	102	72.35	98.06	114.92	167.95	0.0	0.0	65.3	44.4	300	300	CIRCULAR	PVC	-	0.70	80.4	**81.18%**	1.14	1.13	0.65
	102	101	70.22	95.15	111.49	162.91	0.0	0.0	133.2	22.2	450	450	CIRCULAR	CONCRETE	-	0.50	210.3	**63.32%**	1.28	1.17	0.32
L107A	107	101	76.81	104.19	122.14	178.56	0.0	0.0	26.5	46.5	250	250	CIRCULAR	PVC	-	0.65	48.7	**54.44%**	0.98	0.86	0.90
	101	100	69.25	93.81	109.91	160.60	0.0	0.0	155.2	28.5	450	450	CIRCULAR	CONCRETE	-	0.50	210.3	**73.81%**	1.28	1.23	0.39
											450	450									

C.2 Runoff Coefficient/Impervious Calculations

Project Block 167
Desc Richcraft
28-Oct-24

Sub Catchment ID	Total Area (m^2)	Hard Surface (m^2)	Soft Surface (m^2)	Runoff Coefficient, C
UNC-1	681.62	320.11	361.51	**0.53**
UNC-2	1634.57	875.59	758.98	**0.57**
UNC-3	963.56	250.20	713.36	**0.38**
UNC-4	395.08	244.15	150.93	**0.63**
C107A	1613.72	1302.99	310.73	**0.77**
C103A	3036.88	2051.29	985.60	**0.67**
C103B	807.53	456.99	350.54	**0.60**
C108A	1275.38	1147.00	128.38	**0.83**
C104A	1436.52	1211.64	224.88	**0.79**
C106A	2677.14	2245.84	431.30	**0.79**
	1.00	1.00	0.00	**0.90**

C.3 Modified Rational Method Calculations

Stormwater Management Calculations

File No: **160402058**
Project: **955 Borbridge Avenue**
Date: **21-Jan-25**

SWM Approach:
Post-development to 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**
Controlled - Tributary	L108B	Hard	0.009		0.9	0.008		
		Soft	0.021		0.2	0.004		
		Subtotal		0.03			0.012	0.400
Uncontrolled - Non-Tributary	UNC-3	Hard	0.025		0.9	0.022		
		Soft	0.015		0.2	0.003		
		Subtotal		0.04			0.025	0.630
Uncontrolled - Non-Tributary	UNC-2	Hard	0.085		0.9	0.076		
		Soft	0.075		0.2	0.015		
		Subtotal		0.16			0.091	0.570
Uncontrolled - Non-Tributary	UNC-1	Hard	0.033		0.9	0.030		
		Soft	0.037		0.2	0.007		
		Subtotal		0.07			0.037	0.530
Controlled - Tributary	L103A	Hard	0.204		0.9	0.183		
		Soft	0.100		0.2	0.020		
		Subtotal		0.30			0.203	0.670
Controlled - Tributary	L106A	Hard	0.226		0.9	0.203		
		Soft	0.042		0.2	0.008		
		Subtotal		0.27			0.211	0.790
Controlled - Tributary	L104A	Hard	0.121		0.9	0.109		
		Soft	0.023		0.2	0.005		
		Subtotal		0.14			0.113	0.790
Controlled - Tributary	L108A	Hard	0.117		0.9	0.105		
		Soft	0.013		0.2	0.003		
		Subtotal		0.13			0.108	0.830
Controlled - Tributary	L107B	Hard	0.060		0.9	0.054		
		Soft	0.081		0.2	0.016		
		Subtotal		0.14			0.070	0.500
Controlled - Tributary	L107A	Hard	0.131		0.9	0.118		
		Soft	0.030		0.2	0.006		
		Subtotal		0.16			0.124	0.770
Total				**1.450**			**0.996**	
Overall Runoff Coefficient= C:								**0.69**

Total Roof Areas	**0.000**	**ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**1.180**	**ha**
Total Tributary Area to Outlet	**1.180**	**ha**
Total Uncontrolled Areas (Non-Tributary)	**0.270**	**ha**
Total Site	**1.450**	**ha**

Stormwater Management Calculations

Project #160402058, 955 Borbridge Avenue
Modified Rational Method Calculations for Storage

2 yr Intensity $I = a/(t + b)^c$
City of Ottawa

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 Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 1.4500
C: 0.70

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
-	-	**320.0**

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L108B — Controlled - Tributary
Area (ha): 0.03
C: 0.40

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	103.57	3.5	3.5	0.00	**0.00**
10	76.81	2.6	2.6	0.00	**0.00**
15	61.77	2.1	2.1	0.00	**0.00**
20	52.03	1.7	1.7	0.00	**0.00**
25	45.17	1.5	1.5	0.00	**0.00**
30	40.04	1.3	1.3	0.00	**0.00**
35	36.06	1.2	1.2	0.00	**0.00**
40	32.86	1.1	1.1	0.00	**0.00**
45	30.24	1.0	1.0	0.00	**0.00**
50	28.04	0.9	0.9	0.00	**0.00**
55	26.17	0.9	0.9	0.00	**0.00**
60	24.56	0.8	0.8	0.00	**0.00**

Storage: Above CB

Orification Equation: $= CdA(2gh)^{0.5}$ Where C = 0.572
Orifice Diameter: 102.00 mm
Orifice CL Elevation 95.63 m
T/G Elevation 96.96 m
Max Ponding Depth 0.00 m
Downstream W/L 95.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	96.96	1.3	23.9	0.00	0.00	OK

Subdrainage Area: UNC-3 — Uncontrolled - Non-Tributary
Area (ha): 0.04
C: 0.63

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	5.4	5.4		
20	52.03	3.6	3.6		
30	40.04	2.8	2.8		
40	32.86	2.3	2.3		
50	28.04	2.0	2.0		
60	24.56	1.7	1.7		
70	21.91	1.5	1.5		
80	19.83	1.4	1.4		
90	18.14	1.3	1.3		
100	16.75	1.2	1.2		
110	15.57	1.1	1.1		
120	14.56	1.0	1.0		

Subdrainage Area: UNC-2 — Uncontrolled - Non-Tributary
Area (ha): 0.16
C: 0.57

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	19.5	19.5		
20	52.03	13.2	13.2		
30	40.04	10.2	10.2		
40	32.86	8.3	8.3		
50	28.04	7.1	7.1		
60	24.56	6.2	6.2		
70	21.91	5.6	5.6		
80	19.83	5.0	5.0		
90	18.14	4.6	4.6		
100	16.75	4.2	4.2		
110	15.57	3.9	3.9		
120	14.56	3.7	3.7		

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.07
C: 0.53

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)

Project #160402058, 955 Borbridge Avenue
Modified Rational Method Calculations for Storage

100 yr Intensity $I = a/(t + b)^c$
City of Ottawa

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 Predevelopment Target Release from Portion of Site

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L108B — Controlled - Tributary
Area (ha): 0.03
C: 0.50

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	7.4	7.4	0.00	**0.00**
20	119.95	5.0	5.0	0.00	**0.00**
30	91.87	3.8	3.8	0.00	**0.00**
40	75.15	3.1	3.1	0.00	**0.00**
50	63.95	2.7	2.7	0.00	**0.00**
60	55.89	2.3	2.3	0.00	**0.00**
70	49.79	2.1	2.1	0.00	**0.00**
80	44.99	1.9	1.9	0.00	**0.00**
90	41.11	1.7	1.7	0.00	**0.00**
100	37.90	1.6	1.6	0.00	**0.00**
110	35.20	1.5	1.5	0.00	**0.00**
120	32.89	1.4	1.4	0.00	**0.00**

Storage: Surface Storage Above CB

Orifice Equation: $Q = CdA(2gh)^{0.5}$ Where C = 0.572
Orifice Diameter: 102.00 mm
Orifice CL Elevation 95.63 m
T/G Elevation 96.96 m
Max Ponding Depth 0.00 m
Downstream W/L 95.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	96.96	1.3	23.9	0.00	0.00	OK
					0.00	

Subdrainage Area: UNC-3 — Uncontrolled - Non-Tributary
Area (ha): 0.04
C: 0.79

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	15.6	15.6		
20	119.95	10.5	10.5		
30	91.87	8.0	8.0		
40	75.15	6.6	6.6		
50	63.95	5.6	5.6		
60	55.89	4.9	4.9		
70	49.79	4.4	4.4		
80	44.99	3.9	3.9		
90	41.11	3.6	3.6		
100	37.90	3.3	3.3		
110	35.20	3.1	3.1		
120	32.89	2.9	2.9		

Subdrainage Area: UNC-2 — Uncontrolled - Non-Tributary
Area (ha): 0.16
C: 0.71

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	56.6	56.6		
20	119.95	38.0	38.0		
30	91.87	29.1	29.1		
40	75.15	23.8	23.8		
50	63.95	20.3	20.3		
60	55.89	17.7	17.7		
70	49.79	15.8	15.8		
80	44.99	14.3	14.3		
90	41.11	13.0	13.0		
100	37.90	12.0	12.0		
110	35.20	11.2	11.2		
120	32.89	10.4	10.4		

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.07
C: 0.66

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)

Stormwater Management Calculations

Project #160402058, 955 Borbridge Avenue
Modified Rational Method Calculations for Storage

10	76.81	7.9	7.9
20	52.03	5.4	5.4
30	40.04	4.1	4.1
40	32.86	3.4	3.4
50	28.04	2.9	2.9
60	24.56	2.5	2.5
70	21.91	2.3	2.3
80	19.83	2.0	2.0
90	18.14	1.9	1.9
100	16.75	1.7	1.7
110	15.57	1.6	1.6
120	14.56	1.5	1.5

Subdrainage Area: L103A — Controlled - Tributary
Area (ha): 0.30
C: 0.67

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	43.4	43.4	0.0	**0.0**
20	52.03	29.4	29.4	0.0	**0.0**
30	40.04	22.6	22.6	0.0	**0.0**
40	32.86	18.6	18.6	0.0	**0.0**
50	28.04	15.9	15.9	0.0	**0.0**
60	24.56	13.9	13.9	0.0	**0.0**
70	21.91	12.4	12.4	0.0	**0.0**
80	19.83	11.2	11.2	0.0	**0.0**
90	18.14	10.3	10.3	0.0	**0.0**
100	16.75	9.5	9.5	0.0	**0.0**
110	15.57	8.8	8.8	0.0	**0.0**
120	14.56	8.2	8.2	0.0	**0.0**

Storage: Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 140 mm
Orifice CL Elevation 95.88 m
T/G Elevation 97.19 m
Max Ponding Depth 0.00 m
Downstream W/L 95.30 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	97.19	1.31	47.6	0.0	49.6	OK

Subdrainage Area: L106A — Controlled - Tributary
Area (ha): 0.27
C: 0.79

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	45.2	45.2	0.0	**0.0**
20	52.03	30.6	30.6	0.0	**0.0**
30	40.04	23.5	23.5	0.0	**0.0**
40	32.86	19.3	19.3	0.0	**0.0**
50	28.04	16.5	16.5	0.0	**0.0**
60	24.56	14.4	14.4	0.0	**0.0**
70	21.91	12.9	12.9	0.0	**0.0**
80	19.83	11.7	11.7	0.0	**0.0**
90	18.14	10.7	10.7	0.0	**0.0**
100	16.75	9.8	9.8	0.0	**0.0**
110	15.57	9.2	9.2	0.0	**0.0**
120	14.56	8.6	8.6	0.0	**0.0**

Storage: Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 140 mm
Orifice CL Elevation 95.90 m
T/G Elevation 97.21 m
Max Ponding Depth 0.00 m
Downstream W/L 94.51 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	97.21	1.31	47.6	0.0	83.5	OK

Subdrainage Area: L104A — Controlled - Tributary
Area (ha): 0.14
C: 0.79

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	24.2	23.9	0.4	**0.2**
20	52.03	16.4	16.4	0.0	0.0
30	40.04	12.6	12.6	0.0	0.0
40	32.86	10.4	10.4	0.0	0.0
50	28.04	8.8	8.8	0.0	0.0
60	24.56	7.7	7.7	0.0	0.0
70	21.91	6.9	6.9	0.0	0.0
80	19.83	6.3	6.3	0.0	0.0
90	18.14	5.7	5.7	0.0	0.0
100	16.75	5.3	5.3	0.0	0.0
110	15.57	4.9	4.9	0.0	0.0
120	14.56	4.6	4.6	0.0	0.0

Storage: Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.572
Orifice Diameter: 102 mm
Orifice CL Elevation 96.00 m
T/G Elevation 97.33 m
Max Ponding Depth 0.00 m
Downstream W/L 94.03 m

Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check

Project #160402058, 955 Borbridge Avenue
Modified Rational Method Calculations for Storage

10	178.56	23.0	23.0
20	119.95	15.5	15.5
30	91.87	11.8	11.8
40	75.15	9.7	9.7
50	63.95	8.2	8.2
60	55.89	7.2	7.2
70	49.79	6.4	6.4
80	44.99	5.8	5.8
90	41.11	5.3	5.3
100	37.90	4.9	4.9
110	35.20	4.5	4.5
120	32.89	4.2	4.2

Subdrainage Area: L103A — Controlled - Tributary
Area (ha): 0.30
C: 0.84

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	126.2	52.4	73.7	**44.2**
20	119.95	84.8	52.4	32.3	38.8
30	91.87	64.9	52.4	12.5	22.5
40	75.15	53.1	52.4	0.7	1.6
50	63.95	45.2	45.2	0.0	0.0
60	55.89	39.5	39.5	0.0	0.0
70	49.79	35.2	35.2	0.0	0.0
80	44.99	31.8	31.8	0.0	0.0
90	41.11	29.1	29.1	0.0	0.0
100	37.90	26.8	26.8	0.0	0.0
110	35.20	24.9	24.9	0.0	0.0
120	32.89	23.2	23.2	0.0	0.0

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 140 mm
Orifice CL Elevation 95.88 m
T/G Elevation 97.19 m
Max Ponding Depth 0.28 m
Downstream W/L 95.30 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	97.47	1.59	52.4	44.2	49.6	OK
					5.36	

Subdrainage Area: L106A — Controlled - Tributary
Area (ha): 0.27
C: 0.99

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	131.2	52.8	78.5	**47.1**
20	119.95	88.2	52.8	35.4	42.5
30	91.87	67.5	52.8	14.7	26.5
40	75.15	55.2	52.8	2.5	5.9
50	63.95	47.0	47.0	0.0	0.0
60	55.89	41.1	41.1	0.0	0.0
70	49.79	36.6	36.6	0.0	0.0
80	44.99	33.1	33.1	0.0	0.0
90	41.11	30.2	30.2	0.0	0.0
100	37.90	27.9	27.9	0.0	0.0
110	35.20	25.9	25.9	0.0	0.0
120	32.89	24.2	24.2	0.0	0.0

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 140 mm
Orifice CL Elevation 95.90 m
T/G Elevation 97.21 m
Max Ponding Depth 0.30 m
Downstream W/L 94.51 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	97.51	1.61	52.8	47.1	83.5	OK
					36.43	

Subdrainage Area: L104A — Controlled - Tributary
Area (ha): 0.14
C: 0.99

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	70.4	26.0	44.4	**26.6**
20	119.95	47.3	26.0	21.3	25.5
30	91.87	36.2	26.0	10.2	18.4
40	75.15	29.6	26.0	3.6	8.7
50	63.95	25.2	25.2	0.0	0.0
60	55.89	22.0	22.0	0.0	0.0
70	49.79	19.6	19.6	0.0	0.0
80	44.99	17.7	17.7	0.0	0.0
90	41.11	16.2	16.2	0.0	0.0
100	37.90	14.9	14.9	0.0	0.0
110	35.20	13.9	13.9	0.0	0.0
120	32.89	13.0	13.0	0.0	0.0

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.572
Orifice Diameter: 102 mm
Orifice CL Elevation 96.00 m
T/G Elevation 97.33 m
Max Ponding Depth 0.25 m
Downstream W/L 94.03 m

Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check

Stormwater Management Calculations

Project #160402058, 955 Borbridge Avenue
Modified Rational Method Calculations for Storage

	Stage	Head	Discharge	Vreq	Vavail	Volume Check
5-year Water Level	97.33	1.33	23.9	0.2	33.6	OK

Subdrainage Area: L108A — Controlled - Tributary
Area (ha): 0.13
C: 0.83

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	23.0	23.0	0.0	**0.0**
20	52.03	15.6	15.6	0.0	**0.0**
30	40.04	12.0	12.0	0.0	**0.0**
40	32.86	9.9	9.9	0.0	**0.0**
50	28.04	8.4	8.4	0.0	**0.0**
60	24.56	7.4	7.4	0.0	**0.0**
70	21.91	6.6	6.6	0.0	**0.0**
80	19.83	5.9	5.9	0.0	**0.0**
90	18.14	5.4	5.4	0.0	**0.0**
100	16.75	5.0	5.0	0.0	**0.0**
110	15.57	4.7	4.7	0.0	**0.0**
120	14.56	4.4	4.4	0.0	**0.0**

Storage: Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.572
Orifice Diameter: 102 mm
Orifice CL Elevation 95.88 m
T/G Elevation 97.21 m
Max Ponding Depth 0.00 m
Downstream W/L 94.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	97.21	1.33	23.9	0.0	37.3	OK

Subdrainage Area: L107B — Controlled - Tributary
Area (ha): 0.14
C: 0.50

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	15.0	15.0	0.0	**0.0**
20	52.03	10.2	10.2	0.0	**0.0**
30	40.04	7.8	7.8	0.0	**0.0**
40	32.86	6.4	6.4	0.0	**0.0**
50	28.04	5.5	5.5	0.0	**0.0**
60	24.56	4.8	4.8	0.0	**0.0**
70	21.91	4.3	4.3	0.0	**0.0**
80	19.83	3.9	3.9	0.0	**0.0**
90	18.14	3.6	3.6	0.0	**0.0**
100	16.75	3.3	3.3	0.0	**0.0**
110	15.57	3.0	3.0	0.0	**0.0**
120	14.56	2.9	2.9	0.0	**0.0**

Storage: Storage Within Perforated Subdrain & Stone Trench

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.572
Orifice Diameter: 102 mm
Orifice CL Elevation 96.05 m — Subdrain Length = 33.5 m
T/G Elevation 97.03 m — Trench Width = 0.85 m
Max Ponding Depth 0.00 m — Trench Depth = 1.00 m
Downstream W/L 95.86 m — Trench Volume @ 40% Porosity = 11.4

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	97.03	0.98	20.5	0.0	19.8	OK

Subdrainage Area: L107A — Controlled - Tributary
Area (ha): 0.16
C: 0.77

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	26.5	26.5	0.0	**0.0**
20	52.03	18.0	18.0	0.0	**0.0**
30	40.04	13.8	13.8	0.0	**0.0**
40	32.86	11.4	11.4	0.0	**0.0**
50	28.04	9.7	9.7	0.0	**0.0**
60	24.56	8.5	8.5	0.0	**0.0**
70	21.91	7.6	7.6	0.0	**0.0**
80	19.83	6.9	6.9	0.0	**0.0**
90	18.14	6.3	6.3	0.0	**0.0**
100	16.75	5.8	5.8	0.0	**0.0**
110	15.57	5.4	5.4	0.0	**0.0**
120	14.56	5.0	5.0	0.0	**0.0**

Storage: Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.572
Orifice Diameter: 108 mm
Orifice CL Elevation 96.13 m
T/G Elevation 97.45 m
Max Ponding Depth 0.00 m
Downstream W/L 94.10 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	97.45	1.32	26.7	0.0	50.8	OK

SUMMARY TO OUTLET

Vrequired Vavailable*

Tributary Area 1.18 ha

Project #160402058, 955 Borbridge Avenue
Modified Rational Method Calculations for Storage

	Stage	Head	Discharge	Vreq	Vavail	Volume Check
100-year Water Level	97.58	1.58	26.0	26.6	33.6	OK
					6.96	

Subdrainage Area: L108A — Controlled - Tributary
Area (ha): 0.13
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	64.5	26.4	38.1	**22.9**
20	119.95	43.4	26.4	16.9	20.3
30	91.87	33.2	26.4	6.8	12.2
40	75.15	27.2	26.4	0.7	1.7
50	63.95	23.1	23.1	0.0	0.0
60	55.89	20.2	20.2	0.0	0.0
70	49.79	18.0	18.0	0.0	0.0
80	44.99	16.3	16.3	0.0	0.0
90	41.11	14.9	14.9	0.0	0.0
100	37.90	13.7	13.7	0.0	0.0
110	35.20	12.7	12.7	0.0	0.0
120	32.89	11.9	11.9	0.0	0.0

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.572
Orifice Diameter: 102 mm
Orifice CL Elevation 95.88 m
T/G Elevation 97.21 m
Max Ponding Depth 0.30 m
Downstream W/L 94.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	97.51	1.63	26.4	22.9	37.3	OK
					14.44	

Subdrainage Area: L107B — Controlled - Tributary
Area (ha): 0.14
C: 0.63

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	43.7	22.0	21.7	**13.0**
20	119.95	29.4	22.0	7.4	8.8
30	91.87	22.5	22.0	0.5	0.9
40	75.15	18.4	18.4	0.0	0.0
50	63.95	15.7	15.7	0.0	0.0
60	55.89	13.7	13.7	0.0	0.0
70	49.79	12.2	12.2	0.0	0.0
80	44.99	11.0	11.0	0.0	0.0
90	41.11	10.1	10.1	0.0	0.0
100	37.90	9.3	9.3	0.0	0.0
110	35.20	8.6	8.6	0.0	0.0
120	32.89	8.1	8.1	0.0	0.0

Storage: Storage Within Perforated Subdrain & Stone Trench

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.572
Orifice Diameter: 102 mm
Orifice CL Elevation 96.05 m — Subdrain Length = 54.8 m
T/G Elevation 97.03 m — Trench Width = 0.85 m
Max Ponding Depth 0.15 m — Trench Depth = 1.00 m
Downstream W/L 95.86 m — Trench Volume @ 40% Porosity = 18.6

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	97.18	1.13	22.0	13.0	19.8	OK
					6.78	

Subdrainage Area: L107A — Controlled - Tributary
Area (ha): 0.16
C: 0.96

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	77.1	29.5	47.6	**28.5**
20	119.95	51.8	29.5	22.3	26.7
30	91.87	39.7	29.5	10.1	18.2
40	75.15	32.5	29.5	2.9	7.0
50	63.95	27.6	27.6	0.0	0.0
60	55.89	24.1	24.1	0.0	0.0
70	49.79	21.5	21.5	0.0	0.0
80	44.99	19.4	19.4	0.0	0.0
90	41.11	17.8	17.8	0.0	0.0
100	37.90	16.4	16.4	0.0	0.0
110	35.20	15.2	15.2	0.0	0.0
120	32.89	14.2	14.2	0.0	0.0

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.572
Orifice Diameter: 108 mm
Orifice CL Elevation 96.13 m
T/G Elevation 97.45 m
Max Ponding Depth 0.30 m
Downstream W/L 94.10 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	97.75	1.62	29.5	28.5	50.8	OK
					22.26	

SUMMARY TO OUTLET

Vrequired Vavailable*

Tributary Area 1.18 ha

Stormwater Management Calculations

Project #160402058, 955 Borbridge Avenue
Modified Rational Method Calculations for Storage

Total 2yr Flow to Sewer	184.5	L/s	0.2	274.6 m^3	Ok
Non-Tributary Area	0.27	ha			
Total 2yr Flow Uncontrolled	32.8	L/s			
Total Area	1.45	ha			
Total 2yr Flow	217.3	L/s			
Target	320.0	L/s			

Project #160402058, 955 Borbridge Avenue
Modified Rational Method Calculations for Storage

Total 100yr Flow to Sewer	216.7	L/s	182.4	274.6 m^3	Ok
Non-Tributary Area	0.27	ha			
Total 100yr Flow Uncontrolled	95.2	L/s			
Total Area	1.45	ha			
Total 100yr Flow	311.9	L/s			
Target	320.0	L/s			

Appendix D Geotechnical Information

D.1 Geotechnical Investigation Report Excerpts

PATERSON GROUP

Geotechnical Investigation

Proposed Residential Development

955 Borbridge Avenue
Ottawa, Ontario

Prepared for Richcraft Homes Ltd.

Report PG7285-1 dated October 18, 2024

Table of Contents

Appendices

Appendix 1	Soil Profile and Test Data Sheets Symbols and Terms Analytical Testing Results
Appendix 2	Figure 1 - Key Plan Drawing PG7285-1 - Test Hole Location Plan

1.0 Introduction

Paterson Group (Paterson) was commissioned by Richcraft Homes Ltd. to conduct a geotechnical investigation for the proposed residential development to be located at 955 Borbridge Avenue 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 and to;
- ❑ Provide geotechnical recommendations pertaining to the design of the proposed development including construction considerations which may affect the design.

The following 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.

Investigating for the presence or potential presence of contamination on the subject property was not part of the scope of work of the present investigation. Therefore, the present report does not address environmental issues.

2.0 Proposed Development

Based on the available site plan, it is understood that the proposed development will consist of several townhouse blocks and an accessory building, with associated asphalt-paved access lanes and parking areas. An amenity area is also proposed to the south of accessory building.

It is 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 September 20, 2024, and consisted of advancing a total of 4 boreholes to a maximum depth of 5.9 m below existing ground surface. The approximate borehole locations are shown on Drawing PG7285-1 – Test Hole Location Plan included in Appendix 2.

Previous geotechnical investigations on January 31, 2020, August 10, 2022, and April 8, 2022 included test holes at or within the vicinity of the subject site. These test holes consisted of 3 test pits (TP 3-22, TP 10-22, and TP 11-22) and 2 boreholes (BH 2 and BH 20) advanced to a maximum depth of 5.7 m below the existing ground surface.

The borehole locations were distributed in a manner to provide general coverage of the subject site, taking into consideration underground utilities and site features.

The boreholes were completed using a low clearance auger drill rig operated by a two-person crew. The test pits were advanced with an excavator, and backfilled with the excavated soil upon completion. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The testing procedure consisted of augering to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split spoon (SS) sampler. All samples were visually inspected and initially classified on-site. The auger and split-spoon samples were placed in sealed plastic bags. All samples were transported to our laboratory for further examination and classification. The depths at which the auger and split spoon samples were recovered from the boreholes are shown as AU, and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

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

The subsurface conditions observed in the boreholes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data Sheets in Appendix 1 of this report.

