MISSISSIPPI SHORES APARTMENTS, BLOCKS 207 AND 208 - SERVICING AND STORMWATER MANAGEMENT REPORT

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Prepared for:
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Mississippi Shores Apartments, Blocks 207 and 208 - Servicing and Stormwater Management Report

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1 Introduction and Background

Stantec Consulting Ltd. has been commissioned by 1384341 Ontario Ltd. to prepare the following Servicing and Stormwater Management Report for the Mississippi Shores Apartments, Blocks 207 and 208 site located in the northern property parcel within the Bodnar Lands Subdivision in the Town of Carleton Place. The site encompasses approximately 1.21 ha of land, is designated as Residential District under the Official Plan of the Town of Carleton Place, and bordered by Lake Avenue West to the north, O'Donovan Drive to the east, Phase 1 of the Bodnar Lands Subdivision to the south, and vacant lands to the west, as shown in **Figure 1-1**.

Figure 1-1: Site Location

The proposed development consists of four (4) three-storey residential apartment buildings, each will consist of twelve (12) one-bedroom units and nine (9) two-bedroom units for an overall total of forty-eight (48) one-bedroom units and thirty-six (36) two-bedroom units. RLA Architecture Inc. prepared a site plan dated April 2, 2024, attached in **Appendix B**, which defines the overall site configuration.

Servicing criteria for the proposed site was outlined in the Bodnar Lands Subdivision, Carleton Place Servicing and Stormwater Management Report prepared by Stantec in 2021, which includes hydraulic modelling and analysis of the subdivision watermain network, analysis and sizing of the sanitary network, and hydrologic/hydraulic analysis of the subdivision stormwater network. The proposed site will be constructed as part of Phase 1 of the subdivision along with the SWM Pond, as shown in **Figure 1-2** below with the proposed site highlighted in yellow.

All the servicing infrastructure required to service the proposed site within the Bodnar Lands subdivision, including the watermain, pump station, forcemain, sanitary sewers, SWM Pond, storm sewers, and utilities, has been fully constructed.

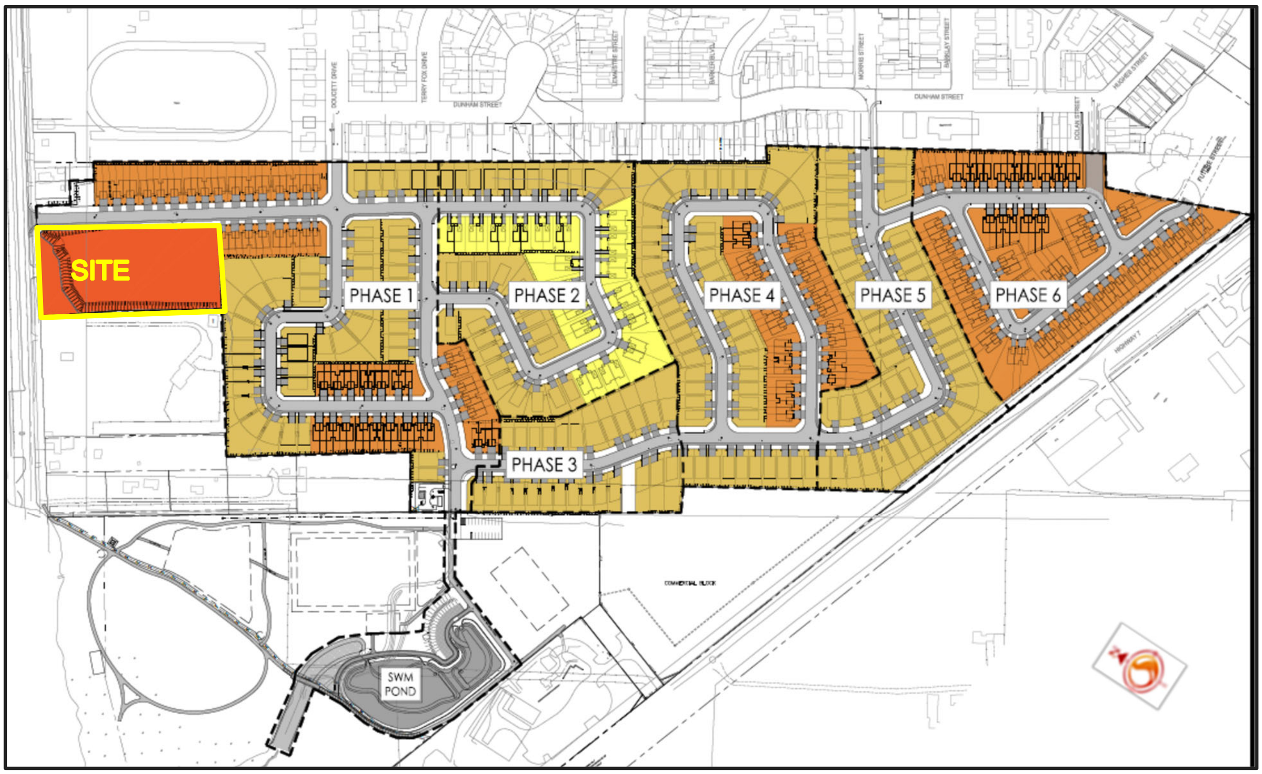


Figure 1-2: Bodnar Lands Subdivision Phasing Plan

1.1 Objective

This site servicing and stormwater management (SWM) report presents a servicing scheme that is free of conflicts, provides on-site servicing in accordance with applicable Town of Carleton Place and County of Lanark design guidelines and recommendations included in the background studies outlined in **Section 2**.

Criteria and constraints identified in the Bodnar Lands Subdivision Servicing and SWM Report have been used as a basis for the detailed servicing design of the proposed development. Specific and potential design criteria and constraints to be addressed are as follows:

- Potable Water Servicing
  - Estimated water demands to characterize the watermain network for the proposed development which will be serviced from the existing 200 mm diameter watermain within the O'Donovan Drive right of way (ROW).
  - Watermain servicing for the development is to be able to provide average day and maximum day (including peak hour) demands (i.e., non-emergency conditions) at pressures within the acceptable range of 345 to 552 kPa (50 to 80 psi).
  - Under fire flow (emergency) conditions, the water distribution system is to maintain a minimum pressure greater than 140 kPa (20 psi).
- Wastewater (Sanitary) Servicing
  - Define and size the sanitary sewer network which will connect to the existing 200 mm diameter sanitary sewers within the O'Donovan Drive ROW. The forcemain for Phase 1 of the Bodnar Lands subdivision and the sanitary pumping station have been constructed.
- Storm Sewer Servicing
  - Define major and minor conveyance systems in conjunction with the proposed grading plan.
  - Determine the stormwater management storage requirements to meet the allowable release rate for the site.
  - Define and size the proposed storm sewer network that will connect to the existing 600 mm diameter storm sewer stub, which in turn connects to the existing 750 mm diameter storm sewer within the O'Donovan Drive ROW.
  - The downstream SWM Pond, designed to provide quantity control for up to the 2-year storm event and Enhanced quality control from the Bodnar Lands subdivision, including the site, has been constructed.
- Prepare a grading plan in accordance with the proposed site plan and existing grades.

The accompanying drawings included in **Appendix F** of this report illustrate the proposed internal servicing scheme for the site.

2 Background

Documents referenced in preparing of this stormwater and servicing report for the Mississippi Shores Apartments development include:

- *City of Ottawa Sewer Design Guidelines* (SDG), City of Ottawa, October 2012, including all subsequent technical bulletins
- *Design Guidelines for Drinking Water Systems,* Ministry of the Environment, Conservation and Parks (MECP), May 2019
- *Water Supply for Public Fire Protection*, Fire Underwriters Survey (FUS), 2020
- *Fire Protection Water Supply Guideline* for Part 3 in the Ontario Building Code, Office of the Fire Marshal (OFM), October 2020
- *Bodnar Lands Subdivision Servicing and Stormwater Management Report,* Stantec Consulting Ltd., April 12, 2021
- *Preliminary Geotechnical Assessment – Bodnar Property, Carleton Place, Ontario*, Houle Chevrier Engineering, October 16, 2014
- *Supplementary Geotechnical Assessment Bodnar Property, Carleton Place, Ontario,* Gemtec Consulting Engineers and Scientists Limited, October 30, 2018
- *Bodnar Subdivision, Town of Carleton Place Environmental Impact Statement – Revised,* Mancuster Environmental Planning Inc., November 10, 2017
- *Town of Carleton Place – Trunk Sanitary Sewers – Hydraulic Capacity Investigation,* J.L. Richards & Associates Limited, March 12, 2014

3 Water Servicing

3.1 Background

The proposed site is located within the Town of Carleton Place's water distribution system for the Bodnar Lands Subdivision, and it will be serviced by the existing 200 mm diameter watermain within O'Donovan Drive.

3.2 Water Demands

3.2.1 POTABLE (DOMESTIC) WATER DEMANDS

Design parameters set in the Bodnar Lands Subdivision report (Stantec Consulting Ltd., April 2021), in combination with Design Guidelines for Drinking Water Systems (Ministry of the Environment, 2019) were used to determine water demands based on projected population densities for residential areas and peaking factors and determine the typical operating pressures to be expected at the site. The site will consist of four (4) three-storey residential apartment buildings comprising of a total of forty-eight (48) one-bedroom units and thirty-six (36) two-bedroom units. The population was estimated using an occupancy of 1.4 persons per unit for one-bedroom apartments and 2.1 persons per unit for two-bedroom apartments from the MECP Water Design Guidelines. The proposed site was estimated to have a total projected population of 143 residents.

The MECP Water Design Guidelines suggest a domestic consumption rate of 270 - 450 L/cap/d. An average day (AVDY) per capita water demand of 350 L/cap/d was used as per the Bodnar Lands Subdivision report (Stantec Consulting Ltd., April 2021). Similarly, as per the Bodnar Lands Subdivision report, for maximum day (MXDY) demand, AVDY is multiplied by a factor of 2.0 and for peak hour (PKHR) demand, MXDY is multiplied by a factor of 1.5. The estimated demands are summarized in **Table 3-1** below and detailed in **Appendix A.1.**

Table 3-1: Estimated Water Demands

One-Bedroom Units	Two-Bedroom Units	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
48	36	143	0.58	1.16	1.74

3.2.2 FIRE FLOW DEMANDS

As per the Bodnar Lands Subdivision report, the "Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code" from the Office of the Fire Marshal (OFM) was reviewed to determine external hydrant flow requirements that meet Part 3 of the Ontario Building Code (OBC) requirements.

As discussed in the Bodnar Lands Subdivision report, the Town of Carleton Place does not have its own design guidelines to follow with respect to fire flow. Typically, communities without guidelines refer to the Office of the Fire Marshal (OFM) and the Fire Underwriters Survey Guideline (FUS) for fire flow requirements. However, the available flow to be provided in a subdivision within a rural community is a function of that community's fire services capabilities. Depending on the fire service capabilities, communities can be rated for minimum protection resulting in higher insurance costs or alternatively fully protected systems with lower insurance costs. As a guiding principle, we attempt to achieve higher protection when feasible however with the understanding of the limitations of distribution systems, in some cases, a lesser protection is completely acceptable for a rural community.

The OFM guideline defines the minimum water supply flow rate (fire flow) as dependent on the minimum water supply required by the building in relation to the following equation:

$$Q = KVS_{TOT} \qquad [1]$$

Where K is the water supply coefficient as determined by Table 1 of the OFM, V is the total building volume in m^3, and S_{tot} is the total spatial coefficient from property lines exposures of all sides.

It was determined that the proposed development is part of group "C" of the occupancy classifications in accordance with Table 3.1.2.1 of the Ontario Building Code. It was further assumed that the type of construction shall be "of combustible construction". Floor assemblies are fire separations but with no fire resistance roofing. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating".

Based on the assumptions mentioned, **Table 3-2** shows the calculated volume of the four buildings, each of which are estimated to have a floor area of 597.67 m^2. The height of each floor is 3.23 meters as per the architectural building sections provided by RLA Architecture.

Table 3-2: Building Volume

Floor	**Area of Floor (m^2)**	**Height of Floor (m)**	**Volume of Floor (m^3)**
1	597.67	3.23	1,930.47
2	597.67	3.23	1,930.47
3	597.67	3.23	1,930.47
		Total	5,791.42

The worst-case scenario is Building 1, for which the value for S_{TOT} of 1.36 was used due to the very close proximity of neighbouring houses and a K value of 23 was selected for care occupancy with a construction type previously mentioned (*Table 1 in OFM guidelines*). With a calculated "Q" of 181,142 L, the resulting minimum water supply flow rate of **5,400 L/min** is required (*Table 2 in OFM guidelines*) for the proposed site and must be maintained for 30 minutes (see **Appendix A.2**).

In comparison, using the FUS formula (see **Appendix A.3**), the required fire flow for the proposed site increases up to 15,000 L/min. The Bodnar Lands Subdivision report outlined that modeling results for the overall subdivision showed difficulties in achieving fire flows based on typical FUS calculations. However, when comparing to the less strict OFM value, a minimum fire flow of 9,700 L/min at 20 psi is achieved at the nodes on O'Donovan Drive adjacent to the proposed site, under all development scenarios assessed.

3.2.3 BOUNDARY CONDITIONS

Boundary conditions were obtained from the Bodnar Lands Subdivision hydraulic modeling results for Nodes 70 and 72, as detailed in the Bodnar Lands Site Servicing and SWM Report by Stantec, dated April 12, 2021, and shown in **Figure 3-1** below.

Figure 3-1: Bodnar Lands Subdivision Connecting Nodes to Site

Eight servicing scenarios were presented in the Bodnar Lands Subdivision hydraulic modeling of the watermain network based on the subdivision phasing plan. For the purpose of the proposed site hydraulic analysis, the boundary conditions for the worst-case scenario, which is Phase 6 + 4th Connection + Dolan Street without Boyd/Arthur Watermain Connection, were used as shown in **Table 3-3** below.

Table 3-3: Water Modeling Boundary Conditions

Servicing Condition	Node 70 (m)	Node 72 (m)
Phase 6 + 4th Connection + Dolan Street without Boyd/Arthur Watermain Connection		
AVDY	182.30	182.34
PKHR	180.78	180.88
MXDY+FF	171.53	172.50

As per the Bodnar Lands Site Servicing and SWM Report, under the worst-case scenario, the available fire flow in the watermain on O'Donovan Drive with a residual pressure of 20 psi is 9,700 L/min at Node 70 and reduced to 9,600 L/min at Node 72. Hydraulic modeling results from the Bodnar Lands Subdivision Servicing and SWM Report are included in **Appendix A.4**.

3.3 Proposed Watermain Servicing and Layout

The proposed development will consist of 84 apartments contained within 4 residential apartment blocks, with associated infrastructure, access roadways and parking. The site will be serviced by a looped private water distribution network of 200 mm mains fed by connections to the existing 200 mm municipal watermains within O'Donovan Street (see **Figure 3-2** and **Drawing SSP-1**).

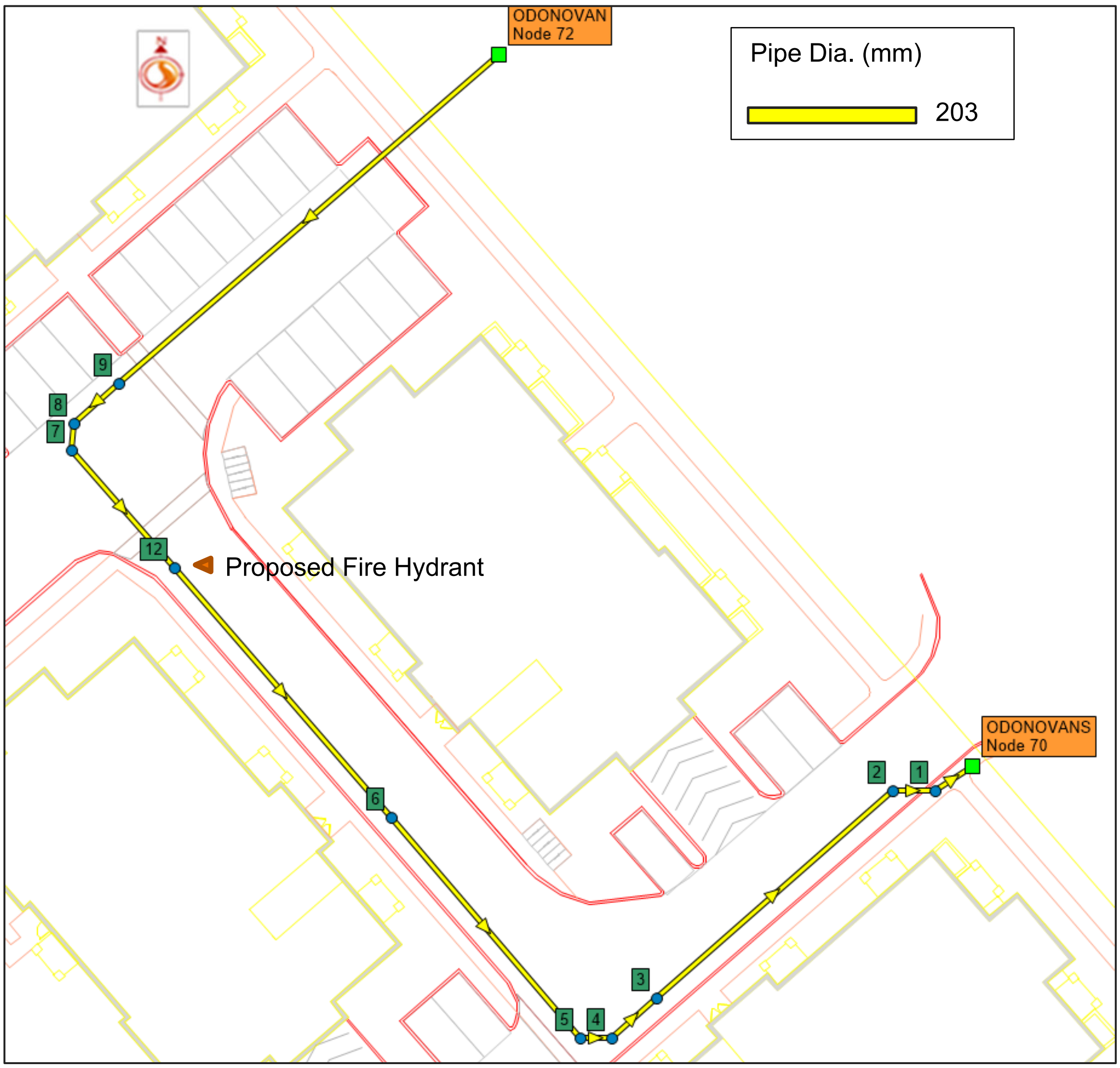


Figure 3-2: Proposed Watermain Network

The apartment buildings will have individual services, each of which will be individually metered. The underground parking garage level will be sprinklered with fire department connections located as shown on the site plan prepared by RLA Architecture. A private hydrant has been proposed on the site to ensure that the fire department connections are located so that the distance to the hydrant is not more than 45 m and is unobstructed as per section 3.2.5.16 of the Ontario Building Code.

As per the NFPA 1 Table 18.5.4.3 (and from the City of Ottawa Technical Bulletin ISTB-2018-02), a fire hydrant within 76 m from a structure can supply a flow of 5,678 L/min. Hence, the maximum required fire flow for this site (5,400 L/min) can be achieved with the proposed private hydrant.

3.4 Hydraulic Assessment

3.4.1 LEVEL OF SERVICE

Based on the Ministry of Environment (MECP) Water Design Guidelines, the desired range of pressure under basic day, maximum day and peak hour demands is 50 to 70 psi and no *less than (40 psi)* at ground elevation. Furthermore, the maximum pressure at any point in the water distribution should not exceed 100 psi; pressure reducing measures are required to service areas where pressures *greater than 80 psi* are anticipated. The objective operating range is 50 - 70 psi and should not drop below 40 psi or exceed 80 psi.

3.4.2 MODEL DEVELOPMENT

The proposed watermain within site were modeled in a H2OMAP hydraulic model to simulate the proposed water network. Hazen-Williams coefficients (“C-Factors”) were applied to the new watermain in accordance with the City of Ottawa’s Water Distribution Design Guidelines and as shown in **Table 3-4** below.

Table 3-4: Proposed Watermain C-Factors

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

3.5 Hydraulic Model Results

The H2OMAP software was used to assess the proposed potable water network under average day, peak hour, and maximum day plus fire flow conditions using the worst-case boundary conditions from the hydraulic model provided in the Bodnar Lands Site Servicing and SWM Report (see report excerpts in **Appendix A.4**).

3.5.1 AVERAGE DAY DEMAND (AVDY)

Under average day demand, hydraulic modelling shows the anticipated pressure range to be 439 kPa to 447.9 kPa (63.7 psi to 65 psi) across the proposed site for the worst-case phasing within the Bodnar Lands Subdivision as shown in **Figure 3-3** below. This is well within the serviceable limit of 276 kPa to 552 kPa (40 psi to 80 psi) as specified in the MECP Water Design Guidelines.

