DEVELOPMENT SERVICING SCENARIO - HIGHWAY 102 WEST CORRIDOR

Future Serviced Communities

March 28, 2025

Prepared for:
Halifax Regional Municipality

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1 Introduction

The Halifax Regional Municipality (HRM), through their Regional Municipal Planning Strategy (Regional Plan), have identified four Future Serviced Communities which require a comprehensive neighbourhood planning process that includes a review of existing servicing infrastructure capacity and constraints. The four study areas are as follows.

- Sandy Lake
- Highway 102 Corridor
- Morris Lake
- Westphal (identified as Akoma Lands in the RFP)

This report summarizes the following with respect to the Highway 102 development:

- Design criteria and regulatory considerations,
- Development scenarios,
- Potable water serviceability,
- Existing wastewater collection system, and
- Development grading.

Conceptual servicing plan measures to meet the established design criteria, and upgrades required to regional infrastructure for water and wastewater servicing, are also discussed.

2 Background and Design Criteria

2.1 Regulatory Considerations

2.1.1 HALIFAX WATER (HW)

HW's *Design Specifications and Supplementary Standard Specifications for Water, Wastewater & Stormwater Systems*, 2023 Edition (DS & SSS) outline the following objectives relating to the design of new servicing systems. This report is to be read in conjunction with the Highway 102 Water Servicing Plan report.

2.1.1.1 Water Distribution System Design

The watermain system shall:

- Be designed to accommodate the greater of Maximum Day Demand plus fire flow demand, or Peak Hour Demand.
- Average Day Demand corresponds to 375 L/person/day.
- Fire flows to meet the higher of HW's requirements or that calculated as prescribed in Water Supply for Public Fire Protection by the Insurance Advisory Organization. Estimated fire flow requirements per DS & SSS Table 3.3 are as follows:

Land Use	Fire Flow (litres/minute)	Duration (hours)	Number of Fire Hydrants
Single unit dwellings	3,300	1.5	1
Two family dwellings	3,300	1.5	1
Townhouse	4,542	1.75	1
Multi-unit high rise	13,620	3	3
Commercial	13,620	3	3
Industrial	13,620	3	3
Institutional	13,620	3	3

- Peaking factors are as per DS & SSS Table 3.1:

Land Use	Minimum Hour	Maximum Day	Peak Hour
Low Density Residential	0.70	1.65	2.50
High Density Residential	0.84	1.30	2.50
Industrial	0.84	1.10	0.90
Commercial	0.84	1.10	1.20
Institutional	0.84	1.10	0.90

- Minimum size for local distribution mains is 200mm, minimum size for Feeder Main is 300mm.

Additional requirements for watermains are noted in the accompanying Stantec report *Halifax Regional Municipality Future Serviced Communities – Highway 102 Water Servicing Plan* (**Appendix A**).

2.1.1.2 Wastewater System – Design Requirements

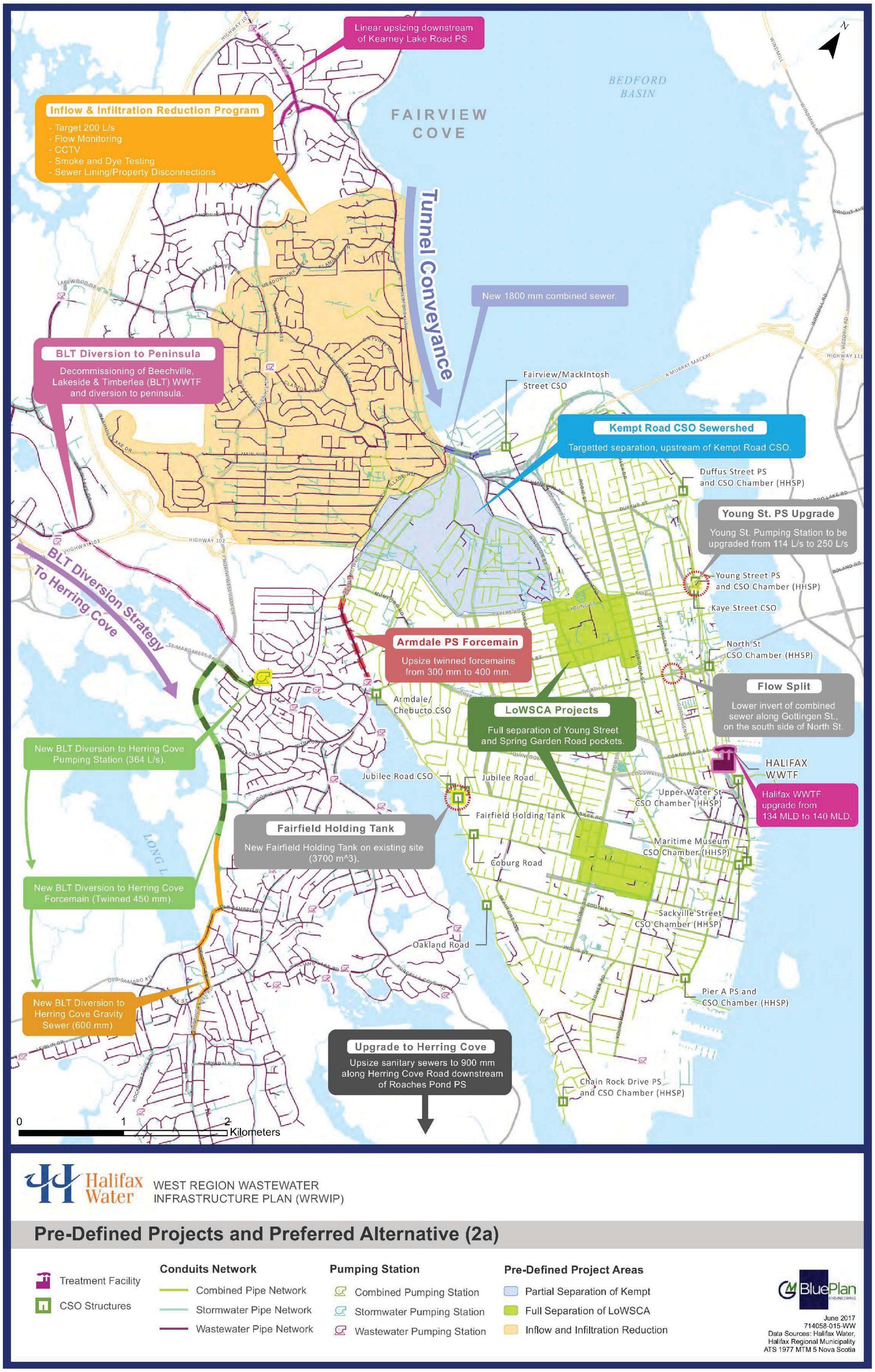
- Average Dry Weather flow corresponds to 300 L/person/day (noted as 375 L/person/day in proposed design sheets to account for 25% safety factor in peak design flows per HW design specifications).
- Peak Dry Weather flow to be determined using peaking factor per the Harmon Formula (minimum of 2.0).
- Infiltration / inflow allowance of 24 m^3/ha/day to be used.
- Pipe minimum and maximum velocities of 0.75m/s and 4.5 m/s respectively, and up to 6.0 m/s with additional energy dissipation and ventilation measures.
- Mannings Roughness coefficients applied per DS & SSS Table 4.1:

PIPE MATERIAL	MANNING ROUGHNESS
Concrete	0.013
PVC	0.010
Polypropylene	0.012
HDPE (Smooth Interior Wall)	0.012

- Minimum wastewater main size of 250mm, and minimum grade of 0.6%.
- Minimum cover is 1.6m, and maximum cover is 5.0m with deeper trunk sewers on exception basis and where a local sanitary sewer for service connections is provided.
- Pump stations classified as Small (firm capacity to 75 L/s), Medium (firm capacity between 75 L/s and 220 L/s), and Large (firm capacity > 220 L/s).

2.2 Infrastructure Master Plan – West Region Wastewater Infrastructure Plan Final Report Volume 3

As noted in Section 6 of the Wastewater Infrastructure Plan, growth in this region triggers a constraint within the linear system between Highway 102 and the Bedford Highway downstream of the Kearney Lake Road PS. The existing sewers are predicted to surcharge resulting in flooding under the 5 year design storm.


Linear upsizing downstream of Kearney Lake Road PS.
Inflow & Infiltration Reduction Program
- Target 200 L/s
- Flow Monitoring
- CCTV
- Smoke and Dye Testing
- Sewer Lining/Property Disconnections
FAIRVIEW COVE
BEDFORD BASIN
Tunnel Conveyance
New 1800 mm combined sewer.
BLT Diversion to Peninsula
Decommissioning of Beechville, Lakeside & Timberlea (BLT) WWTF and diversion to peninsula.
Fairview/MackIntosh Street CSO
Kempt Road CSO Sewershed
Targetted separation, upstream of Kempt Road CSO.
Duffus Street PS and CSO Chamber (HHSP)
Young St. PS Upgrade
Young St. Pumping Station to be upgraded from 114 L/s to 250 L/s
Young Street PS and CSO Chamber (HHSP)
Kaye Street CSO
BLT Diversion Strategy To Herring Cove
Armdale PS Forcemain
Upsize twinned forcemains from 300 mm to 400 mm.
North St CSO Chamber (HHSP)
Flow Split
Lower invert of combined sewer along Gottingen St., on the south side of North St.
Armdale/ Chebucto CSO
LoWSCA Projects
Full separation of Young Street and Spring Garden Road pockets.
New BLT Diversion to Herring Cove Pumping Station (364 L/s).
HALIFAX WWTF
Halifax WWTF upgrade from 134 MLD to 140 MLD.
Jubilee Road CSO
Jubilee Road
Upper Water St CSO Chamber (HHSP)
Fairfield Holding Tank
Fairfield Holding Tank
New Fairfield Holding Tank on existing site (3700 m^3).
Maritime Museum CSO Chamber (HHSP)
Coburg Road
New BLT Diversion to Herring Cove Forcemain (Twinned 450 mm)
Sackville Street CSO Chamber (HHSP)
Oakland Road
New BLT Diversion to Herring Cove Gravity Sewer (600 mm)
Pier A PS and CSO Chamber (HHSP)
Upgrade to Herring Cove
Upsize sanitary sewers to 900 mm along Herring Cove Road downstream of Roaches Pond PS
Chain Rock Drive PS and CSO Chamber (HHSP)
0 1 2 Kilometers
Halifax Water
WEST REGION WASTEWATER INFRASTRUCTURE PLAN (WRWIP)
Pre-Defined Projects and Preferred Alternative (2a)
Treatment Facility
CSO Structures
Conduits Network
Combined Pipe Network
Stormwater Pipe Network
Wastewater Pipe Network
Pumping Station
Combined Pumping Station
Stormwater Pumping Station
Wastewater Pumping Station
Pre-Defined Project Areas
Partial Separation of Kempt
Full Separation of LoWSCA
Inflow and Infiltration Reduction
BluePlan
June 2017
714058-015-WW
Data Sources: Halifax Water, Halifax Regional Municipality
ATS 1977 MTM 5 Nova Scotia

The Wastewater Infrastructure Plan (GM Blue Plan, 2020) identified infrastructure needs to maintain the level-of-service goals for Halifax's existing residents and interests, as well as to maintain these as identified growth occurs. The implications of the FSC growth areas on the Wastewater Infrastructure Plan (WIP) recommendations are thus of interest as these growth areas are in addition to those considered in the 2020 WIP. For the Western Region, Strategy 2a: Maximize Existing Capacity and Herring Cove WWTF (minimize expansion at Halifax WWTF) is identified as the recommended servicing strategy.

The 2020 WIP identified that sanitary sewer upsizing would be required in the Kearney Lake Road area downstream of the Kearney Lake Pumping Station (KLPS, also referred to as PS#2). The required upsizing is identified as needing sewers between 525 and 675mm in diameter. Further, a Memorandum of Understanding between Annapolis Group Inc., Westridge Development Limited, Gateway Material LTD., and the Sisters of Charity, and Halifax Regional Water Commission (HW) was signed on July 17, 2012 to upsize the portion of Kearney Lake Road Sewer (KLRS) between Point 2.80E and 2.80F as identified in Attachment B/Plan No. 2 of the CBCL Report to accommodate flows from HWY 102. Additional upsizing may be required along the Wedgewood Ravine section to accommodate the Hwy 102 buildout.

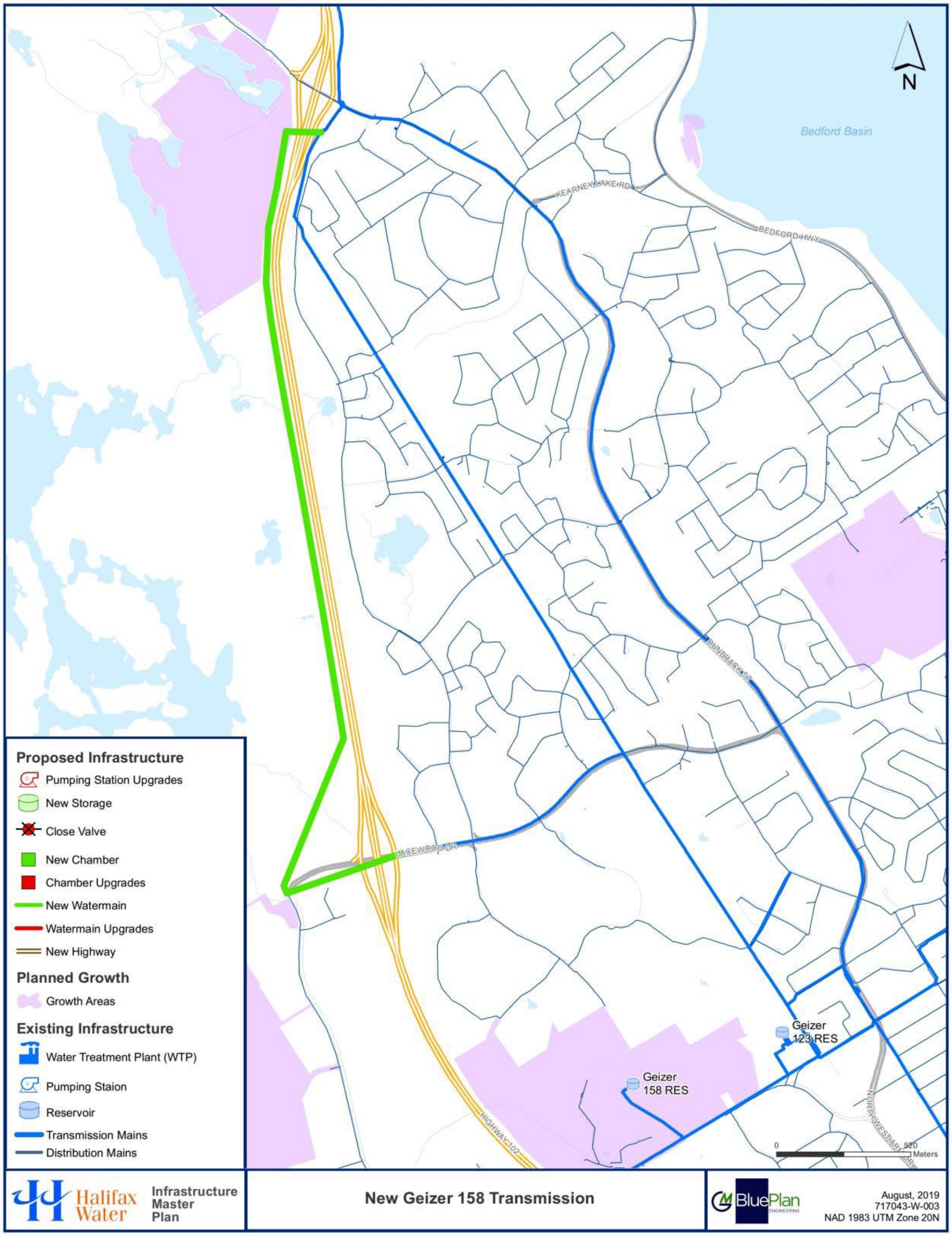
The 2020 WIP does not mention if there is residual capacity at the KLPS for either existing, or for the growth scenarios considered. A 6MLD expansion at the Halifax WWTF is identified.

2.3 Infrastructure Master Plan – Water Infrastructure Servicing Plan Final Report Volume 2

The following items from the IMP volume 2 were noted for use in the preliminary water distribution design:

- Overview of existing water system network
- Existing Pockwock and Lake Major Distribution Systems Schematic
- Proposed projects to enhance system resiliency. *The IMP proposed improvements for a new Geizer 158 Transmission to provide increased conveyance to the Geizer Reservoirs, a second feed to Lakeside High pressure zone, and resiliency to the Geizer supported pressure zones.*

Section 6.2.1.7 of the Water Infrastructure Servicing Plan notes that twinning of the Geizer 158 transmission main has been previously considered to include looping of the Lacewood Drive main at the southern extent of the Highway 102 expansion area. The intent of the twinning was to provide a second feed to the Lakeside High service area and resiliency to Geizer supported pressure zones. The Servicing Plan had considered an alignment planned along the west side of Highway 102 through future development lands to create a system loop as described in the figure below, and to be accommodated within servicing for the Highway 102 expansion area.


N
Bedford Basin
KEARNEY LAKE RD
BEDFORD HWY
DUNBRACK ST
LACEWOOD DR
HIGHWAY 102
NORTHWEST ARM DR
Geizer
123 RES
Geizer
158 RES
0
520
Meters
Proposed Infrastructure
Pumping Station Upgrades
New Storage
Close Valve
New Chamber
Chamber Upgrades
New Watermain
Watermain Upgrades
New Highway
Planned Growth
Growth Areas
Existing Infrastructure
Water Treatment Plant (WTP)
Pumping Staion
Reservoir
Transmission Mains
Distribution Mains
Halifax Water
Infrastructure Master Plan
New Geizer 158 Transmission
BluePlan
ENGINEERING
August, 2019
717043-W-003
NAD 1983 UTM Zone 20N

2.4 Other Regional Considerations

2.4.1 MODELING

It was noted that water modeling was carried out using an isolated steady-state model for each of the four proposed development sites. Stantec's water servicing report (provided in Appendix A) recommended that the modeling for the proposed developments should be based on using a full system model so that the effect of the proposed developments on the level of service on the remaining water system can be assessed. Similarly, the report noted that modeling of the development sites only would not identify potential restrictions in the system that may impact the development sites. It was noted that this approach was outside of the scope of the services for the study as the system fall under the Halifax Water Regional Authority. **Considering the scale of the proposed developments and potential impacts on existing water systems and off-site infrastructure upgrades, the recommended full system modeling should be carried out as part of the upcoming update of the Integrated Resource Plan (IRP).**

2.4.2 WASTEWATER

Developer servicing strategies including those including in Regional Planning Greenfield Sites report, CBCL, 2009 were explored that saw flows being conveyed via tunnel across Highway 102 towards Sherwood Heights and connecting to existing trunk sewer at Wedgewood Ravine. Although technically feasible this alternative would potentially result in additional pumping stations and significant linear upgrades through the existing collection system up to the Kearney Lake Road. Therefore, a single gravity servicing solution discharging to existing KLPS is preferred.