Groundwater

Flexible standpipe piezometers were installed in all boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program. The groundwater level readings were obtained after a suitable stabilization period subsequent to the completion of the field investigation.

3.2 Field Survey

The borehole locations, and ground surface elevation at each borehole location, were surveyed by Paterson using a 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 PG7285-1 – Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. The results are discussed in Section 4.2 and are provided in Appendix 1 of this report.

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

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 vacant with a gravel and grassed surface. The site is bordered by Borbridge Avenue to the north, Ralph Hennessy Avenue to the east, Rockmelon Street to the south, and vacant land to the west. The ground surface across the subject site is relatively flat at approximate geodetic elevation of 96.0 m.

4.2 Subsurface Profile

Generally, the subsurface profile at the borehole locations consists of topsoil or fill underlain by glacial till. The fill was generally observed to consist of a compact, brown silty sand, sandy silt, and/or silty clay with varying amounts of gravel and organics.

The glacial till was encountered underlying the fill at approximate depths of 0.3 to 1.1 m below the existing ground surface. The glacial till was generally observed to consist of compact to very dense, brown silty sand to sandy silt with varying amounts of gravel, cobbles, and boulders.

Practical refusal to augering was encountered at depths ranging from about 3.9 to 5.9 m below the existing ground surface.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each test hole location.

Bedrock

Based on available geological mapping, bedrock in the area of the subject site consists of sandstone and dolomite of the March formation with an overburden drift thickness of about 5 to 10 m in depth.

4.3 Groundwater

Groundwater levels were measured within the installed piezometers at the time of the investigation. The measured groundwater levels noted at that time are presented in Table 1 on next page, and are also presented in Appendix 1.

Table 1 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Dated Recorded
		Depth (m)	Elevation (m)	
BH 1-24	96.04	3.85	92.19	October 8, 2024
BH 2-24	96.65	4.43	92.22	
BH 3-24	96.88	5.10	91.78	
BH 4-24	96.19	4.63	91.56	
BH 2B-22	96.50	2.95	93.55	August 17, 2022
BH 20	96.34	2.30	94.04	Feb 11, 2020
TP 3-22	96.47	DRY	-	April 8, 2022
TP 10-22	95.98	DRY	-	
TP 11-22	96.26	4.9	91.36	

Note: Ground surface elevations at borehole location are referenced to a geodetic datum.

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 approximately 3 to 4 m below ground surface.

However, it should be noted that 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. It is recommended that the proposed structures be founded on conventional spread footings bearing on the undisturbed, compact to very dense glacial till.

As a silty clay deposit was not encountered at this site, the proposed development is not subject to a permissible grade raise restriction or geotechnical tree planting setbacks.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing significant organic materials, should be stripped from under any buildings and other settlement sensitive structures. The existing fill material, free of organic materials, should be reviewed by Paterson personnel at the time of construction to determine if the existing fill can be left in place below paved areas.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the proposed building areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill and beneath exterior parking areas where settlement of the ground surface is of minor concern. In landscaped areas, these materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD.

5.3 Foundation Design

Bearing Resistance Values

Footings supported on the undisturbed, compact to very dense glacial till can be designed using a bearing resistance value at serviceability limit states (SLS) of **200 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **300 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted 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 prior to the placement of concrete for footings.

Footings placed on an undisturbed, compact to very dense glacial till bearing surface and designed using the bearing resistance values at SLS provided above will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Above the groundwater level, 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.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for the foundations considered at this site. Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code (OBC) 2012 for a full discussion of the earthquake design requirements.

5.5 Floor Slab Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the undisturbed, compact to very dense glacial till is considered to be an acceptable subgrade surface on which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

For structures with slab-on-grade construction, the upper 200 mm of sub-slab fill is recommended to consist of OPSS Granular A crushed stone. For structures with basement slabs, it is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone.

All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

5.6 Pavement Design

For design purposes, the pavement structures presented in Tables 2 and 3 below are recommended for the design of the driveways, car parking areas, and local roadways.

Table 2 - Recommended Pavement Structure – Driveways & 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 fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill.	

Table 3 - Recommended Pavement Structure – Local Roadways

Thickness (mm)	Material Description
40	**Wear Course** – Superpave 12.5 Asphaltic Concrete
50	**Binder Course** – Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - OPSS Granular B Type I or II material placed over in situ soil or engineered fill.	

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 vibratory equipment.

6.0 Design and Construction Precautions

6.1 Foundation Backfill

Foundation Drainage

A perimeter foundation drainage system is recommended for each proposed structure with below-grade space. The system should consist of a 100 to 150 mm diameter, geotextile-wrapped, perforated and corrugated plastic pipe which is surrounded on all sides by 150 mm of 19 mm clear crushed stone which is placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The 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 recommended to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover, or an equivalent combination of soil cover and foundation insulation, should be provided in this regard.

Exterior unheated footings, such as isolated piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure, and require additional protection, such as soil cover of 2.1 m, or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The 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 expected that sufficient room will be available for the greater part of the excavation to be undertake by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or 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 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 (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 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.

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.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Groundwater Control for Building Construction

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.

Impacts to Neighbouring Properties

A silty clay deposit was not encountered at this site, therefore no adverse effects to neighbouring properties are expected as a result of dewatering which may occur during construction and due to foundation drainage.

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.

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 a slightly aggressive to moderate corrosive environment.

6.8 Tree Planting Restrictions

As noted above in Section 5.1, a silty clay deposit was not encountered at the subject site. Therefore, tree planting setbacks are not required for the proposed development, from a geotechnical perspective.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❑ Review of the finalized Grading Plan and Servicing Plan, from a geotechnical perspective.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to 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 the completion of a satisfactory inspection program by the geotechnical consultant.

All excess soil must be handled as per ***Ontario Regulation 406/19: On-Site and Excess Soil Management*.**

8.0 Statement of Limitations

The recommendations provided herein 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 Homes Ltd., 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.

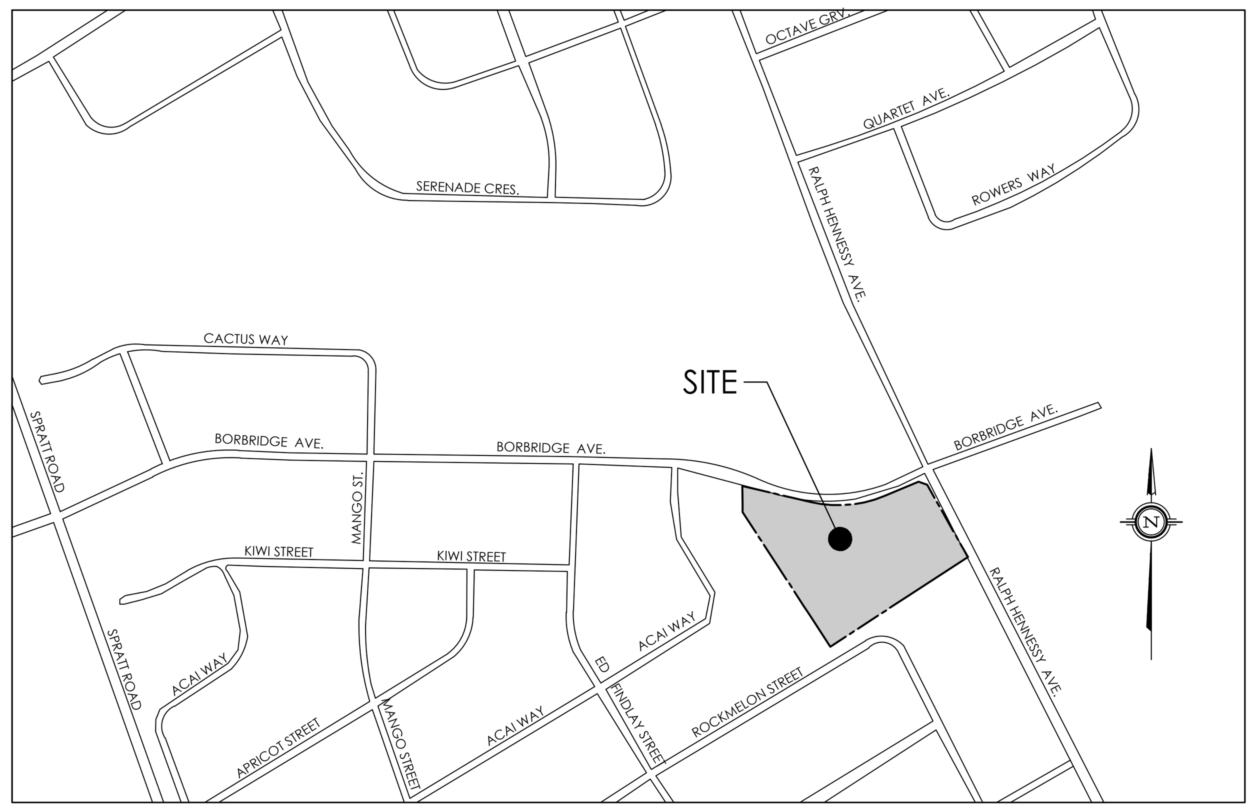
Kinobe Ssekadde, B. Eng.

Scott S. Dennis, P.Eng.

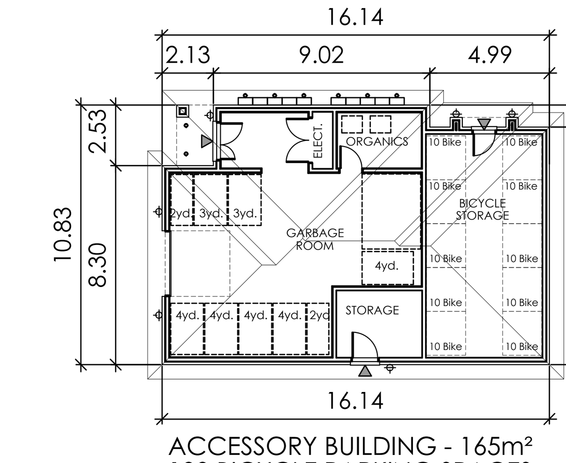
Report Distribution:

- ❑ Richcraft Homes Ltd. (e-mail Copy)
- ❑ Paterson Group (1 Copy)

Appendix E Proposed Site Plan



KEY PLAN
NOT TO SCALE



ACCESSORY BUILDING - 165m²
100 BICYCLE PARKING SPACES

GARBAGE ROOM: (Minimum Required 96 Units) AREA:	88.0 m²
GARBAGE -	5 - 4 cu.yd. Bins 1 - 2 cu.yd. Bin
FIBRE -	2 - 3 cu.yd. Bins
GMP -	1 - 2 cu.yd. Bin
ORGANICS -	2 - 240L Carts

BICYCLE ROOM: 46.0 m²
BICYCLE RACKS SYSTEM
10 RACKS w/ 10 BICYCLES PER RACK

SITE INFORMATION :

PROPOSED ZONING : R4Z - PERMITTED USES : - PLANNED UNIT DEVELOPMENT
- STACKED DWELLING UNITS

SITE AREA : 14,521.93 m²
TOTAL BUILDING AREA : 3,361.5 m²

PROPOSED ZONING:	R4Z	PROVIDED:
LOT AREA (MIN.):	1,400.0 m²	14,521.93 m²
LOT WIDTH (MIN.):	18.0m	69.41 m Ralph Hennessy Ave.
BUILDING HEIGHT (MAX.):	11.0 m	9.45 m
FRONT YARD (MIN.) :	3.0 m	5.68 m
CORNER SIDE YARD (MIN.) :	3.0 m	5.35 m
REAR YARD (MIN.) :	6.0 m	6.10 m
INTERIOR SIDE YARD (MIN.) :		
Within 18m of Front Lot Line	1.5 m	12.65 m @ Block 8
Remainder	7.5 m	
BUILDING SPACING :		
BETWEEN BUILDING & PRIVATE WAY	1.8 m	2.75 m
BETWEEN GARAGE & PRIVATE WAY	5.2 m	n/a
BETWEEN BUILDINGS	1.2 m	7.87 m
MINIMUM LANDSCAPED AREA :	30.0%	46.8 % (6,804.0m²)
PORCH STAIR TO LOT LINE (SECTION 65)	0.60 m	1.16 m

TOTAL AMENITY AREA REQUIRED :
- STACKED DWELLING 6.0m² x 93 = 558.0 m²

COMMUNAL AMENITY AREA REQ'D. (MIN.):
50% of 558 m² = 279.0 m²

- PRIVATE AMENITY AREA -
(BALCONIES & PATIOS) 6.5m² x 93 = 604.5 m²
- COMMUNAL AMENITY AREA - 535.0 m²
TOTAL AMENITY AREA PROVIDED : 1,139.5 m²

ACCESSORY BUILDING	R4Z	PROVIDED:
BUILDING HEIGHT (MAX.):	4.5 m	4.47 m
FLOOR AREA (MAX.) :	200.0 m²	165.0 m²

TERRACE FLATS PARKING :
PARKING REQUIRED : 1.2 Spaces / (93) d.u. + 0.2 / (93) d.u. (Visitor) = 112 + 19 = 131 Spaces

PARKING PROVIDED :			
	2.6m x 5.2m Spaces =	115 Spaces	85.0%
	2.6m x 5.2m Visitor Spaces =	12 Spaces	9.0%
	2.6m x 5.2m E.V. Visitor Spaces =	4 Spaces	3.0%
	3.9m x 5.2m H.C. Visitor Spaces =	4 Spaces	3.0%
	Total =	= 135 Spaces	

BICYCLE PARKING REQUIRED : 93 (0.5 / d.u.) = 47.0 Spaces
BICYCLE PARKING PROVIDED : 100 Interior Spaces

TERRACE FLATS :

BLOCK No. :		BUILDING AREA:	GROSS FLOOR AREA:	No. UNITS:
BLOCK 1 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 2 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 3 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 4 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 5 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 6 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 7 =	TERRACE FLATS	312.5 m²	914.5 m²	9 UNITS
BLOCK 8 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BICYCLE / GARBAGE =		165.0 m²		
TOTAL =		3,361.5 m²	9,447.5 m²	93 UNITS

SNOW STORAGE : SNOW STORAGE WILL BE OFF SITE.

NOTE:
SITE PLAN TO BE READ IN CONJUNCTION WITH :
- LANDSCAPING PLAN PREPARED BY ______________.
- BOUNDARIES DERIVED FROM: PLAN 4M -xxxx BLOCK 167
PREPARED BY ANNIS O'SULLIVAN VOLLEBEKK LTD.

SCALE 0 5 10 20 30 50m

M. David Blakely
Architect Inc.
2200 Prince of Wales Dr. - Suite 101
Ottawa, Ontario K2E 6Z9
Phone (613) 226-8811 Fax (613) 226-7942

GENERAL NOTES:
1. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING AND VERIFYING ALL DIMENSIONS, ANY DISCREPANCY MUST BE REPORTED TO M. DAVID BLAKELY ARCHITECT INC.
2. ALL WORK AND MATERIALS TO BE IN COMPLIANCE WITH ALL CODES, REGULATIONS, AND BY-LAWS.
3. ADDITIONAL DRAWINGS MAY BE ISSUED FOR CLARIFICATION TO ASSIST THE PROPER EXECUTION OF WORK. SUCH DRAWINGS WILL HAVE THE SAME MEANING AND INTENT AS IF THEY WERE INCLUDED WITH THE PLANS IN CONTRACT DOCUMENTS.
4. DO NOT SCALE DRAWINGS.
5. THIS DRAWING SHALL NOT BE USED FOR PERMIT OR CONSTRUCTION UNLESS THE DRAWING BEARS THE ARCHITECT'S SEAL AND SIGNATURE.
6. THIS REPRODUCTION SHALL NOT BE ALTERED

CONSTRUCTION NORTH

SEAL

REVISIONS

No.	DATE	DESCRIPTION	INIT.
10.	01/10/24	REVISED BLOCK LAYOUT	SM
9.	26/09/24	REVISED BLOCK LAYOUT	SM
8.	05/09/24	REV. EV PARKING TO 4 SPACES	SM
7.	26/08/24	AS PER RICHCRAFT'S COMMENTS	SM
6.	21/08/24	REVISED FOR REAR STREET ELEVATION	SM
5.	14/08/24	REVISED ACC. BLDG. LOCATION	SM
4.	31/07/24	REVISED BLOCK LAYOUT	SM
3.	17/07/24	REVISED BLOCK LAYOUT	SM
2.	30/04/24	FOR REVIEW	SM
1.	11/04/24	FOR REVIEW	SM

REVISIONS

No.	DATE	DESCRIPTION	INIT.
20.			
19.			
18.			
17.			
16.			
15.			
14.	28/10/24	REV. DEPRESSED SIDEWALKS & CURBS	SM
13.	21/10/24	AS PER RICHCRAFT'S COMMENTS	SM
12.	16/10/24	REVISED VISITOR PARKING SPACES	SM
11.	09/10/24	REVISED BLOCK LAYOUT	SM

PROJECT
93 UNIT TERRACE FLATS
955 BORBRIDGE AVE.
BLOCK 167
OTTAWA, ONT.

CLIENT
RICHCRAFT

DRAWING TITLE
SITE PLAN

DATE: APR., 2024.
SCALE: 1:500
SHEET No.: SP-1
DRAWN BY: SBM
CHECKED: MDB
REV. 11

D

#________

Appendix F Background Report Excerpts

REPORT
Project: 125581.6.04-03

DESIGN BRIEF
RIVERSIDE SOUTH PHASE 17-1B
4775 & 4875 SPRATT ROAD
RIVERSIDE SOUTH COMMUNITY

Prepared for RIVERSIDE SOUTH DEVELOPMENT CORPORATION (RSDC)
by IBI GROUP

JANUARY 2022
REVISED: MARCH 2022

3 WASTEWATER DISPOSAL

3.1 Existing Conditions

Sanitary flows from the majority of the site are routed to the existing 450 mm sanitary sewer on Ralph Hennessy on the RSDC Phase 13 site north of the BRT corridor. A portion of the west side of the site flows through sewers that are currently being constructed in the Phase 17-1A site which is tributary to the Spratt Road/Brian Good sub trunk via existing sewers in the RSDC Phase 15-2 site. **Figure 1.3,** in **Appendix A**, shows the current location of those sewers.

3.2 Riverside South Community Infrastructure Servicing Study Update – Rideau River Area (2017 ISSU)

The report provided a macro level servicing plan for the portion of the Riverside South Community that will be tributary to Pond 5, which is referred to as the Rideau River Study Area. The limits of the study area are shown on Figure 1.1 from the study and a copy is included in **Appendix A**. The subject property is located within the Rideau River Drainage Area.

The 2017 ISSU Report recommended that wastewater flows from approximately ¾ of the study area is to be routed to the Spratt Road sewer. For reference, a copy of Drawing SAN-1, Sanitary Drainage Plan from the 2017 study is included in **Appendix C**. The 2017 ISSU study recommended that drainage area 2e be tributary to the Spratt Road sewer. A copy of Figure 4.2, Recommended Sanitary Servicing (2017 Update), from the 2017 ISSU Report, together with a related design sheet are both included in **Appendix C**..

3.3 Deviation Report Memorandum Riverside South, Rideau River Drainage Area Sanitary Sewer Design Parameters, IBI Group – 2017 (Deviation Report)

This report, which was accepted by the City of Ottawa in 2017, provided alternative drainage areas for the River Road, Spratt Road and Shoreline Drive collector sewers. This report proposed to expand the drainage area of the River Road collector sewer to better follow the storm sewer flow directions and reduce grade raise challenges associated with the ISSU Spratt Road collector drainage area. The shift of the River Road/Spratt Road drainage area split westward has resulted in additional lands west of Spratt Road being included in the Spratt Road collector drainage area. The deviation memo, supporting figures and sewer design sheets along with City of Ottawa approval emails can all be found in **Appendix C**. The deviation memo and supporting documents confirm that the small portion of the subject lands that was included in the ISSU drainage area 3b which were tributary to the Shoreline Drive collector sewer are now included in the expanded drainage area 2Diii as shown in the deviation report. As such, the western side of the subject lands are tributary to the Spratt Road collector sewer while the remaining is tributary to the Shoreline Drive collector.

3.4 Design Criteria

The estimated wastewater flows from the subject site are based on the revised City of Ottawa design criteria. Among other items, these include:

- Average residential flow = 280 l/c/d

- Peak residential flow factor = (Harmon Formula) x 0.80
- Average commercial flow = 28,000 l/s/ha
- Average institutional flow = 28,000 l/s/ha
- Peak ICI flow factor = 1.5 if ICI area is ≤ 20% total area
  1.0 if ICI area is > 20% total area
- Inflow and Infiltration Rate = 0.33 l/s/ha
- Minimum Full Flow Velocity = 0.60 m/s
- Maximum Full Flow Velocity = 3.0 m/s
- Minimum Pipe Size = 200 mm diameter

In accordance with the Table 4.2 of the Ottawa Sewer Guidelines, the following density rates are estimated for the subject site:

- Single units = 3.4
- Semi units (Duplex) = 2.3
- Townhouse and back to back units = 2.7
- Apartment units = 1.8

Minimum allowable slopes as listed below:

DIAMETER (mm)	SLOPE (%)
200	0.320
250	0.240
300	0.186
375	0.140
450	0.111
525 and larger	0.100

Where practical and where there are less than 10 residential connections, the first lengths of sanitary sewers are designed as 200 mm diameter pipes with a minimum slope of 0.65%.

3.5 Proposed Wastewater Plan

The sanitary outlet for the majority of the site is the 450 mm sanitary sewer stub on Ralph Hennessy north of the BRT corridor. The sewer will be extended on Ralph Hennessy through the site with another branch extending west on Borbridge and south on Ed Findlay. A sanitary drainage area plan, and an external sanitary sewer drainage area plan, showing the external drainage areas, and a sanitary sewer design sheet is included in **Appendix C**. The total area from Phase 17 tributary to the Ralph Hennessy sewer at the BRT corridor is 45.28 hectares with a peak flow of 46.58 l/s, in the ISSU at Node 116 the sanitary drainage area is 48.13 hectares with a total flow of 49.8 l/s. The remainder of the site will drain to the west through stubs on Kiwi, Apricot, Honeydew and Rockmellon Streets in Phase 17-1A and the 4725 Spratt Road site.

An external drainage area plan of lands to the south shows the extension of the Ralph Hennessy sanitary sewer and the extensions of the Ed Findlay and Solarium Avenue sanitary sewers. The sewers are extended using the minimum slopes for the pipe sizes and the inverts are compared with the proposed road grades. At all locations the depths are well in excess of 3 meters allowing normal house construction, the storm sewer are below the sanitary sewers.

During construction, temporary inlet control devices (ICD) will be placed at the first new upstream MH on the sanitary sewers outletting to existing sewers on Ralph Hennessy and on Rockmelon, Honeydew, Apricot and Kiwi Streets in Phase 17-1A and 4725 Spratt Road to prevent excessive groundwater flow into the system which could occur during construction. The ICDs will remain in place until preliminary acceptance at which time it will be removed. Calculations are included in **Appendix C** in which the size of the ICD is calculated based on the design flow of the sewer with the hydraulic head set at the road grade.

4 MINOR STORM SEWERS

4.1 Existing Conditions

As noted in Section 1.6 all minor stormwater from this site is routed to Pond 5 which is located west of Rideau Road and is in service. A 2250 mm storm stub on Borbridge Avenue is currently under construction in the 4725 Spratt Road site. Storm sewers in Phase 17-1A are being constructed on Rockmelon, Honeydew, Apricot and Kiwi Streets at the west limit of the Phase 17-1B site. **Figure 1.3** shows the current location of those sewers.

4.2 Riverside South Community Infrastructure Servicing Study Update – Rideau River Area (2017 ISSU)

Comparison with the 2017 ISSU report is included in Section 5. Figure 4.1 from the 2020 Assessment of Adequacy of Public Service is included in **Appendix D** which shows the proposed minor system layout for this area.

4.3 Design Criteria

In accordance with the City of Ottawa Sewer Design Guidelines, the following design criteria was used to size storm sewers using the rational method:

- Design return period: 1:2 year – local roads; 1:5 year – collector roads; 1:10 year – arterial roads
- Time of Concentration: 10 minutes
- Minimum velocity: 0.8 m/s
- Maximum velocity: 3.0 m/s
- Manning's roughness coefficient: 0.013
- Minimum allowable slopes listed below:

DIAMETER (MM)	SLOPE (%)
250	0.432
300	0.340
375	0.250
450	0.195
525	0.160
600	0.132
675	0.113
750 and larger	0.100

- Runoff Coefficients
- Townhouses
  - Front 0.68
  - Rear 0.44
- Single Family
  - Front 0.63
  - Rear 0.53

Detail calculations for runoff coefficients for the residential lots are included in **Appendix D**.

4.4 Proposed Minor Storm Plan

The storm outlet for the majority of site is the 2250 mm stub on Borbridge Avenue, the sewer will be extended on Borbridge and Ralph Hennessy to service lands to the south along with Ed Findlay Street. Phase 17-1A and sewers on Rockmelon, Honeydew, Apricot and Kiwi Streets will also be extended for the west portion of Phase 17-1B.

Similar to the sanitary sewer temporary ICD's will be placed on the first upstream MH on the storm sewer outletting to existing sewers on Borbridge, Rockmelon, Honeydew, Apricot and Kiwi Streets. Calculations are included in **Appendix D** where the size of the ICD is calculated based on the design flow of the sewer with the hydraulic head set at road grade.

A storm sewer design sheet and storm drainage area plan and external storm drainage area plan are provided in **Appendix D**.

The existing surface drainage in this area generally runs south to north, temporary ditches are proposed along the southern boundary to intercept this flow. The existing flows are directed to two temporary DICB's on Ed Findlay and one on the Rockmellon storm stub at Lavender. As the Ed Findlay sewer has a large upstream drainage area, the DICB leads will limit the flow, for the Rockmellon DICB an ICD will be installed to limit the flow to the design 2 year storm for the storm sewer. Temporary DICB's are placed on the Ralph Hennessy storm sewer to temporary drain the school and mid density blocks while temporary drainage from the park block drains to the park CBMH. On the commercial block at the north end of Ralph Hennessy, an existing DICB will be relocated. Along the north boundary the existing drainage flows away from the development.