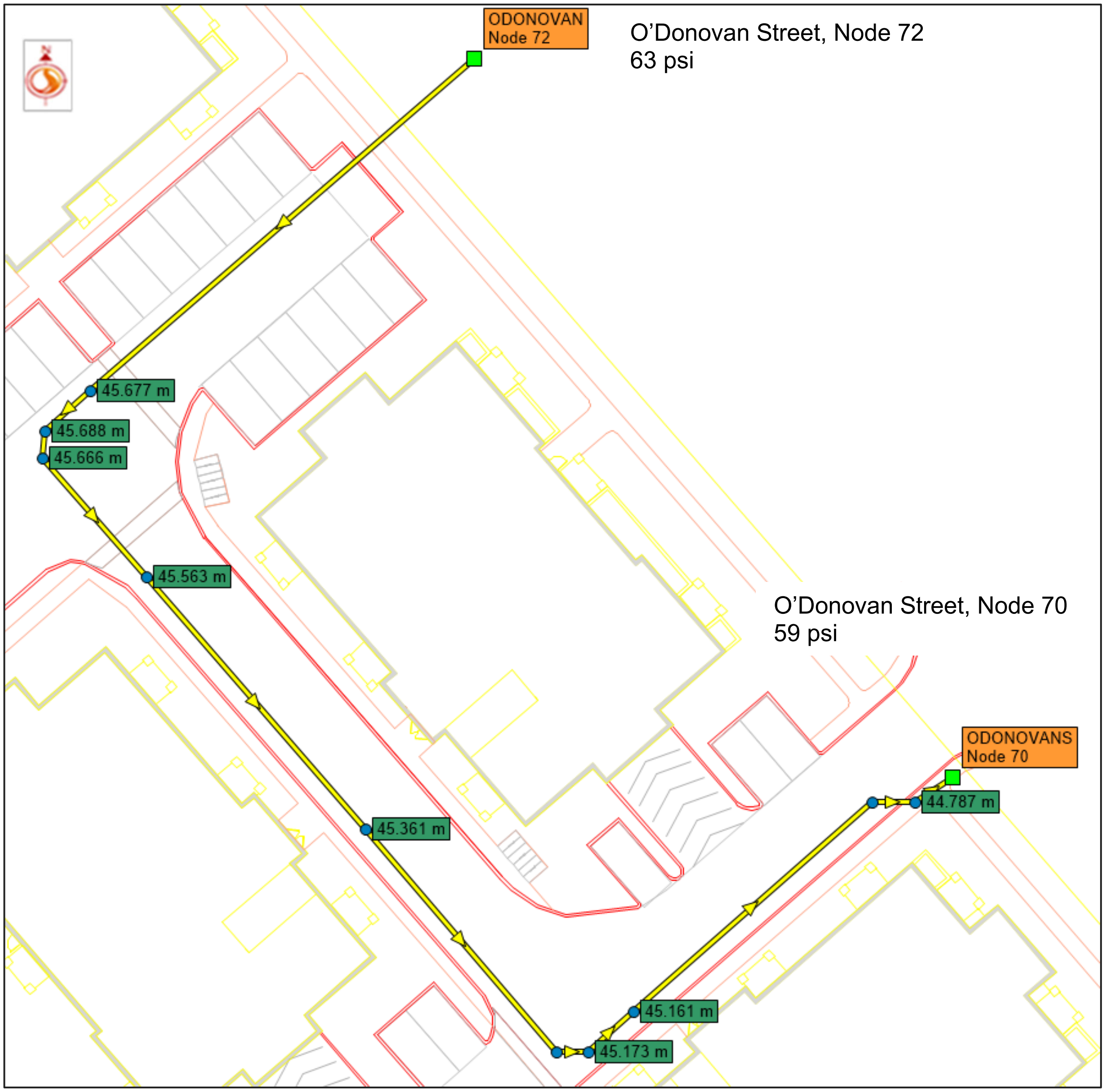


Figure 3-3: AVDY Pressure Results (metre of head)

3.5.2 PEAK HOUR DEMAND (PKHR)

Under peak hour demands, hydraulic modelling indicates that the anticipated pressures range from 424 kPa to 433 kPa (61.5 psi to 62.9 psi) across the proposed site for the worst-case phasing within the Bodnar Lands Subdivision as shown in **Figure 3-4** below. This is well within the serviceable limit of 276 kPa to 552 kPa (40 psi to 80 psi) as specified in the MECP Water Design Guidelines.

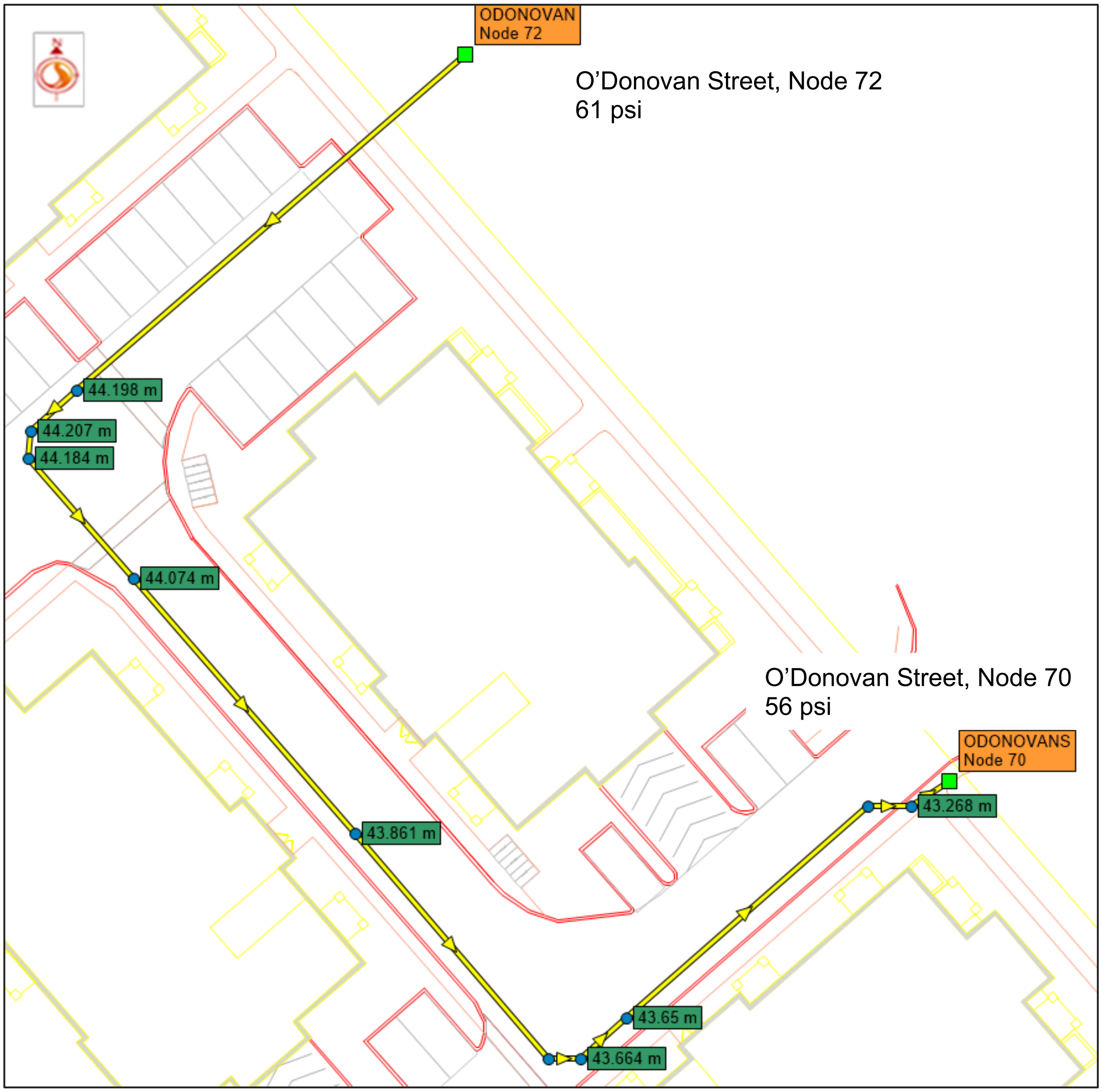


Figure 3-4: PKHR Pressure Results (metres of head)

3.5.3 MAXIMUM DAY DEMAND + FIRE FLOW (MXDY+FF)

The hydraulic modeling was also used to assess whether the proposed watermain could provide the maximum day and fire flow demand to the proposed development while maintaining a residual pressure of 138 kPa (20 psi) under the worst-case scenario, per the City of Ottawa Design Guidelines – Water Distribution. The modeling was carried out using a steady-state maximum day demand scenario along with the automated fire flow simulation feature of H2O Map.

Figure 3-5 illustrates that the proposed watermain can deliver fire flows in excess of 5,400 L/min (90 L/s), while maintaining the required residual pressure of 14.07 metres of head, equivalent to 138 kPa (20 psi).

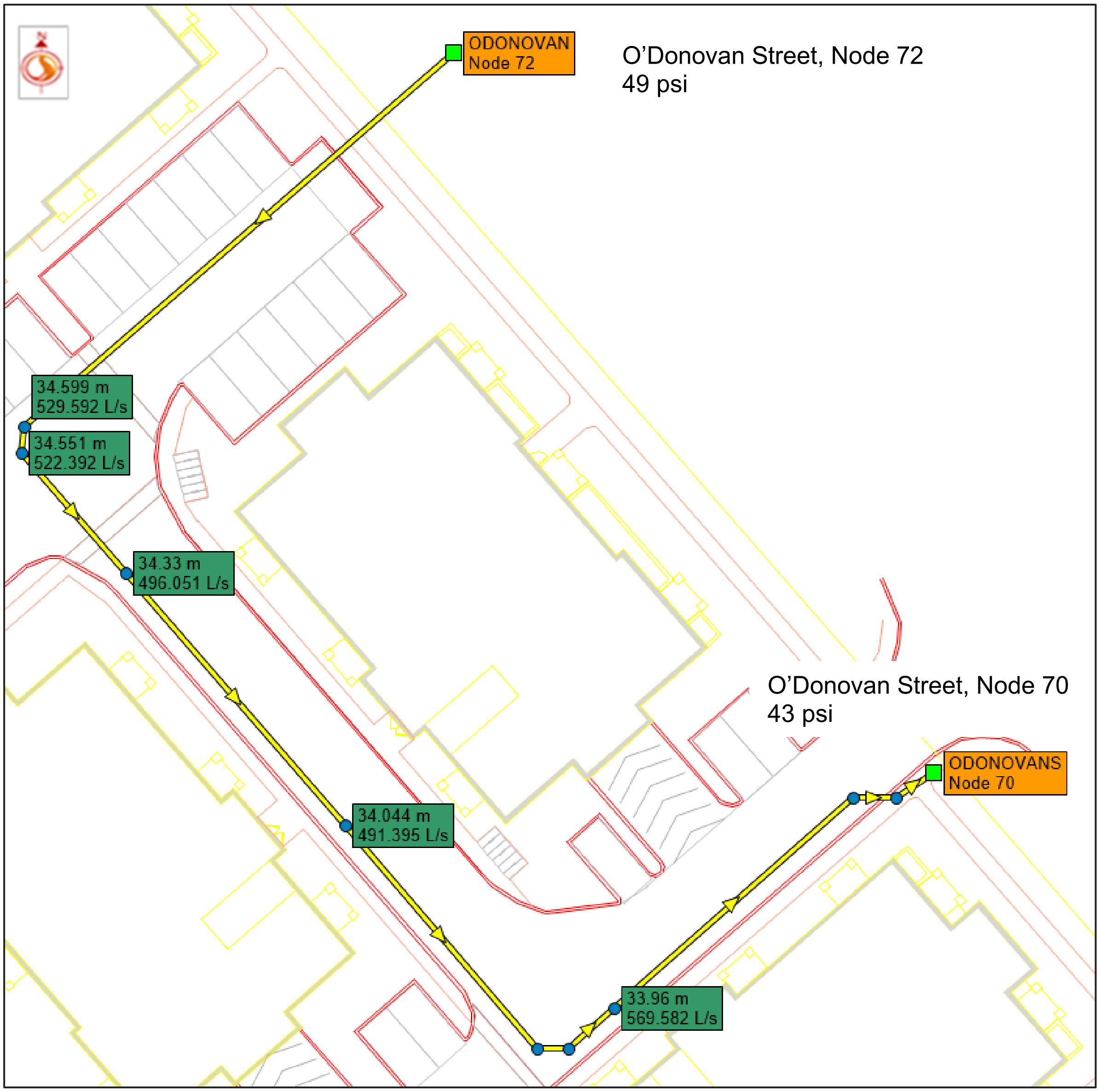


Figure 3-5: MXDY+FF Residual Pressures (metres of head) and Available Fire Flow

4 Wastewater Servicing

4.1 Background

The Mississippi Shores Apartment development is proposed within a 1.21 ha parcel block located in the Bodnar Lands Subdivision for which Stantec prepared a Servicing and Stormwater Management (SWM) Report in April 2021. The Bodnar Lands Servicing and SWM Report provides wastewater servicing design criteria for the site and estimates the sanitary peak flow contributions from the block to the sanitary pump station that services the overall subdivision. Refer to **Appendix C.2** for sanitary excerpts from the Bodnar Lands Subdivision Servicing and SWM Report (Stantec, April 2021).

The Mississippi Shores Apartments site will be serviced with a connection to the 200 mm sanitary sewer within O'Donovan Drive, as illustrated on **Drawing SA-1**. Wastewater from the site will be conveyed via a network of gravity sanitary sewers to the pump station block located near the SWM pond on Griffith Way. From the pump station, sewage peak flows are directed though a 300 mm sanitary force main to the existing 250 mm diameter sanitary sewer within Lake Avenue West.

As part of the Bodnar Lands Subdivision servicing design, Stantec estimated the subject site (referred to as Blocks 207 and 208) to be 1.21 ha in area with a projected population of 130 persons based on 72 apartment units having a population density of 1.8 person/unit, a peak factor of 4.0, and a total wastewater peak flow of 2.4 L/s using design criteria per J.L. Richards 2014 Sanitary Hydraulic Analysis for Carleton Place.

4.2 Design Criteria

As outlined in the background documents, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Velocity – 0.6 m/s
- Maximum Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Minimum size – 200 mm dia. for residential areas, 250 mm for commercial areas
- One-Bedroom Apartment Persons per unit – 1.4
- Two-Bedroom Apartment Persons per unit – 2.1
- Extraneous Flow Allowance – 0.28 L/s/ha
- Manhole Spacing – 120 m
- Minimum Cover – 2.5 m
- Average Daily Discharge / Person – 350 L/cap/day

4.3 Proposed Sanitary Servicing

The proposed 1.21 ha development will consist of four three-storey residential apartment buildings, each will consist of twelve (12) one-bedroom units and nine (9) two-bedroom units for an overall total of forty eight (48) one-bedroom units and thirty-six (36) two-bedroom units and serving a total projected population of 143 persons.

Given the proposed site configuration and grading restrictions, the residential area contributing to sanitary peak flows is approximately 1.05 ha for this site plan application, as illustrated on **Drawing SA-1**. Detailed sanitary sewage calculations are provided in the sanitary sewer design sheet included in **Appendix C.1**.

The anticipated peak wastewater flow generated from the proposed development is summarized in **Table 4-1** below.

Table 4-1: Estimated Peak Wastewater Flow

Population	Peak Factor	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Peak Flow (L/s)
143	3.56	2.1	0.3	2.4

As can be seen in the above table, the total design peak flow for the subject site to be conveyed to the connection at the O'Donovan Drive sewer is 2.4 L/s. This value is equal to the previous estimate of 2.4 L/s by Stantec based on a service area of 1.21 ha and population of 130 people.

A full port backwater valve is to be installed on the sanitary service for the proposed building to prevent any surcharge from the downstream sewer main from impacting the proposed property. A sump pump is also required in the proposed building to discharge internal sewage from the electrical room and elevator pit into the proposed sanitary sewer.

5 Stormwater Management and Servicing

The following sections describe the stormwater management (SWM) design for the Bodnar Lands Subdivision in the context of the governing criteria.

5.1 Existing Conditions

The proposed development site measures approximately 1.21 ha in area and is currently undeveloped. The topography across the site has a downward slope to the north-west. The site is bound by O'Donovan Drive to the east, rural residential lands to the west, residential lands to the south, and Lake Avenue West to the north. Existing grades are provided on the grading plan (**Drawing GP-1**).

An existing ditch along the western boundary of the proposed site within the adjacent rural residential lot conveys runoff from the western portion of the site, while the existing Lake Avenue West roadside ditch captures runoff from the northern portion of the site. Both ditches discharge into an existing 300 mm diameter corrugated steel pipe (CSP) that crosses Lake Avenue West and ultimately discharges into the Mississippi River.

5.2 Stormwater Management Design Criteria

The design methodology for the SWM component of the development is based on the Bodnar Lands Subdivision Servicing and Stormwater Management Report, (Stantec, April 12, 2021) and is summarized as follows:

- Use of the dual drainage principle.
- Provide adequate conveyance of 100-year peak flows off site.
- Size storm sewers for the 5-year runoff from the proposed site areas under free flow conditions.
- Restrict minor system peak flows up to the 100-year storm event to 329.7 L/s (see background report excerpts in **Appendix D.4**)
- Quality control for the proposed site to be provided in the existing Bodnar SWM Pond.
- Building openings should be above the 100-year water level.
- 100-year ponding depth to be restricted to 35 cm.
- Assess the resulting 100-year hydraulic grade line and ensure a minimum clearance of 0.3 m between underside of footing (USF) and 100-year HGL is maintained as much as possible. However, sump pumps and backwater valves are permitted in the Town of Carleton Place and will be provided in an as required basis.

5.3 Proposed Conditions

The proposed residential development consists of four (4) apartment buildings and is located within the Bodnar Lands Subdivision, tributary to the Bodnar SWM wet Pond, which was designed to service the entire Bodnar Lands Subdivision to provide quantity control up to the 2-year storm and to achieve 'Enhanced' level of quality control, which corresponds to 80% Total Suspended Solids (TSS) removal prior to discharging into the wetland environment within the floodplain of the Mississippi River.

The site has been designed using the “dual drainage” principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 5-year design storm and runoff from larger events is conveyed by both minor (pipe) and major (overland) channels, such as roadways and walkways, safely off site without impacting proposed or existing downstream properties. Inlet control devices (ICDs) and road sag storage will be used to restrict inflow rates to the storm sewer and to attenuate 100-year major system peak flows.

Minor system peak flows from the proposed site will be directed to an existing 600 mm diameter storm sewer stub at the site, which discharges into the existing 750 mm diameter storm sewer within O’Donovan Drive. Similarly, major system overflows from the majority of the site will be directed to O’Donovan Drive and ultimately will be routed overland to the Bodnar SWM Pond. Uncontrolled sheet flows from the grassed areas on the west and north sides of the site will be directed as per existing conditions to the adjacent ditches within Lake Avenue West and the existing rural residential lot.

Drawing SD-1 outlines the proposed storm sewer alignment and drainage divides. Emergency major system overflows will be safely conveyed to O’Donovan Drive by engineered (overland) channels such as roadways and walkways.

5.4 Modeling Rationale

A comprehensive hydrologic modeling exercise was completed with PCSWMM which is a front-end GUI to the EPA-SWMM engine. Model files can be examined in any program which can read EPA-SWMM files version 5.1.015. The model accounts for the estimated major and minor systems to evaluate the storm sewer infrastructure and major system segments in the proposed development condition. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems’ response during various storm events. The following assumptions were applied to the detailed model:

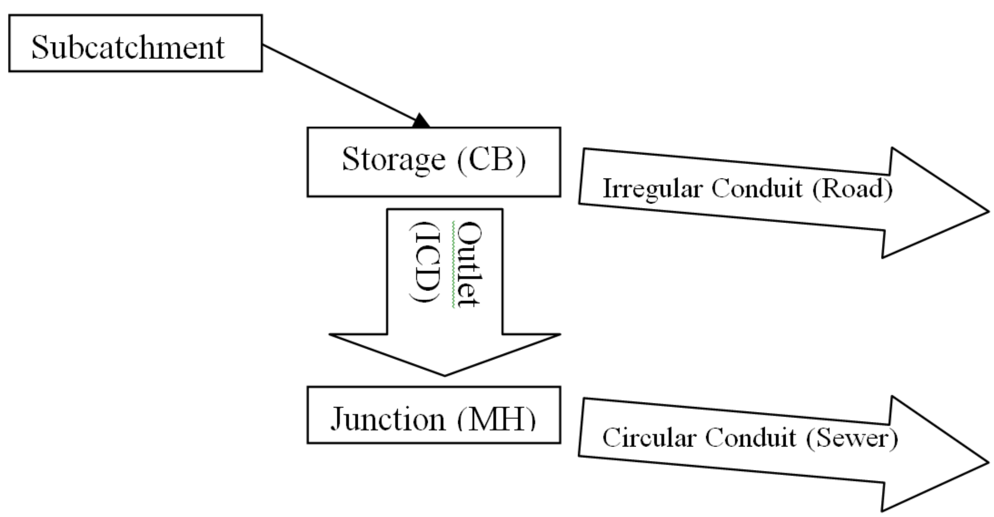
- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning’s ‘n’, and depression storage values.
- 3-hour Chicago Storm distribution for the 5-year to determine lowest inlet capture rates for the different catchments.
- Minor and major system response assessed for the 100-year using the 3-hour Chicago Storm distribution.
- To ‘stress test’ the system a ‘climate change’ scenario was created by adding 20% of the individual intensity values of the 100-year storm at their specified time step.