The KLPS residual capacity was discussed during the HRM Future Service Communities – Halifax Water / Stantec Coordination Meeting held on September 12, 2023. During this meeting it was noted that there is existing residual capacity at the KLPS, and that this available capacity may indeed increase in the future once a planned flow diversion upstream removes flow from those captured by the KLPS. Currently KLPS (PS#2) receives flows from temporary PS#1, and pumps to the highpoint on Kearney Lake Road near Castle Hill Drive. As build-out continues in the collection area for PS#1 (West Bedford and Sandy Lake), the PS#1 will be replaced with the Ultimate PS#1. The future ultimate PS#1 will be pumped via the larger forcemains (some of which are already in place) directly to the high point near Castle Hill. When PS#1 will be disconnected from the KLPS (PS#2), residual capacity will be available for HWY 102, but upgrade to KLPS (PS#2) and associated forcemains may still be required to accommodate full HWY102 development for High Density and Developer scenario. Based on the review of the design flows, PS#2 was designed to accommodate 120L/s from PS#1, which would become available when Ultimate PS#1 and associated forcemains are completed (*Bedford West WW Pumping Stations and Forcemains/ Gravity Sewer/WM Preliminary Design, AECOM March 27, 2013*)

It is to be noted that the previous studies made no allowance for the Hwy 102 lands in the design of the West Bedford pump stations or the forcemains.

Further study to evaluate the alternative options for wastewater servicing for HWY102 is recommended to confirm feasibility of the KLPS to accommodate additional flow from the HWY 102 growth area, and review of other alternatives to wastewater servicing, including construction of new PS and connection to Wedgewood Ravine. The study should also review capacity of Kearney Lake Trunk Sewer, and WWTP capacity. This study should align with the needs for the Sandy Lake growth interest as well as any flow diversion strategies that may have been previously developed.

2.4.3 RESERVOIR REQUIREMENTS

The 2009 CBCL Greenfield Study, which was completed for HRM, noted the requirement for a 5.3ML water storage reservoir within the Highway 102 development area. High ground in the area is just to the west of the study area at the north end of the Hwy 102 lands. This area was identified as the proposed location of the reservoir in the 2009 Greenfield Study (refer to Figure below). It is to be noted the CBCL study considered Highway 102 West Corridor area significantly larger that that contemplated in current study 503 ha vs 254Ha although the population projections for the ultimate development in CBCL report were similar to those considered in the high-density scenario of the current study, 23,000 vs 21,326. **The sizing was based on the assumed development densities at that time. The reservoir sizing requirements will need to be recalculated based on current growth and build-out projections and on the ultimate service boundaries for the local area and reflected in Regional Infrastructure Master Plan Update.**

2.4.4 CAPITAL COST CONTRIBUTIONS (CCC)

Critical infrastructure that provides a regional benefit would form part of a Capital Cost Contribution Policy (CCC) for the area. Infrastructure that may be eligible for cost-sharing include reservoirs, control chambers, booster stations and watermains that are 400mm and greater in diameter. The cost of the applicable portions of reservoir storage, PRVs and main oversizing would form components of a water CCC for the development area.

As noted previously, the study did not analyze the development as part of a full system hydraulic model. As a result, the scope of any required regional infrastructure to support this development is not yet known and any estimates for CCCs based on this study may be incomplete. **It is recommended that the Capital Cost Contribution be updated following completion of the Master Servicing Plan for the Sandy Lake Area, and the Regional Infrastructure Plan update.**

3 Development Scenarios

Stantec has attempted to prepare a conceptual development plan considering local and major connecting roadways, residential development areas, commercial development areas, greenspace, and parks. This concept was heavily influenced by previously prepared development plans by major landowners for the area – the B.D. Stevens Group 'The Lakes' concept and Annapolis Group 'Upland' concepts.

Developer-considered unit density for residential development areas has been superseded for the overall concept in order to develop three density scenarios (identified as Low, Medium, and High) for each development area as described in the *Development Scenario – Highway 102 West Corridor (Stantec, 2024)* report. Recognizing that each development area has unique features and environmental constraints, the following methodology was applied in order to develop residential unit density for each development scenario:

1. Determining the properties comprising each area defined in the HRM Request for Proposals from current Nova Scotia Property Online records.
2. Summing the area of properties recorded in Nova Scotia Property Online records.
3. Subtracting already developed or assigned lands (i.e., lands that have buildings or a designated use such as parkland or road rights-of-way) to determine land available for development.
4. Compiling all development proposed for each study area based on plans or other input from landowners indicating an interest in development to determine the "developer-requested scenario" for each study area.
5. Calculating potential development for remaining lands based on patterns determined from **Step 4** (i.e., assuming remainder lands would be developed with similar density and unit mix as proposed by developers).
6. Determining areas that are wetland and/or 30-metre watercourse buffers (i.e., environmentally constrained) within each area and converting to a percentage for each study area.
7. Excluding the percentage of environmentally constrained land (i.e., wetlands and watercourse buffers) from lands available for development (i.e., subtracting the percentage of land that is environmentally constrained determined for each study area in **Step 6** from land available for development calculated through **Step 3**).
8. Applying an overall population density or similar parameter to create two alternative development scenarios for each study area.
9. Calculating a distribution of residential units by type for each study area based on the distribution of dwelling unit types (i.e., singles, townhouses, apartments) in developer-requested proposals for the specific study area.
10. Calculating commercial space (i.e., gross leasable area or GLA) using the square foot area per person of commercial space provided by developers in submitted plans applied to the total estimated population for each study area and rounded up to the nearest 5,000 square.

Estimates of environmental constraints are based on desktop investigations and measurement in GIS and estimates. The more important consideration is that developer intentions are accurately reflected in developer-requested scenarios, that those intentions are reasonably reflected in alternative scenarios, and both estimation and analysis are consistent across the study areas and their component developments.

Highway 102 – High (Developer-requested)

	Land Area (ac.)		Dwelling Units				Estimated Population		Commercial GLA (sq. ft.)	
Developer	**Total**	**Developable**	**Unit Type**	**Unit Numbers**	**Density**	**Share by Type**	**Residents**	**Density**	**Per Resident**	**Total Area**
B. D. Stevens Group	340	256.7	Multi-unit	8,737	34.0	100.0%	15,727	61.3	15.2	240,000
Annapolis Group	289	218.2	Singles	794		29.3%	2,064			
			Townhouses	108		4.0%	281			
			Multi-unit	1,808		66.7%	3,254			
			All types	**2,710**	**12.4**	**100.0%**	**5,600**	**25.7**	**0.0**	**0**
STUDY AREA	**629**	**474.9**	**All development**	**11,447**	**24.1**		**21,326**	**44.9**	**11.2**	**240,000**

Highway 102 - Low-density

	Land Area (ac.)		Dwelling Units				Estimated Population		Commercial GLA (sq. ft.)	
Developer	**Total**	**Developable**	**Unit Type**	**Unit Numbers**	**Density**	**Share by Type**	**Residents**	**Density**	**Per Resident**	**Total Area**
B. D. Stevens Group	340	256.7	Singles	1,380		29.3%	3,588			
			All types	**1,380**	**5.4**	**100.0%**	**3,588**	**14.0**	**11.2**	**45,000**
Annapolis Group	289	218.2	Singles	1,173		29.3%	3,050			
			All types	**1,173**	**5.4**	**100.0%**	**3,050**	**14.0**	**11.2**	**35,000**
STUDY AREA	**629**	**474.9**	**All development**	**2,553**	**5.4**		**6,638**	**14.0**	**11.2**	**75,000**

Highway 102 - Mid-density

	Land Area (ac.)		Dwelling Units				Estimated Population		Commercial GLA (sq. ft.)	
Developer	**Total**	**Developable**	**Unit Type**	**Unit Numbers**	**Density**	**Share by Type**	**Residents**	**Density**	**Per Resident**	**Total Area**
B. D. Stevens Group	340	256.7	Singles	947		29.3%	2,461			
			Townhouses	129		4.0%	335			
			Multi-unit	2,156		66.7%	3,880			
			All Types	**3,231**	**12.6**	**100.0%**	**6,676**	**26.0**	**11.2**	**75,000**
Annapolis Group	289	218.2	Singles	805		29.3%	2,092			
			Townhouses	109		4.0%	285			
			Multi-unit	1,832		66.7%	3,298			
			All types	**2,746**	**12.6**	**100.0%**	**5,675**	**26.0**	**11.2**	**65,000**
STUDY AREA	**629**	**474.9**	**All development**	**5,977**	**12.6**		**12,351**	**26.0**	**11.2**	**140,000**

Estimated populations have been distributed amongst the development concept area to facilitate local infrastructure sizing and to define capacity constraints for off-site works.

It is to be noted that the density used for water modeling in the low-density scenario, is higher that that presented in the Final Land Suitability report, however, given that the recommendations were already proposing the use of PRVs on laterals in those areas. Reducing the population (and hence demand) may lead to slightly higher pressures but would not change our recommendation of PRVs. Therefore, the updated analysis for the revised low-population scenario model was not deemed necessary at the time of finalizing of this report.

The developer-requested plans used for this analysis showed potential road connections to the lands to the west, outside of the Study Area. In the B. D. Stevens instance, the roads were intended to provide access to the proposed Regional Park or link to the Annapolis Group Lands. In the case of the Annapolis Group, the road connections link to lands designated Urban Reserve in the Regional Plan. No allowance is made in this report for providing servicing extensions, water demands, or sanitary flows for development to the west of the Highway 102 West Corridor Study Area.

4 Potable Water Infrastructure

To assess the ability of servicing the Highway 102 development by existing pressure zones, and to identify infrastructure required to meet the level of service prescribed in HW's DS & SSS, a steady state water network model of the proposed development was built in Innovyze InfoWater Pro 3.5. The water model was used to assess both the high-density and low-density population scenarios presented in **Section 3**. The following sub-sections summarize the water servicing analysis completed for the Highway 102 development, while **Appendix A** contains the full *Halifax Regional Municipality Future Serviced Communities – Highway 102 Water Servicing Plan – Final Report*.

4.1 Connectivity to Municipal Infrastructure

The proposed Highway 102 development is located adjacent to the Geizer 158 High, Pockwock High, Broadholme Intermediate, Kearney Lake Intermediate and Farnhamgate Intermediate pressure zones. These pressure zones are included in the Pockwock Lake system and are serviced by the J. Douglas Kline Water Treatment Facility.

The hydraulic grade lines (HGL) of the adjacent pressure zones are summarized in the following table and illustrated in **Figure 4-1**.

Table 4-1: Adjacent Pressure Zones Hydraulic Grade Lines

Pressure Zone	HGL (ft)	HGL (m)
Geizer 158 High	518	158
Pockwock High	545 - 558	166 - 170
Broadholme Intermediate	340 - 345	104 - 105
Kearney Lake Intermediate	335 - 355	102 - 108
Farnhamgate Intermediate	410 - 420	125 - 128

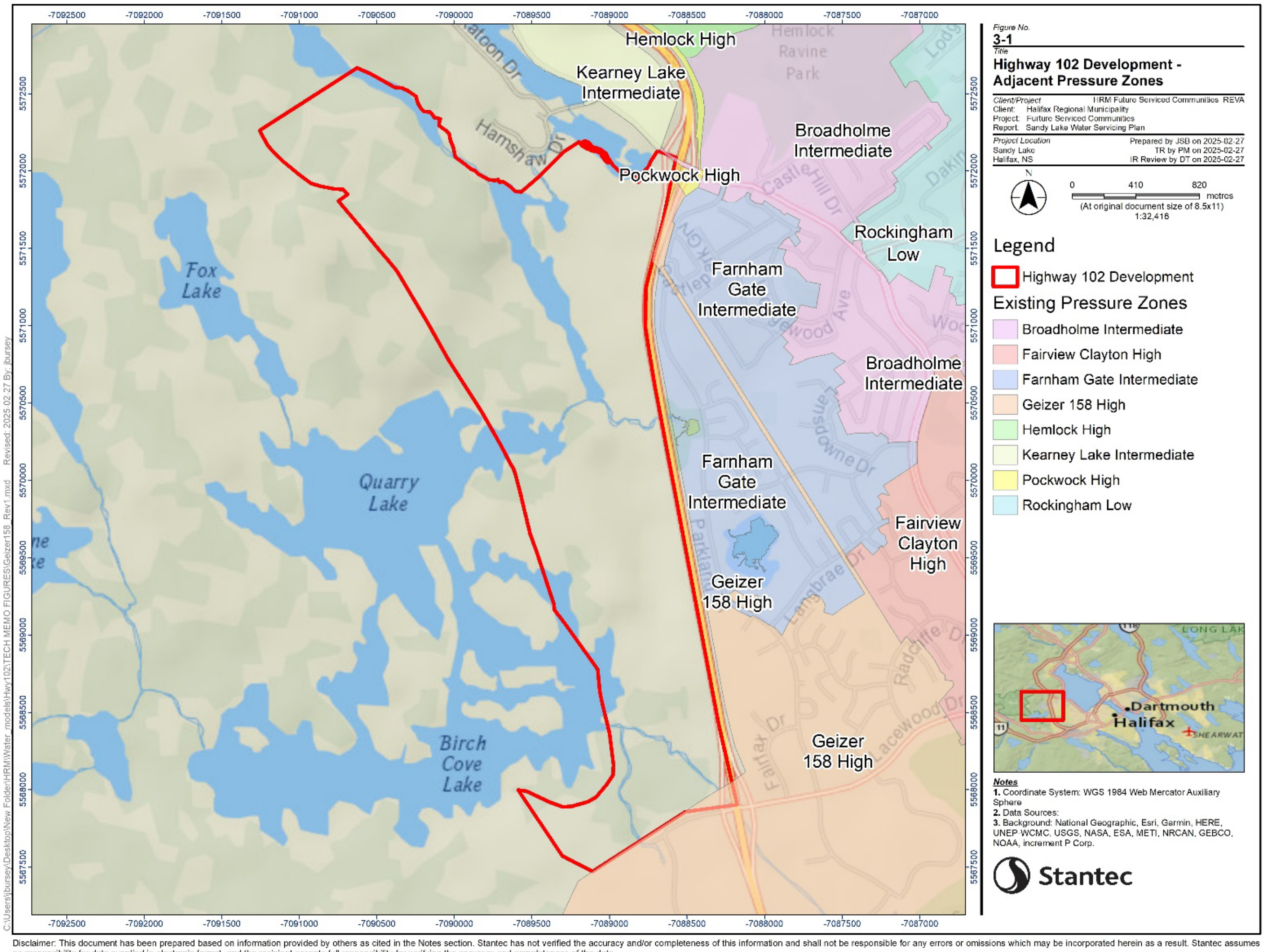


Figure 4-1: Existing Pressure Zones

An existing 750mm watermain is present within Kearney Lake Road to the northeast of the development area, a 400mm watermain stub exists at the intersection of Parkland Drive and Heathside Court to the east, and an existing 400mm watermain is additionally located south of the development area within Chain Link Drive at the extension of Lacewood Drive.

Comparing the serviceable elevation ranges to the development elevation ranges indicate that the proposed re-delineation of the Farnhamgate Intermediate and Broadholme Intermediate pressure zones can accommodate some of the development from a pressure perspective. The highest elevations (approx. 110 - 112 m) lie in the northwest portion of the development. Volume 2 of the IMP proposed improvements for a new Geizer 158 Transmission. Assuming that the Geizer 158 transmission main will be at the same HGL as the Geizer 158 pressure zone, and a distribution main can be connected to it to service the upper portion of the Highway 102 development the proposed pressure zone re-delineations are illustrated in **Figure 4-2**.

It is noted that the highest elevations in the northwest portion of the development can also be serviced by connecting to the Pockwock High pressure zone. However, for this assessment it was assumed the higher elevations will be serviced by connecting to the Geizer 158 pressure zone via the proposed Geizer 158 transmission main. Servicing the northwest area via the Pockwock High pressure zone should be examined during subsequent design stages.

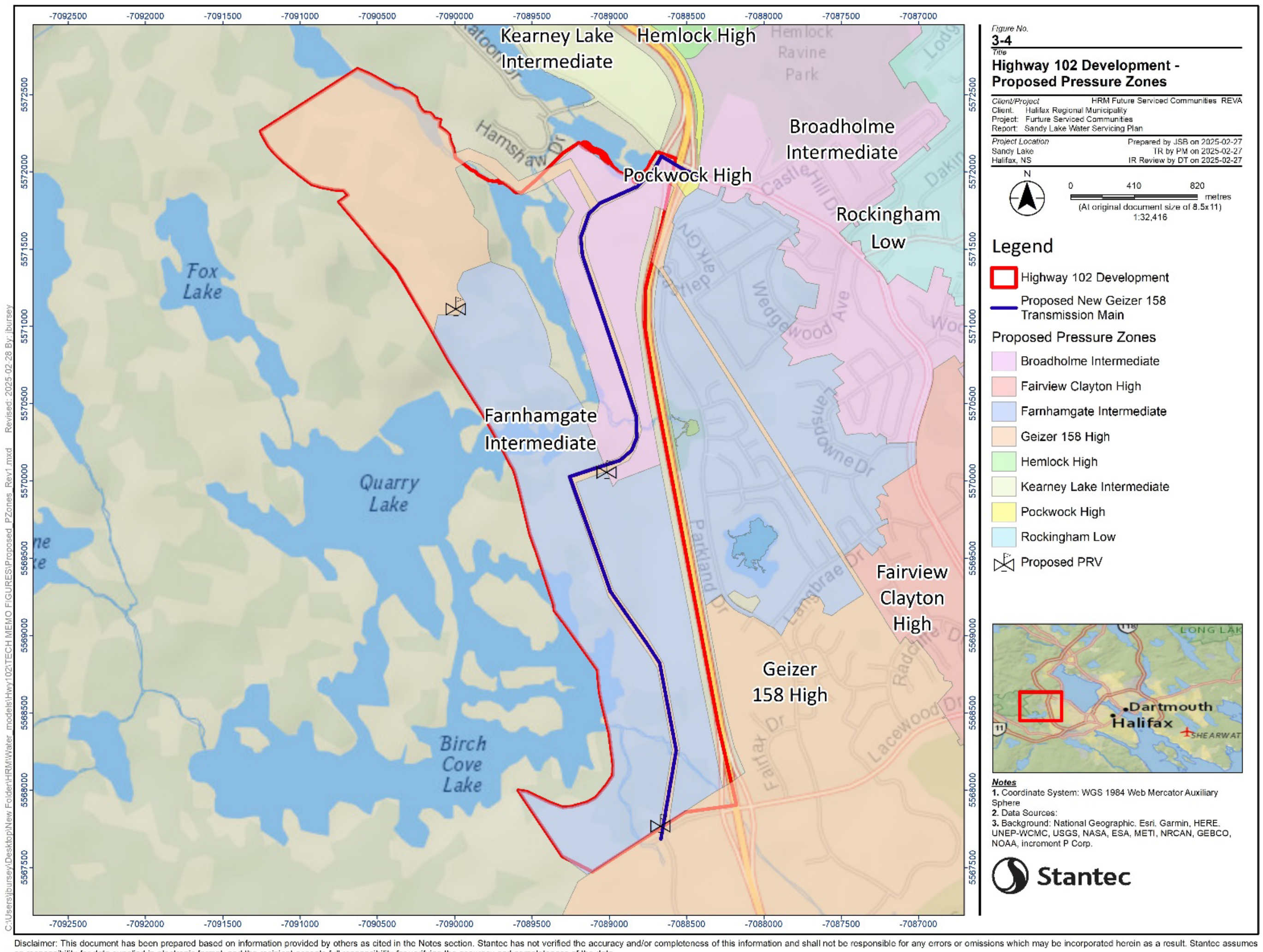


Figure 4-2: Proposed Pressure Zone Re-Delineation

4.2 Water Model

A steady state water network model of the proposed development was built in Innovyze InfoWater Pro 3.5 to assess distribution system requirements within the development to accommodate the MHD, MDD, PHD and MDD+ fire flow (FF) demands for the high-density and low-density scenarios. Reservoirs with fixed head equal to the pressure zones' HGL were used to simulate the connections to the existing Farnhamgate Intermediate, Broadholme Intermediate and Geizer 158 High pressure zones. It is noted that modelling the existing system in this manner does not reflect the actual system, as it assumes the connecting points are always at a constant HGL regardless of demand scenario and that there is an unlimited supply of water from the zone. However, in the absence of a full system model it is a reasonable assumption.

