2370 Tenth Line Road – Site Servicing and Stormwater Management Report

Project #160401710

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Prepared for:

Mattamy (Decoeur) Ltd.

Prepared by:

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0	Site Servicing and SWM Report	A. Shobowale D. Wu	Dec 13 2021	D. Thiffault	K. Smadella
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2	Update based on modified site design	Michael Wu	Dec. 02 2022	D. Thiffault	K. Smadella

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1.0 INTRODUCTION

Mattamy (Decoeur) Ltd. has commissioned Stantec Consulting Ltd. to prepare the following Servicing and Stormwater Management Report for their development site at 2370 Tenth Line Road located within the Avalon West area of the community of Orleans in the City of Ottawa.

The development site is zoned General Mixed-Use GM [950] and measures 3.19 ha in area. The site is bordered by Brian Coburn Boulevard East to the north, Decoeur Drive to the south, Tenth Line Road to the east and a 0.47 ha parcel that is being conveyed to the City for parkland to the west. The site location is outlined in **Figure 1.1**.

The proposed mixed-use development consists of 3 mixed-use blocks, 12 blocks of stacked townhomes, private streets, parking areas and amenity space. The objective of this report is to provide a servicing scenario for the site that is free of conflicts, provides on-site servicing in accordance with City of Ottawa design guidelines, and utilizes the existing local infrastructure in accordance with the various background studies, specifically the East Urban Community (Neighborhood 5), Avalon West – Stage 3 Site Servicing and Stormwater Management Report, prepared by Atrel Engineering, November 2014, as outlined in **Section 2.0**.

Figure 1.1: Site Location

2.0 REFERENCES

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

- East Urban Community (Neighborhood 5) Avalon West – Stage 3 Site Servicing and Stormwater Management Report, Atrel Engineering Ltd., November 2014 (Revision 7)
- Geotechnical Investigation – Proposed Mixed-Use Development – Tenth Line Road and Decoeur Drive, Ottawa Ontario. Paterson Group Inc., August 20, 2021
- City of Ottawa Design Guidelines – Water Distribution, Infrastructure Services Department, City of Ottawa, First Edition, July 2010, and all subsequent Technical Bulletins
- City of Ottawa Sewer Design Guidelines, 2nd Ed., City of Ottawa, October 2012, and all subsequent Technical Bulletins
- Water Supply for Public Fire Protection, Fire Underwriters Survey (FUS), 2020
- Ontario Building Code 2012

3.0 POTABLE WATER

3.1 BACKGROUND

The site at 2370 Tenth Line Road is within the City of Ottawa's 2E pressure zone regulated by the Innes Road Elevated Tank. 300 mm diameter municipal watermains run along the frontage of the site within Brian Coburn Boulevard and Decoeur Drive. A 200 mm municipal watermain is located within Tenth Line Road along the site frontage. The surrounding water distribution system provides opportunity for looping through the site, sufficient fire flow and pressure.

3.2 WATER DEMANDS

3.2.1 Domestic Water Demands

Water demands for the proposed site were estimated using the City of Ottawa Design Guidelines – Water Distribution (July 2010) and ISTB 2021-03 Technical Bulletin. The populations were estimated using an occupancy of 2.1 persons per unit for a one-bedroom unit with den and two-bedroom apartment, 3.1 persons per unit for a two-bedroom unit with den, and 2.7 persons per unit for each townhouse. The proposed site was estimated to have a total projected population of 577 persons.

To estimate the average daily (AVDY) potable water demands for the site, a daily rate of 280 L/cap/day was applied for the residential units and 28,000 L/ha/day for the commercial areas. The maximum daily demands (MXDY) were determined by multiplying the AVDY demands by a factor of 2.5 for residential areas and 1.5 for commercial areas. The peak hour demands (PKHR) were determined by multiplying the MXDY demands by a factor of 2.2 for residential areas and by 1.8 for commercial areas (see **Appendix A.2**). The estimated demands are summarized in **Table 3-1**.

Table 3-1: Estimated Water Demands

Block	Commercial Area (m^2)	Population	ABDY (L/s)	MXDY (L/s)	PKHR (L/s)
A	899	63 persons	0.23	0.58	1.28
B	899	63 persons	0.23	0.58	1.28
C	899	63 persons	0.23	0.58	1.28
Town	-	389 persons	1.26	3.15	6.93
Total	**2697.1**	**577 persons**	**1.96**	**4.89**	**10.77**

3.2.2 Fire Flow Requirements

Wood frame construction was considered in the assessment for fire flow requirements according to the FUS Guidelines. The FUS Guidelines indicate that low hazard occupancies include apartments, dwellings, dormitories, hotels, and schools, and as such, a low hazard occupancy / limited combustible building contents credit was applied. Based on calculations per the FUS Guidelines (**Appendix A.3**), the worst case required fire flows for this site occur at Block A with a required fire flows of 15,000 L/min (250.0 L/s).

3.2.3 Boundary Conditions

Boundary conditions were provided for the site development by the City of Ottawa. These are included in **Appendix A.1** and summarized in **Table 3-2**.

Table 3-2: Hydraulic Analysis Existing Boundary Conditions

Connection	Maximum HGL (m)	Peak Hour HGL (m)	Max. Day plus Fire HGL (m) 267 L/s (16,000 L/min)	Ground Elevation (m)
Brian Coburn Boulevard (Connection #1)	130.3	125.9	124.1	88.3
Decoeur Drive (Connection #2)	130.3	125.8	124.1	87.4

3.3 PROPOSED WATERMAIN SIZING AND LAYOUT

The proposed development will consist of 144 stacked townhome units, 84 apartments and 2690.76 m^2 of commercial space contained within 12 stacked townhome blocks and 3 mixed use 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 300 mm municipal watermains within Brian Coburn Boulevard and Decoeur Drive. A district metering chamber will be installed over the property line valve water at the Decoeur Drive connection in accordance with the Water Distribution Guidelines to facilitate leak detection within the private site by the City of Ottawa (see **Drawing SSP-1)**.

The stacked townhome blocks will be provided with water service connections to each unit. The mixed-use buildings will be provided with an individual service. Each service will be individually metered.

Private hydrants will be installed within the site in proximity to the fire department connections on the mixed use buildings and to the front entrances to each of the stacked townhomes. Hydrants have been sited to meet Ontario Building Code requirements and City of Ottawa design guidelines.

3.4 HYDRAULIC ASSESSMENT

Level of Service

The City of Ottawa Water Distribution Design Guidelines state that the desired range of system pressures under normal demand conditions (i.e. basic day, maximum day and peak hour) should be in the range of 350 to 480 kPa (50 to 70 psi) and no less than 275 kPa (40 psi) at the ground elevation on the streets (i.e. at hydrant level). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way is 552 kPa (80 psi). As per the Ontario Building Code (OBC) & Guide for

Plumbing, if pressures greater than 552 kPa (80 psi) are anticipated, pressure relief measures are required. The maximum pressure at any point in the distribution system in unoccupied areas shall not exceed 689 kPa (100 psi). Under emergency fire flow conditions, the minimum pressure objective in the distribution system is 138 kPa (20 psi).

Model Development

The proposed watermains within the 2370 Tenth Line Road Development were modeled in a H2OMAP hydraulic model to simulate the proposed distribution system. Hazen-Williams coefficients ("C-Factors") were applied to the new watermain in accordance with the City of Ottawa's Water Distribution Design Guidelines and as shown in **Table 3-3** below.

Table 3-3: Proposed Watermain C-Factors

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

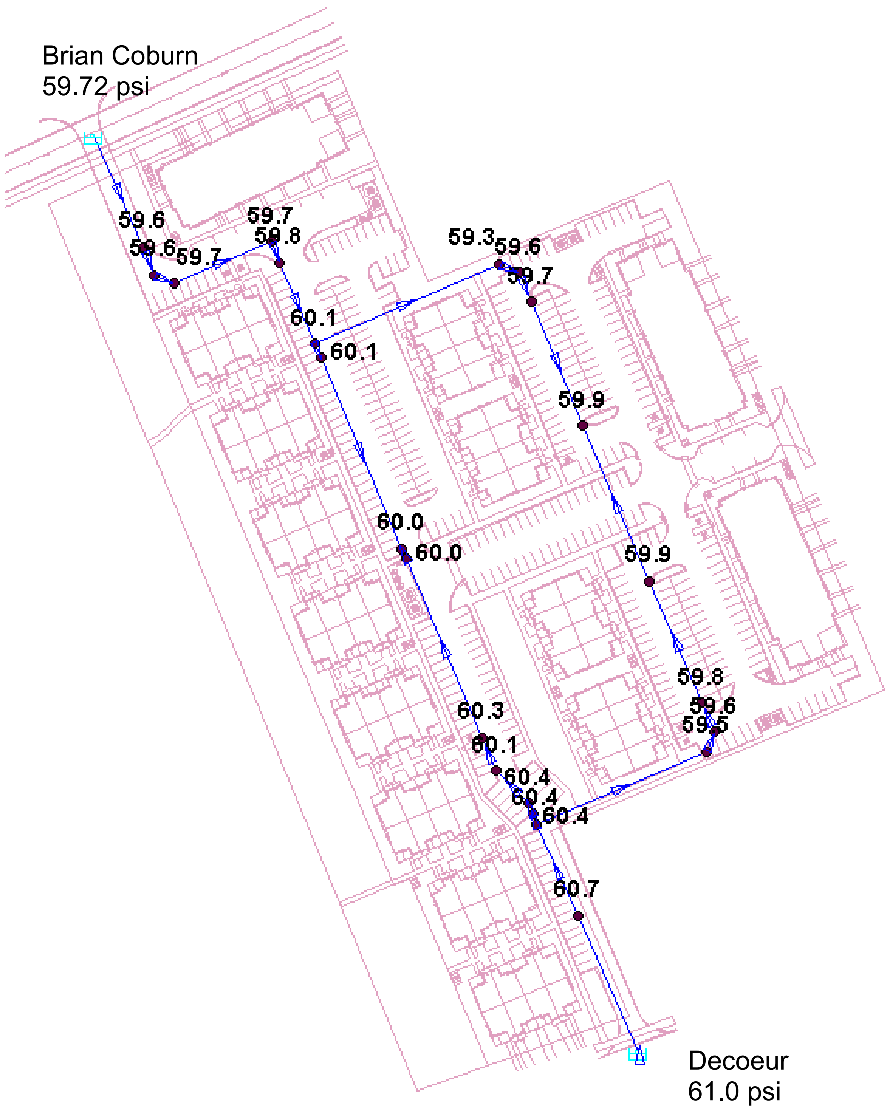
3.5 HYDRAULIC MODEL RESULTS

The H2OMAP model was used to simulate the proposed water demand scenarios based on boundary conditions provided by the City of Ottawa. Specifically, the boundary conditions from the 300 mm diameter watermains along Decoeur Drive and Brian Coburn Boulevard were applied for all three scenarios. The model was tested under average day, peak hour, and maximum day plus fire flow conditions (see **Appendix A.4** for the results).

3.5.1 Average Day Demand (AVDY)

The hydraulic modeling results indicate that under the average day demands, the pressure in the proposed watermain ranges from 409.1 kPa to 418.6 kPa (59.33 psi to 60.72 psi). These pressures are within the serviceable limit of 276 kPa to 552 kPa (40 psi to 80 psi) as specified in the City of Ottawa Design Guidelines – Water Distribution. Results are shown in **Figure 3.1** below.

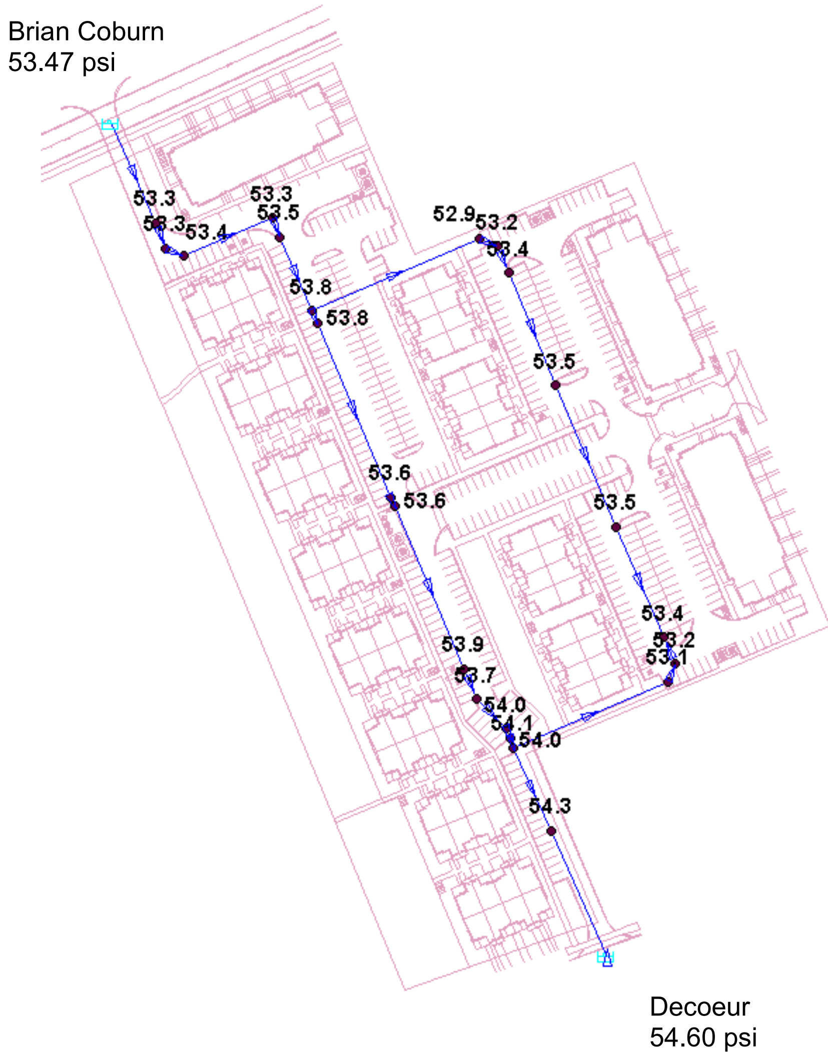
Figure 3.1: AVDY Pressure Results (psi)



3.5.2 Peak Hour Demand (PKHR)

The hydraulic modeling results indicate that under peak hour demands, the pressure in the proposed watermain ranges from 365.0 kPa to 374.5 kPa (52.94 psi to 54.32 psi). These pressures are within the serviceable limit of 276 kPa to 552 kPa (40 psi to 80 psi) as specified in the City of Ottawa Design Guidelines – Water Distribution. Results are shown in **Figure 3.2** below.

Figure 3.2: PKHR Pressure Results (psi)

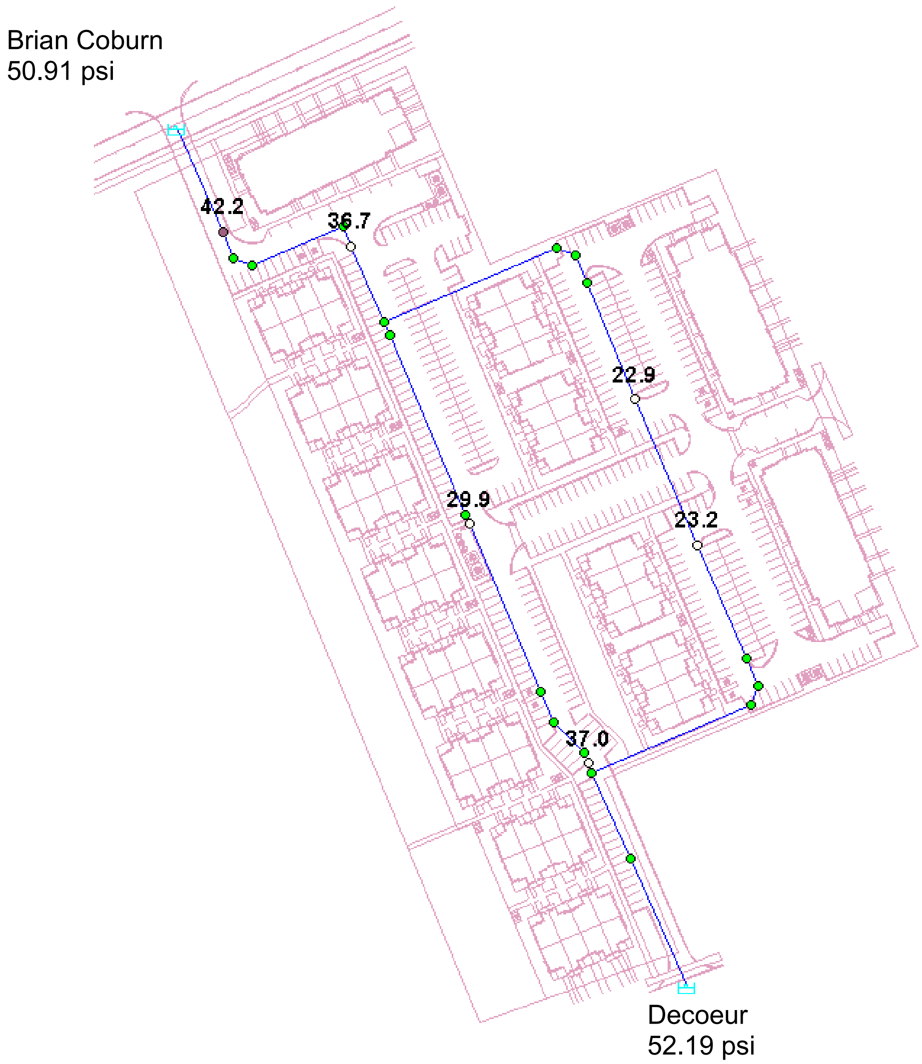


3.5.3 Maximum Day Demand + Fire Flow (MXDY + FF)

The hydraulic model was also used to assess whether the proposed watermains could provide the maximum day and fire flow demands to the proposed development while maintaining a residual pressure of 138 kPa (20 psi), 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 3.3 illustrates that the proposed watermain can deliver flows in excess of 15,000 L/min (250.0 L/s) while maintain the required residual pressure of 138 kPa (20 psi).

Figure 3.3: Fire Flow Results – Residual Pressure (psi)



3.6 CONCLUSION

In conclusion, based on the boundary conditions provided by the City of Ottawa and the conducted hydraulic analysis, the water distribution systems can provide adequate flow and pressure to satisfy the needs of the development per the Fire Underwriters Survey calculation method while respecting the City of Ottawa design guidelines. The proposed water servicing layout will meet domestic demands of the site.

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

Municipal sanitary sewers run along the boundaries of the site within Brian Coburn Boulevard, Tenth Line Road and Decoeur Drive. The development site at 2370 Tenth Line Road will be serviced with a connection to the 250 mm sanitary sewer within Decoeur Drive as per the Avalon West – Stage 3 Site Servicing and Stormwater Management Report, prepared by Atrel Engineering, November 2014. The Avalon West – Stage 3 sanitary collection system is directed to the Tenth Line Road Pumping Station at 2428 Tenth Line Road.

4.2 DESIGN CRITERIA

As outlined in the City's Sewer Design Guidelines, the following design parameters were used to calculate estimated wastewater flow rates and to size on-site sanitary sewers for the proposed phase of the development:

- Minimum Full Flow Velocity – 0.6 m/s
- Maximum Full Flow Velocity – 3.0 m/s
- Manning's roughness coefficient for all smooth walled pipes – 0.013
- Population Persons per unit – 1.4 to 3.1
- Extraneous Flow Allowance – 0.33 L/s/ha
- Residential Average Flows – 280 L/cap/day
- Manhole Spacing – 120 m
- Minimum Cover – 2.5 m

4.3 PROPOSED SERVICING

The proposed development at 2370 Tenth Line Road will consist of 144 stacked townhome units, 84 apartments and 2690.76 m^2 of commercial space contained within 12 stacked townhome blocks and 3 mixed use blocks. The proposed development is consistent with the approved zoning for the site. As shown on **Drawing SA-1**, the development will be serviced by a network of 200 mm and 250 mm diameter sanitary sewers discharging to the existing 250 mm sanitary sewer within Decoeur Drive.

Peak design flow from the site is calculated to be 7.5 L/s. The sanitary design sheet has been included in **Appendix B.1.**

The Avalon West-Stage 3 servicing report assumed that the land that encompasses 2322 Tenth Line Road, 2370 Tenth Line Road and 885 Decoeur Drive would be developed with a commercial use. The peak sanitary design flow assigned to the commercial block was 5.6 L/s as per the sanitary design sheet and sanitary drainage area plan included in **Appendix B.2**. Although the design flows for the proposed mixed-use development on 2370 Tenth Line Road will be slightly higher than assumed in the Avalon West–Stage 3 report, the difference is considered negligible given that the City of Ottawa design criteria for sanitary flows applied to the entire drainage area in design Stage 3 report were considerably more conservative than the current City design criteria.

Full port backwater valves are to be installed on all sanitary services within the site to prevent any surcharge from the downstream sewer main from impacting the proposed property.

5.0 STORMWATER MANAGEMENT

5.1 OBJECTIVES

The goal of this servicing and stormwater management (SWM) plan is to determine the measures necessary to control the quantity and quality of stormwater released from the proposed development to meet the criteria established during the consultation process with City of Ottawa, and to provide sufficient details required for approval and construction.

5.2 EXISTING CONDITIONS AND SWM CRITERIA

The development site at 2370 Tenth Line Road is 3.19 ha in area and is currently vacant. The site is bounded by municipal roadways on the north, south and east sides. The western limit of the development is bounded by a residential subdivision and school. Stormwater generated on the site is subject to the requirements outlined in the Avalon West – Stage 3 Site Servicing and Stormwater Management Report, prepared by Atrel Engineering, November 2014 and design criteria provided by the City of Ottawa as part of the pre-application consultation June 2021. Design criteria are summarized below:

i. Post-development peak flows up to 100-year event are to be controlled to a release rate of 220 L/s/ha. Excess stormwater is to be detained on-site.
ii. The 5-yr storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.
iii. Emergency major overland flows are to be directed to the adjacent municipal ROWs.
iv. Time of concentration (Tc) are for pre-development, with a maximum of 10 min

Other criteria considered in the SWM design are described in Section 5 of the Ottawa Sewer Design Guidelines (October 2012) including all subsequent technical bulletins.

The post-development peak flows up to the 100-year storm event must be controlled to **702.02 L/s**, given the allowable release rate of 220 L/s/ha, and the total site area of 3.19 ha.

5.3 STORMWATER MANAGEMENT DESIGN

As specified in the Avalon West - Stage 3 report, minor system flows from the site are to be directed to Decoeur Drive. Excerpts form the Atrel report are include in **Appendix C.3**. The proposed 3.19 ha development area will be serviced by a new storm sewer connection to the existing 1200 mm diameter concrete storm sewer flowing east to west on Decoeur Drive, as shown on **Drawing SD-1** in **Appendix E**.

Catch basins for the parking areas, all of which are tributary to the private stormwater collection system, will be equipped with inlet control devices (ICDs) to provide surface storage. Rooftop storage is provided for all three mixed-use buildings. The private stormwater system collects flows in a main branch underneath the westernmost parking areas and ultimately outlets to the existing 1200 mm diameter concrete storm sewer on Decoeur Drive (see **Drawing SD-1** in **Appendix E)**.

The site will have four uncontrolled areas that will sheet drain to Brian Coburn Boulevard to the north, Tenth Line Road to the east, and Decoeur Drive to the south. The proposed site plan, drainage areas and proposed storm sewer infrastructure are shown on **Drawing SD-1 and SSP-1.**

5.3.1 Water Quantity Control

The Modified Rational Method (MRM) was used to assess the flow rate and volume of runoff generated under pre-development conditions. The site was subdivided into sub-catchments tributary to separate quantity control measures and subject to different inlet controls. **Drawing SD-1** delineates the appropriate sub-catchment areas. The MRM spreadsheet is included in **Appendix C.1.**

The following assumptions were made in the creation of the storm drainage plan and accompanying MRM spreadsheet:

1) Rooftop storage is available on all three roof catchment areas over the mixed-use buildings.
2) On-site stormwater runoff will be collected using a combination of landscape inlets and catch-basins with ICDs, flows in excess of the allowable release rate with be detained in surface storage areas.
3) Four areas along the northern, eastern, and southern perimeters of the site will respectively sheet drain uncontrolled to Brian Coburn Boulevard, Tenth Line Road, and Decoeur Drive.
4) All captured tributary flows on site will be directed to the 1200 mm diameter concrete storm sewer on Decoeur Drive.

5.3.1.1 Rooftop Storage

Rooftop storage is proposed on each of the three mixed-use buildings on the site (see **Drawing SD-1**).

Rooftop storage will be achieved by installing restricted flow roof drains. The following calculations assume the roof will be equipped with standard Watts Model R1100 Accuflow Roof Drains or approved equivalent, see **Appendix C** for Modified Rational Method design sheet.

Watts Drainage "Accutrol" roof drain weir data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the "Accutrol" weir has been used as an example only, and that other products may be specified for use, provided that the total roof drain release rate is restricted to match the maximum rate of release indicated in **Table 5.1**, and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater.

Table 5-1: Roof Control Area

ROOF ID	Accutrol Weir setting	# of Drains	5-yr Release Rate (L/s)	100 yr Ponding Depth (mm)	100 yr Release (L/s)	100 yr Storage Required (cu.m)	Storage Provided (cu.m)
R104A	25% open	14	10.62	128.2	12.28	25.28	40.0
R107A	25% open	14	10.62	128.2	12.28	25.28	40.0
R107B	25% open	14	10.62	128.2	12.28	25.28	40.0

5.3.1.2 Parking Lots

The private parking lots on the development are each equipped with proposed catchbasins with inlet control devices (ICD) to restrict minor system peak flows to 220 L/s/ha in the 100-year storm event. Ponding depths of up to 0.30 m provide surface storage during the 100-year storm event, and the ICD sizes were choosen to eliminate surface ponding in a 2-year storm event. **Table 5.2** below shows the characteristics of the proposed ICDs (see **Appendix C.1** for detailed calculations).

Table 5-2: Schedule of Inlet Control Devices at Controlled Tributary Areas

Catch Basin ID	Tributary Area ID	ICD Type	5 yr Head (m)	100 yr Head (m)	5 yr Release (L/s)	100 yr Release (L/s)
CB 101A-1	L101A	178 mm HF Orifice	1.23	1.68	69.79	81.43
CB 103A-1	L103A	178 mm HF Orifice	1.53	1.68	77.99	81.72
CB 104A-1	L104A	178 mm HF Orifice	1.53	1.68	77.99	81.72
CB 104B-1	L104B	178 mm HF Orifice	1.53	1.68	77.99	81.72
CB 105A-1	L105A	152 mm HF Orifice	0.28	1.53	24.52	56.87
CB 106A-1	L106A	127 mm HF Orifice	1.53	1.63	39.70	40.98
CB 108A-1	L108A	178 mm HF Orifice	1.53	1.68	77.99	81.72
CB 109A-1	L109A	178 mm HF Orifice	1.53	1.68	77.99	81.72

Given variable release rates by Vortex LMF ICDs, the 5-year storage and flow values are represented by the maximum permissible release rates/storage volumes as a conservative calculation.

5.3.1.3 Uncontrolled Areas

Four uncontrolled areas cannot be graded to enter the site storm sewer system and as such, they will sheet drain to Brian Coburn Boulevard to the north, Tenth Line Road to the east, the proposed City parkland to the west, and Decoeur Drive to the south as per existing conditions (see **Drawing EX-1** and **Drawing SD-1**).

Table 5-3 Peak Uncontrolled 5- and 100- Year run-off

Area IDs	Area (ha)	Runoff 'C' (5- Year)	5 Year uncontrolled peak flow (L/s)	Runoff 'C' (100 -Year)	100 Year uncontrolled peak flow (L/s)
UNC-1	0.05	0.32	4.33	0.40	9.27
UNC-2	0.09	0.20	5.21	0.25	11.17
UNC-3	0.06	0.68	11.82	0.85	25.32
UNC-4	0.10	0.40	10.74	0.50	23.00

As summarized in **Table 5-3** above, UNC-2 will have 11.17 L/s of uncontrolled flow that will discharge into the proposed City Park to the west under the 100-year storm event. This flow rate is insignificant and will be spread over the entire 235 metre-length of the drainage area.

5.3.2 Results

Tables 5-4 and 5-5 demonstrate that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflow for the site.

Table 5-4: Post-Development Discharge (5-Year)

Area Type	$Q_{release}$ (L/s)	Target (L/s)
Rooftop Storage	31.86	**702.02**
Controlled Tributary	523.96	
Uncontrolled	32.10	
Total	**587.91**	

Table 5-5: Post-Development Discharge (100-Year)

Area Type	$Q_{release}$ (L/s)	Target (L/s)
Rooftop Storage	36.84	**702.02**
Controlled Tributary	587.89	
Uncontrolled	68.76	
Total	**693.49**	

5.3.3 Water Quality Control

The 2370 Tenth Line Road development site falls within the Eastern Trunk watershed, which conveys its runoff to the Neighbourhood 5 Stormwater Management Pond. The pond will provide enhanced water quality control (80 % TSS removal) for the upstream development and further attenuate stormwater flows prior to discharge to McKinnon's Creek.

Relevant excepts from the Avalon West – Stage 3 Site Servicing and Stormwater Management Report, are included in **Appendix C.3**.

6.0 GRADING

The development site measures 3.19 ha in area. The existing topography is relatively flat with no significant grade change across the site. The objective of the grading design strategy is to satisfy the stormwater management requirements, adhere to permissible grade raise restrictions (see **Section 10.0**), and provide for minimum cover requirements for sewers. The grading plan has been provided for reference in **Appendix E**.

The grading design meets City of Ottawa guidelines for minimum and maximum slopes, meets the requirements of the private approach bylaw, provides sags for stormwater storage to meet allowable runoff criteria and provides an emergency overland flow outlet to Decoeur Drive (see **Drawing GP-1**).

7.0 UTILITIES

As the subject site lies within residential development community, Hydro One, Bell, Enbridge Gas and Rogers servicing for the proposed site is expected to be readily available within the surrounding municipal roadways. The exact size, location and routing of electrical, gas and telecommunication utilities will be finalized following the site plan servicing design circulation. Mattamy (Decoeur) Ltd intends to service the site with geothermal heating and cooling.

8.0 APPROVALS

The development is expected to be exempt from the requirement for an Ontario Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA), under the Ontario Water Resources Act.

An MECP Permit to Take Water (PTTW) or reporting on the Environmental Activity and Sector Registry (EASR) may be required for the site as some of the proposed works may be below the groundwater elevation shown in the geotechnical report. The geotechnical consultant shall determine whether a PTTW or EASR reporting is required prior to construction.

9.0 EROSION CONTROL

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

Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).

1. Limit extent of exposed soils at any given time.
2. Re-vegetate exposed areas as soon as possible.
3. Minimize the area to be cleared and grubbed.
4. Protect exposed slopes with plastic or synthetic mulches.
5. Provide sediment traps and basins during dewatering.
6. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
7. Plan construction at proper time to avoid flooding.

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

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

Refer to Erosion and Sediment Control Plan included in **Appendix E** for the proposed location of silt fences, cutoff swales, temporary sediment basins and other erosion control structures.

10.0 GEOTECHNICAL INVESTIGATION

A geotechnical investigation for the proposed development was completed by Paterson Group Inc. on August 20, 2021. The field testing consisted of advancing a total of four (4) test holes to a maximum depth of 6.6 m below existing ground surface across the site in addition to the previous investigation completed in 2005 with a borehole advancement to 20 m below existing grade. For details which are not summarized below, please see the original Paterson report included in **Appendix D**.

The subject site is bare agricultural land with approximate geodetic elevation of 87.5 m to 88.5 m. The subsurface profile encountered at the test hole consists of topsoil/fill which is underlain by silty clay. The silty clay was encountered below the topsoil/fill across all test locations and it consisted of weathered silty clay crust followed by firm grey silty clay which was tested, and the values show stiff to very stiff consistency within both profiles. It is shown that the bedrock based on geological mapping of the subject area consists of interbedded limestone and shale of the Lindsay formation, within an overburden drift thickness of 25 m to 50 m depth.

Based on field observation (color and consistency of recovered soil samples) over the current investigation on August 11, 2021, the long-term groundwater table is expected to be at depths of 2 m to 3 m below ground surface although subject to seasonal fluctuations and may vary at time of construction.

Based on the observed soil conditions, a grade raise restriction of between 1.4 m and 2.0 m above existing grade was recommended for housing / roadways. Areas where grades are expected to exceed the maximum permissible grade raise will be subject to either a pre-loading/surcharge program, or lightweight fill and/or other approved means outside of proposed rights-of-way to reduce the risks of unacceptable long-term post construction differential settlements.

According to the geotechnical investigation, the site is considered satisfactory for the proposed development from a geotechnical perspective. It is recommended that the foundation be conventional style shallow foundation placed on an undisturbed, very stiff to stiff brown silty clay, firm grey silty clay or engineered fill placed over one of the above noted bearing surfaces.

It is advised that due to the presence of sensitive silty clay layer, the proposed development will be subject to grade raise restrictions but if a higher permissible grade raise is required, preloading with or without surcharge, lightweight fill and/or other measures should be investigated to minimize risks of unacceptable long-term post construction and differential settlements.

11.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the preceding information, the following conclusions are summarized below:

11.1 POTABLE WATER ANALYSIS

The existing water distribution has sufficient flow and pressure to service the development. Also, pressure across the distribution system meets the pressure range as per City of Ottawa standards under typical demand conditions (peak hour and average day conditions).

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 pressure requirements as per City of Ottawa standards.

11.2 WASTEWATER SERVICING

2370 Tenth Line will be serviced by a network of gravity sewers which will direct wastewater flows to the Decoeur Drive. Although peak design flows are higher than assumed flows of sanitary section of the Avalon Stage 3 design report, the increase in flow from the site from the assumptions made as part of the subdivision design are considered negligible. The receiving sewer system 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

The Modified Rational Method was used to estimate stormwater storage and release from the site. Rooftop storage is available on all three roof catchment areas, and on-site stormwater runoff will be collected using a combination of catch-basins and ICDs, with excess detained as surface storage in the private parking areas. Four areas along the northern, eastern, southern, and western perimeters of the site will respectively sheet drain uncontrolled to Brian Coburn Boulevard, Tenth Line Road, Decoeur Drive, and the adjacent greenspace. All captured tributary flows on site will be directed to the 1200 mm diameter concrete storm sewer flowing east to west on Decoeur Drive. Both the minor system target and major system peak outflow target have been met with the proposed design.

11.4 GRADING

A grading plan has been prepared taking into account required overland flow conveyance, cover over sewers, hydraulic grade line requirements, and grade raise restrictions as identified in the geotechnical investigation.

11.5 UTILITIES

Utility infrastructure exists in the general area of the subject site. Exact size, location and routing of utilities will be finalized at the detailed design stage.