- Runoff Coefficient calculated based on actual soft and hard surfaces on each subarea and converted to equivalent percent imperviousness using the relationship Imp = (C – 0.2)/0.7 (see **Appendix D.2**).
- Subcatchment areas are defined from high-point to high-point where sags occur.
- Width parameter was taken as twice the length of the street/swale segment for two-sided catchments and as the length of the street/swale segment for one-sided catchments.
- Catch basin inflow restricted with inlet-control devices (ICDs).
- Surface ponding in sag storage of irregular parking areas calculated based on grading plans (**Drawing GP-1**).
- Different segment cross-section types defined, accounting for varying access widths, parking stall arrangements, and curb types.

5.4.1 SWMM DUAL DRAINAGE METHODOLOGY

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 5-1**), with: 1) circular conduits representing the sewers & storage nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the saw-toothed overland road network from high-point to low-point and storage nodes representing catch basins and high points. The dual drainage systems are connected via orifice link objects from storage node (i.e., CB) to storage node (i.e., MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node (CB) on the surface so that generated hydrographs are directed there firstly.

Figure 5-1: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catch basins as well as major system junctions. For storage nodes representing catch basins (CBs), the invert of the storage node represents the invert of the CB and the rim of the storage node represents the maximum allowable flow depth elevation above the storage node (equal to the top of the CB plus an additional 0.40 m or higher). The additional depth has been added to rim elevations to allow routing from one surface storage to the next. Storage nodes that represent catch basins at road sags, are surrounded by two transects that represent the road segments forming the sag. The storage value assigned to the storage node represents only the volume available within the structure. However, sag storage within irregular parking areas has been represented with a stage-area curve in the storage node as per **Drawing GP-1**. If the available storage volume in a storage node is exceeded, flows spill above the storage node and into the sag in the irregular conduits (representing roads), or through a weir discharging into the downstream road segment for irregular parking areas. Flow storage volumes exceeding the sag storage available in the transect (roadway) will spill at the downstream highpoint into the next sag and continue routing through the system until ultimately flows either re-enter the minor system or reach the outfall of the major system. Storage nodes representing high points are assigned an invert elevation equal to the transect invert (spill elevation at edge of pavement) and a rim elevation equal to the maximum allowable flow depth elevation above the storage node (equal to the spill elevation at edge of pavement plus an additional 0.40 m). A Storage value of 0 has been assigned to these nodes to disable linear volume calculations. No storage has been accounted for within storage nodes at high points. In this manner, storage will accumulate according to the actual ponding depths before spilling along the roadway conduit, and to the next downstream road conduit.

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

5.4.2 BOUNDARY CONDITIONS

Timeseries were generated from the Bodnar Subdivision PCSWM models to use as boundary conditions at the existing storm stub on O'Donovan Drive (STM111B in Bodnar Subdivision's April 2021 PCSWMM model). The following table summarizes the high-water level (HWL) of the timeseries used as boundary conditions for the different storm events.

Table 5-1: Boundary Conditions at STM111B

Storm Event	HGL (m)
5-year, 3hr Chicago	137.50
100-year, 3hr Chicago	137.61
100-year, 3hr Chicago+20%	137.75

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

5.4.3 HYDROLOGIC PARAMETERS

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

Key parameters for the subject area are summarized below, while an example input file is provided for the 100-year, 3hr Chicago storm which indicates all other parameters (see **Appendix D.3**). For all other input files and results of storm scenarios, please examine the electronic model files included in the digital submission. **Table 5-2** presents the general subcatchment parameters used:

Table 5-2: General Subcatchment Parameters

Subcatchment Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67
Zero Imperv (%)	25

Table 5-3 presents the individual parameters that vary for each of the proposed subcatchments.

Table 5-3: Proposed Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	Imperviousness (%)	Runoff Coefficient
C201A	0.09	59.7	2.5	60.00	0.62
C201B	0.09	24.8	2.5	85.71	0.80
C202A	0.07	50.6	3.5	88.57	0.82
C202B	0.07	45.0	3.0	84.29	0.79
C203A	0.12	33.6	2.0	77.14	0.74
C203B	0.03	21.4	2.0	67.14	0.67
C204A	0.14	41.0	1.5	52.86	0.57
C205A	0.02	17.1	1.5	77.14	0.74
C205B	0.08	17.3	1.5	72.86	0.71
F201C	0.01	6.8	14.6	100.00	0.90
F204B	0.01	6.4	14.7	100.00	0.90
F204C	0.01	7.2	14.6	100.00	0.90
F205C	0.01	7.3	11.1	100.00	0.90
UNC-1	0.25	103.3	30.0	10.00	0.27
UNC-2	0.06	12.8	2.0	10.00	0.27
UNC-3	0.16	46.4	3.0	0.00	0.20

Please note that runoff from areas UNC-1, UNC-2 and UNC-3 cannot be captured into the minor system due to grading constraints and have been modeled to sheet flow uncontrolled towards Lake Avenue West and O'Donovan Drive. Areas F201C, F202C, F202D, and F203C represent the underground parking garage ramps that will be connected to the buildings' internal plumbing system and discharged uncontrolled (up to the 100-year storm) to the site storm system.

Table 5-4 summarizes the storage node parameters used in the model.

Table 5-4: Storage Node Parameters

Storage Node	Invert Elev. (m)	Rim Elev. (m)	Depth (m)
200A-H	140.84	141.24	0.40
200B-H	140.84	141.24	0.40
201A-H	140.99	141.39	0.40
201B-H	140.99	141.39	0.40
202A-H	141.00	141.40	0.40
202B-H	141.05	141.45	0.40
C201A-S	139.36	141.14	1.78
C201B-S	139.36	141.14	1.78
C202A-S	139.49	141.27	1.78
C202B-S	139.49	141.27	1.78
C203A-S	139.47	141.25	1.78
C203B-S	139.47	141.25	1.78
C204A-S	139.45	141.23	1.78
C205A-S	139.57	141.35	1.78
C205B-S	139.57	141.35	1.78

* Rim elevations shown above are 0.4m above the proposed grade elevation

5.4.4 HYDRAULIC PARAMETERS

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

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

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

Table 5-5: Orifice Parameters for Proposed Catchments

Orifice Name	CB ID	Tributary Area ID	Minor System Node	ICD Type	Inlet Elev. (m)	Discharge Coeff.
C201A-IC	C201A-S	C201A	201	CIRCULAR (94mm ORIFICE)	139.36	0.61
C201B-IC	C201B-S	C201B	201	CIRCULAR (102mm ORIFICE)	139.36	0.61
C202A-IC	C202A-S	C202A	202	CIRCULAR (94mm ORIFICE)	139.49	0.61
C202B-IC	C202B-S	C202B	202	CIRCULAR (94mm ORIFICE)	139.49	0.61
C203A-IC	C203A-S	C203A	203	CIRCULAR (127mm ORIFICE)	139.47	0.61

Orifice Name	CB ID	Tributary Area ID	Minor System Node	ICD Type	Inlet Elev. (m)	Discharge Coeff.
C203B-IC	C203B-S	C203B	203	CIRCULAR (83mm ORIFICE)	139.47	0.61
C204A-IC	C204A-S	C204A	204	CIRCULAR (102mm ORIFICE)	139.45	0.61
C205A-IC	C205A-S	C205A	205	CIRCULAR (83mm ORIFICE)	139.57	0.61
C205B-IC	C205B-S	C205B	205	CIRCULAR (94mm ORIFICE)	139.57	0.61

5.5 Model Results and Discussion

The following section summarizes the key hydrologic and hydraulic model results for the proposed development. For detailed model results or inputs please refer to the example input file in **Appendix D.3** and the electronic model files included in the digital submission.

5.5.1 PROPOSED ICD SCHEDULE

Table 5-6 summarizes the orifice link maximum flow rates and heads across the proposed development.

Table 5-6: Proposed Orifice Link Results

Orifice Name	Tributary Area ID	ICD Type	5yr Head (m)	5yr Flow (L/s)	100yr Head (m)	100yr Flow (L/s)
C201A-IC	C201A	CIRCULAR (94mm ORIFICE)	1.00	18.33	1.52	22.77
C201B-IC	C201B	CIRCULAR (102mm ORIFICE)	1.20	23.71	1.53	26.85
C202A-IC	C202A	CIRCULAR (94mm ORIFICE)	1.10	19.24	1.51	22.68
C202B-IC	C202B	CIRCULAR (94mm ORIFICE)	0.94	17.77	1.49	22.55
C203A-IC	C203A	CIRCULAR (127mm ORIFICE)	0.82	29.76	1.52	41.27
C203B-IC	C203B	CIRCULAR (83mm ORIFICE)	0.29	7.26	0.98	14.14
C204A-IC	C204A	CIRCULAR (102mm ORIFICE)	1.11	22.74	1.54	26.96
C205A-IC	C205A	CIRCULAR (83mm ORIFICE)	0.17	5.19	0.48	9.64
C205B-IC	C205B	CIRCULAR (94mm ORIFICE)	1.01	18.42	1.48	22.42

Table 5-7 summarizes the trench drain maximum flow rates across the proposed development.

Table 5-7: Proposed Trench Drain Results

Building	Tributary Area ID	5yr Flow (L/s)	100yr Flow (L/s)
BLDG1	F201C	1.88	3.23
BLDG2	F202C	1.78	3.05
BLDG3	F202D	1.67	2.85
BLDG4	F203C	2.33	4.00

5.5.2 HYDRAULIC GRADE LINE ANALYSIS

The 100-year hydraulic grade line (HGL) elevation across the proposed development was estimated using timeseries from the Bodnar Lands Subdivision PCSWMM model in STM111B within O'Donovan Drive as boundary conditions. The 'climate change' scenario required by the City of Ottawa Sewer Design Guidelines (2012), where 100-year intensities are increased by 20% was also assessed. The storm sewer design sheet is included in **Appendix D.1**.

Table 5-8 below presents the clearance between the proposed storm sewer HGL and the proposed lowest under side of footings (USFs). The electrical room and elevator pit USFs are noted in the table below as they are the lowest areas of the building, however, it should be noted that most of the building is significantly higher.

Table 5-8: Proposed Development Hydraulic Grade Line Results

Manhole ID	USF Elevation	Worst Case 100-year HGL (m)	Prop. USF – HGL Clearance	100-Year 3-hour Chicago +20%	Prop. USF – HGL Clearance
200	N/A	137.61	-	137.76	-
201	138.00	137.67	0.33	137.81	0.19
202	137.93	137.91	0.02	137.93	0.00
203	138.07	138.04	0.03	138.06	0.01
204	N/A	137.76	-	137.82	-
205	N/A	137.97	-	137.99	-

Although a gravity connection is provided from each building for the foundation drains, full port backwater valves will be required on the storm services since there is insufficient clearance between the 100-year HGL and the electrical room underside of footings (USFs).

5.5.3 OVERLAND FLOW

The SWM design for the Bodnar Subdivision assumed that major system peak flows from the proposed site would discharge uncontrolled to O'Donovan Drive (i.e., no on-site storage requirements) and would be routed overland to ultimately discharge into the Bodnar SWM Pond. **Drawing SD-1** shows the proposed emergency overland flow route.

Table 5-9 presents the total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of the proposed street catchbasins for the 5-year and 100-year 3-hr Chicago storm, and the 'climate change' storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed 0.35 m during the 100-year event.

Table 5-9: Proposed Development – Maximum Static and Dynamic Surface Water Depths

Storage node ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	Max. 5 yr HGL (m)	Total Surface Ponding Depth (m)	Max. 100 yr HGL (m)	Total Surface Ponding Depth (m)	Max. 100 yr + 20% HGL (m)	Total Surface Ponding Depth (m)
C201A-S	140.74	141.05	140.36	0.00	140.88	0.14	140.91	0.17
C201B-S	140.74	141.15	140.56	0.00	140.89	0.15	140.90	0.16
C202A-S	140.87	141.15	140.59	0.00	141.00	0.13	141.02	0.15
C202B-S	140.87	141.15	140.43	0.00	140.98	0.11	141.02	0.15
C203A-S	140.85	141.30	140.29	0.00	140.99	0.14	141.04	0.19
C203B-S	140.85	141.15	139.76	0.00	140.45	0.00	140.91	0.06
C204A-S	140.83	141.14	140.56	0.00	140.99	0.16	141.03	0.20
C205A-S	140.95	141.20	139.74	0.00	140.05	0.00	140.40	0.00
C205B-S	140.95	141.20	140.58	0.00	141.05	0.10	141.07	0.12

As can be seen in the above table, 5-year ponding has been kept to a minimum across the proposed site and total 100-year flow depths are well below 35 cm.

5.5.4 OVERALL RELEASE RATES

The overall minor system release rates from the proposed development to the existing storm sewer on O'Donovan Drive as obtained from the Bodnar Lands April 2021 PCSWMM model are 321.9 L/s in the 5-year storm, 329.7 L/s in the 100-year storm, and 332.5 L/s in the 100-yr + 20% storm. Similarly, the overall major system release rates to O'Donovan Drive from the Bodnar Lands April 2021 PCSWMM model are 0.9 L/s in the 5-year storm, 251.5 L/s in the 100-year storm, and 379.4 L/s in the 100-yr + 20% storm.

The allowable release rates to Lake Avenue were calculated based on the difference between the existing peak flows and post development peak flows to Lake Avenue West from the Bodnar Lands Subdivision. **Table 5-10** summarizes the overall site allowable release rates and the proposed development discharges.

Table 5-10: Proposed Development – Peak Outflows

Location	Storm Event		
	5-Year 3hr Chicago (L/s)	100-Year 3hr Chicago (L/s)	100-Year, 3hr Chicago +20% (L/s)
Proposed Minor System Release Rate	170.2	221.2	231.2
Allowable Minor System Release Rate	**321.9**	**329.7**	**332.5**

Location	Storm Event		
	5-Year 3hr Chicago (L/s)	100-Year 3hr Chicago (L/s)	100-Year, 3hr Chicago +20% (L/s)
Proposed Major Flow to O’Donovan (OF-1)	0.0	15.9	29.5
Proposed Major Flow to O’Donovan (OF-2)	0.0	9.1	33.8
Proposed Major Flow to O’Donovan (OF-4)	3.0	11.0	16.1
Total Major Flow to O'Donovan	3.0	36.0	79.4
Allowable Major Flow to O'Donovan	**0.9**	**251.5**	**379.4**
Proposed Sheet Flow to Lake Avenue (OF-3)	39.4	133.4	178.4
Allowable Release Rate to Lake Avenue	**122.0**	**452.0**	**452.0**

*Allowable release rates taken from Bodnar Lands Subdivision, Carleton Place - Servicing and Stormwater Management Report prepared by Stantec dated April 12, 2021 and associated PCSWMM models

As can be seen in the above table, the allowable release rates for both the major and minor system have been met for every design storm event with the exception of the 5-year major flow to O’Donovan Drive. Given that the increase is very minor and only in the 5-year event, no negative downstream impacts are anticipated.

6 Grading and Drainage

The site measures approximately 1.21 ha in area and consists of grassed and treed areas. As detailed in the Bodnar Lands Subdivision Servicing and SWM Report, the topography across the site, like the subdivision, generally slopes from a southeast to the northwest direction, towards the Mississippi River at the northern boundary. A detailed grading plan (see **Drawing GP-1** in **Appendix F**) has been provided to satisfy the stormwater management requirements, as detailed in **Section 5**, adhere to any grade raise restrictions for the site, and provide for minimum cover requirements for storm and sanitary sewers where possible. Site grading has been established to provide emergency overland flow routes required for stormwater management.

7 Utilities

As per the Bodnar Lands Subdivision Servicing and SWM Report, the subdivision is bound by existing commercial and residential development to the east and west, and as such, Hydro, Bell, Gas and Cable servicing for the proposed development should be readily available through existing infrastructure to the north and/or within the Bodnar Lands Subdivision. It is anticipated that the constructed utility infrastructure for Phase 1 of the Bodnar Lands subdivision will be sufficient to provide the means of distribution for the proposed site. Exact size, location and routing of utilities, along with determination of any off-site works required for development will be finalized after design circulation.

8 Erosion Control During Construction

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in the contract documents.

1. Until the local storm sewer and SWM pond are constructed, groundwater in trenches will be pumped into a filter mechanism prior to release to the environment. After construction of the SWM facility, any construction dewatering will be routed to the nearest storm sewer.
2. Seepage barriers to be constructed in any temporary drainage ditches.
3. Install silt barriers/fencing around the perimeter of the site as indicated in **Drawing EC-1** in **Appendix F** to prevent the migration of sediment offsite.
4. Limit extent of exposed soils at any given time.
5. Re-vegetate exposed areas as soon as possible.
6. Minimize the area to be cleared and grubbed.
7. Protect exposed slopes with plastic or synthetic mulches.
8. Provide sediment traps and basins during dewatering.
9. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
10. Plan construction at proper time to avoid flooding.

The RVCA has been consulted to identify any additional erosion and sediment controls that may be required to protect Stillwater Creek during construction.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

11. Verification that water is not flowing under silt barriers.
12. Clean and change silt traps at catch basins.

Refer to **Drawing EC-1** in **Appendix F** for the proposed location of silt fences, sediment traps, and other erosion control measures.

9 Geotechnical Investigation

A preliminary geotechnical investigation was completed by Houle Chevrier Engineering Ltd. in March 2014, followed by a supplementary geotechnical investigation by Gemtec Consulting Engineers and Scientists Limited (GEMTEC) in October 2018, as part of the Bodnar Lands subdivision report.

The preliminary investigation by Houle Chevrier identified the soil stratigraphy as consisting of a topsoil layer, followed by a silty sand and/or a sandy silt overlaying a grey-brown glacial till. No groundwater seepage was observed during the investigation, and the geological mapping of the area suggests that bedrock was anticipated at around 1.9 m below ground level (BGL). The preliminary investigation did not identify any grade raise restrictions for the subdivision.

The supplementary geotechnical investigation by GEMTEC was carried out to provide subsurface information in the area of the SWM Pond and the pump station, and to determine the hydraulic conductivity of the native soil. It is observed that the site may have limited infiltration due to low permeability soils, perched groundwater above the bedrock or increased groundwater levels in the bedrock. Based on the soil texture classification from the hand auger and test pit samples, the infiltration rates range from 0.5 to 25.9 mm/hour.

The preliminary geotechnical investigation identified the required pavement structure for the local roadways, as outlined in **Table 9-1** below.

Table 9-1: Pavement Structure

Thickness (mm)	Material Description
40	Superpave 12.5
40	Superpave 19.0 AC
150	OPSS Granular ‘A’ base
400	OPSS Granular ‘B’ Type II

Please refer to **Appendix E f**or the Bodnar Lands subdivision geotechnical investigation.

10 Approvals and Permits

The proposed development lies on a private site under singular ownership, drains to an approved storm sewer outlet and is not intended to service industrial land uses. As a result, the site is exempt from the Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Application (ECA) process under O.Reg. 525/98.

For ground or surface water volumes pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register to the Environmental Activity and Sector Registry (EASR). It is possible that groundwater may be encountered during the foundation excavation on this site. A minimum of two to four weeks should be allotted for completion of the EASR registration and the preparation of the Water Taking and Discharge Plan by a Qualified Person as stipulated under O.Reg. 63/16. An MECP Permit to Take Water (PTTW), which is required for dewatering volumes exceeding 400,000 L/day, is not anticipated for the site.

11 Conclusions

11.1 Potable Water Servicing

Based on the boundary conditions provided by the hydraulic modelling from the Bodnar Lands Subdivision Servicing and SWM report, the subdivision's water distribution system can provide adequate flow and pressure to service the development. Pressure across the distribution system meets the pressure range as per the MECP Water Design guidelines under typical demand conditions (Average Day and Peak Hour).

The results also indicate that sufficient fire flows are available within the proposed watermain network under emergency fire demand conditions (maximum day + fire flow) while meeting the minimum requirements as per the MECP Water Design guidelines.

11.2 Wastewater Servicing

The site will be serviced by a network of gravity sanitary sewers which will direct wastewater flows to the constructed 200 mm diameter sanitary sewer within O'Donovan Drive. The sanitary sewers constructed for Phase 1 of the Bodnar Lands Subdivision has sufficient capacity to receive the design flows. Design guidelines for slope and velocity have been met within the proposed sewers.

11.3 Stormwater Management and Servicing

The proposed stormwater management plan as shown follows the requirements set in the Bodnar Lands Subdivision Servicing and Stormwater Management Report. The proposed catchbasins will be equipped with ICDs to limit the minor system capture rate to the 5-year runoff from site areas and meet allowable release rate up to the 100-year storm. The storm service laterals for the proposed buildings will be equipped with full port backwater valves. Quality control will be provided by the downstream SWM wet pond to achieve an "Enhanced" level of treatment equivalent to 80% TSS removal. The proposed site design will maintain an emergency overland flow route to O'Donovan Drive and ultimately to the Bodnar Subdivision SWM Pond.

Low Impact Design Stormwater measures were assessed at the draft plan of subdivision stage and were provided across the different phases of the subdivision where feasible. However, no LIDs were anticipated for the proposed private residential block.

11.4 Grading

The proposed grading plan accounts for the required overland flow conveyance identified in the stormwater management plan, acceptable cover over sanitary and storm sewers, and for grade raise restrictions identified in the geotechnical investigations by Houle Chevrier Engineering and by Gemtec Consulting Engineers and Sciences Limited.