5 STORMWATER MANAGEMENT

5.1 Background

Riverside South Phase 17-1B (subject site) is located within the Rideau River Area of the Riverside South Development Community and is tributary to the Pond 5 Stormwater Facility. The stormwater management strategy for the subject site was outlined in the following reports:

- *Riverside South Community Infrastructure Servicing Study Update – Rideau River Area* (Stantec Consulting Ltd., June 2017), referred henceforth as the 2017 ISSU;
- Assessment of Adequacy of Public Services – Claridge Homes Phase 3 Lands – 4725 Spratt Road (IBI Group August 2020)
- Assessment of Adequacy of Public Services RSDC Phase 17 Lands – 4775 & 4725 Spratt Road – Riverside South Community Rideau River Area (IBI Group, July 2020); and,
- Design Brief Riverside South – Phase 15-2, 4 & Spratt Road (IBI Group, August 2019),
- Design Brief Riverside South – Phase 17-1A (IBI Group, September 2021)

The property is east of Spratt Road and south and east of the proposed 4725 Spratt Subdivision and south of the future BRT corridor and east of Phase 17-1A. It is expected that the 4725 Spratt Road site will be built in advance or concurrently with this site. In the 2017 ISSU, the minor storm runoff for the Rideau River Area is proposed to be routed to one of four trunk storm sewers. For reference a copy of Drawing STM1, Storm Sewers from the 2017 ISSU study is included in **Appendix E**. One of the trunk sewers are proposed to be located within the subject property and is tributary to the north inlet of Pond 5. This trunk sewer has two branches which run along Borbridge Street and Atrium Ridge, both converging on Brian Good Avenue (**Figure 5-1**).

The minor storm plan for the subject site is proposed to follow the recommendation of the 2017 ISSU report with only minor adjustments to that plan which have been addressed in the 2018 River Road Report. **Appendix E** includes the applicable sections and information from that report.

Details of the subject site parameters, on-site storage available, restricted minor system rates and assumptions for the areas external to the subject site will be discussed in **Section 5.5**.

5.2 Objective

The purpose of this evaluation is to prepare the dual drainage design, including the minor and major system, for Riverside South Phase 17-1B development. The design includes the assignment of inlet control devices, maximum depth and velocity of flow on the surface and hydraulic grade line analysis. The evaluation takes into consideration the following City of Ottawa documents:

- Ottawa Sewer Design Guidelines (OSDG) (October 2012);
- February 2014 Technical Bulletin ISDTB-2014-01;
- September 2016 Technical Bulletin PIEDTB-2016-01;
- March 2018 Technical Bulletin ISTB-2018-01; and,

- June 2018 Technical Bulletin ISTB-2018-04.

5.3 System Concept

The stormwater management system for the site incorporates standard urban drainage design and stormwater management features that can be summarized as follows:

- a dual drainage concept;
- routing of surface runoff; and,
- an end-of-pipe SWM facility (designed by others).

The stormwater management system has been developed based on the MOE *Stormwater Management Planning and Design Manual* (March 2003) and the *City of Ottawa Sewer Design Guidelines* (OSDG, October 2012), as well as subsequent City of Ottawa Technical Bulletins.

The design of the proposed stormwater management facility (Pond 5) was completed by Stantec Consulting Ltd.

5.3.1 Scope

The evaluation described in the following sections has been completed to support the detail design of Riverside South Phase 17-1B development.

A fully dynamic PCSWMM model was used to evaluate the dual drainage system for the subject site. The River Road model used in the approved August 2018 River Road Report has been used as the base and as detailed design of phases has progressed, the semi-lumped areas were replaced with the detail design information of the corresponding sites. The current development model includes detail design information on River Road, River's Edge Phase 1, River's Edge Phase 2, RSDC PH15-1A, and RSDC PH15-1B, and RSS PH15-3, 4725 Spratt Road, and RSDC PH17-1A developments. As required, adjustments have been made to those drainage boundaries adjacent to Phase 17-1B development. The overall drainage area represented by the PCSWMM model is shown in **Figure 5.1**. The drainage area plans for the subject site are provided on **Drawings 125581-750** in **Appendix E**.

5.4 Dual Drainage Design

The subject site is designed with dual drainage features, accommodating minor and major system flow. During frequent storm events, the effective runoff of a catchment area is directly released via catchbasin inlets to the network of storm sewers, called the minor system. During less frequent storm events, the balance of the flow (in excess of the minor flow) is accommodated by a system of rear yard swales and street segments, called the major system.

All streets within the subject site feature a sawtooth profile with the exception of areas S841B, S906, S908, S933A, and S981A which have a continuous grade profile. The sawtooth profile facilitates surface storage on subdivision streets and is based on maximum 350 mm separation between the low point at the catchbasin and the high overflow point at the downstream end of the segment. **Table 5-3** indicates whether a street segment is continuous or sawtoothed. In accordance with OSDG, rear yard storages have not been accounted for.

Inlet control devices (ICDs) are proposed across the site to maximize the use of available on-site storage and control surcharge of the minor system during infrequent storm events. For those street segments on continuous grade, the inflow to the minor system will be limited by hydraulic characteristic of the catchbasins. As such, the model incorporates the actual flow entering the minor system on continuous grade based on depth-capture curves derived from the Townsend Curves in the Sewer Design Guidelines. Depth-capture curves on continuous grades was provided by the City of Ottawa and are enclosed in **Appendix E**.

The dual drainage system has been evaluated using the fully dynamic PCSWMM model for both the hydrological and hydraulic analysis. The PCSWMM hydrological evaluation offers single storm event flow generation and routing. The major system evaluation is fully dynamic and based on typical road cross sections and road profiles.

According to the September 2016 Technical Bulletin, local streets are required to provide a 2 year level of service without ponding during the storm event. For the subject site, the following approach was taken:

- 2 year level of service provided for all local streets;
- 5 year level of service provided for all collector roads; and,
- 2 year level of service for rear yards.

ICDs were initially sized based on the 2 or 5 year 3 hour Chicago design storm event. In some instances, the proposed ICD release rates and minor system sewer sizing were optimized to protect lots from surface flooding. This was accomplished by increasing ICD release rates above the 2 or 5 year storm event.

The major system flow from the subject site outlet toward 4725 Spratt Road (Borbridge Ave and Kiwi Street) and Phase 17-1A (Apricot St, Honeydew St, and Rockmellon St) at locations shown on **Drawing 125581-750**. It is intended that the total flow from the subject site not impact the receiving developments. Therefore, in some locations, there may be capture greater than 2 or 5 year flow

The drainage area plans are presented on **Drawings 125581-750**. Model files are enclosed in **Appendix E**.

5.5 Stormwater Evaluation

5.5.1 Hydrological Evaluation

Land use, selected modeling routines, and input parameters are discussed in the following sections for the subject site only. Model files are included in **Appendix E.**

Land Use

Riverside South Phase 17-1B development will be developed with a mix of single family units and townhouses. The overall PCSWMM schematic is presented in **Appendix E** and the drainage plan is provided on **Drawings 125581-750.**

Storms and Drainage Area Parameters

The main hydrological parameters for the subject site are presented in **Table 5-2 and Table 5-3.**

- **Design Storms:** The subject site was evaluated using the following storms:
    - 2, 5 and 100 year 3 hour Chicago storm events (10 minute time step), as per the OSDG and the September 2016 Technical Bulletin*;*

  - 100 year 3 hour Chicago storm event (10 minute time step) with 20% increase for Climate Change consideration, as per the OSDG;
  - 25 mm 4 hour Chicago storm event consistent with the 2018 Pond 5 Design Brief; and,
  - 100 year 12 hour SCS Type II storm event consistent with the 2018 Pond 5 Design Brief.

- **Area:** The drainage area was divided into sub-drainage areas based on the proposed minor system network of storm sewers and the rational method spreadsheet with some minor modifications for modeling purposes. See **Drawing 125581-750** for the catchment areas used in the detail evaluation of the subject site.
- **Imperviousness:** PCSWMM provides an opportunity to specify direct and indirect routing to a pervious or impervious area. For this evaluation, all street segments were assumed to be 100% routed to an impervious surface and all rear yards were assumed to be 100% routed to a pervious surface.
- **Infiltration:** Infiltration losses were selected to be consistent with the OSDG. The Horton values are as follows: Max. infiltration rate = 76.2 mm/h, Min. infiltration rate = 13.2 mm/h, Decay constant = 4.14 1/hr.
- **Subcatchment Width:** The catchment width was based on the conveyance route length of the drainage area and multiplied by two. The multiplier of two was only used if the drainage area had runoff contribution from both sides of the drainage area. This approach is consistent with the OSDG.
- **Slope:** The average surface slope was based upon the average slope for both impervious and pervious area. An average slope of 1% has been used for subcatchment flow routing. It should be noted that the appropriate longitudinal slope of streets was accounted in PCSWMM using a combination of nodes with inverts corresponding to gutter elevations, and links with corresponding road cross-sections
- **Initial Abstraction (Detention Storage):** Detention storage depths of 1.57 mm and 4.67 mm were used for impervious and pervious areas, respectively. These values are consistent with the OSDG.
- **Manning's Roughness:** Manning's roughness coefficients of 0.013 and 0.25 were used for impervious and pervious areas, respectively.
- **Baseflow:** No baseflow components were assumed for any of the areas contributing runoff to the minor system within the PCSWMM model.
- **Major System Storage and Routing:** The subject site is comprised of both continuous grade and sawtooth road profiles. For drainage areas with sawtoothing, flow is attenuated within low points with potential overflow cascading to the next segment downstream. The total volume at each low point, up to the overflow depth, is the maximum static storage. Ponding plan is presented on **Drawing 125581-602** to **Drawing 125581-606**. Rear yard segments have a sawtooth pattern with some storage available, but the storage is not accounted for as part of the analysis.

  For street segments with ponding, minor system capture is set to fully utilize storage during the 100 year design storm, while minimizing ponding during the 2 or 5 year event. Cascading overflow from a low point to a downstream segment utilizes the static storage available plus an additional amount of storage equivalent to the depth required for the flow to cascade over the downstream high point. The attenuation in street sags was evaluated to account for static storage and, if overflow occurs, dynamic storage.

For street segments with continuous grade, simulations were based on the approach-capture characteristics of the catchbasin with the constraint that during the 100 year design storm the maximum cascading flow does not exceed 0.35 m.

For street segments with sawtoothing, simulations were based on the constraint that during the 100 year design storm the maximum depth of ponding (including cascading flow where applicable) does not exceed 0.35 m. The surface storages were modeled in PCSWMM using a combination of nodes with inverts corresponding to gutter elevations, and links with corresponding road cross-sections. The evaluation was undertaken assuming dynamic flow conditions. It should be noted that the visual interpretation of street links in the model, is based on illustrating street nodes along the center of the road. However, the invert elevations are modified to correspond to the gutter (CB grill) elevations as indicated above.

Rear yards were considered independently of street segments. Storage volumes in rear yards were not accounted for as available on-site storage. Therefore, in the PCSWMM model, the sawtooth pattern of rear yard swales was neglected, and it was assumed that there is a continuous slope from the high point to the low point elevation of the swale. Simulations were based on the total interception of runoff by the storm inlets. This was done by specifying a subcatchment outlet in the model at the same node as the rear yard ICD outlet link. Overflow from the rear yards cascades to the next downstream segment and then ultimately to a major system road segment via swales.

- **Minor system capture:** The minor system capture for the subject site is based on the 2 or 5 year storm event depending on the road type (local or collector) and for maximum ponding conditions. ICDs are proposed to protect the minor system from surcharge during infrequent storm events and to utilize on-site storage. The assignment and placement of the ICDs within the subject site were determined as part of this evaluation. The inflow rate for the CBs located at low points within the subject site were increased to maintain the major system flow dynamic depth at 0.35 m, if required.

  The City has requested specific ICD sizes to be specified for use on the site. These ICD sizes are documented in City of Ottawa MS-18.4 Inlet Control Devices (ICD's, March 2017). Within the aforementioned document eight (8) ICD sizes are noted. The following table summarizes the ICD sizes assigned to the site including associated flowrate at the maximum allowable ponding depth of 0.35m above top of grate.

Table 5-1: Standard City of Ottawa ICD Sizes

ICD DIAMETER (MM)	ORIFICE AREA (M^2)	MAX FLOW RATE AT MAX PONDING DEPTH OF 0.35 M (L/S)
Vortex	n/a	6
83	0.0054	20.41
94	0.0069	26.18
102	0.0082	30.83
108	0.0092	34.56
127	0.0127	47.80

ICD DIAMETER (MM)	ORIFICE AREA (M^2)	MAX FLOW RATE AT MAX PONDING DEPTH OF 0.35 M (L/S)
152	0.0181	68.46
178	0.0249	93.89

The standard ICDs were assigned to each CB within the subject site. For the evaluation of the site in PCSWMM, a rating curve for each standard ICD has been created. The rating curve was emulating performance of a particular orifice in question to convey the ICD flow to the minor system. The rating curve was based on an average top of grate (T/G) to the center of CB lead height of 1.3 m for the street segments and 1.4 m for the rear yard segments. The ICD size, head and flow are provided on the CB table presented on **Drawing 125581-010**. Any exemptions to the above noted ICDs assumed are indicated in the CB table presented on **Drawing 125581-010**.

Non-Residential Lands

In addition to the above noted assumptions with respect to Phase 17-1B, the following assumptions were used to model the minor and major system flow from the non-residential areas which are tributary to and contribute flow (minor and major) to the subject site. A summary of the areas, storages and parameter assumptions are provided in **Table 5-2.**

- Park Site (PCSWMM ID: P931): The minor system capture limit for the park was based on the 2 year modeled flow as provided in **Table 5-3**. It was also assumed the balance of flow up to the 100 year storm event, to be stored on-site with emergency overflow (excess of the 100 year event) to Ralph Hennessy Ave (area S930).
- School Site (PCSWMM ID: SC933): The institutional site was assumed to be restricted to the 2 year modeled flow as provided in **Table 5-3**. It was also assumed that full on-site storage will be provided (all major flow contained on-site up to and including the 100 year event). Emergency overflow will be routed to adjacent streets Ralph Hennessy Ave (area S933B).
- Commercial Site (PCSWMM ID: COM947): The minor system capture limit for the commercial site was based on the 2 year modeled flow as provided in **Table 5-3**. It was also assumed the balance of flow up to the 100 year storm event, to be stored on-site with emergency overflow (excess of the 100 year event) to Ralph Hennessy Ave (area S946).
- Mid Density Site (PCSWMM ID: MD910): The mid density site was assumed to be restricted to the 5 year modeled flow as provided in **Table 5-3**. It was also assumed that full on-site storage will be provided (all major flow contained on-site up to and including the 100 year event). Emergency overflow will be routed to adjacent streets Borbridge Ave (area S910).

A summary of parameters and assumed inflow for non-residential lands are provided in **Table 5-2** and **Table 5-3**. **Drawing 122581-750** presents the area contributing major and minor flow to the subject site including their segment ID.

Summary of Modeling Files

For ease of review, the following is a reference list of the computer modeling files enclosed in **Appendix E**.

PCSWMM

- 125581-RSSPH17-1B-REV2-25MM.pcz – 25 mm 4 hour Chicago
- 125581-RSSPH17-1B-REV2-2CH.pcz – 2 year 3 hour Chicago
- 125581-RSSPH17-1B-REV2-5CH.pcz – 5 year 3 hour Chicago
- 125581-RSSPH17-1B-REV2-100CH.pcz – 100 year 3 hour Chicago
- 125581-RSSPH17-1B-REV2-100SCS.pcz – 100 year 12 hour SCS Type II
- 125581-RSSPH17-1B-REV2-120CH.pcz – 100 year 3 hour Chicago increased by 20%

Table 5-2 Hydrological Parameters – Subcatchment Summary Table

DRAINAGE AREA ID	AREA (HA)	DOWNSTREAM SEGMENT ID	RECEIVING MH (SEWER NODE)	IMP RATIO	SUBCATCHMENT WIDTH (M)	AVAILABLE STATIC STORAGE (CU-M)(1)
Street Segments						
S804	0.40	Phase 17-1A	MH804	69	217	26.65
S805	0.22	S982	MH805	69	88	21.73
S806	0.43	S982	MH806	69	170	67.22
S807	0.32	S808	MH807	69	104	57.29
S808	0.26	S906B	MH808	69	110	1.48
S822	0.42	Future Phase 17	MH822	61	222	10.15
S825	0.29	S984B	MH825	69	168	45.88
S826	0.47	S825	MH826	69	182	70.18
S828A	0.17	S828B	MH828	61	88	10.86
S828B	0.35	S826	MH828	69	98	97.70
S835A	0.24	S985A	MH835	61	150	6.16
S835B	0.46	S835A	MH835	61	190	52.18
S840	0.29	S986	MH840	61	170	9.42
S841A	0.22	S841C	MH841	61	64	49.81
S841B	0.29	S841A	MH841	61	120	n/a
S841C	0.25	S828B	MH841	69	80	68.34
S905	0.36	4725 Spratt Rd	MH905	76	158	28.74

DRAINAGE AREA ID	AREA (HA)	DOWNSTREAM SEGMENT ID	RECEIVING MH (SEWER NODE)	IMP RATIO	SUBCATCHMENT WIDTH (M)	AVAILABLE STATIC STORAGE (CU-M)[(1)]
S906	0.17	S906B	MH906	69	53	n/a
S906B	0.31	S981B	MH906	69	70	9.03
S908	0.26	S906	MH908	69	62	n/a
S910	0.31	S946	MH910	69	102	83.03
S911	0.11	S946	MH911	61	96	2.03
S911A	0.25	S911	MH911	61	190	46.71
S930	0.37	S946	MH930	69	127	45.99
S931A	0.26	S931B	MH931	69	60	13.86
S931B	0.24	S930	MH931	69	68	29.36
S932	0.26	S841C	MH932	69	132	42.45
S933A	0.21	S933B	MH933	43	105	n/a
S933B	0.27	S931A	MH933	69	52	6.73
S943	0.25	S945	MH943	69	110	7.95
S945	0.22	S947	MH945	69	73	12.80
S946	0.29	S947	MH946	61	90	2.60
S947	0.24	OUT	MH947	69	73	6.47
S961A	0.37	S961B	MH961	69	86	2.32
S961B	0.24	Phase 17-1A	MH961	61	124	22.02
S963	0.27	Phase 17-1A	MH963	69	168	18.09
S981A	0.15	S961B	MH981	69	144	n/a
S981B	0.23	4725 Spratt Rd	MH981	69	83	28.96
S982	0.32	S981B	MH982	69	100	8.25
S984A	0.32	S984B	MH984	61	114	12.51
S984B	0.23	S805	MH984	61	81	7.57
S985A	0.13	S985B	MH985	61	70	8.39
S985B	0.17	S984A	MH985	61	92	2.98

DRAINAGE AREA ID	AREA (HA)	DOWNSTREAM SEGMENT ID	RECEIVING MH (SEWER NODE)	IMP RATIO	SUBCATCHMENT WIDTH (M)	AVAILABLE STATIC STORAGE (CU-M)(1)
S986	0.30	S985A	MH986	61	162	4.30
Rear Yards						
R804	0.42	S804	MH804	47	110	n/a
R806A	0.26	R806B	MH806	34	157	n/a
R806B	0.26	S806	MH806	34	162	n/a
R808	0.14	R806A	MH808	34	92	n/a
R822	0.34	S822	MH822	47	107	n/a
R825	0.33	S825	MH825	47	208	n/a
R826	0.30	R825	MH826	47	190	n/a
R828	0.34	S828B	MH828	34	98	n/a
R835	0.27	S835A	MH835	47	170	n/a
R840	0.30	S840	MH840	47	188	n/a
R841A	0.30	S841A	MH841	47	188	n/a
R841B	0.33	S841C	MH841	47	214	n/a
R906B	0.17	S906B	MH906	34	102	n/a
R932A	0.37	OUT	MH932	34	221	n/a
R932B	0.20	S932	MH932	34	126	n/a
R943	0.35	R944	MH943	34	216	n/a
R944	0.23	S945	MH944	34	131	n/a
R947	0.22	S947	MH947	34	155	n/a
R961	0.18	S961A	MH961	34	116	n/a
R963	0.47	S963	MH963	34	281	n/a
R982	0.42	R906B	MH982	34	184	n/a
R984A	0.23	S984A	MH984	47	158	n/a
R984B	0.13	S984B	MH984	47	80	n/a
R981	0.23	n/a	n/a	43	134	n/a

DRAINAGE AREA ID	AREA (HA)	DOWNSTREAM SEGMENT ID	RECEIVING MH (SEWER NODE)	IMP RATIO	SUBCATCHMENT WIDTH (M)	AVAILABLE STATIC STORAGE (CU-M)(1)
R986	0.23	OUT	MH986	47	148	n/a
Non-Residential Lands						
MD910	1.45	S910	MH910	71	326	100yr on-site storage
P931	2.36	S930	MH931	43	531	100yr on-site storage
SC933	3.12	S933B	MH933	71	702	100yr on-site storage
COM947	0.93	S946	MH947	71	209	100yr on-site storage

(1) The available on-site static storage is based on Drawing 125581-602 to 125581-606.

5.5.2 Results of Hydrological Evaluation

In PCSWMM, the hydraulic grade line (minor system) and major system are simulated simultaneously. The resulting hydraulic grade line is presented in **Section 5.5.3**. The results of the major system evaluation are summarized in the following sections.

The assigned size of the inlet control devices (ICDs) for the subject site was optimized using PCSWMM. ICDs are incorporated into the stormwater management design to protect the minor system from surcharge during infrequent storm events. The ICDs used for the subject site are provided in the CB table presented on **Drawing 125581-010**. It should be noted that due to the major system flow from the future areas, there were a few instances where the flow restriction into the minor system was increased above the 100 year flow.

Table 5-3 Minor Flow Capture for Riverside South Phase 17-1B Development

DRAINAGE AREA ID	CONTINUOUS/SAG (1)	ROAD TYPE	MINOR SYSTEM DESIGN TARGET (BASED ON ROAD TYPE)		100 YEAR CAPTURED FLOW (L/S)	ICD ORIFICE SIZE (MM DIA.)		NOTES
			MINOR SYSTEM DESIGN STORM	GENERATED FLOW ON INDIVIDUAL SEGMENT SIMULATED (L/S)				
Street Segments								
S804	Sag	18m Row, 8.5m asphalt	2	57.9	73.5	108	127	
S805	Sag	18m Row, 8.5m asphalt	2	32.6	36.8	83	83	
S806	Sag	18m Row, 8.5m asphalt	2	62.8	86.6	127	127	
S807	Sag	18m Row, 8.5m asphalt	2	46.7	54.2	102	102	
S808	Sag	18m Row, 8.5m asphalt	2	38.0	45.4	94	94	

DRAINAGE AREA ID	CONTINUOUS/SAG [1]	ROAD TYPE	MINOR SYSTEM DESIGN TARGET (BASED ON ROAD TYPE)		100 YEAR CAPTURED FLOW (L/S)	ICD ORIFICE SIZE (MM DIA.)		NOTES
			MINOR SYSTEM DESIGN STORM	GENERATED FLOW ON INDIVIDUAL SEGMENT SIMULATED (L/S)				
S822	Sag	20m Row, 8.5m asphalt	2	55.1	61.1	108	108	
S825	Sag	18m Row, 8.5m asphalt	2	42.4	47.5	94	94	
S826	Sag	18m Row, 8.5m asphalt	2	68.6	83.2	127	127	
S828A	Sag	18m Row, 8.5m asphalt	2	22.3	34.9	83	83	
S828B	Sag	18m Row, 8.5m asphalt	2	51.1	55.3	102	102	
S835A	Sag	18m Row, 8.5m asphalt	2	31.4	35.9	83	83	
S835B	Sag	18m Row, 8.5m asphalt	2	60.2	72.2	108	127	
S840	Sag	18m Row, 8.5m asphalt	2	38.0	46.0	94	94	
S841A	Sag	18m Row, 8.5m asphalt	2	28.8	74.7	108	127	
S841B	Continuous	18m Row, 8.5m asphalt	2	38.0	0.0	n/a	n/a	
S841C	Sag	18m Row, 8.5m asphalt	2	36.5	47.9	94	94	
S905	Sag	26m Row, 11m asphalt	3	58.1	104.0	127	152	
S906	Continuous	26m Row, 11m asphalt	5	32.7	37.5	n/a		
S906B	Sag	26m Row, 11m asphalt	5	60.6	102.8	152	152	
S908	Continuous	26m Row, 11m asphalt	5	51.5	51.8	n/a	n/a	
S910	Sag	26m Row, 11m asphalt	5	61.4	69.8	108	127	
S911	Sag	26m Row, 11m asphalt	5	19.5	33.3	83	83	
S911A	Sag	26m Row, 11m asphalt	5	44.4	48.7	94	102	
S930	Sag	26m Row, 11m asphalt	5	73.3	81.0	127	127	
S931A	Sag	26m Row, 11m asphalt	5	52.1	58.9	108	108	
S931B	Sag	26m Row, 11m asphalt	5	46.9	52.4	102	102	
S932	Sag	18m Row, 8.5m asphalt	2	38.6	55.2	102	102	
S933A	Continuous	26m Row, 11m asphalt	5	26.1	96.5	n/a	n/a	
S933B	Sag	26m Row, 11m asphalt	5	53.9	60.0	108	127	
S943	Sag	18m Row, 8.5m asphalt	2	36.5	45.1	94	94	

DRAINAGE AREA ID	CONTINUOUS/SAG [1]	ROAD TYPE	MINOR SYSTEM DESIGN TARGET (BASED ON ROAD TYPE)		100 YEAR CAPTURED FLOW (L/S)	ICD ORIFICE SIZE (MM DIA.)		NOTES
			MINOR SYSTEM DESIGN STORM	GENERATED FLOW ON INDIVIDUAL SEGMENT SIMULATED (L/S)				
S945	Sag	18m Row, 8.5m asphalt	2	32.1	36.0	83	83	
S946	Sag	26m Row, 11m asphalt	5	51.5	58.2	108	108	
S947	Sag	26m Row, 11m asphalt	5	47.6	54.7	102	102	
S961A	Sag	18m Row, 8.5m asphalt	2	53.9	59.6	108	108	
S961B	Sag	18m Row, 8.5m asphalt	2	31.4	46.8	94	94	
S963	Sag	18m Row, 8.5m asphalt	2	39.6	47.0	94	94	
S981A	Continuous	18m Row, 8.5m asphalt	2	21.9	24.9	n/a		
S981B	Sag	18m Row, 8.5m asphalt	2	33.6	36.9	83	83	
S982	Sag	18m Row, 8.5m asphalt	2	46.7	53.9	102	102	
S984A	Sag	20m Row, 8.5m asphalt	2	41.9	46.8	94	94	
S984B	Sag	18m Row, 8.5m asphalt	2	30.1	37.2	83	83	
S985A	Sag	18m Row, 8.5m asphalt	2	16.6	35.9	83	83	
S985B	Sag	18m Row, 8.5m asphalt	2	22.6	35.4	83	83	
S986	Sag	18m Row, 8.5m asphalt	2	39.3	46.1	94	94	
Rear Yards								
R804	Rear Yard	Rear Yard	2	23.4	27.5	102		
R806A	Rear Yard	Rear Yard	2	11.9	18.5	83		
R806B	Rear Yard	Rear Yard	2	12.1	18.9	83		
R808	Rear Yard	Rear Yard	2	6.7	18.2	83		
R822	Rear Yard	Rear Yard	2	21.0	23.3	94		
R825	Rear Yard	Rear Yard	2	26.8	28.4	102		
R826	Rear Yard	Rear Yard	2	24.4	28.1	102		
R828	Rear Yard	Rear Yard	2	10.1	18.2	83		
R835	Rear Yard	Rear Yard	2	21.9	23.6	94		
R840	Rear Yard	Rear Yard	2	24.3	29.5	102		

DRAINAGE AREA ID	CONTINUOUS/SAG (1)	ROAD TYPE	MINOR SYSTEM DESIGN TARGET (BASED ON ROAD TYPE)		100 YEAR CAPTURED FLOW (L/S)	ICD ORIFICE SIZE (MM DIA.)	NOTES
			MINOR SYSTEM DESIGN STORM	GENERATED FLOW ON INDIVIDUAL SEGMENT SIMULATED (L/S)			
R841A	Rear Yard	Rear Yard	2	24.3	29.5	102	
R841B	Rear Yard	Rear Yard	2	27.0	27.8	102	
R906B	Rear Yard	Rear Yard	2	7.8	18.5	83	
R932A	Rear Yard	Rear Yard	2	16.8	18.4	83	
R932B	Rear Yard	Rear Yard	2	9.3	18.2	83	
R943	Rear Yard	Rear Yard	2	16.2	18.6	83	
R944	Rear Yard	Rear Yard	2	10.2	18.8	83	
R947	Rear Yard	Rear Yard	2	10.8	18.1	83	
R961	Rear Yard	Rear Yard	2	8.5	17.9	83	
R963	Rear Yard	Rear Yard	2	21.4	23.4	94	
R982	Rear Yard	Rear Yard	2	16.2	18.4	83	
R984A	Rear Yard	Rear Yard	2	19.1	23.3	94	
R984B	Rear Yard	Rear Yard	2	10.4	18.2	83	
R981	Rear Yard	Rear Yard	2	15.4	18.4	83	
R986	Rear Yard	Rear Yard	2	18.8	23.2	94	
Non-Residential Lands							
MD910	Rear Yard	CUSTOM as required	5	320	320	320	
P931	Rear Yard	CUSTOM as required	2	217	217	217	
SC933	Rear Yard	CUSTOM as required	2	475	475	475	
COM947	Rear Yard	CUSTOM as required	2	142	142	142	

(1) if required, the minor flow restriction has been increased in sags to allow full capture of overflow from upstream segments on continuous grade during the design storm event without ponding.
(2) From PCSWMM Output "125581-RSSPH17-1B-REV2-100CH.pcz" presented in Appendix E.