APPENDICES

Appendix A POTABLE WATER ANALYSIS

A.1 BOUNDARY CONDITIONS

Boundary Conditions
2370 Tenthline Road

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	110	1.83
Maximum Daily Demand	272	4.54
Peak Hour	598	9.96
Fire Flow Demand #1	10,000	166.67
Fire Flow Demand #2	16,000	266.67

Location

Results

Connection 1 – Brian Coburn Boulevard

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.3	59.7
Peak Hour	125.9	53.4
Max Day plus Fire 1	126.6	54.5
Max Day plus Fire 2	124.1	50.9

Ground Elevation = 88.3 m

Connection 2 – Decoeur Drive

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.3	60.9
Peak Hour	125.8	54.6
Max Day plus Fire 1	126.6	55.7
Max Day plus Fire 2	124.1	52.2

Ground Elevation = 87.4 m

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

A.2 WATER DEMAND CALCULATIONS

2370 TENTH LINE RD - Domestic Water Demand Estimates
Site Plan provided by Kohn Partnership Architects (Dated 2022-09-09)
Mixed Use Units Breakdown provided by Mattamy (Dated 2022-08-23)
Project No: 160401710

Population densities as per MECP Guidelines:

1 Bedroom + Den	2.1	ppu
2 Bedroom Apartment	2.1	ppu
2 Bedroom + Den	3.1	ppu
Town Home	2.7	ppu

Demand conversion factors as per MECP Guidelines:

Residential	280	L/cap/day
Commercial	28000	L/ha-day

Building ID	Commercial Area (m^2)	1 Bedroom + Den Units	2 Bedroom Units	2 Bedroom + Den Units	Number of Town Homes Units[3]	Population	Daily Rate of Demand (L/c/day) or (L/ha/day)	Avg. Day Demand		Max. Day Demand[1, 2]		Peak Hour Demand[1, 2]	
								(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
BLOCK A	897	22	2	4		63	280	14.0	0.23	34.9	0.58	76.8	1.28
BLOCK B	897	22	2	4		63	280	14.0	0.23	34.9	0.58	76.8	1.28
BLOCK C	897	22	2	4		63	280	14.0	0.23	34.9	0.58	76.8	1.28
BLOCK 1-12 (Residential)					144	389	280	75.6	1.26	189.0	3.15	415.8	6.93
Total:	**2690.8**	**66.0**	**6.0**	**12.0**	**144.0**	**577**		**117.5**	**1.96**	**293.7**	**4.89**	**646.1**	**10.77**

NOTE
1 Average day water demand for Amenity/Commercial Area: 28,000 L/ha/d
2 Water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate
3 Water demand criteria used to estimate peak demand rates for commercial/amenity areas are as follows:
maximum day demand rate = 1.5 x average day demand rate
peak hour demand rate = 1.8 x maximum day demand rate

A.3 FUS CALCULATIONS

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401710
Project Name: 2370 Tenth Line Road Orleans Decoeur
Date: 2022-09-23
Fire Flow Calculation #: 1
Description: Block A

Notes: Mixed-use block with commercial space on ground floor and and residential apartments above. September 9, 2022

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								-	-
		896.92	896.92	896.92						2690.76	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min								-	17000
4	Determine Occupancy Charge	Limited Combustible								-15%	14450
5	Determine Sprinkler Reduction	None								0%	0
		Non-Standard Water Supply or N/A								0%	
		Not Fully Supervised or N/A								0%	
		% Coverage of Sprinkler System								0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall		Firewall / Sprinklered ?	-	-
		North	20.1 to 30	20.06	3	61-80	Type V		NO	6%	867
		East	> 30	10	2	0-20	Type V		NO	0%	
		South	> 30	30	2	41-60	Type V		NO	0%	
		West	> 30	10	2	0-20	Type V		NO	0%	
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 #: 160401710
Project Name: 2370 Tenth Line Road Orleans Decoeur
Date: 2022-09-23
Fire Flow Calculation #: 2
Description: Block 2

Notes: Stacked townhouses

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								-	-
		432.68	432.68	432.68						1298.04	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min								-	12000
4	Determine Occupancy Charge	Limited Combustible								-15%	10200
5	Determine Sprinkler Reduction	None								0%	0
		Non-Standard Water Supply or N/A								0%	
		Not Fully Supervised or N/A								0%	
		% Coverage of Sprinkler System								0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall		Firewall / Sprinklered ?	-	-
		North	20.1 to 30	20.77	3	61-80	Type V		NO	6%	612
		East	> 30	50	12	> 100	Type V		NO	0%	
		South	> 30	30	5	> 100	Type V		NO	0%	
		West	> 30	40	2	61-80	Type V		NO	0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min									11000
		Total Required Fire Flow in L/s									183.3
		Required Duration of Fire Flow (hrs)									2.00
		Required Volume of Fire Flow (m^3)									1320

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401710
Project Name: 2370 Tenth Line Road Orleans Decoeur
Date: 2022-09-23
Fire Flow Calculation #: 3
Description: Block 8

Notes: Stacked townhouses

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								-	-
		432.68	432.68	432.68						1298.04	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min								-	12000
4	Determine Occupancy Charge	Limited Combustible								-15%	10200
5	Determine Sprinkler Reduction	None								0%	0
		Non-Standard Water Supply or N/A								0%	
		Not Fully Supervised or N/A								0%	
		% Coverage of Sprinkler System								0%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall		Firewall / Sprinklered ?	-	-
		North	3.1 to 10	26.97	3	81-100	Type V		NO	19%	3876
		East	> 30	10	1	0-20	Type V		NO	0%	
		South	3.1 to 10	26.97	3	81-100	Type V		NO	19%	
		West	> 30	10	1	0-20	Type V		NO	0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min									14000
		Total Required Fire Flow in L/s									233.3
		Required Duration of Fire Flow (hrs)									3.00
		Required Volume of Fire Flow (m^3)									2520

A.4 HYDRAULIC ANALYSIS

AVDY

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	0	1	52.89	204	110	0.49	0.02
1001	1	2	6	204	110	0.49	0.02
1002	2	3	9.13	204	110	0.49	0.02
1003	3	4	38.4	204	110	0.15	0.00
1004	4	5	48.85	204	110	0.04	0
1005	5	6	38.26	204	110	-0.07	0
1006	6	7	9.47	204	110	-0.41	0.01
1007	7	8	6	204	110	-0.41	0.01
1008	8	9	57.91	204	110	-0.41	0.01
1010	11	12	8.43	204	110	0.91	0.03
1011	12	13	6.02	204	110	0.91	0.03
1012	13	14	30.56	204	110	0.91	0.03
1013	14	15	6.46	204	110	0.68	0.02
1014	15	9	25.53	204	110	0.68	0.02
1015	9	16	4.59	204	110	0.27	0.01
1016	16	17	59.55	204	110	0.06	0.00
1017	17	18	3.61	204	110	-0.15	0.00
1018	18	19	55.92	204	110	-0.15	0.00
1019	19	20	10.27	204	110	-0.36	0.01
1020	20	21	13.18	204	110	-0.36	0.01
1021	21	26	3.41	204	110	-0.36	0.01
11	7000	11	33.99	204	110	0.91	0.03
19	0	24	30.61	204	110	-0.85	0.03
21	24	7002	47.97	204	110	-1.06	0.03
23	26	0	3.11	204	110	-0.36	0.01

AVDY

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)	Pressure (kPa)
0	0	87.78	130.3	60.45	416.8
1	0	88.45	130.3	59.50	410.2
11	0	88.40	130.3	59.56	410.7
12	0	88.39	130.3	59.58	410.8
13	0	88.3	130.3	59.71	411.7
14	0.23	88.31	130.3	59.69	411.5
15	0	88.2	130.3	59.84	412.6
16	0.21	88	130.3	60.13	414.6
17	0.21	88.12	130.3	59.97	413.5
18	0	88.11	130.3	59.98	413.5
19	0.21	87.91	130.3	60.27	415.5
2	0	88.39	130.3	59.58	410.8
20	0	87.99	130.3	60.14	414.7
21	0	87.84	130.3	60.36	416.2
24	0.21	87.59	130.3	60.72	418.6
26	0	87.81	130.3	60.4	416.4
3	0.34	88.26	130.3	59.76	412.0
4	0.11	88.19	130.3	59.86	412.7
5	0.11	88.19	130.3	59.86	412.7
6	0.34	88.27	130.3	59.75	412.0
7	0	88.36	130.3	59.61	411.0
8	0	88.57	130.3	59.33	409.1
9	0	88	130.3	60.13	414.6

PKHR

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1000	0	1	52.89	204	110	0.53	0.02
1001	1	2	6	204	110	0.53	0.02
1002	2	3	9.13	204	110	0.53	0.02
1003	3	4	38.4	204	110	-1.33	0.04
1004	4	5	48.85	204	110	-1.91	0.06
1005	5	6	38.26	204	110	-2.49	0.08
1006	6	7	9.47	204	110	-3.77	0.12
1007	7	8	6	204	110	-3.77	0.12
1008	8	9	57.91	204	110	-3.77	0.12
1010	11	12	8.43	204	110	10.10	0.31
1011	12	13	6.02	204	110	10.10	0.31
1012	13	14	30.56	204	110	10.10	0.31
1013	14	15	6.46	204	110	8.82	0.27
1014	15	9	25.53	204	110	8.82	0.27
1015	9	16	4.59	204	110	5.04	0.15
1016	16	17	59.55	204	110	3.88	0.12
1017	17	18	3.61	204	110	2.72	0.08
1018	18	19	55.92	204	110	2.72	0.08
1019	19	20	10.27	204	110	1.56	0.05
1020	20	21	13.18	204	110	1.56	0.05
1021	21	26	3.41	204	110	1.56	0.05
11	7000	11	33.99	204	110	10.10	0.31
19	0	24	30.61	204	110	1.04	0.03
21	24	7002	47.97	204	110	-0.12	0.00
23	26	0	3.11	204	110	1.56	0.05

PKHR

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)	Pressure (kPa)
0	0	87.78	125.80	54.05	372.7
1	0	88.45	125.80	53.10	366.1
11	0	88.40	125.87	53.26	367.2
12	0	88.39	125.87	53.28	367.4
13	0	88.3	125.86	53.4	368.2
14	1.28	88.31	125.84	53.34	367.8
15	0	88.2	125.83	53.49	368.8
16	1.16	88	125.81	53.75	370.6
17	1.16	88.12	125.81	53.58	369.4
18	0	88.11	125.81	53.59	369.5
19	1.16	87.91	125.8	53.87	371.4
2	0	88.39	125.8	53.18	366.7
20	0	87.99	125.8	53.74	370.5
21	0	87.84	125.8	53.96	372.0
24	1.16	87.59	125.8	54.32	374.5
26	0	87.81	125.8	54.01	372.4
3	1.86	88.26	125.8	53.36	367.9
4	0.58	88.19	125.8	53.46	368.6
5	0.58	88.19	125.8	53.46	368.6
6	1.28	88.27	125.81	53.36	367.9
7	0	88.36	125.81	53.23	367.0
8	0	88.57	125.81	52.94	365.0
9	0	88	125.81	53.76	370.7

MXDY+FF

ID	Static Demand (L/s)	Static Pressure (psi)	Static Pressure (kPa)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Residual Pressure (kPa)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)	Available Flow Pressure (kPa)
11	0	50.74	349.8	124.1	250.00	42.19	290.9	501.4	20	137.9
15	0	51.03	351.8	124.1	250.00	36.7	253.0	381.09	20	137.9
18	0	51.17	352.8	124.09	250.00	29.91	206.2	308.01	20	137.9
26	0	51.59	355.7	124.1	250.00	37.05	255.5	381.92	20	137.9
4	0.26	51.04	351.9	124.09	250.00	23.18	159.8	265.43	20	137.9
5	0.26	51.04	351.9	124.09	250.00	22.93	158.1	264.16	20	137.9

Appendix B SANITARY SEWER CALCULATIONS

B.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:

ORLEANS DECOEUR RESIDENTIAL DEVELOPMENT

DATE: 2022-09-23
REVISION: 2
DESIGN BY: MJS
CHECKED BY: MW

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401710

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / 1 BED+DEN & 2 BED	2.1	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / 2 BED+DEN	3.1				

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 1 BED+DEN & 2 BED APT	UNITS TOWN	UNITS 2 BED+DEN 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)
R120A	120	12	0.10	24	0	4	63	0.10	63	3.63	0.7	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.19	0.1	0.8	10.9	150	PVC	DR 28	1.00	15.3	**5.53%**	0.86
G12A	12	10	0.00	0	0	0	0	0.10	63	3.63	0.7	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.36	0.0	0.36	0.56	0.2	1.0	35.1	250	PVC	SDR 35	0.30	33.2	**2.87%**	0.67
R11A	11	10	0.17	0	24	0	65	0.17	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.17	0.1	0.8	37.3	200	PVC	SDR 35	1.00	33.4	**2.45%**	1.05
G10A	10	8	0.00	0	0	0	0	0.28	128	3.57	1.5	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.67	0.0	0.31	1.03	0.3	1.8	59.5	250	PVC	SDR 35	0.30	33.2	**5.56%**	0.67
R9A	9	8	0.19	0	24	0	65	0.19	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.19	0.1	0.8	37.4	200	PVC	SDR 35	1.00	33.4	**2.47%**	1.05
	8	7	0.00	0	0	0	0	0.47	192	3.52	2.2	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.0	0.00	1.23	0.4	2.6	14.5	250	PVC	SDR 35	0.30	33.2	**7.92%**	0.67
R15A	15	13	0.46	0	24	0	65	0.46	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.46	0.46	0.2	0.9	69.6	200	PVC	SDR 35	0.50	23.6	**3.87%**	0.74
R14A	14	13	0.46	0	24	0	65	0.46	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.46	0.46	0.2	0.9	70.7	200	PVC	SDR 35	0.50	23.6	**3.87%**	0.74
R161A	161	16	0.10	24	0	4	63	0.10	63	3.63	0.7	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.19	0.1	0.8	8.9	150	PVC	DR 28	1.00	15.3	**5.54%**	0.86
R160A	160	16	0.10	24	0	4	63	0.10	63	3.63	0.7	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.19	0.1	0.8	7.6	150	PVC	DR 28	1.00	15.3	**5.53%**	0.86
G16A	16	13	0.00	0	0	0	0	0.21	126	3.57	1.5	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.1	0.04	0.43	0.1	1.7	32.2	250	PVC	SDR 35	0.30	33.2	**5.07%**	0.67
	13	7	0.00	0	0	0	0	1.13	255	3.49	2.9	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.1	0.00	1.36	0.4	3.4	55.6	250	PVC	SDR 35	0.30	33.4	**10.16%**	0.67
G7A	7	5	0.00	0	0	0	0	1.60	448	3.40	4.9	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.51	1.22	0.1	0.51	3.09	1.0	6.0	45.0	250	PVC	SDR 35	0.30	33.2	**18.18%**	0.67
R6A	6	5	0.20	0	24	0	65	0.20	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.20	0.20	0.1	0.8	37.4	200	PVC	SDR 35	1.00	33.4	**2.47%**	1.05
	5	4	0.00	0	0	0	0	1.79	512	3.37	5.6	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.1	0.00	3.29	1.1	6.8	26.4	250	PVC	SDR 35	0.30	33.2	**20.41%**	0.67
	4	2	0.00	0	0	0	0	1.79	512	3.37	5.6	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.1	0.00	3.29	1.1	6.8	33.6	250	PVC	SDR 35	0.30	33.2	**20.41%**	0.67
R3A	3	2	0.19	0	24	0	65	0.19	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.19	0.1	0.8	37.3	200	PVC	SDR 35	1.00	33.4	**2.47%**	1.05
	2	1	0.00	0	0	0	0	1.99	577	3.35	6.3	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.1	0.00	3.48	1.1	7.5	48.2	250	PVC	SDR 35	0.30	33.2	**22.63%**	0.67
																												250						

B.2 BACKGROUND REPORT EXCERPTS

2322, 2370 Tenth Line Road, 885 Decoeur Drive

SANITARY SEWER COMPUTATION FORM

Table 21

PROJECT:	Neighbourhood 5 - Avalon West - STAGE 3	q=	350 l/cap.day
DATE: **November, 2014**	CLIENT: Minto Communities Inc.	i=	0.28 l/ha.s
DESIGNED BY: AGS	PROJECT #: 131004	PVC/CONC N=	0.013
CHECKED BY: JMD	BY: ATREL ENGINEERING LTD	OTHER N=	0.024

Townhouse= 2.7 person/unit
Back to Back= 2.1 person/unit
Single Dwellings= 3.4 person/unit

STREET NAMES	LOCATION FROM (Up)		LOCATION TO (Down)		RESIDENTIAL INDIVIDUAL AREA (ha.)	RESIDENTIAL INDIVIDUAL POP.	RESIDENTIAL CUMULATIVE AREA (ha.)	RESIDENTIAL CUMULATIVE POP.	RESIDENTIAL PEAKING FACTOR M	RESIDENTIAL FLOW Q(p) (L/S)	COMM./INST. INDIVIDUAL AREA (ha.)	COMM./INST. INDIVIDUAL POP.	COMM./INST. CUMULATIVE AREA (ha.)	COMM./INST. CUMULATIVE POP.	COMM./INST. PEAKING FACTOR M	COMM./INST. FLOW Q(p) (L/S)	**PEAK DES. Q(d) (L/S)**	TYPE PIPE	DIA. (NOM) (mm)	DIA. (ACT) (MM)	SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	UpStream Obv. (M)	UpStream Inv. (M)	DwnStream Obv. (M)	DwnStream Inv. (M)
Commercial	MH	100	MH	3102							4.79	685	4.79	685	1.50	4.16	5.50	PVC	250	251.5	0.24	22.5	29.59	81%	0.60	82.89	82.64	82.84	82.59
Site Plan No.1	MH	3101	MH	3102	0.18	17.0	0.18	17	4.00	0.28							0.33	PVC	200	201.2	2.00	45.0	47.11	99%	1.48	84.19	83.99	83.29	83.09
Décoeur Drive	MH	3102	MH	3103	0.26		0.44	17	4.00	0.28			4.79	685	1.50	4.16	5.90	PVC	250	251.5	0.24	57.0	29.59	80%	0.60	82.78	82.53	82.64	82.39
Décoeur Drive	MH	3103	MH	3104	0.23		0.67	17	4.00	0.28			4.79	685	1.50	4.16	5.97	PVC	250	251.5	0.24	85.0	29.59	80%	0.60	82.64	82.39	82.44	82.19
School	MH	101	MH	3104							2.44	350	2.44	350	1.50	2.13	2.81	PVC	250	251.5	0.24	23.5	29.59	91%	0.60	82.73	82.48	82.67	82.42
Magnolia Street	MH	3104	MH	3107	0.08		0.75	17	4.00	0.28			7.23	1035	1.50	6.29	8.80	PVC	250	251.5	0.24	50.5	29.59	70%	0.60	82.38	82.13	82.26	82.01
Site Plan No.1	MH	3105	MH	3106	0.26	26.0	0.26	26.0	4.00	0.42							0.49	PVC	200	201.17	0.90	59.0	31.60	98%	0.99	85.19	84.99	84.66	84.46
Site Plan No.1	MH	3106	MH	3107	0.29	30.0	0.55	56.0	4.00	0.91							1.06	PVC	200	201.17	2.00	70.0	47.11	98%	1.48	84.06	83.86	82.66	82.46
Magnolia Street	MH	3107	MH	3115	0.08		1.38	73.0	4.00	1.18			7.23	1035	1.50	6.29	9.88	PVC	300	299.21	0.19	48.5	41.86	76%	0.60	82.16	81.86	82.07	81.77
Hepatica Crescent	MH	3110	MH	3112	0.28	11.0	0.28	11.0	4.00	0.18							0.26	PVC	200	201.17	1.60	31.5	42.14	99%	1.33	85.11	84.91	84.61	84.41
Park	MH	3111	MH	3112	1.19		1.19										0.33	PVC	200	201.17	0.32	14.0	18.93	98%	0.60	84.12	83.92	84.07	83.87
Hepatica Crescent	MH	3112	MH	3115	0.32	14.0	1.79	25.0	4.00	0.41							0.91	PVC	200	201.17	2.00	97.0	47.11	98%	1.48	84.01	83.81	82.07	81.87
Hepatica Crescent	MH	3113	MH	3114	0.54	50.0	0.54	50.0	4.00	0.81							0.96	PVC	200	201.17	0.65	80.0	26.86	96%	0.84	85.25	85.05	84.73	84.53
Hepatica Crescent	MH	3114	MH	3115	0.52	47.0	1.06	97.0	4.00	1.57							1.87	PVC	200	201.17	1.80	86.5	44.69	96%	1.41	84.13	83.93	82.57	82.37
Magnolia Street	MH	3115	MH	3124	0.49	34.0	4.72	229.0	4.00	3.71			7.23	1035	1.50	6.29	13.35	PVC	300	299.21	0.19	79.0	41.86	68%	0.60	82.07	81.77	81.92	81.62
Genévriers Street	MH	3116	MH	3117	0.33	21.0	0.33	21.0	4.00	0.34							0.43	PVC	200	201.17	0.65	59.0	26.86	98%	0.84	84.90	84.70	84.52	84.32
Genévriers Street	MH	3117	MH	3118	0.18	51.0	0.51	72.0	4.00	1.17							1.31	PVC	200	201.17	0.65	12.0	26.86	95%	0.84	84.49	84.29	84.41	84.21
Genévriers Street	MH	3118	MH	3119	0.65	58.0	1.16	130.0	4.00	2.11							2.43	PVC	200	201.17	1.50	77.5	40.80	94%	1.28	84.38	84.18	83.22	83.02
Genévriers Street	MH	3119	MH	3124	0.15	7.0	1.31	137.0	4.00	2.22							2.59	PVC	200	201.17	1.50	52.5	40.80	94%	1.28	82.62	82.42	81.83	81.63
Hepatica Crescent	MH	3113	MH	3120	0.05	3.0	0.05	3.0	4.00	0.05							0.06	PVC	200	201.17	0.65	10.0	26.86	100%	0.84	85.23	85.03	85.16	84.96
Hepatica Crescent	MH	3120	MH	3122	0.28	17.0	0.33	20.0	4.00	0.32							0.42	PVC	200	201.17	2.10	71.5	48.27	99%	1.52	85.13	84.93	83.63	83.43
Hepatica Crescent	MH	3121	MH	3122	0.27	21.0	0.27	21.0	4.00	0.34							0.42	PVC	200	201.17	0.88	69.0	31.25	99%	0.98	84.78	84.58	84.17	83.97
Genévriers Street	MH	3122	MH	3123	0.40	28.0	1.00	69.0	4.00	1.12							1.40	PVC	200	201.17	0.75	86.5	28.85	95%	0.91	83.57	83.37	82.92	82.72
Genévriers Street	MH	3123	MH	3124	0.48	34.0	1.48	103.0	4.00	1.67							2.08	PVC	200	201.17	0.75	88.5	28.85	93%	0.91	82.71	82.51	82.05	81.85
Magnolia Street	MH	3124	MH	3273	0.49	41.0	8.00	510.0	3.97	8.20			7.23	1035	1.50	6.29	18.75	PVC	300	299.21	0.19	79.0	41.86	55%	0.60	81.55	81.25	81.40	81.10
Site Plan No.2	MH	3129	MH	3130	0.79	84.0	0.79	84.0	4.00	1.36							1.58	PVC	200	201.17	0.32	91.5	18.93	92%	0.60	84.32	84.12	84.02	83.82
Site Plan No.2	MH	3130	MH	3131			0.79	84.0	4.00	1.36							1.58	PVC	200	201.17	0.32	120.0	18.93	92%	0.60	84.02	83.82	83.63	83.43
Des Aubépines Drive	MH	3131	MH	3140	0.22		1.01	84.0	4.00	1.36							1.64	PVC	250	251.46	0.24	51.0	29.59	94%	0.60	83.62	83.37	83.50	83.25
Commercial	MH	106	MH	3133														PVC	250	251.5	0.24	9.0	29.59	100%	0.60	84.15	83.90	84.13	83.88
Street No.12	MH	3132	MH	3133	0.08		0.08										0.02	PVC	200	201.17	0.65	41.5	26.86	100%	0.84	84.41	84.21	84.14	83.94
Street No.8	MH	3133	MH	3134	0.48	57.0	0.56	57.0	4.00	0.92							1.08	PVC	250	251.46	0.24	85.5	29.59	96%	0.60	84.13	83.88	83.92	83.67
Street No.8	MH	3134	MH	3139A	0.51	63.0	1.07	120.0	4.00	1.94							2.24	PVC	250	251.46	0.24	83.5	29.59	92%	0.60	83.92	83.67	83.72	83.47

SANITARY SEWER COMPUTATION FORM

Table 21

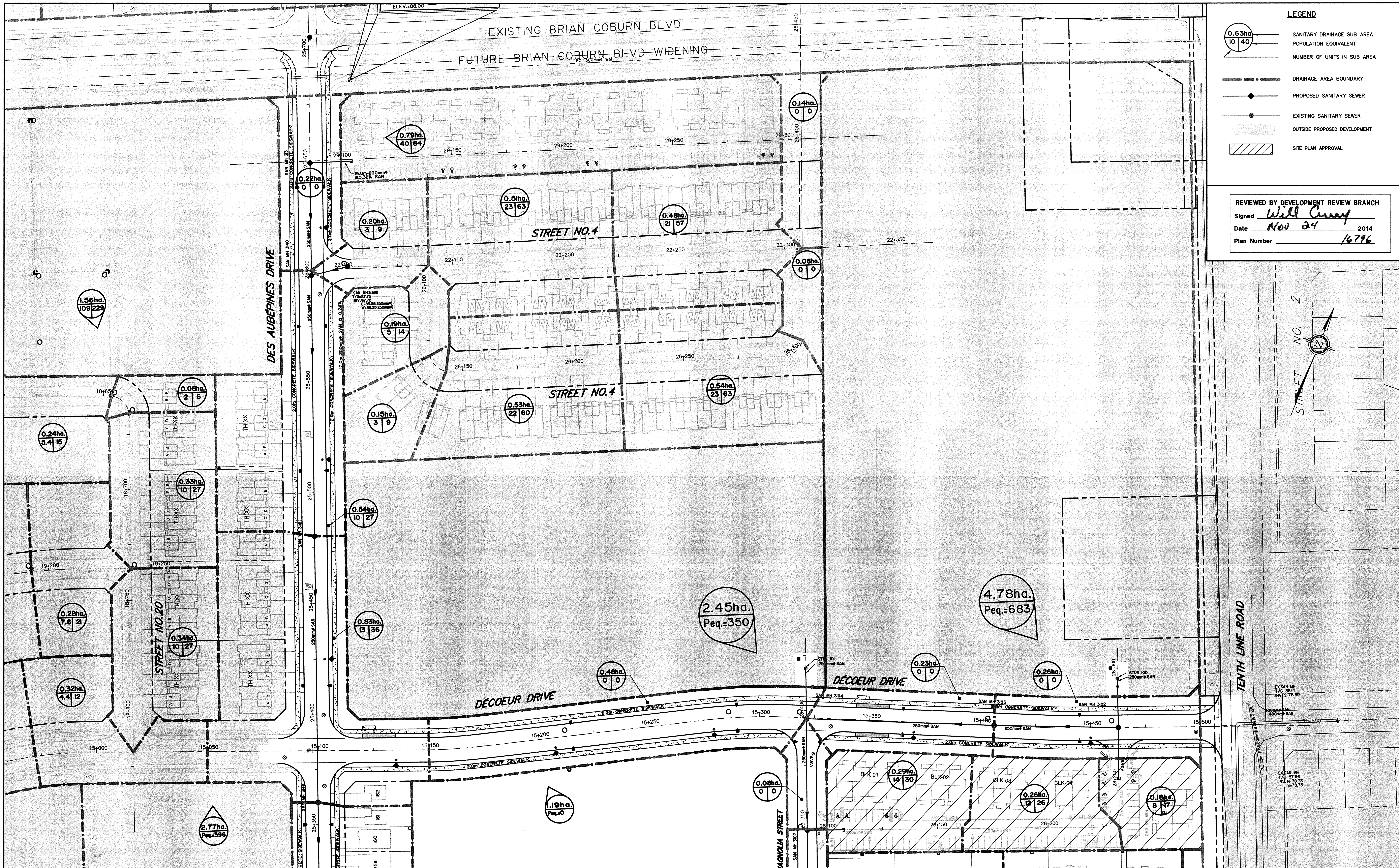
DATE:	**November, 2014**	PROJECT:	Neighbourhood 5 - Avalon West - STAGE 3
DESIGNED BY:	AGS	CLIENT:	Minto Communities Inc.
CHECKED BY:	JMD	PROJECT #:	131004
		BY:	ATREL ENGINEERING LTD

q= 350 l/cap.day
i= 0.28 l/ha.s
PVC/CONC N= 0.013
OTHER N= 0.024

Townhouse= 2.7 person/unit
Back to Back= 2.1 person/unit
Single Dwellings= 3.4 person/unit

STREET NAMES	LOCATION FROM (Up)		LOCATION TO (Down)		RESIDENTIAL INDIVIDUAL AREA (ha.)	RESIDENTIAL INDIVIDUAL POP.	RESIDENTIAL CUMULATIVE AREA (ha.)	RESIDENTIAL CUMULATIVE POP.	RESIDENTIAL PEAKING FACTOR M	RESIDENTIAL FLOW Q(p) (L/S)	COMMERCIAL , INSTITUTIONAL INDIVIDUAL AREA (ha.)	COMMERCIAL , INSTITUTIONAL INDIVIDUAL POP.	COMMERCIAL , INSTITUTIONAL CUMULATIVE AREA (ha.)	COMMERCIAL , INSTITUTIONAL CUMULATIVE POP.	COMMERCIAL , INSTITUTIONAL PEAKING FACTOR M	COMMERCIAL , INSTITUTIONAL FLOW Q(p) (L/S)	**PEAK DES. Q(d) (L/S)**	SEWER DATA TYPE PIPE	SEWER DATA DIA. (N0M) (mm)	SEWER DATA (ACT) (MM)	SEWER DATA SLOPE (%)	SEWER DATA LENGTH (M)	SEWER DATA CAP. (L/S)	SEWER DATA Remaining Capacity (%)	SEWER DATA VEL. (M/S)	UpStream Obv. (M)	UpStream Inv. (M)	DwnStream Obv. (M)	DwnStream Inv. (M)
Street No.12	MH	3132	MH	3135														PVC	200	201.17	0.65	9.5	26.86	100%	0.84	84.55	84.35	84.49	84.29
Street No.12	MH	3135	MH	3136	0.54	63.0	0.54	63.0	4.00	1.02							1.17	PVC	200	201.17	0.32	76.0	18.93	94%	0.60	84.46	84.26	84.21	84.01
Street No.12	MH	3136	MH	3137	0.53	60.0	1.07	123.0	4.00	1.99							2.29	PVC	200	201.17	0.32	79.0	18.93	88%	0.60	84.21	84.01	83.95	83.75
Street No.12	MH	3137	MH	3138	0.15	9.0	1.22	132.0	4.00	2.14							2.48	PVC	200	201.17	0.32	10.5	18.93	87%	0.60	83.92	83.72	83.89	83.69
Street No.12	MH	3138	MH	3139A	0.19	14.0	1.41	146.0	4.00	2.37							2.76	PVC	200	201.17	0.32	41.0	18.93	85%	0.60	83.86	83.66	83.73	83.53
Street No.8	MH	3139A	MH	3139B	0.20	9.0	2.68	275	4.00	4.46							5.21	PVC	250	251.5	0.24	36.5	29.59	82%	0.60	83.72	83.47	83.63	83.38
Street No.8	MH	3139B	MH	3140			2.68	275	4.00	4.46							5.21	PVC	250	251.5	0.24	17.0	29.59	82%	0.60	83.60	83.35	83.56	83.31
Des Aubépines Drive	MH	3140	MH	3141	0.54	27.0	4.23	386.0	4.00	6.25							7.44	PVC	250	251.46	0.24	117.5	29.59	75%	0.60	83.50	83.25	83.22	82.97
Des Aubépines Drive	MH	3141	MH	3142	0.83	36.0	5.06	422.0	4.00	6.84							8.25	PVC	250	251.46	0.24	120.0	29.59	72%	0.60	83.22	82.97	82.93	82.68
Des Aubépines Drive	MH	3142	MH	3143	0.54	28.0	5.60	450.0	4.00	7.29							8.85	PVC	250	251.46	0.24	101.0	29.59	70%	0.60	82.93	82.68	82.69	82.44
Des Aubépines Drive	MH	3143	MH	3271	0.86	55.0	6.46	505.0	3.97	8.13							9.93	PVC	250	251.46	0.24	119.5	29.59	66%	0.60	82.69	82.44	82.40	82.15
Street No.11	MH	3270	MH	3271	45.26	3308.0	45.26	3308.0	3.41	45.64	12.78	1828.0	12.78	1828	1.50	11.11	73.00	CONC	450	457.20	0.11	120.0	98.65	26%	0.60	81.81	81.36	81.68	81.23
Hepatica Crescent	MH	3271	MH	3272	0.69	45.0	52.41	3858.0	3.35	52.31			12.78	1828	1.50	11.11	81.67	CONC	525	533.40	0.11	99.5	148.80	45%	0.67	81.53	81.00	81.42	80.89
Hepatica Crescent	MH	3272	MH	3273	0.83	58.0	53.24	3916.0	3.34	53.01			12.78	1828	1.50	11.11	82.60	CONC	525	533.40	0.11	120.0	149.48	45%	0.67	81.42	80.89	81.29	80.76
Hepatica Crescent	MH	3273	MH	3274	0.49	31.0	61.73	4457.0	3.29	59.42			20.01	2863	1.50	17.40	99.70	CONC	525	533.40	0.11	79.0	149.48	33%	0.67	81.29	80.76	81.20	80.67
Hepatica Crescent	MH	3274	MH	3275	0.60	38.0	62.33	4495.0	3.29	59.86			20.01	2863	1.50	17.40	100.31	CONC	525	533.40	0.11	89.0	149.48	33%	0.67	81.20	80.67	81.10	80.57
Hepatica Crescent	MH	3275	MH	3276			62.33	4495.0	3.29	59.86			20.01	2863	1.50	17.40	100.31	CONC	525	533.40	0.11	8.5	149.48	33%	0.67	81.10	80.57	81.09	80.56
Hepatica Crescent	MH	3276	MH	15166			62.33	4495.0	3.29	59.86			20.01	2863	1.50	17.40	100.31	CONC	675	685.80	0.12	34.5	303.78	67%	0.82	81.09	80.41	81.05	80.37

Proposed Stage 3 Sanitary Sewers
Future Stages Sanitary Sewers



THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

minto

No.	REVISION △-APPLIES WHEN DRAWING MODIFIED	DATE	BY
1	AS PER CITY COMMENTS	JULY 25/14	JMD
2	AS PER CITY COMMENTS	AUG 12/14	JMD
3	AS PER CITY COMMENTS	SEPT 10/14	JMD
4	ISSUED FOR TENDER	SEPT 12/14	JMD
5	ISSUED FOR CONSTRUCTION	SEPT 16/14	JMD
6	ISSUED FOR CONSTRUCTION	OCT 9/14	JMD
7	AS PER CITY COMMENTS	OCT 31/14	JMD
8	AS PER CITY COMMENTS	NOV 6/14	JMD
9	AS PER CITY COMMENTS	NOV 18/14	JMD
10	AS PER CITY COMMENTS	NOV 20/14	JMD

SCALE 1:750 (8m 0 24m)

DESIGN AGS
CHECKED JMD
DRAWN PNC
CHECKED AGS
APPROVED JMD

LICENSED PROFESSIONAL ENGINEER A.G.Y. SAUVE 100142393 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.M.J. DECOEUR PROVINCE OF ONTARIO

ATREL Engineering Ltd Ltée
Engineers - Ingénieurs
380 LAURIER ST., ROCKLAND, ONTARIO K4K 1G2
TEL.: (613) 446-7423 FAX: (613) 446-7425

CITY OF OTTAWA
EAST URBAN COMMUNITY
AVALON WEST STAGE 3

MINTO COMMUNITIES INC.