Currently, the three pressure zone extension areas are modeled as being serviced by single feeds. However, it is anticipated that during detailed design/construction, the watermains within the new serviced area will be connected and isolation valves and/or pressure reducing valves (PRV) used to maintain the pressure boundaries (potential locations for these valves are illustrated in **Figure 4-2**). Such design allows for redundancy; in the event of a watermain break the pressure zone boundary valve(s) can be opened and act as a secondary feed until repairs to the watermain can be made. Isolation valves, used to separate the pressure zones, are mimicked in the model by “closing” pipes.

A new 500 mm diameter watermain connected to the existing 400 mm diameter watermain in the intersection of Parkland Drive and Heathside Crescent is proposed for the Farnhamgate zone connection. A new 400 mm watermain will connect to the existing 400 mm watermain along Kearney Lake Road near the intersection with Highway 102 for the Broadholme Intermediate zone connection. While a new 300 mm diameter watermain was assumed to connect to the proposed new Geizer 158 transmission main (assumed to be installed through the Highway 102 development) and Geizer 158 High pressure zone.

The resultant pressures in consideration of the PHD for the high-density scenario are presented in **Figure 4-3**, and available fire flows under MDD and the high-density scenario are shown in **Figure 4-4**. Pressures under the PHD scenario range from approximately 50 psi to 79 psi, with the exception of the low elevation along the proposed street servicing the northwest development area (approx. 101 psi) and in immediate proximity to the connection to the new Geizer 158 transmission main (129 psi). The available fire flow range is approximately 4,100 Lpm to 24,600 Lpm and meets or exceeds total MDD + FF demands.

Additional modeled scenarios are available for review within the *Halifax Regional Municipality Future Serviced Communities – Highway 102 Water Servicing Plan* report presented in **Appendix A**.

4.3 Water Servicing Conclusions and Recommendations

4.3.1 CONCLUSIONS

A water system model was developed using InfoWater Pro to estimate the development distribution system requirements to achieve the level of service set out in Halifax Water’s Design Specification. The model development assumes that the connection to each existing pressure zone is a constant HGL with unlimited flow (i.e. the connections are modelled as fixed head reservoirs). This assumption does not reflect the actual system, however, in the absence of a full system model it is a reasonable assumption.

The water model results indicate the following for both the high-density and low-density population scenarios:

Flow Scenario	Pressure Range (psi)	Max Velocity (m/s)	Available Fire Flow (Lpm)
MDD High Density	51 – 82*	< 1.5	N/A
PHD High Density	50 – 79*	< 1.5	N/A
MHD High Density	51 – 84*	< 1.5	N/A
MDD + FF High Density	> 22	< 2.4	4,100 – 24,600**
MDD Low Density	51 – 84*	< 1.5	N/A
PHD Low Density	51 – 82*	< 1.5	N/A
MHD Low Density	51 – 85*	< 1.5	N/A
MDD + FF Low Density	> 22	< 2.4	4,500 – 26,300**

* With the exception of the low-lying elevations along the proposed street servicing the northwest and the connection to the new Geizer 158 transmission main. However, there are no planned serviced lots in these areas.

** Based on the assumptions of a constant HGL at the connections to the existing pressure zones. Therefore, the values for available fire flow should be considered with a low level of confidence.

Pressure reducing valves installed on the water service lines (in accordance with Halifax Water's Supplementary Standard Specifications) should be considered in those locations identified with pressure above the range identified in the Design Specification.

4.3.2 RECOMMENDATIONS

The presented subdivision plan is preliminary and subject to change, therefore the MHD, MDD, PHD and required FF demands presented in this report may change resulting in changes to proposed water distribution preliminary design. It is recommended that the level of service and distribution system requirements be reassessed during subsequent design stages. Also, during the next stages of design the sizing and placement of regional water infrastructure should be considered.

In the absence of a full system model, the effect of the proposed development on the level of service of the remaining system could not be assessed. Also, the effect of potential restrictions within the existing system on the proposed development could not be assessed. In Halifax Water's 2019 IMP, it was recommended that an all-pipe hydraulic model be developed. An all-pipe model can be used to assess fire flow objectives at each property or node in the system. It is recommended that the proposed development be incorporated in the all-pipe model to perform a more refined fire flow level of service assessment for the development.

As noted, the northwest portion of the development can also be serviced by connecting to the Pockwock High pressure zone (rather than the Geizer 158 zone). The Pockwock High HGL is higher than the Geizer 158 HGL. Therefore, pressures presented for the various population densities and demand scenarios (**Appendix A**) would be greater when serviced by the Pockwock High zone. It is recommended that servicing the northwest area via the Pockwock High pressure zone be examined during subsequent design stages.

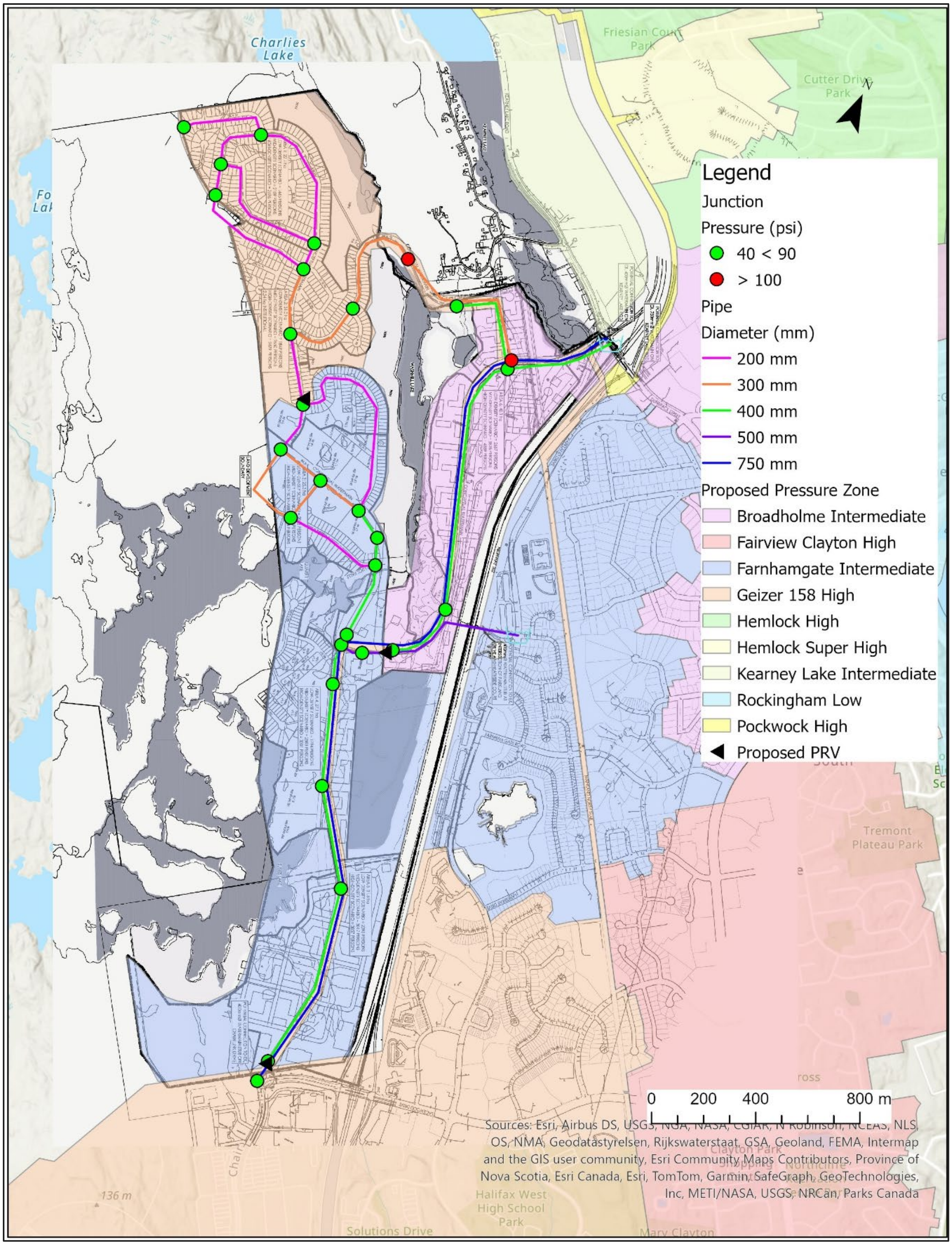


Figure 4-3: Pressure Distribution Under PHD (High-Density Scenario)

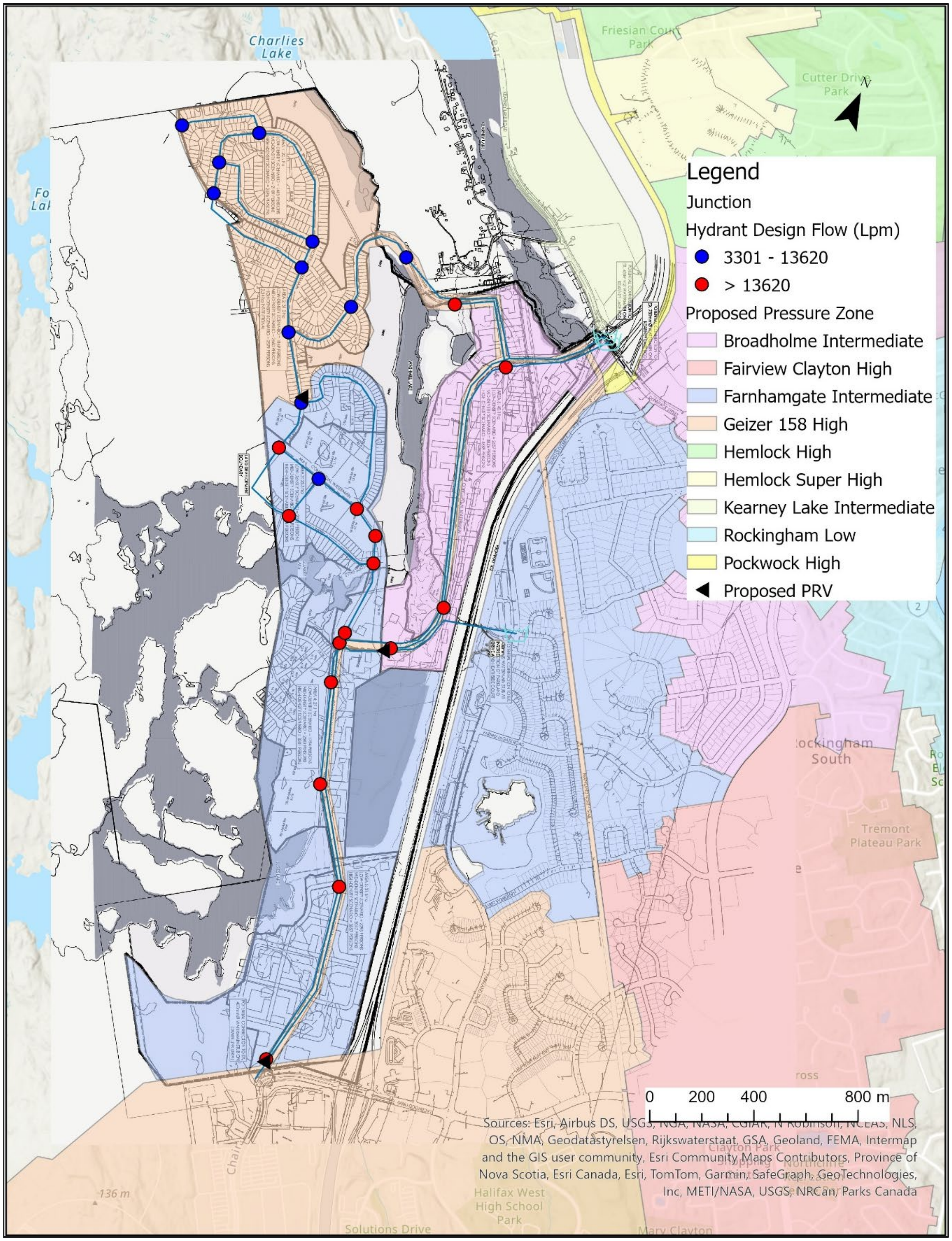


Figure 4-4: Available Fire Flow @ 22 psi under MDD (High-Density Scenario)

5 Wastewater Infrastructure

As indicated in the Infrastructure Master Plan, it is assumed that the development area will ultimately contribute sanitary flows to linear infrastructure within Dunbrack Street to the east and to Duffus Street PS. Existing sanitary sewers within the Farnham Gate area to the east of Highway 102 are sized to meet only local sanitary contributing flows, with some areas subject to high infiltration inflows per results of the Infrastructure Master Plan study. Additionally, a sufficiently deep gravity sewer connection does not currently exist to divert flows across Highway 102 to permit connection to gravity mains downstream of the Kearney Lake dual forcemains.

In review of preliminary grading for the development area, it was identified that sufficient grade exists to permit a gravity connection for the entirety of the Highway 102 contributing area directly to the KLPS, also referred to as PS#2 to the northwest, assuming upsizing of approximately 690m of sanitary sewer along Kearney Lake Road from immediately west of Highway 102 to the existing pump station. Flows ultimately remain directed south-east towards the Halifax Wastewater Treatment Facility (WWTF).

A network of gravity sanitary sewers has been conceptualized for the development area as indicated on **Drawing SA-1**. Sizing of the gravity sewers has been completed as per Halifax Water design requirements noted in sections above, and based on population estimates for the development area. Design sheets for the gravity sewer segments are included in **Appendix B** and are based on the highest (worst-case) population density scenario.

An estimated peak sanitary discharge from the HWY 102 development area for the three density scenarios, with results included in **Appendix B** and summarized in the table below:

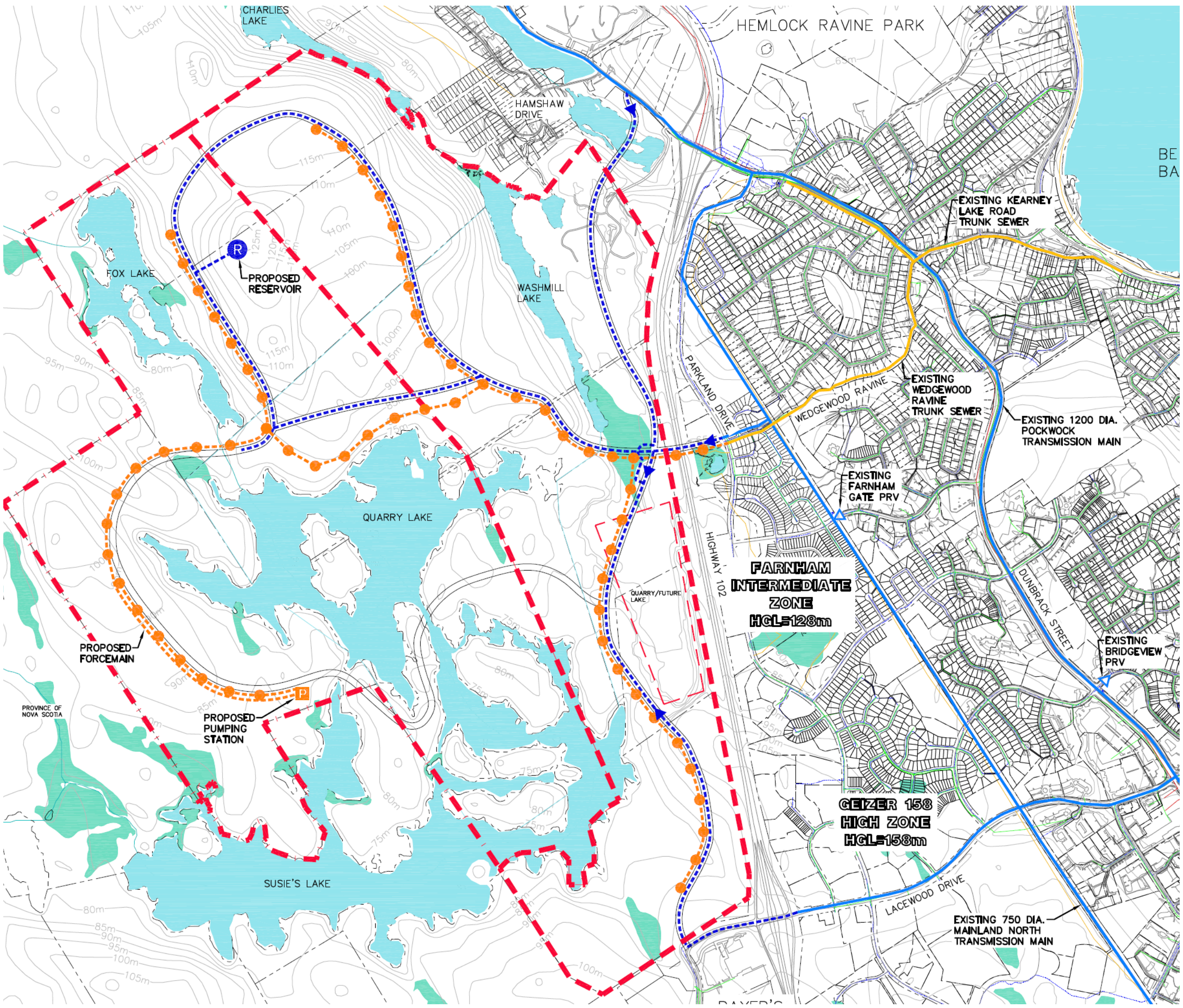
Table 5-1: Estimated Peak Sanitary Discharge

Development Scenario	Population	ICI Contributing Area (ha)	Total Catchment Area (ha)	Peak Flow (L/s)
Low	6,638	2.33	177.09	141.3
Medium	12,351	2.33	177.09	204.7
High (Developer-Requested)	21,326	2.33	177.09	294.1

Due to grading constraints in areas adjacent to existing watercourses (particularly on the eastern boundaries of Washmill Lake and Susie's Lake), sanitary sewer depths may exceed the maximum permissible sewer cover of 5.0m. Deep sewer depths occur in developer suggested areas of high density multi-unit blocks, where service connections to the deep main may be effectively minimized. Alternatively, a local sanitary sewer may be proposed at detailed design to run parallel to the deeper sewer segments.