The storage available on-site and its maximum depth and the results of the PCSWMM evaluation for the subject site are presented in **Table 5.4**. The ponding plan for the subject site is presented on **Drawing 125581-602** to **Drawing 125581-606.**

Table 5-4 Summary of On-Site Storage during the Target Minor System Design Storm

DRAINAGE AREA ID	MINOR SYSTEM DESIGN STORM	AVAILABLE STATIC STORAGE (CU-M)(1)	AVAILABLE STATIC DEPTH (M)(2)	MAXIMUM DEPTH AT LOW POINT (M) – IF APPLICABLE DURING THE TARGET MINOR SYSTEM DESIGN STORM	OVERFLOW (L/S)
Riverside South Phase 17-1B (Subject site)					
S804	Sag	26.7	0.25	0	0
S805	Sag	21.7	0.27	0	0
S806	Sag	67.2	0.27	0	0
S807	Sag	57.3	0.27	0	0
S808	Sag	1.5	0.13	0	0
S822	Sag	10.2	0.18	0	0
S825	Sag	45.9	0.25	0	0
S826	Sag	70.2	0.25	0	0
S828A	Sag	10.9	0.19	0	0
S828B	Sag	97.7	0.30	0	0
S835A	Sag	6.2	0.16	0	0
S835B	Sag	52.2	0.25	0	0
S840	Sag	9.4	0.15	0	0
S841A	Sag	49.8	0.25	0	0
S841B	Continuous	n/a	n/a	0.06	35.3
S841C	Sag	68.3	0.30	0	0
S905	Sag	28.7	0.21	0	0
S906	Continuous	n/a	n/a	0.05	48.94
S906B	Sag	9.0	0.16	0	0
S908	Continuous	n/a	n/a	0.04	32.03
S910	Sag	83.0	0.32	0	0
S911	Sag	2.0	0.11	0	0
S911A	Sag	46.7	0.25	0	0

DRAINAGE AREA ID	MINOR SYSTEM DESIGN STORM	AVAILABLE STATIC STORAGE (CU-M)(1)	AVAILABLE STATIC DEPTH (M)(2)	MAXIMUM DEPTH AT LOW POINT (M) – IF APPLICABLE DURING THE TARGET MINOR SYSTEM DESIGN STORM	OVERFLOW (L/S)
S930	Sag	46.0	0.24	0	0
S931A	Sag	13.9	0.15	0	0
S931B	Sag	29.4	0.20	0	0
S932	Sag	42.5	0.24	0	0
S933A	Continuous	n/a	n/a	0.03	12.46
S933B	Sag	6.7	0.15	0	0
S943	Sag	8.0	0.11	0	0
S945	Sag	12.8	0.18	0	0
S946	Sag	2.6	0.14	0	0
S947	Sag	6.5	0.15	0	0
S961A	Sag	2.3	0.13	0	0
S961B	Sag	22.0	0.21	0	0
S963	Sag	18.1	0.21	0	0
S981A	Continuous	n/a	n/a	0.03	9.16
S981B	Sag	29.0	0.24	0	0
S982	Sag	8.3	0.15	0	0
S984A	Sag	12.5	0.25	0	0
S984B	Sag	7.6	0.17	0	0
S985A	Sag	8.4	0.15	0	0
S985B	Sag	3.0	0.15	0	0
S986	Sag	4.3	0.16	0	0
Riverside South Phase 17-1A and 4725 Spratt Road					
S905	Sag	28.7	0.21	0	0
S972	Sag	26.5	0.18	0	0
S816	Sag	41.2	0.25	0	0

DRAINAGE AREA ID	MINOR SYSTEM DESIGN STORM	AVAILABLE STATIC STORAGE (CU-M)(1)	AVAILABLE STATIC DEPTH (M)(2)	MAXIMUM DEPTH AT LOW POINT (M) – IF APPLICABLE DURING THE TARGET MINOR SYSTEM DESIGN STORM	OVERFLOW (L/S)
S803B	Sag	4.4	0.13	0	0
S821	Sag	69.0	0.25	0	0

*(1) The available on-site static storage is based on **Drawing 125581-602** to **Drawing 125581-606**.*
*(2) The available static depth is based on **Drawing 125581-602** to **Drawing 125581-606**.*
(3) The resulting storage was simulated in PCSWMM based on road profile and cross sections for that street segment.

The results of the on-site detention analysis show that during the restricted inflow rate of the 2 or 5 year storm event, there is no ponding on the subject site.

Table 5-5 and Table 5-6 summarize the cascading overflows for each subcatchment on the subject site and the downstream subcatchments on Spratt Road for the 100 year 3 hour Chicago storm event and the 100 year Chicago storm increased by 20%, respectively. The cascading overflow is the flow exiting a drainage area when maximum minor system inflow and maximum available ponding has been utilized. The 18 m, 20 m and 26 m ROW sections, with the corresponding longitudinal profiles, were imported into PCSWMM to determine the depth and velocity of cascading overflow for continuous and sawtooth street segments.

It should be noted that for the purposes of modeling, where there are VPI in the road profile, the vertical curves have been flattened to straight line slopes between the two points. This approach is considered conservative with respect to the model.

Table 5-5 Summary of Velocity x Depth during the 100 Year 3 Hour Chicago Storm

DRAINAGE AREA ID	CONTINUOUS/SAG	AVAILABLE STATIC DEPTH (M) (1)	MAXIMUM DEPTH AT LOW POINT (M) – IF APPLICABLE	CASCADING DEPTH (m)(2)	VELOCITY (M/S)	VELOCITY X DEPTH (M^2/S)
Riverside South Phase 17-1B (Subject site)						
S804	Sag	0.25	0.25	0.00	0.00	0.00
S805	Sag	0.27	0.18	0.00	0.00	0.00
S806	Sag	0.27	0.31	0.04	0.54	0.02
S807	Sag	0.27	0.21	0.00	0.00	0.00
S808	Sag	0.13	0.17	0.04	0.46	0.02
S822	Sag	0.18	0.22	0.04	0.09	0.00
S825	Sag	0.25	0.30	0.05	0.76	0.04
S826	Sag	0.25	0.18	0.00	0.00	0.00

DRAINAGE AREA ID	CONTINUOUS/SAG	AVAILABLE STATIC DEPTH (M) [1]	MAXIMUM DEPTH AT LOW POINT (M) – IF APPLICABLE	CASCADING DEPTH (m)[2]	VELOCITY (M/S)	VELOCITY X DEPTH (M^2/S)
S828A	Sag	0.19	0.13	0.01	0.13	0.00
S828B	Sag	0.30	0.28	0.00	0.00	0.00
S835A	Sag	0.16	0.21	0.05	0.45	0.02
S835B	Sag	0.25	0.20	0.00	0.00	0.00
S840	Sag	0.15	0.21	0.06	0.72	0.04
S841A	Sag	0.25	0.30	0.05	0.49	0.02
S841B	Continuous	n/a	0.07	0.07	0.97	0.07
S841C	Sag	0.30	0.36	0.06	0.65	0.04
S905	Sag	0.21	0.26	0.05	1.37	0.07
S906	Continuous	n/a	0.06	0.06	1.59	0.10
S906B	Sag	0.16	0.24	0.07	0.91	0.06
S908	Continuous	n/a	0.05	0.05	0.71	0.04
S910	Sag	0.32	0.11	0.00	0.00	0.00
S911	Sag	0.11	0.01	0.00	0.00	0.00
S911A	Sag	0.25	0.13	0.00	0.00	0.00
S930	Sag	0.24	0.11	0.00	0.00	0.00
S931A	Sag	0.15	0.12	0.00	0.00	0.00
S931B	Sag	0.20	0.11	0.00	0.00	0.00
S932	Sag	0.24	0.22	0.01	0.07	0.00
S933A	Continuous	n/a	0.04	0.04	0.85	0.03
S933B	Sag	0.15	0.11	0.00	0.00	0.00
S943	Sag	0.11	0.14	0.03	0.77	0.02
S945	Sag	0.18	0.22	0.03	0.28	0.01
S946	Sag	0.14	0.09	0.00	0.00	0.00
S947	Sag	0.15	0.23	0.08	0.57	0.05
S961A	Sag	0.13	0.18	0.05	0.19	0.01

DRAINAGE AREA ID	CONTINUOUS/SAG	AVAILABLE STATIC DEPTH (M) (1)	MAXIMUM DEPTH AT LOW POINT (M) – IF APPLICABLE	CASCADING DEPTH (m)(2)	VELOCITY (M/S)	VELOCITY X DEPTH (M^2/S)
S961B	Sag	0.21	0.25	0.04	0.52	0.02
S963	Sag	0.21	0.27	0.06	0.63	0.04
S981A	Continuous	n/a	0.04	0.04	0.58	0.02
S981B	Sag	0.24	0.29	0.06	0.59	0.04
S982	Sag	0.15	0.18	0.03	0.10	0.00
S984A	Sag	0.25	0.28	0.03	0.28	0.01
S984B	Sag	0.17	0.23	0.06	0.60	0.04
S985A	Sag	0.15	0.19	0.04	0.16	0.01
S985B	Sag	0.15	0.19	0.04	0.35	0.01
S986	Sag	0.16	0.21	0.05	0.45	0.02
Riverside South Phase 17-1A and 4725 Spratt Road						
S905	Sag	0.21	0.26	0.05	1.37	0.07
S972	Sag	0.18	0.23	0.05	0.13	0.01
S816	Sag	0.25	0.28	0.03	0.00	0.00
S803B	Sag	0.13	0.05	0.00	0.00	0.00
S821	Sag	0.25	0.29	0.04	1.53	0.06

*(1) The available static depth is based on **Drawing 125581-602** to **Drawing 125581-606.***
(2) Evaluated at most downstream node within drainage area. From PCSWMM Output "125581-RSSPH17-1B-REV2-100CH.pcz" presented in Appendix E.

Table 5-6 Summary of Velocity x Depth during the 100 Year 3 Hour Chicago Storm Increased by 20%

DRAINAGE AREA ID	CONTINUOUS/SAG	AVAILABLE STATIC Depth (M) (1)	MAXIMUM DEPTH AT LOW POINT (M) – IF APPLICABLE	Cascading Depth (m)(2)	VELOCITY (M/S)	VELOCITY X DEPTH (M^2/S)
Riverside South Phase 17-1B (Subject site)						
S804	Sag	0.25	0.28	0.03	0.11	0.00
S805	Sag	0.27	0.23	0.00	0.00	0.00

DRAINAGE AREA ID	CONTINUOUS/SAG	AVAILABLE STATIC Depth (M) (1)	MAXIMUM DEPTH AT LOW POINT (M) – IF APPLICABLE	Cascading Depth (m)(2)	VELOCITY (M/S)	VELOCITY X DEPTH (M^2/S)
S806	Sag	0.27	0.37	0.10	0.88	0.09
S807	Sag	0.27	0.26	0.00	0.00	0.00
S808	Sag	0.13	0.18	0.04	0.56	0.02
S822	Sag	0.18	0.27	0.08	0.14	0.01
S825	Sag	0.25	0.34	0.09	0.83	0.07
S826	Sag	0.25	0.27	0.02	0.15	0.00
S828A	Sag	0.19	0.24	0.05	0.33	0.02
S828B	Sag	0.30	0.38	0.07	0.20	0.01
S835A	Sag	0.16	0.23	0.07	0.56	0.04
S835B	Sag	0.25	0.26	0.01	0.07	0.00
S840	Sag	0.15	0.22	0.07	0.81	0.06
S841A	Sag	0.25	0.32	0.07	0.57	0.04
S841B	Continuous	n/a	0.07	0.07	0.96	0.07
S841C	Sag	0.30	0.40	0.10	0.76	0.08
S905	Sag	0.21	0.30	0.08	1.50	0.12
S906	Continuous	n/a	0.07	0.07	1.58	0.11
S906B	Sag	0.16	0.26	0.09	1.07	0.10
S908	Continuous	n/a	0.06	0.06	0.75	0.05
S910	Sag	0.32	0.15	0.00	0.00	0.00
S911	Sag	0.11	0.06	0.00	0.00	0.00
S911A	Sag	0.25	0.18	0.00	0.00	0.00
S930	Sag	0.24	0.15	0.00	0.00	0.00
S931A	Sag	0.15	0.22	0.07	0.16	0.01
S931B	Sag	0.20	0.24	0.04	0.30	0.01
S932	Sag	0.24	0.31	0.06	0.14	0.01
S933A	Continuous	n/a	0.09	0.09	0.85	0.08

DRAINAGE AREA ID	CONTINUOUS/SAG	AVAILABLE STATIC Depth (M) (1)	MAXIMUM DEPTH AT LOW POINT (M) – IF APPLICABLE	Cascading Depth (m)(2)	VELOCITY (M/S)	VELOCITY X DEPTH (M^2/S)
S933B	Sag	0.15	0.22	0.07	0.27	0.02
S943	Sag	0.11	0.15	0.03	0.79	0.02
S945	Sag	0.18	0.23	0.04	0.32	0.01
S946	Sag	0.14	0.14	0.00	0.00	0.00
S947	Sag	0.15	0.25	0.10	0.66	0.07
S961A	Sag	0.13	0.19	0.06	0.24	0.01
S961B	Sag	0.21	0.34	0.13	0.73	0.09
S963	Sag	0.21	0.29	0.08	0.72	0.06
S981A	Continuous	n/a	0.04	0.04	0.60	0.02
S981B	Sag	0.24	0.35	0.11	0.93	0.10
S982	Sag	0.15	0.24	0.08	0.20	0.02
S984A	Sag	0.25	0.31	0.06	0.57	0.03
S984B	Sag	0.17	0.29	0.12	0.76	0.09
S985A	Sag	0.15	0.22	0.07	0.16	0.01
S985B	Sag	0.15	0.25	0.10	0.37	0.04
S986	Sag	0.16	0.23	0.07	0.56	0.04
Riverside South Phase 17-1A and 4725 Spratt Road						
S905	Sag	0.21	0.30	0.08	1.50	0.12
S972	Sag	0.18	0.25	0.07	0.14	0.01
S816	Sag	0.25	0.39	0.14	0.76	0.11
S803B	Sag	0.13	0.08	0.01	0.03	0.00
S821	Sag	0.25	0.38	0.11	1.77	0.19

*(1) The available static depth is based on **Drawing 125581-602** to **Drawing 125581-606***
(2) Evaluated at most downstream node within drainage area. From PCSWMM Output “125581-RSSPH17-1B-REV2-120CH.pcz” presented in Appendix E.

The product of velocity x depth (v x d) should be less than 0.6 m^2/s for street segments during the 100 year storm event as per the 2012 OSDG. For the street segments within the subject site, the product of v x d is less than 0.6 m^2/s during the 100 year storm event.

Within the subject site under the 100 year Chicago storm event, all street segments have a total ponding depth of less than 0.35 m.

For the 100 year storm event increased by 20%, the v x d results are provided for information purposes. During the 100 year storm event increased by 20%, the total depth of ponding is less than 0.35 m throughout the subject site except at the following locations: S828B, S841C, S981B. These areas are noted in **Table 5-6** in red and bold.

The following table summarizes the extend of ponding, property line elevation and the garage elevations for the street segments where summation of depth of ponding and depth of cascading flow exceeds 0.35 m during the 100 year Chicago design storm event increased by 20%.

Table 5-7: Critical Ponding Locations during the Stress Test and Adjacent Property Elevations

DRAINAGE AREA ID	TOP OF GRATE ELEVATION (M)	MAX. DEPTH AT LOW POINT (M)	(1) CORRESPONDING ELEVATION (M)	(2) ADJACENT CRITICAL ELEVATION		DIFFERENCE (2) – (1)
				LOCATION	(2) ELEVATION (M)	
S828B	97.07	0.38	97.43	Garage	97.75	0.32
S806	96.48	0.37	96.85	Garage	97.35	0.5
S841C	97.12	0.40	97.52	Garage	97.80	0.28
Riverside South Phase 17-1A and 4725 Spratt Road						
S816	94.87	0.39	95.26	Garage	95.45	0.19
S821	96.42	0.38	96.8	Garage	96.90	0.1

During the 100 year Chicago design storm event increased by 20%, the major system will cascade from each street segment noted in **Table 5-7** but remains below adjacent critical elevation.

5.5.3 Hydraulic Evaluation

The evaluation of the hydraulic grade line (HGL) was completed using PCSWMM. As noted previously, the PCSWMM model has been used to simulate both the hydrology and hydraulics for the subject site. Minor system losses were accounted for in accordance with Appendix 6-B of the 2012 OSDG.

Simulations were performed for various storms to confirm the performance of the downstream Pond 5 SWM facility and the hydraulic grade line (HGL) through the subject site.

5.5.4 Results of Hydraulic Evaluation

The hydraulic grade line (HGL) was analyzed using PCSWMM for the 100 year 3 hour Chicago storm; the governing storm event for the subdivision. The corresponding stress test (100 year 3 hour Chicago storm + 20% increase in intensity) was also simulated. The 100 year 12 hour SCS Type II storm was also simulated to assess the receiving SWM facility.

The HGL elevations are presented in the following **Table 5-8**, along with a comparison of underside of footing (USF) elevations. Where USF elevations are not available, a comparison with existing ground elevations (EG) is provided.

Table 5-8 Storm Hydraulic Grade Line for Riverside South Phase 17-1B for the 100 Year 3 Hour Chicago and 100 Year 3 Hour Chicago increased by 20% Storm Events

PCSWMM MH (SEWER NODE)	USF / (Existing Ground Elevation) (M)	STORM HYDRAULIC GRADE LINE			
		100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO + 20%	
		HGL (M)	USF–HGL (EG - HGL) (M)	HGL (M)	USF–HGL (EG - HGL) (M)
Riverside South Phase 17-1B (Subject site)					
BLK934	96.57	95.98	0.59	96.21	0.36
MH933	96.57	95.69	0.88	95.91	0.66
MH932	95.69	95.01	0.68	95.17	0.52
MH931	95.79	94.69	1.10	94.82	0.97
MH930B	95.89	94.17	1.72	94.26	1.63
MH910	94.94	92.44	2.50	92.64	2.30
MH946	93.42	92.61	0.81	92.82	0.60
MH947	93.02	92.67	0.35	92.88	0.14
MH943	93.97	92.96	1.01	92.96	1.01
MH944	94.49	92.65	1.84	92.86	1.63
MH945	93.42	92.63	0.79	92.84	0.58
MH911	N/A	95.13	n/a	95.14	n/a
MH909	96.09	92.24	3.85	92.41	3.68
MH908	96.09	92.19	3.90	92.35	3.74
MH907	94.99	91.99	3.00	92.12	2.87
MH906	94.59	91.95	2.64	92.07	2.52
MH905	93.77	91.68	2.09	91.79	1.98
Blk905	93.77	91.45	2.32	91.56	2.21
MH981	94.52	92.16	2.36	92.32	2.20
MH982	94.99	92.44	2.55	92.61	2.38
MH805	94.88	92.66	2.22	92.85	2.03

PCSWMM MH (SEWER NODE)	USF / (Existing Ground Elevation) (M)	STORM HYDRAULIC GRADE LINE			
		100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO + 20%	
		HGL (M)	USF–HGL (EG - HGL) (M)	HGL (M)	USF–HGL (EG - HGL) (M)
MH984	95.09	92.93	2.16	93.14	1.95
MH985	95.19	93.36	1.83	93.57	1.62
MH986	95.64	93.75	1.89	93.97	1.67
MH987	95.64	94.03	1.61	94.24	1.40
BLK822	95.19	92.94	2.25	92.94	2.25
MH822	96.09	93.01	3.08	93.01	3.08
MH825	95.25	93.29	1.96	93.52	1.73
MH826	95.5	93.72	1.78	93.98	1.52
MH827	95.5	93.78	1.72	94.04	1.46
MH828	95.39	94.00	1.39	94.31	1.08
MH841	95.34	94.30	1.04	94.59	0.75
MH842	95.34	94.40	0.94	94.68	0.66
MH840	95.8	94.11	1.69	94.37	1.43
MH835	95.3	93.77	1.53	93.99	1.31
BLK804	94.64	92.82	1.82	92.82	1.82
MH804	95.54	92.82	2.72	92.82	2.72
MH806	95.49	93.77	1.72	93.77	1.72
MH807	95.14	93.79	1.35	93.79	1.35
MH808	95.19	93.60	1.59	93.60	1.59
BLK960	93.07	91.23	1.84	91.32	1.75
MH961	93.82	92.76	1.06	92.76	1.06
BLK963	94.3	92.01	2.29	92.03	2.27
MH963	94.69	92.09	2.60	92.10	2.59
MH962	94.67	92.18	2.49	92.18	2.49

The HGL results presented in **Table 5-8** indicates that the minimum 0.3 m clearance between the USF and HGL is maintained across the subject site during the 100 year 3 hour Chicago and the 100 year 3 hour Chicago increased by 20% storm event, respectively.

5.6 Performance of Pond 5 Facility

The Pond 5 Facility has been designed and is currently under construction. The design is presented in the reported entitled Riverside South Pond 5 Facility Design Brief (Stantec Consulting Ltd., May 2018). The overall PCSWMM model includes the features of the Pond 5 Facility which provides a dynamic representation of the entire storm system. The hydraulic performance of the stormwater facility is compared and summarized in the following table for those storm events which were used to evaluate the detail design of Riverside South Phase 17-1B.