11.5 Utilities

Utility infrastructure has been constructed within the general area of the subject site as part of Phase 1 of the Bodnar Lands subdivision. It is anticipated that the constructed infrastructure is adequate to provide a means of distribution for the proposed site. Exact size, location and routing of utilities will be finalized once detailed design has been finalized.

11.6 Approvals and Permits

This site is exempt from the Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Application (ECA) process under O.Reg. 525/98. For the expected dewatering needs of 50,000 to 400,000 L/day, the proponent will need to register on the MECP's Environmental Activity and Sector Registry (EASR). A Permit to Take Water, for dewatering needs in excess of 400,000 L/day, is not anticipated for this site.

APPENDICES

Appendix A Potable Water

A.1 Domestic Water Demands

Domestic Water Demand Estimates - Mississippi Shores Aprtments
Site Plan provided by RLA Architecture on April 2, 2024
Project No. 160401796

Population densities as per MECP Guidelines:		
One-bedroom	1.4	ppu
Two-bedroom	2.1	ppu

Stantec

Building ID	No. of Units[2]		Population	Daily Rate of Demand (L/cap/day)	Avg Day Demand		Max Day Demand[1]		Peak Hour Demand[1]	
	One-bedroom	Two-bedroom			(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
1	12	9	36	350	8.7	0.14	17.4	0.29	26.0	0.43
2	12	9	36	350	8.7	0.14	17.4	0.29	26.0	0.43
3	12	9	36	350	8.7	0.14	17.4	0.29	26.0	0.43
4	12	9	36	350	8.7	0.14	17.4	0.29	26.0	0.43
Total Site :	**48**	**36**	**143**	**-**	**34.7**	**0.58**	**69.4**	**1.16**	**104.1**	**1.74**

Notes:
1 Water demand criteria used to estimate peak demand ratesfrom MECP Water Design Guidelines are as follows:
maximum day demand rate = 2 x average day demand rate
peak hour demand rate = 1.5 x maximum day demand rate
2 Number of apartment units counted as per **RLA Architecture "Typ. Floor" plan dated February 6, 2024**

A.2 Fire Flow Demands (OBC)

Fire Flow Calculations as per Ontario Building Code 2006 (Appendix A)

Job#	160401796	Building 1	Designed by:	MW
Date	3-Jul-23		Checked by:	
			Description:	3-storey with basement

$$Q = KVS_{tot}$$

Q = Volume of water required (L)

V = Total building volume (m3)

K = Water supply coefficient from Table 1

S_{tot} = Sotal of spatial coefficeint values from property line exposures on all sides as obtained from the formula

$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$

1	Type of construction	Building Classification		Water Supply Coefficient
	combustible without Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		23
2	Area of one floor (m^2)	number of floors	height of ceiling (m)	Total Building Volume (m^3)
	597.67	3	3.23	5,791
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	6.4	0.36	1.36
	East	12.1	0	
	South	34.7	0	
	West	18.5	0	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				181,142
				Minimum Required Fire Flow (L/min)
				5,400

Fire Flow Calculations as per Ontario Building Code 2006 (Appendix A)

Job#	160401796	Building 2	Designed by:	MW
Date	3-Jul-23		Checked by:	
			Description:	3-storey with basement

$Q = KVS_{tot}$

Q = Volume of water required (L)

V = Total building volume (m3)

K = Water supply coefficient from Table 1

S_{tot} = Sotal of spatial coefficeint values from property line exposures on all sides as obtained from the formula

$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$

1	Type of construction	Building Classification		Water Supply Coefficient
	combustible without Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		23
2	Area of one floor (m^2)	number of floors	height of ceiling (m)	Total Building Volume (m^3)
	597.67	3	3.23	5,791
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	8.2	0.18	1.18
	East	18.5	0	
	South	11.9	0	
	West	24.6	0	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				157,168
				Minimum Required Fire Flow (L/min)
				4,500

Fire Flow Calculations as per Ontario Building Code 2006 (Appendix A)

Job#	160401796	Building 3	Designed by:	MW
Date	3-Jul-23		Checked by:	
			Description:	3-storey with basement

$Q = KVS_{tot}$

Q = Volume of water required (L)
V = Total building volume (m3)
K = Water supply coefficient from Table 1
S_{tot} = Sotal of spatial coefficeint values from property line exposures on all sides as obtained from the formula
$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$

1	Type of construction	Building Classification		Water Supply Coefficient
	combustible without Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		23
2	Area of one floor (m^2)	number of floors	height of ceiling (m)	Total Building Volume (m^3)
	597.67	3	3.23	5,791
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	11.9	0	1
	East	22	0	
	South	12.8	0	
	West	28.6	0	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				133,193
				Minimum Required Fire Flow (L/min)
				3,600

Fire Flow Calculations as per Ontario Building Code 2006 (Appendix A)

Job#	160401796	Building 4	Designed by:	MW
Date	3-Jul-23		Checked by:	
			Description:	3-storey with basement

$Q = KVS_{tot}$

Q = Volume of water required (L)
V = Total building volume (m3)
K = Water supply coefficient from Table 1
S_{tot} = Sotal of spatial coefficeint values from property line exposures on all sides as obtained from the formula
$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$

1	Type of construction	Building Classification		Water Supply Coefficient
	combustible without Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		23
2	Area of one floor (m^2)	number of floors	height of ceiling (m)	Total Building Volume (m^3)
	597.67	3	3.23	5,791
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	6.4	0.36	1.36
	East	24.6	0	
	South	35	0	
	West	13.3	0	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				181,142
				Minimum Required Fire Flow (L/min)
				5,400

A.3 Fire Flow Demands (FUS 2020)

Stantec

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401796
Project Name: Mississippi Shores Apartments
Date: 7/3/2023
Fire Flow Calculation #: 1
Description: 3-storey apartment building. Building 1

Notes: Site Plan Provided by RLA Architecture on June 26, 2023

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							-	-
		598	598	598					1793	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min							-	14000
4	Determine Occupancy Charge	Limited Combustible							-15%	11900
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	18.6	2	21-49	Type V	NO	0%	3213
		East	10.1 to 20	33.1	2	61-80	Type V	NO	13%	
		South	> 30	18.6	1	0-20	Type V	NO	0%	
		West	10.1 to 20	33.1	3	81-100	Type V	NO	14%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min								15000
		Total Required Fire Flow in L/s								250.0
		Required Duration of Fire Flow (hrs)								3.00
		Required Volume of Fire Flow (m^3)								2700

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401796
Project Name: Mississippi Shores Apartments
Date: 3/16/2023
Fire Flow Calculation #: 2
Description: 3-storey apartment building. Building 2

Notes: Site Plan Provided by RLA Architecture on June 26, 2023

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										-	-
		598	598	598								1793	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	14000
4	Determine Occupancy Charge	Limited Combustible										-15%	11900
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	33.1	2	61-80	Type V	NO				0%	3570
		East	10.1 to 20	18.6	3	41-60	Type V	NO				12%	
		South	10.1 to 20	33.1	3	81-100	Type V	NO				14%	
		West	20.1 to 30	18.6	3	41-60	Type V	NO				4%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											15000
		Total Required Fire Flow in L/s											250.0
		Required Duration of Fire Flow (hrs)											3.00
		Required Volume of Fire Flow (m^3)											2700

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec

Stantec Project #: 160401796
Project Name: Mississippi Shores Apartments
Date: 3/16/2023
Fire Flow Calculation #: 3
Description: 3-storey apartment building. Building 3

Notes: Site Plan Provided by RLA Architecture on June 26, 2023

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										-	-
		598	598	598								1793	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min										-	14000
4	Determine Occupancy Charge	Limited Combustible										-15%	11900
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	33.1	3	81-100	Type V	NO				14%	2618
		East	20.1 to 30	18.6	3	41-60	Type V	NO				4%	
		South	> 30	33.1	2	61-80	Type V	NO				0%	
		West	20.1 to 30	18.6	3	41-60	Type V	NO				4%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											15000
		Total Required Fire Flow in L/s											250.0
		Required Duration of Fire Flow (hrs)											3.00
		Required Volume of Fire Flow (m^3)											2700

Stantec

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401796
Project Name: Mississippi Shores Apartments
Date: 3/16/2023
Fire Flow Calculation #: 4
Description: 3-storey apartment building. Building 4

Notes: Site Plan Provided by RLA Architecture on June 26, 2023

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										-	-
		598	598	598								1793	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min										-	14000
4	Determine Occupancy Charge	Limited Combustible										-15%	11900
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	18.6	2	21-49	Type V		NO			0%	952
		East	20.1 to 30	33.1	3	81-100	Type V		NO			8%	
		South	> 30	18.6	1	0-20	Type V		NO			0%	
		West	> 30	33.1	0	0-20	Type V		NO			0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											13000
		Total Required Fire Flow in L/s											216.7
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1950

A.4 Excerpt from Bodnar Lands Subdivision Site Servicing and SWM Report (Stantec, April 2021) - Hydraulic Modelling Results

Bodnar Lands Subdivision, Carleton Place - Servicing and Stormwater Management Report

Job #160401129

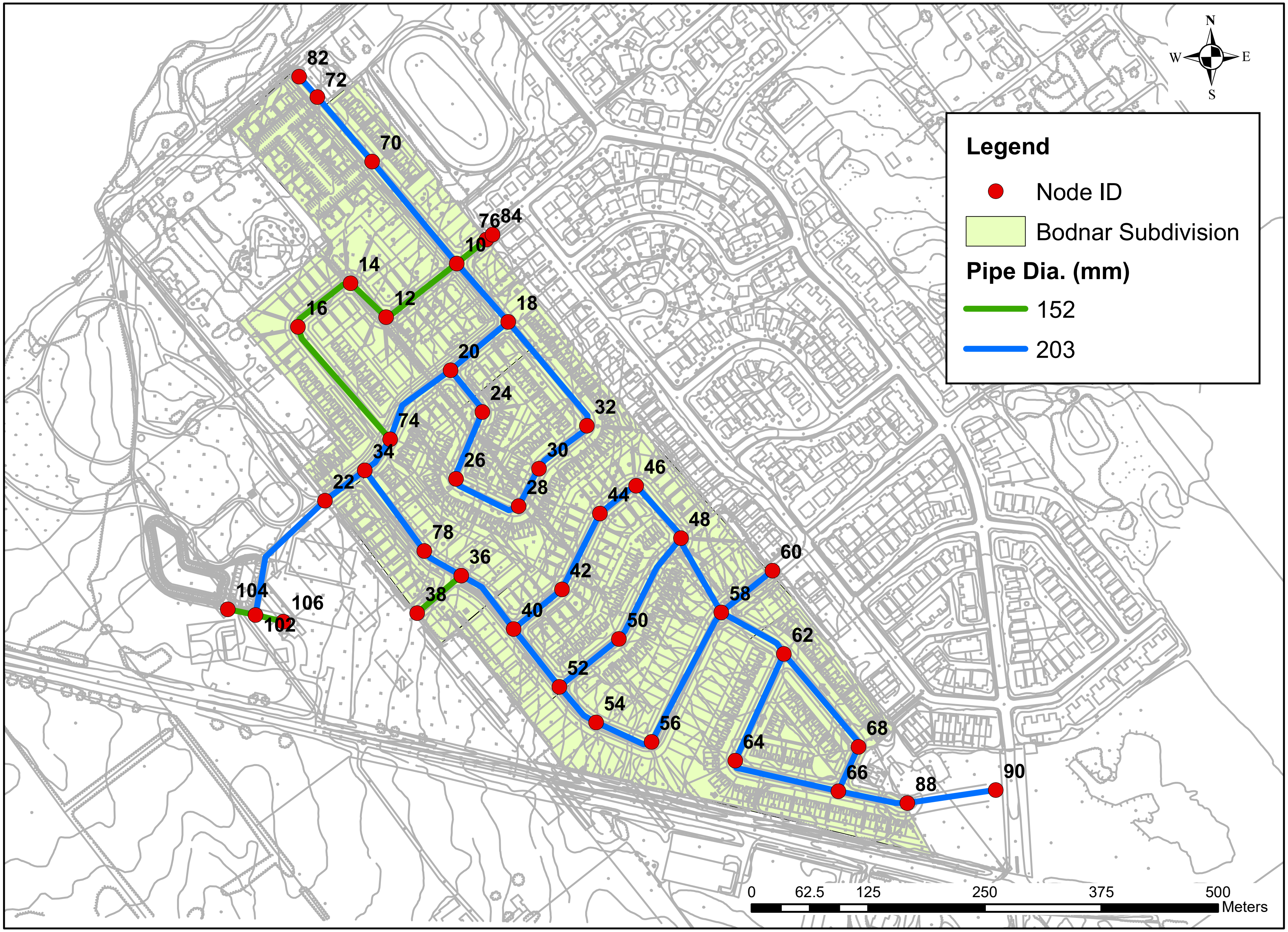
Prepared for:
1384341 Ontario Inc.

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

April 12, 2021

Revision	Description	Prepared by		Checked by
0	Site Servicing and Stormwater Management Report	Ana Paerez	November 12, 2018	Kris Kilborn
1	Site Servicing and Stormwater Management Report	Ana Paerez	February 3, 2020	Kris Kilborn
2	Site Servicing and Stormwater Management Report	Ana Paerez	August 7, 2020	Kris Kilborn
3	Site Servicing and Stormwater Management Report	Ana Paerez	December 11, 2020	Kris Kilborn
4	Site Servicing and Stormwater Management Report	Ana Paerez	April 12, 2021	Kris Kilborn

Figure A1: Model Node IDs



Phase 6 + 4th Connection + Dolan St - AVDY Demand Conditions (Without Boyd St / Arthur St Watermain Connection)

			MAX	66
			MIN	52
ID	**Demand (Lpm)**	**Elevation (m)**	**Head (m)**	**Pressure (psi)**
10	14.40	140.92	182.25	59
12	14.40	139.82	182.24	60
14	14.40	139.80	182.23	60
16	14.40	139.53	182.22	61
18	14.40	140.83	182.23	59
20	14.40	140.09	182.23	60
22	59.40	137.30	182.20	64
24	9.60	140.72	182.23	59
26	9.60	141.86	182.23	57
28	9.60	142.07	182.23	57
30	9.60	142.14	182.23	57
32	9.60	142.50	182.23	56
34	14.40	139.30	182.21	61
36	10.80	140.96	182.19	59
38	43.20	141.30	182.19	58
40	10.20	142.57	182.19	56
42	10.20	142.96	182.19	56
44	10.20	143.53	182.19	55
46	10.20	144.04	182.19	54
48	10.20	144.42	182.19	54
50	10.20	144.18	182.19	54
52	10.20	143.69	182.19	55
54	12.96	143.85	182.19	55
56	12.96	143.95	182.19	54
58	12.96	144.09	182.19	54
60	0	145.57	182.19	52
62	16.80	144.19	182.19	54
64	16.80	144.31	182.19	54
66	16.80	144.53	182.19	54
68	16.80	144.12	182.19	54
70	14.40	141.12	182.30	59
72	0	138.00	182.34	63
74	14.40	139.39	182.21	61
76	0.00	142.81	182.25	56
78	10.8	140.02	182.20	60
82	0	135.99	182.35	66
88	0	144.63	182.19	53
90	0	144.22	182.19	54

Phase 6 + 4th Connection + Dolan St - PKHR Demand Conditions (Without Boyd St / Arthur St Watermain Connection)

			MAX	64
			MIN	50

ID	Demand (Lpm)	Elevation (m)	Head (m)	Pressure (psi)
10	42.60	140.92	180.65	56
12	42.60	139.82	180.59	58
14	42.60	139.80	180.57	58
16	42.60	139.53	180.55	58
18	42.60	140.83	180.58	57
20	42.60	140.09	180.56	58
22	178.80	137.30	180.50	61
24	29.40	140.72	180.56	57
26	29.40	141.86	180.56	55
28	29.40	142.07	180.57	55
30	29.40	142.14	180.57	55
32	29.40	142.50	180.57	54
34	42.60	139.30	180.52	59
36	32.40	140.96	180.51	56
38	129.00	141.30	180.49	56
40	30.60	142.57	180.51	54
42	30.60	142.96	180.51	53
44	30.60	143.53	180.51	53
46	30.60	144.04	180.51	52
48	30.60	144.42	180.51	51
50	30.60	144.18	180.51	52
52	30.60	143.69	180.51	52
54	40.80	143.85	180.52	52
56	40.80	143.95	180.54	52
58	40.80	144.09	180.58	52
60	0	145.57	180.60	50
62	50.40	144.19	180.58	52
64	50.40	144.31	180.58	52
66	50.40	144.53	180.58	51
68	50.40	144.12	180.58	52
70	42.60	141.12	180.78	56
72	0	138.00	180.88	61
74	42.60	139.39	180.53	58
76	0	142.81	180.66	54
78	32.40	140.02	180.51	58
82	0	135.99	180.91	64
88	0	144.63	180.59	51
90	0	144.22	180.59	52

Phase 6 + 4th Connection + Dolan St - MXDY+FF (Without Boyd St / Arthur St Watermain Connection)

				MAX	10,500
				MIN	4,400
ID	**Static Demand (Lpm)**	**Static Pressure (psi)**	**Static Head (m)**	**Available Flow at Hydrant (Lpm)**	**Available Flow Pressure (psi)**
10	28.20	41	170.05	10,400	20
104	0.00	47	170.10	5,100	20
106	0.00	47	170.10	4,900	20
12	28.20	43	170.05	6,300	20
14	28.20	43	170.05	5,700	20
16	28.20	43	170.06	5,700	20
18	28.20	42	170.05	10,200	20
20	28.20	43	170.06	10,400	20
22	46.20	47	170.10	8,700	20
24	19.80	42	170.05	9,200	20
26	19.80	40	170.05	8,200	20
28	19.80	40	170.05	7,900	20
30	19.80	40	170.05	7,900	20
32	19.80	39	170.05	8,000	20
34	28.20	44	170.10	10,200	20
36	21.60	42	170.23	8,900	20
38	85.80	41	170.22	4,400	20
40	20.40	39	170.32	8,500	20
42	20.40	39	170.33	7,300	20
44	20.40	38	170.33	6,600	20
46	20.40	37	170.34	6,300	20
48	20.40	37	170.35	6,200	20
50	20.40	37	170.37	6,800	20
52	20.40	38	170.38	8,300	20
54	27	38	170.47	8,600	20
56	27.00	38	170.58	9,400	20
58	27.00	38	170.87	9,800	20
60	0.00	36	170.89	9,000	20
62	33.60	38	170.93	9,000	20
64	33.60	38	170.95	8,300	20
66	33.6	38	170.97	8,400	20
68	33.60	38	170.97	8,600	20
70	28.2	43	171.53	9,700	20
72	0.00	49	172.50	9,600	20
74	28.2	44	170.08	10,500	20
76	0	36	168.10	8,100	20
78	21.6	43	170.19	9,300	20
82	0	52	172.81	9,700	20
88	0	37	170.98	7,600	20
90	0	38	170.99	6,700	20

Dead-end locations for future park building, MVCA property, and commercial block.