The Highway 102 Corridor lands have been shown to be able to be serviced by a single gravity system draining to the existing KLPS. It should be noted that review of gravity servicing for the Highway 102 Corridor lands was limited to conceptual sewer elevations based on the topographical and existing infrastructure dataset provided. Feasibility of the recommended design should be demonstrated by further study, detailed profiles of required sewers, and construction recommendations.

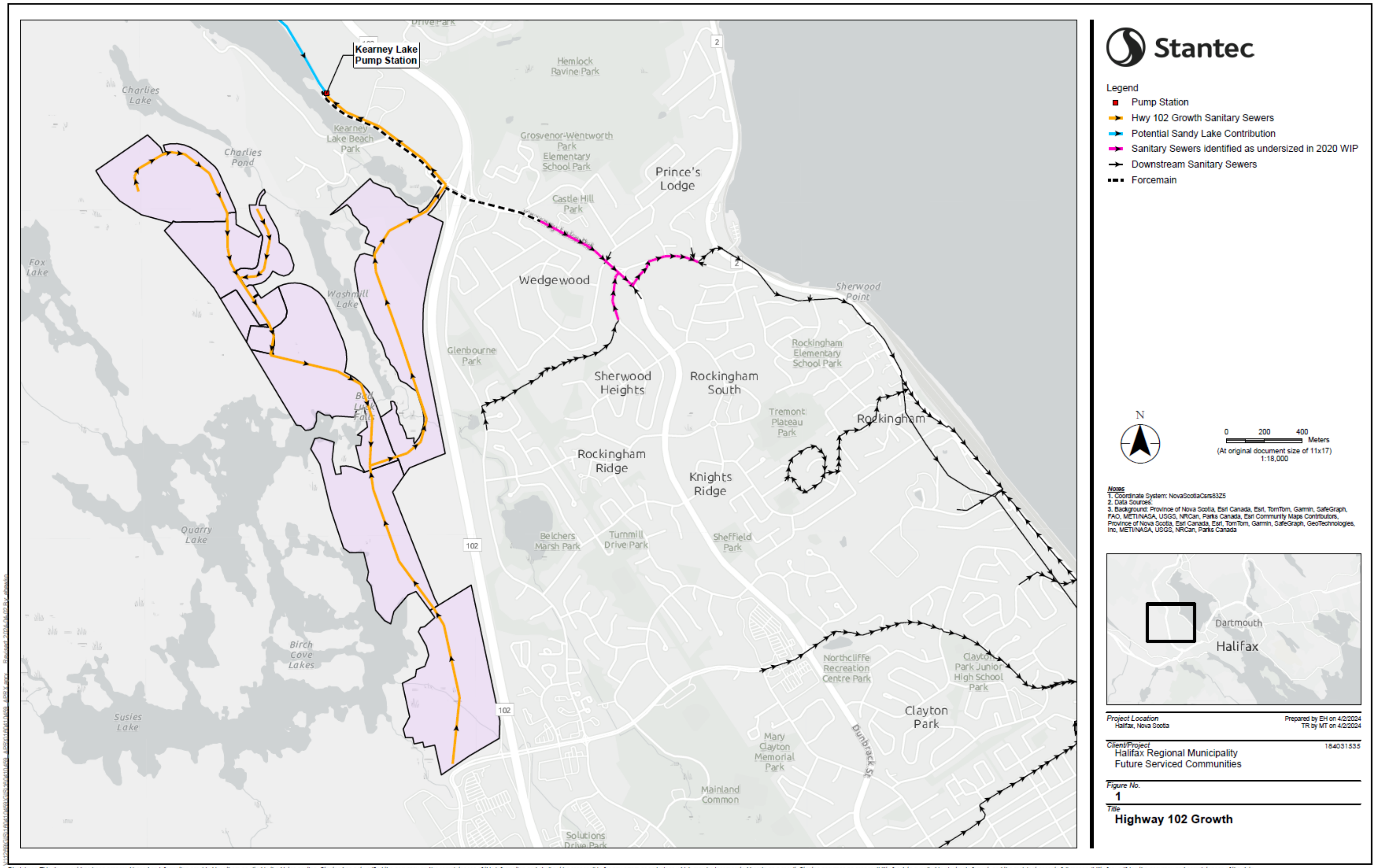
Servicing strategies were explored in prior studies that saw sanitary flows being conveyed across Highway 102 towards Sherwood Heights, in particular that demonstrated by the *Cost of Servicing Plan – Regional Planning Greenfield Sites* report prepared by CBCL Consulting Engineers in February 2009. The CBCL servicing scheme is demonstrated below for reference:



Such arrangements are also technically feasible but would result in additional pumping stations and linear upgrades through the existing collection system along Wedgewood Ravine. The CBCL study also did not identify a sanitary sewer outlet for regions of the Highway 102 development area northeast of Washmill Lake. Although a singular gravity servicing solution is preferred for servicing the entire development area, it is recommended that both approaches be assessed within an updated study for the KLPS and surrounding trunk sewers. The study is to establish if the KLPS can accommodate additional flow from the HWY 102 growth area, including review of Kearney Lake Trunk Sewer, Wedgewood Ravine Trunk Sewer, and WWTP capacity aligning with needs for the Sandy Lake growth interest as well as any flow diversion strategies that may have previously been developed.

It is appreciated that development of the Highway 102 development area may progress in a phased approach and that this may not align with the ultimate solution identified. Should this be considered, a cost benefit evaluation of the impacts is recommended to fully understand the lifecycle costing implications of an interim pumping station that may not be required in the long term.

Development Servicing Scenario - Highway 102 West Corridor
5 Wastewater Infrastructure



6 Grading

The objectives of the grading design strategy are to identify the elevation range requiring potable water servicing, estimate wastewater collection points, satisfy the stormwater management requirements, adhere to permissible grade raise restrictions where possible for the development area, and provide for minimum cover requirements for storm and sanitary sewers. The grading design also follows any recommendations outlined in the Infrastructure Master Plan where possible, and endeavors to provide an overland route to existing watercourses as described in Stantec's *Halifax Regional Municipality Future Serviced Communities – Highway 102 Watershed and Stormwater Management Study – Revised Draft Report* dated February 2025).

Preliminary grading has been set at conceptual road centerline, with a minimum overland flow slope of 0.1% from high point to high point. Grading endeavours to maintain a road longitudinal slope less than 3% in the majority of development areas to facilitate driveway access and limit requirements for retaining walls at future internal property lines. Tie-ins to existing surrounding Rights-of-Way have been respected based on high level topography as obtained by provincially sourced LiDAR.

Development setbacks should be established based on the worst-case scenario between the regulatory 100-year floodplain, the meander belt width of the watercourse, aquatic setback limit of 15 meters from top-of-bank or 30 meters from normal high-water marks whichever is greater; and the slope stability setback.

Based on the above, it is recommended that no active development be permitted within the limits of the 100-year regulatory floodplain. Some reduced-risk uses, such as recreational sports fields and trails, may be considered. This is subject to design considerations that effectively mitigate and/or minimize the impact of such development on the floodplain and protect the riparian corridor functions.

Moreover, any proposed development should adhere to the constraints identified in the constraint mapping presented in the *Highway 102 Corridor Interim Report* (Stantec, 2024). This includes areas of significant wildlife habitat, wetlands, steep slopes, and other environmentally sensitive areas. In areas where development is proposed within or in proximity to the identified floodplain, suitable mitigation measures should be implemented.

Within the Highway 102 development highly sloped areas are noted under existing conditions in proximity to the quarry immediately adjacent to the Highway. It is likely that retaining walls will be required in proximity to the quarry to facilitate development and tie-in to surrounding roadways without heavy deviation from current elevations of Highway 102. Even then, areas of significant cut are noted immediately south of the quarry area due to a substantial hill in existing conditions. Further geotechnical investigations of this area are recommended to ensure sufficiency of soil bearing capacity or other required methods of stabilization during detailed design.

The conceptual Grading Plan for the development area is indicated on **Drawing GP-1** in **Appendix C**.

7 Preliminary Costing

The scope of work for this project involves costing of infrastructure upgrades. Since many servicing projects would be associated with road improvements, the costing can be found in the HWY 102 Area Summary Report and coordinated with the transportation conclusions.

APPENDICES

Appendix A Potable Water Infrastructure

HALIFAX REGIONAL MUNICIPALITY FUTURE SERVICED COMMUNITIES – HIGHWAY 102 WATER SERVICING PLAN

Final Report

February 27, 2025

Prepared for:
Halifax Regional Municipality

Prepared by:
Stantec Consulting Ltd.

Project Number:
160410459

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
0	Draft	JB	2024-05-07	JS	2024-05-10	DT	2024-05-10
1	Rev1	JB	2024-10-31				
2	Final	JB	2024-11-04	JS	2024-11-11	DT	2024-12-13
3	Final Rev1	JB	2025-02-12			DT	2025-02-12
4	Final Rev2	JB	2025-02-27			DT	2025-02-27

The conclusions in the Report titled Halifax Regional Municipality Future Serviced Communities – Highway 102 Water Servicing Plan are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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1 Introduction

The Halifax Regional Municipality (HRM), through their Regional Municipal Planning Strategy (Regional Plan), have identified four Future Serviced Communities which require a comprehensive neighbourhood planning process that includes a review of existing servicing infrastructure capacity and constraints. The four study areas are as follow.

- Sandy Lake
- Highway 102 Corridor
- Eastern Passage (identified as Morris Lake in the RFP)
- Westphal (identified as Akoma Lands in the RFP)

This draft report outlines the results from the review of the potable water servicing within the Highway 102 Development area and summarizes the conceptual water servicing plan required to meet the established level of service and design criteria.

2 Level of Service and Design Criteria

The following resources were used to define the level of service and design criteria for potable water servicing:

- Halifax Water's Design Specifications (June, 2023)
- Halifax Water's Water Infrastructure Servicing Plan Final Report Volume 2 of the Infrastructure Master Plan
- Halifax Water's Regional Pressure Zone Map: West-Central-East (Map Issued April 2023)

2.1 Halifax Water Design Specifications

The Halifax Water Design Specifications was reviewed, and the following items were noted for use in the preliminary water distribution designs:

- Water System extensions must be carried out in conformance with a Water Master Plan.
- Water distribution systems are to be designed to accommodate the greater of Maximum Day Demand plus Fire Flow demand (MDD + FF), or Peak Hour Demand (PHD).
- Design to be supported by a hydraulic analysis to determine flows, pressures and velocities under Maximum Day Demand plus fire flow demand, Peak Hour Demand and Minimum Hour Demand conditions, describing any impacts on the existing system.

However, without access to the regional water model the potential affects of a proposed design to the existing system cannot be assessed.

- The analysis is to begin at a location of known hydraulic grade and include demands on the existing system downstream of the known hydraulic grade line, as well as demands generated by the proposed development. Hydrant flow test(s) are to be conducted to confirm the static hydraulic grade line and determine the system curve and available residual pressure at the boundaries of the analysis.
- Hazen Williams 'C' values to be used for the design of water distribution systems, regardless of pipe material, will be:

Table 2-1: Friction Factors from Halifax Water Design Specifications

Diameter of Water Main (mm)	‘C’ Factor
150	100
200 to 250	110
300 to 600	120
Larger than 600	130

- Estimated fire flow requirements as shown in the table below:

Table 2-2: Fire Flow Requirements

Land Use	Fire Flow (Lpm)	Duration (hrs)	Number of Fire Hydrants
Single Unit Dwellings	3,300	1.5	1
Two Family Dwellings	3,300	1.5	1
Townhouse	4,542	1.75	1
Multi-unit high rise	13,620	3	3
Commercial	13,620	3	3
Industrial	13,620	3	3
Institutional	13,620	3	3

- Maximum pipe velocity is not to exceed the following:

Table 2-3: Maximum Pipe Velocity

Flow Condition	Max Velocity (m/s)
Peak Hour Demands	1.5
Fire Flow	2.4

- Minimum watermain size:

  - 200 mm for local distribution watermain
  - 300 mm for feeder mains

- Allowable pressure range:
  - ADD and MDD: 50 – 80 psi
  - Minimum Hour (MHD) and PHD: 40 – 90 psi
  - MDD + FF: > 22 psi

- The per capita average day demand (ADD) is 375 L/per/day.

- The peaking factors used to calculate MHD, PHD and MDD must be based on:
  - Historical information
  - Nova Scotia Environment guidelines, or
  - As directed by the Engineer

  Where the proposed development requires a booster station, pressure reducing valve (PRV) or storage, peaking factors shall be determined in consultation with the Engineer.

Table 2-4: Peaking Factors

Land Use	Minimum Hour	Maximum Day	Peak Hour
Low Density Residential	0.70	1.65	2.50
High Density Residential	0.84	1.30	2.50
Industrial	0.84	1.10	0.90
Commercial	0.84	1.10	1.20
Institutional	0.84	1.10	0.90

2.2 Halifax Water IMP Volume 2

The following items from the IMP volume 2 were noted for use in the preliminary water distribution design:

- Overview of existing water system network

- Existing Pockwock and Lake Major Distribution Systems Schematic

- Proposed projects to enhance system resiliency. *The IMP proposed improvements for a new Geizer 158 Transmission to provide increased conveyance to the Geizer Reservoirs, a second feed to Lakeside High pressure zone, and resiliency to the Geizer supported pressure zones.*

2.3 Halifax Water's Regional Pressure Zone Map

Halifax Water provided a copy of the Regional Pressure Zone Map: West-Central-East (Map Issued April 2023). The pressure zone map was used to determine the hydraulic grade line of potential connection points for the proposed development area.

3 Proposed Development

3.1 Site Location

The Highway 102 Development is in the southwest area of Halifax Regional Municipality (HRM), south of the community of Kearney Lake, and west of Highway 102. The proposed development area borders Susies Lake and Quarry Lake to the west and the right-of-way for Highway 102 to the east, totalling approximately 285 hectares of largely undeveloped land.

3.2 Adjacent System Description

The proposed Highway 102 development is located adjacent to the Geizer 158 High, Pockwock High, Broadholme Intermediate, Kearney Lake Intermediate and Farnhamgate Intermediate pressure zones. These pressure zones are included in the Pockwock Lake system and are serviced by the J. Douglas Kline Water Treatment Facility.

The hydraulic grade lines (HGL) of the adjacent pressure zones are summarized in the following table and illustrated in **Figure 3-1**. Note Pockwock High pressure zone is not visible on **Figure 3-1**, however it is located at the confluence of Broadholme Intermediate, Kearney Lake Intermediate and Farnhamgate Intermediate zones.

Table 3-1: Adjacent Pressure Zones Hydraulic Grade Lines

Pressure Zone	HGL (ft)	HGL (m)
Geizer 158 High	518	158
Pockwock High	545 - 558	166 - 170
Broadholme Intermediate	340 - 345	104 - 105
Kearney Lake Intermediate	335 - 355	102 - 108
Farnhamgate Intermediate	410 - 420	125 - 128

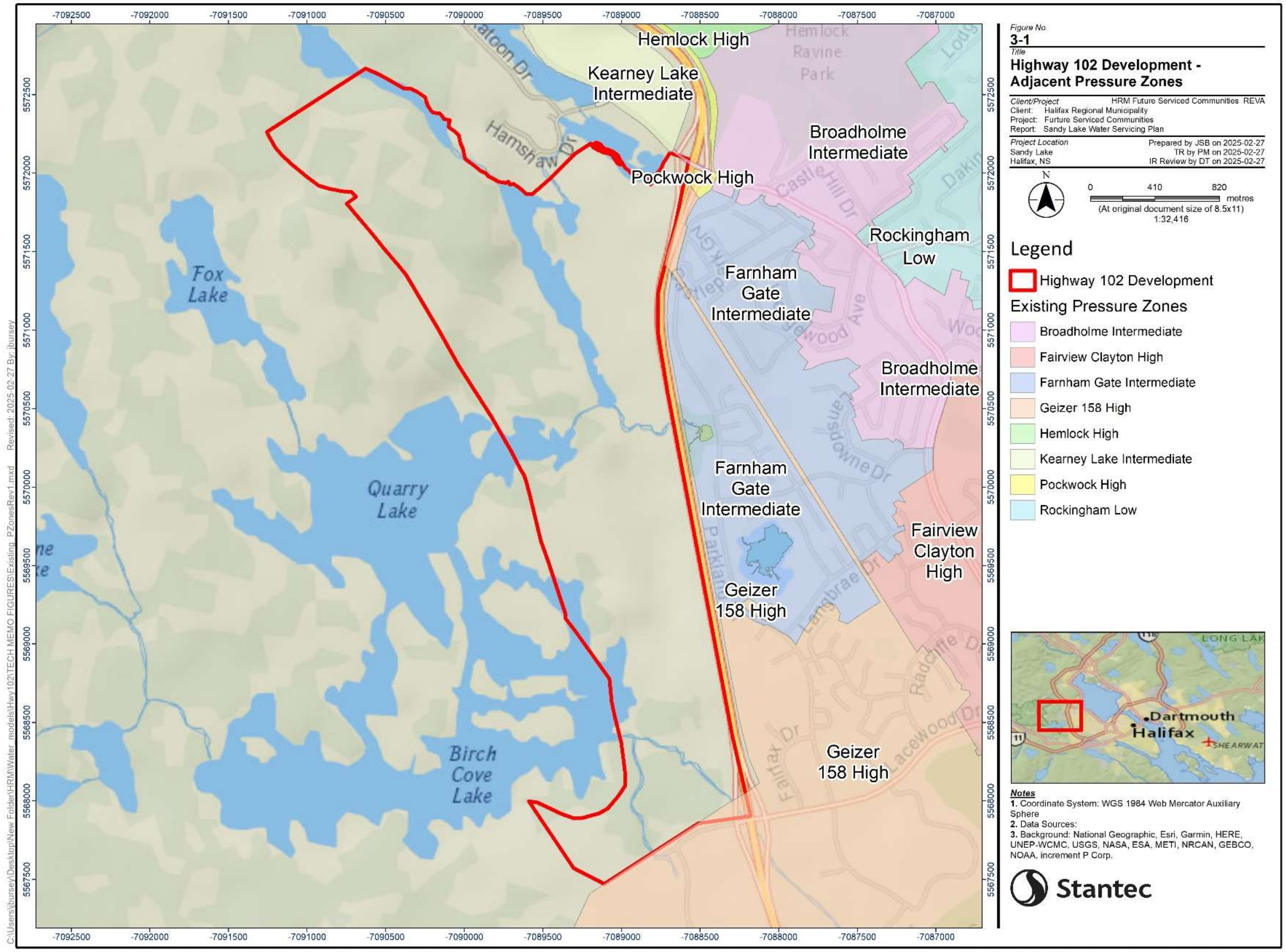

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Figure 3-1: Highway 102 Development - Adjacent Pressure Zones

3.3 Proposed Development

3.3.1 GRADING

The proposed grading plan (street level) for the Highway 102 development ranges from approximately 60 m near the northeast to 112 m near the northwest extents of the development (**Figure 3-2**).