Table 5-9 Performance of Pond 5 Facility

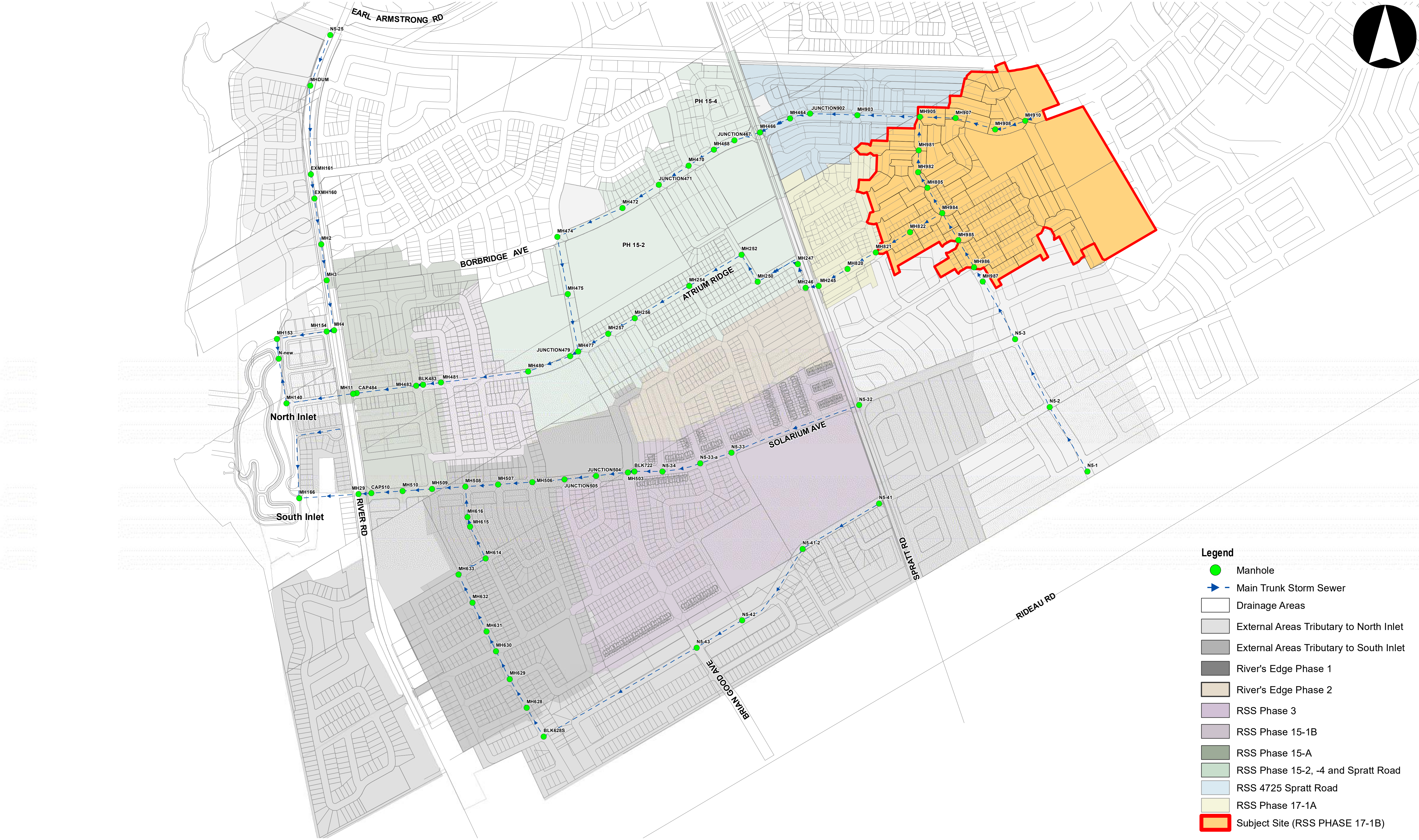
Storm Event	Current Evaluation				From May 2018 Facility Design Brief			
	Peak Pond Inflow (cms)		Peak Pond Discharge (cms)	Pond W/L (m)	Peak Pond Inflow (cms)		Peak Pond Discharge (cms)(2)	Pond W/L (m)(2)
	North Inlet	South Inlet			North Inlet(1)	South Inlet(1)		
Permanent Storage	n/a	n/a	n/a	82.60	n/a	n/a	n/a	82.60(2)
25 mm 4 hour Chicago	7.2	7.0	3.8	83.19	6.3	6.9	4.8	83.25
5 year 3 hour Chicago	11.8	11.2	9.7	83.46	11.7	11.1	11.4	83.53
100 year 3 hour Chicago	13.5	12.5	18.1	83.75	15.7	12.7	21.0	83.88
100 year 12 hour SCS Type II	12.9	12.1	19.3	83.80	15.3	12.6	23.1	83.96
100 year 3 hour Chicago + 20%	13.9	12.8	20.4	83.84	n/a	n/a	24.2	84.00

(1) From Table 3-1 from 2018 Facility Design Brief.
(2) From Table 3-2 from 2018 Facility Design Brief.
(3) From Table 4-2 from 2018 Facility Design Brief.

Note that the Stantec 2018 Pond 5 model was based on a semi-lumped basis, using the ISSU Horton infiltration parameters which are more conservative than the City guideline (Max. infiltration rate =53 mm/hr & Min. infiltration rate = 0.053 mm/hr). The current Ph 17-1B model uses the City infiltration parameters for both semi-lumped and detailed areas. This change reduces the flow volume in the pond for all storm events. As expected, this results in a lower pond HGL and ultimately lower peak outflow.

Comparison of the results also shows that during frequent storm events (specifically the 25mm and 5 year storms), the current evaluation produces peakier inflow to the pond while the pond HGL is lower than the Stantec 2018 Pond 5 design. Again, this is due to the change of the

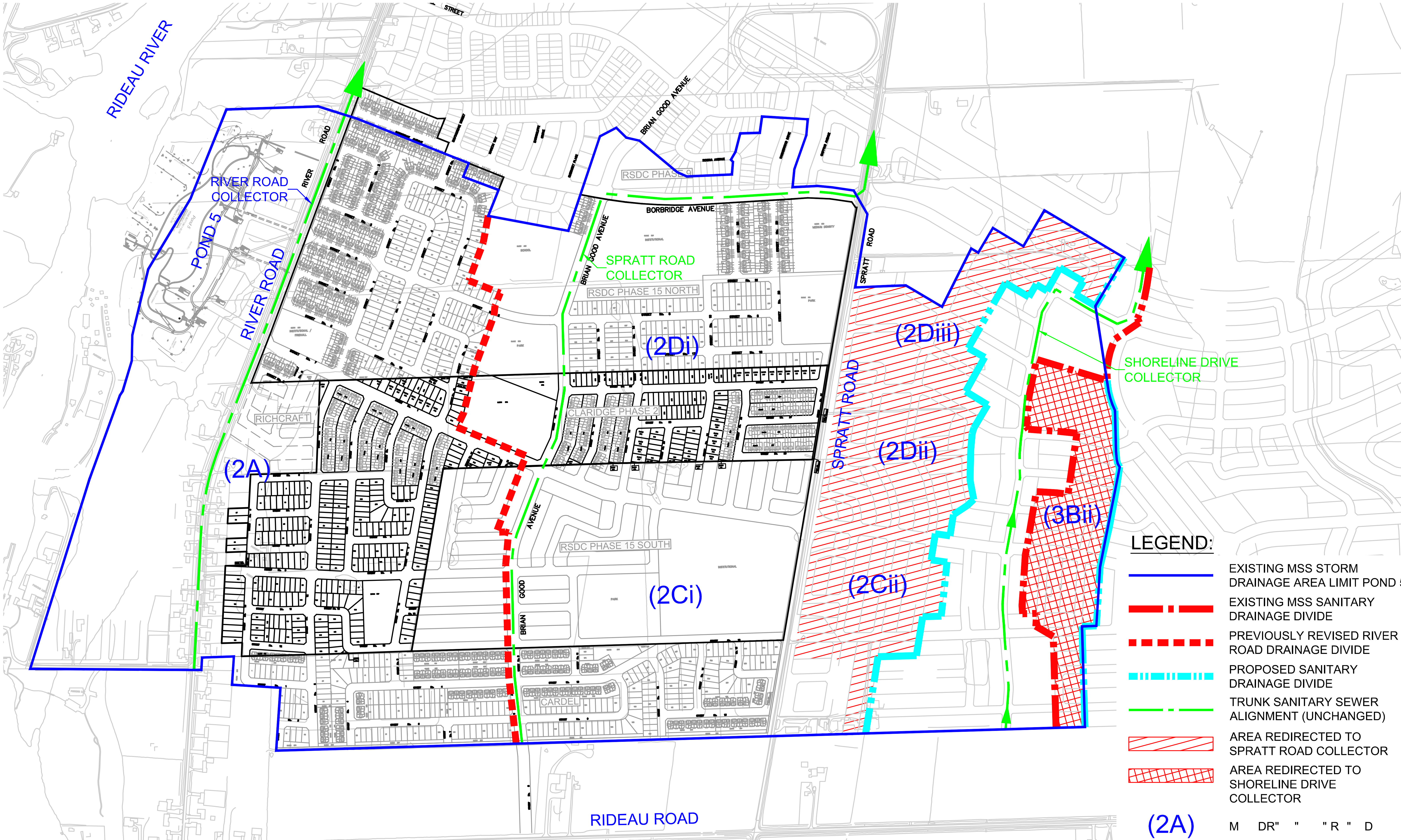
Scale	Project Title	Drawing Title	Sheet No.
NTS	DESIGN BRIEF RSDC PHASE 17 LANDS RIVERSIDE SOUTH COMMUNITY RIDEAU RIVER AREA	125581-FIG-1.4-PHASING - PHASING PLAN	FIGURE 1.4



IBI

Scale 1:9000

Project Title	Drawing Title	Sheet No.
RIVERSIDE SOUTH DEVELOPMENT PHASE 17-1B	KEY PLAN - SUBJECT SITE RIVERSIDE SOUTH DEVELOPMENT AREA	FIGURE 5.1



IBI

SPRATT ROAD COLLECTOR AND SHORELINE DRIVE COLLECTOR

Temporary Sanitary Construction ICDs
RSS Phase 17-1B

Structure	Flow (l/s)	Grade Elev. (m)	Pipe Invert (m)	Pipe Size (m)	Height (m)	Area (Sq m)	Orifice Size Sq. mm	Orifice Size mm dia.
Sanitary								
Ralph Hennesy MH947A	46.58	94.75	86.75	0.450	7.78	0.0062	79	89
Kiwi MH950A	0.99	95.30	89.74	0.200	5.46	0.0002	13	14
Rockmelon MH821A	1.18	96.90	93.33	0.200	3.47	0.0002	15	17
Honeydew MH803A	1.31	96.60	93.17	0.200	3.33	0.0003	16	18
Apricot MH811A	0.87	95.80	92.34	0.200	3.36	0.0002	13	15

Based On Equation: Where: A=(Q/(C*(2*g*h)^.5)
C= 0.61
g= 9.81

2022-01-25

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SANITARY SEWER DESIGN SHEET

RSS Phase 17-1B
CITY OF OTTAWA
Urbandale

LOCATION				RESIDENTIAL										ICI AREAS								INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL	PROPOSED SEWER DESIGN						
				AREA	UNIT TYPES				AREA	POPULATION		RES	PEAK	AREA (Ha)						ICI	PEAK	AREA (Ha)		FLOW			FLOW	CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
														INSTITUTIONAL		COMMERCIAL		INDUSTRIAL																
STREET	AREA ID	FROM MH	TO MH	w/ Units (Ha)	SF	SD	TH	APT	w/o Units (Ha)	IND	CUM	PEAK FACTOR	FLOW (L/s)	IND	CUM	IND	CUM	IND	CUM	PEAK FACTOR	FLOW (L/s)	IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	
Lavender Street	MH932A	MH932A	MH841A	0.33			8			21.6	21.6	3.70	0.26	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.33	0.33	0.11	0.00	0.00	0.37	27.59	84.16	200	0.65	0.851	27.22	98.67%
Rockmellon Street	EXT-2	MH842A	MH841A						0.67	54.3	54.3	3.65	0.64	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.67	0.67	0.22	0.00	0.00	0.86	20.24	40.08	200	0.35	0.624	19.38	95.74%
Lavender Street	MH841A	MH841A	MH840A	0.59	12					40.8	116.7	3.58	1.35	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.59	1.59	0.52	0.00	0.00	1.88	20.24	91.28	200	0.35	0.624	18.36	90.72%
	MH840A	MH840A	MH986A	0.67	13					44.2	160.9	3.54	1.85	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.67	2.26	0.75	0.00	0.00	2.59	20.24	117.20	200	0.35	0.624	17.65	87.19%
Ed Findlay Street	EXT-3	MH987A	MH986A						16.06	1300.9	1300.9	3.18	13.40	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	16.06	16.06	5.30	0.00	0.00	18.70	31.02	40.00	250	0.25	0.612	12.32	39.71%
Ed Findlay Street	MH986A	MH986A	MH985A	0.52	10					34.0	1495.7	3.14	15.24	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.52	18.84	6.22	0.00	0.00	21.46	31.02	79.99	250	0.25	0.612	9.56	30.82%
Fuchsia Street	MH828A	MH828A	MH835A	0.71	15					51.0	51.0	3.65	0.60	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.71	0.71	0.23	0.00	0.00	0.84	27.59	96.64	200	0.65	0.851	26.75	96.96%
	MH835A	MH835A	MH985A	0.70	14					47.6	98.6	3.60	1.15	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.70	1.41	0.47	0.00	0.00	1.61	20.24	116.90	200	0.35	0.624	18.63	92.02%
Ed Findlay Street	MH985A	MH985A	MH984A	0.52	10					34.0	1628.3	3.12	16.48	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.52	20.77	6.85	0.00	0.00	23.33	45.12	81.00	300	0.20	0.618	21.78	48.28%
Rockmellon Street	MH841B	MH841A	MH828A	0.29			8			21.6	21.6	3.70	0.26	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.29	0.29	0.10	0.00	0.00	0.35	20.24	80.15	200	0.35	0.624	19.89	98.25%
	MH828A	MH828A	MH827A	0.35			11			29.7	51.3	3.65	0.61	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.35	0.64	0.21	0.00	0.00	0.82	20.24	72.44	200	0.35	0.624	19.42	95.96%
	MH827A	MH827A	MH826A	0.10			3			8.1	59.4	3.64	0.70	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.10	0.74	0.24	0.00	0.00	0.94	20.24	11.94	200	0.35	0.624	19.30	95.33%
	MH826A	MH826A	MH825A	0.68	10		7			52.9	112.3	3.58	1.30	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.68	1.42	0.47	0.00	0.00	1.77	20.24	108.52	200	0.35	0.624	18.47	91.24%
	MH825A	MH825A	MH984A	0.57	5		9			41.3	153.6	3.55	1.77	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.57	1.99	0.66	0.00	0.00	2.42	20.24	101.41	200	0.35	0.624	17.82	88.03%
Ed Findlay Street	MH984A	MH984A	MH805A	0.32	6					20.4	1802.3	3.10	18.09	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.32	23.08	7.62	0.00	0.00	25.70	45.12	81.00	300	0.20	0.618	19.41	43.03%
Honeydew Street	MH806A	MH806A	MH805A	0.63			21			56.7	56.7	3.64	0.67	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.63	0.63	0.21	0.00	0.00	0.88	27.59	105.13	200	0.65	0.851	26.71	96.82%
Ed Findlay Street	MH805C	MH805A	MH982A	0.27			7			18.9	1877.9	3.09	18.78	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.27	23.98	7.91	0.00	0.00	26.69	45.12	44.47	300	0.20	0.618	18.42	40.84%
	MH982A	MH982A	MH981A	0.33			8			21.6	1899.5	3.08	18.98	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.33	24.31	8.02	0.00	0.00	27.00	45.12	55.50	300	0.20	0.618	18.12	40.16%
	MH981A	MH981A	MH905A	0.39			11			29.7	1929.2	3.08	19.25	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.39	24.70	8.15	0.00	0.00	27.40	45.12	83.00	300	0.20	0.618	17.72	39.27%
Borbridge Avenue	MH905A	MH905A	MH906A	0.50			13			35.1	1964.3	3.07	19.57	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.50	25.20	8.32	0.00	0.00	27.88	45.12	80.00	300	0.20	0.618	17.23	38.20%
Honeydew Street	MH806B	MH806A	MH807A	0.63			4			10.8	10.8	3.73	0.13	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.63	0.63	0.21	0.00	0.00	0.34	20.24	11.48	200	0.35	0.624	19.90	98.33%
	MH807A	MH807A	MH808A	0.22			15			40.5	51.3	3.65	0.61	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.22	0.85	0.28	0.00	0.00	0.89	20.24	65.57	200	0.35	0.624	19.36	95.62%
	MH808A	MH808A	MH906A	0.51			7			18.9	70.2	3.63	0.82	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.51	1.36	0.45	0.00	0.00	1.27	34.22	53.19	200	1.00	1.055	32.94	96.28%
Borbridge Avenue	MH906A	MH906A	MH907A	0.11			3			8.1	2042.6	3.06	20.28	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.11	26.67	8.80	0.00	0.00	29.08	45.12	14.10	300	0.20	0.618	16.04	35.55%
	MD MH907A	MH907A	MH908A	0.58			14		1.45	226.3	2268.9	3.03	22.31	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	2.03	28.70	9.47	0.00	0.00	31.78	45.12	106.09	300	0.20	0.618	13.34	29.56%
	MH908A	MH908A	MH909A	0.14			3			8.1	2277.0	3.03	22.38	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.14	28.84	9.52	0.00	0.00	31.90	45.12	20.50	300	0.20	0.618	13.22	29.30%
	MH909A	MH909A	MH910A	0.15						0.0	2277.0	3.03	22.38	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.15	28.99	9.57	0.00	0.00	31.95	59.68	64.81	300	0.35	0.818	27.73	46.47%
Ralph Hennessy Avenue	EXT-1	BLK934A	MH933A						8.97	726.6	726.6	3.31	7.79	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	8.97	8.97	2.96	0.00	0.00	10.75	31.02	32.29	250	0.25	0.612	20.27	65.35%
	INST MH933A	MH933A	MH932A	0.60			11			29.7	756.3	3.30	8.09	3.12	3.12	0.00	0.00	0.00	0.00	1.50	1.52	3.72	12.69	4.19	0.00	0.00	13.79	31.02	120.00	250	0.25	0.612	17.23	55.54%
	MH932B	MH932A	MH931A	0.14			3			8.1	764.4	3.30	8.17	0.00	3.12	0.00	0.00	0.00	0.00	1.50	1.52	0.14	12.83	4.23	0.00	0.00	13.92	31.02	37.08	250	0.25	0.612	17.10	55.13%
	MH931A	MH931A	MH930A	0.56			14			37.8	802.2	3.29	8.55	0.00	3.12	0.00	0.00	0.00	0.00	1.50	1.52	0.56	13.39	4.42	0.00	0.00	14.48	31.02	98.38	250	0.25	0.612	16.54	53.31%
		MH931D	MH930A	2.36						0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	2.36	2.36	0.78	0.00	0.00	0.78	34.22	15.00	200	1.00	1.055	33.44	97.72%
	MH930A	MH930A	MH910A	0.39			5			13.5	815.7	3.28	8.68	0.00	3.12	0.00	0.00	0.00	0.00	1.00	1.01	0.39	16.14	5.33	0.00	0.00	15.02	31.02	120.00	250	0.25	0.612	16.00	51.58%
Ralph Hennessy Avenue	COMM MH910A	MH910A	MH946A	0.42			9			24.3	3117.0	2.94	29.72	0.00	3.12	0.93	0.93	0.00	0.00	1.00	1.31	1.35	46.48	15.34	0.00	0.00	46.38	81.80	90.05	375	0.20	0.717	35.43	43.31%
Pomelo Street	MH943B	MH943A	MH944A	0.63			18			48.6	48.6	3.65	0.58	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.63	0.63	0.21	0.00	0.00	0.78	27.59	72.75	200	0.65	0.851	26.80	97.16%
	MH944A	MH944A	MH945A	0.11			2			5.4	54.0	3.65	0.64	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.11	0.74	0.24	0.00	0.00	0.88	20.24	27.95	200	0.35	0.624	19.36	95.64%
	MH945A	MH945A	MH946A	0.07			1			2.7	56.7	3.64	0.67	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.07	0.81	0.27	0.00	0.00	0.94	41.91	25.86	200	1.50	1.292	40.97	97.76%
Ralph Hennessy Avenue	MH946A	MH946A	MH947A	0.25			5			13.5	3187.2	2.94	30.33	0.00	3.12	0.00	0.93	0.00	0.00	1.00	1.31	0.25	47.54	15.69	0.00	0.00	47.33	81.80	52.18	375	0.20	0.717	34.47	42.14%
	MH947A	MH947A	EXBLK25	0.10						0.0	3187.2	2.94	30.33	0.00	3.12	0.00	0.93	0.00	0.00	1.00	1.31	0.10	47.64	15.72	0.00	0.00	47.36	122.63	38.82	450	0.17	0.747	75.28	61.38%
Rockmellon Street	MH984A	MH984A	MH822A	0.63	12					40.8	40.8	3.67	0.48	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.63	0.63	0.21	0.00	0.00	0.69	27.59	96.12	200	0.65	0.851	26.89	97.49%
	MH822A	MH822A	BLK822A	0.51	8					27.2	68.0	3.63	0.80	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.51	1.14	0.38	0.00	0.00	1.18	20.24	83.68	200	0.35	0.624	19.07	94.19%
Honeydew Street	MH805B	MH805A	MH804A	0.52			17			45.9	45.9	3.66	0.54	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.52	0.52	0.17	0.00	0.00	0.72	27.59	87.33	200	0.65	0.851	26.87	97.41%
	MH804A	MH804A	BLK804A	0.49			14			37.8	83.7	3.61	0.98	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.49	1.01	0.33	0.00	0.00	1.31	20.24	46.40	200	0.35	0.624	18.93	93.51%
Kiwi Street	MH981B	MH981A	MH961A	0.43			15			40.5	40.5	3.67	0.48	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.43	0.43	0.14	0.00	0.00	0.62	34.22	79.99	200	1.00	1.055	33.59	98.18%
	MH961A	MH961A	BLK960A	0.34			8			21.6	62.1	3.64	0.73	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.34	0.77	0.25	0.00	0.00	0.99	60.24	62.08	200	3.10	1.858	59.26	98.36%
Apricot Street	MH961B	MH961A	MH962A	0.25			7			18.9	18.9	3.71	0.23	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.25	0.25	0.08	0.00	0.00	0.31	27.59	54.55	200	0.65	0.851	27.28	98.88%
	MH962A	MH962A	MH963A	0.23			5			13.5	32.4	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.23	0.48	0.16	0.00	0.00	0.54	20.24	16.83	200	0.35	0.624	19.70	97.31%
	MH963A	MH963A	BLK963A	0.31			7			18.9	51.3	3.65	0.61	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.31	0.79	0.26	0.00	0.00	0.87	20.24	34.28	200	0.35	0.624	19.38	95.71%
Borbridge Avenue	MH905A	MH905A	BLK905A	0.53			16			43.2	43.2	3.66	0.51	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.53	0.53	0.17	0.00	0.00	0.69	35.06	13.94	200	1.05	1.081	34.37	98.04%

Design Parameters:

Residential			ICI Areas			
SF	3.4	p/p/u				
TH/SD	2.7	p/p/u	INST	28,000	L/Ha/day	
APT	1.8	p/p/u	COM	28,000	L/Ha/day	
MD	130	p/p/Ha	IND	35,000	L/Ha/day	MOE Chart
Future	81	p/p/Ha		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area,

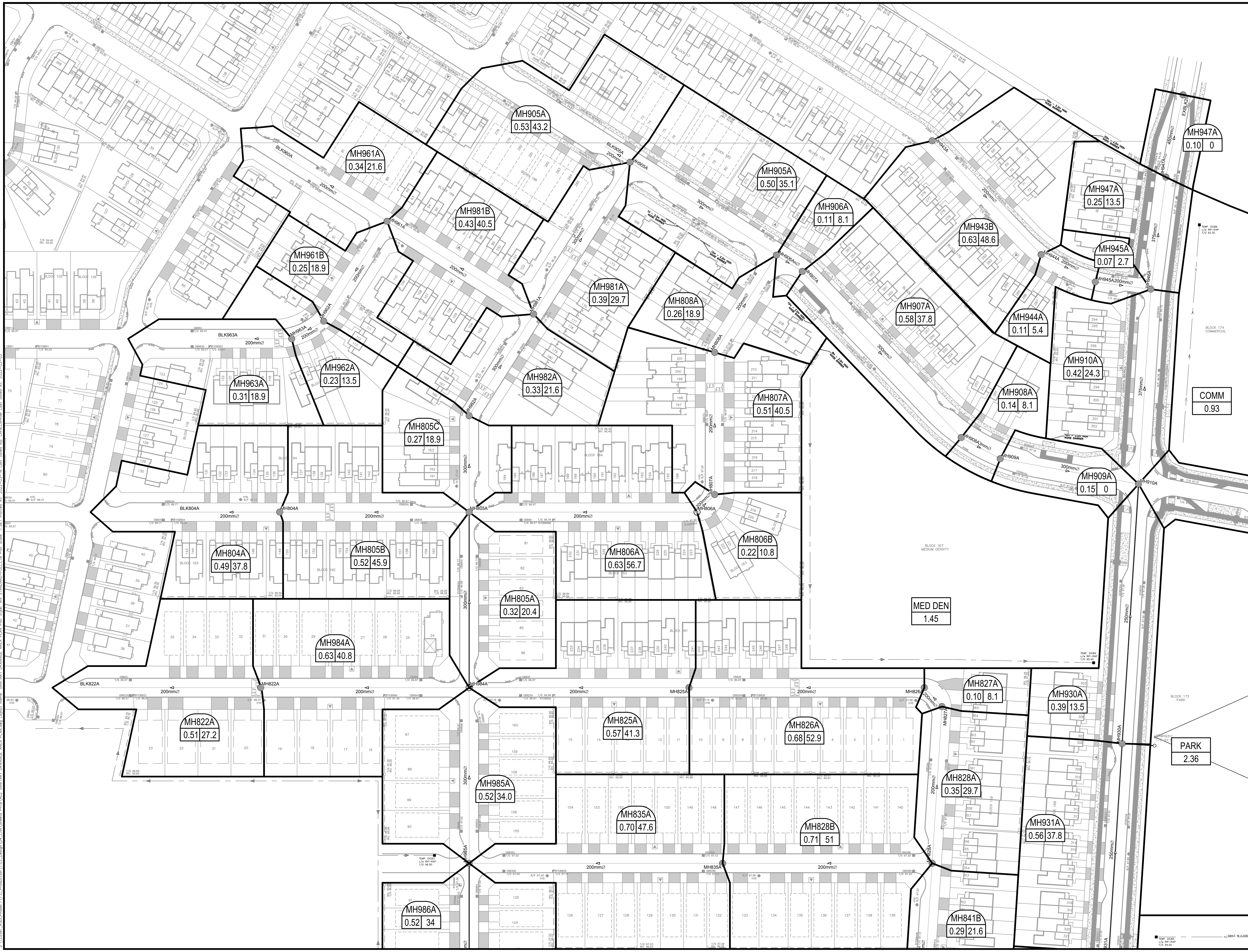
Designed: LME

Checked:

Dwg. Reference: 125581-401

No.	Revision	Date
1.	1st Submission	2022-01-25
2.	2nd Submission	2022-03-17

File Reference: Date: Sheet No:



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEY PLAN
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2	SUBMISSION 2 FOR CITY REVIEW	L.M.E.	2022:03:17
1	SUBMISSION 1 FOR CITY REVIEW	L.M.E.	2022:01:25