PLAN
SANITARY DRAINAGE AREA PLAN

CLIENT No. 148
PROJECT No. 131004
DATE NOVEMBER 2013
DRAWING No. 131004-SAN2

16796

D07-16-09-0018 - Phase 7

Appendix C STORMWATER MANAGEMENT CALCULATIONS

C.1 MODIFIED RATIONAL METHOD CALCULATIONS

Project #160401710, Decoeur/Tenth Line
Roof Drain Design Sheet, Area R104A
Standard Watts Roof Drain with Adjustable Accutrol Weir

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.000000	0.0000	0.00	0.000	0	0.00	0.00	0.000
0.025	0.000315	0.0044	0.19	0.025	22.22	0.19	0.19	0.025
0.050	0.000631	0.0088	1.48	0.050	88.89	1.30	1.48	0.050
0.075	0.000710	0.0099	5.00	0.075	200.00	3.52	5.00	0.075
0.100	0.000789	0.0110	11.85	0.100	355.56	6.85	11.85	0.100
0.125	0.000867	0.0121	23.15	0.125	555.56	11.30	23.15	0.125
0.150	0.000946	0.0132	40.00	0.150	800.00	16.85	40.00	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.3	146.8	1.3	0.04077
4.8	354.1	3.5	0.13914
11.7	620.7	6.9	0.31155
23.0	930.2	11.3	0.56995
39.8	1272.1	16.9	0.9233

Rooftop Storage Summary

Total Building Area (sq.m)		1000
Assume Available Roof Area (sq.	80%	800
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		14
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		40
Estimated 100 Year Drawdown Time (h)		0.6

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

Adjustable Accutrol Weir Flow Rate Settings From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	25%	Closed
0.025	0.3154	0.3154	0.3154	**0.3154**	0.3154
0.05	0.6308	0.6308	0.6308	**0.6308**	0.3154
0.075	0.9462	0.8674	0.7885	**0.7097**	0.3154
0.1	1.2617	1.104	0.9462	**0.7885**	0.3154
0.125	1.5771	1.3405	1.104	**0.8674**	0.3154
0.15	1.8925	1.5771	1.2617	**0.9462**	0.3154

Calculation Results

	2yr	5yr	100yr	Available
Qresult (cu.m/s)	0.010	0.011	0.012	-
Depth (m)	0.077	0.091	0.128	0.150
Volume (cu.m)	5.5	9.3	25.3	40.0
Draintime (hrs)	0.2	0.3	0.6	

Project #160401710, Decoeur/Tenth Line
Roof Drain Design Sheet, Area R107A
Standard Watts Roof Drain with Adjustable Accutrol Weir

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.000000	0.0000	0.00	0.000	0	0.00	0.00	0.000
0.025	0.000315	0.0044	0.19	0.025	22.22	0.19	0.19	0.025
0.050	0.000631	0.0088	1.48	0.050	88.89	1.30	1.48	0.050
0.075	0.000710	0.0099	5.00	0.075	200.00	3.52	5.00	0.075
0.100	0.000789	0.0110	11.85	0.100	355.56	6.85	11.85	0.100
0.125	0.000867	0.0121	23.15	0.125	555.56	11.30	23.15	0.125
0.150	0.000946	0.0132	40.00	0.150	800.00	16.85	40.00	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.3	146.8	1.3	0.04077
4.8	354.1	3.5	0.13914
11.7	620.7	6.9	0.31155
23.0	930.2	11.3	0.56995
39.8	1272.1	16.9	0.9233

Rooftop Storage Summary

Total Building Area (sq.m)		1000
Assume Available Roof Area (sq.	80%	800
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		14
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		40
Estimated 100 Year Drawdown Time (h)		0.6

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

Adjustable Accutrol Weir Flow Rate Settings From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	25%	Closed
0.025	0.3154	0.3154	0.3154	**0.3154**	0.3154
0.05	0.6308	0.6308	0.6308	**0.6308**	0.3154
0.075	0.9462	0.8674	0.7885	**0.7097**	0.3154
0.1	1.2617	1.104	0.9462	**0.7885**	0.3154
0.125	1.5771	1.3405	1.104	**0.8674**	0.3154
0.15	1.8925	1.5771	1.2617	**0.9462**	0.3154

Calculation Results

	2yr	5yr	100yr	Available
Qresult (cu.m/s)	0.010	0.011	0.012	-
Depth (m)	0.077	0.091	0.128	0.150
Volume (cu.m)	5.5	9.3	25.3	40.0
Draintime (hrs)	0.2	0.3	0.6	

Project #160401710, Decoeur/Tenth Line
Roof Drain Design Sheet, Area R107B
Standard Watts Roof Drain with Adjustable Accutrol Weir

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.000000	0.0000	0.00	0.000	0	0.00	0.00	0.000
0.025	0.000315	0.0044	0.19	0.025	22.22	0.19	0.19	0.025
0.050	0.000631	0.0088	1.48	0.050	88.89	1.30	1.48	0.050
0.075	0.000710	0.0099	5.00	0.075	200.00	3.52	5.00	0.075
0.100	0.000789	0.0110	11.85	0.100	355.56	6.85	11.85	0.100
0.125	0.000867	0.0121	23.15	0.125	555.56	11.30	23.15	0.125
0.150	0.000946	0.0132	40.00	0.150	800.00	16.85	40.00	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.3	146.8	1.3	0.04077
4.8	354.1	3.5	0.13914
11.7	620.7	6.9	0.31155
23.0	930.2	11.3	0.56995
39.8	1272.1	16.9	0.9233

Rooftop Storage Summary

Total Building Area (sq.m)		1000
Assume Available Roof Area (sq.	80%	800
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		14
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		40
Estimated 100 Year Drawdown Time (h)		0.6

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

Adjustable Accutrol Weir Flow Rate Settings From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	25%	Closed
0.025	0.3154	0.3154	0.3154	**0.3154**	0.3154
0.05	0.6308	0.6308	0.6308	**0.6308**	0.3154
0.075	0.9462	0.8674	0.7885	**0.7097**	0.3154
0.1	1.2617	1.104	0.9462	**0.7885**	0.3154
0.125	1.5771	1.3405	1.104	**0.8674**	0.3154
0.15	1.8925	1.5771	1.2617	**0.9462**	0.3154

Calculation Results

	2yr	5yr	100yr	Available
Qresult (cu.m/s)	0.010	0.011	0.012	-
Depth (m)	0.077	0.091	0.128	0.150
Volume (cu.m)	5.5	9.3	25.3	40.0
Draintime (hrs)	0.2	0.3	0.6	

Stormwater Management Calculations

File No: **160401710**
Project: **Decoeur/Tenth Line**
Date: **22-Nov-22**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"		"A x C"	Overall Runoff Coefficient
Controlled - Tributary	L109A	Hard	0.329		0.9	0.296		
		Soft	0.049		0.2	0.010		
		Subtotal		0.377271			0.3055895	0.810
Controlled - Tributary	L108A	Hard	0.330		0.9	0.297		
		Soft	0.025		0.2	0.005		
		Subtotal		0.355079			0.3018172	0.850
Controlled - Tributary	L106A	Hard	0.177		0.9	0.160		
		Soft	0.026		0.2	0.005		
		Subtotal		0.2036			0.164916	0.810
Controlled - Tributary	L105A	Hard	0.086		0.9	0.077		
		Soft	0.037		0.2	0.007		
		Subtotal		0.1227			0.084663	0.690
Controlled - Tributary	L104B	Hard	0.335		0.9	0.302		
		Soft	0.037		0.2	0.007		
		Subtotal		0.3727			0.309341	0.830
Controlled - Tributary	L104A	Hard	0.309		0.9	0.278		
		Soft	0.077		0.2	0.015		
		Subtotal		0.385979			0.293344	0.760
Controlled - Tributary	L103A	Hard	0.313		0.9	0.282		
		Soft	0.117		0.2	0.023		
		Subtotal		0.43			0.3053	0.710
Controlled - Tributary	L101A	Hard	0.243		0.9	0.219		
		Soft	0.111		0.2	0.022		
		Subtotal		0.3543			0.240924	0.680
Roof	R107B	Hard	0.100		0.9	0.090		
		Soft	0.000		0.2	0.000		
		Subtotal		0.1			0.09	0.900
Roof	R107A	Hard	0.100		0.9	0.090		
		Soft	0.000		0.2	0.000		
		Subtotal		0.1			0.09	0.900
Roof	R104A	Hard	0.100		0.9	0.090		
		Soft	0.000		0.2	0.000		
		Subtotal		0.1			0.09	0.900
Uncontrolled - Non-Tributary	UNC-4	Hard	0.026		0.9	0.024		
		Soft	0.066		0.2	0.013		
		Subtotal		0.092661			0.0370644	0.400
Uncontrolled - Non-Tributary	UNC-3	Hard	0.041		0.9	0.037		
		Soft	0.019		0.2	0.004		
		Subtotal		0.06			0.0408	0.680
Uncontrolled - Non-Tributary	UNC-2	Hard	0.000		0.9	0.000		
		Soft	0.090		0.2	0.018		
		Subtotal		0.09			0.018	0.200
Uncontrolled - Non-Tributary	UNC-1	Hard	0.008		0.9	0.007		
		Soft	0.039		0.2	0.008		
		Subtotal		0.0467			0.014944	0.320
Total				**3.191**			**2.387**	
Overall Runoff Coefficient= C:								**0.75**

Total Roof Areas	**0.300 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**2.602 ha**
Total Tributary Area to Outlet	**2.902 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.289 ha**
Total Site	**3.191 ha**

Stormwater Management Calculations

Project #160401710, Decoeur/Tenth Line
Modified Rational Method Calculatons for Storage

2 yr Intensity	I = a/(t + b	a =	732.951	**t (min)**	**I (mm/hr)**
City of Ottawa		b =	6.199	10	76.81
		c =	0.81	20	52.03
				30	40.04
				40	32.86
				50	28.04
				60	24.56
				70	21.91
				80	19.83
				90	18.14
				100	16.75
				110	15.57
				120	14.56

2 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 3.1910
C: 0.20

Typical Time of Concentration

Qallow (L/s/ha)	Area (ha)	Qtarget (L/s)
220	3.19	**702.02**

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L109A — Controlled - Tributary
Area (ha): 0.38
C: 0.81

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	65.25	65.25	0.00	**0.00**
20	52.03	44.20	65.25	0.00	0.00
30	40.04	34.02	65.25	0.00	0.00
40	32.86	27.92	65.25	0.00	0.00
50	28.04	23.82	65.25	0.00	0.00
60	24.56	20.86	65.25	0.00	0.00
70	21.91	18.62	65.25	0.00	0.00
80	19.83	16.85	65.25	0.00	0.00
90	18.14	15.41	65.25	0.00	0.00
100	16.75	14.23	65.25	0.00	0.00
110	15.57	13.23	65.25	0.00	0.00
120	14.56	12.37	65.25	0.00	0.00

No surface storage.

Storage: Above CB

Orifice Equation: : CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.62 m
T/G Elevation 88.00 m
Max Ponding Depth 0.00 m
Downstream W/L 86.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	87.69	1.07	65.25	0.00	125.40	OK

Subdrainage Area: L108A — Controlled - Tributary
Area (ha): 0.36
C: 0.85

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	64.44	64.44	0.00	**0.00**
20	52.03	43.66	64.44	0.00	0.00
30	40.04	33.60	64.44	0.00	0.00
40	32.86	27.57	64.44	0.00	0.00
50	28.04	23.53	64.44	0.00	0.00
60	24.56	20.61	64.44	0.00	0.00
70	21.91	18.39	64.44	0.00	0.00
80	19.83	16.64	64.44	0.00	0.00
90	18.14	15.22	64.44	0.00	0.00
100	16.75	14.05	64.44	0.00	0.00
110	15.57	13.06	64.44	0.00	0.00
120	14.56	12.22	64.44	0.00	0.00

Storage: Above CB

Orifice Equation: : CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.62 m
T/G Elevation 88.00 m
Max Ponding Depth 0.00 m
Downstream W/L 86.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	87.66	1.04	64.44	0.00	130.00	OK

Subdrainage Area: L106A — Controlled - Tributary
Area (ha): 0.20
C: 0.81

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	35.21	35.21	0.00	**0.00**
20	52.03	23.85	35.21	0.00	0.00
30	40.04	18.36	35.21	0.00	0.00
40	32.86	15.07	35.21	0.00	0.00
50	28.04	12.86	35.21	0.00	0.00
60	24.56	11.26	35.21	0.00	0.00
70	21.91	10.05	35.21	0.00	0.00
80	19.83	9.09	35.21	0.00	0.00
90	18.14	8.32	35.21	0.00	0.00
100	16.75	7.68	35.21	0.00	0.00
110	15.57	7.14	35.21	0.00	0.00
120	14.56	6.68	35.21	0.00	0.00

Storage: Above CB

Orifice Equation: : CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 127.00 mm
Invert Elevation 86.59 m
T/G Elevation 87.97 m
Max Ponding Depth 0.00 m
Downstream W/L 84.86 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	87.79	1.20	35.21	0.00	50.40	OK

Subdrainage Area: L105A — Controlled - Tributary
Area (ha): 0.12
C: 0.69

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	18.08	18.08	0.00	0.00
20	52.03	12.25	18.08	0.00	0.00
30	40.04	9.42	18.08	0.00	0.00
40	32.86	7.74	18.08	0.00	0.00
50	28.04	6.60	18.08	0.00	0.00
60	24.56	5.78	18.08	0.00	0.00
70	21.91	5.16	18.08	0.00	0.00
80	19.83	4.67	18.08	0.00	0.00
90	18.14	4.27	18.08	0.00	0.00
100	16.75	3.94	18.08	0.00	0.00
110	15.57	3.66	18.08	0.00	0.00
120	14.56	3.43	18.08	0.00	0.00

No surface storage.

Storage: Above CB

Orifice Equation: : CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 152.00 mm
Invert Elevation 86.82 m
T/G Elevation 88.20 m
Max Ponding Depth 0.00 m
Downstream W/L 86.43 m

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

Project #160401710, Decoeur/Tenth Line
Modified Rational Method Calculatons for Storage

5 yr Intensity	I = a/(t + b)^c	a =	998.071	**t (min)**	**I (mm/hr)**
City of Ottawa		b =	6.053	10	104.19
		c =	0.814	20	70.25
				30	53.93
				40	44.18
				50	37.65
				60	32.94
				70	29.37
				80	26.56
				90	24.29
				100	22.41
				110	20.82
				120	19.47

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 3.1910
C: 0.20

Typical Time of Concentration

Qallow (L/s/ha)	Area (ha)	Qtarget (L/s)
220	3.19	**702.02**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L109A — Controlled - Tributary
Area (ha): 0.38
C: 0.81

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	88.52	77.99	10.53	**6.32**
20	70.25	59.68	77.99	0.00	0.00
30	53.93	45.81	77.99	0.00	0.00
40	44.18	37.54	77.99	0.00	0.00
50	37.65	31.99	77.99	0.00	0.00
60	32.94	27.99	77.99	0.00	0.00
70	29.37	24.95	77.99	0.00	0.00
80	26.56	22.57	77.99	0.00	0.00
90	24.29	20.63	77.99	0.00	0.00
100	22.41	19.04	77.99	0.00	0.00
110	20.82	17.69	77.99	0.00	0.00
120	19.47	16.54	77.99	0.00	0.00

Storage: Above CB

Orifice Equation: : CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.62 m
T/G Elevation 88.00 m
Max Ponding Depth 0.15 m
Downstream W/L 86.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	88.15	1.53	77.99	6.32	125.40	OK

Subdrainage Area: L108A — Controlled - Tributary
Area (ha): 0.36
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	87.42	77.99	9.44	**5.66**
20	70.25	58.94	77.99	0.00	0.00
30	53.93	45.25	77.99	0.00	0.00
40	44.18	37.07	77.99	0.00	0.00
50	37.65	31.59	77.99	0.00	0.00
60	32.94	27.64	77.99	0.00	0.00
70	29.37	24.64	77.99	0.00	0.00
80	26.56	22.29	77.99	0.00	0.00
90	24.29	20.38	77.99	0.00	0.00
100	22.41	18.80	77.99	0.00	0.00
110	20.82	17.47	77.99	0.00	0.00
120	19.47	16.33	77.99	0.00	0.00

Storage: Above CB

Orifice Equation: : CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.62 m
T/G Elevation 88.00 m
Max Ponding Depth 0.15 m
Downstream W/L 86.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	88.15	1.53	77.99	5.66	130.00	OK

Subdrainage Area: L106A — Controlled - Tributary
Area (ha): 0.20
C: 0.81

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	47.77	39.70	8.07	**4.84**
20	70.25	32.21	39.70	0.00	0.00
30	53.93	24.72	39.70	0.00	0.00
40	44.18	20.26	39.70	0.00	0.00
50	37.65	17.26	39.70	0.00	0.00
60	32.94	15.10	39.70	0.00	0.00
70	29.37	13.47	39.70	0.00	0.00
80	26.56	12.18	39.70	0.00	0.00
90	24.29	11.14	39.70	0.00	0.00
100	22.41	10.27	39.70	0.00	0.00
110	20.82	9.55	39.70	0.00	0.00
120	19.47	8.93	39.70	0.00	0.00

Storage: Above CB

Orifice Equation: : CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 127.00 mm
Invert Elevation 86.59 m
T/G Elevation 87.97 m
Max Ponding Depth 0.15 m
Downstream W/L 84.86 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	88.12	1.53	39.70	4.84	50.40	OK

Subdrainage Area: L105A — Controlled - Tributary
Area (ha): 0.12
C: 0.69

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	24.52	24.52	0.00	**0.00**
20	70.25	16.53	24.52	0.00	0.00
30	53.93	12.69	24.52	0.00	0.00
40	44.18	10.40	24.52	0.00	0.00
50	37.65	8.86	24.52	0.00	0.00
60	32.94	7.75	24.52	0.00	0.00
70	29.37	6.91	24.52	0.00	0.00
80	26.56	6.25	24.52	0.00	0.00
90	24.29	5.72	24.52	0.00	0.00
100	22.41	5.27	24.52	0.00	0.00
110	20.82	4.90	24.52	0.00	0.00
120	19.47	4.58	24.52	0.00	0.00

Storage: Above CB

Orifice Equation: : CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 152.00 mm
Invert Elevation 86.82 m
T/G Elevation 88.20 m
Max Ponding Depth 0.00 m
Downstream W/L 86.43 m

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

Project #160401710, Decoeur/Tenth Line
Modified Rational Method Calculatons for Storage

100 yr Intensity	I = a/(t + b)^c	a =	1735.688	**t (min)**	**I (mm/hr)**
City of Ottawa		b =	6.014	10	178.56
		c =	0.820	20	119.95
				30	91.87
				40	75.15
				50	63.95
				60	55.89
				70	49.79
				80	44.99
				90	41.11
				100	37.90
				110	35.20
				120	32.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 3.1910
C: 0.20

Estimated Time of Concentration after Development

Qallow (L/s/ha)	Area (ha)	Qtarget (L/s)
220	3.19	**702.02**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L109A — Controlled - Tributary
Area (ha): 0.38
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	187.28	81.72	105.55	**63.33**
20	119.95	125.81	81.72	44.09	52.90
30	91.87	96.35	81.72	14.63	26.34
40	75.15	78.81	81.72	0.00	0.00
50	63.95	67.08	81.72	0.00	0.00
60	55.89	58.62	81.72	0.00	0.00
70	49.79	52.22	81.72	0.00	0.00
80	44.99	47.19	81.72	0.00	0.00
90	41.11	43.12	81.72	0.00	0.00
100	37.90	39.75	81.72	0.00	0.00
110	35.20	36.92	81.72	0.00	0.00
120	32.89	34.50	81.72	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.62 m
T/G Elevation 88.00 m
Max Ponding Depth 0.30 m
Downstream W/L 86.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	88.30	1.68	81.72	63.33	125.40	OK
					62.07	

Subdrainage Area: L108A — Controlled - Tributary
Area (ha): 0.36
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	176.26	81.72	94.54	**56.72**
20	119.95	118.41	81.72	36.69	44.02
30	91.87	90.68	81.72	8.96	16.14
40	75.15	74.18	81.72	0.00	0.00
50	63.95	63.13	81.72	0.00	0.00
60	55.89	55.17	81.72	0.00	0.00
70	49.79	49.15	81.72	0.00	0.00
80	44.99	44.41	81.72	0.00	0.00
90	41.11	40.58	81.72	0.00	0.00
100	37.90	37.41	81.72	0.00	0.00
110	35.20	34.75	81.72	0.00	0.00
120	32.89	32.47	81.72	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.62 m
T/G Elevation 88.00 m
Max Ponding Depth 0.30 m
Downstream W/L 86.52 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	88.30	1.68	81.72	56.72	130.00	OK
					73.28	

Subdrainage Area: L106A — Controlled - Tributary
Area (ha): 0.20
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	101.07	40.98	60.09	**36.05**
20	119.95	67.89	40.98	26.92	32.30
30	91.87	52.00	40.98	11.02	19.84
40	75.15	42.53	40.98	1.56	3.73
50	63.95	36.20	40.98	0.00	0.00
60	55.89	31.64	40.98	0.00	0.00
70	49.79	28.18	40.98	0.00	0.00
80	44.99	25.47	40.98	0.00	0.00
90	41.11	23.27	40.98	0.00	0.00
100	37.90	21.45	40.98	0.00	0.00
110	35.20	19.92	40.98	0.00	0.00
120	32.89	18.62	40.98	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 127.00 mm
Invert Elevation 86.59 m
T/G Elevation 87.97 m
Max Ponding Depth 0.25 m
Downstream W/L 84.86 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	88.22	1.63	40.98	36.05	50.40	OK
					14.35	

Subdrainage Area: L105A — Controlled - Tributary
Area (ha): 0.12
C: 0.86

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	52.53	56.87	0.00	**0.00**
20	119.95	35.29	56.87	0.00	**0.00**
30	91.87	27.03	56.87	0.00	**0.00**
40	75.15	22.11	56.87	0.00	**0.00**
50	63.95	18.82	56.87	0.00	**0.00**
60	55.89	16.44	56.87	0.00	**0.00**
70	49.79	14.65	56.87	0.00	**0.00**
80	44.99	13.24	56.87	0.00	**0.00**
90	41.11	12.09	56.87	0.00	**0.00**
100	37.90	11.15	56.87	0.00	**0.00**
110	35.20	10.36	56.87	0.00	**0.00**
120	32.89	9.68	56.87	0.00	**0.00**

No surface storage.

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.57
Orifice Diameter: 152.00 mm
Invert Elevation 86.82 m
T/G Elevation 88.20 m
Max Ponding Depth 0.15 m
Downstream W/L 86.43 m

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

Stormwater Management Calculations

Project #160401710, Decoeur/Tenth Line
Modified Rational Method Calculatons for Storage

2-year Water Level	86.97	0.15	18.08	0.00	8.50	OK

Subdrainage Area: L104B — Controlled - Tributary
Area (ha): 0.37
C: 0.83

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	66.05	66.05	0.00	**0.00**
20	52.03	44.75	66.05	0.00	**0.00**
30	40.04	34.44	66.05	0.00	**0.00**
40	32.86	28.26	66.05	0.00	**0.00**
50	28.04	24.11	66.05	0.00	**0.00**
60	24.56	21.12	66.05	0.00	**0.00**
70	21.91	18.84	66.05	0.00	**0.00**
80	19.83	17.05	66.05	0.00	**0.00**
90	18.14	15.60	66.05	0.00	**0.00**
100	16.75	14.40	66.05	0.00	**0.00**
110	15.57	13.39	66.05	0.00	**0.00**
120	14.56	12.52	66.05	0.00	**0.00**

No surface storage.

Storage: Above CB

Orifice Equation: CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.44 m
T/G Elevation 87.82 m
Max Ponding Depth 0.00 m
Downstream W/L 85.01 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	87.54	1.10	66.05	0.00	63.50	OK

Subdrainage Area: L104A — Controlled - Tributary
Area (ha): 0.39
C: 0.76

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	62.63	62.63	0.00	**0.00**
20	52.03	42.43	62.63	0.00	0.00
30	40.04	32.66	62.63	0.00	0.00
40	32.86	26.80	62.63	0.00	0.00
50	28.04	22.87	62.63	0.00	0.00
60	24.56	20.03	62.63	0.00	0.00
70	21.91	17.87	62.63	0.00	0.00
80	19.83	16.17	62.63	0.00	0.00
90	18.14	14.80	62.63	0.00	0.00
100	16.75	13.66	62.63	0.00	0.00
110	15.57	12.70	62.63	0.00	0.00
120	14.56	11.88	62.63	0.00	0.00

Storage: Above CB

Orifice Equation: CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.51 m
T/G Elevation 87.89 m
Max Ponding Depth 0.00 m
Downstream W/L 85.01 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	87.50	0.99	62.63	0.00	83.00	OK

Subdrainage Area: L103A — Controlled - Tributary
Area (ha): 0.43
C: 0.71

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	65.19	65.19	0.00	0.00
20	52.03	44.16	65.19	0.00	0.00
30	40.04	33.99	65.19	0.00	0.00
40	32.86	27.89	65.19	0.00	0.00
50	28.04	23.80	65.19	0.00	0.00
60	24.56	20.84	65.19	0.00	0.00
70	21.91	18.60	65.19	0.00	0.00
80	19.83	16.83	65.19	0.00	0.00
90	18.14	15.40	65.19	0.00	0.00
100	16.75	14.21	65.19	0.00	0.00
110	15.57	13.21	65.19	0.00	0.00
120	14.56	12.36	65.19	0.00	0.00

No surface storage.

Storage: Above CB

Orifice Equation: CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.30 m
T/G Elevation 87.68 m
Max Ponding Depth 0.00 m
Downstream W/L 84.63 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	87.37	1.07	65.19	0.00	74.60	OK

Subdrainage Area: L101A — Controlled - Tributary
Area (ha): 0.35
C: 0.68

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	51.44	51.44	0.00	0.00
20	52.03	34.85	51.44	0.00	**0.00**
30	40.04	26.82	51.44	0.00	**0.00**
40	32.86	22.01	51.44	0.00	**0.00**
50	28.04	18.78	51.44	0.00	**0.00**
60	24.56	16.45	51.44	0.00	**0.00**
70	21.91	14.68	51.44	0.00	**0.00**
80	19.83	13.28	51.44	0.00	**0.00**
90	18.14	12.15	51.44	0.00	**0.00**
100	16.75	11.22	51.44	0.00	**0.00**
110	15.57	10.43	51.44	0.00	**0.00**
120	14.56	9.75	51.44	0.00	**0.00**

Storage: Above CB

Orifice Equation: CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.14 m
T/G Elevation 87.52 m
Max Ponding Depth 0.00 m
Downstream W/L 84.38 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	86.81	0.67	51.44	0.00	49.20	OK

Subdrainage Area: R107B — Roof
Area (ha): 0.10 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	19.22	10.02	9.20	5.52	76.9	0.00
20	52.03	13.02	9.64	3.38	4.05	68.3	0.00
30	40.04	10.02	8.96	1.06	1.90	53.0	0.00
40	32.86	8.22	7.74	0.48	1.16	43.8	0.00
50	28.04	7.02	6.73	0.29	0.86	38.1	0.00
60	24.56	6.14	5.97	0.18	0.64	33.8	0.00
70	21.91	5.48	5.37	0.11	0.47	30.4	0.00
80	19.83	4.96	4.89	0.07	0.33	27.7	0.00
90	18.14	4.54	4.50	0.04	0.21	25.5	0.00
100	16.75	4.19	4.16	0.03	0.17	23.6	0.00
110	15.57	3.90	3.87	0.02	0.16	21.9	0.00
120	14.56	3.64	3.62	0.02	0.15	20.5	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	76.89	0.08	10.02	5.52	40.00	0.00

Project #160401710, Decoeur/Tenth Line
Modified Rational Method Calculatons for Storage

5-year Water Level	87.10	0.28	24.52	0.00	8.50	OK

Subdrainage Area: L104B — Controlled - Tributary
Area (ha): 0.37
C: 0.83

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	89.60	77.99	11.62	**6.97**
20	70.25	60.41	77.99	0.00	0.00
30	53.93	46.38	77.99	0.00	0.00
40	44.18	38.00	77.99	0.00	0.00
50	37.65	32.38	77.99	0.00	0.00
60	32.94	28.33	77.99	0.00	0.00
70	29.37	25.26	77.99	0.00	0.00
80	26.56	22.84	77.99	0.00	0.00
90	24.29	20.89	77.99	0.00	0.00
100	22.41	19.27	77.99	0.00	0.00
110	20.82	17.91	77.99	0.00	0.00
120	19.47	16.74	77.99	0.00	0.00

Storage: Above CB

Orifice Equation: CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.44 m
T/G Elevation 87.82 m
Max Ponding Depth 0.15 m
Downstream W/L 85.01 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	87.97	1.53	77.99	6.97	63.50	OK

Subdrainage Area: L104A — Controlled - Tributary
Area (ha): 0.39
C: 0.76

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	84.97	77.99	6.98	**4.19**
20	70.25	57.29	77.99	0.00	0.00
30	53.93	43.98	77.99	0.00	0.00
40	44.18	36.03	77.99	0.00	0.00
50	37.65	30.71	77.99	0.00	0.00
60	32.94	26.87	77.99	0.00	0.00
70	29.37	23.95	77.99	0.00	0.00
80	26.56	21.66	77.99	0.00	0.00
90	24.29	19.81	77.99	0.00	0.00
100	22.41	18.27	77.99	0.00	0.00
110	20.82	16.98	77.99	0.00	0.00
120	19.47	15.88	77.99	0.00	0.00

Storage: Above CB

Orifice Equation: CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.51 m
T/G Elevation 87.89 m
Max Ponding Depth 0.15 m
Downstream W/L 85.01 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	88.04	1.53	77.99	4.19	83.00	OK

Subdrainage Area: L103A — Controlled - Tributary
Area (ha): 0.43
C: 0.71

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	88.43	77.99	10.45	**6.27**
20	70.25	59.62	77.99	0.00	0.00
30	53.93	45.77	77.99	0.00	0.00
40	44.18	37.50	77.99	0.00	0.00
50	37.65	31.96	77.99	0.00	0.00
60	32.94	27.96	77.99	0.00	0.00
70	29.37	24.93	77.99	0.00	0.00
80	26.56	22.54	77.99	0.00	0.00
90	24.29	20.61	77.99	0.00	0.00
100	22.41	19.02	77.99	0.00	0.00
110	20.82	17.67	77.99	0.00	0.00
120	19.47	16.52	77.99	0.00	0.00

Storage: Above CB

Orifice Equation: CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.30 m
T/G Elevation 87.68 m
Max Ponding Depth 0.15 m
Downstream W/L 84.63 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	87.83	1.53	77.99	6.27	74.60	OK

Subdrainage Area: L101A — Controlled - Tributary
Area (ha): 0.35
C: 0.68

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	69.79	69.79	0.00	**0.00**
20	70.25	47.05	69.79	0.00	**0.00**
30	53.93	36.12	69.79	0.00	**0.00**
40	44.18	29.59	69.79	0.00	**0.00**
50	37.65	25.22	69.79	0.00	**0.00**
60	32.94	22.06	69.79	0.00	**0.00**
70	29.37	19.67	69.79	0.00	**0.00**
80	26.56	17.79	69.79	0.00	**0.00**
90	24.29	16.27	69.79	0.00	**0.00**
100	22.41	15.01	69.79	0.00	**0.00**
110	20.82	13.95	69.79	0.00	**0.00**
120	19.47	13.04	69.79	0.00	**0.00**

No surface storage.

Storage: Above CB

Orifice Equation: CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.14 m
T/G Elevation 87.52 m
Max Ponding Depth 0.00 m
Downstream W/L 84.38 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	87.37	1.23	69.79	0.00	49.20	OK

Subdrainage Area: R107B — Roof
Area (ha): 0.10 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	26.07	10.62	15.45	**9.27**	90.6	0.00
20	70.25	17.58	10.50	7.08	8.49	87.8	0.00
30	53.93	13.49	10.11	3.38	6.09	79.0	0.00
40	44.18	11.05	9.52	1.53	3.68	65.6	0.00
50	37.65	9.42	8.88	0.54	1.63	51.0	0.00
60	32.94	8.24	7.91	0.34	1.21	44.8	0.00
70	29.37	7.35	7.12	0.23	0.98	40.3	0.00
80	26.56	6.65	6.48	0.16	0.79	36.7	0.00
90	24.29	6.08	5.96	0.12	0.64	33.7	0.00
100	22.41	5.61	5.52	0.08	0.51	31.3	0.00
110	20.82	5.21	5.15	0.06	0.40	29.2	0.00
120	19.47	4.87	4.83	0.04	0.31	27.3	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	90.57	0.09	10.62	9.27	40.00	0.00

Project #160401710, Decoeur/Tenth Line
Modified Rational Method Calculatons for Storage

100-year Water Level	88.35	1.53	56.87	0.00	8.50	OK
					8.50	

Subdrainage Area: L104B — Controlled - Tributary
Area (ha): 0.37
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	185.01	81.72	103.29	**61.97**
20	119.95	124.28	81.72	42.56	51.07
30	91.87	95.19	81.72	13.46	24.24
40	75.15	77.86	81.72	0.00	0.00
50	63.95	66.26	81.72	0.00	0.00
60	55.89	57.91	81.72	0.00	0.00
70	49.79	51.59	81.72	0.00	0.00
80	44.99	46.62	81.72	0.00	0.00
90	41.11	42.60	81.72	0.00	0.00
100	37.90	39.27	81.72	0.00	0.00
110	35.20	36.47	81.72	0.00	0.00
120	32.89	34.08	81.72	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.44 m
T/G Elevation 87.82 m
Max Ponding Depth 0.30 m
Downstream W/L 85.01 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	88.12	1.68	81.72	61.97	63.50	OK
					1.53	

Subdrainage Area: L104A — Controlled - Tributary
Area (ha): 0.39
C: 0.95

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	182.02	81.72	100.30	**60.18**
20	119.95	122.27	81.72	40.55	48.66
30	91.87	93.65	81.72	11.93	21.47
40	75.15	76.60	81.72	0.00	0.00
50	63.95	65.19	81.72	0.00	0.00
60	55.89	56.98	81.72	0.00	0.00
70	49.79	50.75	81.72	0.00	0.00
80	44.99	45.86	81.72	0.00	0.00
90	41.11	41.91	81.72	0.00	0.00
100	37.90	38.64	81.72	0.00	0.00
110	35.20	35.88	81.72	0.00	0.00
120	32.89	33.53	81.72	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.51 m
T/G Elevation 87.89 m
Max Ponding Depth 0.30 m
Downstream W/L 85.01 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	88.19	1.68	81.72	60.18	83.00	OK
					22.82	

Subdrainage Area: L103A — Controlled - Tributary
Area (ha): 0.43
C: 0.89

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	189.44	81.72	107.72	**64.63**
20	119.95	127.26	81.72	45.54	54.64
30	91.87	97.46	81.72	15.74	28.34
40	75.15	79.72	81.72	0.00	0.00
50	63.95	67.85	81.72	0.00	0.00
60	55.89	59.30	81.72	0.00	0.00
70	49.79	52.82	81.72	0.00	0.00
80	44.99	47.73	81.72	0.00	0.00
90	41.11	43.62	81.72	0.00	0.00
100	37.90	40.21	81.72	0.00	0.00
110	35.20	37.35	81.72	0.00	0.00
120	32.89	34.90	81.72	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.30 m
T/G Elevation 87.68 m
Max Ponding Depth 0.30 m
Downstream W/L 84.63 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	87.98	1.68	81.72	64.63	74.60	OK
					9.97	

Subdrainage Area: L101A — Controlled - Tributary
Area (ha): 0.35
C: 0.85

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	149.49	81.43	68.06	**40.83**
20	119.95	100.42	81.43	18.99	22.79
30	91.87	76.91	81.43	0.00	0.00
40	75.15	62.91	81.43	0.00	0.00
50	63.95	53.54	81.43	0.00	0.00
60	55.89	46.80	81.43	0.00	0.00
70	49.79	41.68	81.43	0.00	0.00
80	44.99	37.67	81.43	0.00	0.00
90	41.11	34.42	81.43	0.00	0.00
100	37.90	31.73	81.43	0.00	0.00
110	35.20	29.47	81.43	0.00	0.00
120	32.89	27.54	81.43	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.57
Orifice Diameter: 178.00 mm
Invert Elevation 86.14 m
T/G Elevation 87.52 m
Max Ponding Depth 0.30 m
Downstream W/L 84.38 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	87.82	1.68	81.43	40.83	49.20	OK
					8.37	

Subdrainage Area: R107B — Roof
Area (ha): 0.10 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	49.64	12.08	37.56	22.53	123.6	0.00
20	119.95	33.35	12.28	21.06	**25.28**	128.2	0.00
30	91.87	25.54	12.20	13.34	24.01	126.3	0.00
40	75.15	20.89	11.97	8.92	21.40	121.1	0.00
50	63.95	17.78	11.67	6.11	18.32	114.3	0.00
60	55.89	15.54	11.35	4.19	15.07	107.1	0.00
70	49.79	13.84	11.03	2.81	11.80	99.8	0.00
80	44.99	12.51	10.60	1.90	9.14	90.1	0.00
90	41.11	11.43	10.20	1.23	6.64	81.0	0.00
100	37.90	10.54	9.78	0.75	4.52	71.6	0.00
110	35.20	9.79	9.32	0.46	3.05	61.2	0.00
120	32.89	9.14	8.91	0.24	1.72	51.7	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	128.16	0.13	12.28	25.28	40.00	0.00