A.5 Hydraulic Analysis Results

Junction Results - Basic Day (Phase 6, with 4th Connection, Dolan Street, without Boyd/Arthur WM Connection)

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
1	0.00	137.51	182.30	44.79	63.69	439.10
2	0.00	137.47	182.30	44.83	63.75	439.56
3	0.14	137.15	182.31	45.16	64.22	442.76
4	0.00	137.14	182.31	45.17	64.23	442.88
5	0.00	137.12	182.31	45.19	64.26	443.03
6	0.28	136.95	182.32	45.36	64.50	444.73
12	0.00	136.76	182.32	45.56	64.79	446.71
7	0.00	136.66	182.33	45.67	64.94	447.72
9	0.14	136.65	182.33	45.68	64.95	447.82
8	0.00	136.64	182.33	45.69	64.97	447.93

Link Results - Basic Day (Phase 6, with 4th Connection, Dolan Street, without Boyd/Arthur WM Connection)

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	1	ODONOVANS	3.52	204	110	5.38	0.16
1001	2	1	3.17	204	110	5.38	0.16
1002	3	2	23.48	204	110	5.38	0.16
1003	4	3	4.46	204	110	5.52	0.17
1004	5	4	2.36	204	110	5.52	0.17
1005	6	5	21.57	204	110	5.52	0.17
1006	7	12	13.33	204	110	5.80	0.18
1007	8	7	2.37	204	110	5.80	0.18
1008	9	8	4.45	204	110	5.80	0.18
11	ODONOVAN	9	37.59	204	110	5.94	0.18
15	12	6	24.75	204	110	5.80	0.18

Junction Results - Peak Hour (Phase 6, with 4th Connection, Dolan Street, without Boyd/Arthur WM Connection)

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
1	0.00	137.51	180.78	43.27	61.53	424.21
2	0.00	137.47	180.78	43.32	61.59	424.68
3	0.43	137.15	180.80	43.65	62.07	427.95
4	0.00	137.14	180.80	43.66	62.09	428.09
5	0.00	137.12	180.80	43.68	62.11	428.24
6	0.86	136.95	180.82	43.86	62.37	430.02
12	0.00	136.76	180.83	44.07	62.67	432.11
7	0.00	136.66	180.84	44.18	62.83	433.19
9	0.43	136.65	180.85	44.20	62.85	433.32
8	0.00	136.64	180.85	44.21	62.86	433.41

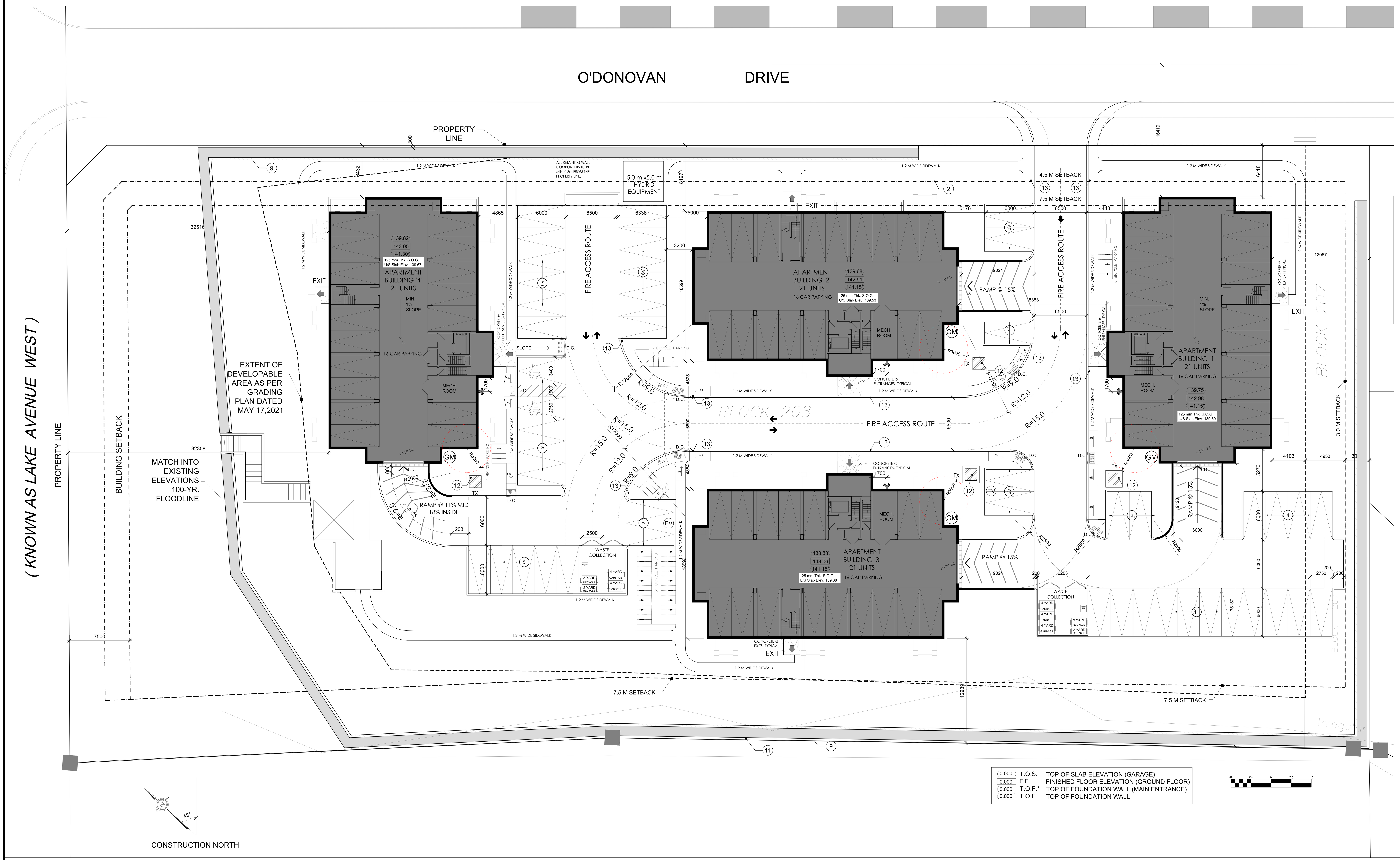
Link Results - Peak Hour (Phase 6, with 4th Connection, Dolan Street, without Boyd/Arthur WM Connection)

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	1	ODONOVANS	3.52	204	110	8.36	0.26
1001	2	1	3.17	204	110	8.36	0.26
1002	3	2	23.48	204	110	8.36	0.26
1003	4	3	4.46	204	110	8.79	0.27
1004	5	4	2.36	204	110	8.79	0.27
1005	6	5	21.57	204	110	8.79	0.27
1006	7	12	13.33	204	110	9.65	0.30
1007	8	7	2.37	204	110	9.65	0.30
1008	9	8	4.45	204	110	9.65	0.30
11	ODONOVAN	9	37.59	204	110	10.08	0.31
15	12	6	24.75	204	110	9.65	0.30

Fire Flow Results - Max Day + 5,400 L/min

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)
1	0.00	43.27	61.53	424.21	180.78	90.00	32.94	46.84537968	1363.69	20
12	0.00	44.08	62.67	432.13	180.84	90.00	34.33	48.8162301	496.05	20
2	0.00	43.32	61.59	424.68	180.78	90.00	33.93	48.25028604	1016.96	20
3	0.29	43.65	62.07	427.97	180.80	90.00	33.96	48.2901012	569.58	20
4	0.00	43.67	62.09	428.11	180.80	90.00	33.94	48.25881786	546.92	20
5	0.00	43.68	62.11	428.25	180.80	90.00	33.94	48.25881786	537.23	20
6	0.58	43.86	62.37	430.04	180.82	90.00	34.04	48.40954668	491.40	20
7	0.00	44.19	62.83	433.21	180.85	90.00	34.55	49.13048547	522.39	20
8	0.00	44.21	62.86	433.42	180.85	90.00	34.60	49.19874003	529.59	20
9	0.29	44.20	62.85	433.34	180.85	90.00	34.64	49.25988474	545.14	20

Appendix B Site Plan



IT IS THE RESPONSIBILITY OF THE APPROPRIATE CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE AND TO REPORT ALL ERRORS AND/OR OMISSIONS TO THE ARCHITECT.

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

THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION UNTIL SIGNED BY THE ARCHITECT.

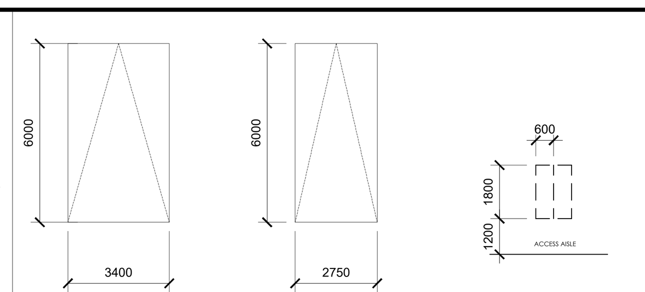
DO NOT SCALE DRAWINGS.

KEY MAP

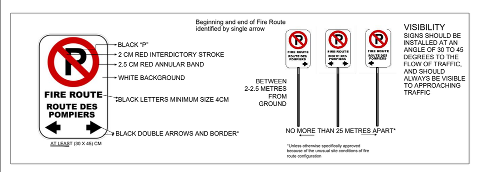
DRAWING NOTES

1. PROPERTY LINE
2. BUILDING SETBACKS
3. EXTENT OF DEVELOPABLE AREA
4. 1.2 M WIDE SIDEWALK & CURB
5. COMMUNITY MAIL BOXES AS PER CANADA POST STANDARDS
6. 1.2 M WIDE SIDEWALK & CURB
7. BICYCLE PARKING SPACE
8. GAS REGULATOR / METER EQUIPMENT AREA
9. RETAINING WALL
10. DEPRESSED CURB
11. FENCE
12. PAD MOUNTED TRANSFORMER
13. FIRE ROUTE SIGNAGE

GM GAS METER
GM EV CHARGING POINT



TYP. BARRIER-FREE CAR PARKING SPACE
TYP. CAR PARKING SPACE
TYP. BIKE PARKING SPACE



GUIDELINE FOR FIRE ROUTE SIGNAGE

SITE PLAN SYMBOLS

- CONCRETE UNIT PAVERS SURFACE ±
- TOWN SIDEWALK
- CONCRETE SURFACE
- ASPHALT WALK / DRIVEWAY
- SOFT LANDSCAPING
- RIVER STONE
- BIKE RACK
- TWO WAY VEHICLE CIRCULATION
- MAIN ENTRANCE
- APARTMENT ENTRANCE
- PROPERTY LINE
- TOWN STREET LIGHTING
- TACTILE WALKING SURFACE INDICATORS (TWSI)

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GEMTECH

LANDSCAPE ARCHITECT
Rudy Levstek

PROJECT INFORMATION

LAND USE DESIGNATION		RESIDENTIAL DISTRICT
SITE AREA		12,045.58 sq. m. (129,657.5 sq. ft.)
BLOCK - 207		596.07 sq. m.
BLOCK - 208		11,449.51 sq. m.
LOT COVERAGE (MAXIMUM)		60%
LOT FRONTAGE (MINIMUM)		35 m.
FRONT YARD SETBACK:	MIN.	4.5 m.
	MAX.	7.5 m.
EXTERIOR SIDE YARD SETBACK:	MIN.	4.5 m.
	MAX.	7.5 m.
INTERIOR SIDE YARD SETBACK:		3.0 m.
REAR YARD SETBACK:		7.5 m.
LANDSCAPE AREA 30% MINIMUM		

PROJECT STATISTICS

BUILDING HEIGHT 14.0 m
AVERAGE MEAN GRADE (GEO. ELEV.) 141.0 a.s.l.

UNIT STATISTICS

BUILDING NO.	BUILDING AREA	FLOOR AREA	NO. OF UNITS
BLOCK-1	594.72 sq. m.	1,753.24 sq m.	21
BLOCK-2	594.72 sq. m.	1,753.24 sq m.	21
BLOCK-3	594.72 sq. m.	1,753.24 sq m.	21
BLOCK-4	594.72 sq. m.	1,753.24 sq m.	21
TOTAL	2,378.88 sq. m.	7,012.96 sq. m.	84

CAR PARKING

REQUIRED BY DEVELOPMENT PERMIT BY-LAW

RESIDENTS	1.25 PER (84) D.U.	105
VISITOR	0.25 PER (84) D.U.	21
TOTAL PARKING REQUIRED		126
PROVIDED		
RESIDENCE		89
VISITOR		21
TOTAL		110 (64 UNDER GROUND) (46 SURFACE)

BICYCLE PARKING

REQUIRED		
APARTMENT BUILDING	0.5 PER (84) D.U.	42
FOR DEVELOPMENT WITH 20 OR MORE DWELLING		6
TOTAL		48
PROVIDED		
BICYCLE PARKING		50

LOT COVERAGE

ASPHALT DRIVEWAY / WALKWAY	= 3,038.59 sq. m.	27%
BUILDING FOOTPRINT 4 X Typ.18 Unit Building	= 2,378.88 sq. m.	20%
LANDSCAPE OPEN SPACE		
BLOCK-207, 208	= 6,436.73 sq. m.	53%
TOTAL	= 12,045.58 sq. m.	100%

BUILDING AREAS
(CONSTRUCTION AREA - TYP. 18 UNIT BLOCK)

BASEMENT LEVEL:	594.72 sq. m.
GROUND FLOOR LEVEL:	594.72 sq. m.
SECOND FLOOR LEVEL:	579.26 sq. m.
THIRD FLOOR LEVEL:	579.26 sq. m.
TOTAL AREA (G+2+3) TYP. 18 UNIT BLOCK):	1,753.24 sq. m.

LEGAL DESCRIPTION
PLAN OF SURVEY OF

BLOCKS 207, 208
Part of Lot 12, Concession 11
Geographic Township of Beckwith

Surveyed by Annis, O'Sullivan, Vollebekk Ltd.

PROJECT DEVELOPER
CAVANAGH DEVELOPMENTS
(1384341 Ontario Limited)

No.	DESCRIPTION	DATE
06	ISSUED FOR SPA COMMENTS	2024-04-02
05	REVISIONS FOR WASTE ENCLOSURE SIZING	2024-02-16
04	REVISIONS FOR HYDRO ONE COMMENTS	2023-12-21
03	ISSUED FOR SPA COMMENTS	2023-11-03
02	ISSUED FOR SPA COMMENTS	2023-09-13
01	ISSUED FOR SPA	2023-07-19

REVISIONS:

ARCHITECT SEAL: ONTARIO ASSOCIATION OF ARCHITECTS RODERICK I. LAHEY LICENCE 4375

NORTH ARROW: PROJECT NORTH

CLIENT: CAVANAGH DEVELOPMENTS

ARCHITECT: rla/architecture
56 Beech Street, Ottawa, Ontario K1S 3J6
t.613.724.9932 f.613.724.1209 www.rodericklahey.ca

PROJECT TITLE:
Mississippi Shores Development
Town of Carleton Place ONTARIO

SHEET TITLE:
SITE PLAN

DRAWN:	CHECKED:
RLA	X.Y.
SCALE: AS INDICATED	SHEET No. SP-01
PROJECT No. 2135	

PEN STYLE: 0_RLA Master-50%_2010.ctb
PAPER SIZE: ISO Full Bleed B1 (1000.00 X 707.00 MM)
PLOT SCALE: 1:1
F:\2021\2135 - Mississippi Shores\02 Working Drawings\01 CAD\01 Sheets\Site Plan\2135- Site Plan.dwg
PLOT DATE: Tuesday, April 02, 2024

Appendix C Sanitary Servicing

C.1 Sanitary Design Sheet

Stantec

SUBDIVISION:
Mississippi Shores Apartments

DATE: 4/15/2024
REVISION: 4
DESIGN BY: WAJ
CHECKED BY: AMP

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401796

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350	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 / 3-BEDROOM	3.1	INSTITUTIONAL	28,000	l/ha/day	MINIMUM COVER	2.50	m
PERSONS / 2-BEDROOM	2.1	INFILTRATION	0.33	l/s/Ha	HARMON CORRECTION FACTOR	0.8	
PERSONS / 1-BEDROOM	1.4						

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)	APARTMENT UNITS 3-BEDROOM	2-BEDROOM	1-BEDROOM	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)
R303A	303	302	0.38	0	9	12	36	0.38	36	3.67	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.38	0.38	0.1	0.7	8.0	200	PVC	SDR 35	0.50	23.6	**2.78%**	0.74	0.27
R302A	302	301	0.30	0	18	24	71	0.68	107	3.59	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.30	0.68	0.2	1.8	56.7	200	PVC	SDR 35	0.32	18.9	**9.42%**	0.60	0.31
R301A	301	300	0.37	0	9	12	36	1.05	143	3.56	2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.37	1.05	0.3	2.4	24.4	200	PVC	SDR 35	0.32	18.9	**12.71%**	0.60	0.34
	300	11B	0.00	0	0	0	0	1.05	143	3.56	2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.05	0.3	2.4	9.1	200	PVC	SDR 35	0.32	18.9	**12.71%**	0.60	0.34
																												200							

C.2 Excerpt from Bodnar Lands Subdivision Site Servicing and SWM Report (Stantec, April 2021) – Wastewater Criteria/Results

Bodnar Lands Subdivision, Carleton Place - Servicing and Stormwater Management Report

Job #160401129

Prepared for:
1384341 Ontario Inc.

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

April 12, 2021

Revision	Description	Prepared by		Checked by
0	Site Servicing and Stormwater Management Report	Ana Paerez	November 12, 2018	Kris Kilborn
1	Site Servicing and Stormwater Management Report	Ana Paerez	February 3, 2020	Kris Kilborn
2	Site Servicing and Stormwater Management Report	Ana Paerez	August 7, 2020	Kris Kilborn
3	Site Servicing and Stormwater Management Report	Ana Paerez	December 11, 2020	Kris Kilborn
4	Site Servicing and Stormwater Management Report	Ana Paerez	April 12, 2021	Kris Kilborn

3.3 PROPOSED SANITARY SEWER SERVICING

The proposed Bodnar Subdivision will be serviced by a network of gravity sewers which will direct wastewater flows to the proposed sanitary pump station located on Street 3. It is also proposed to provide servicing to future residential units along Lake Avenue and adjacent to the Roy Brown Park, as well as to the Mississippi Valley Conservation Authority Building (MVCA) Building, a future park building, and a future commercial property to the south, which results in a proposed trunk gravity sanitary sewer with an average installation depth of 4-5 meters for the western portion of the development. The proposed trunk sewer alignment is shown on **Drawings SA-1** to **SA-3.**

The sanitary sewer design sheet and associated drainage area plan can be found in **Appendix B.1**. Based on the proposed unit count, assumed commercial flows, and assumed future residential density tributary to the Boundary Road conceptual sewer, estimated peak sanitary outflows from the site are above that anticipated by the *Trunk Sanitary Sewers and Hydraulic Capacity Investigation.* It is of note that the sanitary contribution identified by J.L. Richards and Associates for the future Bodnar lands (Sewer run from MH002 to MH003) is lower largely in part due to the assumed unit density of 2.5 persons/unit used in the hydraulic capacity investigation, compared to that used for the current analysis of 2.7 persons/unit for townhomes and 3.4 persons/unit for single family homes. In addition, 3.0 ha of additional residential area within the existing track field, and 5.6 ha of additional commercial area including the Mississippi Valley Conservation Authority office have been included in the design of the proposed sanitary system that will convey sewage peak flows to the proposed pumping station and to the outlet to the Lake Avenue West sewer.

The associated sewage peak flows to the Lake Avenue West sewer connection are summarized in **Table 6** below.

Table 6: Wastewater Connections to Existing Lake Avenue Sanitary Sewer

Sewer Run	JLR Qtotal (L/sec)	Stantec Qtotal (L/sec)	Increase (L/sec)
MH002 – MH003	53.5	66.7	13.2

1. The above peak flows include sewage contribution from the proposed Bodnar Lands Development serviced through the proposed pumping station as well as sewage contribution from the existing adjacent subdivision discharging into the Lake Avenue trunk sewer.

Based on design spreadsheets within the *Hydraulic Capacity Investigation* (see **Appendix B.2**), downstream sewers are expected to have a minimum residual capacity of 35.6 L/s (sewer run MH006 to MH007), and thus the expected peak discharge increase of 13.2 L/s is within the capacity of the receiving sewers.

The proposed 114 cubic meter tank will provide 92.4 cubic meters of effective wastewater storage. This additional volume corresponds to an increase in response time of 38 minutes giving a total response time of 62 minutes.

3.4.6.2 Response time

A preliminary analysis under peak flow conditions of the minor system has identified response times for all areas in the event of a pumping station failure which corresponds to the amount of time before wastewater reaches the critical underside of footing. This response time includes ultimate build out of all 6 phases, wet well storage, commercial properties and storage tank. Results are listed in the **Table 9** below.

Table 9: Response Time Summary

Storage Area	Available storage (m^3)	Response Time (minutes)
Wet Well	22	9
Phase 1 through 6	23	10
Commercial	13	5
Storage Tank	92	38
Total	**151**	**62**

Approved/Final Response times will be required prior to issuing the station's ECA application to the MECP. The Town and OCWA will ultimately agree with the response times selected and have the appropriate emergency response plans in place once the station is turned over to the municipality and their operating contractor.

3.5 SANITARY HGL ANALYSIS

A sanitary hydraulic grade line analysis was completed on the proposed sanitary sewer system across the subdivision assuming catastrophic failure of the pump station. The boundary condition was increased iteratively until either the worst-case HGL reached the proposed under side of footing (USF) elevation and/or it reached the proposed manhole top of grate elevation which resulted in a worst-case HGL at the pump station of 136.65 m.

The HGL analysis includes the proposed sanitary sewers within the Bodnar Lands Development, external wastewater flows from the future developments and the Bodnar Lands Pumping Station located on Street 3 adjacent to the Roy Brown Park.

3.5.1 Sanitary HGL Analysis Criteria

As per the City of Ottawa's Technical bulletin from March 2018, annual flow parameters are to be used to assess the HGL in the sanitary system assuming a catastrophic failure of the pump station with wet weather peak flows being discharged through the emergency overflow into the underground storage tank. The HGL under this scenario cannot touch the proposed under side of footing (USF).

3.5.2 Design Parameters and Assumptions

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

Table 10: Wastewater Annual and Rare Flow Parameters

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

Sanitary inflows from the proposed and future developments were obtained from the detailed sanitary drainage plans included in **Appendix F**, using the annual parameters shown in the above table. Detailed calculations are provided in **Appendix B.4.**

3.5.3 Sanitary HGL Analysis Results

The following table summarizes the HGL results from the catastrophic failure (annual parameters) scenario.