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title
RIVERSIDE SOUTH
PHASE 17-1B

LICENSED PROFESSIONAL ENGINEER
L. M. ERION
13379508
2022/03/17
PROVINCE OF ONTARIO

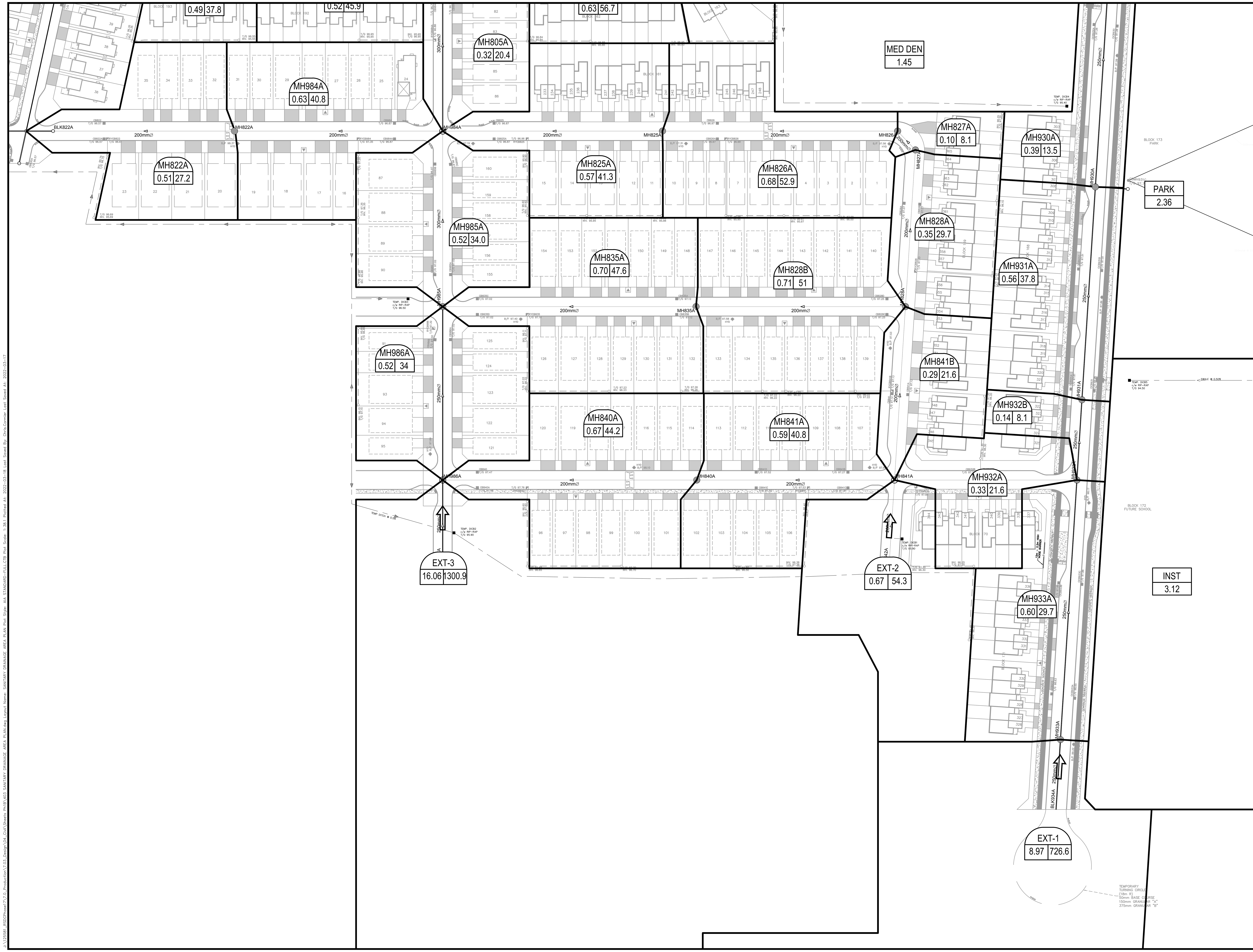
Drawing Title
SANITARY DRAINAGE
AREA PLAN

Scale
1:750

Design	Date
L.E.	JULY 2021
Drawn	**Checked**
C.C.	L.E.
Project No.	**Drawing No.**
125581	402

D07-16-20-0018

#18485



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEY PLAN
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6	REVISED SERVICE LATERALS AND HYDRANTS	L.M.E	2022:02:01
5	ISSUED FOR CONSTRUCTION	L.M.E	2021:09:29
4	SUBMISSION 3 FOR CITY REVIEW	L.M.E	2021:09:14
3	SUBMISSION 2 FOR CITY REVIEW	L.M.E	2021:08:24
2	ISSUED FOR TENDER	L.M.E	2021:08:04
1	SUBMISSION 1 FOR CITY REVIEW	L.M.E	2021:07:23

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Project Title
RIVERSIDE SOUTH
PHASE 17-1B

LICENSED PROFESSIONAL ENGINEER
L. M. ERION
13379508
2022/02/01
PROVINCE OF ONTARIO

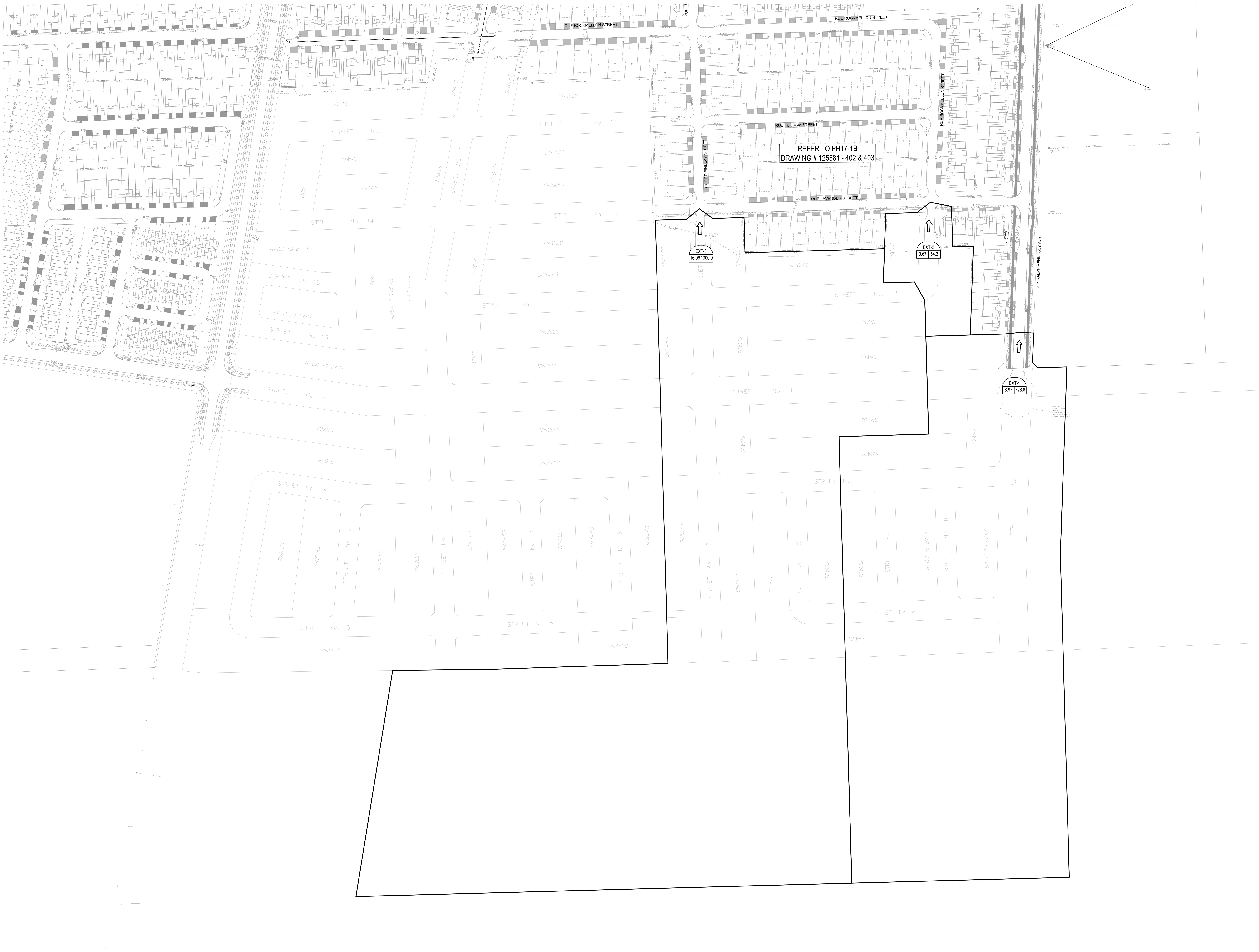
Drawing Title
SANITARY DRAINAGE
AREA PLAN

Scale
1:750

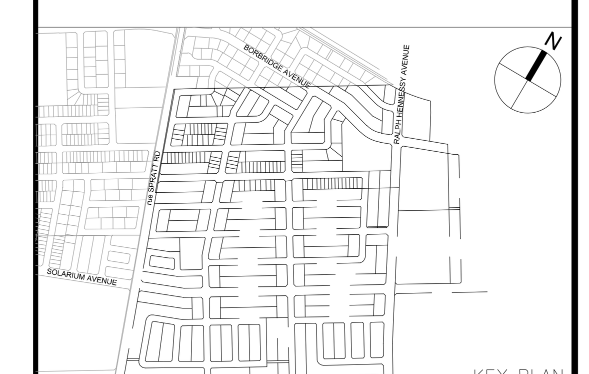
Design	Date
L.E.	JULY 2021
Drawn	Checked
C.C.	L.E.
Project No.	Drawing No.
125581	403

D07-16-20-0018

#18485



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY PLAN
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
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5			
4			
3			
2	SUBMISSION 2 FOR CITY REVIEW	L.M.E	2022:03:17
1	SUBMISSION 1 FOR CITY REVIEW	L.M.E	2022:01:25

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Project Title
RIVERSIDE SOUTH

LICENSED PROFESSIONAL ENGINEER
L. M. ERION
13379508
2022/03/17
PROVINCE OF ONTARIO

N

Drawing Title
EXTERNAL SANITARY DRAINAGE AREA PLAN

Scale
1:1500

Design	Date
L.E.	JULY 2021
Drawn	Checked
C.C.	L.E.
Project No.	Drawing No.
125581	404

D07-16-20-0018

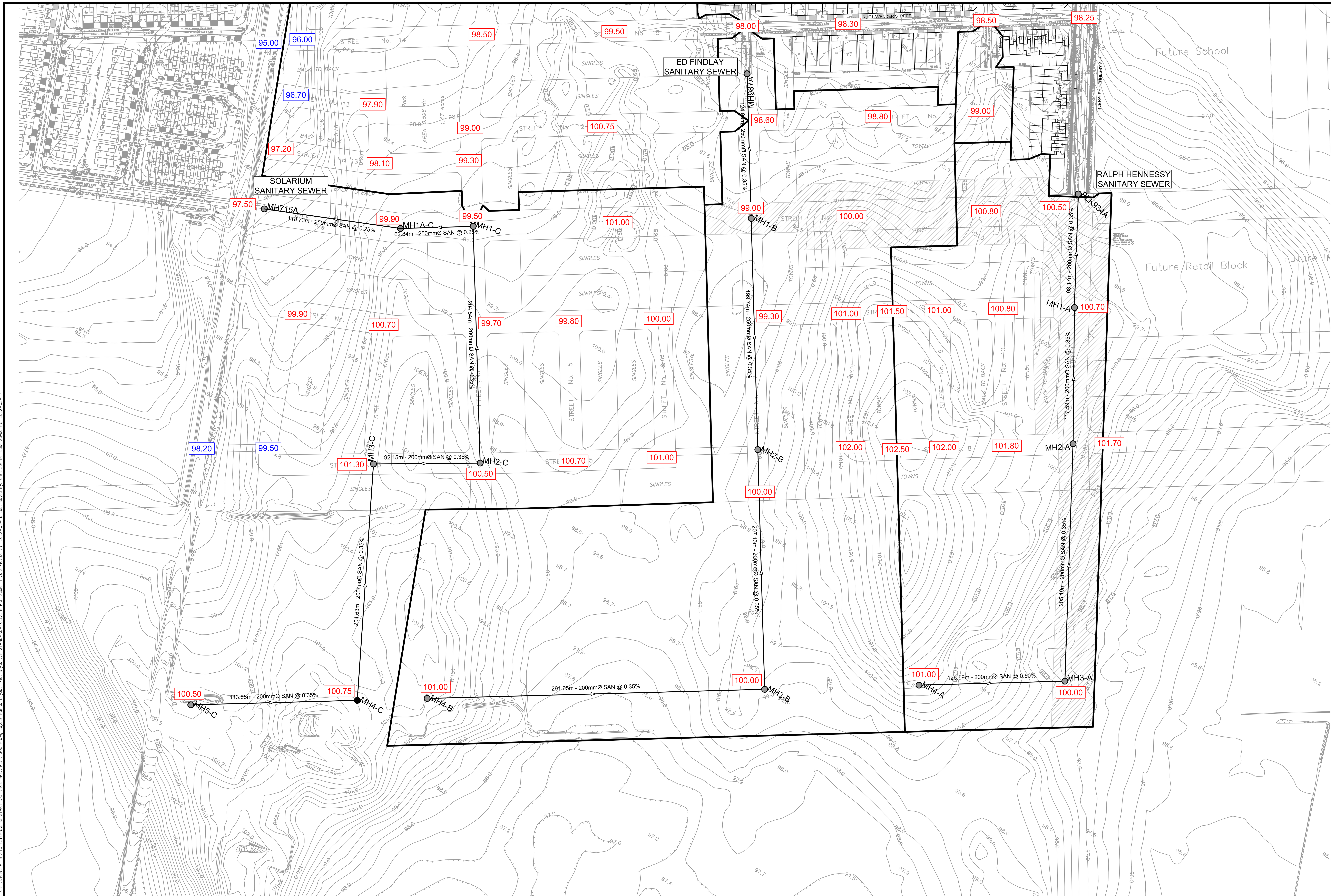
#18485

LEGEND:

101.80 HIGH POINT AND/OR INTERSECTION GRADE

99.50 LOW POINT

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY PLAN
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2	SUBMISSION 2 FOR CITY REVIEW	L.M.E.	2022:03:17
1	SUBMISSION 1 FOR CITY REVIEW	L.M.E.	2022:01:25

SOLARIUM AVENUE SANITARY SEWER

STRUCTURE	ROAD GRADE	PIPE INVERT	DIFFERENCE (m)
MH 1-C	99.50	93.75	5.75
MH 2-C	100.50	94.55	5.95
MH 3-C	101.30	94.95	6.35
MH 4-C	100.75	95.70	5.05
MH 5-C	100.50	96.25	4.25

ED FINDLAY SANITARY SEWER

STRUCTURE	ROAD GRADE	PIPE INVERT	DIFFERENCE (m)
MH 1-B	99.00	93.80	5.20
MH 2-B	100.00	94.35	5.65
MH 3-B	100.00	95.15	4.85
MH 4-B	101.00	96.15	4.85

RALPH HENNESSY SANITARY SEWER

STRUCTURE	ROAD GRADE	PIPE INVERT	DIFFERENCE (m)
MH 1-A	100.70	94.95	5.75
MH 2-A	101.70	95.40	6.30
MH 3-A	100.00	96.15	3.85
MH 4-A	101.00	96.80	4.20

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Project Title

RIVERSIDE SOUTH

LICENSED PROFESSIONAL ENGINEER
L. M. ERION
13379508
2022/03/17
PROVINCE OF ONTARIO

N

Drawing Title

EXTERNAL SANITARY DRAINAGE AREA PLAN
SOUTH BOUNDARY

Scale
1:1500

Design	L.E.	Date	JULY 2021
Drawn	C.C.	Checked	L.E.
Project No.	125581	Drawing No.	410

D07-16-20-0018

#18485

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STORM SEWER DESIGN SHEET

RSS Phase 17-1B
City of Ottawa
Urbandale

LOCATION				AREA (Ha)								RATIONAL DESIGN FLOW																		SEWER DATA						
STREET	AREA ID	FROM	TO	C= 0.63	C= 0.68	C= 0.50	C= 0.53	C= 0.63	C= 0.44	C= 0.68	C= 0.70	IND 2.78AC	CUM 2.78AC	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW IND	FIXED FLOW CUM	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PE SIZE (m DIA	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	AVAIL CAP (2yr) (%)
Lavender Street	S932, R932A&B	MH932	MH841						0.57	0.26		1.19	1.19			10.00	1.40	11.40	76.81	104.19	122.14	178.56	91.30						91.30	108.21	79.62	375	0.35	0.949	16.91	15.63%
Rockmellon Street	EXT-2	MH842	MH841					0.45				0.79	0.79			10.00	0.68	10.68	76.81	104.19	122.14	178.56	60.53						60.53	108.21	38.67	375	0.35	0.949	47.68	44.06%
Lavender Street	S841A&B, R841A	MH841	MH840				0.30	0.51				1.34	3.31			10.68	1.17	11.85	74.29	100.74	118.07	172.58	246.06						246.06	378.96	91.12	600	0.35	1.298	132.90	35.07%
	S840, R840	MH840	MH986				0.30	0.29				0.95	4.26			11.85	1.49	13.33	70.37	95.35	111.72	163.26	299.91						299.91	378.96	115.78	600	0.35	1.298	79.05	20.86%
Ed Findlay Street	EXT-3	MH987	MH986	0.98				14.13				24.75	24.75	1.72	1.72	17.84	0.40	18.24	55.78	75.37	88.23	128.77	1,380.43	129.36					1,509.79	1,818.95	37.00	1200	0.20	1.558	309.16	17.00%
Ed Findlay Street	S986, R986	MH986	MH985				0.23	0.30				0.86	29.87	0.00	1.72	13.33	0.85	14.19	66.00	89.35	104.67	152.90	1,971.62	153.36					2,124.99	2,490.17	85.99	1350	0.20	1.685	365.18	14.66%
Fushia Street	S828A	MH828	MH835					0.17				0.30	0.30			10.00	1.64	11.64	76.81	104.19	122.14	178.56	22.87						22.87	50.02	96.85	250	0.65	0.987	27.15	54.28%
	S835A&B, R835	MH835	MH985				0.27	0.70				1.62	1.92			11.64	1.79	13.43	71.05	96.28	112.83	164.87	136.52						136.52	175.96	115.29	450	0.35	1.072	39.44	22.41%
Ed Findlay Street	S985A&B	MH985	MH984					0.31				0.54	32.34	0.00	1.72	14.19	0.80	14.99	63.76	86.29	101.06	147.60	2,061.86	148.10					2,209.96	2,490.17	81.00	1350	0.20	1.685	280.21	11.25%
Rockmellon Street	S841B, R841B	MH841	MH828				0.33			0.25		0.96	0.96			10.00	1.46	11.46	76.81	104.19	122.14	178.56	73.64						73.64	108.21	83.16	375	0.35	0.949	34.57	31.95%
	S828B, R828	MH828	MH827						0.34	0.35		1.08	2.04			11.46	1.12	12.58	71.62	97.06	113.75	166.23	145.84						145.84	175.96	72.17	450	0.35	1.072	30.12	17.12%
		MH827	MH826									0.00	2.04			12.58	0.19	12.77	68.13	92.28	108.11	157.96	138.74						138.74	175.96	12.30	450	0.35	1.072	37.22	21.15%
	S826, R826	MH826	MH825				0.30			0.47		1.33	3.37			12.77	1.51	14.29	67.58	91.52	107.21	156.64	227.52						227.52	265.43	107.97	525	0.35	1.188	37.91	14.28%
	S825, R825	MH825	MH984				0.33			0.29		1.03	4.40			14.29	1.29	15.58	63.50	85.93	100.64	146.99	279.48						279.48	378.96	100.31	600	0.35	1.298	99.48	26.25%
Ed Findlay Street	S984B, R984B	MH984	MH805				0.13	0.23				0.59	37.33	0.00	1.72	14.99	0.69	15.68	61.80	83.60	97.90	142.97	2,307.22	143.49					2,450.71	3,297.98	75.00	1500	0.20	1.808	847.27	25.69%
Honeydew Street	S806, R806A&B	MH806	MH805						0.52	0.43		1.45	1.45			10.00	1.39	11.39	76.81	104.19	122.14	178.56	111.29						111.29	141.68	103.47	375	0.60	1.243	30.40	21.45%
Ed Findlay Street		MH805	MH982									0.00	38.78	0.00	1.72	15.68	0.43	16.11	60.21	81.43	95.35	139.22	2,335.22	139.76					2,474.99	3,297.98	46.60	1500	0.20	1.808	822.99	24.95%
	S982, R982	MH982	MH981						0.42	0.32		1.12	39.90	0.00	1.72	16.11	0.52	16.62	59.27	80.14	93.84	137.00	2,365.03	137.55					2,502.59	3,297.98	56.13	1500	0.20	1.808	795.40	24.12%
	S981B, R981	MH981	MH905						0.23	0.23		0.72	40.62	0.00	1.72	16.62	0.78	17.41	58.18	78.65	92.08	134.43	2,363.17	134.99					2,498.17	3,297.98	85.09	1500	0.20	1.808	799.81	24.25%
Ralph Hennessy Ave.	EXT-1 S933A	BLK934	MH933	2.54				5.70				9.98	9.98	4.45	4.45	14.41	0.40	14.81	63.19	85.51	100.15	146.26	630.84	380.38					1,011.22	1,274.02	33.80	1050	0.20	1.425	262.80	20.63%
	S933A&B, P933	MH933	MH932		0.48						3.12	6.07	16.05	0.91	5.36	14.81	1.25	16.05	62.23	84.19	98.59	143.98	999.02	450.90					1,449.92	1,818.95	116.49	1200	0.20	1.558	369.04	20.29%
	931A	MH932	MH931		0.26							0.00	16.05	0.49	5.85	16.05	0.59	16.64	59.39	80.30	94.02	137.28	953.46	469.56					1,423.02	1,818.95	55.23	1200	0.20	1.558	395.93	21.77%
	S931B	MH931	MH930B		0.24							0.00	16.05	0.45	6.30	16.64	0.92	17.57	58.14	78.60	92.02	134.34	933.43	495.25					1,428.68	1,818.95	86.41	1200	0.20	1.558	390.27	21.46%
	P931	CBMH931C	MH930B			2.36						3.28	3.28			10.00	0.17	10.17	76.81	104.19	122.14	178.56	251.95	0.00					251.95	297.43	18.00	450	1.00	1.812	45.48	15.29%
	S930	MH930B	MH910		0.37							0.00	19.33	0.70	7.00	17.57	1.28	18.85	56.30	76.08	89.06	130.00	1,088.61	532.63					1,621.25	1,818.95	120.00	1200	0.20	1.558	197.70	10.87%
Ralph Hennessy Ave.	S947, P947, R947	MH947	MH946		0.24				0.22		0.93	2.08	2.08	0.45	0.45	10.00	0.88	10.88	76.81	104.19	122.14	178.56	159.67	47.27					206.94	286.47	51.72	600	0.20	0.982	79.53	27.76%
Pomelo Street	S943, R943	MH943	MH944						0.35	0.25		0.90	0.90			10.00	0.90	10.90	76.81	104.19	122.14	178.56	69.18						69.18	147.47	69.62	375	0.65	1.293	78.29	53.09%
	R944	MH944	MH945						0.23			0.28	1.18			10.90	0.53	11.43	73.52	99.68	116.83	170.75	86.91						86.91	108.21	30.28	375	0.35	0.949	21.30	19.69%
	S945	MH945	MH946							0.22		0.42	1.60			11.43	0.33	11.75	71.72	97.21	113.91	166.47	114.61						114.61	175.96	20.98	450	0.35	1.072	61.36	34.87%
Ralph Hennessy Ave.	S946	MH946	MH910		0.29							0.00	3.68	0.55	1.00	11.75	1.38	13.13	70.67	95.76	112.21	163.96	259.82	95.94					355.76	392.18	87.77	675	0.20	1.062	36.41	9.29%
Borbridge Ave.	S911, S911A	MH911	MH910		0.36							0.00	0.00	0.68	0.68	10.00	1.61	11.61	76.81	104.19	122.14	178.56	0.00	70.91					70.91	141.68	120.00	375	0.60	1.243	70.77	49.95%
Borbridge Ave.	S910, P910	MH910	MH909		0.31						1.45	2.82	25.83	0.59	9.27	18.85	0.53	19.38	53.95	72.88	85.29	124.47	1,393.83	675.50					2,069.33	4,252.35	60.80	1650	0.20	1.927	2183.02	51.34%
		MH909	MH908									0.00	25.83	0.00	9.27	19.38	0.17	19.55	53.05	71.65	83.85	122.36	1,370.57	664.10					2,034.67	4,252.35	19.36	1650	0.20	1.927	2217.68	52.15%
	S908	MH908	MH907		**0.26**							0.00	25.83	0.49	9.76	19.55	0.92	20.46	52.77	71.27	83.40	121.70	1,363.34	695.59					2,058.93	4,252.35	105.80	1650	0.20	1.927	2193.42	51.58%
		MH907	MH906									0.00	25.83	0.00	9.76	20.46	0.11	20.57	51.30	69.26	81.04	118.24	1,325.30	675.98					2,001.28	4,252.35	12.68	1650	0.20	1.927	2251.07	52.94%
Honeydew Street		MH806	MH807									0.00	0.00			10.00	0.20	10.20	76.81	104.19	122.14	178.56	0.00						0.00	50.02	11.72	250	0.65	0.987	50.02	100.00%
	S807	MH807	MH808							0.32		0.60	0.60			10.20	1.34	11.53	76.05	103.16	120.92	176.77	46.01						46.01	59.68	65.52	300	0.35	0.818	13.68	22.91%
	S807, R807	MH808	MH906						0.14	0.26		0.66	1.27			11.53	1.00	12.54	71.38	96.74	113.36	165.66	90.49						90.49	108.21	57.14	375	0.35	0.949	17.72	16.38%
Borbridge Ave.	S906&B, R906A&B	MH906	MH905		0.48				0.39			0.48	27.58	0.91	10.67	20.57	0.68	21.25	51.13	69.02	80.77	117.84	1,410.11	736.34					2,146.45	4,252.35	79.00	1650	0.20	1.927	2105.89	49.52%
Borbridge Ave.		MH905	BLK905									0.00	68.20	0.00	12.38	17.41	0.13	17.53	56.61	76.50	89.56	130.73	3,860.58	947.45					4,808.03	8,089.52	17.00	2100	0.20	2.263	3281.50	40.56%
Rockmellon Street	S948A, R948A	MH984	MH822				0.23	0.32				0.90	0.90			10.00	1.23	11.23	76.81	104.19	122.14	178.56	69.07	93.70					69.07	147.47	95.56	375	0.65	1.293	78.39	53.16%
	S822, R822	MH822	BLK822				0.34	0.42				1.24	2.14			11.23	1.36	12.59	72.38	98.11	114.98	168.04	154.59	209.55					154.59	175.96	87.24	450	0.35	1.072	21.37	12.14%
Honeydew Street	S805	MH805	MH804							0.22		0.42	0.42			10.00	1.45	11.45	76.81	104.19	122.14	178.56	31.94	43.33					31.94	50.02	85.89	250	0.65	0.987	18.07	36.14%
	S804, R804	MH804	BLK804				0.43			0.39		1.37	1.79			11.45	0.79	12.24	71.65	97.11	113.80	166.31	128.02	173.51					128.02	175.96	50.85	450	0.35	1.072	47.94	27.25%
Kiwi Street	S981A	MH981	MH961							0.15		0.28	0.28			10.00	1.20	11.20	76.81	104.19	122.14	178.56	21.78	29.54					21.78	57.20	81.49	250	0.85	1.129	35.42	61.92%
	S961B	MH961	BLK960							0.24		0.45	0.74			11.20	0.48	11.68	72.47	98.24	115.13	168.26	53.43	72.43					53.43	159.51	62.97	300	2.50	2.186	106.08	66.50%