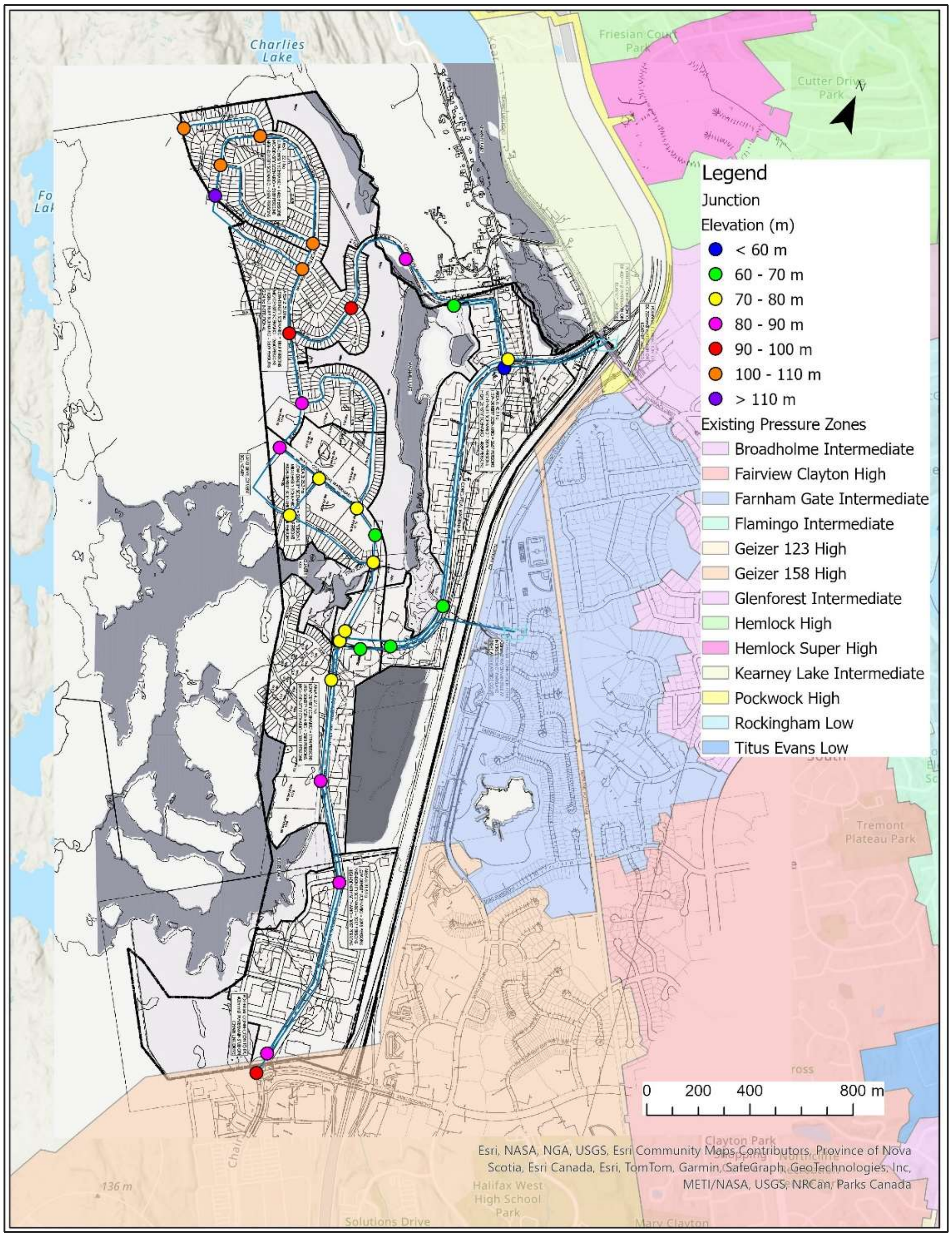


Figure 3-2: Proposed Site Grading

3.3.2 HYDRAULIC GRADE

Halifax Water's water system level of service pressure range is 50 – 80 psi for ADD and MDD, and 40 – 90 psi for PHD and MHD. Given the hydraulic grade line of the adjacent pressure zones, the serviceable range of elevations within those pressure zones are presented in **Table 3-2**. Comparing the serviceable elevation ranges to the development elevation ranges indicate that the proposed re-delineation of the Farnhamgate Intermediate and Broadholme Intermediate pressure zones can accommodate some of the development from a pressure perspective. The highest elevations (approx. 110 - 112 m) lie in the northwest portion of the development. Volume 2 of the IMP proposed improvements for a new Geizer 158 Transmission to provide increased conveyance to the Geizer Reservoirs, a second feed to Lakeside High pressure zone, and resiliency to the Geizer supported pressure zones. The IMP proposed aligning the new transmission main on the west side of Highway 102 through potential future development lands, as illustrated in **Figure 3-3**. When the Geizer 158 Transmission main is constructed, the higher elevations can be serviced by a connection to the transmission main. Therefore, it was assumed that the Geizer 158 transmission main will be at the same HGL as the Geizer 158 pressure zone, and a distribution main can be connected to it to service the upper portion of the Highway 102 development. It was assumed the diameter of the new Geizer 158 transmission main will be 750 mm. The proposed pressure zone re-delineations are illustrated in **Figure 3-4**. The Farnhamgate zone connection is proposed at the intersection of Parkland Drive and Heathside Crescent to the existing 400 mm diameter watermain. While the Broadholme Intermediate zone connection is proposed at the intersection of Kearney Lake Road and Highway 102 to the existing 400 mm diameter watermain. The Geizer 158 pressure zone will extend along the new transmission main, proposed through the development, with a connection to feed the northwestern portion of the development.

It is noted that the highest elevations in the northwest portion of the development can also be serviced by connecting to the Pockwock High pressure zone. However, for this assessment it was assumed the higher elevations will be serviced by connecting to the Geizer 158 pressure zone via the proposed Geizer 158 transmission main. Servicing the northwest area via the Pockwock High pressure zone should be examined during subsequent design stages.

Table 3-2: Serviceable Range per Pressure Zone (From 40 to 90 psi)

Pressure Zone	HGL (m)	Serviceable Elevation (m)*	
		Low	High
Geizer 158 High	158	95	130
Pockwock High	166 - 170	103 - 107	138 - 142
Broadholme Intermediate	104 - 105	41 - 42	76 - 77
Kearney Lake Intermediate	102 - 108	39 - 45	74 - 80
Farnhamgate Intermediate	125 - 128	62 - 65	97 - 100

* Neglecting friction loss

Hydrant flow tests were conducted near the proposed connection points at the north end of Chain Lake Drive near Lacewood Drive Road and Lacewood Drive near Fairfax Drive to confirm the static pressure of the Geizer 158 High zone, and on Heathside Crescent near Parkland Drive to confirm the static pressure of Farnhamgate Intermediate zone. The test results are presented in **Appendix A**. The static pressure reported during the tests are presented in **Table 3-3**. As shown the HGL estimated from Tests #1 and 2 aligns with the existing HGL for Geizer 158 High, and the HGL corresponding to Test #3 is within the range of HGL given for Farnhamgate Intermediate pressure zone.

Table 3-3: Summary of Static Pressures Recorded

Test #	Test Location	Static Pressure (psi)	Approx. Ground Elev. (m)	HGL (m)
1	Chain Lake Drive near Lacewood Drive Road	84	98	157
2	Lacewood Drive near Fairfax Drive	74	104	156
3	Heathside Crescent near Parkland Drive	85	66	125.9

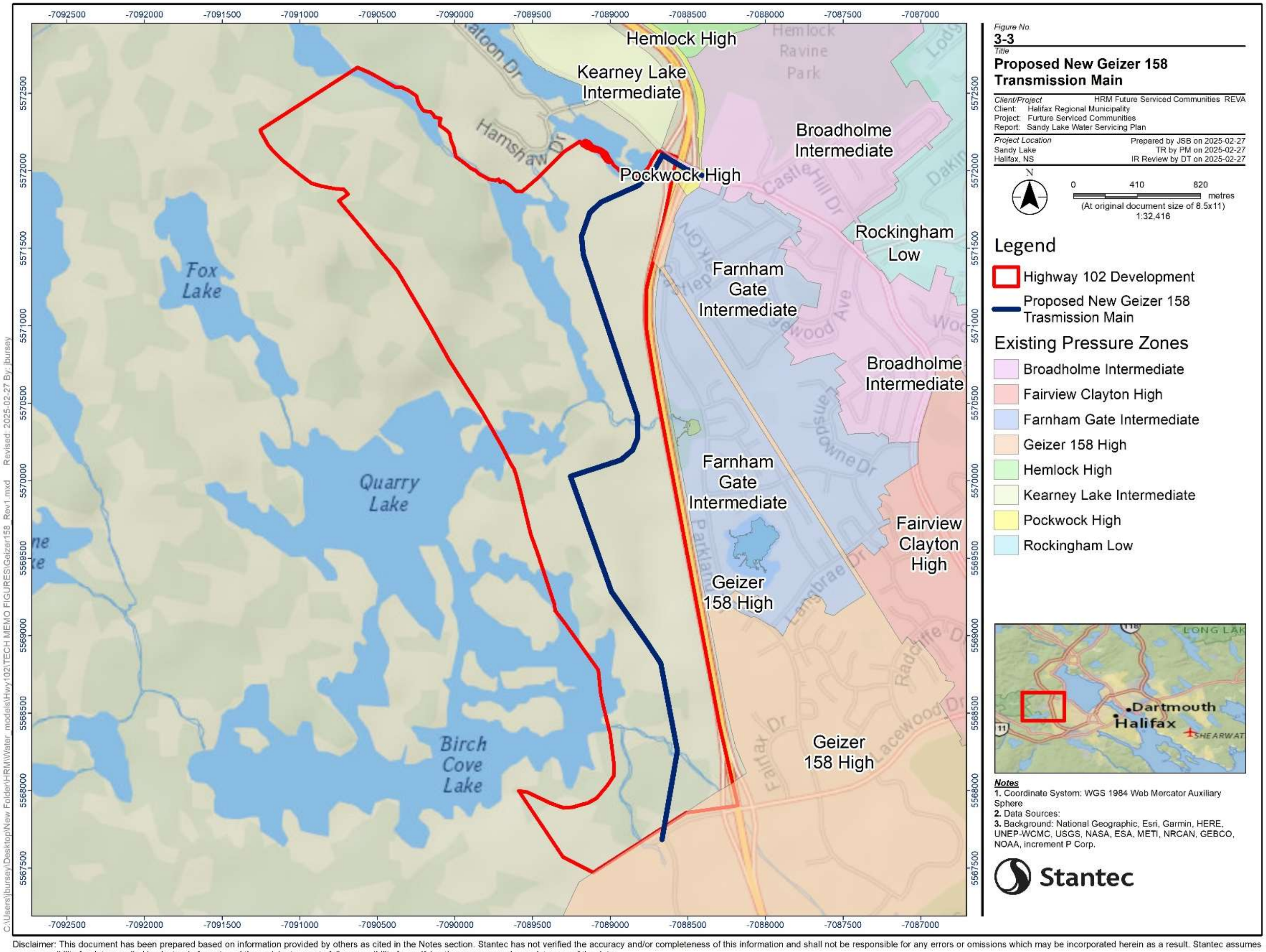


Figure 3-3: Proposed New Geizer 158 Transmission Main

3.3.3 DEMANDS

Various development scenarios were prepared, considering different land uses/building types to estimate potential population. Populations corresponding to high- and low-density scenarios are described in Section 2 of Stantec's *Halifax Regional Municipality Future Serviced Communities Volume 2: Highway 102 Area* and presented in **Table 3-4**. The corresponding demands are presented in **Table 3-5**: Proposed Demands

Scenario	ADD (Lpm)	MHD (Lpm)	MDD (Lpm)	PHD (Lpm)
High Density	5,554	4,665	7,728	13,884
Low Density	3,093	2,598	4,323	7,773

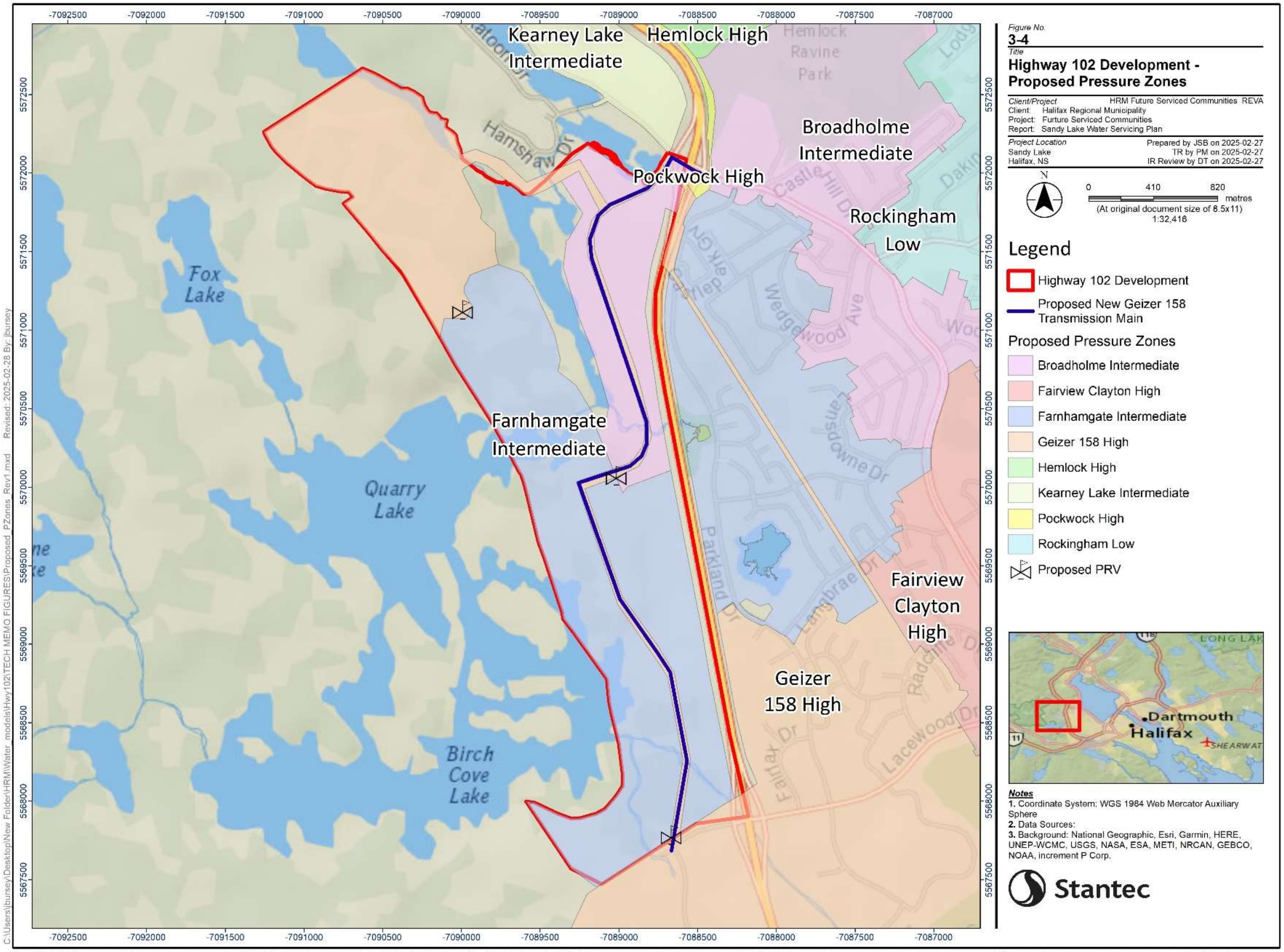


Figure 3-4: Highway 102 Development - Proposed Pressure Zone Re-Delineation

. Peaking factors per Halifax Water's Design Specification (**Section 2.1**) were applied to estimate MHD, MDD and PHD. Blended peaking factors were used for MHD and MDD scenarios. However, a PHD peaking factor of 2.5 is suggested for both low-density residential and high-density residential.