Table 11: Catastrophic Pump Station Failure Sanitary HGL – Annual Parameters

San. MH ID	MH T/G (m)	Prop. USF (m)	Boundary Condition = 136.65 m		
			Worst-Case HGL (m)	HGL – USF Clearance (m)	HGL – T/G Clearance (m)
2	137.44	137.33	136.67	0.66	0.77
3	139.03	137.31	136.71	0.60	2.32
4	139.18	137.31	136.72	0.59	2.46
5	139.37	137.16	136.76	0.40	2.61
6	139.42	137.36	136.78	0.58	2.64
7	140.09	137.62	136.81	0.81	3.28
8	140.83	137.96	136.84	1.12	3.99

San. MH ID	MH T/G (m)	Prop. USF (m)	Boundary Condition = 136.65 m		
			Worst-Case HGL (m)	HGL – USF Clearance (m)	HGL – T/G Clearance (m)
9	140.92	138.06	136.86	1.20	4.06
10	140.96	138.76	136.86	1.90	4.10
11	141.00	138.90	136.87	2.03	4.13
11A	138.79	137.53	136.87	0.66	1.92
11B	141.30	N/A	137.95	-	3.35
12	141.86	139.40	138.10	1.30	3.76
13	142.77	139.91	138.76	1.15	4.01
14	142.81	140.40	138.85	1.55	3.96
15	142.42	140.36	139.32	1.04	3.10
16	140.95	138.46	137.48	0.98	3.47
17	141.10	139.26	137.94	1.32	3.16
18	142.19	139.36	138.31	1.05	3.88
19	142.14	139.94	138.38	1.56	3.76
20	142.32	140.09	138.75	1.34	3.57
21	142.27	140.36	138.83	1.53	3.44
22	139.43	137.16	136.76	0.40	2.67
23	139.51	137.42	136.76	0.66	2.75
24	139.51	137.56	136.76	0.80	2.75
25	139.70	137.56	136.76	0.80	2.94
26	139.77	137.81	136.76	1.05	3.01
27	139.69	137.81	136.76	1.05	2.93
28	139.82	137.91	136.76	1.15	3.06
29	140.48	137.48	136.82	0.66	3.66
31	141.33	138.56	136.88	1.68	4.45
32	142.57	139.72	137.55	2.17	5.02
33	143.22	140.69	139.85	0.84	3.37
34	143.74	141.26	140.43	0.83	3.31
35	144.24	141.66	140.72	0.94	3.52
36	144.19	142.11	140.81	1.30	3.38
37	144.46	142.11	141.22	0.89	3.24
38	144.54	142.66	141.32	1.34	3.22
39	143.75	140.70	137.95	2.75	5.80
40	144.18	141.71	140.14	1.57	4.04
41	144.40	142.26	141.09	1.17	3.31

San. MH ID	MH T/G (m)	Prop. USF (m)	Boundary Condition = 136.65 m		
			Worst-Case HGL (m)	HGL – USF Clearance (m)	HGL – T/G Clearance (m)
42	143.55	141.41	138.25	3.16	5.30
43	143.77	141.41	138.34	3.07	5.43
44	144.08	141.79	138.61	3.18	5.47
45	144.03	141.99	138.67	3.32	5.36
46	144.16	141.99	139.00	2.99	5.16
47	144.19	142.03	139.37	2.66	4.82
48	144.32	142.31	139.45	2.86	4.87
49	145.59	142.61	142.38	0.23	3.21
50	144.28	142.26	139.89	2.37	4.39
51	144.47	142.26	140.26	2.00	4.21
52	144.51	142.41	140.48	1.93	4.03
53	144.58	142.51	140.57	1.94	4.01
54	144.79	142.48	141.14	1.34	3.65
55	144.70	142.68	141.41	1.27	3.29
56	144.85	142.68	141.61	1.07	3.24
57	144.23	142.33	140.64	1.69	3.59
58	144.19	142.41	140.96	1.45	3.23
59	144.19	142.48	141.02	1.46	3.17
60	136.90	N/A	136.67	-	0.23
61	137.47	N/A	136.67	-	0.80
62	137.42	N/A	136.67	-	0.75
69	136.67	N/A	136.67	-	0.00
69A	136.90	N/A	136.67	-	0.23
70	136.70	N/A	136.67	-	0.03
71	138.74	N/A	136.67	-	2.07

As can be seen in the above table, the worst-case annual HGL during catastrophic pump failure remains below the proposed USF elevations across the proposed development and below the proposed sanitary manholes top of grate elevation with a maximum water level in the emergency storage tank of 136.65 m. Based on correspondence attached in **Appendix B.4**, the maximum water elevation of 136.65 m in the storage tank will result in a reduction of 5.7 m^3 of effective storage, which in turn results in storage time of 64 minutes.

Stantec

SUBDIVISION: **Bodnar Lands**

DATE: 3/15/2021
REVISION: 3
DESIGN BY: WAJ
CHECKED BY: AMP

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

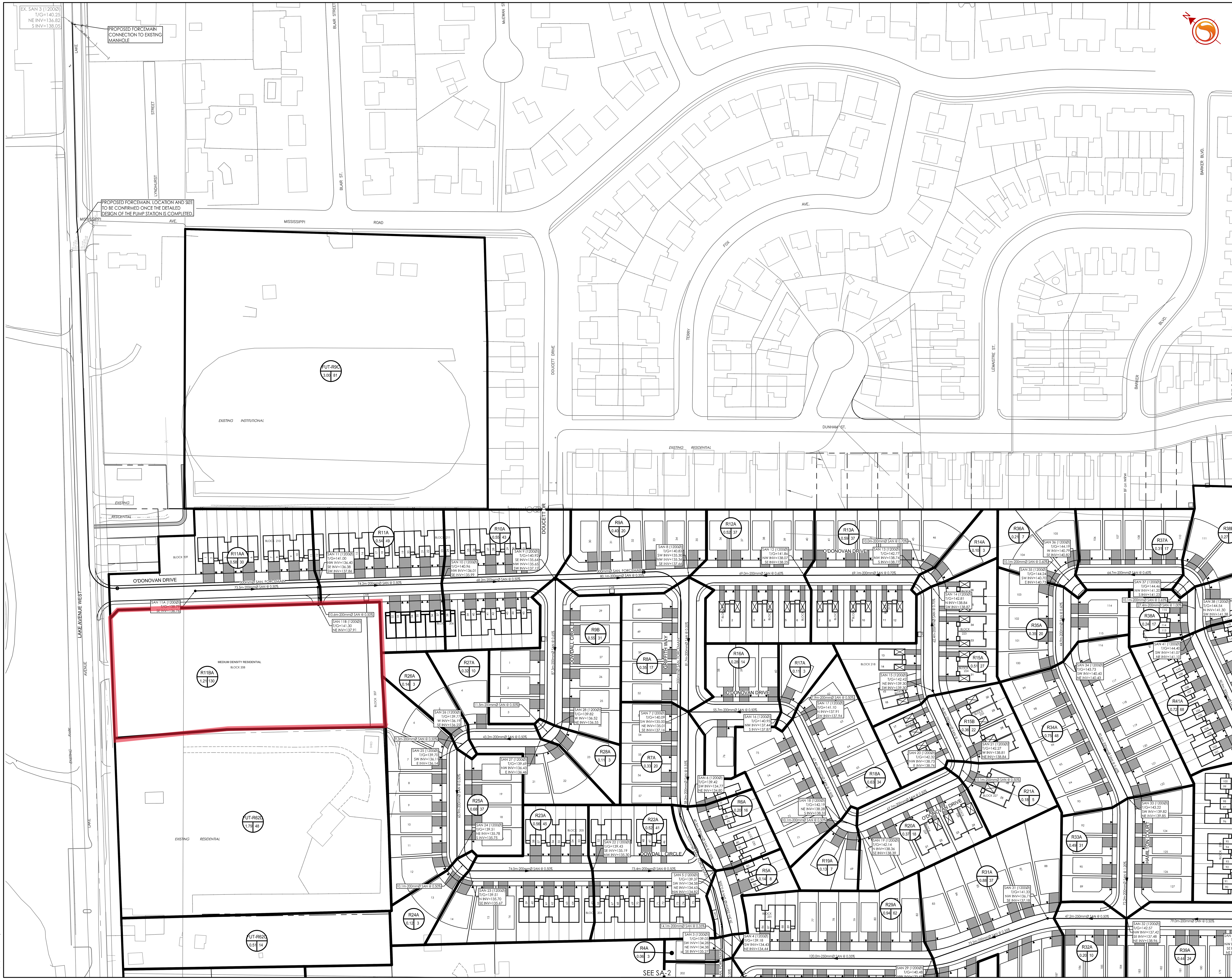
FILE NUMBER: 160401129

DESIGN PARAMETERS

Design Criteria as per J.L. Richards 2014 Sanitary Hydraulic Analysis for Carleton Place

MAX PEAK FACTOR (RES.)=	4.0	FUT. AVG. DAILY FLOW / PERSON	350 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 COMMERCIAL:	2.7	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	0.28 L/s/ha	HARMON CORRECTION FACTOR	1.0
PERSONS / APARTMENT	1.8	Future Residential Density	27 per/ha	EX. AVG. DAILY FLOW / PERSON	430 L/p/day

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)
R11AA	11A	11	0.58	0	11	0	30	0.58	30	4.00	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.58	0.58	0.2	0.6	73.5	200	PVC	SDR 35	0.50	23.6	2.72%	0.74	0.27
R11BA	11B	11	1.21	0	0	72	130	1.21	130	4.00	2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.21	1.21	0.3	2.4	10.6	200	PVC	SDR 35	0.50	23.6	10.31%	0.74	0.40
R11A	11	10	0.54	0	18	0	49	2.33	208	4.00	3.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.54	2.33	0.7	4.0	74.2	200	PVC	SDR 35	0.50	23.6	17.01%	0.74	0.46
R10A	10	9	0.55	0	16	0	43	2.88	251	4.00	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.55	2.88	0.8	4.9	68.2	200	PVC	SDR 35	0.50	23.6	20.62%	0.74	0.49
FUT-R9C, R9A	9	8	3.40	6	0	0	101	6.28	353	4.00	5.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3.40	6.28	1.8	7.5	80.1	200	PVC	SDR 35	0.35	19.8	37.77%	0.62	0.49
R15A	15	14	0.51	0	10	0	27	0.51	27	4.00	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.51	0.51	0.1	0.6	62.4	200	PVC	SDR 35	0.70	28.0	2.08%	0.88	0.30
R14A	14	13	0.10	1	0	0	3	0.62	30	4.00	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.10	0.62	0.2	0.7	10.0	200	PVC	SDR 35	0.70	28.0	2.38%	0.88	0.30
R13A	13	12	0.59	6	6	0	37	1.21	67	4.00	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.59	1.21	0.3	1.4	69.1	200	PVC	SDR 35	0.70	28.0	5.09%	0.88	0.39
R12A	12	8	0.52	6	6	0	37	1.72	104	4.00	1.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.52	1.72	0.5	2.2	69.0	200	PVC	SDR 35	0.60	25.9	8.35%	0.81	0.41
R8A	8	7	0.35	5	0	0	17	8.36	473	3.99	7.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.35	8.36	2.3	10.0	81.7	200	PVC	SDR 35	0.35	19.8	50.45%	0.62	0.53
R15B	15	21	0.36	0	8	0	22	0.36	22	4.00	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.36	0.36	0.1	0.5	46.6	200	PVC	SDR 35	1.00	33.4	1.35%	1.05	0.30
R21A	21	20	0.18	0	2	0	5	0.54	27	4.00	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.18	0.54	0.2	0.6	10.1	200	PVC	SDR 35	0.50	23.6	2.49%	0.74	0.27
R20A	20	19	0.37	2	4	0	18	0.91	45	4.00	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.37	0.91	0.3	1.0	67.7	200	PVC	SDR 35	0.50	23.6	4.13%	0.74	0.31
R19A	19	18	0.13	2	0	0	7	1.04	51	4.00	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.13	1.04	0.3	1.1	10.1	200	PVC	SDR 35	0.50	23.6	4.76%	0.74	0.32
R18A	18	17	0.63	10	0	0	34	1.67	85	4.00	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.63	1.67	0.5	1.9	67.4	200	PVC	SDR 35	0.50	23.6	7.83%	0.74	0.37
R17A	17	16	0.11	1	0	0	3	1.77	89	4.00	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.11	1.77	0.5	1.9	7.9	200	PVC	SDR 35	0.50	23.6	8.19%	0.74	0.37
R16A	16	7	0.28	4	0	0	14	2.06	102	4.00	1.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.28	2.06	0.6	2.2	55.7	200	PVC	SDR 35	0.50	23.6	9.46%	0.74	0.39
R7A	7	6	0.33	5	1	0	20	10.75	595	3.93	9.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.33	10.75	3.0	12.5	58.2	200	PVC	SDR 35	0.35	19.8	63.16%	0.62	0.57
R6A	6	5	0.20	0	6	0	16	10.95	611	3.93	9.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.20	10.95	3.1	12.8	40.5	200	PVC	SDR 35	0.35	19.8	64.67%	0.62	0.57
R9B	9	28	0.55	9	0	0	31	0.55	31	4.00	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.55	0.55	0.2	0.7	87.3	200	PVC	SDR 35	0.65	27.0	2.41%	0.85	0.29
R28A	28	27	0.11	1	0	0	3	0.66	34	4.00	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.11	0.66	0.2	0.7	11.5	200	PVC	SDR 35	0.50	23.6	3.11%	0.74	0.28
R27A	27	26	0.32	3	0	0	10	0.98	44	4.00	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.32	0.98	0.3	1.0	43.2	200	PVC	SDR 35	0.50	23.6	4.19%	0.74	0.31
R26A	26	25	0.14	1	0	0	3	1.12	48	4.00	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.14	1.12	0.3	1.1	9.3	200	PVC	SDR 35	0.50	23.6	4.59%	0.74	0.32
R25A	25	24	0.68	11	0	0	37	1.79	85	4.00	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.68	1.79	0.5	1.9	65.9	200	PVC	SDR 35	0.50	23.6	7.95%	0.74	0.37
R24A	24	23	0.12	1	0	0	3	1.92	88	4.00	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.12	1.92	0.5	2.0	10.1	200	PVC	SDR 35	0.50	23.6	8.33%	0.74	0.38
R23A	23	22	0.56	3	13	0	45	2.48	134	4.00	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.56	2.48	0.7	2.9	74.0	200	PVC	SDR 35	0.50	23.6	12.10%	0.74	0.42
R22A	22	5	0.52	0	15	0	41	3.00	174	4.00	2.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.52	3.00	0.8	3.7	73.4	200	PVC	SDR 35	0.50	23.7	15.42%	0.75	0.45
R5A	5	4	0.14	0	3	0	8	14.09	794	3.86	12.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.14	14.09	3.9	16.4	39.5	200	PVC	SDR 35	0.35	19.7	82.90%	0.62	0.62
R4A	4	3	0.06	1	0	0	3	14.16	797	3.86	12.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	14.16	4.0	16.4	14.1	200	PVC	SDR 35	0.35	19.8	83.07%	0.62	0.62
R49A	49	48	0.57	9	0	0	31	0.57	31	4.00	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.57	0.57	0.2	0.7	68.8	200	PVC	SDR 35	1.50	41.0	1.60%	1.29	0.40
R54A	54	59	0.37	0	9	0	24	0.37	24	4.00	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.37	0.37	0.1	0.5	49.9	200	PVC	SDR 35	1.00	33.4	1.49%	1.05	0.32
R59A	59	58	0.06	0	0	0	0	0.43	24	4.00	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	0.43	0.1	0.5	7.8	200	PVC	SDR 35	0.50	23.6	2.17%	0.74	0.26
R58A	58	57	0.45	0	13	0	35	0.88	59	4.00	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.45	0.88	0.2	1.2	61.7	200	PVC	SDR 35	0.50	23.6	5.11%	0.74	0.33
R57A	57	50	0.44	0	14	0	38	1.32	97	4.00	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.44	1.32	0.4	1.9	62.2	200	PVC	SDR 35	0.50	23.6	8.22%	0.74	0.37

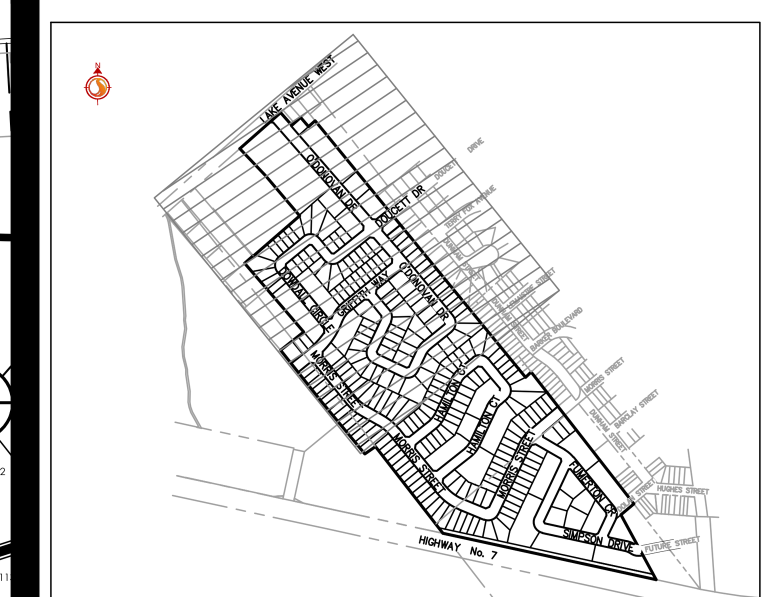


Stantec

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

Legend

- R1A — SANITARY DRAINAGE AREA ID#
- 1.00 | 50 — POPULATION; SANITARY DRAINAGE AREA ha.
- SANITARY DRAINAGE AREA
- PROPOSED SANITARY SEWER
- PROPOSED SANITARY FORCEMAIN
- PROPOSED SANITARY PUMPING STATION
- SERVICE LATERAL LOCATION
- SERVICE LATERAL LOCATION. UNIT TO BE EQUIPPED WITH SUMP PUMP TO DISCHARGE TO THE SURFACE.



LOCATION PLAN
N.T.S.

13	REVISED STREET NAMES	WAJ	KJK	22.04.29
12	REVISED RETAINING WALLS	WAJ	KJK	22.04.08
11	REVISED RETAINING WALLS	WAJ	KJK	22.03.30
10	REVISED RETAINING WALLS	WAJ	KJK	22.02.07
9	REVISED EROSION CONTROL AS PER MVCA COMMENTS	WAJ	KJK	21.11.10
8	REVISED CB115C-1 LOCATION	WAJ	KJK	21.11.04
7	REVISED LAKE AVENUE FORCEMAIN LAYOUT	WAJ	KJK	21.10.19
6	ISSUED FOR CONSTRUCTION	WAJ	KJK	21.05.10
5	REVISED AS PER TOWN COMMENTS	WAJ	KJK	21.04.12
4	REVISED AS PER TOWN COMMENTS	WAJ	KJK	20.12.09
3	REVISED AS PER TOWN COMMENTS	WAJ	KJK	20.08.07
2	REVISED AS PER TOWN COMMENTS	WAJ	KJK	20.01.31
1	ISSUED TO TOWN OF CARLETON PLACE AND MVCA	WAJ	KJK	18.11.12
Revision		By	Appd.	YY.MM.DD

File Name: 160401129-SA.dwg	WAJ	KJK	WAJ	18.04.20
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

1384341 ONTARIO LTD.

BODNAR LANDS

CARLETON PLACE, ON, CANADA

Title

SANITARY DRAINAGE PLAN

Project No.	Scale
160401129	1:1500

Drawing No.	Sheet	Revision
SA-1	50 of 59	13

ORIGINAL SHEET - ARCH D

Appendix D Stormwater Management

D.1 Storm Sewer Design Sheet

Stantec

Mississippi Shores Apartments	
DATE:	2024-04-24
REVISION:	3
DESIGN BY:	WAJ
CHECKED BY:	AMP

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: **160401796**

DESIGN PARAMETERS

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

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

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

LOCATION / DRAINAGE AREA

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)
C203A, C203B	203	202	0.00	0.156	0.00	0.000	0.000	0.00	0.73	0.00	0.00	0.000	0.000	0.113	0.113	0.000	0.000	0.000	0.000
C205A, C205B, F205C	205	202	0.00	0.105	0.00	0.008	0.000	0.00	0.72	0.00	0.90	0.000	0.000	0.075	0.075	0.000	0.000	0.007	0.007
C202A, C202B	202	201	0.00	0.138	0.00	0.000	0.000	0.00	0.81	0.00	0.00	0.000	0.000	0.111	0.300	0.000	0.000	0.000	0.007
C204A, F204B, F204C	204	201	0.00	0.135	0.00	0.012	0.000	0.00	0.57	0.00	0.90	0.000	0.000	0.077	0.077	0.000	0.000	0.011	0.011
C201A, C201B, F201C	201	200	0.00	0.181	0.00	0.006	0.000	0.00	0.71	0.00	0.90	0.000	0.000	0.129	0.506	0.000	0.000	0.005	0.024
	200	111B	0.00	0.000	0.00	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.506	0.000	0.000	0.000	0.024

PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
C203A, C203B	203	202	10.00	76.81	104.19	122.14	178.56	0.0	0.0	32.8	18.8	300	300	CIRCULAR	PVC	SDR 35	0.50	68.0	**48.28%**	0.97	0.82	0.38
			10.38																			
C205A, C205B, F205C	205	202	10.00	76.81	104.19	122.14	178.56	0.0	0.0	25.4	18.2	300	300	CIRCULAR	PVC	SDR 35	0.50	68.0	**37.41%**	0.97	0.76	0.40
			10.40																			
C202A, C202B	202	201	10.40	75.30	102.13	119.71	174.99	0.0	0.0	88.7	54.3	450	450	CIRCULAR	CONCRETE	100-D	0.30	162.9	**54.43%**	0.99	0.87	1.04
			11.44																			
C204A, F204B, F204C	204	201	10.00	76.81	104.19	122.14	178.56	0.0	0.0	27.8	20.6	300	300	CIRCULAR	PVC	SDR 35	0.50	68.0	**40.93%**	0.97	0.78	0.44
			10.44																			
C201A, C201B, F201C	201	200	11.44	71.69	97.17	113.87	166.41	0.0	0.0	147.6	25.9	525	525	CIRCULAR	CONCRETE	100-D	0.30	245.8	**60.05%**	1.10	0.99	0.43
	200	111B	11.87	70.29	95.25	111.61	163.08	0.0	0.0	144.7	5.2	525	525	CIRCULAR	CONCRETE	100-D	0.30	245.5	**58.94%**	1.10	0.99	0.09
			11.96									600	600									