Stormwater Management Calculations

Project #160401710, Decoeur/Tenth Line
Modified Rational Method Calculatons for Storage

Subdrainage Area: R107A — Roof
Area (ha): 0.10 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	19.22	10.02	9.20	5.52	76.9	0.00
20	52.03	13.02	9.64	3.38	4.05	68.3	0.00
30	40.04	10.02	8.96	1.06	1.90	53.0	0.00
40	32.86	8.22	7.74	0.48	1.16	43.8	0.00
50	28.04	7.02	6.73	0.29	0.86	38.1	0.00
60	24.56	6.14	5.97	0.18	0.64	33.8	0.00
70	21.91	5.48	5.37	0.11	0.47	30.4	0.00
80	19.83	4.96	4.89	0.07	0.33	27.7	0.00
90	18.14	4.54	4.50	0.04	0.21	25.5	0.00
100	16.75	4.19	4.16	0.03	0.17	23.6	0.00
110	15.57	3.90	3.87	0.02	0.16	21.9	0.00
120	14.56	3.64	3.62	0.02	0.15	20.5	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	76.89	0.08	10.02	5.52	40.00	0.00

Subdrainage Area: R104A — Roof
Area (ha): 0.10 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	19.22	10.02	9.20	5.52	76.9	0.00
20	52.03	13.02	9.64	3.38	4.05	68.3	0.00
30	40.04	10.02	8.96	1.06	1.90	53.0	0.00
40	32.86	8.22	7.74	0.48	1.16	43.8	0.00
50	28.04	7.02	6.73	0.29	0.86	38.1	0.00
60	24.56	6.14	5.97	0.18	0.64	33.8	0.00
70	21.91	5.48	5.37	0.11	0.47	30.4	0.00
80	19.83	4.96	4.89	0.07	0.33	27.7	0.00
90	18.14	4.54	4.50	0.04	0.21	25.5	0.00
100	16.75	4.19	4.16	0.03	0.17	23.6	0.00
110	15.57	3.90	3.87	0.02	0.16	21.9	0.00
120	14.56	3.64	3.62	0.02	0.15	20.5	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	76.89	0.08	10.02	5.52	40.00	0.00

Subdrainage Area: UNC-4 — Uncontrolled - Non-Tributary
Area (ha): 0.09
C: 0.40

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	7.91	7.91		
20	52.03	5.36	5.36		
30	40.04	4.13	4.13		
40	32.86	3.39	3.39		
50	28.04	2.89	2.89		
60	24.56	2.53	2.53		
70	21.91	2.26	2.26		
80	19.83	2.04	2.04		
90	18.14	1.87	1.87		
100	16.75	1.73	1.73		
110	15.57	1.60	1.60		
120	14.56	1.50	1.50		

Subdrainage Area: UNC-3 — Uncontrolled - Non-Tributary
Area (ha): 0.06
C: 0.68

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	8.71	8.71		
20	52.03	5.90	5.90		
30	40.04	4.54	4.54		
40	32.86	3.73	3.73		
50	28.04	3.18	3.18		
60	24.56	2.79	2.79		
70	21.91	2.49	2.49		
80	19.83	2.25	2.25		
90	18.14	2.06	2.06		
100	16.75	1.90	1.90		
110	15.57	1.77	1.77		
120	14.56	1.65	1.65		

Subdrainage Area: UNC-2 — Uncontrolled - Non-Tributary
Area (ha): 0.09
C: 0.20

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	3.84	3.84		
20	52.03	2.60	2.60		
30	40.04	2.00	2.00		
40	32.86	1.64	1.64		
50	28.04	1.40	1.40		
60	24.56	1.23	1.23		
70	21.91	1.10	1.10		
80	19.83	0.99	0.99		
90	18.14	0.91	0.91		
100	16.75	0.84	0.84		
110	15.57	0.78	0.78		
120	14.56	0.73	0.73		

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.05
C: 0.32

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	3.19	3.19		
20	52.03	2.16	2.16		
30	40.04	1.66	1.66		
40	32.86	1.37	1.37		
50	28.04	1.16	1.16		
60	24.56	1.02	1.02		
70	21.91	0.91	0.91		
80	19.83	0.82	0.82		
90	18.14	0.75	0.75		
100	16.75	0.70	0.70		
110	15.57	0.65	0.65		
120	14.56	0.60	0.60		

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	2.902 ha			
Total 2yr Flow to Sewer	458.35 L/s	16.56	704.60 m³	Ok
Non-Tributary Area	0.289 ha			
Total 2yr Flow Uncontrolled	23.66 L/s			
Total Area	3.191 ha			
Total 2yr Flow	482.01 L/s			
Target	702.02 L/s			

Project #160401710, Decoeur/Tenth Line
Modified Rational Method Calculatons for Storage

Subdrainage Area: R107A — Roof
Area (ha): 0.10 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	26.07	10.62	15.45	**9.27**	90.6	0.00
20	70.25	17.58	10.50	7.08	8.49	87.8	0.00
30	53.93	13.49	10.11	3.38	6.09	79.0	0.00
40	44.18	11.05	9.52	1.53	3.68	65.6	0.00
50	37.65	9.42	8.88	0.54	1.63	51.0	0.00
60	32.94	8.24	7.91	0.34	1.21	44.8	0.00
70	29.37	7.35	7.12	0.23	0.98	40.3	0.00
80	26.56	6.65	6.48	0.16	0.79	36.7	0.00
90	24.29	6.08	5.96	0.12	0.64	33.7	0.00
100	22.41	5.61	5.52	0.08	0.51	31.3	0.00
110	20.82	5.21	5.15	0.06	0.40	29.2	0.00
120	19.47	4.87	4.83	0.04	0.31	27.3	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	90.57	0.09	10.62	9.27	40.00	0.00

Subdrainage Area: R104A — Roof
Area (ha): 0.10 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	26.07	10.62	15.45	**9.27**	90.6	0.00
20	70.25	17.58	10.50	7.08	8.49	87.8	0.00
30	53.93	13.49	10.11	3.38	6.09	79.0	0.00
40	44.18	11.05	9.52	1.53	3.68	65.6	0.00
50	37.65	9.42	8.88	0.54	1.63	51.0	0.00
60	32.94	8.24	7.91	0.34	1.21	44.8	0.00
70	29.37	7.35	7.12	0.23	0.98	40.3	0.00
80	26.56	6.65	6.48	0.16	0.79	36.7	0.00
90	24.29	6.08	5.96	0.12	0.64	33.7	0.00
100	22.41	5.61	5.52	0.08	0.51	31.3	0.00
110	20.82	5.21	5.15	0.06	0.40	29.2	0.00
120	19.47	4.87	4.83	0.04	0.31	27.3	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	90.57	0.09	10.62	9.27	40.00	0.00

Subdrainage Area: UNC-4 — Uncontrolled - Non-Tributary
Area (ha): 0.09
C: 0.40

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	10.74	10.74		
20	70.25	7.24	7.24		
30	53.93	5.56	5.56		
40	44.18	4.55	4.55		
50	37.65	3.88	3.88		
60	32.94	3.39	3.39		
70	29.37	3.03	3.03		
80	26.56	2.74	2.74		
90	24.29	2.50	2.50		
100	22.41	2.31	2.31		
110	20.82	2.15	2.15		
120	19.47	2.01	2.01		

Subdrainage Area: UNC-3 — Uncontrolled - Non-Tributary
Area (ha): 0.06
C: 0.68

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	11.82	11.82		
20	70.25	7.97	7.97		
30	53.93	6.12	6.12		
40	44.18	5.01	5.01		
50	37.65	4.27	4.27		
60	32.94	3.74	3.74		
70	29.37	3.33	3.33		
80	26.56	3.01	3.01		
90	24.29	2.75	2.75		
100	22.41	2.54	2.54		
110	20.82	2.36	2.36		
120	19.47	2.21	2.21		

Subdrainage Area: UNC-2 — Uncontrolled - Non-Tributary
Area (ha): 0.09
C: 0.20

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	5.21	5.21		
20	70.25	3.52	3.52		
30	53.93	2.70	2.70		
40	44.18	2.21	2.21		
50	37.65	1.88	1.88		
60	32.94	1.65	1.65		
70	29.37	1.47	1.47		
80	26.56	1.33	1.33		
90	24.29	1.22	1.22		
100	22.41	1.12	1.12		
110	20.82	1.04	1.04		
120	19.47	0.97	0.97		

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.05
C: 0.32

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	4.33	4.33		
20	70.25	2.92	2.92		
30	53.93	2.24	2.24		
40	44.18	1.84	1.84		
50	37.65	1.56	1.56		
60	32.94	1.37	1.37		
70	29.37	1.22	1.22		
80	26.56	1.10	1.10		
90	24.29	1.01	1.01		
100	22.41	0.93	0.93		
110	20.82	0.87	0.87		
120	19.47	0.81	0.81		

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	2.902 ha			
Total 5yr Flow to Sewer	555.82 L/s	62.05	704.60 m³	Ok
Non-Tributary Area	0.289 ha			
Total 5yr Flow Uncontrolled	32.10 L/s			
Total Area	3.191 ha			
Total 5yr Flow	587.91 L/s			
Target	702.02 L/s			

Project #160401710, Decoeur/Tenth Line
Modified Rational Method Calculatons for Storage

Subdrainage Area: R107A — Roof
Area (ha): 0.10 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	49.64	12.08	37.56	22.53	123.6	0.00
20	119.95	33.35	12.28	21.06	**25.28**	128.2	0.00
30	91.87	25.54	12.20	13.34	24.01	126.3	0.00
40	75.15	20.89	11.97	8.92	21.40	121.1	0.00
50	63.95	17.78	11.67	6.11	18.32	114.3	0.00
60	55.89	15.54	11.35	4.19	15.07	107.1	0.00
70	49.79	13.84	11.03	2.81	11.80	99.8	0.00
80	44.99	12.51	10.60	1.90	9.14	90.1	0.00
90	41.11	11.43	10.20	1.23	6.64	81.0	0.00
100	37.90	10.54	9.78	0.75	4.52	71.6	0.00
110	35.20	9.79	9.32	0.46	3.05	61.2	0.00
120	32.89	9.14	8.91	0.24	1.72	51.7	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	128.16	0.13	12.28	25.28	40.00	0.00

Subdrainage Area: R104A — Roof
Area (ha): 0.10 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	49.64	12.08	37.56	22.53	123.6	0.00
20	119.95	33.35	12.28	21.06	**25.28**	128.2	0.00
30	91.87	25.54	12.20	13.34	24.01	126.3	0.00
40	75.15	20.89	11.97	8.92	21.40	121.1	0.00
50	63.95	17.78	11.67	6.11	18.32	114.3	0.00
60	55.89	15.54	11.35	4.19	15.07	107.1	0.00
70	49.79	13.84	11.03	2.81	11.80	99.8	0.00
80	44.99	12.51	10.60	1.90	9.14	90.1	0.00
90	41.11	11.43	10.20	1.23	6.64	81.0	0.00
100	37.90	10.54	9.78	0.75	4.52	71.6	0.00
110	35.20	9.79	9.32	0.46	3.05	61.2	0.00
120	32.89	9.14	8.91	0.24	1.72	51.7	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	128.16	0.13	12.28	25.28	40.00	0.00

Subdrainage Area: UNC-4 — Uncontrolled - Non-Tributary
Area (ha): 0.09
C: 0.50

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	23.00	23.00		
20	119.95	15.45	15.45		
30	91.87	11.83	11.83		
40	75.15	9.68	9.68		
50	63.95	8.24	8.24		
60	55.89	7.20	7.20		
70	49.79	6.41	6.41		
80	44.99	5.79	5.79		
90	41.11	5.30	5.30		
100	37.90	4.88	4.88		
110	35.20	4.53	4.53		
120	32.89	4.24	4.24		

Subdrainage Area: UNC-3 — Uncontrolled - Non-Tributary
Area (ha): 0.06
C: 0.85

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	25.32	25.32		
20	119.95	17.01	17.01		
30	91.87	13.03	13.03		
40	75.15	10.65	10.65		
50	63.95	9.07	9.07		
60	55.89	7.92	7.92		
70	49.79	7.06	7.06		
80	44.99	6.38	6.38		
90	41.11	5.83	5.83		
100	37.90	5.37	5.37		
110	35.20	4.99	4.99		
120	32.89	4.66	4.66		

Subdrainage Area: UNC-2 — Uncontrolled - Non-Tributary
Area (ha): 0.09
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	11.17	11.17		
20	119.95	7.50	7.50		
30	91.87	5.75	5.75		
40	75.15	4.70	4.70		
50	63.95	4.00	4.00		
60	55.89	3.50	3.50		
70	49.79	3.11	3.11		
80	44.99	2.81	2.81		
90	41.11	2.57	2.57		
100	37.90	2.37	2.37		
110	35.20	2.20	2.20		
120	32.89	2.06	2.06		

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.05
C: 0.40

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	9.27	9.27		
20	119.95	6.23	6.23		
30	91.87	4.77	4.77		
40	75.15	3.90	3.90		
50	63.95	3.32	3.32		
60	55.89	2.90	2.90		
70	49.79	2.59	2.59		
80	44.99	2.34	2.34		
90	41.11	2.13	2.13		
100	37.90	1.97	1.97		
110	35.20	1.83	1.83		
120	32.89	1.71	1.71		

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	2.902 ha			
Total 100yr Flow to Sewer	624.73 L/s	459.55	704.60 m³	Ok
Non-Tributary Area	0.289 ha			
Total 100yr Flow Uncontrolled	68.76 L/s			
Total Area	3.191 ha			
Total 100yr Flow	693.49 L/s			
Target	702.02 L/s			

C.2 STORM SEWER DESIGN SHEET

Stantec	DECOEUR	STORM SEWER DESIGN SHEET (City of Ottawa)	DESIGN PARAMETERS
	DATE: 2022-11-22		$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)
	REVISION: 2		
	DESIGNED BY: MJS	FILE NUMBER: 160401710	
	CHECKED BY: DT		

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

LOCATION			DRAINAGE AREA																									PIPE SELECTION										
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	TIME OF FLOW (min)
R104A	BLDG C	104	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	12.3	12.3	12.3	9.4	200	200	CIRCULAR	PVC	-	1.00	33.3	**36.87%**	1.05	0.19
																				10.19																		
L105A	105A-1	104	0.12	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.083	0.083	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	17.8	27.2	200	200	CIRCULAR	PVC	-	1.00	33.3	**53.35%**	1.05	0.50
																				10.50																		
L104A, L104B	104	103	0.76	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.603	0.686	0.000	0.000	0.000	0.000	0.000	0.000	10.50	74.95	101.64	119.14	174.14	0.0	12.3	155.1	108.6	450	450	CIRCULAR	CONCRETE	-	0.40	188.1	**82.45%**	1.15	1.59
																				12.08																		
	109A-1	109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	10.5	200	200	CIRCULAR	PVC	-	1.00	33.3	**0.00%**	1.05	0.00
L109A	109	106	0.38	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.306	0.306	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	65.2	40.7	300	300	CIRCULAR	PVC	-	0.75	83.3	**78.30%**	1.18	0.59
																				10.59																		
	108A-1	108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	10.4	200	200	CIRCULAR	PVC	-	1.00	33.3	**0.00%**	1.05	0.00
L108A	108	106	0.36	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.302	0.302	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	64.4	46.1	300	300	CIRCULAR	PVC	-	0.75	83.3	**77.33%**	1.18	0.67
																				10.67																		
	BLDG A	107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	12.3	12.3	12.3	9.0	200	200	CIRCULAR	PVC	-	1.00	33.3	**36.87%**	1.05	0.19
																				10.19																		
	BLDG B	107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	12.3	12.3	12.3	7.4	200	200	CIRCULAR	PVC	-	1.00	33.3	**36.87%**	1.05	0.15
																				10.15																		
R107B, R107A	107	106	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.19	76.10	103.23	121.00	176.88	0.0	24.6	24.6	35.2	300	300	CIRCULAR	PVC	-	0.50	68.0	**36.12%**	0.97	0.78
																				10.97																		
L106A	106	103	0.20	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.166	0.773	0.000	0.000	0.000	0.000	0.000	0.000	10.97	73.28	99.35	116.44	170.18	0.0	24.6	181.9	52.1	600	600	CIRCULAR	CONCRETE	-	0.15	248.1	**73.33%**	0.85	1.06
																				12.03																		
L103A	103	102	0.43	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.306	1.765	0.000	0.000	0.000	0.000	0.000	0.000	12.08	69.64	94.34	110.54	161.52	0.0	36.8	378.3	48.5	750	750	CIRCULAR	CONCRETE	-	0.15	449.8	**84.11%**	0.99	0.82
	102	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.765	0.000	0.000	0.000	0.000	0.000	0.000	12.90	67.21	91.01	106.62	155.77	0.0	36.8	366.4	22.0	750	750	CIRCULAR	CONCRETE	-	0.15	449.8	**81.46%**	0.99	0.37
L101A	101	100	0.35	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.241	2.006	0.000	0.000	0.000	0.000	0.000	0.000	13.28	66.16	89.57	104.93	153.28	0.0	36.8	405.5	81.4	825	825	CIRCULAR	CONCRETE	-	0.15	580.0	**69.92%**	1.05	1.36
																				14.64								825	825								

C.3 BACKGROUND REPORT EXCERPTS

ii) The storm sewer on Des Aubépines Drive (referred as the Eastern Trunk as per IBI Group Report) is already constructed and is designed to carry the flow from this proposed development. The trunk information was extracted from IBI's As-Built Drawings of Neighbourhood 5, Phase 1, dated December 17th, 2009.

iii) There is an existing 28.0m – 675mmø sanitary concrete stub west of existing San MH 15166 located on Tenth Line Rd near the pumping station.

iv) It is proposed to connect directly on these services as they have been designed accordingly. The watermain, storm and sanitary sewer design of Avalon West Stage 3 were done in conjunction with IBI's reports titled "Mer Bleue Community Design Plan Infrastructure Servicing Study report dated April 2006" and "Avalon West (Neighbourhood 5), Stormwater Management Facility Design, Revision 5" dated October 2013.

1.4 Storm Sewer

The "Mer Bleue Community Design Plan Infrastructure Servicing Study" and "Avalon West (Neighbourhood 5), Stormwater Management Facility Design Report" prepared by IBI Group recommends that the storm water of Avalon West Stage 3 be conveyed to the future Storm Water Management (SWM) Basin located south of Neigbourhood 5. The Avalon West Stage 3 development falls within the Eastern Trunk watershed, which conveys its runoff to a SWM pond. This SWM facility (designed by others) will control both the quantity and quality of the storm water from Avalon West Stage 3. The attenuated flow will then discharge via a storm sewer, which will outlet into the McKinnon Creek located south of the proposed pond. According to IBI Group's memo"Update to Avalon West Stormwater Management Facility Design Report: Proposed Mattamy Bisson Lands" dated November 3, 2014 the pond level for the 100yr will be 84.65 m once the Mattamy Bisson lands are developed.

1.4.1 Design Constraints

The main storm drainage design constraints can be summarized as follows:

a) Minor System

1) Storm sewer will be designed using the Rational formula for the 5 year storm using an inlet time of 10 minutes for roads.
2) All residential inlets will be equipped with flow restrictors. The term "inlet" means "a single catch basin" or "a group of interconnected catchbasins" connected by a single lead into the minor system. The inflow rate into the minor system shall be 220 L/s/ha, as per IBI's report.
3) Catch basin densities and capacities for commercial development should be assessed on a site specific basis to limit the inflow into the minor system to a maximum of 220 L/s/ha, as per IBI's report.
4) Green space areas shall be restricted to 220L/s/ha, as per IBI's report.
5) The arterial roads area shall be restricted to a 1:10 year storm and a 10 minute inlet time which represents 238 l/s/ha according to IBI's report.

6) The hydraulic grade line shall be computed and the maximum permitted hydraulic grade line elevation is to be 0.30m below the underside of footing.
7) Dynamic modelling shall be provided for all submerged outlets.

b) Major System

1) Grading design is to be based on split lot drainage.
2) The commercial developments and green space shall be designed to provide an on-site storage to retain the 100 year storm event.
3) On site detention storage of 124 m^3/ha for Townhouses, 108 m^3/ha for single family units and 168 m^3/ha for stacked homes may be provided in the following areas:
   i) Road low points (Sawtoothing design)
   ii) Parking Areas on private sites

c) Street and Rear Yard Emergency Overflow

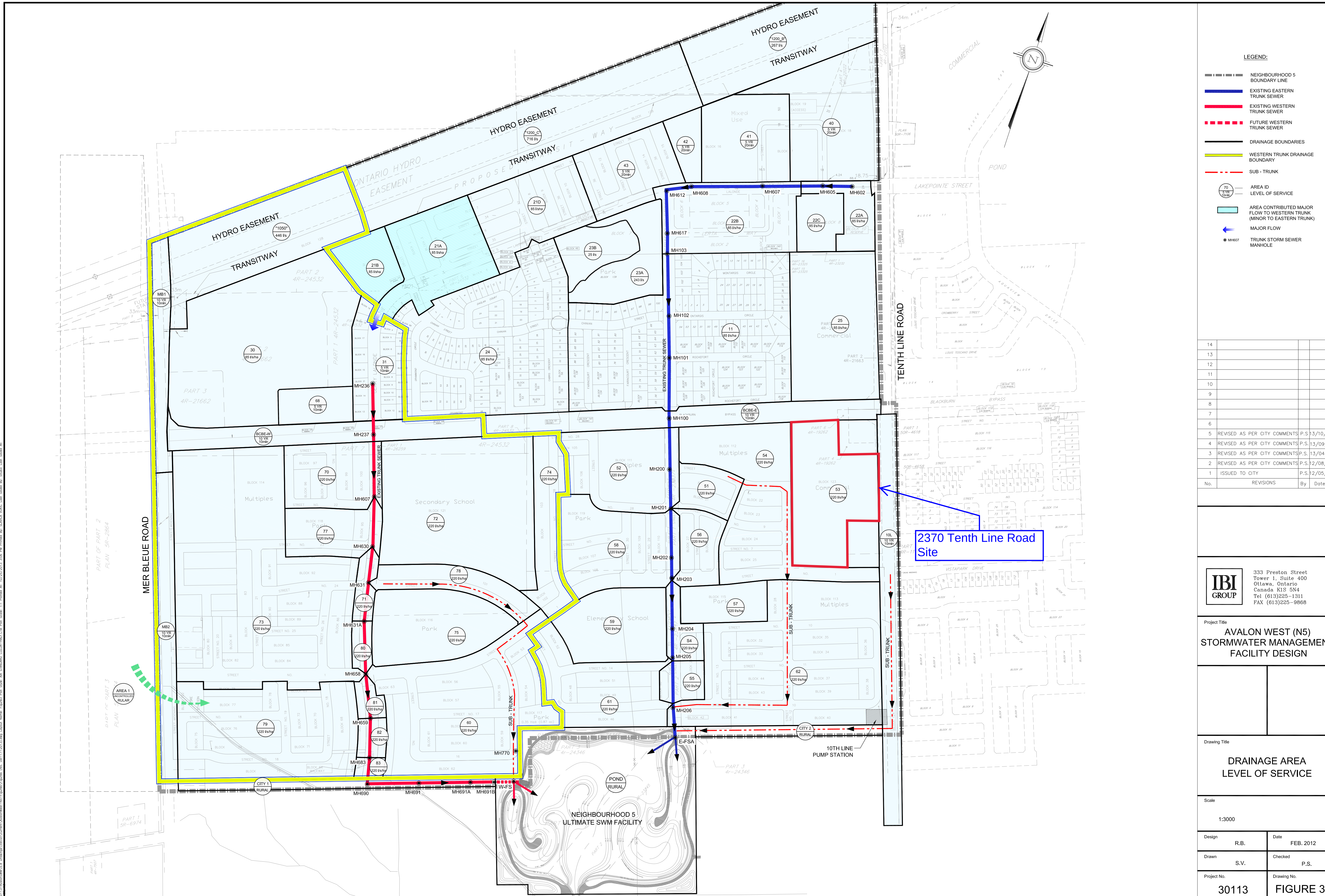
1) On street routing to emergency storage area must be provided and illustrated on the grade control plan. This routing must incorporate a maximum 0.30m flow depth on street under either static or dynamic conditions. An overall positive slope of 0.10% will be required across consecutive high points for routing purposes.
2) A maximum ponding depth of 0.30m will be allowed in the rear yards.
3) A ponding area plan that includes an identification number, the area, the depth, the volume and an elevation will be required.

d) Water Quality

An Enhanced Level of Protection (80 % removal of Total Suspended Solids) will be achieved in the ultimate stormwater management wet pond, as per IBI's reports. The Best Management Practices should also be implemented within the subdivision design and during construction.

e) Geotechnical Constraints

The geotechnical investigation conducted for Neighbourhood 5 – Avalon West indicates that the low lying lands are prone to an excessive soil consolidation, and can only be developed with grade raise restriction or by using non-standard techniques, such as structural slabs.


LEGEND:
NEIGHBOURHOOD 5 BOUNDARY LINE
EXISTING EASTERN TRUNK SEWER
EXISTING WESTERN TRUNK SEWER
FUTURE WESTERN TRUNK SEWER
DRAINAGE BOUNDARIES
WESTERN TRUNK DRAINAGE BOUNDARY
SUB - TRUNK
AREA ID LEVEL OF SERVICE
AREA CONTRIBUTED MAJOR FLOW TO WESTERN TRUNK (MINOR TO EASTERN TRUNK)
MAJOR FLOW
TRUNK STORM SEWER MANHOLE
HYDRO EASEMENT
TRANSITWAY
ONTARIO HYDRO EASEMENT
MER BLEUE ROAD
TENTH LINE ROAD
EXISTING TRUNK SEWER
SUB - TRUNK
2370 Tenth Line Road Site
10TH LINE PUMP STATION
NEIGHBOURHOOD 5 ULTIMATE SWM FACILITY
POND RURAL
Secondary School
Park
Multiples
Commercial
Mixed Use
5 REVISED AS PER CITY COMMENTS P.S. 13/10/25
4 REVISED AS PER CITY COMMENTS P.S. 13/09/19
3 REVISED AS PER CITY COMMENTS P.S. 13/04/08
2 REVISED AS PER CITY COMMENTS P.S. 12/08/14
1 ISSUED TO CITY P.S. 12/05/30
No. REVISIONS By Date
IBI GROUP
333 Preston Street Tower 1, Suite 400 Ottawa, Ontario Canada K1S 5N4 Tel (613)225-1311 FAX (613)225-9868
Project Title
AVALON WEST (N5) STORMWATER MANAGEMENT FACILITY DESIGN
Drawing Title
DRAINAGE AREA LEVEL OF SERVICE
Scale 1:3000
Design R.B.
Date FEB. 2012
Drawn S.V.
Checked P.S.
Project No. 30113
Drawing No. FIGURE 3

STORM SEWER COMPUTATION FORM

DESIGNED BY: AGS
CHECKED BY: JMD

Neighbourhood 5 - Avalon West - STAGE 3
Minto Communities Inc.
131004
ATREL ENGINEERING LTD
November 2014