Table 3-4: Population Estimates

Scenario	Population
High Density	21,326
Low Density	11,872

Table 3-5: Proposed Demands

Scenario	ADD (Lpm)	MHD (Lpm)	MDD (Lpm)	PHD (Lpm)
High Density	5,554	4,665	7,728	13,884
Low Density	3,093	2,598	4,323	7,773

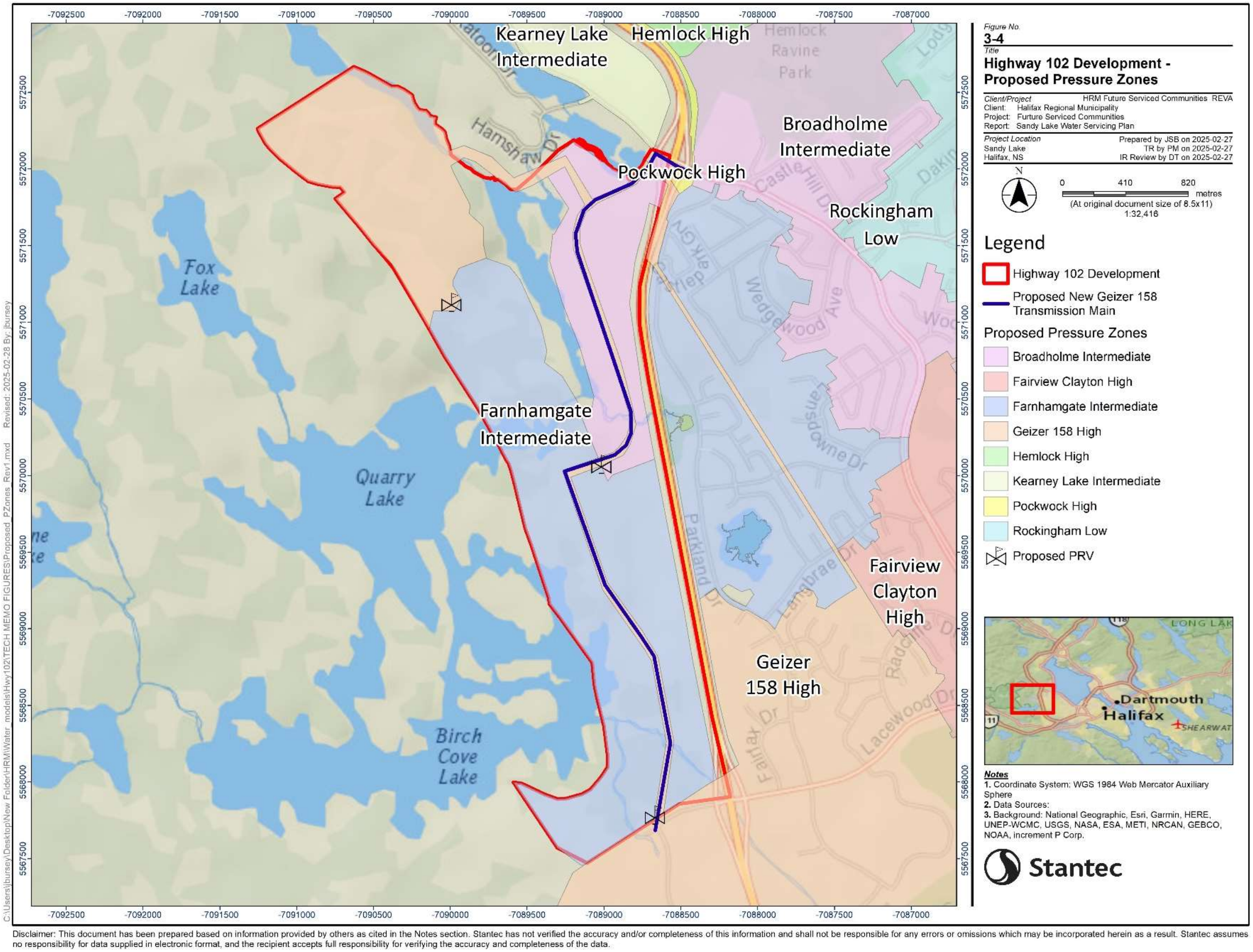


Figure 3-4: Highway 102 Development - Proposed Pressure Zone Re-Delineation

3.3.4 WATER MODEL

A steady state water network model of the proposed development was built in Innovyze InfoWater Pro 3.5 to assess distribution system requirements within the development to accommodate the MHD, MDD, PHD and MDD+FF demands for the high-density and low-density scenarios. Per the criteria outlined in **Section 2.1** water distribution systems are to be designed to accommodate the greater of MDD + FF, or PHD. Reservoirs with fixed head equal to the pressure zones' HGL were used to simulate the connections to the existing Farnhamgate Intermediate, Broadholme Intermediate and Geizer 158 High pressure zones. It is noted that modelling the existing system in this manner does not reflect the actual system, as it assumes the connecting points are always at a constant HGL regardless of demand scenario and that there is an unlimited supply of water from the zone. However, in the absence of a full system model it is a reasonable assumption. The distribution system within the development was edited to achieve the level of service as described in **Section 2.** Currently, the three pressure zone extension areas are modeled as being serviced by single feeds. However, it is anticipated that during detailed design/construction, the watermains within the new serviced area will be connected and isolation valves and/or pressure reducing valves (PRV) used to maintain the pressure boundaries (potential locations for these valves are illustrated in **Figure 3-4**). Such design allows for redundancy; in the event of a watermain break the pressure zone boundary valve(s) can be opened and act as a secondary feed until repairs to the watermain can be made. Isolation valves, used to separate the pressure zones, are mimicked in the model by "closing" pipes.

A new 500 mm diameter watermain connected to the existing 400 mm diameter watermain in the intersection of Parkland Drive and Heathside Crescent is proposed for the Farnhamgate zone connection. A new 400 mm watermain will connect to the existing 400 mm watermain along Kearney Lake Road near the intersection with Highway 102 for the Broadholme Intermediate zone connection. While a new 300 mm diameter watermain was assumed to connect to the proposed new Geizer 158 transmission main and Geizer 158 High pressure zone. The locations of these connections are presented in **Figure 3-5**.

3.3.4.1 High-Density Population Scenario

Figure 3-5 illustrates the distribution of MDD for the high-density scenario throughout the model. The demands were distributed by density of development proposed, and generally (coarsely) placed at the nodes with the highest ground elevation. Placing the demands at the higher elevations is considered conservative from a hydraulics perspective, as the pressure at these nodes will account for headlosses resulting from the total demand and hence will be the lowest in their local areas. **Figure 3-6** presents the anticipated corresponding pressures at each node, which range from 51 psi to 82 psi (which is slightly above the upper range of 80 psi), within the serviced areas of the development. It is noted that the pressure modeled at the low elevation along the proposed street servicing the northwest, is above the range (approx. 105 psi), and the pressure at the connection to the Geizer 158 new transmission main is approximately 129 psi. However, there are no planned serviced lots in these areas. **Figure 3-6** also illustrates the proposed watermain sizes which range from 200 mm to 500 mm diameter, and a 750 mm diameter for the new Geizer 158 transmission main. These pipe sizes represent the backbone watermains for the development and do not include all local pipes.

The distribution of PHD is illustrated in **Figure 3-7**, and the results of the PHD analysis are presented in **Figure 3-8**. Pressures under the PHD scenario range from approximately 50 psi to 79 psi, with the exception of the low elevation along the proposed street servicing the northwest (approx. 101 psi) and the connection to the new Geizer 158 transmission main (129 psi). For this scenario, all pipe velocities are less than 1.5 m/s (in accordance with Halifax Water's Design Specifications).

MHD were also simulated, the distribution of MHDs and the resulting pressures are presented in **Figure 3-9** and **Figure 3-10**, respectively . Pressures under the MHD scenario range from approximately 51 psi to 84 psi, except for the low elevation along the proposed street servicing the northwest (approx. 106 psi) and the connection to the new Geizer 158 transmission main (129 psi).

Pressure reducing valves installed on the water service lines (in accordance with Halifax Water's Supplementary Standard Specifications) should be considered in those locations identified with pressure above the range identified in the Design Specification.

Fire flow analysis in InfoWater Pro returns the flow available at each hydrant while maintaining residual pressure of 22 psi throughout the system and not exceeding pipe velocities of 2.4 m/s. The fire-flows required per Halifax Water's Design Specification vary by land use type as described in **Section 2.1**. The required fire-flows are presented in **Figure 3-11**. The total MDD + FF demand at each node is presented in **Figure 3-12**, and the results of the fire analysis are presented in **Figure 3-13**. The available fire flow range is approximately 4,100 Lpm to 24,600 Lpm and meets, or exceeds, the total MDD + FF demands. However, it is important to note that these results are based on the assumptions of a constant HGL at the connections to the existing pressure zones, and therefore should be considered with caution. Without a full system model, it is unknown if the system can really provide the fire flows presented. Therefore, it is recommended to examine the development's effect on the entire system by using a full (calibrated) system model (including any upstream improvements/upgrades required within the existing system due to the addition of these lands, such as, the proposed new 158 Geizer transmission main). However, such model development is beyond the scope of this study. Hence the pressures and available fire flows presented in the report should be considered preliminary.

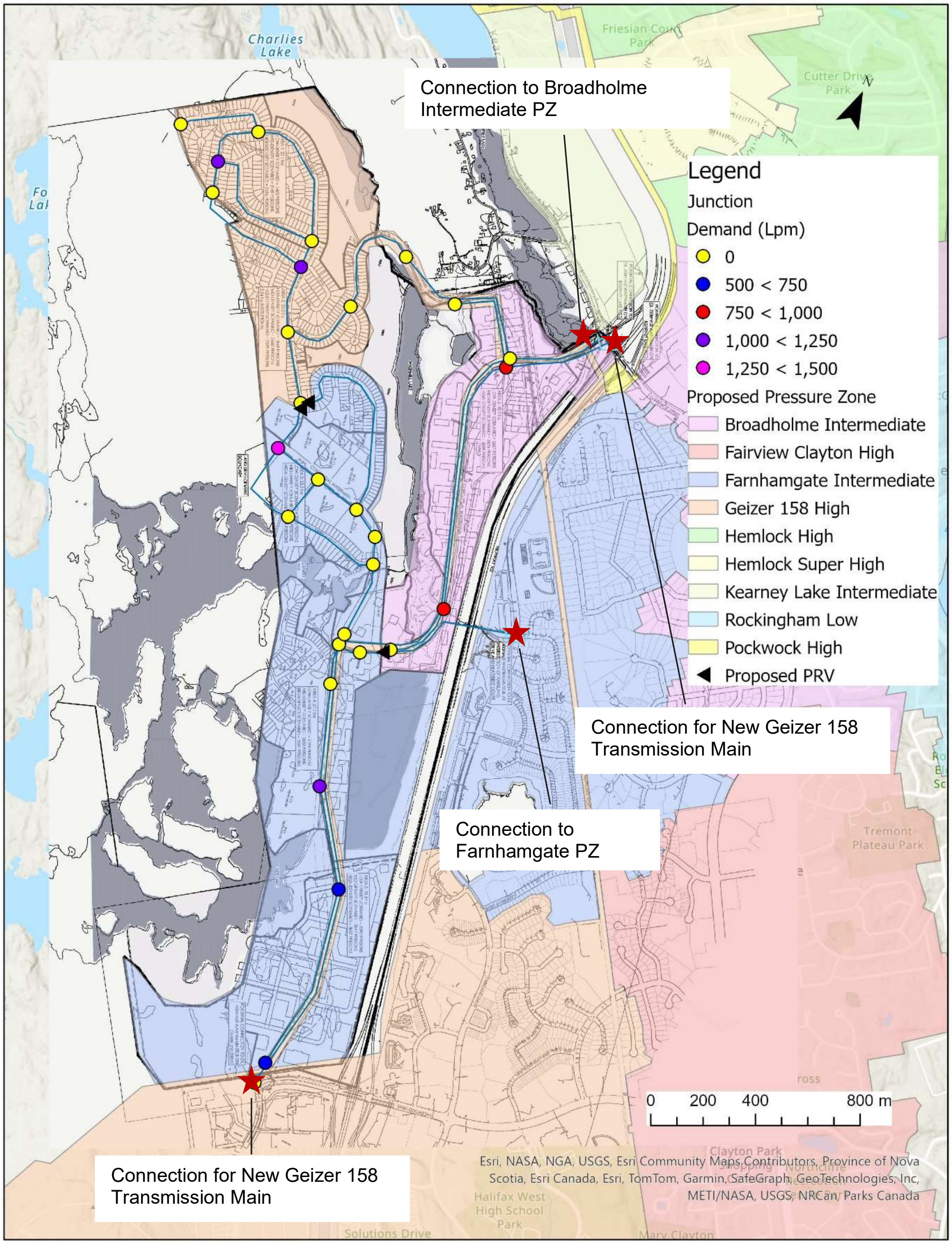


Figure 3-5: MDD Distribution (High-Density Scenario)

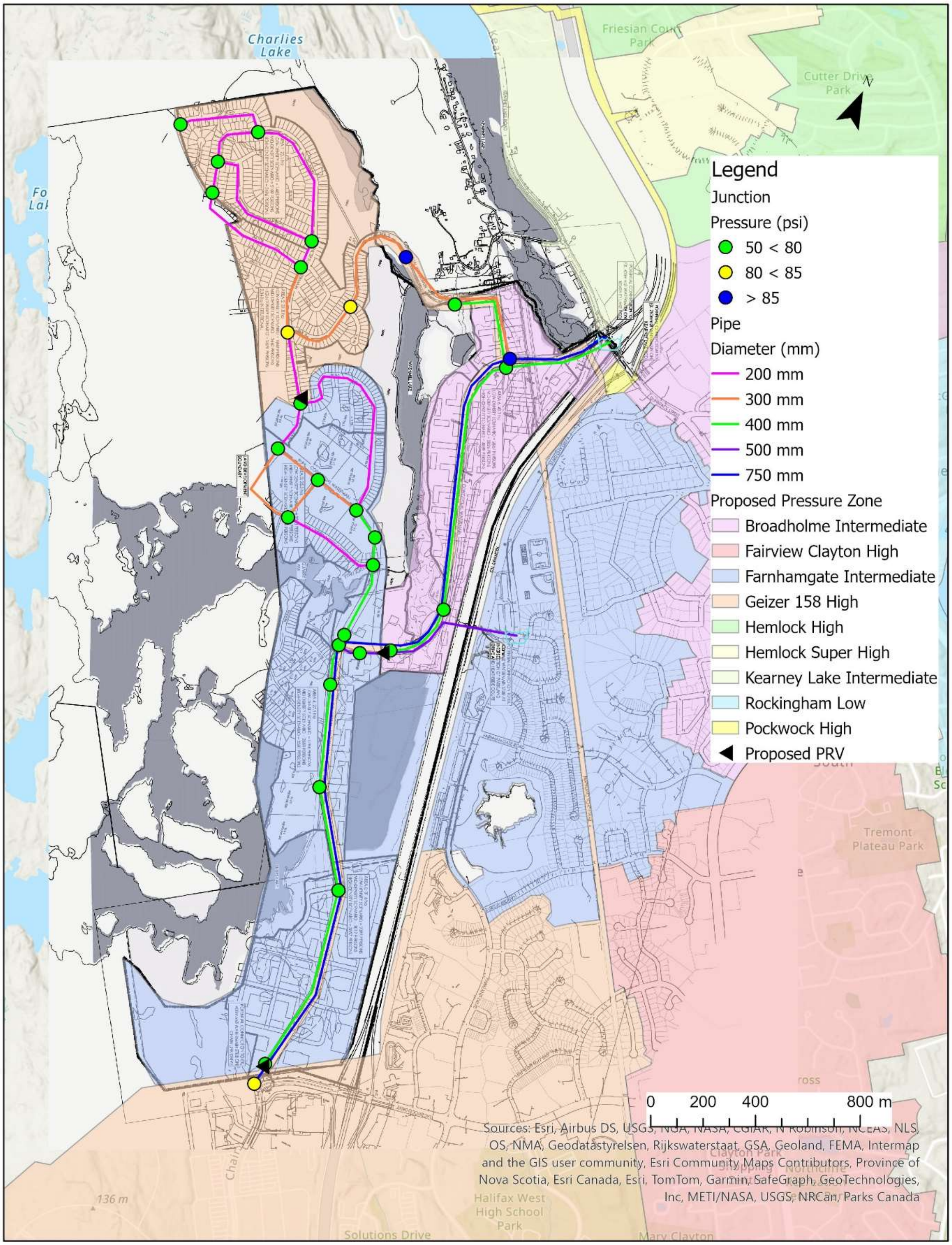


Figure 3-6: Pressure Distribution Under MDD (High-Density Scenario)

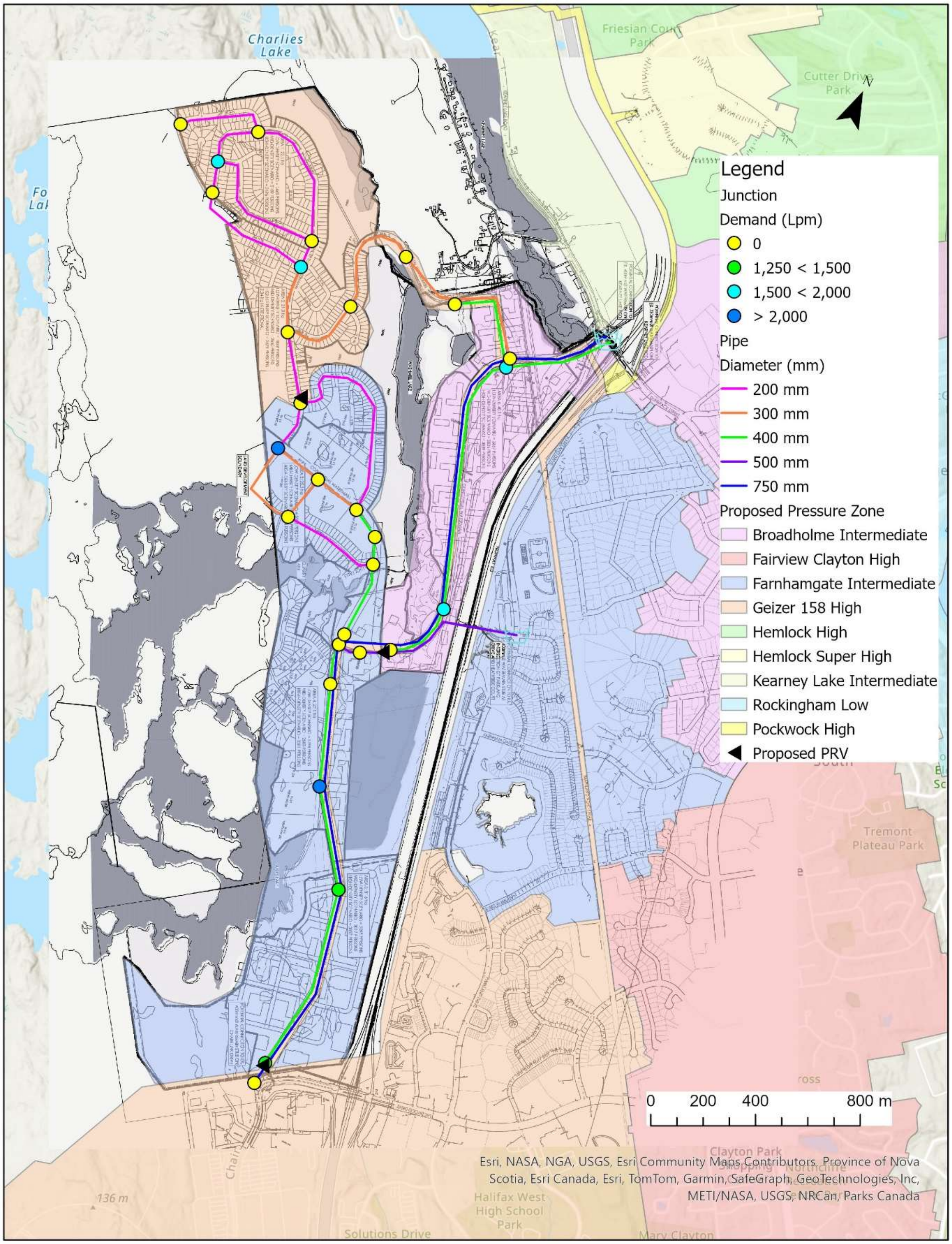


Figure 3-7: PHD Distribution (High-Density Scenario)