D.2 Runoff Coefficient Calculations

Project No. 160401796
Mississippi Shores Apartments
Runoff Coefficient Calculations

Runoff Coeeficient for Hard Areas, C=0.90
Runoff Coeeficient for Soft Areas, C=0.20

ID	Total Area (m^2)	Hard Area (m^2)	Soft Area (m^2)	C-Value
C201A	895	543	352	0.62
C201B	917	787	130	0.80
C202A	709	610	99	0.80
C202B	666	592	74	0.82
C203A	1242	959	283	0.74
C203B	321	214	107	0.67
C204A	1354	723	631	0.57
C205A	205	157	48	0.74
C205B	848	616	232	0.71
F201C	65	65	0	0.90
F202C	61	61	0	0.90
F202D	58	58	0	0.90
F203C	81	81	0	0.90
UNC-1	2479	246	2233	0.27
UNC-2	563	58	505	0.27
UNC-3	1579	0	1579	0.20

D.3 PCSWMM Model Input

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

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

START_DATE           03/16/2023
START_TIME           00:00:00
REPORT_START_DATE    03/16/2023
REPORT_START_TIME    00:00:00
END_DATE             03/16/2023
END_TIME             06:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         1
RULE_STEP            00:00:00

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

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

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

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width
%Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- -------- ----------------
;0.62
C201A            RG1              C201A-S          0.089481 60       59.654
2.5      0
;0.80
C201B            RG1              C201B-S          0.091694 85.714   24.781
2.5      0
;0.82
C202A            RG1              C202A-S          0.070892 88.571   50.637
3.5      0
;0.79
C202B            RG1              C202B-S          0.06745  84.286   44.967   3
      0
;0.74
C203A            RG1              C203A-S          0.124192 77.143   33.565   2
      0
;0.67
C203B            RG1              C203B-S          0.032112 67.143   21.408   2
      0
;0.57
C204A            RG1              C204A-S          0.1354   52.857   41.03
1.5      0
;0.74
C205A            RG1              C205A-S          0.020491 77.143   17.076
1.5      0
;0.71
C205B            RG1              C205B-S          0.084761 72.857   17.298
1.5      0
;0.90
F201C            RG1              201              0.006144 100      6.827
14.6     0
;0.90
F204B            RG1              204              0.005756 100      6.396
14.7     0
;0.90
F204C            RG1              204              0.006513 100      7.237
14.6     0
;0.90
F205C            RG1              205              0.008064 100      7.331
11.1     0
;0.27
UNC-1            RG1              of3              0.247868 10       103.278  30
      0
;0.27
UNC-2            RG1              OF4              0.056303 10       12.796   2
      0
;0.20
UNC-3            RG1              of3              0.157878 0        46.435   3
      0

[SUBAREAS]
```

```
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
  PctRouted
;;-------------- ---------- ---------- ---------- ---------- ----------
---------- ----------
C201A            0.013      0.25       1.57       4.67       25         OUTLET

C201B            0.013      0.25       1.57       4.67       25         OUTLET

C202A            0.013      0.25       1.57       4.67       25         OUTLET

C202B            0.013      0.25       1.57       4.67       25         OUTLET

C203A            0.013      0.25       1.57       4.67       25         OUTLET

C203B            0.013      0.25       1.57       4.67       25         OUTLET

C204A            0.013      0.25       1.57       4.67       25         OUTLET

C205A            0.013      0.25       1.57       4.67       25         OUTLET

C205B            0.013      0.25       1.57       4.67       25         OUTLET

F201C            0.013      0.25       1.57       4.67       25         OUTLET

F204B            0.013      0.25       1.57       4.67       25         OUTLET

F204C            0.013      0.25       1.57       4.67       25         OUTLET

F205C            0.013      0.25       1.57       4.67       25         OUTLET

UNC-1            0.013      0.25       1.57       4.67       25         OUTLET

UNC-2            0.013      0.25       1.57       4.67       25         OUTLET

UNC-3            0.013      0.25       1.57       4.67       25         OUTLET


[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
C201A            76.2       13.2       4.14       7          0
C201B            76.2       13.2       4.14       7          0
C202A            76.2       13.2       4.14       7          0
C202B            76.2       13.2       4.14       7          0
C203A            76.2       13.2       4.14       7          0
C203B            76.2       13.2       4.14       7          0
C204A            76.2       13.2       4.14       7          0
C205A            76.2       13.2       4.14       7          0
C205B            76.2       13.2       4.14       7          0
F201C            76.2       13.2       4.14       7          0
F204B            76.2       13.2       4.14       7          0
F204C            76.2       13.2       4.14       7          0
F205C            76.2       13.2       4.14       7          0
UNC-1            76.2       13.2       4.14       7          0
UNC-2            76.2       13.2       4.14       7          0
UNC-3            76.2       13.2       4.14       7          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To

;;-------------- ---------- ---------- ---------------- --------
----------------
111B             137.09     TIMESERIES BC_100YR         NO

OF1              140.81     FREE                        NO

OF2              140.81     FREE                        NO

OF3              135        FREE                        NO

OF4              140.84     FREE                        NO


[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params
        SurDepth Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- -----------
---------------------------- -------- -------- -------- -------- --------
200              136.88   3.907      0          FUNCTIONAL  0         0
1.13     0        0
200A-H           140.84   0.4        0          FUNCTIONAL  0         0
0        0        0
200B-H           140.84   0.4        0          FUNCTIONAL  0         0
0        0        0
201              136.988  4.054      0          FUNCTIONAL  0         0
1.13     0        0
201A-H           140.99   0.4        0          FUNCTIONAL  0         0
0        0        0
201B-H           140.99   0.4        0          FUNCTIONAL  0         0
0        0        0
202              137.226  3.868      0          FUNCTIONAL  0         0
1.13     0        0
202A-H           141      0.4        0          FUNCTIONAL  0         0
0        0        0
202B-H           141.05   0.4        0          FUNCTIONAL  0         0
0        0        0
203              137.468  3.472      0          FUNCTIONAL  0         0
1.13     0        0
204              137.316  3.767      0          FUNCTIONAL  0         0
1.13     0        0
205              137.465  3.522      0          FUNCTIONAL  0         0
1.13     0        0
C201A-S          139.36   1.78       0          FUNCTIONAL  0         0
0        0        0
C201B-S          139.36   1.78       0          FUNCTIONAL  0         0
0        0        0
C202A-S          139.49   1.78       0          FUNCTIONAL  0         0
0        0        0
```

```
C202B-S          139.49   1.78       0          FUNCTIONAL  0         0
0        0        0
C203A-S          139.47   1.78       0          TABULAR     C203A
        0        0
C203B-S          139.47   1.78       0          TABULAR     C203B
        0        0
C204A-S          139.45   1.78       0          TABULAR     C204A
        0        0
C205A-S          139.57   1.78       0          TABULAR     C205A
        0        0
C205B-S          139.57   1.78       0          TABULAR     C205B
        0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness
InOffset   OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ----------
---------- ---------- ---------- ----------
200-111B         200              111B             5.166      0.013      137.18
   137.165    0          0
201-200          201              200              25.856     0.013      137.288
   137.21     0          0
202-201          202              201              54.285     0.013      137.526
   137.363    0          0
203-202          203              202              18.845     0.013      137.778
   137.684    0          0
204-201          204              201              20.584     0.013      137.616
   137.513    0          0
205-202          205              202              18.214     0.013      137.775
   137.684    0          0
C1               C201B-S          200B-H           7.6        0.013      140.74
   140.84     0          0
C10              202B-H           C202B-S          27.5       0.013      141.05
   140.87     0          0
C11              202A-H           C202A-S          27.5       0.013      141
   140.87     0          0
C12              C202B-S          201A-H           29.3       0.013      140.87
   140.99     0          0
C13              C202A-S          201A-H           27         0.013      140.87
   140.99     0          0
C16              201B-H           C201B-S          27.3       0.013      140.99
   140.74     0          0
C17              201A-H           C201A-S          15.6       0.013      140.99
   140.74     0          0
C18              C201A-S          200A-H           7.6        0.013      140.74
   140.84     0          0
C19              200A-H           OF2              13.5       0.013      140.84
   140.81     0          0
C20              200B-H           OF1              9          0.013      140.84
   140.81     0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset
Qcoeff     Gated    CloseTime
```

```
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- ----------
C201A-IC         C201A-S          201              SIDE         139.36     0.61
     NO       0
C201B-IC         C201B-S          201              SIDE         139.36     0.61
     NO       0
C202A-IC         C202A-S          202              SIDE         139.49     0.61
     NO       0
C202B-IC         C202B-S          202              SIDE         139.49     0.61
     NO       0
C203A-IC         C203A-S          203              SIDE         139.47     0.61
     NO       0
C203B-IC         C203B-S          203              SIDE         139.47     0.61
     NO       0
C204A-IC         C204A-S          204              SIDE         139.45     0.61
     NO       0
C205A-IC         C205A-S          205              SIDE         139.57     0.61
     NO       0
C205B-IC         C205B-S          205              SIDE         139.57     0.61
     NO       0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt
Qcoeff     Gated    EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff.
Curve
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- -------- ---------- ---------- ---------- ----------
----------------
C14              C204A-S          201B-H           TRANSVERSE   140.99     1.38
     NO       0        0          YES
C3               C203A-S          202A-H           TRANSVERSE   141        1.38
     NO       0        0          YES
C4               C203B-S          202A-H           TRANSVERSE   141        1.38
     NO       0        0          YES
C8               C205A-S          202B-H           TRANSVERSE   141.05     1.38
     NO       0        0          YES
C9               C205B-S          202B-H           TRANSVERSE   141.05     1.38
     NO       0        0          YES

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
200-111B         CIRCULAR     0.525            0          0          0
1
201-200          CIRCULAR     0.525            0          0          0
1
202-201          CIRCULAR     0.45             0          0          0
1
203-202          CIRCULAR     0.3              0          0          0
1
204-201          CIRCULAR     0.3              0          0          0
1
```

```
205-202          CIRCULAR     0.3              0           0           0
1
C1               IRREGULAR    Access_half_R    0           0           0
1
C10              IRREGULAR    Access_half_L    0           0           0
1
C11              IRREGULAR    Access_half_R    0           0           0
1
C12              IRREGULAR    Access_half_L    0           0           0
1
C13              IRREGULAR    Access_half_R    0           0           0
1
C16              IRREGULAR    Access_half_R    0           0           0
1
C17              IRREGULAR    Access_parking_half_L 0      0           0
1
C18              IRREGULAR    Access_parking_half_L 0      0           0
1
C19              IRREGULAR    Access_half_L    0           0           0
1
C20              IRREGULAR    Access_half_R    0           0           0
1
C201A-IC         CIRCULAR     0.094            0           0           0
C201B-IC         CIRCULAR     0.102            0           0           0
C202A-IC         CIRCULAR     0.094            0           0           0
C202B-IC         CIRCULAR     0.094            0           0           0
C203A-IC         CIRCULAR     0.127            0           0           0
C203B-IC         CIRCULAR     0.083            0           0           0
C204A-IC         CIRCULAR     0.102            0           0           0
C205A-IC         CIRCULAR     0.083            0           0           0
C205B-IC         CIRCULAR     0.094            0           0           0
C14              RECT_OPEN    0.24             2           0           0
C3               RECT_OPEN    0.25             2           0           0
C4               RECT_OPEN    0.25             2           0           0
C8               RECT_OPEN    0.3              2           0           0
C9               RECT_OPEN    0.3              2           0           0

[TRANSECTS]
;;Transect Data in HEC-2 format
;
NC 0.01     0.01     0.01
X1 Access_half_L     5        0.0      0.0      0.0      0.0      0.0      0.0
   0.0
GR 0.1      -5.95    0.05     -3.45    0.05     -3.25    -0.1     -3.25    0
   0
;
NC 0.01     0.01     0.01
X1 Access_half_R     5        0.0      0.0      0.0      0.0      0.0      0.0
   0.0
GR 0        0        -0.1     3.25     0.05     3.25     0.05     3.45     0.1
   5.95
;
NC 0.01     0.01     0.01
X1 Access_parking_full  11       0.0      0.0      0.0      0.0      0.0
0.0      0.0
GR 0.17     -7.2     0.15     -6.2     0.15     -6       0        -6       -0.1
   -3.25
GR 0        0        -0.1     3.25     0        6        0.15     6        0.15
   6.2
GR 0.17     7.2
;
NC 0.01     0.01     0.01
X1 Access_parking_half_L  6        0.0      0.0      0.0      0.0      0.0
0.0      0.0
GR 0.17     -7.2     0.15     -6.2     0.15     -6       0        -6       -0.1
   -3.25
GR 0        0
;
NC 0.01     0.01     0.01
X1 Access_parking_half_R  6        0.0      0.0      0.0      0.0      0.0
0.0      0.0
GR 0        0        -0.1     3.25     0        6        0.15     6        0.15
   6.2
GR 0.17     7.2
;
NC 0.01     0.01     0.01
X1 Transect1         10       0.0      0.0      0.0      0.0      0.0      0.0
   0.0
GR 0.17     -7.2     0.15     -6.2     0.15     -6       0        -6       -0.1
   -3.25
GR 0        0        -0.1     3.25     0.15     3.25     0.15     3.45     0.22
   7.1

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
201-200          0          0.116      0          NO         0
202-201          0          1.344      0          NO         0
203-202          0          1.323      0          NO         0
204-201          0          0.022      0          NO         0
205-202          0          1.286      0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
C201A            Storage    0          0
C201A                       1.38       0.36
C201A                       1.48       21.5

C201B            Storage    0          0
C201B                       1.38       0.36
C201B                       1.48       22.7

C202A            Storage    0          0
C202A                       1.38       0.36
C202A                       1.5        132.2

C202B            Storage    0          0
```

```
C202B                   1.38       0.36
C202B                   1.5        97.4

C203A           Storage 0          0
C203A                   1.38       0.36
C203A                   1.53       92.2

C203B           Storage 0          0
C203B                   1.38       0.36
C203B                   1.53       108.5

C204A           Storage 0          0
C204A                   1.38       0.36
C204A                   1.54       109.5

C205A           Storage 0          0
C205A                   1.38       0.36
C205A                   1.48       34.9

C205B           Storage 0          0
C205B                   1.38       0.36
C205B                   1.48       115

[TIMESERIES]
;;Name          Date       Time       Value
;;------------- ---------- ---------- ----------
100YRCHI                   0:00       0
100YRCHI                   0:10       6.05
100YRCHI                   0:20       7.54
100YRCHI                   0:30       10.16
100YRCHI                   0:40       15.97
100YRCHI                   0:50       40.65
100YRCHI                   1:00       178.56
100YRCHI                   1:10       54.05
100YRCHI                   1:20       27.32
100YRCHI                   1:30       18.24
100YRCHI                   1:40       13.74
100YRCHI                   1:50       11.06
100YRCHI                   2:00       9.29
100YRCHI                   2:10       8.02
100YRCHI                   2:20       7.08
100YRCHI                   2:30       6.35
100YRCHI                   2:40       5.76
100YRCHI                   2:50       5.28
100YRCHI                   3:00       4.88

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

```
[TAGS]
Node       111B             MN
Node       200              MN
Node       200A-H           MJ
Node       200B-H           MJ
Node       201              MN
Node       201A-H           MJ
Node       201B-H           MJ
Node       202              MN
Node       202A-H           MJ
Node       202B-H           MJ
Node       203              MN
Node       204              MN
Node       205              MN
Node       C201A-S          MJ
Node       C201B-S          MJ
Node       C202A-S          MJ
Node       C202B-S          MJ
Node       C203A-S          MJ
Node       C203B-S          MJ
Node       C204A-S          MJ
Node       C205A-S          MJ
Node       C205B-S          MJ
Link       200-111B         MN
Link       201-200          MN
Link       202-201          MN
Link       203-202          MN
Link       204-201          MN
Link       205-202          MN
Link       C1               MJ
Link       C10              MJ
Link       C11              MJ
Link       C12              MJ
Link       C13              MJ
Link       C16              MJ
Link       C17              MJ
Link       C18              MJ
Link       C19              MJ
Link       C20              MJ
Link       C14              MJ
Link       C3               MJ
Link       C4               MJ
Link       C8               MJ
Link       C9               MJ

[MAP]
DIMENSIONS      409397.7019      4997950.2825     409577.9721      4998135.0275

UNITS           Meters

[COORDINATES]
;;Node          X-Coord            Y-Coord
;;------------- ------------------ ------------------
111B            409543.1           4998036
```

OF1	409548.549	4998038.184
OF2	409547.132	4998040.915
OF3	409430.747	4998104.146
OF4	409565.998	4998013.959
200	409538.2	4998034
200A-H	409542.402	4998039.669
200B-H	409545.285	4998036.175
201	409518.7	4998017
201A-H	409526.428	4998025.354
201B-H	409519.382	4998013.481
202	409483	4998058
202A-H	409486.27	4998058.297
202B-H	409481.6	4998052.772
203	409497.2	4998070
204	409503.2	4998004
205	409469.3	4998046
C201A-S	409535.502	4998033.617
C201B-S	409539.291	4998030.664
C202A-S	409506.906	4998033.285
C202B-S	409504.052	4998030.409
C203A-S	409494.871	4998071.121
C203B-S	409497.499	4998068.29
C204A-S	409506.958	4997998.788
C205A-S	409471.981	4998053.128
C205B-S	409468.507	4998047.732

D.4 Excerpt from Bodnar Lands Subdivision Site Servicing and SWM Report (Stantec, April 2021) - SWM Criteria/Results

Bodnar Lands Subdivision, Carleton Place - Servicing and Stormwater Management Report

Job #160401129

Prepared for:
1384341 Ontario Inc.

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

April 12, 2021

Revision	Description	Prepared by		Checked by
0	Site Servicing and Stormwater Management Report	Ana Paerez	November 12, 2018	Kris Kilborn
1	Site Servicing and Stormwater Management Report	Ana Paerez	February 3, 2020	Kris Kilborn
2	Site Servicing and Stormwater Management Report	Ana Paerez	August 7, 2020	Kris Kilborn
3	Site Servicing and Stormwater Management Report	Ana Paerez	December 11, 2020	Kris Kilborn
4	Site Servicing and Stormwater Management Report	Ana Paerez	April 12, 2021	Kris Kilborn

The following table summarizes the varying parameters for each of the drainage areas.

Table 12: Existing Catchment Parameters

Model Catchment ID	Description	Area (ha)	Slope (%)	IMP (%)	Runoff Method	Width (m)	Flow Length (m)	CN
EXT-1	Existing Subdivision with Major flow through site	0.08	2.0	64.3	Hortons	24.0	33.3	N/A
EXT-2	Existing Subdivision RY with overland flow through site	1.26	2.0	35.7	Hortons	441.9	28.5	N/A
SITE1	Site Area Tributary to Ditch	17.01	2.1	0.0	Nash IUH	N/A	506.0	78.0
DRAIN	Site Area Tributary to Ditch	7.13	1.4	0.0	Nash IUH	N/A	494.0	79.0
SITE2	Site Area Tributary to Lake Avenue	7.40	2.7	0.0	Nash IUH	N/A	329.0	78.0

The hydrological model was run using the 25 mm, 4-hour Chicago storm, as well as the 3-hour Chicago and the 12 and 24-hour SCS Type II distributions for the 2, 5, and 100-year return periods using City of Ottawa IDF parameters. **Table 13** summarizes the existing condition peak flows tributary to the proposed outlet and to Lake Avenue.

Table 13: Existing Condition Peak Flows

Storm Event	Existing Condition Peak Flow to Outlet Ditch (m^3/s)	Existing Condition Peak Flow to Lake Avenue (m^3/s)
25mm – 4hr Chicago	0.036	0.016
2yr - 12hr SCS	0.212	0.119
5yr - 12hr SCS	0.491	0.285
100yr - 12hr SCS	1.675	0.878
2yr - 24hr SCS	0.233	0.148
5yr - 24hr SCS	0.470	0.296
100yr - 24hr SCS	1.357	0.770
2yr - 3hr Chicago	0.119	0.069
5yr - 3hr Chicago	0.316	0.195
100yr - 3hr Chicago	1.252	0.725

4.2 PROPOSED CONDITIONS

The proposed subdivision will consist of a mix of townhomes, single family homes and terrace homes, a high density residential private block, a SWM wet pond, and associated transportation and servicing infrastructure. The proposed wet pond will provide quality control and quantity control up to the 2-year storm event for the proposed subdivision, external areas routed through the proposed site minor and major systems (EXT-1, EXT-2, C109B, C112B, C132B, C150D), as well as a future commercial block (area C162A) and a future park building (area C102A). Site sewers will outlet to the proposed SWM wet pond that will provide quality control and mitigate post development peak flows as much as possible while protecting the proposed basements from flooding. Inlet control devices at road low points will be used to restrict inflow rates to the sewer to approximately the 5-year runoff from the proposed site areas only and to provide attenuating surface storage. The proposed storm sewer system has been sized to accommodate 5-year peak flows from the proposed development area only, but inlet control devices have been sized to ensure no surface ponding occurs on street catchments during the 2-year storm (i.e., 2-year capture of external runoff routed through site and directed to SWM Pond).