STORM FREQUENCY : 5 YEAR
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 1

STREET NAMES	LOCATION FROM (Up)		TO (Down)		AREA (ha.) RUNOFF COEFFICIENT 0.20	0.27	0.29	0.30	0.36	0.39	0.45	0.48	0.50	0.55	0.60	0.62	0.65	0.70	0.75	0.80	0.85	0.70	0.70	0.76	RATIONAL METHOD INDIV. 2.78AR	ACCUM. 2.78AR	5 YEAR TIME CONC. (MIN)	RAINF. INTENS. (MM/HR)	FLOW (L/S)	Commercial & green space area Restr Flow (L/S)	Cum Flow (L/S)	ACTUAL PIPE FLOW (L/S)	SEWER DATA PIPE TYPE	DIA. (NOM) (mm)	(ACT)	SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	UpStream Hgl at UP-MH (M)	Hgl Out UP-MH (M)	Down MH Hgl (M)	SURG AT UP MH (M)	USF ELEV (M)	UpStream HGL FREEBOARD (M)	Comment
Future Site Plan	MH	Stub1	MH	602																				0.70			15.00	83.56		103.91	103.91	103.91	CONC	450	457.2	0.20	9.0	133.02	22%	0.81	0.19	86.05	85.60	0.54	no	86.03	85.58	86.05	86.05	86.04		n/a	n/a	n/a
Bluestone Private	MH	601	MH	602														0.64							1.25	1.25	15.00	83.56	104.07			104.07	CONC	525	533.4	1.03	112.0	455.34	77%	2.04	0.92	86.62	86.10	-0.02	no	85.47	84.95	86.62	86.62	86.04		87.50	0.88	OK
G.Lalonde Drive	MH	602	MH	605											0.34										0.57	1.81	15.92	80.71	146.29		103.91	250.20	CONC	600	609.6	0.20	82.5	286.47	13%	0.98	1.40	85.49	84.89	-0.59	no	85.32	84.72	86.04	86.04	85.91	0.55	87.50	1.46	OK
Bluestone Private	MH	603	MH	605													0.28	0.61							1.69	1.69	15.00	83.56	141.47			141.47	CONC	525	533.4	1.20	112.5	491.48	71%	2.20	0.85	86.49	85.97	-0.77	no	85.14	84.62	86.49	86.49	85.91		87.38	0.89	OK
Future Site Plan	MH	Stub2	MH	605		4.94																		3.65			15.00	83.56		813.80	813.80	813.80	CONC	975	990.6	0.16	9.0	935.18	13%	1.21	0.12	85.94	84.97	0.02	no	85.93	84.96	85.94	85.94	85.93		n/a	n/a	n/a
G.Lalonde Drive	MH	605	MH	607											0.19										0.32	3.82	17.32	76.75	293.38		917.71	1211.09	CONC	1350	1371.6	0.10	80.0	1760.81	31%	1.19	1.12	85.91	84.56		no	85.83	84.48	85.91	85.91	85.83		86.78	0.87	OK
Future Site Plan	MH	Stub3	MH	607																				1.33			15.00	83.56		197.43	197.43	197.43	CONC	600	609.6	0.15	9.0	248.09	20%	0.85	0.18	85.84	85.24		no	85.83	85.23	85.84	85.84	85.83		n/a	n/a	n/a
G.Lalonde Drive	MH	607	MH	608													0.25								0.45	4.27	18.44	73.88	315.78		1115.14	1430.92	CONC	1350	1371.6	0.10	103.0	1760.81	19%	1.19	1.44	85.83	84.48		no	85.73	84.38	85.83	85.83	85.76		86.74	0.91	OK
Future Street	MH	Stub4	MH	608												0.74								1.50	1.28	1.28	15.00	83.56	106.58	222.66	222.66	329.24	CONC	750	762.0	0.15	9.0	449.81	27%	0.99	0.15	85.74	84.99		no	85.73	84.98	85.77	85.77	85.76	0.03	n/a	n/a	n/a
G.Lalonde Drive	MH	608	MH	612													0.56								1.01	6.56	19.88	70.52	462.73		1337.80	1800.52	CONC	1350	1371.6	0.12	94.0	1928.87	7%	1.31	1.20	85.73	84.38	0.05	no	85.62	84.27	85.76	85.76	85.66	0.03	86.70	0.94	OK
Petrichor Crescent	MH	650	MH	651										0.27	0.17										0.70	0.70	10.00	104.19	72.56			72.56	PVC	375	366.4	0.26	39.5	84.05	14%	0.80	0.83	86.16	85.79		no	86.06	85.69	86.17	86.17	86.09	0.01	n/a	n/a	n/a
Petrichor Crescent	MH	651	MH	652														0.35							0.68	1.38	10.83	100.02	137.78			137.78	CONC	525	533.4	0.16	111.0	179.46	23%	0.80	2.30	86.06	85.54		no	85.88	85.36	86.09	86.06	85.88		86.71	0.65	OK
G.Lalonde Drive	MH	652	MH	654									0.18												0.25	1.63	13.13	90.13	146.70			146.70	CONC	525	533.4	0.16	51.5	179.46	18%	0.80	1.07	85.82	85.30		no	85.74	85.22	85.86	85.83	85.77	0.01	n/a	n/a	n/a
Petrichor Crescent	MH	653	MH	654														0.58							1.13	1.13	10.00	104.19	117.60			117.60	CONC	525	533.4	0.20	118.5	200.65	41%	0.90	2.20	85.98	85.46		no	85.74	85.22	85.98	85.98	85.77		86.63	0.65	OK
G.Lalonde Drive	MH	654	MH	655									0.19												0.26	3.02	14.20	86.24	260.49			260.49	CONC	675	685.8	0.15	54.0	339.63	23%	0.92	0.98	85.74	85.07		no	85.66	84.99	85.77	85.74	85.66		n/a	n/a	n/a
G.Lalonde Drive	MH	655	MH	612																						3.02	15.18	82.99	250.67			250.67	CONC	1200	1219.2	0.15	19.0	1575.26	84%	1.35	0.23	85.66	84.46	0.06	no	85.63	84.43	85.66	85.66	85.66		n/a	n/a	n/a
Petrichor Crescent	MH	656	MH	658										0.27	0.20										0.75	0.75	10.00	104.19	77.77			77.77	PVC	375	366.4	0.35	37.5	97.52	20%	0.92	0.68	85.87	85.50		no	85.74	85.37	85.87	85.87	85.77		n/a	n/a	n/a
Transit Way/Hydro	MH	657	MH	658			9.47																				10.00	104.19		716.00	716.00	716.00	CONC	1200	1219.2	0.15	9.0	1575.26	55%	1.35	0.11	85.75	84.55		no	85.74	84.54	85.77	85.77	85.77	0.02	n/a	n/a	n/a
Petrichor Crescent	MH	658	MH	612										0.18				0.38							1.01	1.76	10.68	100.75	177.43		716.00	893.43	CONC	1200	1219.2	0.15	115.0	1575.26	43%	1.35	1.42	85.74	84.54		no	85.57	84.37	85.77	85.74	85.66		86.63	0.89	OK
Strasbourg Street	MH	612	MH	617													0.25								0.45	11.79	21.08	67.97	801.71		2053.79	2855.50	CONC	1800	1828.8	0.10	83.5	3792.13	25%	1.44	0.96	85.57	83.77		no	85.49	83.69	85.66	85.57	85.49		86.68	1.11	OK
Lerta Crescent	MH	613	MH	614							0.20						0.31								0.81	0.81	15.00	83.56	67.71			67.71	PVC	375	366.4	0.35	61.0	97.52	31%	0.92	1.10	86.18	85.81		no	85.97	85.60	86.18	86.18	85.98		86.78	0.60	OK
Lerta Crescent	MH	614	MH	615							0.21														0.26	1.07	16.10	80.17	86.03			86.03	CONC	450	457.2	0.26	9.5	151.66	43%	0.92	0.17	85.97	85.52		no	85.95	85.50	85.98	85.97	85.96		86.89	0.92	OK
Lerta Crescent	MH	615	MH	616							0.28						0.37								1.02	2.09	16.27	79.66	166.64			166.64	CONC	525	533.4	0.30	83.5	245.74	32%	1.10	1.27	85.95	85.43		no	85.70	85.18	85.96	85.95	85.70		86.67	0.72	OK
Lerta Crescent	MH	616	MH	617							0.59						0.40								1.46	3.55	17.54	76.17	270.62			270.62	CONC	675	685.8	0.76	106.5	764.49	65%	2.07	0.86	85.70	85.03	-0.60	no	84.89	84.22	85.70	85.70	85.49		86.55	0.85	OK
Strasbourg Street	MH	617	MH	1103													0.07								0.13	15.47	22.04	66.07	1022.39		2053.79	3076.18	CONC	1800	1828.8	0.10	42.0	3792.13	19%	1.44	0.48	85.49	83.69		no	85.45	83.65	85.49	85.49	85.45		n/a	n/a	n/a
Strasbourg Street	MH	1103	MH	1102				1.89			0.51														2.21	17.69	22.53	65.15	1152.41		2053.79	3206.21	CONC	1800	1828.8	0.10	121.8	3792.13	15%	1.44	1.41	85.45	83.65	0.01	no	85.33	83.53	85.45	85.45	85.36		n/a	n/a	n/a
G.Lalonde Drive	MH	234	MH	233													0.37								0.67	0.67	10.00	104.19	69.66			69.66	PVC	375	366.4	0.40	48.7	104.25	33%	0.99	0.82	86.36	85.98	-0.04	no	86.17	85.79	86.36	86.36	86.24		86.99	0.63	OK
G.Lalonde Drive	MH	233	MH	211													0.18								0.33	0.99	10.82	100.05	99.43			99.43	CONC	450	457.2	0.26	31.0	151.66	34%	0.92	0.56	86.21	85.76	0.23	1	86.13	85.68	86.24	86.24	86.21	0.03	86.75	0.51	OK
G. Lalonde Drive	MH	624	MH	211										0.14				0.27							0.74	0.74	10.00	104.19	77.05			77.05	CONC	450	457.2	0.35	77.5	175.96	56%	1.07	1.21	86.40	85.95	-0.08	X	86.13	85.68	86.40	86.40	86.21		86.93	0.53	OK
Trigoria Crescent	MH	680	MH	681													0.27								0.49	0.49	10.00	104.19	50.83			50.83	CONC	600	609.6	0.26	25.0	326.62	84%	1.12	0.37	86.42	85.82		no	86.35	85.75	86.42	86.42	86.38		86.85	0.43	OK
Future Site Plan	MH	690	MH	681										0.18							0.32				1.03	1.03	10.00	104.19	107.46			107.46	CONC	450	457.2	0.20	112.0	133.02	19%	0.81	2.30	86.57	86.12		no	86.35	85.90	86.57	86.57	86.38		87.75	1.18	OK
Trigoria Crescent	MH	681	MH	682																						1.52	12.30	93.42	141.93			141.93	CONC	600	609.6	0.26	41.0	326.62	57%	1.12	0.61	86.35	85.75		no	86.24	85.64	86.38	86.36	86.34	0.01	86.85	0.49	OK
Future Site Plan	MH	691	MH	692													0.06			0.32					0.82	0.82	10.00	104.19	85.45			85.45	CONC	525	533.4	0.16	50.0	179.46	52%	0.80	1.04	86.42	85.90		no	86.34	85.82	86.42	86.42	86.38		87.67	1.25	OK
Future Site Plan	MH	692	MH	682																0.21					0.47	1.29	11.04	99.01	127.44			127.44	CONC	525	533.4	0.16	44.5	179.46	29%	0.80	0.92	86.31	85.79		no	86.24	85.72	86.38	86.38	86.34	0.07	87.52	1.14	OK
Trigoria Crescent	MH	682	MH	211														0.22							0.43	3.23	12.91	90.96	294.21			294.21	CONC	600	609.6	0.26	44.0	326.62	10%	1.12	0.66	86.24	85.64	-0.08	no	86.13	85.53	86.34	86.30	86.21	0.06	86.80	0.50	OK
Chinian Street	MH	211	MH	210						0.55			0.16												0.82	5.79	13.57	88.48	512.00			512.00	CONC	825	838.2	0.10	55.4	473.55	-8%	0.86	1.08	86.21	85.39	0.03	no	86.15	85.33	86.21	86.21	86.15		n/a	n/a	n/a
Chinian Street	MH	210	MH	209																						5.79	14.65	84.72	490.24			490.24	CONC	825	838.2	0.10	23.9	473.55	-4%	0.86	0.46	86.12	85.30	0.03	no	86.10	85.28	86.15	86.13	86.10	0.01	88.72	2.59	OK
																											16.19							975																				
Chinian Street	MH	209	MH	208											0.33										0.55	6.67	16.19	79.91	533.25			533.25	CONC	975	990.6	0.11	37.8	775.41	31%	1.01	0.63	86.07	85.10	-0.01	no	86.03	85.06	86.08	86.07	86.03		88.64	2.57	OK
Chinian Street	MH	208	MH	207						0.37															0.40	7.07	16.81	78.13	552.71			552.71	CONC	975	990.6	0.10	30.1	739.33	25%	0.96	0.52	86.01	85.04		no	85.98	85.01	86.02	86.01	85.98		88.47	2.46	OK
Chinian Street	MH	207	MH	206																						7.07	17.34	76.70	542.60			542.60	CONC	975	990.6	0.10	20.6	739.33	27%	0.96	0.36	85.95	84.98	0.01	no	85.93	84.96	85.95	85.95	85.93		88.70	2.75	OK
																											13.21							1350																				
Petrichor Crescent	MH	629	MH	630										0.32				0.63							1.72	1.72	10.00	104.19	178.71			178.71	CONC	525	533.4	0.20	118.5	200.65	11%	0.90	2.20	86.23	85.71		no	85.99	85.47	86.23	86.23	86.02		86.71	0.48	OK
G. Lalonde Drive	MH	630	MH	635				1.25					0.15												1.25	2.97	12.20	93.85	278.38			278.38	CONC	750	762.0	0.15	78.0	449.81	38%	0.99	1.32	85.99	85.24		no	85.87	85.12	86.02	85.99	85.95		n/a	n/a	n/a
G. Lalonde Drive	MH	633	MH	634										0.16				0.31							0.85	0.85	10.00	104.19	88.34			88.34	CONC	450	457.2	0.20	91.0	133.02	34%	0.81	1.87	86.19	85.74		no	86.01	85.56	86.19	86.19	86.01		86.98	0.79	OK
G. Lalonde Drive	MH	634	MH	635														0.25							0.49	1.33	11.87	95.25	127.10			127.10	CONC	675	685.8	0.18	75.5	372.05	66%	1.01	1.25	86.01	85.34		no	85.87	85.20	86.01	86.01	85.95		87.08	1.07	OK
Trigoria Crescent	MH	660	MH	661															0.52						1.08	1.08	10.00	104.19	112.96			112.96	CONC	450	457.2	0.20	110.0	133.02	15%	0.81	2.26	86.46	86.01		no	86.24	85.79	86.46	86.46	86.24		87.47	1.01	OK
Trigoria Crescent	MH	661	MH	662															0.29						0.60	1.69	12.26	93.59	158.06			158.06	CONC	525	533.4	0.16	63.0	179.46	12%	0.80	1.31	86.24	85.72		no	86.14	85.62	86.24	86.24	86.15		87.56	1.32	OK
Trigoria Crescent	MH	662	MH	663																						1.69	13.57	88.48	149.43			149.43	CONC	525	533.4	0.16	11.0	179.46	17%	0.80	0.23	86.11	85.59		no	86.09	85.57	86.15	86.14	86.13	0.03	86.91	0.77	OK
Trigoria Crescent	MH	663	MH	667																						1.69	13.80	87.65	148.03			148.03	CONC	525	533.4	0.16	39.0	179.46	18%	0.80	0.81	86.06	85.54		no	86.00	85.48	86.13	86.12	86.08	0.06	86.91	0.79	OK
Citrine Street	MH	665	MH	666														0.50							0.97	0.97	10.00	104.19	101.38			101.38	CONC	450	457.2	0.20	89.0	133.02	24%	0.81	1.83	86.30	85.85		no	86.12	85.67	86.30	86.30	86.15		87.38	1.08	OK
Citrine Street	MH	666	MH	667														0.25							0.49	1.46	11.83	95.42	139.27			139.27	CONC	525	533.4	0.16	72.5	179.46	22%	0.80	1.50	86.12	85.60		no	86.00	85.48	86.15	86.15	86.08	0.03	87.43	1.28	OK
Trigoria Crescent	MH	667	MH	673														0.27							0.53	3.67	14.61	84.85	311.72			311.72	CONC	675	685.8	0.20	47.0	392.18	21%	1.06	0.74	86.00	85.33		no	85.91	85.24	86.08	86.07	86.01	0.07	86.84	0.77	OK
Nacarat Street	MH	670	MH	671										0.27				0.13							0.67	0.67	10.00	104.19	69.37			69.37	PVC	375	366.4	0.26	83.5	84.05	17%	0.80	1.75	86.43	86.06		no	86.21	85.84	86.43	86.43	86.24		86.83	0.40	OK
Tungsten Terrace	MH	671	MH	672											0.20										0.33	1.00	11.75	95.79	95.73			95.73	CONC	450	457.2	0.20	56.0	133.02	28%	0.81	1.15	86.21	85.76		no	86.10	85.65	86.24	86.21	86.13		87.44	1.23	OK
Tungsten Terrace	MH	672	MH	673											0.35										0.58	1.58	12.90	91.03	144.12			144.12	CONC	525	533.4	0.16	120.0	179.46	20%	0.80	2.49	86.10	85.58		no	85.91	85.39	86.13	86.13	86.01	0.03	87.38	1.25	OK
Trigoria Crescent	MH	673	MH	635																						5.26	15.39	82.32	432.75			432.75	CONC	825	838.2	0.15	23.5	579.98	25%	1.05	0.37	85.91	85.09		no	85.87	85.05	86.01	85.97	85.95	0.06	86.84	0.87	OK

LICENSED PROFESSIONAL ENGINEER
A. G. Y. SAUVE
100142393
Nov. 20, 2014
PROVINCE OF ONTARIO

STORM SEWER COMPUTATION FORM

DESIGNED BY: AGS
CHECKED BY: JMD

Neighbourhood 5 - Avalon West - STAGE 3
Minto Communities Inc.
131004
ATREL ENGINEERING LTD
November 2014

STORM FREQUENCY : 5 YEAR
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 1

STREET NAMES	LOCATION FROM (Up)	LOCATION TO (Down)	AREA (ha.) RUNOFF COEFFICIENT 0.20	0.27	0.29	0.30	0.36	0.39	0.45	0.48	0.50	0.55	0.60	0.62	0.65	0.70	0.75	0.80	0.85	0.70	0.70	0.76
Chinian Street	MH 635	MH 216								0.60												
Azure Street	MH 216	MH 202								0.37												
Chinian Street	MH 202	MH 201																				
Chinian Street	MH 201	MH 1112							0.26	0.27												
Chinan Street	MH 1113	MH 1112							0.04				0.65									
Chinian Street	MH 1112	MH 1111D							0.30													
Chinian Street	MH 1111D	MH 1111							0.29													
Chinian Street	MH 1111	MH 1111E							0.25													
Chinian Street	MH 1111E	MH 1102							0.33													
Montagris Circle	MH 1104	MH 1102							2.95													
Strasbourg Street	MH 1102	MH 1101							0.22				0.32									
Rochefort Circle	MH 1117	MH 1101											2.97									
Strasbourg Street	MH 1101	MH 50543									0.60											
Brian Coburn Blvd.	MH 199	MH 50543																4.74		1.61		
Brian Coburn Blvd.	MH 196	MH 50543																		1.34		
Des Aubépines Drive	MH 50543	MH 50544											0.30									
Site Plan No.2	MH 3511	MH 3512																0.28				
Site Plan No.2	MH 3512	MH 3513																0.24				
Street No.4	MH 3513	MH 3515											0.12									
Street No.4	MH 3514	MH 3515														0.14						
Street No.4	MH 3515	MH 3516									0.10					0.48						
Street No.4	MH 3516	MH 3521									0.12					0.31						
Street No.4	MH 3514	MH 3517																				
Street No.4	MH 3517	MH 3518									0.17					0.39						
Street No.4	MH 3518	MH 3519									0.14					0.38						
Street No.4	MH 3519	MH 3520									0.15											
Street No.4	MH 3520	MH 3521									0.06					0.13						
Street No.4	MH 3521	MH 3522									0.05											
Street No.4	MH 3522	MH 50544																				
Multiple Block	MH 500	MH 50544															1.56					
Des Aubépines Drive	MH 50544	MH 53620														0.16						
Des Aubépines Drive	MH 53620	MH 53621									0.31					0.34						
Des Aubépines Drive	MH 53621	MH 53622														0.42						
Décoeur Drive	MH 3550	MH 53622									0.18		0.44		5.46							
Des Aubépines Drive	MH 53622	MH 53644														0.37						
Elementary School	MH 504	MH 53644															2.77					
Des Aubépines Drive	MH 53644	MH 53645														0.28						
Street No. 9	MH 3553	MH 53645														0.58						
Des Aubépines Drive	MH 53645	MH 53646														0.41						
Street No.5	MH 3567	MH 53646	0.35									1.73				1.36						
Neighbourhood Park	MH 505	MH 3571	1.19																			
Décoeur Drive	MH 3571	MH 3572											0.25									
Décoeur Drive	MH 3572	MH 3576											0.18									
School	MH 501	MH 3576															2.44					
Commercial	MH 503	MH 3574															4.78					
Site Plan No.1	MH 3573	MH 3574																0.12				
Décoeur Drive	MH 3574	MH 3575											0.26									
Décoeur Drive	MH 3575	MH 3576											0.34									
Magnolia Street	MH 3576	MH 3579														0.09						
Site Plan No.1	MH 3577	MH 3578																0.23				
Site Plan No.1	MH 3578	MH 3579																0.13				
Magnolia Street	MH 3579	MH 3585									0.13					0.18						
Hepatica Crescent	MH 3581	MH 3582										0.31			0.24							
Hepatica Crescent	MH 3582	MH 3585													0.22							
Hepatica Crescent	MH 3583	MH 3584									0.17					0.41						
Hepatica Crescent	MH 3584	MH 3585														0.24						

STREET NAMES	FROM (Up)	TO (Down)	RATIONAL METHOD INDIV. 2.78AR	ACCUM. 2.78AR	5 YEAR TIME CONC. (MIN)	RAINF. INTENS. (MM/HR)	FLOW (L/S)	Commercial & green space area Restr Flow (L/S)	Cum Flow (L/S)	**ACTUAL PIPE FLOW (L/S)**	SEWER DATA PIPE TYPE	DIA. (N0M) (mm)	(ACT)	SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	**UpStream Hgl at UP-MH (M)**	Hgl Out UP-MH (M)	Down MH Hgl (M)	SURG AT UP MH (M)	UpStream USF ELEV (M)	HGL FREEBOARD (M)	Comment
Chinian Street	MH 635	MH 216	0.80	10.36	15.76	81.18	840.89			840.89	CONC	975	990.6	0.13	87.7	842.96	0%	1.09	1.34	85.87	84.90		no	85.76	84.79	85.95	85.89	85.78	0.02	n/a	n/a	n/a
Azure Street	MH 216	MH 202	0.49	10.85	17.10	77.34	839.29			839.29	CONC	975	990.6	0.10	86.9	739.33	-14%	0.96	1.51	85.76	84.79		no	85.67	84.70	85.78	85.78	85.67	0.02	88.37	2.59	OK
Chinian Street	MH 202	MH 201		24.02	20.26	69.67	1673.13			1673.13	CONC	1350	1371.6	0.10	37.7	1760.81	5%	1.19	0.53	85.67	84.32	0.03	no	85.63	84.28	85.67	85.67	85.63		88.52	2.85	OK
Chinian Street	MH 201	MH 1112	0.69	24.70	20.79	68.56	1693.47			1693.47	CONC	1350	1371.6	0.10	35.8	1760.81	4%	1.19	0.50	85.60	84.25	0.04	no	85.56	84.21	85.63	85.63	85.60	0.03	88.14	2.51	OK
Chinan Street	MH 1113	MH 1112	1.13	1.13	16.65	78.58	89.13			89.13	CONC	450	457.2	0.20	75.7	133.02	33%	0.81	1.56	85.67	85.22		no	85.52	85.07	85.67	85.67	85.60		88.30	2.63	OK
Chinian Street	MH 1112	MH 1111D	0.38	26.21	21.29	67.54	1770.23			1770.23	CONC	1350	1371.6	0.10	56.6	1760.81	-1%	1.19	0.79	85.52	84.17		no	85.46	84.11	85.60	85.60	85.54	0.08	88.30	2.70	OK
Chinian Street	MH 1111D	MH 1111	0.36	26.57	22.08	65.98	1753.28			1753.28	CONC	1350	1371.6	0.10	23.8	1760.81	0%	1.19	0.33	85.43	84.08		no	85.41	84.06	85.54	85.51	85.49	0.08	n/a	n/a	n/a
Chinian Street	MH 1111	MH 1111E	0.31	28.85	22.42	65.36	1885.35			1885.35	CONC	1350	1371.6	0.11	48.4	1846.76	-2%	1.25	0.65	85.41	84.06		no	85.36	84.01	85.49	85.49	85.43	0.08	n/a	n/a	n/a
Chinian Street	MH 1111E	MH 1102	0.41	29.26	23.06	64.17	1877.51			1877.51	CONC	1350	1371.6	0.11	30.8	1846.76	-2%	1.25	0.41	85.36	84.01	0.01	no	85.33	83.98	85.43	85.40	85.36	0.04	n/a	n/a	n/a
Montagris Circle	MH 1104	MH 1102	3.69	3.69	18.64	73.40	270.88			270.88	CONC	600	609.6	0.20	85.8	286.47	5%	0.98	1.46	85.52	84.92	0.03	no	85.35	84.75	85.60	85.52	85.36		n/a	n/a	n/a
Strasbourg Street	MH 1102	MH 1101	0.81	51.45	23.93	62.66	3223.63		2053.79	5277.43	CONC	2100	2133.6	0.10	76.5	5720.16	8%	1.60	0.80	85.32	83.22		no	85.24	83.14	85.36	85.36	85.29	0.04	87.79	2.43	OK
Rochefort Circle	MH 1117	MH 1101	4.95	4.95	18.61	73.45	363.87			363.87	CONC	675	685.8	0.20	85.8	392.18	7%	1.06	1.35	85.44	84.77	0.03	no	85.27	84.60	85.44	85.44	85.29		87.79	2.35	OK
Strasbourg Street	MH 1101	MH 50543	0.83	57.23	24.73	61.33	3510.18		2053.79	5563.98	CONC	2100	2133.6	0.11	118.1	5999.35	7%	1.68	1.17	85.24	83.14		no	85.11	83.01	85.29	85.29	85.18	0.05	87.79	2.50	OK
Brian Coburn Blvd.	MH 199	MH 50543	10.54	10.54	18.10	74.72	787.68	383.18	383.18	1170.86	CONC	1050	1066.8	0.20	120.0	1274.02	8%	1.43	1.40	85.35	84.30		no	85.11	84.06	85.38	85.38	85.18	0.03	n/a	n/a	n/a
Brian Coburn Blvd.	MH 196	MH 50543			15.28	82.67		318.92	318.92	318.92	CONC	600	609.6	0.30	120.0	350.85	9%	1.20	1.66	85.49	84.89	0.02	no	85.13	84.53	85.49	85.49	85.18		n/a	n/a	n/a
Des Aubépines Drive	MH 50543	MH 50544	0.50	68.28	25.90	59.49	4061.77		2755.89	6817.66	CONC	2250	2286.0	0.10	96.9	6875.59	1%	1.68	0.96	85.11	82.86		no	85.01	82.76	85.18	85.18	85.09	0.07	85.89	0.71	OK
Site Plan No.2	MH 3511	MH 3512	0.62	0.62	10.00	104.19	64.88			64.88	CONC	525	533.4	0.16	99.0	179.46	64%	0.80	2.05	85.78	85.26		no	85.62	85.10	85.78	85.78	85.62		n/a	n/a	n/a
Site Plan No.2	MH 3512	MH 3513	0.53	1.16	12.05	94.46	109.24			109.24	CONC	525	533.4	0.16	99.0	179.46	39%	0.80	2.05	85.62	85.10		no	85.46	84.94	85.62	85.62	85.46		n/a	n/a	n/a
Street No.4	MH 3513	MH 3515	0.20	1.36	14.11	86.55	117.42			117.42	CONC	525	533.4	0.20	52.5	200.65	41%	0.90	0.97	85.40	84.88		no	85.29	84.77	85.42	85.40	85.31		n/a	n/a	n/a
Street No.4	MH 3514	MH 3515	0.27	0.27	10.00	104.19	28.39			28.39	PVC	300	299.2	0.34	44.5	55.99	49%	0.80	0.93	85.44	85.14		no	85.29	84.99	85.44	85.44	85.31		n/a	n/a	n/a
Street No.4	MH 3515	MH 3516	1.07	2.70	15.08	83.29	225.06			225.06	CONC	750	762.0	0.10	85.5	367.27	39%	0.81	1.77	85.29	84.54		no	85.20	84.45	85.31	85.29	85.20		86.28	0.99	OK
Street No.4	MH 3516	MH 3521	0.77	3.47	16.85	78.01	270.87			270.87	CONC	825	838.2	0.10	86.5	473.55	43%	0.86	1.68	85.20	84.38		no	85.11	84.29	85.20	85.20	85.12		86.06	0.86	OK
Street No.4	MH 3514	MH 3517			10.00	104.19					PVC	375	366.4	0.26	10.0	84.05	100%	0.80	0.21	85.51	85.14		no	85.48	85.11	85.51	85.51	85.48		86.35	0.84	OK
Street No.4	MH 3517	MH 3518	1.00	1.00	10.21	103.10	102.61			102.61	CONC	525	533.4	0.20	78.0	198.12	48%	0.89	1.47	85.48	84.96		no	85.33	84.81	85.48	85.48	85.33		86.38	0.90	OK
Street No.4	MH 3518	MH 3519	0.93	1.93	11.68	96.10	185.41			185.41	CONC	675	685.8	0.15	78.5	339.63	45%	0.92	1.42	85.33	84.66		no	85.21	84.54	85.33	85.33	85.21		86.22	0.89	OK
Street No.4	MH 3519	MH 3520	0.21	2.14	13.10	90.25	192.94			192.94	CONC	675	685.8	0.15	10.5	339.63	43%	0.92	0.19	85.18	84.51		no	85.16	84.49	85.19	85.18	85.17		86.05	0.87	OK
Street No.4	MH 3520	MH 3521	0.34	2.47	13.29	89.53	221.52			221.52	CONC	750	762.0	0.11	44.0	385.20	42%	0.84	0.87	85.16	84.41		no	85.11	84.36	85.17	85.16	85.12		86.14	0.98	OK
Street No.4	MH 3521	MH 3522	0.07	6.02	18.53	73.65	443.07			443.07	CONC	975	990.6	0.13	36.5	842.96	47%	1.09	0.56	85.11	84.14		no	85.06	84.09	85.12	85.12	85.11	0.01	85.91	0.79	OK
Street No.4	MH 3522	MH 50544		6.02	19.09	72.32	435.07			435.07	CONC	975	990.6	0.13	18.5	842.96	48%	1.09	0.28	85.03	84.06		no	85.01	84.04	85.11	85.10	85.09	0.07	85.94	0.84	OK
					19.37																											
Multiple Block	MH 500	MH 50544	3.25	3.25	13.10	90.26	293.58			293.58	CONC	750	762.0	0.20	11.5	519.40	43%	1.14	0.17	85.03	84.28		no	85.01	84.26	85.10	85.10	85.09	0.07	86.00	0.90	OK
Des Aubépines Drive	MH 50544	MH 53620	0.31	77.86	26.87	58.07	4521.12		2755.89	7277.02	CONC	2250	2286.0	0.10	74.5	6875.59	-6%	1.68	0.74	85.01	82.76		no	84.94	82.69	85.09	85.09	85.01	0.08	85.94	0.85	OK
Des Aubépines Drive	MH 53620	MH 53621	1.09	78.95	27.61	57.03	4502.46		2755.89	7258.35	CONC	2250	2286.0	0.12	69.5	7373.25	2%	1.80	0.64	84.94	82.69		no	84.86	82.61	85.01	85.01	84.93	0.07	85.88	0.87	OK
Des Aubépines Drive	MH 53621	MH 53622	0.82	79.77	28.25	56.15	4478.88		2755.89	7234.77	CONC	2250	2286.0	0.13	74.0	7809.17	7%	1.90	0.65	84.86	82.61		no	84.76	82.51	84.93	84.93	84.85	0.07	85.73	0.80	OK
Décoeur Drive	MH 3550	MH 53622	10.85	10.85	18.54	73.64	799.02			799.02	CONC	1350	1371.6	0.10	75.0	1760.81	55%	1.19	1.05	84.84	83.49		no	84.76	83.41	84.87	84.87	84.85	0.03	85.80	0.93	OK
Des Aubépines Drive	MH 53622	MH 53644	0.72	91.34	28.90	55.31	5051.83		2755.89	7807.72	CONC	2550	2590.8	0.11	88.0	9836.90	21%	1.87	0.79	84.76	82.21		no	84.67	82.12	84.85	84.85	84.79	0.09	85.60	0.75	OK
					29.69																											
Elementary School	MH 504	MH 53644	5.78	5.78	13.52	88.66	512.05			512.05	CONC	975	990.6	0.20	12.5	1045.56	51%	1.36	0.15	84.70	83.73		no	84.67	83.70	84.81	84.80	84.79	0.10	85.67	0.87	OK
Des Aubépines Drive	MH 53644	MH 53645	0.54	97.66	29.69	54.31	5303.75		2755.89	8059.64	CONC	2550	2590.8	0.11	83.7	9836.90	18%	1.87	0.75	84.67	82.12		no	84.58	82.03	84.79	84.79	84.73	0.12	85.43	0.64	OK
Street No. 9	MH 3553	MH 53645	1.13	1.13	13.37	89.22	100.70			100.70	CONC	675	685.8	0.11	14.5	296.09	66%	0.80	0.30	84.60	83.93		no	84.58	83.91	84.73	84.73	84.73	0.13	85.25	0.52	OK
Des Aubépines Drive	MH 53645	MH 53646	0.80	99.58	30.43	53.41	5318.75		2755.89	8074.65	CONC	2550	2590.8	0.11	74.5	9836.90	18%	1.87	0.67	84.58	82.03		no	84.50	81.95	84.73	84.73	84.68	0.15	85.28	0.55	OK
Street No.5	MH 3567	MH 53646	5.49	5.49	15.15	83.08	455.80			455.80	CONC	975	990.6	0.11	118.0	775.41	41%	1.01	1.95	84.63	83.66		no	84.50	83.53	84.72	84.72	84.68	0.09	85.65	0.93	OK
Neighbourhood Park	MH 505	MH 3571	0.66	0.66	10.00	104.19	68.94			68.94	PVC	375	366.4	0.26	18.0	84.05	18%	0.80	0.38	85.36	84.99		no	85.31	84.94	85.37	85.37	85.34	0.01	n/a	n/a	n/a
Décoeur Drive	MH 3571	MH 3572	0.42	1.08	10.38	102.25	110.29			110.29	CONC	450	457.2	0.20	74.0	133.02	17%	0.81	1.52	85.31	84.86		no	85.16	84.71	85.34	85.31	85.18		n/a	n/a	n/a
Décoeur Drive	MH 3572	MH 3576	0.30	1.38	11.90	95.13	131.17			131.17	CONC	525	533.4	0.16	32.0	179.46	27%	0.80	0.66	85.16	84.64		no	85.11	84.59	85.18	85.18	85.15	0.02	n/a	n/a	n/a
					12.56																											
School	MH 501	MH 3576	5.09	5.09	13.93	87.17	443.47			443.47	CONC	900	914.4	0.20	19.0	844.60	47%	1.29	0.25	85.15	84.25		no	85.11	84.21	85.16	85.16	85.15	0.01	86.22	1.06	OK
Commercial	MH 503	MH 3574	9.97	9.97	15.05	83.40	831.71			831.71	CONC	1200	1219.2	0.20	17.0	1818.95	54%	1.56	0.18	85.35	84.15		no	85.32	84.12	85.35	85.35	85.32		86.48	1.13	OK
Site Plan No.1	MH 3573	MH 3574	0.27	0.27	10.00	104.19	27.81			27.81	PVC	300	299.2	1.00	45.0	96.02	71%	1.37	0.55	85.71	85.41		no	85.26	84.96	85.71	85.71	85.30		87.14	1.43	OK
Décoeur Drive	MH 3574	MH 3575	0.43	10.67	15.23	82.82	883.95			883.95	CONC	1200	1219.2	0.11	56.5	1348.97	34%	1.16	0.81	85.26	84.06		no	85.20	84.00	85.30	85.26	85.20		86.87	1.61	OK
Décoeur Drive	MH 3575	MH 3576	0.57	11.24	16.04	80.33	902.93			902.93	CONC	1200	1219.2	0.11	85.0	1348.97	33%	1.16	1.23	85.20	84.00		no	85.11	83.91	85.20	85.20	85.15		86.88	1.68	OK
Magnolia Street	MH 3576	MH 3579	0.18	17.88	17.27	76.87	1374.56			1374.56	CONC	1500	1524.0	0.11	51.5	2445.85	44%	1.34	0.64	85.11	83.61		no	85.05	83.55	85.15	85.11	85.05		n/a	n/a	n/a
Site Plan No.1	MH 3577	MH 3578	0.51	0.51	10.00	104.19	53.30			53.30	PVC	375	366.4	0.26	59.5	84.05	37%	0.80	1.24	85.56	85.19		no	85.41	85.04	85.56	85.56	85.41		87.00	1.44	OK
Site Plan No.1	MH 3578	MH 3579	0.29	0.80	11.24	98.05	78.50			78.50	CONC	450	457.2	0.20	71.5	131.34	40%	0.80	1.49	85.41	84.96	0.22	no	85.27	84.82	85.41	85.41	85.27		86.88	1.47	OK
Magnolia Street	MH 3579	MH 3585	0.53	19.21	17.91	75.20	1444.84			1444.84	CONC	1650	1676.4	0.10	48.0	3006.86	52%	1.36	0.59	85.05	83.40		no	85.00	83.35	85.05	85.05	85.00		n/a	n/a	n/a
Hepatica Crescent	MH 3581	MH 3582	0.91	0.91	10.00	104.19	94.57			94.57	CONC	525	533.4	0.16	82.5	179.46	47%	0.80	1.71	85.26	84.74		no	85.13	84.61	85.26	85.26	85.13		85.88	0.62	OK
Hepatica Crescent	MH 3582	MH 3585	0.40	1.31	11.71	95.94	125.22			125.22	CONC	600	609.6	0.13	95.5	232.73	46%	0.80	2.00	85.13	84.53		no	85.00	84.40	85.13	85.13	85.00		85.77	0.64	OK
Hepatica Crescent	MH 3583	MH 3584	1.03	1.03	10.00	104.19	107.75			107.75	CONC	525	533.4	0.16	83.0	179.46	40%	0.80	1.72	85.41	84.89		no	85.28	84.76	85.41	85.41	85.28		85.88	0.47	OK
Hepatica Crescent	MH 3584	MH 3585	0.47	1.50	11.72	95.90	143.97			143.97	CONC	600	609.6	0.15	88.0	248.09	42%	0.85	1.73	85.28	84.68	0.15	no	85.15	84.55	85.28	85.28	85.15		85.92	0.64	OK

2322, 2370 Tenth Line Road, 885 Decoeur Drive

LICENSED PROFESSIONAL ENGINEER
A. G. Y. SAUVE
100142393
Nov. 20, 2014
PROVINCE OF ONTARIO

STORM SEWER COMPUTATION FORM

DESIGNED BY: AGS
CHECKED BY: JMD

Neighbourhood 5 - Avalon West - STAGE 3
Minto Communities Inc.
131004
ATREL ENGINEERING LTD
November 2014

STORM FREQUENCY : 5 YEAR
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 1

STREET NAMES	LOCATION FROM (Up)		LOCATION TO (Down)		AREA (ha.) RUNOFF COEFFICIENT 0.20	0.27	0.29	0.30	0.36	0.39	0.45	0.48	0.50	0.55	0.60	0.62	0.65	0.70	0.75	0.80	0.85	0.70	0.70	0.76
Magnolia Street	MH	3585	MH	3594										0.14				0.37						
Genévriers Street	MH	3586	MH	3587										0.42				0.22						
Genévriers Street	MH	3587	MH	3588																				
Genévriers Street	MH	3588	MH	3589														0.40						
Genévriers Street	MH	3589	MH	3594																				
Hepatica Crescent	MH	3583	MH	3590																				
Hepatica Crescent	MH	3590	MH	3592														0.04						
Hepatica Crescent	MH	3591	MH	3592														0.18						
Genévriers Street	MH	3592	MH	3593										0.29				0.40						
Genévriers Street	MH	3593	MH	3594										0.12				0.24						
Magnolia Street	MH	3594	MH	3597										0.16				0.28						
Hepatica Crescent	MH	3595	MH	3596										0.37				0.31						
Hepatica Crescent	MH	3596	MH	3597										0.29				0.23						
Hepatica Crescent	MH	3597	MH	3598										0.73				0.56						
Hepatica Crescent	MH	3598	MH	53646										0.48				0.32						
Des Aubépines Drive	MH	53646	MH	HEADWALL																				

STREET NAMES	FROM	TO	RATIONAL METHOD INDIV. 2.78AR	RATIONAL METHOD ACCUM. 2.78AR	5 YEAR TIME CONC. (MIN)	RAINF. INTENS. (MM/HR)	FLOW (L/S)	Commercial & green space area Restr Flow (L/S)	Cum Flow (L/S)	**ACTUAL PIPE FLOW (L/S)**	PIPE TYPE	DIA. (N0M) (mm)	(ACT)	SLOPE (%)	LENGTH (M)	SEWER DATA CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	**UpStream Hgl at UP-MH (M)**	Hgl Out UP-MH (M)	Down MH Hgl (M)	SURG AT UP MH (M)	UpStream USF ELEV (M)	HGL FREEBOARD (M)	Comment
Magnolia Street	3585	3594	0.93	22.95	18.50	73.73	1692.38			1692.38	CONC	1650	1676.4	0.10	79.0	3006.86	44%	1.36	0.97	85.00	83.35		no	84.92	83.27	85.00	85.00	84.92		85.63	0.63	OK
Genévriers Street	3586	3587	1.07	1.07	10.00	104.19	111.51			111.51	CONC	525	533.4	0.16	59.0	179.46	38%	0.80	1.22	85.20	84.68		no	85.11	84.59	85.20	85.20	85.11		85.60	0.40	OK
Genévriers Street	3587	3588		1.07	11.22	98.14	105.04			105.04	CONC	525	533.4	0.16	11.5	179.46	41%	0.80	0.24	85.08	84.56		no	85.06	84.54	85.08	85.08	85.06		85.79	0.71	OK
Genévriers Street	3588	3589	0.78	1.85	11.46	97.05	179.42			179.42	CONC	675	685.8	0.11	77.5	294.79	39%	0.80	1.62	85.06	84.39		no	84.97	84.30	85.06	85.06	84.97		85.59	0.53	OK
Genévriers Street	3589	3594		1.85	13.08	90.32	166.97			166.97	CONC	750	762.0	0.11	48.0	390.41	57%	0.86	0.93	84.97	84.22		no	84.92	84.17	84.97	84.97	84.92		85.71	0.74	OK
Hepatica Crescent	3583	3590			10.00	104.19					PVC	300	299.2	0.34	10.5	55.99	100%	0.80	0.22	85.52	85.22		no	85.48	85.18	85.52	85.52	85.48		86.08	0.56	OK
Hepatica Crescent	3590	3592	0.08	0.08	10.22	103.05	8.02			8.02	PVC	300	299.2	0.34	71.5	55.99	86%	0.80	1.50	85.45	85.15		no	85.21	84.91	85.45	85.45	85.22		85.96	0.51	OK
Hepatica Crescent	3591	3592	0.35	0.35	10.00	104.19	36.50			36.50	PVC	375	366.4	0.26	69.0	84.05	57%	0.80	1.44	85.39	85.02		no	85.21	84.84	85.39	85.39	85.22		85.86	0.47	OK
Genévriers Street	3592	3593	1.22	1.65	11.72	95.92	158.26			158.26	CONC	675	685.8	0.11	90.0	294.79	46%	0.80	1.88	85.21	84.54		no	85.11	84.44	85.22	85.21	85.11		85.84	0.63	OK
Genévriers Street	3593	3594	0.65	2.30	13.60	88.39	203.34			203.34	CONC	750	762.0	0.10	90.0	367.27	45%	0.81	1.86	85.11	84.36	0.10	no	85.02	84.27	85.11	85.11	85.02		85.75	0.64	OK
Magnolia Street	3594	3597	0.79	27.89	19.46	71.45	1992.91			1992.91	CONC	1800	1828.8	0.10	84.0	3792.13	47%	1.44	0.97	84.92	83.12		no	84.84	83.04	84.92	84.92	84.84		85.64	0.72	OK
Hepatica Crescent	3595	3596	1.17	1.17	10.00	104.19	121.80			121.80	CONC	525	533.4	0.16	71.0	179.46	32%	0.80	1.47	85.14	84.62		no	85.03	84.51	85.14	85.14	85.03		85.59	0.45	OK
Hepatica Crescent	3596	3597	0.89	2.06	11.47	97.01	199.84			199.84	CONC	675	685.8	0.12	80.5	303.78	34%	0.82	1.63	85.03	84.36	0.15	no	84.93	84.26	85.03	85.03	84.93		85.54	0.51	OK
Hepatica Crescent	3597	3598	2.21	32.16	20.43	69.31	2228.89			2228.89	CONC	1800	1828.8	0.13	118.0	4323.69	48%	1.65	1.19	84.78	82.98		no	84.63	82.83	84.82	84.78	84.72		85.35	0.57	OK
Hepatica Crescent	3598	53646	1.36	33.51	21.63	66.87	2241.15			2241.15	CONC	1800	1828.8	0.13	101.5	4323.69	48%	1.65	1.03	84.63	82.83		no	84.50	82.70	84.72	84.72	84.68	0.09	85.20	0.48	OK
Des Aubépines Drive	53646	HEADWALL		138.58	31.10	52.63	7293.72		2755.89	10049.61	CONC	2700	2743.2	0.10	38.5	11180.46	10%	1.89	0.34	84.50	81.80		no	84.46	81.76	84.68	84.68	84.65	0.18	n/a	n/a	n/a
					31.44																											