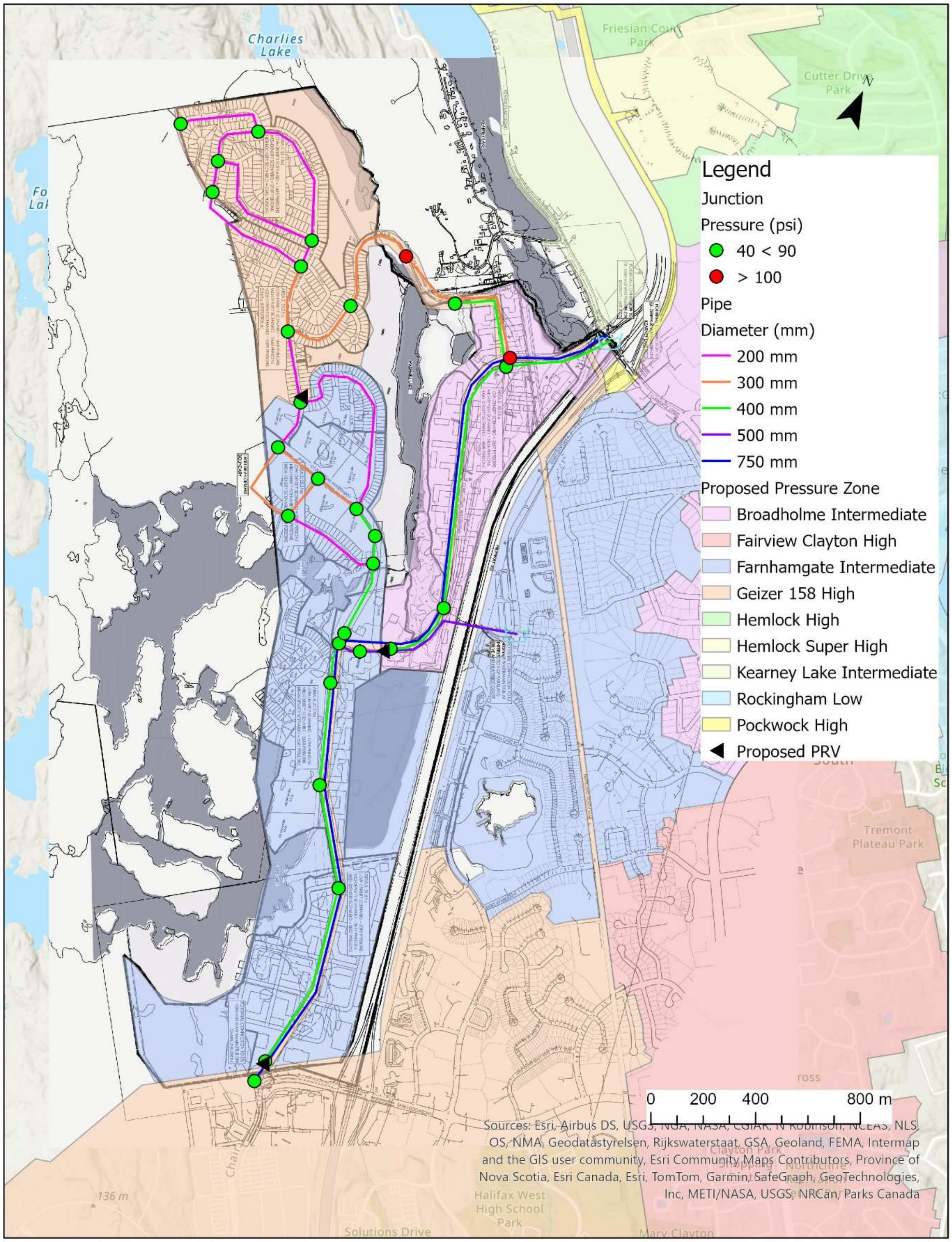


Figure 3-8: Pressure Distribution Under PHD (High-Density Scenario)

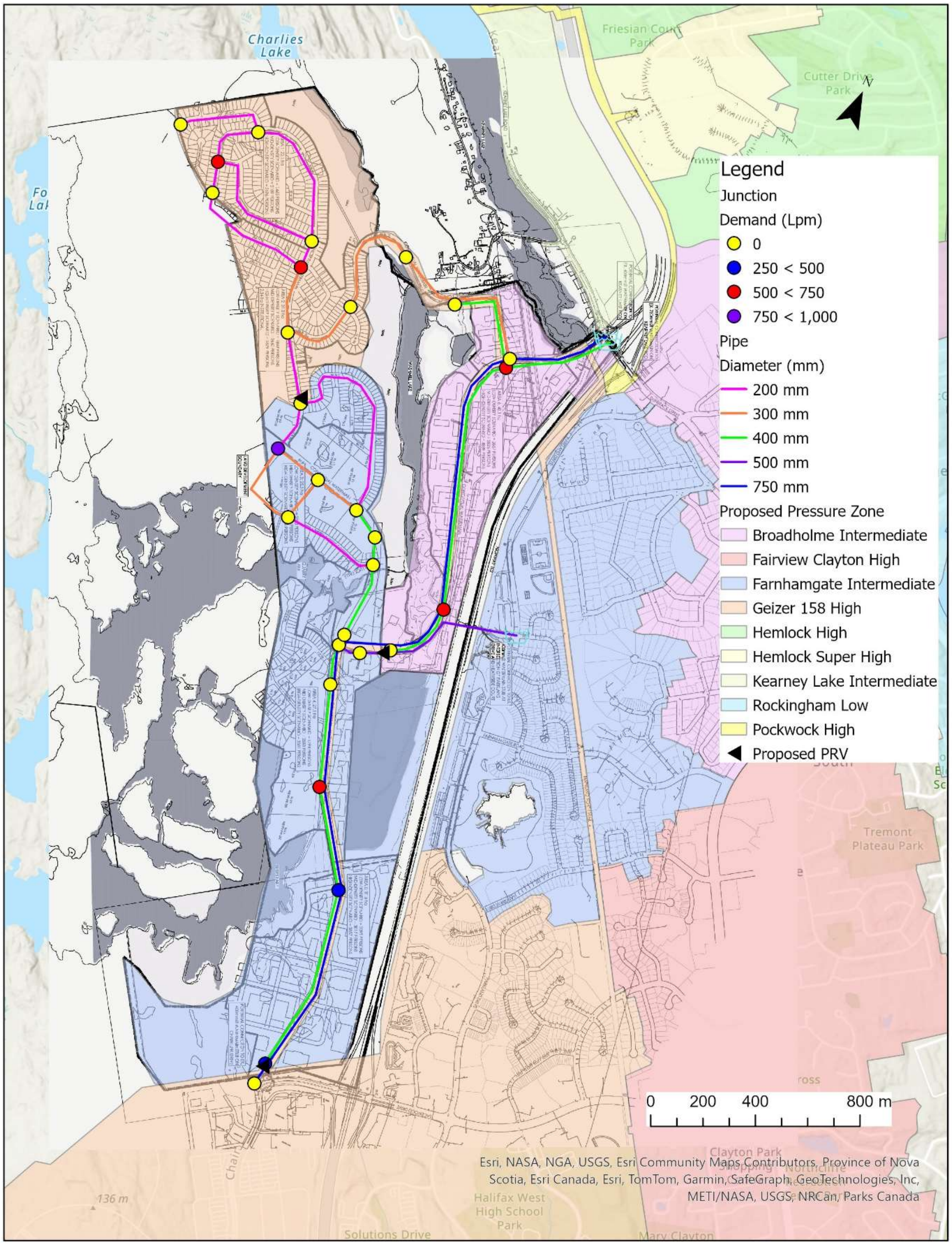


Figure 3-9: MHD Distribution (High-Density Scenario)

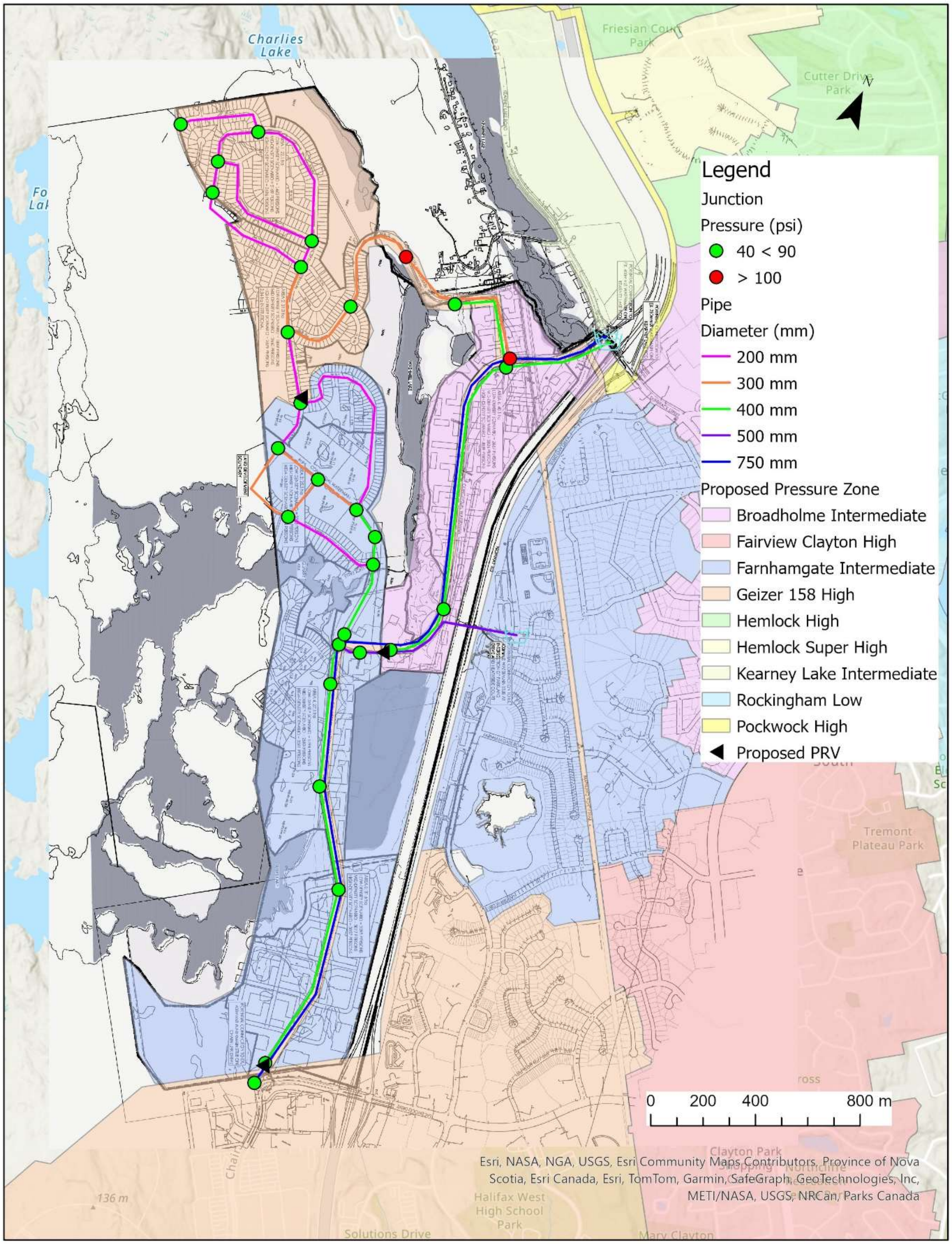


Figure 3-10: Pressure Distribution Under MHD (High-Density Scenario)

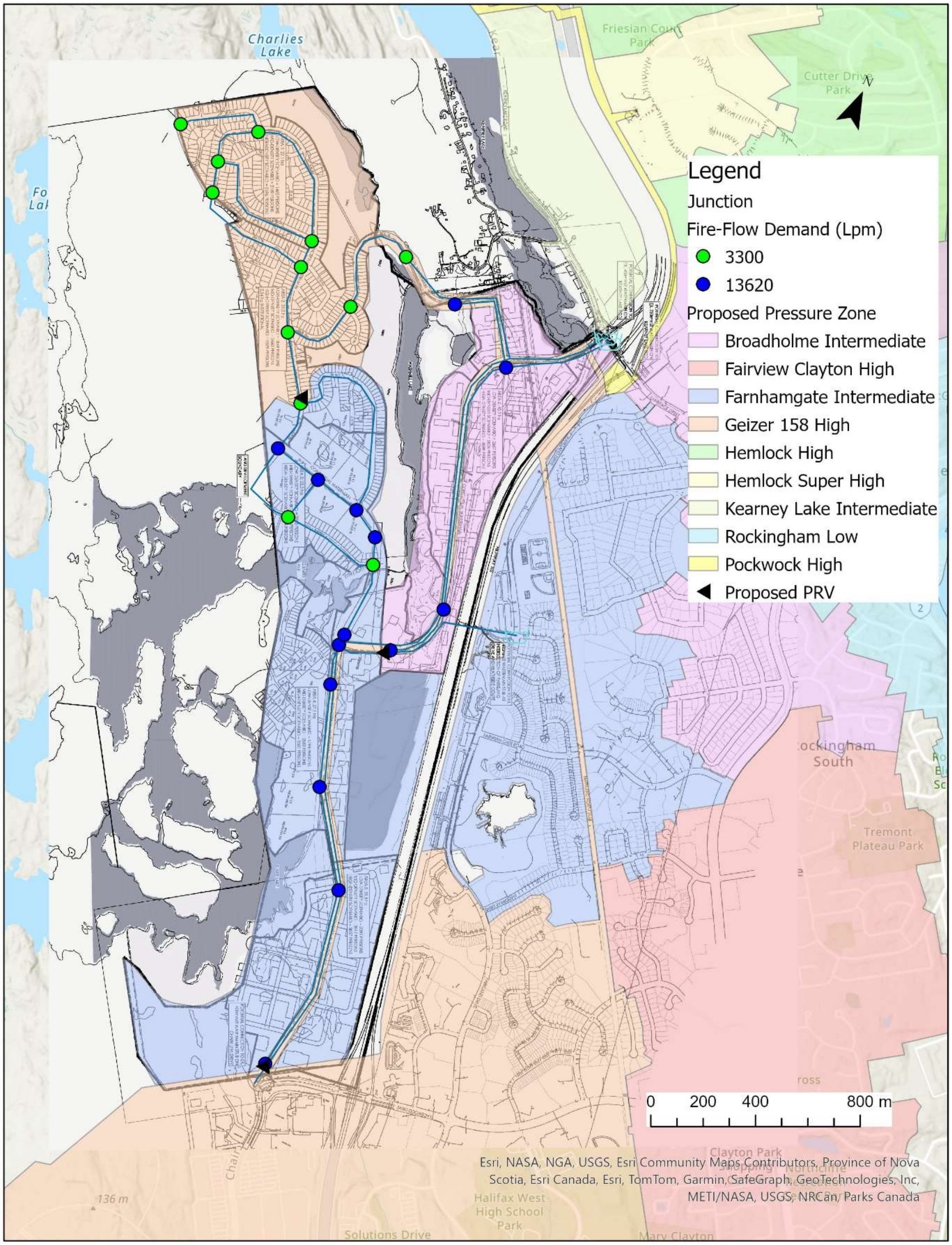


Figure 3-11: Required Fire-Flow

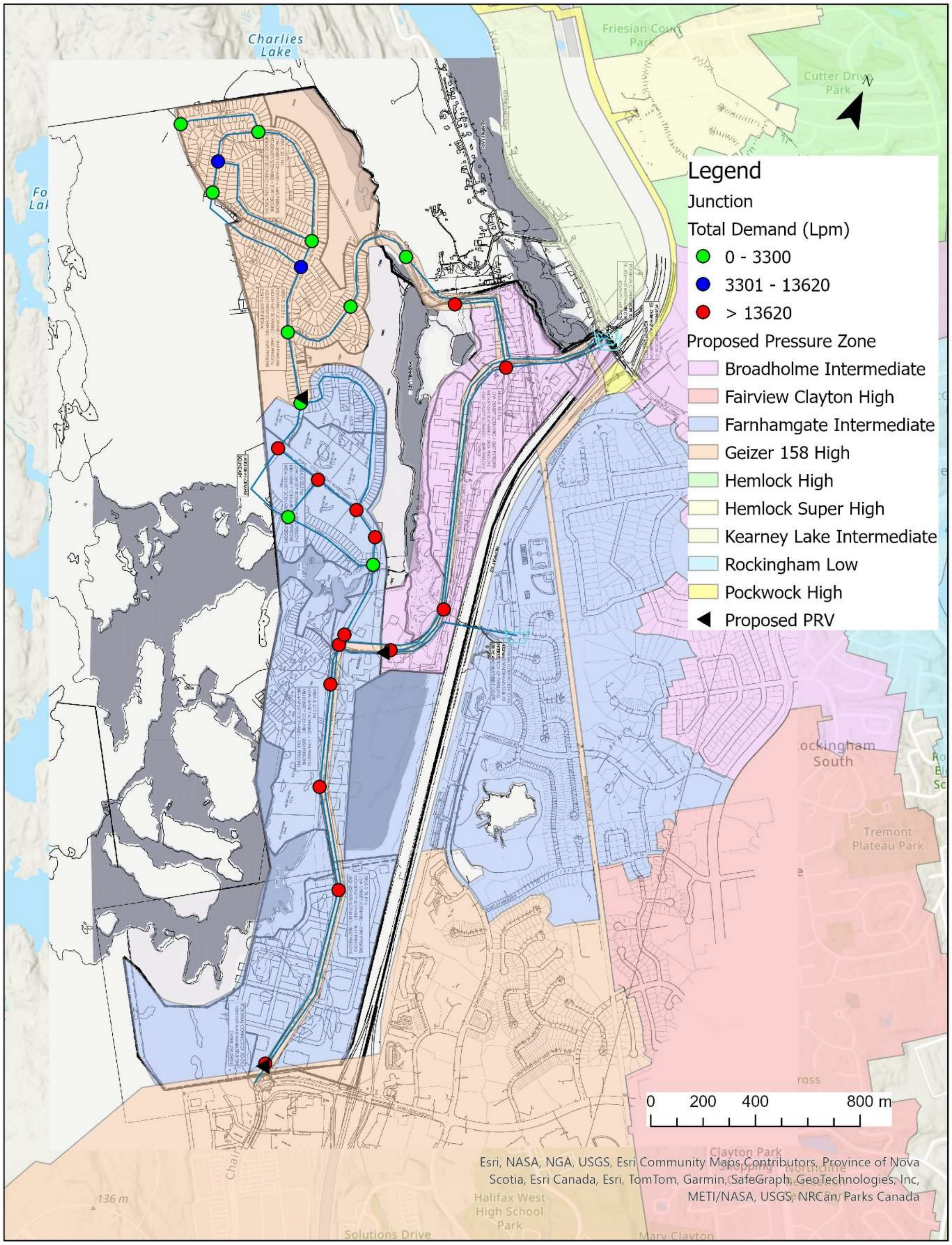


Figure 3-12: Total MDD + FF Demands (High-Density Scenario)