Major system peak flows from the entire site will be directed west towards Street 3 and towards the proposed Roy Brown Park which will be graded to convey runoff towards a proposed overland flow channel that will also serve as the overflow spillway outlet from the SWM wet pond and will direct runoff to an existing ditch within the ash swamp and ultimately to the Mississippi River (see **Drawings SD-1** and **SD-2**).

4.3 SWM CRITERIA

The following summarizes the SWM criteria for the proposed development as per conversations with Town and MVCA staff.

- SWM facility to be designed to provide 'Enhanced' level of treatment as per Ministry of the Environment, Conservation and Parks (MECP) recommendations which represents an equivalent 80% TSS removal.
- Due to the proximity of the site to the Mississippi River, quantity control is not a requirement for the proposed development. However, the MVCA has expressed concerns about the negative impacts that the proposed development peak flows might have on the existing natural features downstream of the site within the existing ash swamp environment. As a result, it has been recommended to optimize the size of the wet pond to attenuate post development peak flows up to the 2-year storm event to pre-development levels.
- Provide adequate conveyance of 100-year peak flows off site.
- Provide best management practices to prevent disturbances to the riverine wetland environment.

modeling of the site hydrology and hydraulics allowed for an analysis of the systems response during various storm events. The following assumptions were applied to the hydrologic/hydraulic model:

- 25 mm, 4-hour Chicago Storm for forebay and bypass structure sizing, 2-year, 5-year, 100-year and 100-year increased by 20%, 3-hour Chicago Storm distribution for sewer sizing, overall quantity control and HGL analysis, 100-year, 24-hour SCS Type II distribution for HGL analysis and post to pre-development peak flow comparison, and 2-year, 5-year and 100-year, 12-hour SCS Type II distribution for HGL analysis and pond performance assessment.
- Runoff Coefficient calculated based on actual soft and hard surfaces on each subarea and converted to equivalent percent imperviousness using the relationship Imp = (C – 0.2)/0.7 (see **Appendix C.4**).
- Subcatchment areas obtained from high point to high point as per detailed grading and lumped for future development blocks.
- The width parameter was measured as twice the road/rear yard swale for two-sided catchments and equal to the length of the road/rear yard swale for one-sided catchments. The width parameter for the commercial block was defined as 225 m/ha as per the City of Ottawa Sewer Design Guidelines.
- Minor system inflow from lumped subcatchments representing future development blocks was restricted with outlet curves with the 5-year runoff as maximum inflow rate at the top of grate and increased by 10% at a ponding depth of 0.35m.
- The future commercial block was assumed to provide on-site storage for up to the 100-year storm.
- The future HD residential block 208 (area C111BA) and the future park building block (area C102A) were assumed to have no surface storage available on-site for conservatism.
- Runoff from external areas within the existing adjacent subdivision (areas EXT-1, EXT-2, C109B, C112B, C132B, C150D) is to be routed through the proposed site, while ensuring no surface ponding occurs on streets during the 2-year storm (i.e. 2-year runoff from the above-mentioned areas will be directed to the proposed SWM Pond through the site storm sewer system).
- Segment cross-section types defined to account for the different right-of-ways and overland flow corridor swales.

4.5.1 SWMM Dual Drainage Methodology

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 4**), with: 1) circular conduits representing the sewers & junction nodes representing

Subcatchment Parameter	Value
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67
Zero Imperv (%)	0

Table 15 presents the individual parameters that vary for each of the proposed subcatchments.

Table 15: Proposed Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient	Subarea Routing	% Routed
C102A	1.31	295.0	2.0	22.9%	0.36	PERVIOUS	30
C103A	0.36	105.0	2.0	68.6%	0.68	OUTLET	100
C103B	0.23	123.0	2.0	47.1%	0.53	PERVIOUS	100
C103C	0.74	326.0	2.0	35.7%	0.45	PERVIOUS	100
C105A	0.11	74.0	2.0	55.7%	0.59	OUTLET	100
C105B	0.65	316.0	2.0	32.9%	0.43	PERVIOUS	100
C106A	0.41	99.0	2.0	62.9%	0.64	OUTLET	100
C106B	0.25	146.0	2.0	32.9%	0.43	PERVIOUS	100
C107A	0.11	84.0	2.0	41.4%	0.49	PERVIOUS	100
C107B	0.35	226.0	2.0	41.4%	0.49	PERVIOUS	100
C108A	0.30	81.0	2.0	62.9%	0.64	OUTLET	100
C108B	0.65	299.0	2.0	21.4%	0.35	PERVIOUS	100
C109A	0.46	161.7	2.0	55.7%	0.59	OUTLET	100
C109B	0.24	29.0	2.0	35.7%	0.45	PERVIOUS	100
C110A	0.33	140.0	2.0	71.4%	0.70	OUTLET	100
C111A	0.35	113.0	2.0	74.3%	0.72	OUTLET	100
C111AA	0.24	61.9	2.0	68.6%	0.68	OUTLET	100
C111AB	0.43	187.0	2.0	28.6%	0.40	PERVIOUS	100
C111B	0.34	180.0	2.0	35.7%	0.45	PERVIOUS	100
C111BA	1.20	271.1	2.0	85.7%	0.80	PERVIOUS	30
C112A	0.93	274.0	2.0	60.0%	0.62	OUTLET	100
C112B	0.45	58.0	2.0	35.7%	0.45	PERVIOUS	100
C115A	0.56	246.0	2.0	60.0%	0.62	OUTLET	100
C115B	0.12	83.2	2.0	34.3%	0.44	PERVIOUS	100
C115C	0.50	273.0	2.0	34.3%	0.44	PERVIOUS	100
C116A	0.52	228.0	2.0	64.3%	0.65	OUTLET	100
C120A	0.30	70.8	2.0	57.1%	0.60	OUTLET	100
C121A	0.34	202.0	2.0	34.3%	0.44	PERVIOUS	100
C122A	0.27	136.0	2.0	75.7%	0.73	OUTLET	100
C123A	0.39	133.8	2.0	68.6%	0.68	OUTLET	100
C123B	0.22	110.0	2.0	41.4%	0.49	PERVIOUS	100
C125A	0.37	146.8	2.0	71.4%	0.70	OUTLET	100
C127A	0.62	280.0	2.0	67.1%	0.67	OUTLET	100
C129A	0.39	155.0	2.0	70.0%	0.69	OUTLET	100

Table 18: Target Capture Rates and On-Site Storage Requirements for Future Areas

Outlet Name	Tributary Area ID	Description	Minor System Node	100-Year Minor System Capture Rate (L/s)	On-Site Storage
C102A-IC	C102A	Park Building Block	102	133.6	No Storage
C111BA-IC	C111BA	HD Residential	111B	329.7	No Storage
C162A-IC	C162A	Commercial Block	162	797.3	100-year On-Site Storage

4.7 MODEL RESULTS AND DISCUSSION

The following section summarizes the key hydrologic and hydraulic model results. For detailed model results or inputs please refer to the example input file in **Appendix C.4** and the electronic model files included in the digital submission package.

4.7.1 Hydrology

Table 19 summarizes the orifice/outlet link maximum flow rates and heads across the proposed development.

Table 19: Orifice Link Results

Orifice Name	Tributary Area ID	ICD Type	5yr Head (m)	100yr Head (m)	5yr Flow (L/s)	100yr Flow (L/s)
C102A-IC	C102A	310mmORIFICE	2.04	2.54	101.2	133.6
C103A-IC(1)	C103A	IPEX TEMPEST HF (127mm" ORIFICE)	1.40	1.46	36.9	36.8
C103A-IC(2)	C103A	IPEX TEMPEST HF (127mm" ORIFICE)	1.40	1.46	36.9	36.8
C103B-IC	C103B	IPEX TEMPEST HF (127mm" ORIFICE)	1.56	1.80	34.3	35.4
C103C-IC	C103C	IPEX TEMPEST HF (152mm" ORIFICE)	2.38	2.44	45.8	43.8
C105A-IC(1)	C105A	IPEX TEMPEST HF (83mm" ORIFICE)	0.69	1.55	11.1	16.8
C105A-IC(2)	C105A	IPEX TEMPEST HF (83mm" ORIFICE)	0.69	1.55	11.1	16.8
C105B-IC	C105B	IPEX TEMPEST HF (127mm" ORIFICE)	1.64	1.77	40.3	41.9
C106A-IC(1)	C106A	IPEX TEMPEST HF (178mm" ORIFICE)	1.40	1.61	72.2	77.7
C106A-IC(2)	C106A	IPEX TEMPEST HF (178mm" ORIFICE)	1.40	1.61	72.2	77.7
C108A-IC(1)	C108A	IPEX TEMPEST HF (127mm" ORIFICE)	1.43	1.63	37.5	40.2
C108A-IC(2)	C108A	IPEX TEMPEST HF (127mm" ORIFICE)	1.43	1.63	37.5	40.2
C108B-IC	C108B	IPEX TEMPEST HF (102mm" ORIFICE)	1.60	1.73	25.8	26.8
C109A-IC(1)	C109A	IPEX TEMPEST HF (152mm" ORIFICE)	1.34	1.62	51.6	57.2
C109A-IC(2)	C109A	IPEX TEMPEST HF (152mm" ORIFICE)	1.34	1.62	51.6	57.2
C110A-IC(1)	C110A	IPEX TEMPEST HF (127mm" ORIFICE)	1.41	1.55	37.2	39.1
C110A-IC(2)	C110A	IPEX TEMPEST HF (127mm" ORIFICE)	1.41	1.55	37.2	39.1

Orifice Name	Tributary Area ID	ICD Type	5yr Head (m)	100yr Head (m)	5yr Flow (L/s)	100yr Flow (L/s)
C150B-IC	C150B	IPEXLMF105	2.64	2.77	15.9	16.3
C153A-IC	C153A	IPEXLMF105	1.55	1.65	12.2	12.6
C156A-IC	C156A	IPEXLMF75	0.68	1.74	4.1	6.6
C158A-IC	C158A	IPEXLMF105	1.02	1.62	9.9	12.5
C158B-IC	C158B	IPEXLMF105	1.54	1.67	12.2	12.7
C155B-IC	C155B	IPEXLMF105	1.01	1.71	9.8	12.8
C154C-IC	C154C	IPEXLMF105	1.04	1.71	10.0	12.7
C154D-IC	C154D	IPEXLMF105	1.04	1.67	10.0	12.7

4.7.2 Proposed Development Hydraulic Grade Line Analysis

Table 20 summarizes the worst case HGL results in the development during the 100-year storm event and the 'climate change' scenario required by the City of Ottawa Sewer Design Guidelines (2012), where 100-year intensities are increased by 20%.

Table 20: Proposed Condition Hydraulic Grade Line Results

MH ID	USF (m)	100-Year HGL					100-Year + 20% HGL	
		3-hr Chicago HGL (m)	24-hr SCS HGL (m)	12-hr SCS HGL (m)	Worst Case 100YR HGL (m)	USF – HGL Clearance (m)	Worst Case 100YR+20% HGL (m)	USF –HGL Clearance (m)
100	N/A	136.28	136.26	136.27	136.28	-	136.30	-
101	N/A	136.29	136.27	136.28	136.29	-	136.31	-
102	137.33	136.55	136.53	136.53	136.55	0.78	136.58	0.75
103	137.31	136.60	136.57	136.58	136.60	0.71	136.63	0.68
104	137.31	136.65	136.63	136.63	136.65	0.66	136.68	0.63
105	137.41	136.73	136.71	136.71	136.73	0.68	136.77	0.64
106	137.62	136.89	136.86	136.86	136.89	0.73	136.94	0.68
107	137.62	137.07	137.05	137.04	137.07	0.55	137.14	0.48
+24.6m	138.46	137.79	137.78	137.78	137.79	0.67	137.79	0.67
+39.7m	138.75	137.97	137.96	137.96	137.97	0.78	137.97	0.78
116	139.09	138.16	138.15	138.15	138.16	0.93	138.16	0.93
108	137.96	137.32	137.28	137.27	137.32	0.64	137.40	0.56
109	137.96	137.41	137.36	137.34	137.41	0.55	137.49	0.47
110	138.97	137.49	137.41	137.39	137.49	1.48	137.58	1.39
+15.9m	139.16	137.54	137.46	137.44	137.54	1.62	137.65	1.51
111	139.15	137.58	137.50	137.48	137.58	1.57	137.71	1.44

Avenue, while runoff from area C111AB will be conveyed through a proposed swale to an existing ditch that ultimately discharges into Lake Avenue. The following table compares the existing and post development peak flows to Lake Avenue from the site area.

Table 23: Post to Pre-Development Site Discharges to Lake Avenue

Storm Event	Existing Peak Flows to Lake Avenue (m^3/s)	Post Development Peak Flows to Lake Avenue (m^3/s)
2yr - 3hr Chicago	0.069	0.030
5yr - 3hr Chicago	0.195	0.073
100yr - 3hr Chicago	0.725	0.273

1. The above pre to post development peak flow comparison does not include existing runoff from the adjacent track field area since that area drains towards Lake Avenue both under existing and proposed conditions.

4.8 LOW IMPACT DEVELOPMENT CONSIDERATIONS

The Town recommends Low Impact Development (LID) measures be implemented across the proposed development to further enhance water quality of runoff and to reduce post development volume of runoff where feasible. LID is a stormwater management strategy that seeks to mitigate the impacts of increased runoff and stormwater pollution by managing runoff as close to its source as possible. These low impact development practices include green roofs, bioretention, permeable pavement, soakaways, perforated pipe systems, enhanced grassed swales, dry swales and rainwater harvesting.

Stormwater Management Guidelines from the MECP recommend the use of a "treatment train" approach to reduce the impacts of stormwater runoff. A treatment train approach is a combination of lot level, conveyance, and end-of-pipe stormwater management practices. At a lot level, the proposed development is designed to direct roof runoff to grassed areas, while an end-of-pipe stormwater management wet pond is proposed to provide quantity and quality control of storm runoff prior to discharging into the Mississippi River.

The ultimate goal of LID is to maintain natural hydrologic conditions, including minimizing the volume of runoff produced at the site. Runoff reduction is defined as the total runoff volume reduced through urban tree canopy interception, evaporation, rainwater harvesting, and engineered infiltration and evapotranspiration stormwater best management practices. **Table 24** was taken from the Credit Valley Conservation Low Impact Development Stormwater Management Planning and Design Guide (CVC, 2010, Table 3.4.1) and shows a comparison of site constraints for a range of structural LID SWM practices.

Appendix E Geotechnical Investigation

Bodnar Lands Subdivision, Carleton Place - Servicing and Stormwater Management Report

Job #160401129

Prepared for:
1384341 Ontario Inc.

Prepared by:
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April 12, 2021

Revision	Description	Prepared by		Checked by
0	Site Servicing and Stormwater Management Report	Ana Paerez	November 12, 2018	Kris Kilborn
1	Site Servicing and Stormwater Management Report	Ana Paerez	February 3, 2020	Kris Kilborn
2	Site Servicing and Stormwater Management Report	Ana Paerez	August 7, 2020	Kris Kilborn
3	Site Servicing and Stormwater Management Report	Ana Paerez	December 11, 2020	Kris Kilborn
4	Site Servicing and Stormwater Management Report	Ana Paerez	April 12, 2021	Kris Kilborn

5.0 GEOTECHNICAL CONSIDERATIONS

A preliminary geotechnical investigation was completed by Houle Chevrier Engineering Ltd. in October of 2014. The report summarizes the existing soil conditions within the subject area and provides construction recommendations. For details which are not summarized below, please see the original Houle Chevrier report.

Subsurface soil conditions within the subject area were determined from 17 test pits distributed across Bodnar Lands subdivision. In general soil stratigraphy consisted of a topsoil layer followed by a silty sand and/or a sandy silt overlaying a grey brown glacial till. Based on available geological mapping of the area, bedrock was anticipated at between ground elevation and 1.9 m depth.

No groundwater seepage occurred in the test pits during the short time observed after excavation. Groundwater inflow levels may vary depending on seasonal changes.

The required pavement structure for the local roadways is outlined in **Table 31** below.

Table 32: Pavement Structure – Local Roadways

Thickness (mm)	Material Description
40	Superpave 12.5
40	Superpave 19.0 AC
150	OPSS Granular 'A' base
400	OPSS Granular 'B' Type II

The site as per the Houle Chevrier Geotechnical Investigation does not have any grade raise restrictions for the proposed development.

5.1 SUPPLEMENTARY GEOTECHNICAL INVESTIGATION

A supplementary geotechnical investigation was recently completed by Gemtec Consulting Engineers and Scientists Limited (GEMTEC) to provide subsurface information in the area of the SWM Pond and the pump station and to determine the hydraulic conductivity of the native soil. Excerpts from the geotechnical investigations are included in **Appendix D**.

The supplemental test pit investigation was carried out on October 5, 2018, at which time seven (7) test pits, numbered 18-1 to 18-7, inclusive, were advanced at the site using a rubber tired backhoe supplied and operated by Thomas Cavanagh Construction Ltd. (Cavanagh).

GEMTEC completed field infiltration tests (Guelph Permeametre testing) at three (3) locations, GP18-1 to GP18-3, in order to estimate infiltration rates at the subject site. The soils conditions above the depth of infiltration testing consist of brown silty clay, trace sand with organic material (topsoil).

Infiltration testing was completed at GP18-1; however, due to the presence of low permeability soils and/or high groundwater table, hydraulic conductivity estimates could not be calculated (steady state not achieved). Similarly, infiltration testing could not be completed at GP18-2 due to high groundwater table (0.25 metres below ground surface). Based on the fact that ponded water was observed after approximately 14 mm of precipitation (Appleton Weather Station; climate.weather.gc.ca) on October 8, 2018, it is considered that the subject site may have limited infiltration due to low permeability soils, perched groundwater above the bedrock or increased groundwater levels in the bedrock.

The calculated saturated field hydraulic conductivity for GP18-3 is 2 x 10^{-4} cm/s. The corresponding estimated infiltration rates, based on K_{fs}, is 54 mm/hour. Infiltration rates were also estimated based on grain size analysis and soil texture classification for the guelph permeameter hand auger holes (GP18-1 to GP18-3) as well as the test pit samples (TP 18-5 and 18-6). Using the Hazen Method, infiltration rates based on grain size distribution testing for the hand auger samples and test pit samples are 32 mm/hour and 26 mm/hour, respectively. It is noted that infiltration rates could not be measured for GP18-1 and TP18-6 due to the high percentage of clay in the soil. The infiltration rates based on the soil texture classification for the hand auger samples and test pit samples for these areas range from 0.5 to 25.9 mm/hour.

The estimated infiltration rates do not include a design safety factor, which typically ranges from 1 to 8.5. The safety correction factor depends on the ratio of mean measured infiltration rates (geometric mean measured infiltration rate at the proposed bottom elevation divided by the geometric mean infiltration rate of the least permeable soil horizon within 1.5 metres below the proposed bottom elevation).

Practical refusal to further advancement of the test pits by the backhoe excavator occurred in all the supplemental test pits at depths ranging from 0.3 to 1.4 metres below ground surface (elevations 135.0 to 143.4 metres, geodetic datum).

No groundwater seepage into the open test pits was observed upon completion of excavating. Groundwater was noted to be perched on the bedrock in test pits 18-3, 18-5 and 18-6. It should be noted that the groundwater conditions were only observed during the relatively short period of time that the test pits were left open following excavation. The groundwater levels are expected to vary seasonally and may be higher during wet periods of the year such as the early spring or following periods of precipitation, particularly within the silty sand /sandy silt deposits.

The subsurface conditions in the area of the proposed pond generally consist of topsoil overlying silty sand or glacial till. At test pits 18-6 and 18-7, the bedrock was encountered at 1.4 and 0.3

metres below ground surface (elevations 135.0 to 136.2 metres, geodetic), respectively. Groundwater was perched on the bedrock in test pit 18-6.

The following three (3) liner alternatives can be considered for the proposed SWM pond:

- Compacted Clay Liner (Alternative 1);
- Geosynthetic Clay Liner (Alternative 2); and,
- Combined Geosynthetic Clay Liner and Compacted Clay Liner (Alternative 3).

The proposed SWM pond will include a compacted clay liner (CCL) with the following specifications.

- The storm water management pond liner will consist of a 750 mm thick compacted clay liner (CCL).
- To reduce the potential for desiccation, the CCL should be covered with a protective layer immediately following construction. The protective layer will consist of about 300 mm, minimum, of sand and gravel. The protective layer could be increased to about 450 mm, minimum, around the water level to account for fluctuations in the water level and wave action.
- The CCL should be placed on a prepared foundation/subgrade. The CCL should not be placed directly on the bedrock.
- The CCL should be compacted in 150 mm to 200 mm thick lifts to at least 95% of the Standard Proctor dry density.
- Full time compaction testing will be required during construction of the CCL.

Appendix F Drawings