Existing Storm Sewers
Existing Eastern Trunk
Stage 2 Storm Sewers
Proposed Stage 3 Storm Sewers
Future Stages Storm Sewers

STORM SEWER COMPUTATION FORM

DESIGNED BY: AGS
CHECKED BY: JMD

PROJECT: **Neighbourhood 5 - Avalon West - STAGE 3**
CLIENT: Minto Communities Inc.
PROJECT #: 131004
BY: ATREL ENGINEERING LTD
DATE: November 2014

RESTRICTED FLOW : Various L/S/Ha.
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 2

STREET NAMES	LOCATION FROM (Up)		TO (Down)		AREA (ha.) RUNOFF COEFFICIENT 0.20	0.27	0.29	0.30	0.36	0.39	0.45	0.48	0.50	0.55	0.60	0.62	0.65	0.70	0.75	0.80	0.85	0.70	0.70	0.76	Indiv Various L/s/ha	Cumul L/s/ha	FLOW (L/S)	Commercial & green space area Restr Flow (L/S)	Commercial & green space area Cum Flow (L/S)
Future Site Plan	MH	Stub1	MH	602																				0.70				103.91	103.91
Bluestone Private	MH	601	MH	602														0.64							54.40	54.40	54.40		
G.Lalonde Drive	MH	602	MH	605											0.34										28.90	83.30	83.30		103.91
Bluestone Private	MH	603	MH	605													0.28	0.61							75.65	75.65	75.65		
Future Site Plan	MH	Stub2	MH	605		4.94																		3.65				813.80	813.80
G.Lalonde Drive	MH	605	MH	607											0.19										16.15	175.10	175.10		917.71
Future Site Plan	MH	Stub3	MH	607																				1.33				197.43	197.43
G.Lalonde Drive	MH	607	MH	608													0.25								21.25	196.35	196.35		1115.14
Future Street	MH	Stub4	MH	608												0.74								1.50	62.90	62.90	62.90	222.66	222.66
G.Lalonde Drive	MH	608	MH	612													0.56								47.60	306.85	306.85		1337.80
Petrichor Crescent	MH	650	MH	651										0.27	0.17										37.40	37.40	37.40		
Petrichor Crescent	MH	651	MH	652														0.35							29.75	67.15	67.15		
G.Lalonde Drive	MH	652	MH	654									0.18												15.30	82.45	82.45		
Petrichor Crescent	MH	653	MH	654														0.58							49.30	49.30	49.30		
G.Lalonde Drive	MH	654	MH	655									0.19												16.15	147.90	147.90		
G.Lalonde Drive	MH	655	MH	612																						147.90	147.90		
Petrichor Crescent	MH	656	MH	658										0.27	0.20										39.95	39.95	39.95		
Transit Way/Hydro	MH	657	MH	658			9.47																					716.00	716.00
Petrichor Crescent	MH	658	MH	612										0.18				0.38							47.60	87.55	87.55		716.00
Strasbourg Street	MH	612	MH	617													0.25								21.25	563.55	563.55		2053.79
Lerta Crescent	MH	613	MH	614							0.20						0.31								43.35	43.35	43.35		
Lerta Crescent	MH	614	MH	615							0.21														17.85	61.20	61.20		
Lerta Crescent	MH	615	MH	616							0.28						0.37								55.25	116.45	116.45		
Lerta Crescent	MH	616	MH	617							0.59						0.40								84.15	200.60	200.60		
Strasbourg Street	MH	617	MH	1103													0.07								5.95	770.10	770.10		2053.79
Strasbourg Street	MH	1103	MH	1102				1.89			0.51														204.00	974.10	974.10		2053.79
G.Lalonde Drive	MH	234	MH	233													0.37								31.45	31.45	31.45		
G.Lalonde Drive	MH	233	MH	211													0.18								15.30	46.75	46.75		
G. Lalonde Drive	MH	624	MH	211										0.14				0.27							34.85	34.85	34.85		
Trigoria Crescent	MH	680	MH	681													0.27								22.95	22.95	22.95		
Future Site Plan	MH	690	MH	681										0.18							0.32				42.50	42.50	42.50		
Trigoria Crescent	MH	681	MH	682																						65.45	65.45		
Future Site Plan	MH	691	MH	692													0.06			0.32					32.30	32.30	32.30		
Future Site Plan	MH	692	MH	682																0.21					17.85	50.15	50.15		
Trigoria Crescent	MH	682	MH	211														0.22							18.70	134.30	134.30		
Chinian Street	MH	211	MH	210						0.55			0.16												60.35	276.25	276.25		
Chinian Street	MH	210	MH	209																						276.25	276.25		
Chinian Street	MH	209	MH	208											0.33										28.05	330.65	330.65		
Chinian Street	MH	208	MH	207						0.37															31.45	362.10	362.10		
Chinian Street	MH	207	MH	206																						362.10	362.10		
Petrichor Crescent	MH	629	MH	630										0.32				0.63							80.75	80.75	80.75		
G. Lalonde Drive	MH	630	MH	635				1.25					0.15												119.00	199.75	199.75		
G. Lalonde Drive	MH	633	MH	634										0.16				0.31							39.95	39.95	39.95		
G. Lalonde Drive	MH	634	MH	635														0.25							21.25	61.20	61.20		
Trigoria Crescent	MH	660	MH	661															0.52						44.20	44.20	44.20		
Trigoria Crescent	MH	661	MH	662															0.29						24.65	68.85	68.85		
Trigoria Crescent	MH	662	MH	663																						68.85	68.85		
Trigoria Crescent	MH	663	MH	667																						68.85	68.85		
Citrine Street	MH	665	MH	666														0.50							42.50	42.50	42.50		
Citrine Street	MH	666	MH	667														0.25							21.25	63.75	63.75		
Trigoria Crescent	MH	667	MH	673														0.27							22.95	155.55	155.55		
Nacarat Street	MH	670	MH	671										0.27				0.13							34.00	34.00	34.00		
Tungsten Terrace	MH	671	MH	672											0.20										17.00	51.00	51.00		
Tungsten Terrace	MH	672	MH	673											0.35										29.75	80.75	80.75		
Trigoria Crescent	MH	673	MH	635																						236.30	236.30		

STREET NAMES	FROM	TO	(2) Local F.R. (L/S)	Above ground Qty	Restricted Flow (L/S)	Cum Restricted Flow (L/S)	**ACTUAL PIPE FLOW (L/S)**	PIPE TYPE	DIA. (N0M) (mm)	(ACT)	SEWER DATA SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	**UpStream Hgl at UP-MH (M)**	Hgl Out UP-MH (M)	Down MH Hgl (M)	SURG AT UP MH (M)	UpStream USF ELEV (M)	HGL FREEBOARD (M)	Comment
Future Site Plan	Stub1	602	13.40	7.75	103.91	103.91	103.91	CONC	450	457.2	0.20	9.0	133.02	22%	0.81	0.19	86.05	85.60	0.54	no	86.03	85.58	86.05	86.05	86.03		n/a	n/a	n/a
Bluestone Private	601	602	13.40	3.74	50.12	50.12	50.12	CONC	525	533.4	1.03	112.0	455.34	89%	2.04	0.92	86.62	86.10	-0.02	no	85.47	84.95	86.62	86.62	86.00		87.50	0.88	OK
G.Lalonde Drive	602	605	13.40	2.96	39.66	193.69	193.69	CONC	600	609.6	0.20	82.5	286.47	32%	0.98	1.40	85.49	84.89	-0.59	no	85.32	84.72	86.00	86.00	85.92	0.51	87.50	1.50	OK
Bluestone Private	603	605	13.40	5.81	77.85	77.85	77.85	CONC	525	533.4	1.20	112.5	491.48	84%	2.20	0.85	86.49	85.97	-0.77	no	85.14	84.62	86.49	86.49	85.92		87.38	0.89	OK
Future Site Plan	Stub2	605	13.40	60.73	813.80	813.80	813.80	CONC	975	990.6	0.16	9.0	935.18	13%	1.21	0.12	85.94	84.97	0.02	no	85.93	84.96	85.94	85.94	85.93		n/a	n/a	n/a
G.Lalonde Drive	605	607	13.40	1.48	19.83	1105.18	1105.18	CONC	1350	1371.6	0.10	80.0	1760.81	37%	1.19	1.12	85.91	84.56		no	85.83	84.48	85.92	85.92	85.89	0.01	86.78	0.86	OK
Future Site Plan	Stub3	607	13.40	14.73	197.43	197.43	197.43	CONC	600	609.6	0.15	9.0	248.09	20%	0.85	0.18	85.84	85.24		no	85.83	85.23	85.90	85.90	85.89	0.06	n/a	n/a	n/a
G.Lalonde Drive	607	608	13.40	2.00	26.80	1329.40	1329.40	CONC	1350	1371.6	0.10	103.0	1760.81	25%	1.19	1.44	85.83	84.48		no	85.73	84.38	85.89	85.89	85.83	0.06	86.74	0.85	OK
Future Street	Stub4	608	13.40	23.30	312.26	312.26	312.26	CONC	750	762.0	0.15	9.0	449.81	31%	0.99	0.15	85.74	84.99		no	85.73	84.98	85.84	85.84	85.83	0.10	n/a	n/a	n/a
G.Lalonde Drive	608	612	13.40	3.48	46.63	1688.29	1688.29	CONC	1350	1371.6	0.12	94.0	1928.87	12%	1.31	1.20	85.73	84.38	0.05	no	85.62	84.27	85.83	85.83	85.74	0.10	86.70	0.87	OK
Petrichor Crescent	650	651	13.40	4.44	59.50	59.50	59.50	PVC	375	366.4	0.26	39.5	84.05	29%	0.80	0.83	86.16	85.79		no	86.06	85.69	86.16	86.16	86.08		n/a	n/a	n/a
Petrichor Crescent	651	652	13.40	3.28	44.00	103.50	103.50	CONC	525	533.4	0.16	111.0	179.46	42%	0.80	2.30	86.06	85.54		no	85.88	85.36	86.08	86.06	85.89		86.71	0.65	OK
G.Lalonde Drive	652	654	13.40	2.31	31.00	134.50	134.50	CONC	525	533.4	0.16	51.5	179.46	25%	0.80	1.07	85.82	85.30		no	85.74	85.22	85.89	85.87	85.82	0.05	n/a	n/a	n/a
Petrichor Crescent	653	654	13.40	6.57	88.00	88.00	88.00	CONC	525	533.4	0.20	118.5	200.65	56%	0.90	2.20	85.98	85.46		no	85.74	85.22	85.98	85.98	85.82		86.63	0.65	OK
G.Lalonde Drive	654	655	13.40	2.31	31.00	253.50	253.50	CONC	675	685.8	0.15	54.0	339.63	25%	0.92	0.98	85.74	85.07		no	85.66	84.99	85.82	85.79	85.74	0.05	n/a	n/a	n/a
G.Lalonde Drive	655	612	13.40			253.50	253.50	CONC	1200	1219.2	0.15	19.0	1575.26	84%	1.35	0.23	85.66	84.46	0.06	no	85.63	84.43	85.74	85.74	85.74	0.08	n/a	n/a	n/a
Petrichor Crescent	656	658	13.40	4.44	59.50	59.50	59.50	PVC	375	366.4	0.35	37.5	97.52	39%	0.92	0.68	85.87	85.50		no	85.74	85.37	85.87	85.87	85.82		n/a	n/a	n/a
Transit Way/Hydro	657	658	13.40	53.43	716.00	716.00	716.00	CONC	1200	1219.2	0.15	9.0	1575.26	55%	1.35	0.11	85.75	84.55		no	85.74	84.54	85.82	85.82	85.82	0.07	n/a	n/a	n/a
Petrichor Crescent	658	612	13.40	4.44	59.50	835.00	835.00	CONC	1200	1219.2	0.15	115.0	1575.26	47%	1.35	1.42	85.74	84.54		no	85.57	84.37	85.82	85.79	85.74	0.05	86.63	0.84	OK
Strasbourg Street	612	617	13.40	2.00	26.80	2803.59	2803.59	CONC	1800	1828.8	0.10	83.5	3792.13	26%	1.44	0.96	85.57	83.77		no	85.49	83.69	85.74	85.66	85.61	0.09	86.68	1.02	OK
Lerta Crescent	613	614	13.40	3.00	40.20	40.20	40.20	PVC	375	366.4	0.35	61.0	97.52	59%	0.92	1.10	86.18	85.81		no	85.97	85.60	86.18	86.18	85.97		86.78	0.60	OK
Lerta Crescent	614	615	13.40	1.00	13.40	53.60	53.60	CONC	450	457.2	0.26	9.5	151.66	65%	0.92	0.17	85.97	85.52		no	85.95	85.50	85.97	85.97	85.95		86.89	0.92	OK
Lerta Crescent	615	616	13.40	3.48	46.63	100.23	100.23	CONC	525	533.4	0.30	83.5	245.74	59%	1.10	1.27	85.95	85.43		no	85.70	85.18	85.95	85.95	85.70		86.67	0.72	OK
Lerta Crescent	616	617	13.40	6.00	80.40	180.63	180.63	CONC	675	685.8	0.76	106.5	764.49	76%	2.07	0.86	85.70	85.03	-0.60	no	84.89	84.22	85.70	85.70	85.61		86.55	0.85	OK
Strasbourg Street	617	1103	13.40			2984.22	2984.22	CONC	1800	1828.8	0.10	42.0	3792.13	21%	1.44	0.48	85.49	83.69		no	85.45	83.65	85.61	85.61	85.58	0.12	n/a	n/a	n/a
Strasbourg Street	1103	1102	13.40	21.37	286.34	3270.57	3270.57	CONC	1800	1828.8	0.10	121.8	3792.13	14%	1.44	1.41	85.45	83.65	0.01	no	85.33	83.53	85.58	85.58	85.49	0.13	n/a	n/a	n/a
G.Lalonde Drive	234	233	13.40	2.00	26.80	26.80	26.80	PVC	375	366.4	0.40	48.7	104.25	74%	0.99	0.82	86.36	85.98	-0.04	no	86.17	85.79	86.36	86.36	86.22		86.99	0.63	OK
G.Lalonde Drive	233	211	13.40	1.00	13.40	40.20	40.20	CONC	450	457.2	0.26	31.0	151.66	73%	0.92	0.56	86.21	85.76	0.23	1	86.13	85.68	86.22	86.22	86.21	0.02	86.75	0.53	OK
G. Lalonde Drive	624	211	13.40	3.47	46.50	46.50	46.50	CONC	450	457.2	0.35	77.5	175.96	74%	1.07	1.21	86.40	85.95	-0.08	X	86.13	85.68	86.40	86.40	86.21		86.93	0.53	OK
Trigoria Crescent	680	681	13.40	1.16	15.50	15.50	15.50	CONC	600	609.6	0.26	25.0	326.62	95%	1.12	0.37	86.42	85.82		no	86.35	85.75	86.42	86.42	86.35		86.85	0.43	OK
Future Site Plan	690	681	13.40	3.17	42.50	42.50	42.50	CONC	450	457.2	0.20	112.0	133.02	68%	0.81	2.30	86.57	86.12		no	86.35	85.90	86.57	86.57	86.35		87.75	1.18	OK
Trigoria Crescent	681	682	13.40			58.00	58.00	CONC	600	609.6	0.26	41.0	326.62	82%	1.12	0.61	86.35	85.75		no	86.24	85.64	86.35	86.35	86.25		86.85	0.50	OK
Future Site Plan	691	692	13.40	2.41	32.30	32.30	32.30	CONC	525	533.4	0.16	50.0	179.46	82%	0.80	1.04	86.42	85.90		no	86.34	85.82	86.42	86.42	86.34		87.67	1.25	OK
Future Site Plan	692	682	13.40	1.33	17.85	50.15	50.15	CONC	525	533.4	0.16	44.5	179.46	72%	0.80	0.92	86.31	85.79		no	86.24	85.72	86.31	86.31	86.25		87.52	1.21	OK
Trigoria Crescent	682	211	13.40	1.16	15.50	123.65	123.65	CONC	600	609.6	0.26	44.0	326.62	62%	1.12	0.66	86.24	85.64	-0.08	no	86.13	85.53	86.25	86.24	86.21		86.80	0.56	OK
Chinian Street	211	210	13.40	1.00	13.40	223.75	223.75	CONC	825	838.2	0.10	55.4	473.55	53%	0.86	1.08	86.21	85.39	0.03	no	86.15	85.33	86.21	86.21	86.15		n/a	n/a	n/a
Chinian Street	210	209	13.40			223.75	223.75	CONC	825	838.2	0.10	23.9	473.55	53%	0.86	0.46	86.12	85.30	0.03	no	86.10	85.28	86.12	86.12	86.10		88.72	2.60	OK
									975																				
Chinian Street	209	208	13.40	2.09	28.05	278.15	278.15	CONC	975	990.6	0.11	37.8	775.41	64%	1.01	0.63	86.07	85.10	-0.01	no	86.03	85.06	86.07	86.07	86.03		88.64	2.57	OK
Chinian Street	208	207	13.40	2.35	31.45	309.60	309.60	CONC	975	990.6	0.10	30.1	739.33	58%	0.96	0.52	86.01	85.04		no	85.98	85.01	86.01	86.01	85.98		88.47	2.46	OK
Chinian Street	207	206	13.40			309.60	309.60	CONC	975	990.6	0.10	20.6	739.33	58%	0.96	0.36	85.95	84.98	0.01	no	85.93	84.96	85.95	85.95	85.93		88.70	2.75	OK
									1350																				
Petrichor Crescent	629	630	13.40	6.27	84.00	84.00	84.00	CONC	525	533.4	0.20	118.5	200.65	58%	0.90	2.20	86.23	85.71		no	85.99	85.47	86.23	86.23	86.00		86.71	0.48	OK
G. Lalonde Drive	630	635	13.40	3.02	40.50	124.50	124.50	CONC	750	762.0	0.15	78.0	449.81	72%	0.99	1.32	85.99	85.24		no	85.87	85.12	86.00	85.99	85.89		n/a	n/a	n/a
G. Lalonde Drive	633	634	13.40	3.47	46.50	46.50	46.50	CONC	450	457.2	0.20	91.0	133.02	65%	0.81	1.87	86.19	85.74		no	86.01	85.56	86.19	86.19	86.01		86.98	0.79	OK
G. Lalonde Drive	634	635	13.40	1.64	22.00	68.50	68.50	CONC	675	685.8	0.18	75.5	372.05	82%	1.01	1.25	86.01	85.34		no	85.87	85.20	86.01	86.01	85.89		87.08	1.07	OK
Trigoria Crescent	660	661	13.40	3.47	46.50	46.50	46.50	CONC	450	457.2	0.20	110.0	133.02	65%	0.81	2.26	86.46	86.01		no	86.24	85.79	86.46	86.46	86.24		87.47	1.01	OK
Trigoria Crescent	661	662	13.40	1.64	22.00	68.50	68.50	CONC	525	533.4	0.16	63.0	179.46	62%	0.80	1.31	86.24	85.72		no	86.14	85.62	86.24	86.24	86.14		87.56	1.32	OK
Trigoria Crescent	662	663	13.40			68.50	68.50	CONC	525	533.4	0.16	11.0	179.46	62%	0.80	0.23	86.11	85.59		no	86.09	85.57	86.11	86.11	86.09		86.91	0.80	OK
Trigoria Crescent	663	667	13.40			68.50	68.50	CONC	525	533.4	0.16	39.0	179.46	62%	0.80	0.81	86.06	85.54		no	86.00	85.48	86.06	86.06	86.00		86.91	0.85	OK
Citrine Street	665	666	13.40	2.80	37.50	37.50	37.50	CONC	450	457.2	0.20	89.0	133.02	72%	0.81	1.83	86.30	85.85		no	86.12	85.67	86.30	86.30	86.12		87.38	1.08	OK
Citrine Street	666	667	13.40	1.16	15.50	53.00	53.00	CONC	525	533.4	0.16	72.5	179.46	70%	0.80	1.50	86.12	85.60		no	86.00	85.48	86.12	86.12	86.00		87.43	1.31	OK
Trigoria Crescent	667	673	13.40	1.64	22.00	143.50	143.50	CONC	675	685.8	0.20	47.0	392.18	63%	1.06	0.74	86.00	85.33		no	85.91	85.24	86.00	86.00	85.92		86.84	0.84	OK
Nacarat Street	670	671	13.40	2.31	31.00	31.00	31.00	PVC	375	366.4	0.26	83.5	84.05	63%	0.80	1.75	86.43	86.06		no	86.21	85.84	86.43	86.43	86.22		86.83	0.40	OK
Tungsten Terrace	671	672	13.40	1.16	15.50	46.50	46.50	CONC	450	457.2	0.20	56.0	133.02	65%	0.81	1.15	86.21	85.76		no	86.10	85.65	86.22	86.21	86.10		87.44	1.23	OK
Tungsten Terrace	672	673	13.40	2.31	31.00	77.50	77.50	CONC	525	533.4	0.16	120.0	179.46	57%	0.80	2.49	86.10	85.58		no	85.91	85.39	86.10	86.10	85.92		87.38	1.28	OK
Trigoria Crescent	673	635	13.40			221.00	221.00	CONC	825	838.2	0.15	23.5	579.98	62%	1.05	0.37	85.91	85.09		no	85.87	85.05	85.92	85.91	85.89		86.84	0.93	OK

STORM SEWER COMPUTATION FORM

DESIGNED BY: AGS
CHECKED BY: JMD

PROJECT: **Neighbourhood 5 - Avalon West - STAGE 3**
CLIENT: Minto Communities Inc.
PROJECT #: 131004
BY: ATREL ENGINEERING LTD
DATE: November 2014

RESTRICTED FLOW : Various L/S/Ha.
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 2

STREET NAMES	LOCATION	FROM (Up)		TO (Down)	AREA (ha.) RUNOFF COEFFICIENT 0.20	0.27	0.29	0.30	0.36	0.39	0.45	0.48	0.50	0.55	0.60	0.62	0.65	0.70	0.75	0.80	0.85	0.70	0.70	0.76	Indiv Various L/s/ha	Cumul L/s/ha	FLOW (L/S)	Commercial & green space area Restr Flow (L/S)	Cum Flow (L/S)
Chinian Street	MH	635	MH	216								0.60													51.00	548.25	548.25		
Azure Street	MH	216	MH	202								0.37													31.45	579.70	579.70		
Chinian Street	MH	202	MH	201																						1290.30	1290.30		
Chinian Street	MH	201	MH	1112							0.26	0.27													45.05	1335.35	1335.35		
Chinan Street	MH	1113	MH	1112							0.04				0.65										58.65	58.65	58.65		
Chinian Street	MH	1112	MH	1111D							0.30														25.50	1419.50	1419.50		
Chinian Street	MH	1111D	MH	1111							0.29														24.65	1444.15	1444.15		
Chinian Street	MH	1111	MH	1111E							0.25														21.25	1570.80	1570.80		
Chinian Street	MH	1111E	MH	1102							0.33														28.05	1598.85	1598.85		
Montagris Circle	MH	1104	MH	1102							2.95														250.75	250.75	250.75		
Strasbourg Street	MH	1102	MH	1101							0.22				0.32										45.90	2869.60	2869.60		2053.79
Rochefort Circle	MH	1117	MH	1101											2.97										252.45	252.45	252.45		
Strasbourg Street	MH	1101	MH	50543									0.60												51.00	3173.05	3173.05		2053.79
Brian Coburn Blvd.	MH	199	MH	50543																4.74		1.61			402.90	402.90	402.90	383.18	383.18
Brian Coburn Blvd.	MH	196	MH	50543																		1.34						318.92	318.92
Des Aubépines Drive	MH	50543	MH	50544											0.30										66.00	3641.95	3641.95		2755.89
Site Plan No.2	MH	3511	MH	3512																0.28					61.60	61.60	61.60		
Site Plan No.2	MH	3512	MH	3513																0.24					52.80	114.40	114.40		
Street No.4	MH	3513	MH	3515											0.12										26.40	140.80	140.80		
Street No.4	MH	3514	MH	3515														0.14							30.80	30.80	30.80		
Street No.4	MH	3515	MH	3516									0.10					0.48							127.60	299.20	299.20		
Street No.4	MH	3516	MH	3521									0.12					0.31							94.60	393.80	393.80		
Street No.4	MH	3514	MH	3517																									
Street No.4	MH	3517	MH	3518									0.17					0.39							123.20	123.20	123.20		
Street No.4	MH	3518	MH	3519									0.14					0.38							114.40	237.60	237.60		
Street No.4	MH	3519	MH	3520									0.15												33.00	270.60	270.60		
Street No.4	MH	3520	MH	3521									0.06					0.13							41.80	312.40	312.40		
Street No.4	MH	3521	MH	3522									0.05												11.00	717.20	717.20		
Street No.4	MH	3522	MH	50544																						717.20	717.20		
Multiple Block	MH	500	MH	50544															1.56						343.20	343.20	343.20		
Des Aubépines Drive	MH	50544	MH	53620														0.16							35.20	4737.55	4737.55		2755.89
Des Aubépines Drive	MH	53620	MH	53621									0.31					0.34							143.00	4880.55	4880.55		2755.89
Des Aubépines Drive	MH	53621	MH	53622														0.42							92.40	4972.95	4972.95		2755.89
Décoeur Drive	MH	3550	MH	53622									0.18		0.44		5.46								1337.60	1337.60	1337.60		
Des Aubépines Drive	MH	53622	MH	53644														0.37							81.40	6391.95	6391.95		2755.89
Elementary School	MH	504	MH	53644															2.77						609.40	609.40	609.40		
Des Aubépines Drive	MH	53644	MH	53645														0.28							61.60	7062.95	7062.95		2755.89
Street No. 9	MH	3553	MH	53645														0.58							127.60	127.60	127.60		
Des Aubépines Drive	MH	53645	MH	53646														0.41							90.20	7280.75	7280.75		2755.89
Street No.5	MH	3567	MH	53646	0.35									1.73				1.36							756.80	756.80	756.80		
Neighbourhood Park	MH	505	MH	3571	1.19																				261.80	261.80	261.80		
Décoeur Drive	MH	3571	MH	3572											0.25										55.00	316.80	316.80		
Décoeur Drive	MH	3572	MH	3576											0.18										39.60	356.40	356.40		
School	MH	501	MH	3576															2.44						536.80	536.80	536.80		
Commercial	MH	503	MH	3574															4.78						1052.26	1052.26	1052.26		
Site Plan No.1	MH	3573	MH	3574																0.12					26.40	26.40	26.40		
Décoeur Drive	MH	3574	MH	3575											0.26										57.20	1135.86	1135.86		
Décoeur Drive	MH	3575	MH	3576											0.34										74.80	1210.66	1210.66		
Magnolia Street	MH	3576	MH	3579														0.09							19.80	2123.66	2123.66		
Site Plan No.1	MH	3577	MH	3578																0.23					50.60	50.60	50.60		
Site Plan No.1	MH	3578	MH	3579																0.13					28.60	79.20	79.20		
Magnolia Street	MH	3579	MH	3585									0.13					0.18							68.20	2271.06	2271.06		
Hepatica Crescent	MH	3581	MH	3582										0.31			0.24								121.00	121.00	121.00		
Hepatica Crescent	MH	3582	MH	3585													0.22								48.40	169.40	169.40		
Hepatica Crescent	MH	3583	MH	3584									0.17					0.41							127.60	127.60	127.60		
Hepatica Crescent	MH	3584	MH	3585														0.24							52.80	180.40	180.40		