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STORM SEWER DESIGN SHEET

RSS Phase 17-1B
City of Ottawa
Urbandale

LOCATION				AREA (Ha)								RATIONAL DESIGN FLOW																		SEWER DATA						
STREET	AREA ID	FROM	TO	C= 0.63	C= 0.68	C= 0.50	C= 0.53	C= 0.63	C= 0.44	C= 0.68	C= 0.70	IND 2.78AC	CUM 2.78AC	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW IND	FIXED FLOW CUM	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	AVAIL CAP (2yr) (%)
Apricot Street	S961A, R961	MH961	MH962						0.18	0.37		0.92	0.92			10.00	0.57	10.57	76.81	104.19	122.14	178.56	70.63	95.82					70.63	191.84	57.47	375	1.10	1.683	121.21	63.18%
		MH962	MH963									0.00	0.92			10.57	0.28	10.85	74.69	101.28	118.71	173.52	68.68	93.14					68.68	108.21	15.79	375	0.35	0.949	39.53	36.53%
	S963, R963	MH963	BLK963						0.47	0.27		1.09	2.00			10.85	0.56	11.40	73.70	99.92	117.11	171.17	147.77	200.34					147.77	175.96	35.70	450	0.35	1.072	28.20	16.03%

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient 0.013

Designed: LME

Checked:

Dwg. Reference: 125581-501

No.	Revision	Date
1.	1st Submission	2022-01-25
2.	2nd Submission	2022-03-17

File Reference:	Date:	Sheet No:
125581-6.04	2022-03-18	1 of 1

Inlet Time

External Draiinage Area	Length of Pipe Upstream (m)	Velocity (m/s)	Travel Time (min)	Inlet Time (min)
EXT-1	450	1.70	4.41	14.41
EXT-3	800	1.70	7.84	17.84

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEY PLAN
NTS

No.	REVISIONS	By	Date
14			
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2	SUBMISSION 2 FOR CITY REVIEW	L.M.E.	2022:03:17
1	SUBMISSION 1 FOR CITY REVIEW	L.M.E.	2022:01:25

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Project Title

RIVERSIDE SOUTH

PHASE 17-1B

LICENSED PROFESSIONAL ENGINEER
L. M. ERION
13379508
2022/03/17
PROVINCE OF ONTARIO

Drawing Title

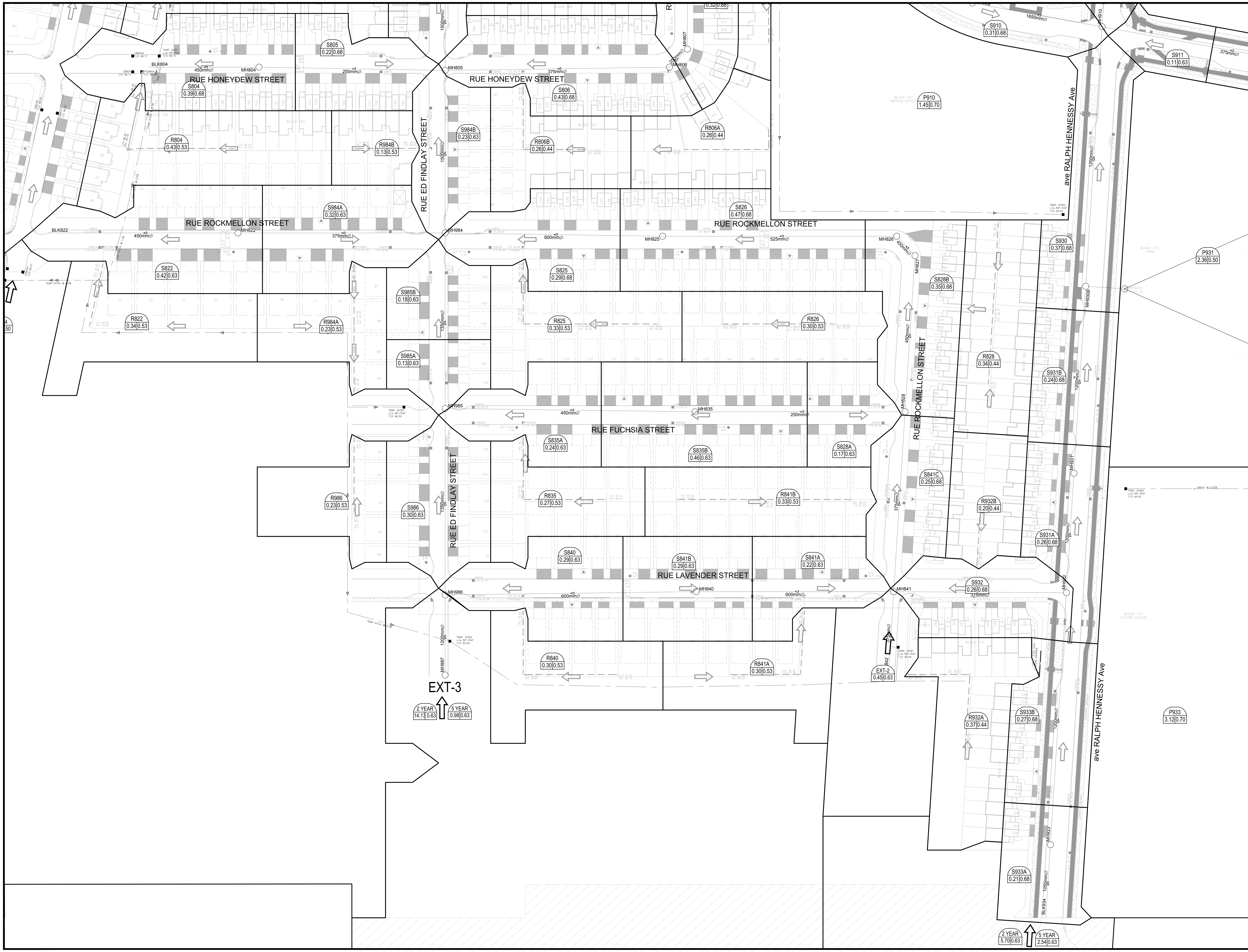
STORM DRAINAGE
AREA PLAN

Scale
1:750

Design	Date
L.E.	JULY 2021
Drawn	Checked
C.C.	L.E.
Project No.	Drawing No.
125581	502

D07-16-20-0018

#18485



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEY PLAN
NTS

No.	REVISIONS	By	Date
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2	SUBMISSION 2 FOR CITY REVIEW	L.M.E	2022:03:17
1	SUBMISSION 1 FOR CITY REVIEW	L.M.E	2022:01:25

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Project Title

RIVERSIDE SOUTH

PHASE 17-1B

LICENSED PROFESSIONAL ENGINEER
L. M. ERION
13379508
2022/03/17
PROVINCE OF ONTARIO

Drawing Title

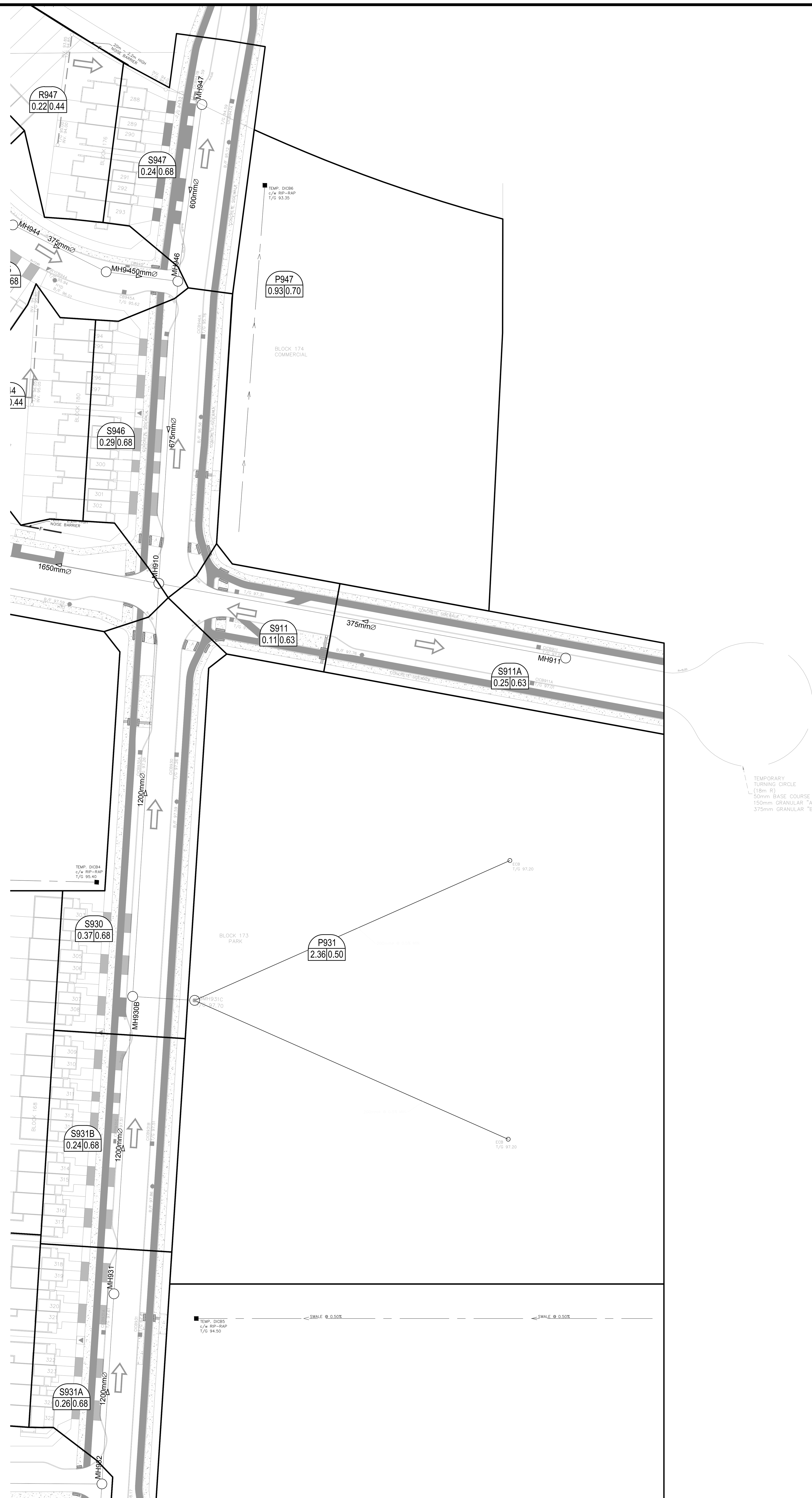
STORM DRAINAGE
AREA PLAN

Scale
1:750

Design	Date
L.E.	JULY 2021
Drawn	Checked
C.C.	L.E.
Project No.	Drawing No.
125581	503

D07-16-20-0018

#18485



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEY PLAN
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No.	REVISIONS	By	Date
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2	SUBMISSION 2 FOR CITY REVIEW	L.M.E	2022:03:17
1	SUBMISSION 1 FOR CITY REVIEW	L.M.E	2022:01:25

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Project Title

RIVERSIDE SOUTH

PHASE 17-1B

LICENSED PROFESSIONAL ENGINEER
L. M. ERION
13379508
2022/03/17
PROVINCE OF ONTARIO

N

Drawing Title

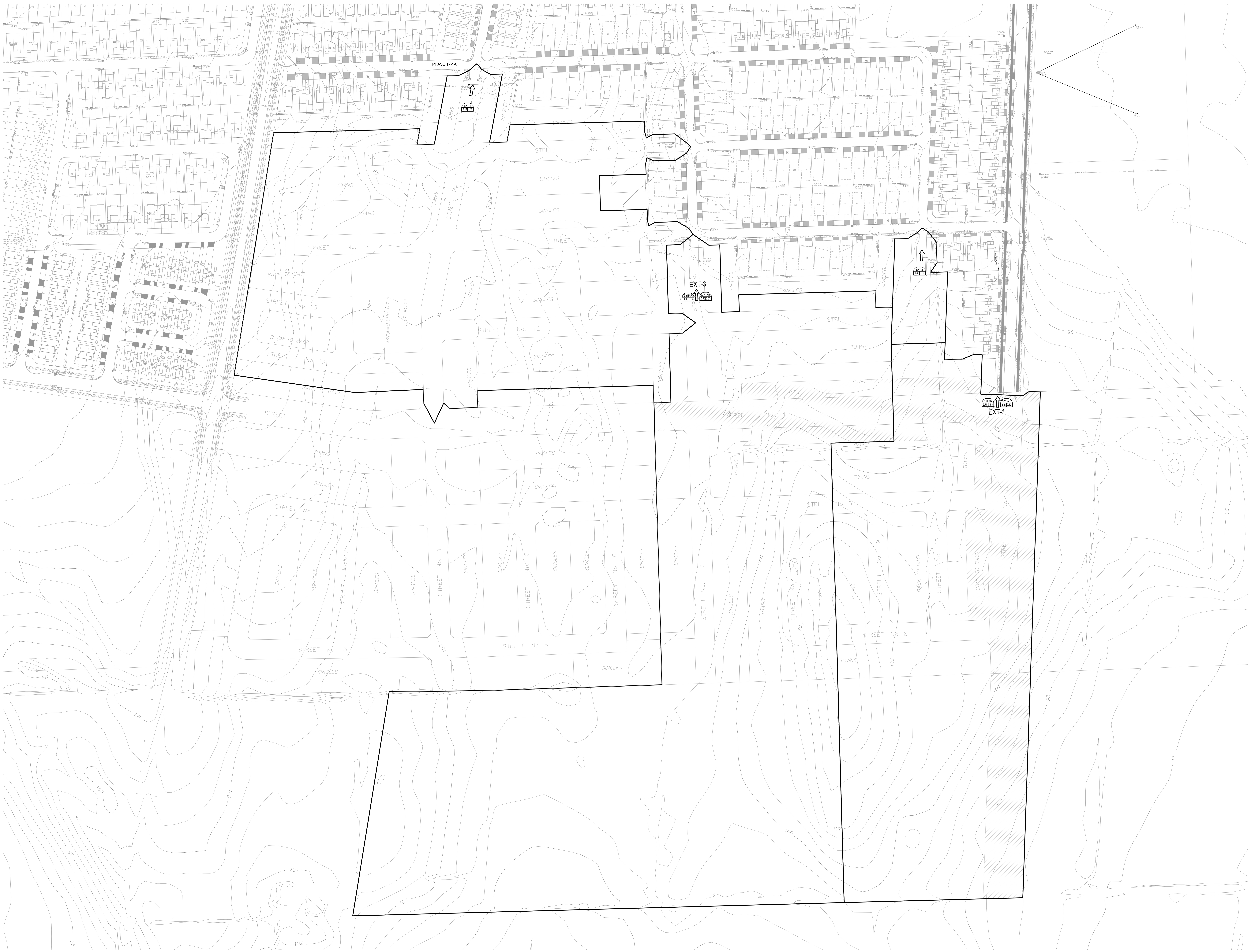
STORM DRAINAGE
AREA PLAN

Scale
1:750

Design	L.E.	Date	JULY 2021
Drawn	C.C.	Checked	L.E.
Project No.	125581	Drawing No.	504

D07-16-20-0018

#18485



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEY PLAN
NTS

No.	REVISIONS	By	Date
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2	SUBMISSION 2 FOR CITY REVIEW	L.M.E	2022:03:17
1	SUBMISSION 1 FOR CITY REVIEW	L.M.E	2022:01:25

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Project Title
RIVERSIDE SOUTH

LICENSED PROFESSIONAL ENGINEER
L. M. ERION
13379508
2022/03/17
PROVINCE OF ONTARIO

N

Drawing Title
EXTERNAL STORM DRAINAGE AREA PLAN

Scale
1:1500

Design	Date
L.E.	JULY 2021
Drawn	Checked
C.C.	L.E.
Project No.	Drawing No.
125581	505

D07-16-20-0018

#18485

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STORM SEWER DESIGN SHEET

River Road
City of Ottawa
Riverside South Development Corporation

LOCATION				AREA (Ha)						RATIONAL DESIGN FLOW																	SEWER DATA						
				Existing	Single Family		Townhouse		Walden	2 Year		5 Year		10 Year																			
STREET	AREA ID	FROM	TO	C= 0.25	C= 0.41	C= 0.50	C= 0.63	C= 0.63	C= 0.67	IND 2.78AC	CUM 2.78AC	IND 2.78AC	CUM 2.78AC	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (L/s)	AVAIL CAP (%)
North Outlet																																	
River Road	EXT-1		EXMH160		5.15	4.44			1.90	0.00	0.00	12.04	12.04	3.54	3.54	12.78			67.56	91.50	107.20	0.00	1,101.80	379.36		1,481.16							
River Road		EXMH160	MH2							0.00	0.00	0.00	12.04	0.00	3.54	12.78	1.45	14.23	67.56	91.50	107.20	0.00	1,101.80	379.36		1,481.16	3,006.86	118.40	1650	0.10	1.362	1525.71	50.74%
River Road		MH2	MH3							0.00	0.00	0.00	12.04	0.00	3.54	14.23	1.15	15.37	63.66	86.14	100.89	0.00	1,037.30	357.06		1,394.35	3,006.86	93.83	1650	0.10	1.362	1612.51	53.63%
Borbridge Avenue	EXT-2	CAP	MH3				1.86	0.60		3.26	3.26	1.05	1.05	0.00	0.00	12.56	0.21	12.77	68.21	92.39	108.24	222.21	97.08	0.00		319.29	572.93	25.00	600	0.80	1.963	253.64	44.27%
River Road		MH3	MH4							0.00	3.26	0.00	13.09	0.00	3.54	15.37	1.49	16.87	60.90	82.37	96.45	198.38	1,078.39	341.34		1,618.11	3,792.13	129.25	1800	0.10	1.444	2174.02	57.33%
Street No. 3	EXT-3	CAP	MH4				8.36			14.64	14.64	0.00	0.00	0.00	0.00	16.67	0.22	16.89	58.09	78.53	91.94	850.60	0.00	0.00		850.60	1,117.30	22.89	900	0.35	1.701	266.70	23.87%
Street No. 3 West		MH4	MH154							0.00	17.90	0.00	13.09	0.00	3.54	16.87	0.26	17.12	57.69	77.98	91.29	1,032.55	1,020.88	323.06		2,376.50	3,792.13	22.11	1800	0.10	1.444	1415.63	37.33%
Street No. 3 West	154	MH154	CAP				2.11			3.70	21.59	0.00	13.09	0.00	3.54	17.12	1.36	18.48	57.17	77.28	90.47	1,234.68	1,011.72	320.15		2,566.55	3,792.13	117.91	1800	0.10	1.444	1225.58	32.32%
Street No. 5	EXT-4	CAP	MH11				103.76	2.60		181.73	181.73	4.55	4.55	0.00	0.00	33.75	0.39	34.14	36.97	49.75	58.15	6,718.47	226.56	0.00		6,945.03	14,807.43	47.00	3000	0.10	2.029	7862.40	53.10%
Street No. 1 West	11	MH11	CAP				1.06			1.86	183.58	0.00	4.55	0.00	0.00	34.14	1.02	33.75	36.68	49.36	57.69	6,734.45	224.79	0.00		6,959.24	14,807.43	124.30	3000	0.10	2.029	7848.20	53.00%
South Outlet																																	
River Road	EXT-6		MH28				17.38			30.44	30.44	0.00	0.00	0.00	0.00	16.67			58.09	78.53	91.94	1,768.36	0.00	0.00		1,768.36							
River Road		MH28	MH29							0.00	30.44	0.00	0.00	0.00	0.00	16.67	1.05	17.72	58.09	78.53	91.94	1,768.36	0.00	0.00		1,768.36	4,486.91	107.73	1800	0.14	1.708	2718.55	60.59%
Street No. 7	EXT-5	CAP	MH29				122.85	2.77		215.16	245.60	4.85	4.85	0.00	0.00	23.33	0.27	23.60	47.22	63.69	74.51	11,597.38	309.00	0.00		11,906.38	14,807.43	33.00	3000	0.10	2.029	2901.05	19.59%
River Road		MH30	MH29							0.00	0.00	0.00	0.00	0.00	0.00	10.00	1.65	11.65	76.81	104.19	122.14	0.00	0.00	0.00		0.00	129.34	112.57	375	0.50	1.134	129.34	100.00%
		MH29	CAP							0.00	276.04	0.00	4.85	0.00	0.00	23.60	1.17	24.78	46.87	63.22	73.95	12,938.66	306.70	0.00		13,245.36	14,807.43	142.90	3000	0.10	2.029	1562.08	10.55%
Roadside Ditch Conveyance																																	
Culvert STA 1+280	A9, A11*	MHA	Outlet																						325*	325.00	2,178.02	28.32	900	1.33	3.317	1853.02	85.08%
Culvert STA 1+680	A5, A7*	DICB3	DICB4																						150*	150.00	162.91	23.00	450	0.30	0.992	12.91	7.93%
	A6, A8*	DICB4	MHB																						161*	311.00	350.85	57.40	600	0.30	1.202	39.85	11.36%
		MHB	MHC																							311.00	350.85	41.32	600	0.30	1.202	39.85	11.36%
		MHC	HW42																							311.00	350.85	22.06	600	0.30	1.202	39.85	11.36%

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

* Drainage Areas per Figure 4.3 and 100 year flows from Table 4.2 of the Design Brief

Designed: LME

Checked:

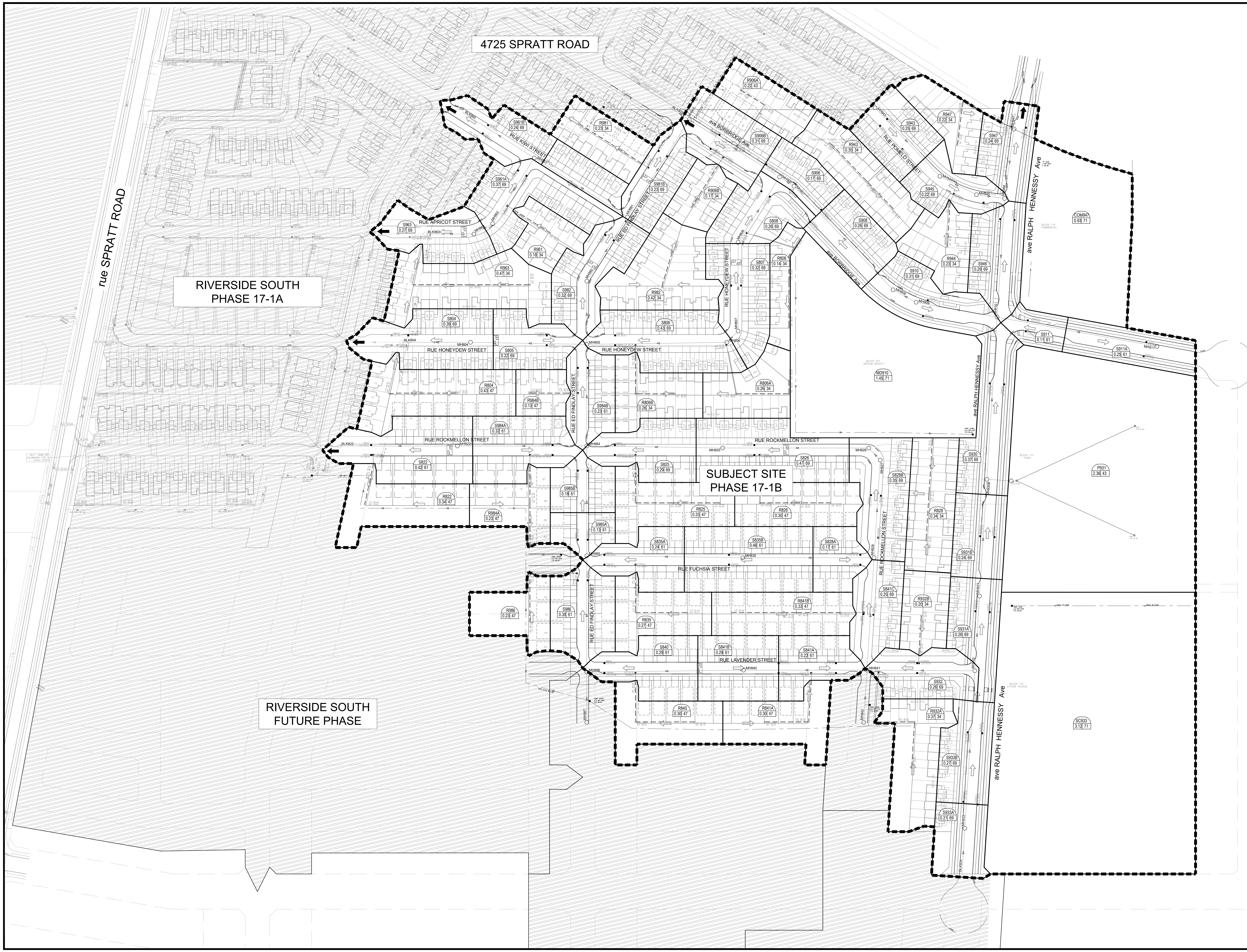
Dwg. Reference: 114373-500

No.	Revision	Date
1.	City submission No. 1	27-04-2018
2.	City submission No. 2	03-07-2018