STREET NAMES	FROM (Up)	TO (Down)	(2) Local F.R. (L/S)	Above ground Qty	Restricted Flow (L/S)	Cum Restricted Flow (L/S)	ACTUAL PIPE FLOW (L/S)	PIPE TYPE	DIA. (N0M) (mm)	(ACT)	SEWER DATA SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	UpStream Hgl at UP-MH (M)	Hgl Out UP-MH (M)	Down MH Hgl (M)	SURG AT UP MH (M)	UpStream USF ELEV (M)	HGL FREEBOARD (M)	Comment
Chinian Street	635	216	13.40	3.81	51.00	465.00	465.00	CONC	975	990.6	0.13	87.7	842.96	45%	1.09	1.34	85.87	84.90		no	85.76	84.79	85.89	85.87	85.76		n/a	n/a	n/a
Azure Street	216	202	13.40	2.35	31.45	496.45	496.45	CONC	975	990.6	0.10	86.9	739.33	33%	0.96	1.51	85.76	84.79		no	85.67	84.70	85.76	85.76	85.67		88.37	2.61	OK
Chinian Street	202	201	13.40			1154.55	1154.55	CONC	1350	1371.6	0.10	37.7	1760.81	34%	1.19	0.53	85.67	84.32	0.03	no	85.63	84.28	85.67	85.67	85.64		88.52	2.85	OK
Chinian Street	201	1112	13.40	3.36	45.05	1199.60	1199.60	CONC	1350	1371.6	0.10	35.8	1760.81	32%	1.19	0.50	85.60	84.25	0.04	no	85.56	84.21	85.64	85.64	85.62	0.04	88.14	2.50	OK
Chinan Street	1113	1112	13.40	4.38	58.65	58.65	58.65	CONC	450	457.2	0.20	75.7	133.02	56%	0.81	1.56	85.67	85.22		no	85.52	85.07	85.67	85.67	85.62		88.30	2.63	OK
Chinian Street	1112	1111D	13.40	1.90	25.50	1283.75	1283.75	CONC	1350	1371.6	0.10	56.6	1760.81	27%	1.19	0.79	85.52	84.17		no	85.46	84.11	85.62	85.62	85.59	0.10	88.30	2.68	OK
Chinian Street	1111D	1111	13.40	1.84	24.65	1308.40	1308.40	CONC	1350	1371.6	0.10	23.8	1760.81	26%	1.19	0.33	85.43	84.08		no	85.41	84.06	85.59	85.57	85.56	0.14	n/a	n/a	n/a
Chinian Street	1111	1111E	13.40	1.59	21.25	1435.05	1435.05	CONC	1350	1371.6	0.11	48.4	1846.76	22%	1.25	0.65	85.41	84.06		no	85.36	84.01	85.56	85.56	85.53	0.15	n/a	n/a	n/a
Chinian Street	1111E	1102	13.40	2.09	28.05	1463.10	1463.10	CONC	1350	1371.6	0.11	30.8	1846.76	21%	1.25	0.41	85.36	84.01	0.01	no	85.33	83.98	85.53	85.51	85.49	0.15	n/a	n/a	n/a
Montagris Circle	1104	1102	13.40	18.71	250.75	250.75	250.75	CONC	600	609.6	0.20	85.8	286.47	12%	0.98	1.46	85.52	84.92	0.03	no	85.35	84.75	85.67	85.62	85.49	0.10	n/a	n/a	n/a
Strasbourg Street	1102	1101	13.40	3.43	45.90	5030.32	5030.32	CONC	2100	2133.6	0.10	76.5	5720.16	12%	1.60	0.80	85.32	83.22		no	85.24	83.14	85.49	85.49	85.43	0.17	87.79	2.30	OK
Rochefort Circle	1117	1101	13.40	18.84	252.45	252.45	252.45	CONC	675	685.8	0.20	85.8	392.18	36%	1.06	1.35	85.44	84.77	0.03	no	85.27	84.60	85.50	85.50	85.43	0.06	87.79	2.29	OK
Strasbourg Street	1101	50543	13.40	3.81	51.00	5333.77	5333.77	CONC	2100	2133.6	0.11	118.1	5999.35	11%	1.68	1.17	85.24	83.14		no	85.11	83.01	85.43	85.43	85.33	0.19	87.79	2.36	OK
Brian Coburn Blvd.	199	50543	13.40	58.66	786.08	786.08	786.08	CONC	1050	1066.8	0.20	120.0	1274.02	38%	1.43	1.40	85.35	84.30		no	85.11	84.06	85.42	85.42	85.33	0.07	n/a	n/a	n/a
Brian Coburn Blvd.	196	50543	13.40	23.80	318.92	318.92	318.92	CONC	600	609.6	0.30	120.0	350.85	9%	1.20	1.66	85.49	84.89	0.02	no	85.13	84.53	85.63	85.63	85.33	0.14	n/a	n/a	n/a
Des Aubépines Drive	50543	50544	13.40	3.59	48.16	6486.93	6486.93	CONC	2250	2286.0	0.10	96.9	6875.59	6%	1.68	0.96	85.11	82.86		no	85.01	82.76	85.33	85.33	85.24	0.22	85.89	0.56	OK
Site Plan No.2	3511	3512	13.40	4.60	61.60	61.60	61.60	CONC	525	533.4	0.16	99.0	179.46	66%	0.80	2.05	85.78	85.26		no	85.62	85.10	85.78	85.78	85.62		n/a	n/a	n/a
Site Plan No.2	3512	3513	13.40	3.94	52.80	114.40	114.40	CONC	525	533.4	0.16	99.0	179.46	36%	0.80	2.05	85.62	85.10		no	85.46	84.94	85.62	85.62	85.53		n/a	n/a	n/a
Street No.4	3513	3515	13.40	1.97	26.40	140.80	140.80	CONC	525	533.4	0.20	52.5	200.65	30%	0.90	0.97	85.40	84.88		no	85.29	84.77	85.53	85.51	85.46	0.11	n/a	n/a	n/a
Street No.4	3514	3515	13.40	2.30	30.80	30.80	30.80	PVC	300	299.2	0.34	44.5	55.99	45%	0.80	0.93	85.44	85.14		no	85.29	84.99	85.51	85.51	85.46	0.07	n/a	n/a	n/a
Street No.4	3515	3516	13.40	9.52	127.60	299.20	299.20	CONC	750	762.0	0.10	85.5	367.27	19%	0.81	1.77	85.29	84.54		no	85.20	84.45	85.46	85.43	85.37	0.14	86.28	0.85	OK
Street No.4	3516	3521	13.40	7.06	94.60	393.80	393.80	CONC	825	838.2	0.10	86.5	473.55	17%	0.86	1.68	85.20	84.38		no	85.11	84.29	85.37	85.37	85.31	0.17	86.06	0.69	OK
Street No.4	3514	3517	13.40					PVC	375	366.4	0.26	10.0	84.05	100%	0.80	0.21	85.51	85.14		no	85.48	85.11	85.51	85.51	85.49		86.35	0.84	OK
Street No.4	3517	3518	13.40	9.19	123.20	123.20	123.20	CONC	525	533.4	0.20	78.0	198.12	38%	0.89	1.47	85.48	84.96		no	85.33	84.81	85.49	85.49	85.43	0.01	86.38	0.89	OK
Street No.4	3518	3519	13.40	8.54	114.40	237.60	237.60	CONC	675	685.8	0.15	78.5	339.63	30%	0.92	1.42	85.33	84.66		no	85.21	84.54	85.43	85.43	85.37	0.10	86.22	0.79	OK
Street No.4	3519	3520	13.40	2.46	33.00	270.60	270.60	CONC	675	685.8	0.15	10.5	339.63	20%	0.92	0.19	85.18	84.51		no	85.16	84.49	85.37	85.36	85.35	0.18	86.05	0.69	OK
Street No.4	3520	3521	13.40	3.12	41.80	312.40	312.40	CONC	750	762.0	0.11	44.0	385.20	19%	0.84	0.87	85.16	84.41		no	85.11	84.36	85.35	85.34	85.31	0.18	86.14	0.80	OK
Street No.4	3521	3522	13.40	0.82	11.00	717.20	717.20	CONC	975	990.6	0.13	36.5	842.96	15%	1.09	0.56	85.11	84.14		no	85.06	84.09	85.31	85.31	85.28	0.20	85.91	0.60	OK
Street No.4	3522	50544	13.40			717.20	717.20	CONC	975	990.6	0.13	18.5	842.96	15%	1.09	0.28	85.03	84.06		no	85.01	84.04	85.28	85.26	85.24	0.23	85.94	0.68	OK
Multiple Block	500	50544	13.40	25.61	343.20	343.20	343.20	CONC	750	762.0	0.20	11.5	519.40	34%	1.14	0.17	85.03	84.28		no	85.01	84.26	85.25	85.25	85.24	0.22	86.00	0.75	OK
Des Aubépines Drive	50544	53620	13.40	2.59	34.72	7582.05	7582.05	CONC	2250	2286.0	0.10	74.5	6875.59	-10%	1.68	0.74	85.01	82.76		no	84.94	82.69	85.24	85.24	85.15	0.23	85.94	0.70	OK
Des Aubépines Drive	53620	53621	13.40	6.49	86.96	7669.01	7669.01	CONC	2250	2286.0	0.12	69.5	7373.25	-4%	1.80	0.64	84.94	82.69		no	84.86	82.61	85.15	85.15	85.06	0.21	85.88	0.73	OK
Des Aubépines Drive	53621	53622	13.40	6.77	90.72	7759.73	7759.73	CONC	2250	2286.0	0.13	74.0	7809.17	1%	1.90	0.65	84.86	82.61		no	84.76	82.51	85.06	85.06	84.97	0.20	85.73	0.67	OK
Décoeur Drive	3550	53622	13.40	100.65	1348.76	1348.76	1348.76	CONC	1350	1371.6	0.10	75.0	1760.81	23%	1.19	1.05	84.84	83.49		no	84.76	83.41	85.01	85.01	84.97	0.17	85.80	0.79	OK
Des Aubépines Drive	53622	53644	13.40	6.19	82.88	9191.36	9191.36	CONC	2550	2590.8	0.11	88.0	9836.90	7%	1.87	0.79	84.76	82.21		no	84.67	82.12	84.97	84.97	84.89	0.21	85.60	0.63	OK
Elementary School	504	53644	13.40	45.48	609.40	609.40	609.40	CONC	975	990.6	0.20	12.5	1045.56	42%	1.36	0.15	84.70	83.73		no	84.67	83.70	84.91	84.90	84.89	0.20	85.67	0.77	OK
Des Aubépines Drive	53644	53645	13.40	5.97	80.00	9880.76	9880.76	CONC	2550	2590.8	0.11	83.7	9836.90	0%	1.87	0.75	84.67	82.12		no	84.58	82.03	84.89	84.89	84.80	0.22	85.43	0.54	OK
Street No. 9	3553	53645	13.40	10.03	134.36	134.36	134.36	CONC	675	685.8	0.11	14.5	296.09	55%	0.80	0.30	84.60	83.93		no	84.58	83.91	84.80	84.80	84.80	0.20	85.25	0.45	OK
Des Aubépines Drive	53645	53646	13.40	9.55	128.00	10143.12	10143.12	CONC	2550	2590.8	0.11	74.5	9836.90	-3%	1.87	0.67	84.58	82.03		no	84.50	81.95	84.80	84.80	84.72	0.22	85.28	0.48	OK
Street No.5	3567	53646	13.40	56.51	757.28	757.28	757.28	CONC	975	990.6	0.11	118.0	775.41	2%	1.01	1.95	84.63	83.66		no	84.50	83.53	84.84	84.84	84.72	0.21	85.65	0.81	OK
Neighbourhood Park	505	3571	13.40	4.01	53.76	53.76	53.76	PVC	375	366.4	0.26	18.0	84.05	36%	0.80	0.38	85.36	84.99		no	85.31	84.94	85.38	85.38	85.36	0.02	n/a	n/a	n/a
Décoeur Drive	3571	3572	13.40	3.09	41.44	95.20	95.20	CONC	450	457.2	0.20	74.0	133.02	28%	0.81	1.52	85.31	84.86		no	85.16	84.71	85.36	85.34	85.26	0.03	n/a	n/a	n/a
Décoeur Drive	3572	3576	13.40	2.31	31.00	126.20	126.20	CONC	525	533.4	0.16	32.0	179.46	30%	0.80	0.66	85.16	84.64		no	85.11	84.59	85.26	85.26	85.23	0.10	n/a	n/a	n/a
School	501	3576	13.40	40.06	536.80	536.80	536.80	CONC	900	914.4	0.20	19.0	844.60	36%	1.29	0.25	85.15	84.25		no	85.11	84.21	85.25	85.25	85.23	0.10	86.22	0.97	OK
Commercial	503	3574	13.40	78.53	1052.26	1052.26	1052.26	CONC	1200	1219.2	0.20	17.0	1818.95	42%	1.56	0.18	85.35	84.15		no	85.32	84.12	85.41	85.41	85.40	0.06	86.48	1.07	OK
Site Plan No.1	3573	3574	13.40	2.17	29.12	29.12	29.12	PVC	300	299.2	1.00	45.0	96.02	70%	1.37	0.55	85.71	85.41		no	85.26	84.96	85.71	85.71	85.40		87.14	1.43	OK
Décoeur Drive	3574	3575	13.40	3.09	41.44	1122.82	1122.82	CONC	1200	1219.2	0.11	56.5	1348.97	17%	1.16	0.81	85.26	84.06		no	85.20	84.00	85.40	85.34	85.30	0.08	86.87	1.53	OK
Décoeur Drive	3575	3576	13.40	2.90	38.80	1161.62	1161.62	CONC	1200	1219.2	0.11	85.0	1348.97	14%	1.16	1.23	85.20	84.00		no	85.11	83.91	85.30	85.30	85.23	0.10	86.88	1.58	OK
Magnolia Street	3576	3579	13.40	2.31	31.00	1855.62	1855.62	CONC	1500	1524.0	0.11	51.5	2445.85	24%	1.34	0.64	85.11	83.61		no	85.05	83.55	85.23	85.16	85.13	0.05	n/a	n/a	n/a
Site Plan No.1	3577	3578	13.40	4.26	57.12	57.12	57.12	PVC	375	366.4	0.26	59.5	84.05	32%	0.80	1.24	85.56	85.19		no	85.41	85.04	85.56	85.56	85.41		87.00	1.44	OK
Site Plan No.1	3578	3579	13.40	2.42	32.48	89.60	89.60	CONC	450	457.2	0.20	71.5	131.34	32%	0.80	1.49	85.41	84.96	0.22	no	85.27	84.82	85.41	85.41	85.27		86.88	1.47	OK
Magnolia Street	3579	3585	13.40	4.01	53.76	1998.98	1998.98	CONC	1650	1676.4	0.10	48.0	3006.86	34%	1.36	0.59	85.05	83.40		no	85.00	83.35	85.13	85.13	85.11	0.08	n/a	n/a	n/a
Hepatica Crescent	3581	3582	13.40	6.77	90.72	90.72	90.72	CONC	525	533.4	0.16	82.5	179.46	49%	0.80	1.71	85.26	84.74		no	85.13	84.61	85.26	85.26	85.17		85.88	0.62	OK
Hepatica Crescent	3582	3585	13.40	4.78	64.00	154.72	154.72	CONC	600	609.6	0.13	95.5	232.73	34%	0.80	2.00	85.13	84.53		no	85.00	84.40	85.17	85.17	85.11	0.04	85.77	0.60	OK
Hepatica Crescent	3583	3584	13.40	7.86	105.28	105.28	105.28	CONC	525	533.4	0.16	83.0	179.46	41%	0.80	1.72	85.41	84.89		no	85.28	84.76	85.41	85.41	85.28		85.88	0.47	OK
Hepatica Crescent	3584	3585	13.40	3.68	49.28	154.56	154.56	CONC	600	609.6	0.15	88.0	248.09	38%	0.85	1.73	85.28	84.68	0.15	no	85.15	84.55	85.28	85.28	85.15		85.92	0.64	OK

2322, 2370 Tenth Line Road, 885 Decoeur Drive

LICENSED PROFESSIONAL ENGINEER
A. G. Y. SAUVE
100142393
Nov.20 2014
PROVINCE OF ONTARIO

STORM SEWER COMPUTATION FORM

DESIGNED BY: AGS
CHECKED BY: JMD

PROJECT: **Neighbourhood 5 - Avalon West - STAGE 3**
CLIENT: Minto Communities Inc.
PROJECT #: 131004
BY: ATREL ENGINEERING LTD
DATE: November 2014

RESTRICTED FLOW : Various L/S/Ha.
RATIONAL METHOD Q= 2.78 AIR
PVC/CONC N= 0.013
CSP N= 0.024
CORR N= 0.021

Table 2

LOCATION / AREA (ha.) RUNOFF COEFFICIENT

STREET NAMES	FROM	(Up)	TO	(Down)	0.20	0.27	0.29	0.30	0.36	0.39	0.45	0.48	0.50	0.55	0.60	0.62	0.65	0.70	0.75	0.80	0.85	0.70	0.70	0.76
Magnolia Street	MH	3585	MH	3594										0.14				0.37						
Genévriers Street	MH	3586	MH	3587										0.42				0.22						
Genévriers Street	MH	3587	MH	3588																				
Genévriers Street	MH	3588	MH	3589														0.40						
Genévriers Street	MH	3589	MH	3594																				
Hepatica Crescent	MH	3583	MH	3590																				
Hepatica Crescent	MH	3590	MH	3592														0.04						
Hepatica Crescent	MH	3591	MH	3592														0.18						
Genévriers Street	MH	3592	MH	3593										0.29				0.40						
Genévriers Street	MH	3593	MH	3594										0.12				0.24						
Magnolia Street	MH	3594	MH	3597										0.16				0.28						
Hepatica Crescent	MH	3595	MH	3596										0.37				0.31						
Hepatica Crescent	MH	3596	MH	3597										0.29				0.23						
Hepatica Crescent	MH	3597	MH	3598										0.73				0.56						
Hepatica Crescent	MH	3598	MH	53646										0.48				0.32						
Des Aubépines Drive	MH	53646	MH	HEADWALL																				

Location (From–To)	Indiv Various L/s/ha	Cumul L/s/ha	FLOW (L/S)	Commercial & green space area Restr Flow (L/S)	Commercial & green space area Cum Flow (L/S)	Above ground (2) Local F.R. (L/S)	Above ground Qty	Above ground Restricted Flow (L/S)	Above ground Cum Restricted Flow (L/S)	**ACTUAL PIPE FLOW (L/S)**	PIPE TYPE	PIPE DIA. (N0M) (mm)	PIPE (ACT)
3585–3594	112.20	2733.06	2733.06			13.40	8.68	116.28	2424.54	2424.54	CONC	1650	1676.4
3586–3587	140.80	140.80	140.80			13.40	9.46	126.72	126.72	126.72	CONC	525	533.4
3587–3588		140.80	140.80			13.40			126.72	126.72	CONC	525	533.4
3588–3589	88.00	228.80	228.80			13.40	6.10	81.76	208.48	208.48	CONC	675	685.8
3589–3594		228.80	228.80			13.40			208.48	208.48	CONC	750	762.0
3583–3590						13.40					PVC	300	299.2
3590–3592	8.80	8.80	8.80			13.40					PVC	300	299.2
3591–3592	39.60	39.60	39.60			13.40	2.76	36.96	36.96	36.96	PVC	375	366.4
3592–3593	151.80	200.20	200.20			13.40	9.95	133.28	170.24	170.24	CONC	675	685.8
3593–3594	79.20	279.40	279.40			13.40	5.10	68.32	238.56	238.56	CONC	750	762.0
3594–3597	96.80	3338.06	3338.06			13.40	8.26	110.64	2982.22	2982.22	CONC	1800	1828.8
3595–3596	149.60	149.60	149.60			13.40	9.03	120.96	120.96	120.96	CONC	525	533.4
3596–3597	114.40	264.00	264.00			13.40	8.12	108.80	229.76	229.76	CONC	675	685.8
3597–3598	283.80	3885.86	3885.86			13.40	20.21	270.88	3482.86	3482.86	CONC	1800	1828.8
3598–53646	176.00	4061.86	4061.86			13.40	12.60	168.80	3651.66	3651.66	CONC	1800	1828.8
53646–HEADWALL		12099.41	12099.41		2755.89	13.40			14552.06	14552.06	CONC	2700	2743.2

Location (From–To)	SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	TIME OF FLOW (MIN)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	Inv to Inv (M)	DwStream Obv. (M)	DwStream Inv. (M)	**UpStream Hgl at UP-MH (M)**	Hgl Out UP-MH (M)	Down MH Hgl (M)	SURG AT UP MH (M)	UpStream USF ELEV (M)	HGL FREEBOARD (M)	Comment
3585–3594	0.10	79.0	3006.86	19%	1.36	0.97	85.00	83.35		no	84.92	83.27	85.11	85.11	85.06	0.11	85.63	0.52	OK
3586–3587	0.16	59.0	179.46	29%	0.80	1.22	85.20	84.68		no	85.11	84.59	85.20	85.20	85.15		85.60	0.40	OK
3587–3588	0.16	11.5	179.46	29%	0.80	0.24	85.08	84.56		no	85.06	84.54	85.15	85.14	85.13	0.06	85.79	0.65	OK
3588–3589	0.11	77.5	294.79	29%	0.80	1.62	85.06	84.39		no	84.97	84.30	85.13	85.12	85.08	0.06	85.59	0.47	OK
3589–3594	0.11	48.0	390.41	47%	0.86	0.93	84.97	84.22		no	84.92	84.17	85.08	85.08	85.06	0.11	85.71	0.63	OK
3583–3590	0.34	10.5	55.99	100%	0.80	0.22	85.52	85.22		no	85.48	85.18	85.52	85.52	85.48		86.08	0.56	OK
3590–3592	0.34	71.5	55.99	100%	0.80	1.50	85.45	85.15		no	85.21	84.91	85.45	85.45	85.22		85.96	0.51	OK
3591–3592	0.26	69.0	84.05	56%	0.80	1.44	85.39	85.02		no	85.21	84.84	85.39	85.39	85.22		85.86	0.47	OK
3592–3593	0.11	90.0	294.79	42%	0.80	1.88	85.21	84.54		no	85.11	84.44	85.22	85.21	85.11		85.84	0.63	OK
3593–3594	0.10	90.0	367.27	35%	0.81	1.86	85.11	84.36	0.10	no	85.02	84.27	85.11	85.11	85.06		85.75	0.64	OK
3594–3597	0.10	84.0	3792.13	21%	1.44	0.97	84.92	83.12		no	84.84	83.04	85.06	85.06	85.01	0.14	85.64	0.58	OK
3595–3596	0.16	71.0	179.46	33%	0.80	1.47	85.14	84.62		no	85.03	84.51	85.14	85.14	85.07		85.59	0.45	OK
3596–3597	0.12	80.5	303.78	24%	0.82	1.63	85.03	84.36	0.15	no	84.93	84.26	85.07	85.07	85.01	0.04	85.54	0.47	OK
3597–3598	0.13	118.0	4323.69	19%	1.65	1.19	84.78	82.98		no	84.63	82.83	85.01	84.91	84.81	0.13	85.35	0.44	OK
3598–53646	0.13	101.5	4323.69	16%	1.65	1.03	84.63	82.83		no	84.50	82.70	84.81	84.81	84.72	0.18	85.20	0.39	OK
53646–HEADWALL	0.10	38.5	11180.46	-30%	1.89	0.34	84.50	81.80		no	84.46	81.76	84.72	84.72	84.65	0.22	n/a	n/a	n/a

Existing Storm Sewers
Existing Eastern Trunk
Stage 2 Storm Sewers
Proposed Stage 3 Storm Sewers
Future Stages Storm Sewers

Appendix D GEOTECHNICAL INVESTIGATION

patersongroup

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Noise and Vibration Studies

Geotechnical Investigation

Proposed Mixed-Use Development
Tenth Line Road and Decoeur Drive
Ottawa, Ontario

Prepared For

Mattamy Homes

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Consulting Engineers
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August 20, 2021

Report: PG5914-1

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Symbols and Terms
Grain Size Distribution and Hydrometer Testing Results
Atterberg Limit Testing Results
Shrinkage Testing Results
Analytical Test Results

Appendix 2 Figure 1 - Key Plan
Drawing PG5914-1 - Test Hole Location Plan

1.0 Introduction

Paterson Group (Paterson) was commissioned by Mattamy Homes to conduct a geotechnical investigation for the proposed mixed-use development site (subject site) to be located on Tenth Line Road and Decoeur Drive in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the geotechnical investigation was to:

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

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

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

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development will consist of five three-storey mixed-use buildings and several blocks of back-to-back three-story stacked town homes, with slab-on-grade, crawl spaces or full basements. It is also anticipated that one level of underground parking will be located below each of the proposed mixed-use buildings.

Associated roadways, walkways, at-grade parking areas and landscaped areas are also anticipated as part of the development. It is expected that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on August 5, 2021 and consisted of advancing a total of four (4) test holes to a maximum depth of 6.6 m below existing ground surface. A previous geotechnical investigation was completed by this firm within the subject site on September 28, 2005 which included one (1) borehole advanced to a maximum depth 20 m below existing grade. The test hole locations were distributed in a manner to provide general coverage of the subject site and taking into consideration underground utilities and site features. The test hole locations are shown on Drawing PG5914-1 - Test Hole Location Plan included in Appendix 2.

The test holes were drilled using a track mounted drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

The soil samples were recovered from the auger flights and using a 50 mm diameter split-spoon sampler or 73 mm diameter thin walled Shelby tubes in combination with a piston sampler. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. The Shelby tubes were sealed at both ends. All samples were transported to our laboratory. The depths at which the auger and split-spoon, and Shelby tube samples were recovered from the boreholes are shown as AU, SS, ant TW, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

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

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed at borehole BH 5 (2005). The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

Undrained shear strength testing, using a vane apparatus, was carried out at regular intervals of depth in cohesive soils.

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

Groundwater

All boreholes were fitted with flexible standpipe piezometers to allow for groundwater level monitoring. Groundwater level observations are discussed in Section 4.3 and are presented in the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

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

3.2 Field Survey

The test hole locations were selected by Paterson to provide general coverage of the proposed development, taking into consideration the existing site features and underground utilities. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson using a handheld GPS and referenced to a geodetic datum. The location of the test holes and ground surface elevation at each test hole location are presented on Drawing PG5914-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. A total of 1 shrinkage test, 1 grain size distribution analysis, and 4 Atterberg limit tests were completed on selected soil samples.

The results are presented in Subsection 4.2 and on Grain Size Distribution and Hydrometer Testing, and Atterberg Limit Results and Shrinkage Test Results presented in Appendix 1.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures, one of which was collected from borehole BH 2-21. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the samples. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site consists of an agricultural land. The existing ground surface across the subject site is relatively at grade with adjacent properties and roadways at approximate geodetic elevation of 87.5 to 88.5 m. A patch of trees was noted within central south portion of the site, while the remainder of the site was covered with grass and vegetation. A 0.5m high pile of fill was observed to cover a large area within the south portion of the site.

The site is bordered by Brian Coburn Boulevard to the north, Tenth Line Road to the east, Decoeur Drive to the south, and a school and residential dwellings to the west.

4.2 Subsurface Profile

Generally, the soil profile at the test hole locations consists of topsoil and/or fill underlain by a deep deposit of silty clay. The fill was encountered at the location of BH 1-21. The fill layer extended down to approximately 0.9 m depth below ground surface and it was observed to consist of organics and silty clay. The silty clay was encountered beneath the topsoil and/or fill at all test hole locations. The silty clay deposit consisted of a weathered silty clay crust followed by firm grey silty clay.

The upper portion of the silty clay has been weathered to a brown desiccated crust at all test hole locations. In situ shear vane field tests carried out within the silty clay crust yielded peak undisturbed shear strength values in excess of 100 kPa. These values reflect a stiff to very stiff consistency in the silty clay crust. Grey silty clay was encountered below the brown silty clay crust in all boreholes. In situ shear vane field testing conducted within the grey silty clay layer yielded undisturbed shear strength values generally ranging from 24 to 45 kPa. These values are indicative of a firm consistency. The natural moisture of grey silty clay materials, as measured in the consolidation test samples ranged from 27 to 87 percent.

Practical refusal to DCPT was encountered at borehole BH 5 (2005) at a depth of 20 m below the existing ground surface.

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

Bedrock

Based on available geological mapping, the bedrock in the subject area consists of interbedded limestone and shale of the Lindsay formation, with an overburden drift thickness of 25 to 50 m depth.

Grain Size Distribution and Hydrometer Testing

One sieve analysis was completed to classify selected soil samples according to the Unified Soil Classification System (USCS). The results are summarized in Table 1 and presented in Appendix 1.

Table 1 – Summary of Grain Size Distribution Analysis

Borehole	Sample	Gravel (%)	Sand (%)	Silt and Clay (%)
BH 1-21	SS 3	0	0.5	99.5

Atterberg Limit Tests

Four selected silty clay samples were submitted for Atterberg limits testing. The results are summarized in Table 2 and presented in Appendix 1.

Table 2 – Atterberg Limits Results

Borehole	Sample	Depth (m)	LL (%)	PL (%)	PI (%)
BH 1-21	SS2	1.16	61	26	35
BH 2-21	SS2	0.76	62	25	37
BH 3-21	SS3	1.52	60	24	36
BH 4-21	SS3	1.52	60	23	37

Note: LL: Liquid Limit; PL: Plastic Limit; PI: Plastic Index; CH: Inorganic Clay of High Plasticity.

Shrinkage Test

The results of the shrinkage limit test indicate a shrinkage limit of 7.59 and a shrinkage ratio of 1.82.

4.3 Groundwater

Groundwater levels were measured over the current investigation on August 11, 2021, within the installed standpipes. The measured groundwater levels are presented in Table 3 below.

Table 3 – Summary of Groundwater Levels				
Test Hole Number	**Ground Surface Elevation (m)**	**Measured Groundwater Level**		**Dated Recorded**
		Depth (m)	**Elevation (m)**	
Current Investigation				
BH 1-21	88.49	3.25	85.24	August 11, 2021
BH 2-21	88.21	3.55	84.66	
BH 3-21	87.98	3.26	84.72	
BH 4-21	87.53	3.53	84.00	
Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS using a geodetic datum.				

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

Long-term groundwater levels can be estimated based on the observed color and consistency of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at approximate depths of 2 to 3 m below ground surface. The recorded groundwater levels are noted on the Soil Profile and Test Data sheet presented in Appendix 1.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. The proposed buildings can be founded using conventional style shallow foundations placed on an undisturbed, very stiff to stiff brown silty clay, firm grey silty clay or engineered fill placed over one of the above noted bearing surfaces

Due to the presence of the sensitive silty clay layer, the proposed development will be subjected to grade raise restrictions. If a higher permissible grade raise is required, preloading with or without surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction and differential settlements.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing significant organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures. Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the placement of additional suitable fill material.

Fill Placement

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

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of SPMDD.

If excavated brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, it is recommended that the material be placed under dry conditions and above freezing temperatures. The silty clay should be compacted in thin lifts to at least 95% of the material's SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as Miradrain G100N or Delta Drain 6000.

Excess Soils

Excess soils generated by construction activities that will be transported off-site should be handled as per *Ontario Regulation 406/19: On-Site Excess Soil Management*.

5.3 Foundation Design

Bearing Resistance Values (Conventional Shallow Foundation)

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, founded on an undisturbed, very stiff to stiff brown silty clay can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **250 kPa** incorporating a geotechnical factor of 0.5.

Strip footings, up to 2 m wide, and pad footings, up to 4 m wide, founded on an undisturbed, firm grey silty clay can be designed using a bearing resistance value at SLS of **70 kPa** and a factored bearing resistance value at ULS of **150 kPa** incorporating a geotechnical factor of 0.5.

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

Footings bearing on an undisturbed soil bearing surface and designed using the bearing resistance values provided herein will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

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

Permissible Grade Raise

Based on the undrained shear strength values of the silty clay deposit, encountered throughout the subject, a permissible grade raise restriction of **1.0 m** is recommended for the subject site. If greater permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements. Provided sufficient time is available to induce the required settlements, consideration could be given to surcharging the subject site.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class E** for foundations bearing over the deep silty clay deposit identified throughout the subject site. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab / Slab-on-grade Construction

With the removal of all topsoil and deleterious fill within the footprint of the proposed building, the very stiff to stiff brown silty clay and firm grey silty clay will be considered an acceptable subgrade upon which to commence backfilling for floor slab construction. Any soft areas should be removed and backfilled with OPSS Granular B Type II, with a maximum particle size of 50 mm and compacted to 98% of the material's SPMDD.

Where existing fill, free of deleterious material and significant organic content, is encountered below the floor slab, provisions should be made to removing the existing fill from within the building footprint and replacing the fill with OPSS Granular A or Granular B Type II compacted to a minimum 98% of the material's SPMDD. It is also acceptable to use workable, site excavated brown silty clay material, free of deleterious materials and organics, below the floor slab and outside the lateral support zone of the proposed footings provided the material is reviewed and approved by Paterson prior to placement.

If the silty clay is to be used as backfill material, it is critical that the material be placed under dry conditions and above freezing temperatures and be compacted using a sheepsfoot roller making several passes under the full supervision of Paterson field personnel.

It is recommended that the upper 200 mm of sub-floor fill consists of OPSS Granular A crushed stone. All backfill material within the footprint of the proposed buildings (but outside the zones of influence of the footings) should be placed in maximum 300 mm thick loose layers and compacted to at least 95% of its SPMDD. Within the zones of influence of the footings, the backfill material should be compacted to a minimum of 98% of its SPMDD.

5.6 Basement Wall

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

The applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight. However, if a full drainage system is being implemented and approved by Paterson at the time of construction, hydrostatic pressure can be omitted in the structural design.

Two distinct conditions, static and seismic, should be reviewed for design calculations. The corresponding parameters are presented below.

Lateral Earth Pressures

The static horizontal earth pressure (po) can be calculated using a triangular earth pressure distribution equal to Ko·γ·H where:

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

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

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

Seismic Earth Pressures

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

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

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

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32 g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

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

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

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

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Pavement Design

Car only parking areas, heavy truck parking areas and access lanes are anticipated at this site. The proposed pavement structures are presented in Tables 4 and 5.

Table 4 – Recommended Pavement Structure – Driveways and Car Only Parking Areas

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

Table 5 – Recommended Pavement Structure – Access Lanes and Local Residential Roadways	
Thickness (mm)	**Material Description**
40	**Wear Course –** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Wear Course –** HL-8 or Superpave 19 Asphaltic Concrete
150	**BASE –** OPSS Granular A Crushed Stone
400	**SUBBASE –** OPSS Granular B Type II
Subgrade – Either fill, in-situ soil, or OPSS Granular B Type I or II material placed over in-situ soil.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable compaction equipment.

The pavement granular (base and subbase) should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable compaction equipment.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, such as Terrafix 200 or equivalent, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

Due to the impervious nature of the subgrade materials, consideration should be given to installing subdrains during the pavement construction. These drains should extend in four orthogonal directions or longitudinally when placed along a curb. The clear crushed stone surrounding the drainage lines or the pipe, should be wrapped with suitable filter cloth. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be shaped to promote water flow to the drainage lines. Discharge of the subdrains should be directed by gravity to storm sewers or deeper drainage ditches

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed buildings. The system should consist of a 150 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Underfloor Drainage

Underfloor drainage may be required to control water infiltration below the basement area for the underground parking structure. For preliminary design purposes, it is recommended that 150 mm diameter perforated PVC pipes be placed at every bay opening. The spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

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

Backfill material below sidewalk subgrade areas or other settlement sensitive structures should consist of free draining, non-frost susceptible material placed in maximum 300 mm thick loose lifts and compacted to at least 98% of its SPMDD under dry and above freezing conditions.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover (or insulation equivalent) should be provided in this regard.

Other exterior unheated footings, such as those for isolated exterior piers and retaining walls, are more prone to deleterious movement associated with frost action. These should be provided with a minimum 2.1 m thick soil cover (or insulation equivalent).

The footings located along parking garage entrance may require protection against frost action depending on the founding depth. Unheated structures, such as the access ramp wall footings, may be required to be insulated against the deleterious effect of frost action. A minimum of 2.1 m of soil cover alone, or a minimum of 0.6 m of soil cover, in conjunction with foundation insulation, should be provided.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e., unsupported excavations). Where space restrictions exist, or to reduce the trench width, the excavation can be carried out within the confines of a fully braced steel trench box.

The excavations for the proposed development will be mostly through a very stiff to stiff silty clay. The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

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

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

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding layer should be increased to a minimum thickness of 300 mm where the subgrade consists of grey silty clay. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 99% of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the upper portion of the dry to moist (not wet) silty clay and silty sand above the cover material if the excavation and filling operations are carried out in dry weather conditions. Any stones greater than 200 mm in their longest dimension should be removed from these materials prior to placement.

The backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce potential differential frost heaving. The backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

Clay Seals

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, sub-bedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Groundwater Control for Building Construction

Due to the relatively impervious nature of the silty clay materials, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

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

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

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

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

6.7 Corrosion Potential and Sulphate

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

6.8 Landscaping Considerations

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. Grain size distribution and hydrometer testing were also completed on selected soil sample at BH 2. The above noted soil samples were recovered from elevations below the anticipated design underside of footing elevation and 3.5 m depth below anticipated finished grade. The results of our testing are presented in Subsection 4.2 and in Appendix 1.

Based on the results of our review, the subject site is considered as a low/medium sensitivity area for tree planting according to the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines).

Since the modified plasticity limit (PI) does not exceed 40%, large trees (mature height over 14 m) can be planted at the subject site provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g., in a park or other green space).

According to the City of Ottawa Tree Planting Guidelines, tree planting setback limits may be reduced to 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the following conditions are met:

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

- A small tree must be provided with a minimum of 25 m^3 of available soil volume while a medium tree must be provided with a minimum of 30 m3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

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

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

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

In-Ground Swimming Pools

The in-situ soils are considered to be acceptable for the installation of in-ground swimming pools. The soil removed to accommodate an in-ground swimming pool weighs more than the water filled in-ground pool. Therefore, no additional load is being applied to the underlying sensitive clays.

Aboveground Swimming Pools, Hot Tubs, Decks and Additions

If consideration is given to construction of an above ground swimming pool, a hot tub or an exterior deck, a geotechnical consultant should be retained by the homeowner to review the site conditions. No additional grading should be placed around the exterior structure. The swimming pool should be located at least 3 m away from the existing foundation to avoid adding localized loading to the foundation and the hot tub should be located at least 2 m away from the existing foundation. Otherwise, construction is considered routine, and can be constructed in accordance with the manufacturer's specifications.

7.0 Recommendations

It is recommended that the following be carried out once the master plan and detailed site plans are prepared for the subject site:

- Review of the grading plans from a geotechnical perspective
- Observation of all bearing surfaces prior to the placement of concrete.
- Sampling and testing of the concrete and fill materials.
- Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- Observation of all subgrades prior to backfilling.
- Field density tests to determine the level of compaction achieved.
- Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

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

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

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

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

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
Sept. 7, 2021
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Maha Saleh, M.A.Sc., PEng. (Prov.)

David J. Gilbert, P.Eng

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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

GRAIN-SIZE DISTRIBUTION AND HYDROMETER TESTING RESULTS

ATTERBERG LIMIT TESTING RESULTS

SHRINKAGE TESTING RESULTS

ANALYTICAL TESTING RESULTS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
Tenth Line Rd. & Decoeur Drive, Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG5914**

REMARKS

HOLE NO. **BH 1-21**

BORINGS BY Track-Mount Power Auger

DATE August 5, 2021

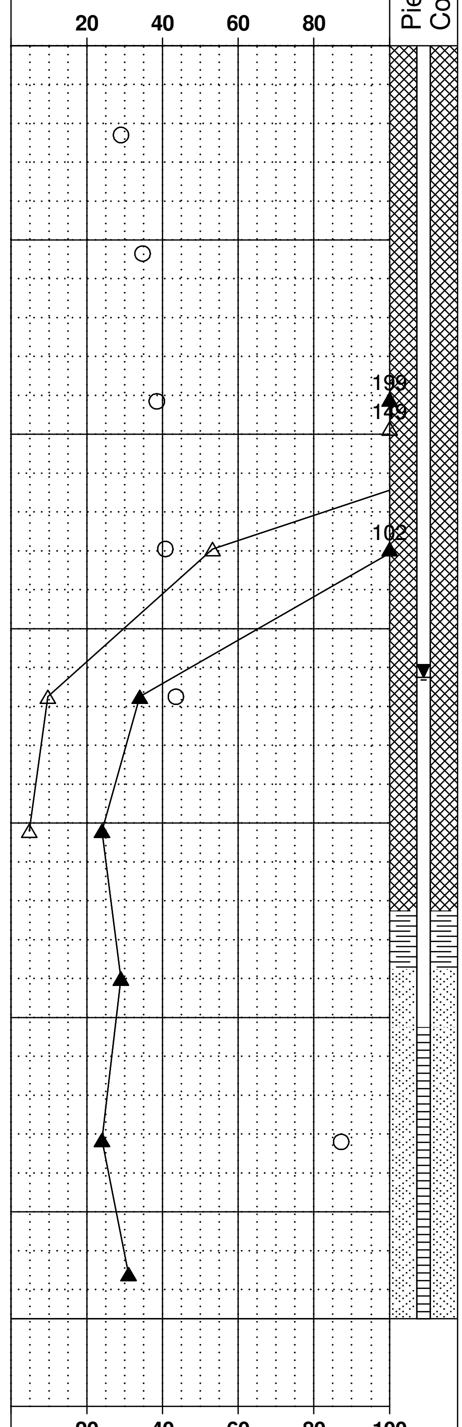
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.49
FILL: Organics and silty clay (to 0.05)							
FILL: Brown silty clay (0.05 – 0.97)		AU	1				
TOPSOIL (0.97 – 1.17)		SS	2	42	7	1	87.49
Very stiff to stiff, brown **SILTY CLAY** - firm and grey by 3.0m depth (1.17 – 6.55)		SS	3	75	P	2	86.49
		SS	4	100	P		
						3	85.49
		SS	5	83	P		
		TW	6	100	P	4	84.49
						5	83.49
		SS	7	100	P		
						6	82.49
6.55 End of Borehole							

(GWL @ 3.25m - August 11, 2021)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
Tenth Line Rd. & Decoeur Drive, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5914

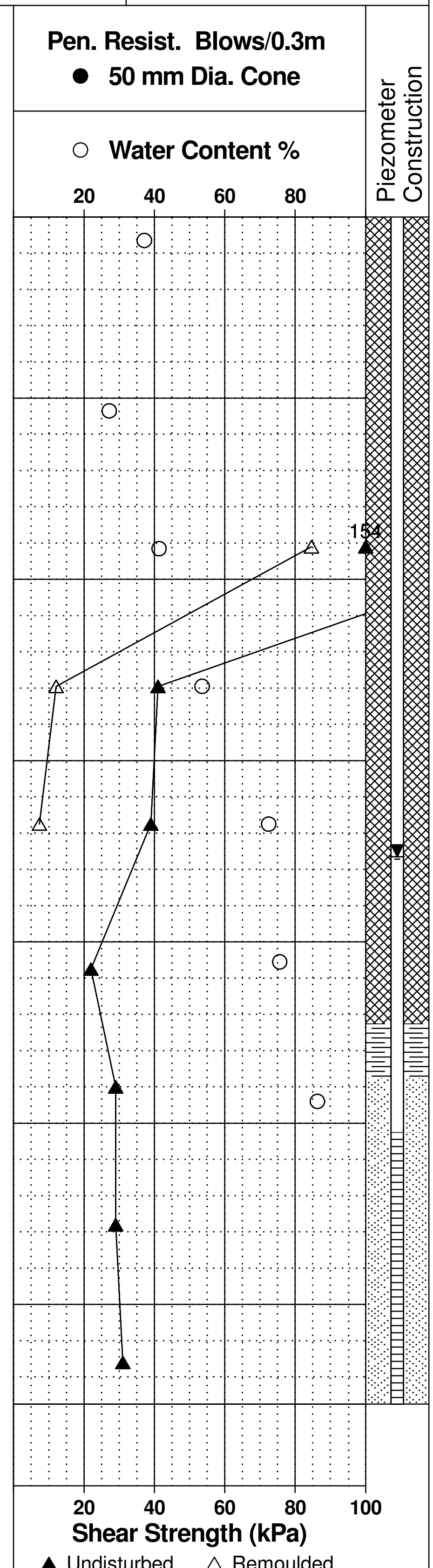
REMARKS

HOLE NO. BH 2-21

BORINGS BY Track-Mount Power Auger

DATE August 5, 2021

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.21
TOPSOIL (to 0.25)	AU	1				
	SS	2	50	10	1	87.21
	SS	3	67	P	2	86.21
Very stiff to stiff, brown **SILTY CLAY** - firm and grey by 2.3m depth	SS	4	83	P	3	85.21
	SS	5	100	P	4	84.21
	TW	6	100	P	5	83.21
(to 6.55)	SS	7	100	P	6	82.21
End of Borehole						
(GWL @ 3.53m - August 11, 2021)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
Tenth Line Rd. & Decoeur Drive, Ottawa, Ontario

DATUM Geodetic

REMARKS

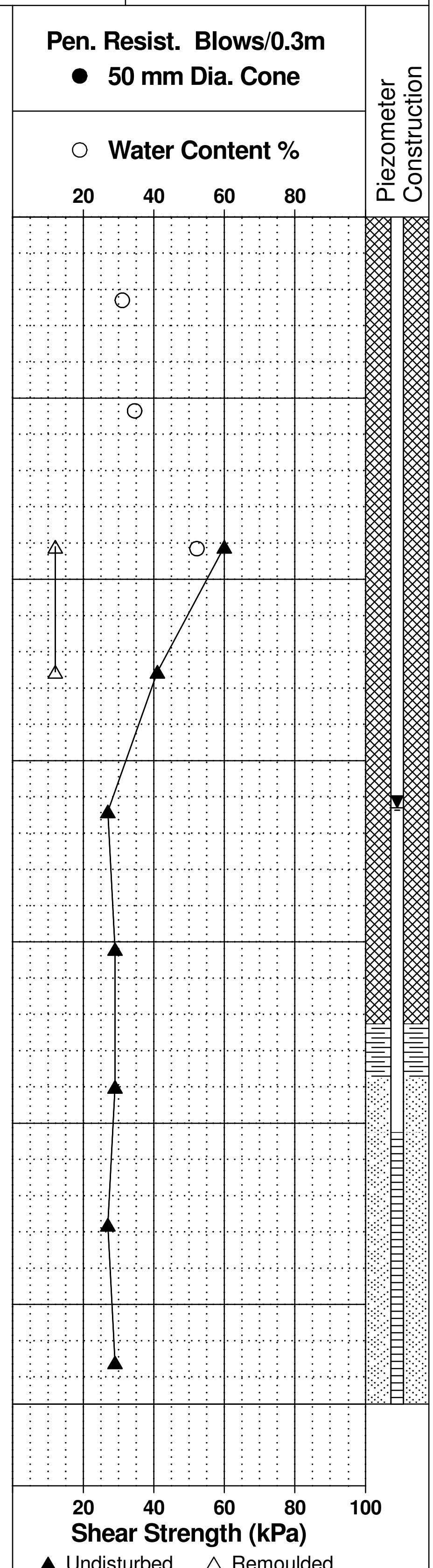
BORINGS BY Track-Mount Power Auger

DATE August 5, 2021

FILE NO. PG5914

HOLE NO. BH 3-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.98
TOPSOIL (to 0.30)							
		AU	1				
		SS	2	67	10	1	86.98
		SS	3	100	P	2	85.98
Very stiff to stiff, brown **SILTY CLAY**							
- firm and grey by 2.8m depth						3	84.98
		TW	4	83	P		
						4	83.98
						5	82.98
						6	81.98
(to 6.55)							
End of Borehole							
(GWL @ 3.26m - August 11, 2021)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
Tenth Line Rd. & Decoeur Drive, Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG5914**

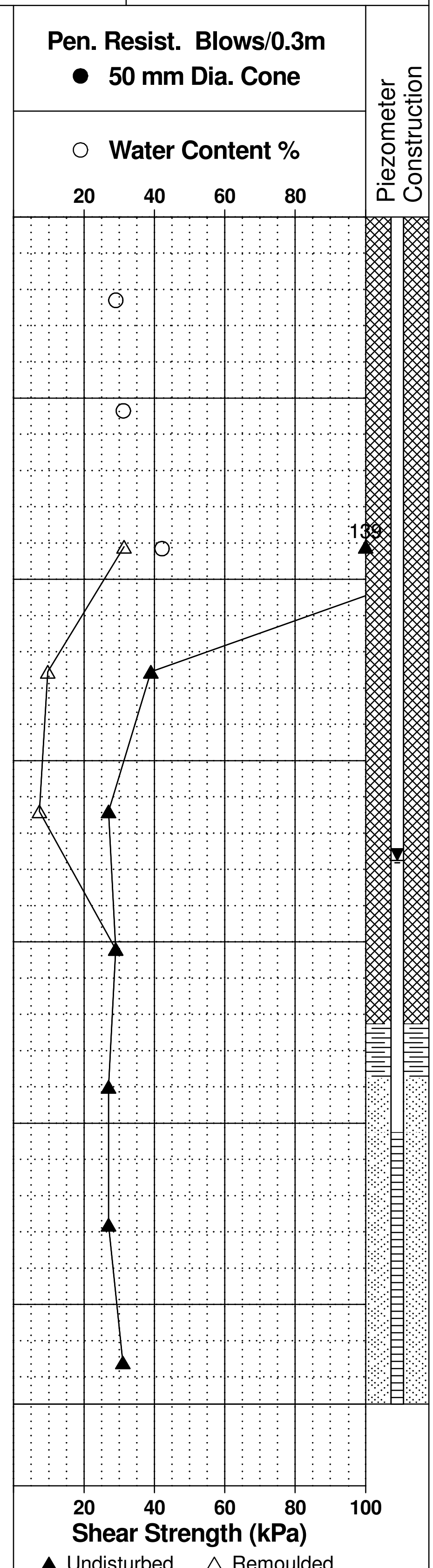
REMARKS

HOLE NO. **BH 4-21**

BORINGS BY Track-Mount Power Auger

DATE August 5, 2021

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	87.53
TOPSOIL (to 0.25)						
Very stiff to stiff, brown **SILTY CLAY**	AU	1				
	SS	2	67	10	1	86.53
	SS	3	100	P	2	85.53
- firm and grey by 3.0m depth	TW	4	17	P	3	84.53
					4	83.53
					5	82.53
					6	81.53
(to 6.55)						
End of Borehole						
(GWL @ 3.55m - August 11, 2021)						



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Development, Mer Bleue Rd. and 10th Line Rd.
Ottawa, Ontario

DATUM Approximate geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE 28 Sep 05

FILE NO. PG0685

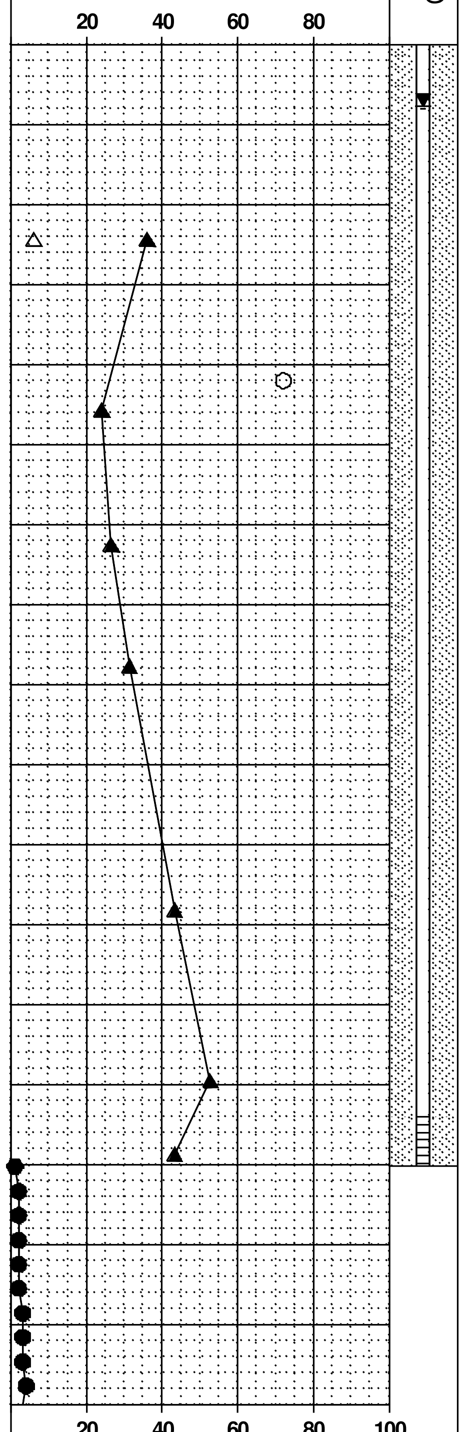
HOLE NO. BH 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.75
TOPSOIL 0.18							
Very stiff to firm, brown **SILTY CLAY**		SS	1	75	17	1	86.75
		SS	2	100	4	2	85.75
- firm to soft and grey by 2.6m depth						3	84.75
		SS	3	100	1		
		TW	4	97		4	83.75
						5	82.75
		SS	5	100	1		
- firm by 6.0m depth						6	81.75
		SS	6	100	1	7	80.75
						8	79.75
						9	78.75
		SS	7	100	1		
						10	77.75
						11	76.75
						12	75.75
- stiff to firm by 12.5m depth		SS	8	100	1		
						13	74.75
14.02						14	73.75
Dynamic Cone Penetration Test commenced @ 14.02m depth						15	72.75
						16	71.75
						17	70.75

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Development, Mer Bleue Rd. and 10th Line Rd.
Ottawa, Ontario

DATUM Approximate geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE 28 Sep 05

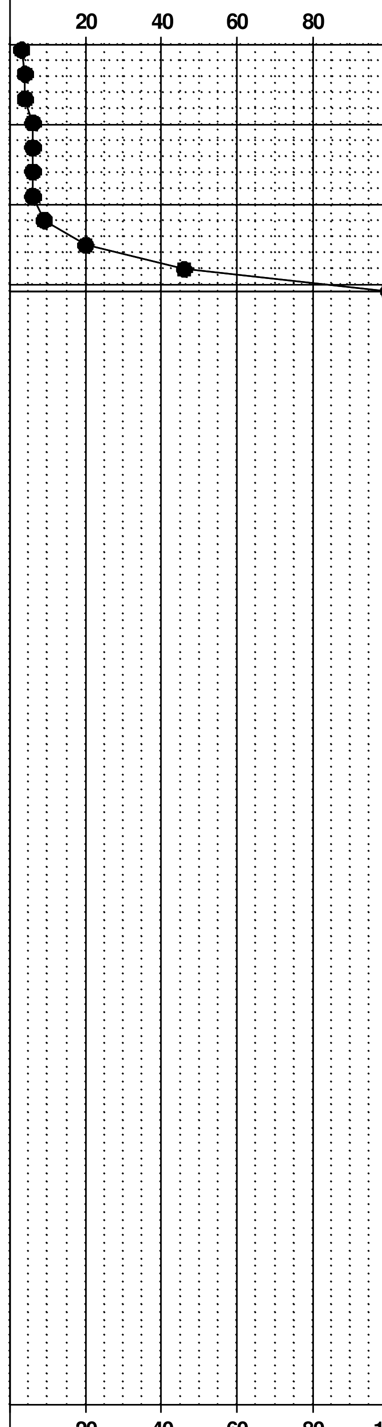
FILE NO. PG0685

HOLE NO. BH 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Inferred **SILTY CLAY**						17	70.75
						18	69.75
						19	68.75
20.09						20	67.75
End of Borehole DCPT refusal @ 20.09m depth (GWL @ 0.77m-Oct. 28/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

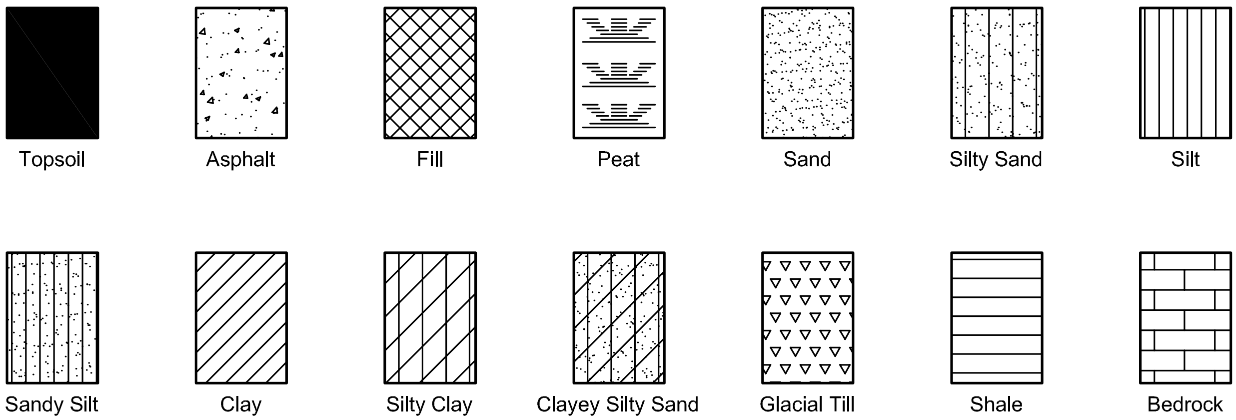
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

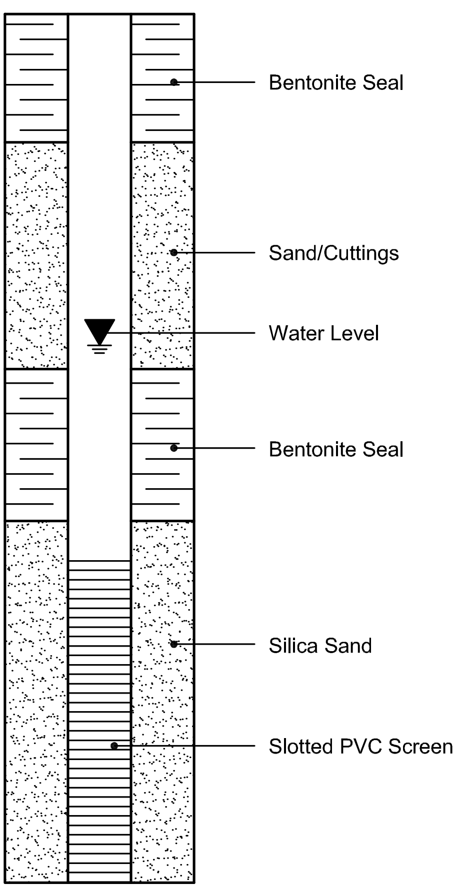
SYMBOLS AND TERMS (continued)

STRATA PLOT

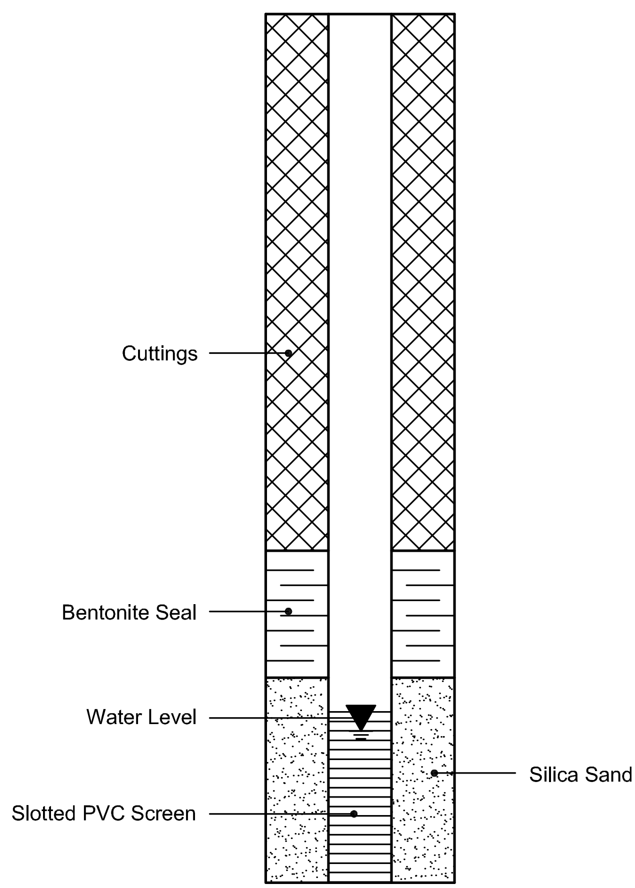


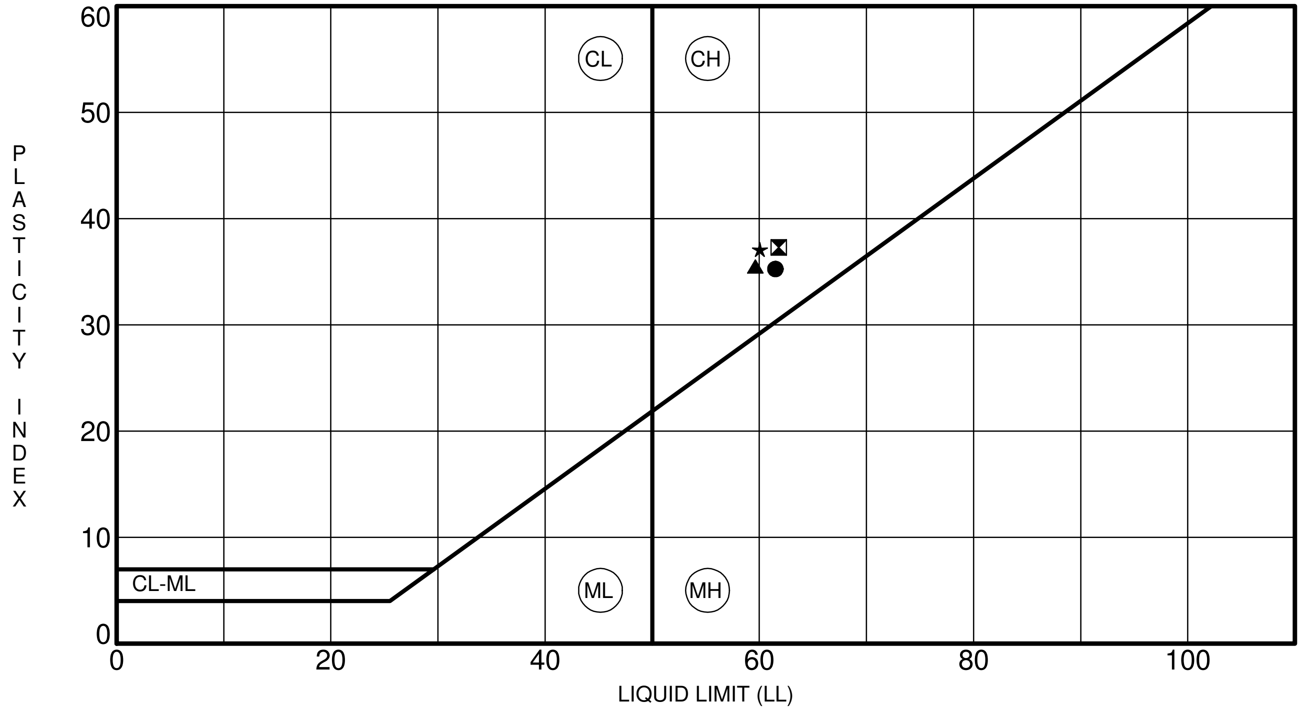
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-21**	**SS 2**	**61**	**26**	**35**		**CH - Inorganic clays of high plasticity**
⧗	**BH 2-21**	**SS 2**	**62**	**25**	**37**		**CH - Inorganic clays of high plasticity**
▲	**BH 3-21**	**SS 3**	**60**	**24**	**36**		**CH - Inorganic clays of high plasticity**
★	**BH 4-21**	**SS 3**	**60**	**23**	**37**		**CH - Inorganic clays of high plasticity**

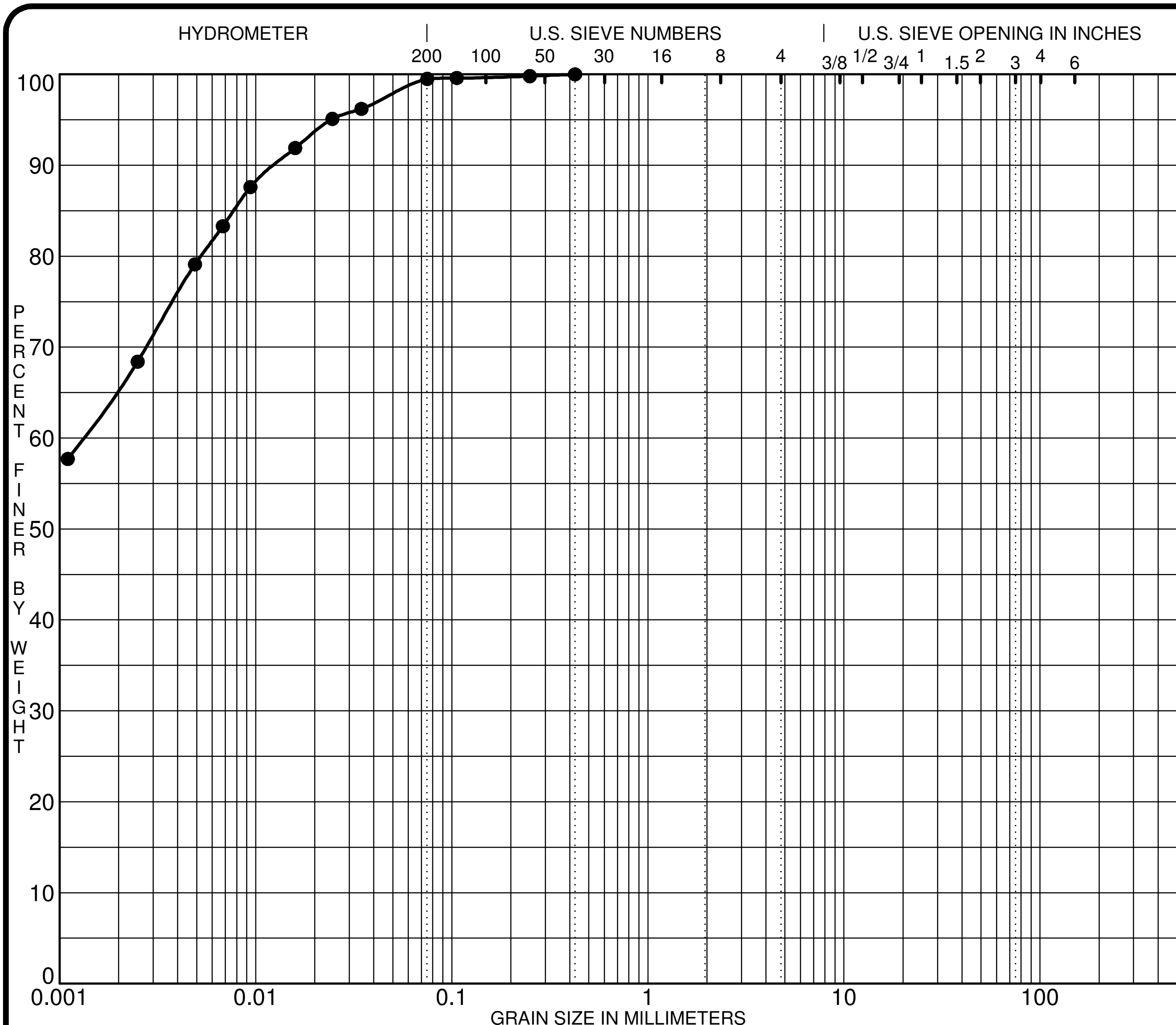
Mixed Use

CLIENT **Mattamy Homes**
FILE NO. **PG5914**
PROJECT **Geotechnical Investigation - Proposed ~~Residential/Commercial~~ Development**
DATE **5 Aug 21**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS



SILT OR CLAY	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	BH 1-21	SS 3	CH - Inorganic clays of high plasticity						
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH 1-21	SS 3	0.43	0.00			0.0	0.5	99.5	
⊠										
▲										
★										

Mixed Use

CLIENT **Mattamy Homes** FILE NO. **PG5914**

PROJECT **Geotechnical Investigation - Proposed** DATE **5 Aug 21**

~~**Residential/Commercial**~~ **Development**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION

patersongroup
consulting engineers

Linear Shrinkage
ASTM D4943-02

CLIENT:	Mattamy Homes	DEPTH	5'-7'	FILE NO.:	PG5914
PROJECT:	Tenth Line Rd & Decoeur Rd	BH OR TP No:	BH2-21 SS3	DATE SAMPLED	5-Aug-21
LAB No:	27172	TESTED BY:	DB	DATE RECEIVED	9-Aug-21
SAMPLED BY:	PB	DATE REPORTED:	16-Aug-21	DATE TESTED	11-Aug-21

LABORATORY INFORMATION & TEST RESULTS

		Calibration (Two Trials)	**Tin NO.(x33)**	
Tare	4.54	Tin	4.49	4.49
Soil Pat Wet + Tare	66.02	Tin + Grease	4.54	4.54
Soil Pat Wet	57.58	Glass	48.97	48.97
Soil Pat Dry + Tare	42.57	Tin + Glass + Water	91.07	91.07
Soil Pat Dry	38.03	Volume	37.56	37.56
Moisture	**51.41**	**Average Volume**	**37.56**	

Soil Pat + String	38.12
Soil Pat + Wax + String in Air	42.03
Soil Pat + Wax + String in Water	16.74
Volume Of Pat (Vdx)	25.29

RESULTS:

Shrinkage Limit	**7.59**
Shrinkage Ratio	**1.820**
Volumetric Shrinkage	**79.741**
Linear Shrinkage	**17.752**

REVIEWED BY:	Curtis Beadow	Joe Forsyth, P. Eng.
	[signature]	[signature]

PARACEL
LABORATORIES LTD.

Order #: 2133111

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 32631

Report Date: 12-Aug-2021

Order Date: 9-Aug-2021

Project Description: PG5914

	Client ID:	BH2-21 SS3	-	-	-
	Sample Date:	06-Aug-21 09:00	-	-	-
	Sample ID:	2133111-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	70.0	-	-	-
General Inorganics					
pH	0.05 pH Units	7.85	-	-	-
Resistivity	0.10 Ohm.m	18.1	-	-	-
Anions					
Chloride	5 ug/g dry	114	-	-	-
Sulphate	5 ug/g dry	257	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG5914-1 – TEST HOLE LOCATION PLAN

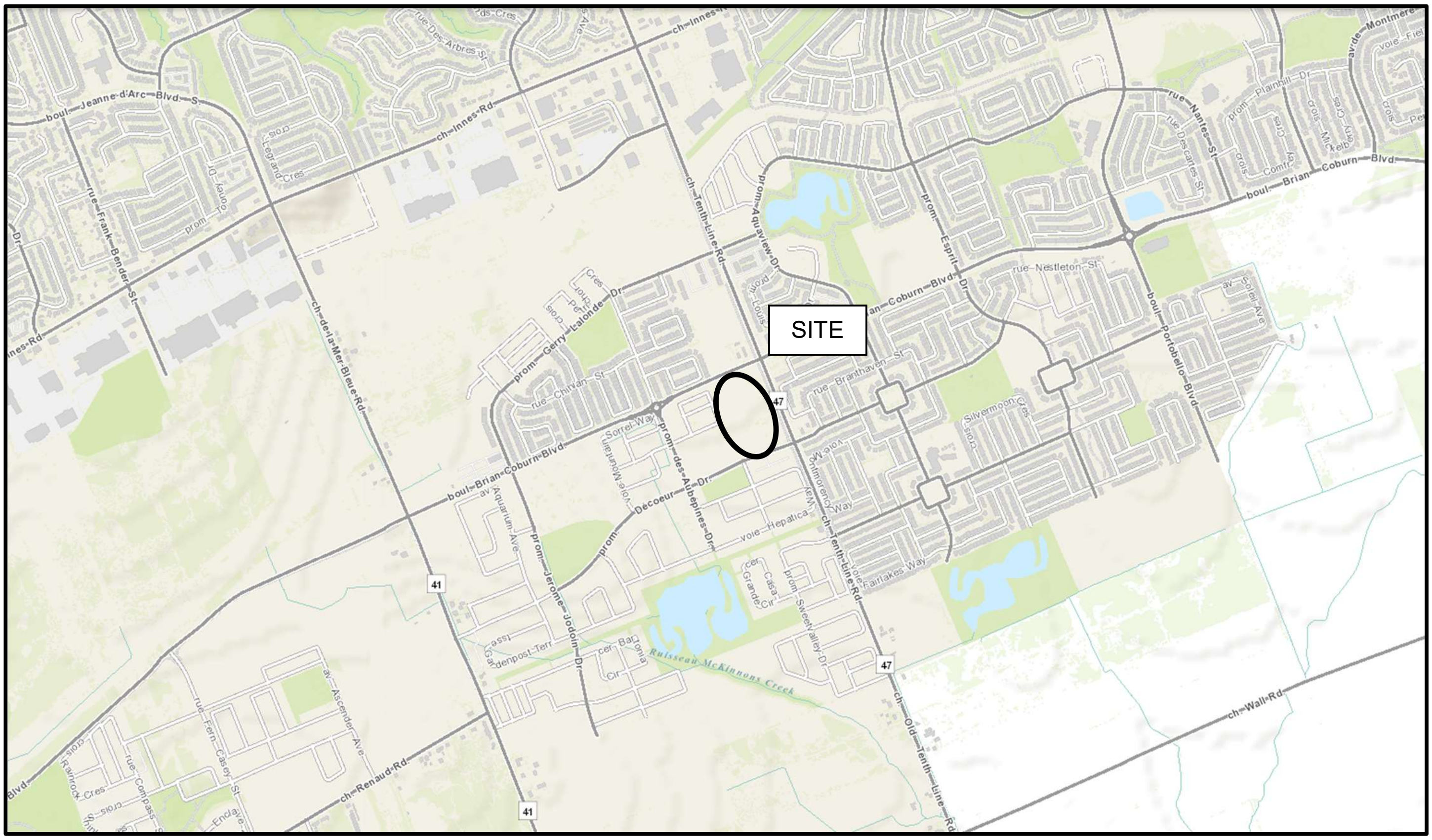
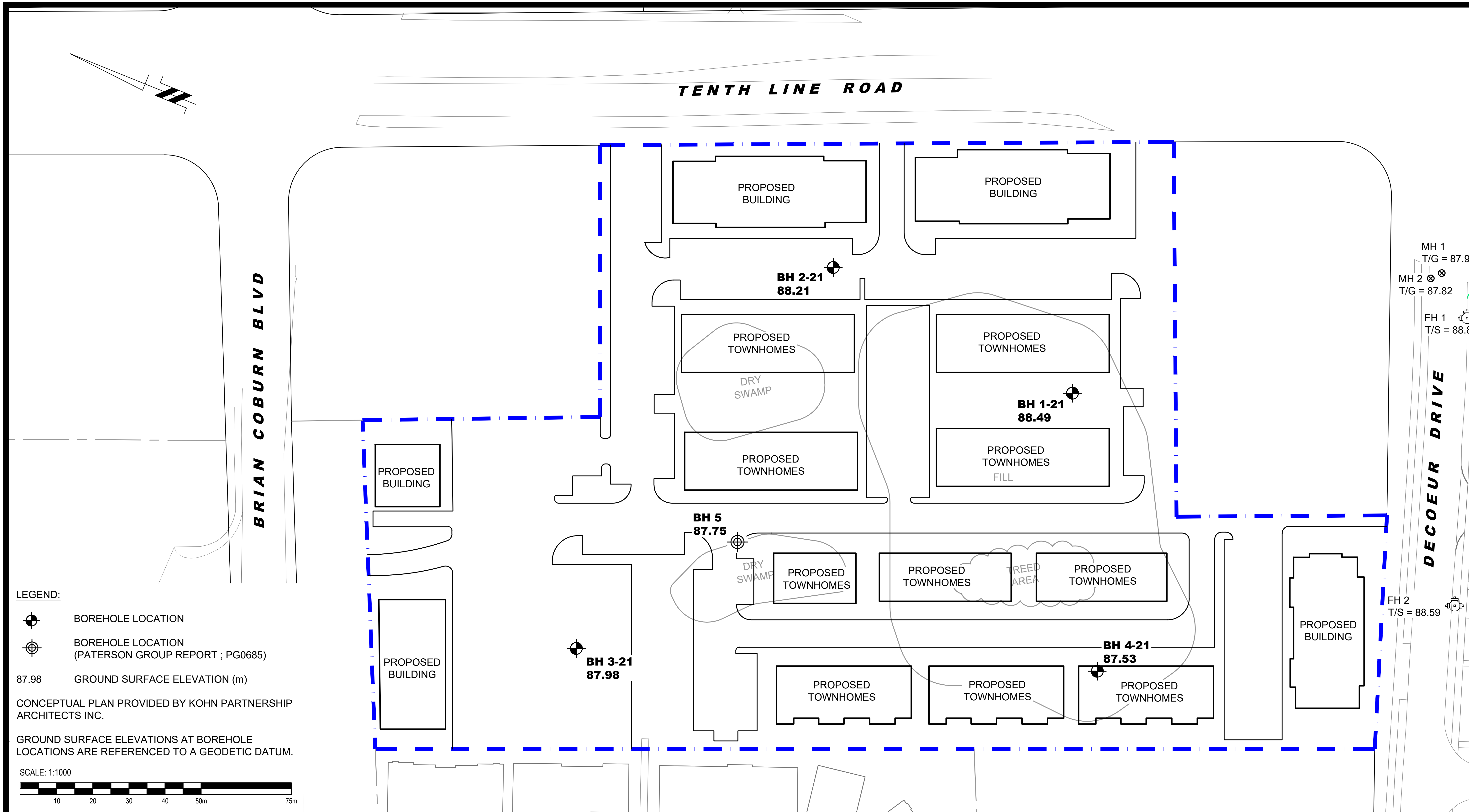


FIGURE 1

KEY PLAN



patersongroup
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154 Colonnade Road South
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NO.	REVISIONS	DATE	INITIAL

MATTAMY HOMES
GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
TENTH LINE ROAD AT DECOEUR DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale:	1:1000	Date:	08/2021
Drawn by:	JM	Report No.:	PE5914-1
Checked by:	FC	Dwg. No.:	PG5914-1
Approved by:	DJG	Revision No.:	

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11x17

Appendix E DRAWINGS