File Reference:	Date:	Sheet No:
114373.5.7.1	7/3/2018	1 of 1

Inlet Time

External Draiinage Area	Length of Pipe Upstream (m)	Velocity (m/s)	Travel Time (min)	Inlet Time (min)
EXT-1	250	1.50	2.78	12.78
EXT-2	230	1.50	2.56	12.56
EXT-3	600	1.50	6.67	16.67
EXT-4	2,850	2.00	23.75	33.75
EXT-5	1,600	2.00	13.33	23.33
EXT-6	600	1.50	6.67	16.67



LEGEND:

- PHASE 17-1A BOUNDARY
- DRAINAGE AREAS
- RIVERSIDE SOUTH PHASE 2 DRAINAGE AREA
- S588 — AREA ID
- 0.20 | 71 — IMPERVIOUS VALUE / AREA (ha)
- MAJOR FLOW

KEY PLAN
NTS

No.	REVISIONS	By	Date
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2	SUBMISSION 2 FOR CITY REVIEW	P.S.	2022:03:17
1	SUBMISSION 1 FOR CITY REVIEW	P.S.	2022:01:25

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Project Title

RIVERSIDE SOUTH
PHASE 17-1B

LICENSED PROFESSIONAL ENGINEER
P. SPAL
2022/03/17
PROVINCE OF ONTARIO

Drawing Title

PCSWMM STORM DRAINAGE AREA PLAN

Scale
1:1250

Design	Date
M.G.	JANUARY 2022
Drawn	**Checked**
J.S.F.	P.S.
Project No.	**Drawing No.**
125581	750

D07-16-20-0018

#18485

POND ID	S905
TOP OF GRATE (m)	94.93
STATIC ELEV (m)	95.14
STATIC DEPTH (m)	0.21
STATIC VOLUME (m³)	24.42
100yr ELEV (m)	95.19
100yr + 20% ELEV (m)	95.23

POND ID	S961B
TOP OF GRATE (m)	94.92
STATIC ELEV (m)	95.13
STATIC DEPTH (m)	0.21
STATIC VOLUME (m³)	19.79
100yr ELEV (m)	95.17
100yr + 20% ELEV (m)	95.26

POND ID	S906A
TOP OF GRATE (m)	95.44
STATIC ELEV (m)	95.58
STATIC DEPTH (m)	0.14
STATIC VOLUME (m³)	4.72
100yr ELEV (m)	95.68
100yr + 20% ELEV (m)	95.70

POND ID	S981B
TOP OF GRATE (m)	95.32
STATIC ELEV (m)	95.56
STATIC DEPTH (m)	0.24
STATIC VOLUME (m³)	28.96
100yr ELEV (m)	95.61
100yr + 20% ELEV (m)	95.67

POND ID	S961C
TOP OF GRATE (m)	95.62
STATIC ELEV (m)	95.72
STATIC DEPTH (m)	0.10
STATIC VOLUME (m³)	0.76
100yr ELEV (m)	95.80
100yr + 20% ELEV (m)	95.81

POND ID	S906B
TOP OF GRATE (m)	95.44
STATIC ELEV (m)	95.60
STATIC DEPTH (m)	0.16
STATIC VOLUME (m³)	4.31
100yr ELEV (m)	95.68
100yr + 20% ELEV (m)	95.70

POND ID	S961A
TOP OF GRATE (m)	95.62
STATIC ELEV (m)	95.75
STATIC DEPTH (m)	0.13
STATIC VOLUME (m³)	1.56
100yr ELEV (m)	95.80
100yr + 20% ELEV (m)	95.81

POND ID	S808A
TOP OF GRATE (m)	96.48
STATIC ELEV (m)	96.55
STATIC DEPTH (m)	0.07
STATIC VOLUME (m³)	0.27
100yr ELEV (m)	96.65
100yr + 20% ELEV (m)	96.66

POND ID	S808
TOP OF GRATE (m)	96.48
STATIC ELEV (m)	96.61
STATIC DEPTH (m)	0.13
STATIC VOLUME (m³)	1.21
100yr ELEV (m)	96.65
100yr + 20% ELEV (m)	96.66

POND ID	S963
TOP OF GRATE (m)	95.47
STATIC ELEV (m)	95.68
STATIC DEPTH (m)	0.21
STATIC VOLUME (m³)	18.09
100yr ELEV (m)	95.74
100yr + 20% ELEV (m)	95.76

POND ID	S982
TOP OF GRATE (m)	96.27
STATIC ELEV (m)	96.42
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	8.25
100yr ELEV (m)	96.46
100yr + 20% ELEV (m)	96.53

POND ID	S807
TOP OF GRATE (m)	96.87
STATIC ELEV (m)	97.14
STATIC DEPTH (m)	0.27
STATIC VOLUME (m³)	57.29
100yr ELEV (m)	97.08
100yr + 20% ELEV (m)	97.13

POND ID	S804
TOP OF GRATE (m)	96.17
STATIC ELEV (m)	96.42
STATIC DEPTH (m)	0.25
STATIC VOLUME (m³)	26.65
100yr ELEV (m)	96.42
100yr + 20% ELEV (m)	96.45

POND ID	S806
TOP OF GRATE (m)	96.67
STATIC ELEV (m)	96.94
STATIC DEPTH (m)	0.27
STATIC VOLUME (m³)	67.22
100yr ELEV (m)	96.98
100yr + 20% ELEV (m)	97.04

POND ID	S805
TOP OF GRATE (m)	96.67
STATIC ELEV (m)	96.94
STATIC DEPTH (m)	0.27
STATIC VOLUME (m³)	34.69
100yr ELEV (m)	96.85
100yr + 20% ELEV (m)	96.90

POND ID	S984B
TOP OF GRATE (m)	96.77
STATIC ELEV (m)	96.94
STATIC DEPTH (m)	0.17
STATIC VOLUME (m³)	17.18
100yr ELEV (m)	97.00
100yr + 20% ELEV (m)	97.06

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

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2	SUBMISSION 2 FOR CITY REVIEW	L.M.E	2022:03:17
1	SUBMISSION 1 FOR CITY REVIEW	L.M.E	2022:01:25

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Project Title
RIVERSIDE SOUTH

LICENSED PROFESSIONAL ENGINEER
L. M. ERION
13379508
2022/03/17
PROVINCE OF ONTARIO

Drawing Title
PONDING PLAN

Scale
1 : 500

Design	Date
L.E.	JULY 2021
Drawn	Checked
C.C.	L.E.
Project No.	Drawing No.
125581	602

D07-16-20-0018

#18485

S808	
96.48	
96.61	
0.13	
1.21	
96.65	
96.66	

POND ID	S943
TOP OF GRATE (m)	95.76
STATIC ELEV (m)	95.87
STATIC DEPTH (m)	0.11
STATIC VOLUME (m³)	4.62
100yr ELEV (m)	95.90
100yr + 20% ELEV (m)	95.91

POND ID	S947
TOP OF GRATE (m)	94.59
STATIC ELEV (m)	94.74
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	6.47
100yr ELEV (m)	94.82
100yr + 20% ELEV (m)	94.84

POND ID	S945
TOP OF GRATE (m)	95.62
STATIC ELEV (m)	95.80
STATIC DEPTH (m)	0.18
STATIC VOLUME (m³)	12.80
100yr ELEV (m)	95.84
100yr + 20% ELEV (m)	95.85

POND ID	S946A
TOP OF GRATE (m)	95.76
STATIC ELEV (m)	95.86
STATIC DEPTH (m)	0.10
STATIC VOLUME (m³)	1.03
100yr ELEV (m)	95.85
100yr + 20% ELEV (m)	95.90

POND ID	S946
TOP OF GRATE (m)	95.76
STATIC ELEV (m)	95.90
STATIC DEPTH (m)	0.14
STATIC VOLUME (m³)	1.57
100yr ELEV (m)	95.85
100yr + 20% ELEV (m)	95.90

POND ID	S911B
TOP OF GRATE (m)	97.31
STATIC ELEV (m)	97.42
STATIC DEPTH (m)	0.11
STATIC VOLUME (m³)	1.60
100yr ELEV (m)	97.32
100yr + 20% ELEV (m)	97.37

POND ID	S911A
TOP OF GRATE (m)	97.01
STATIC ELEV (m)	97.26
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	46.71
100yr ELEV (m)	97.14
100yr + 20% ELEV (m)	97.19

POND ID	S910
TOP OF GRATE (m)	97.18
STATIC ELEV (m)	97.50
STATIC DEPTH (m)	0.32
STATIC VOLUME (m³)	83.03
100yr ELEV (m)	97.29
100yr + 20% ELEV (m)	97.33

POND ID	S911C
TOP OF GRATE (m)	97.38
STATIC ELEV (m)	97.45
STATIC DEPTH (m)	0.07
STATIC VOLUME (m³)	0.43
100yr ELEV (m)	97.32
100yr + 20% ELEV (m)	97.37

POND ID	S930
TOP OF GRATE (m)	97.26
STATIC ELEV (m)	97.50
STATIC DEPTH (m)	0.24
STATIC VOLUME (m³)	45.99
100yr ELEV (m)	97.37
100yr + 20% ELEV (m)	97.41

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Drawing Title

PONDING PLAN

Scale: 1 : 500

Design	Date
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125581	603

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#18485

POND ID	S822
TOP OF GRATE (m)	96.57
STATIC ELEV (m)	96.75
STATIC DEPTH (m)	0.18
STATIC VOLUME (m³)	10.15
100yr ELEV (m)	96.79
100yr + 20% ELEV (m)	96.84

POND ID	S984A
TOP OF GRATE (m)	96.87
STATIC ELEV (m)	97.12
STATIC DEPTH (m)	0.25
STATIC VOLUME (m³)	26.68
100yr ELEV (m)	97.15
100yr + 20% ELEV (m)	97.18

POND ID	S825
TOP OF GRATE (m)	96.87
STATIC ELEV (m)	97.12
STATIC DEPTH (m)	0.25
STATIC VOLUME (m³)	45.88
100yr ELEV (m)	97.17
100yr + 20% ELEV (m)	97.21

POND ID	S826
TOP OF GRATE (m)	96.97
STATIC ELEV (m)	97.22
STATIC DEPTH (m)	0.25
STATIC VOLUME (m³)	70.18
100yr ELEV (m)	97.15
100yr + 20% ELEV (m)	97.24

POND ID	S985B
TOP OF GRATE (m)	96.97
STATIC ELEV (m)	97.12
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	9.35
100yr ELEV (m)	97.16
100yr + 20% ELEV (m)	97.22

POND ID	S985A
TOP OF GRATE (m)	97.02
STATIC ELEV (m)	97.17
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	8.39
100yr ELEV (m)	97.21
100yr + 20% ELEV (m)	97.24

POND ID	S835A
TOP OF GRATE (m)	97.02
STATIC ELEV (m)	97.18
STATIC DEPTH (m)	0.16
STATIC VOLUME (m³)	11.5
100yr ELEV (m)	97.23
100yr + 20% ELEV (m)	97.25

POND ID	S835B
TOP OF GRATE (m)	97.12
STATIC ELEV (m)	97.37
STATIC DEPTH (m)	0.25
STATIC VOLUME (m³)	52.18
100yr ELEV (m)	97.32
100yr + 20% ELEV (m)	97.38

POND ID	S986
TOP OF GRATE (m)	97.02
STATIC ELEV (m)	97.18
STATIC DEPTH (m)	0.16
STATIC VOLUME (m³)	8.56
100yr ELEV (m)	97.23
100yr + 20% ELEV (m)	97.25

POND ID	S840
TOP OF GRATE (m)	97.47
STATIC ELEV (m)	97.62
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	9.42
100yr ELEV (m)	97.68
100yr + 20% ELEV (m)	97.69

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Drawing Title
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Scale
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Design	Date
L.E.	JULY 2021
Drawn	Checked
C.C.	L.E.
Project No.	Drawing No.
125581	604

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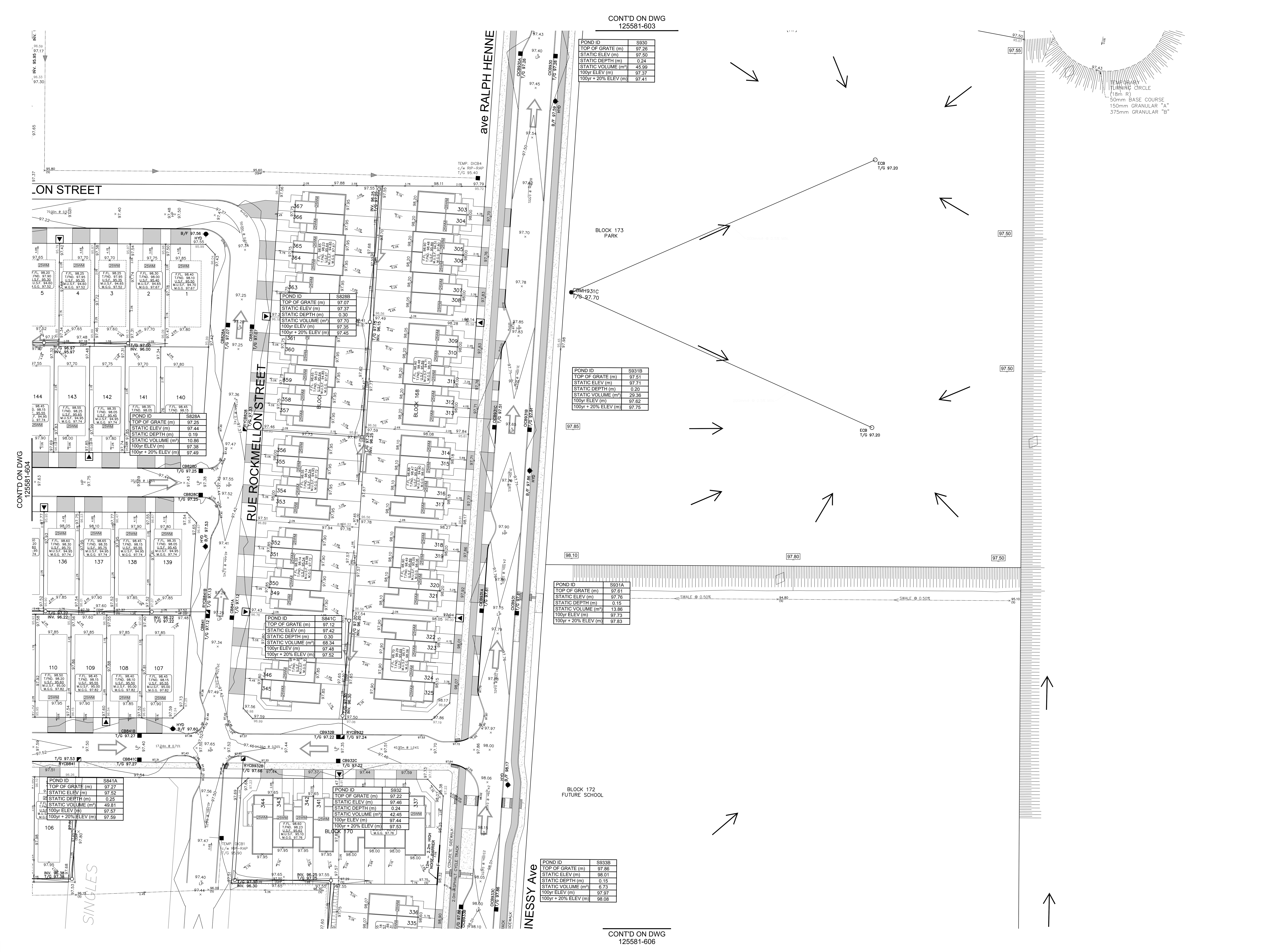

POND ID	S930
TOP OF GRATE (m)	97.26
STATIC ELEV (m)	97.50
STATIC DEPTH (m)	0.24
STATIC VOLUME (m³)	45.99
100yr ELEV (m)	97.37
100yr + 20% ELEV (m)	97.41

POND ID	S828B
TOP OF GRATE (m)	97.07
STATIC ELEV (m)	97.37
STATIC DEPTH (m)	0.30
STATIC VOLUME (m³)	97.70
100yr ELEV (m)	97.35
100yr + 20% ELEV (m)	97.45

POND ID	S828A
TOP OF GRATE (m)	97.25
STATIC ELEV (m)	97.44
STATIC DEPTH (m)	0.19
STATIC VOLUME (m³)	10.86
100yr ELEV (m)	97.38
100yr + 20% ELEV (m)	97.49

POND ID	S931B
TOP OF GRATE (m)	97.51
STATIC ELEV (m)	97.71
STATIC DEPTH (m)	0.20
STATIC VOLUME (m³)	29.36
100yr ELEV (m)	97.62
100yr + 20% ELEV (m)	97.75

POND ID	S931A
TOP OF GRATE (m)	97.61
STATIC ELEV (m)	97.76
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	13.86
100yr ELEV (m)	97.73
100yr + 20% ELEV (m)	97.83

POND ID	S841C
TOP OF GRATE (m)	97.12
STATIC ELEV (m)	97.42
STATIC DEPTH (m)	0.30
STATIC VOLUME (m³)	68.34
100yr ELEV (m)	97.48
100yr + 20% ELEV (m)	97.52

POND ID	S841A
TOP OF GRATE (m)	97.27
STATIC ELEV (m)	97.52
STATIC DEPTH (m)	0.25
STATIC VOLUME (m³)	49.81
100yr ELEV (m)	97.57
100yr + 20% ELEV (m)	97.59

POND ID	S932
TOP OF GRATE (m)	97.22
STATIC ELEV (m)	97.46
STATIC DEPTH (m)	0.24
STATIC VOLUME (m³)	42.45
100yr ELEV (m)	97.44
100yr + 20% ELEV (m)	97.53

POND ID	S933B
TOP OF GRATE (m)	97.86
STATIC ELEV (m)	98.01
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	6.73
100yr ELEV (m)	97.97
100yr + 20% ELEV (m)	98.08

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125581	605

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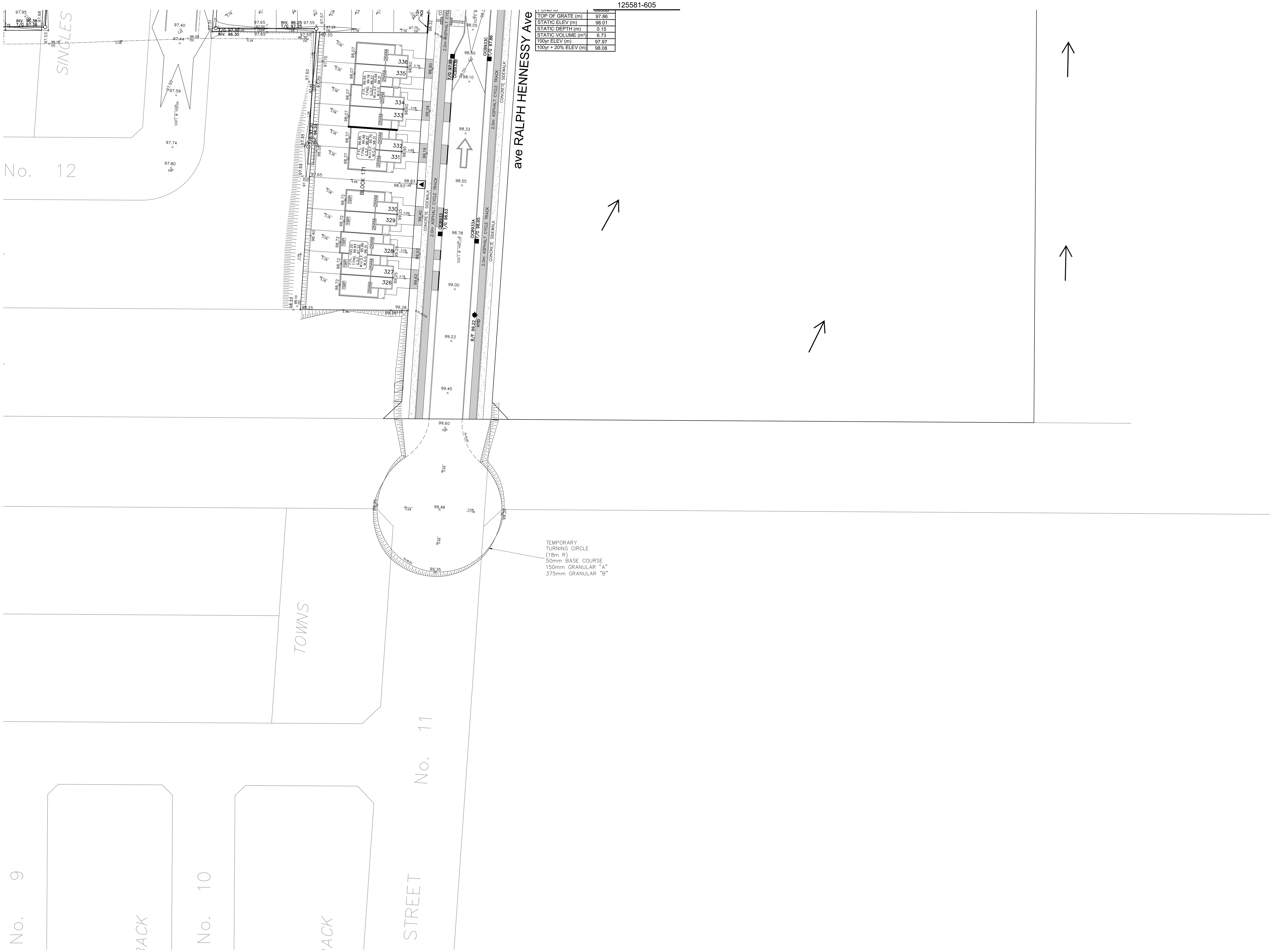
#18485

CONT'D ON DWG
125581-605

POND ID	[illegible]
TOP OF GRATE (m)	97.86
STATIC ELEV (m)	98.01
STATIC DEPTH (m)	0.15
STATIC VOLUME (m^3)	6.73
100yr ELEV (m)	97.97
100yr + 20% ELEV (m)	98.08



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#18485

Common Curves for Analysis of Existing ROWs, No Gutter, For PCSWMM

Curves for Catch Basins on a Slope

Ottawa Standard

Depth (m)	$Q_{capture}$ (m^3/s)
0.000	0.000
0.010	0.001
0.015	0.003
0.021	0.006
0.030	0.012
0.040	0.020
0.050	0.030
0.054	0.034
0.060	0.040
0.080	0.050
1.000	0.050

Fish or fishbone Type

Depth (m)	$Q_{capture}$ (m^3/s)
0.000	0.000
0.010	0.001
0.015	0.003
0.021	0.007
0.030	0.014
0.040	0.024
0.050	0.036
0.054	0.041
0.060	0.047
0.070	0.050
1.000	0.050

Curb Inlets

Depth (m)	$Q_{capture}$ (m^3/s)
0.000	0.000
0.010	0.001
0.015	0.002
0.021	0.004
0.030	0.006
0.040	0.009
0.050	0.013
0.054	0.014
0.060	0.017
0.070	0.021
0.080	0.026
0.090	0.031
0.140	0.050
1.000	0.050

Curves for Catch Basins in a Low Point

Sag, Ottawa Standard

Depth (m)	$Q_{capture}$ (m^3/s)
0.000	0.000
0.050	0.008
0.080	0.022
0.090	0.034
0.100	0.048
0.104	0.052
0.110	0.060
0.140	0.080
0.150	0.085
0.160	0.090
0.170	0.095
0.200	0.097
0.300	0.100
1.000	0.100

Sag, fish or fishbone

Depth (m)	$Q_{capture}$ (m^3/s)
0.000	0.000
0.050	0.010
0.080	0.027
0.090	0.042
0.100	0.060
0.104	0.065
0.110	0.075
0.120	0.082
0.130	0.090
0.150	0.095
0.200	0.097
0.300	0.100
1.000	0.100

Sag, curb inlet

Depth (m)	$Q_{capture}$ (m^3/s)
0.000	0.000
0.018	0.002
0.030	0.010
0.040	0.018
0.050	0.030
0.060	0.050
0.070	0.080
0.100	0.093
0.200	0.097
0.300	0.100
1.000	0.100

General Notes

- The curves were developed from the Townsend curves in the Sewer Design Guidelines (even though that had a gutter) and a manning's calculation of road geometry to convert to a depth-flow curve
- The curves are **depth**-flow curves. Caution should be excercised if using these curves for the **head**-flow options in PCSWMM
- All curves were developed using a 2% cross slope
- The curves were simplified from a family of curves (for different road geometries and longitudinal slopes) since they were relatively consistent
- Ottawa "Standard" (rectangular grid) CB curves in a low point were generated from the Percent area difference from fish type curves found in the Sewer Design Guidelines 2012
- Fishbone was assumed to be the same as Fish Type
- Note that the curb inlet curves assume no local depression and a typical cross fall. These were derived from the Sewer Design Guidelines. Use caution with these curves and refer to original sources where necessary.
- All catch basins on a slope were assumed to have a max capture rate of 50 L/s according to Townsend's report from 1981.
- Catch basins in a low point or "sag" were assumed to have a max capture rate of 100 L/s which was calculated using the orifice equation Q=CdA*SQRT(2gh) based on the following: C=0.61, diameter of lead is 200 mm, depth from rim of CB to springline of orifice is 1.1 m, depth in major system is 0.3 m.
- The low point curves were capped at ~100 L/s because it was assumed that the orifice behaviour (unlike the orifice equation) would level out in reality.
- There are other types of CB's in the Ottawa area; These curves could be modified to fit that specific type.
- Separate curves for manhole and surcharging may also be required in PCSWMM
- Separate curves are required when modelling ICDs
- Separate curves are required for DICBs
- Separate curves are required if the ROW has gutters