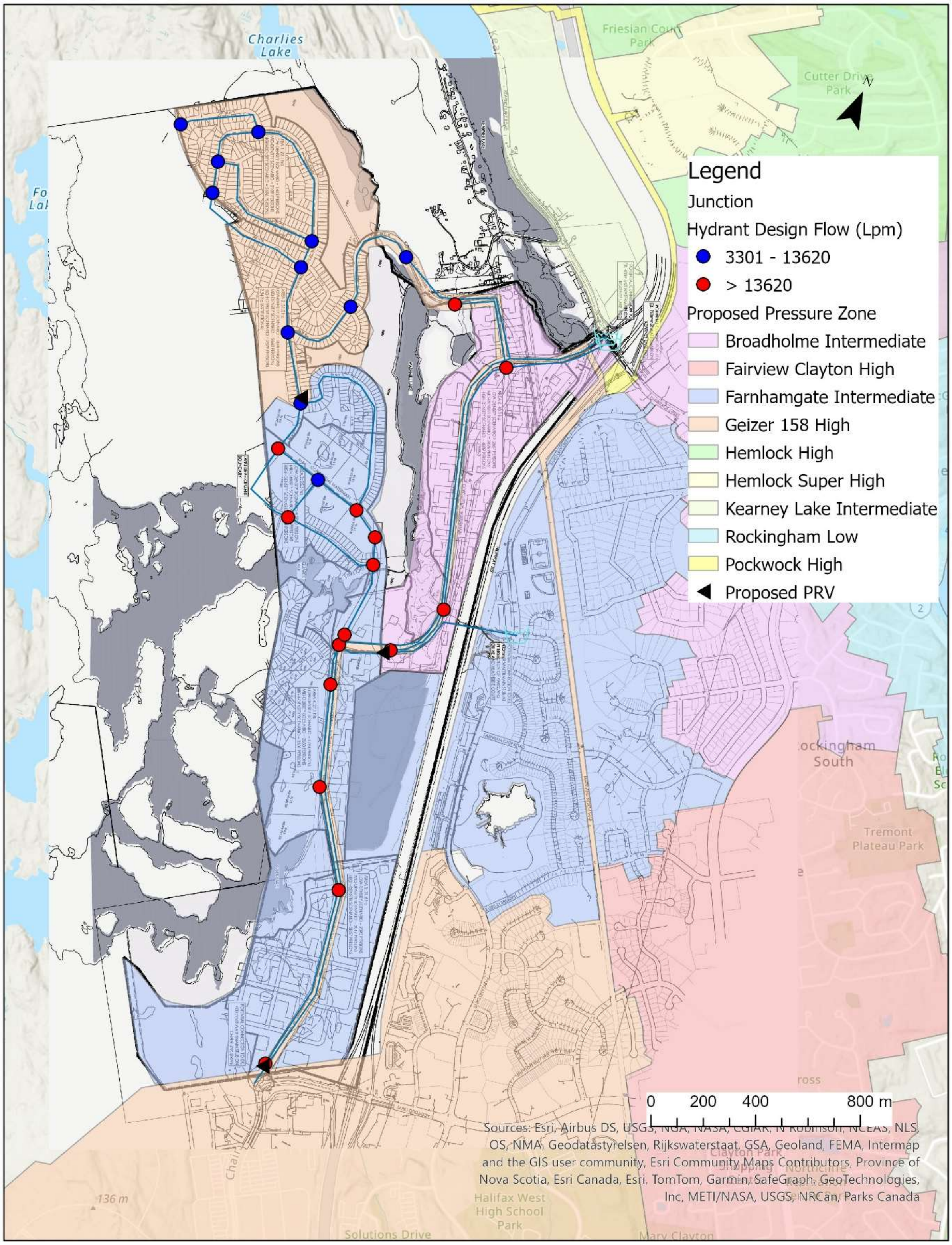


Figure 3-13: Available Hydrant Flow (High-Density Scenario)

3.3.4.2 Low-Density Population Scenario

Figure 3-14 illustrates the distribution of MDD for the low-density scenario throughout the model. Demands corresponding to the low-density scenario were distributed as described in **Section 3.3.4.1**. **Figure 3-15** presents the anticipated corresponding pressures at each node, which range from 51 psi to 84 psi (which is slightly above the upper range of 80 psi), within the serviced areas of the development. It is noted that the pressure modeled at the low-lying elevation along the proposed street servicing the northwest, is above the range (approx. 106 psi), as is the pressure modelled at the connection to the Geizer 158 new transmission main (approx. 129 psi). However, there are no planned serviced lots in these areas. The high pressure is due to low ground elevation in this area, compared to the HGL of Geizer 158 High zone.

The demand distribution and results of the PHD analysis are presented in **Figure 3-17** and **Figure 3-17**, respectively. Pressures under the PHD scenario range from approximately 51 psi to 82 psi, with the exception of the low elevation along the proposed street servicing the northwest (approx. 105 psi) and the connection to the new Geizer 158 transmission main (129 psi). The maximum velocity for the PHD scenario is less than 1.5 m/s throughout the proposed system.

The demand distribution for the MHD scenario is shown in **Figure 3-18**, and the resulting pressures are presented in **Figure 3-19**. Pressures under the MHD scenario range from approximately 51 psi to 85 psi, except for the low elevation along the proposed street servicing the northwest (approx. 107 psi) and the connection to the new Geizer 158 transmission main (129 psi).

Required fire-flows for the low-density scenario remain the same as for the high-density scenario presented in **Figure 3-11**. The total MDD + FF required demand at each node is presented in **Figure 3-20**, and the results of the fire analysis are presented in **Figure 3-21**. The available hydrant flow range is approximately 4,500 Lpm to 26,300 Lpm and meets or exceeds, the total MDD + FF demands. However, as with the high-density population analysis, it is important to note that these results are based on the assumptions of a constant HGL at the connections to the existing pressure zones and therefore should be considered with caution. Without a full system model, it is unknown if the system can really provide the fire flows presented. Therefore, it is recommended to examine the development’s effect on the entire system by using a full (calibrated) system model (including any upstream improvements/upgrades required within the existing system due to the addition of these lands, such as, the proposed new 158 Geizer transmission main). However, such model development is beyond the scope of this study. Hence the pressures and available fire flows presented in the report should be considered preliminary.

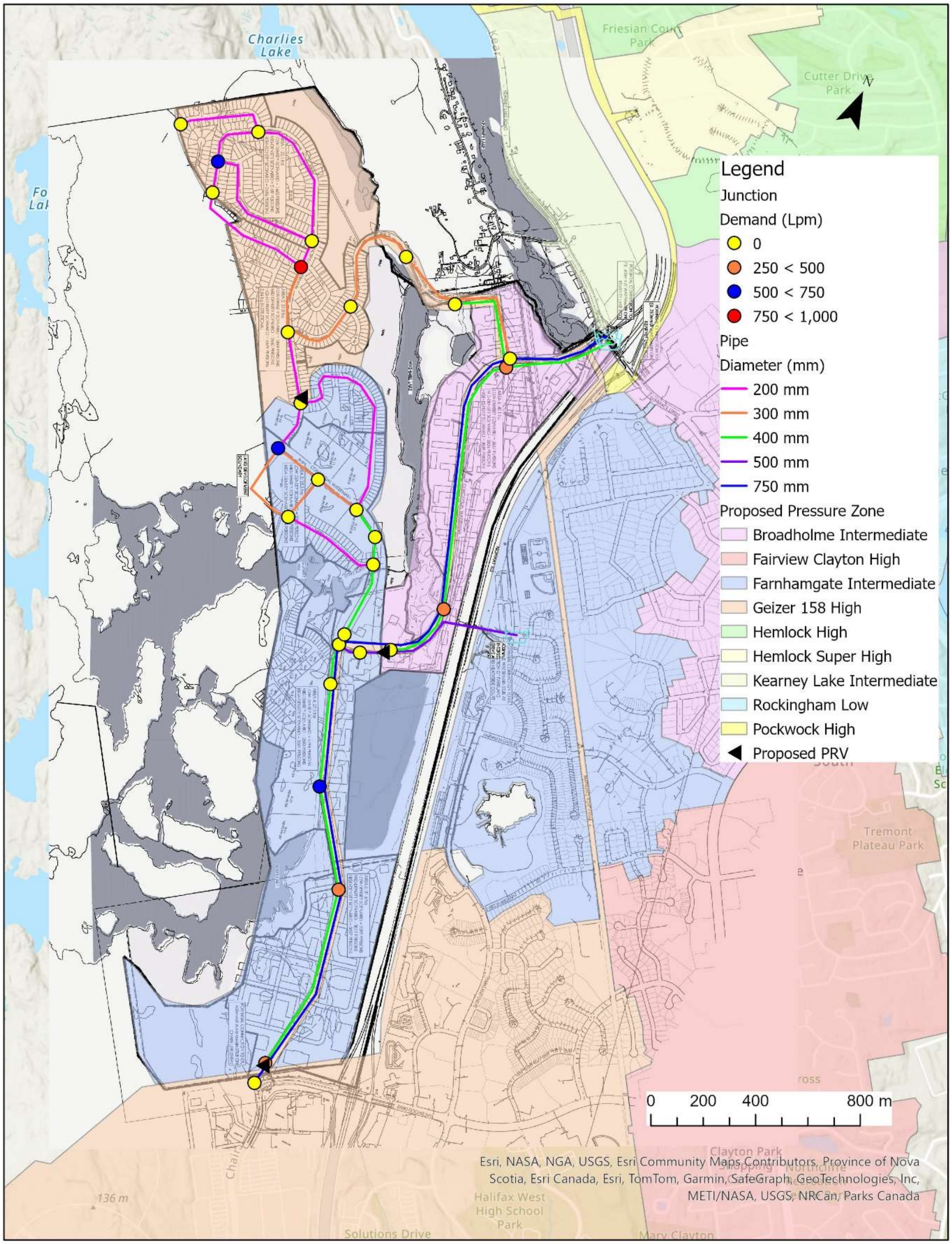


Figure 3-14: MDD Distribution (Low-Density Scenario)

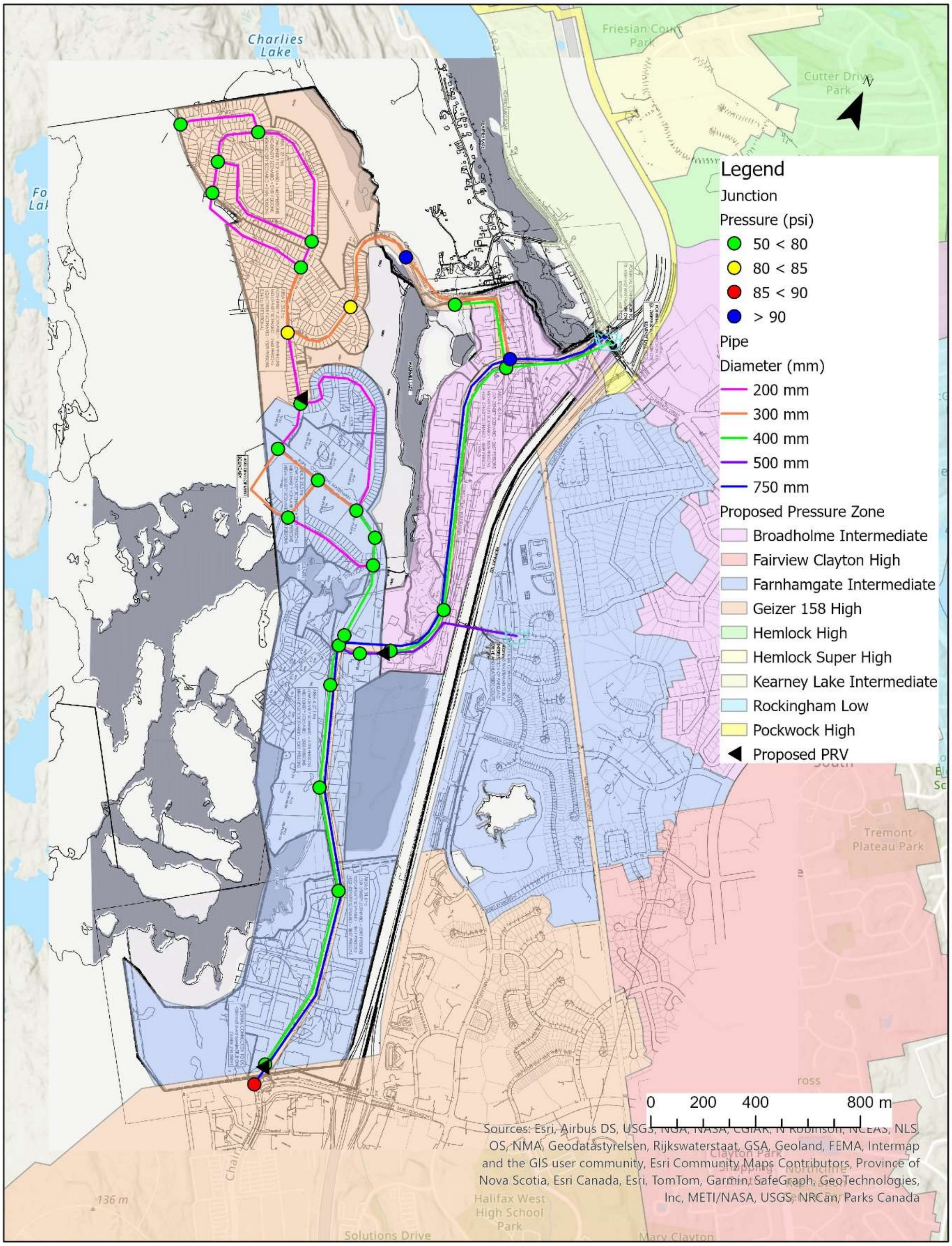


Figure 3-15: Pressure Distribution Under MDD (Low-Density Scenario)

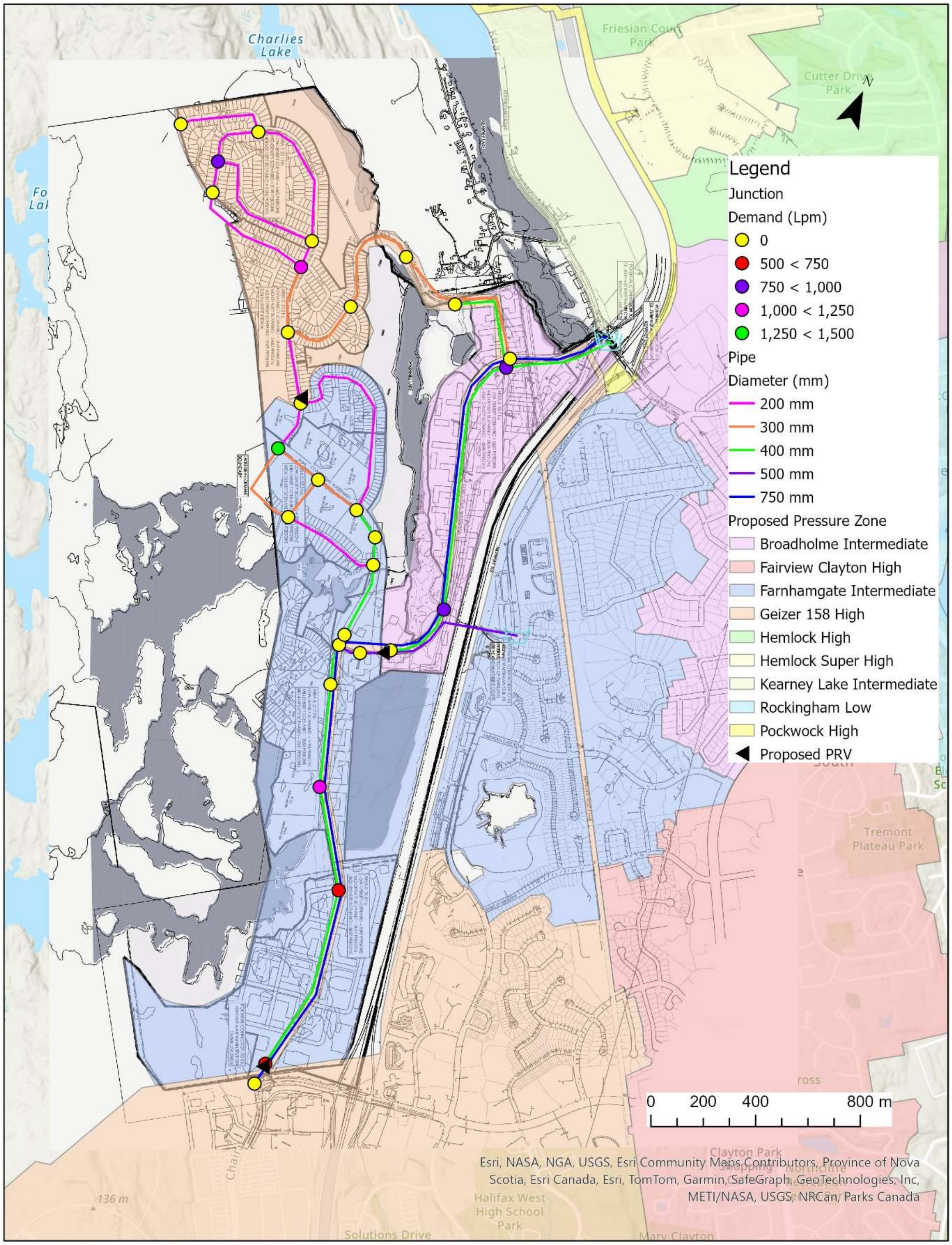


Figure 3-16: PHD Distribution (Low-Density Scenario)

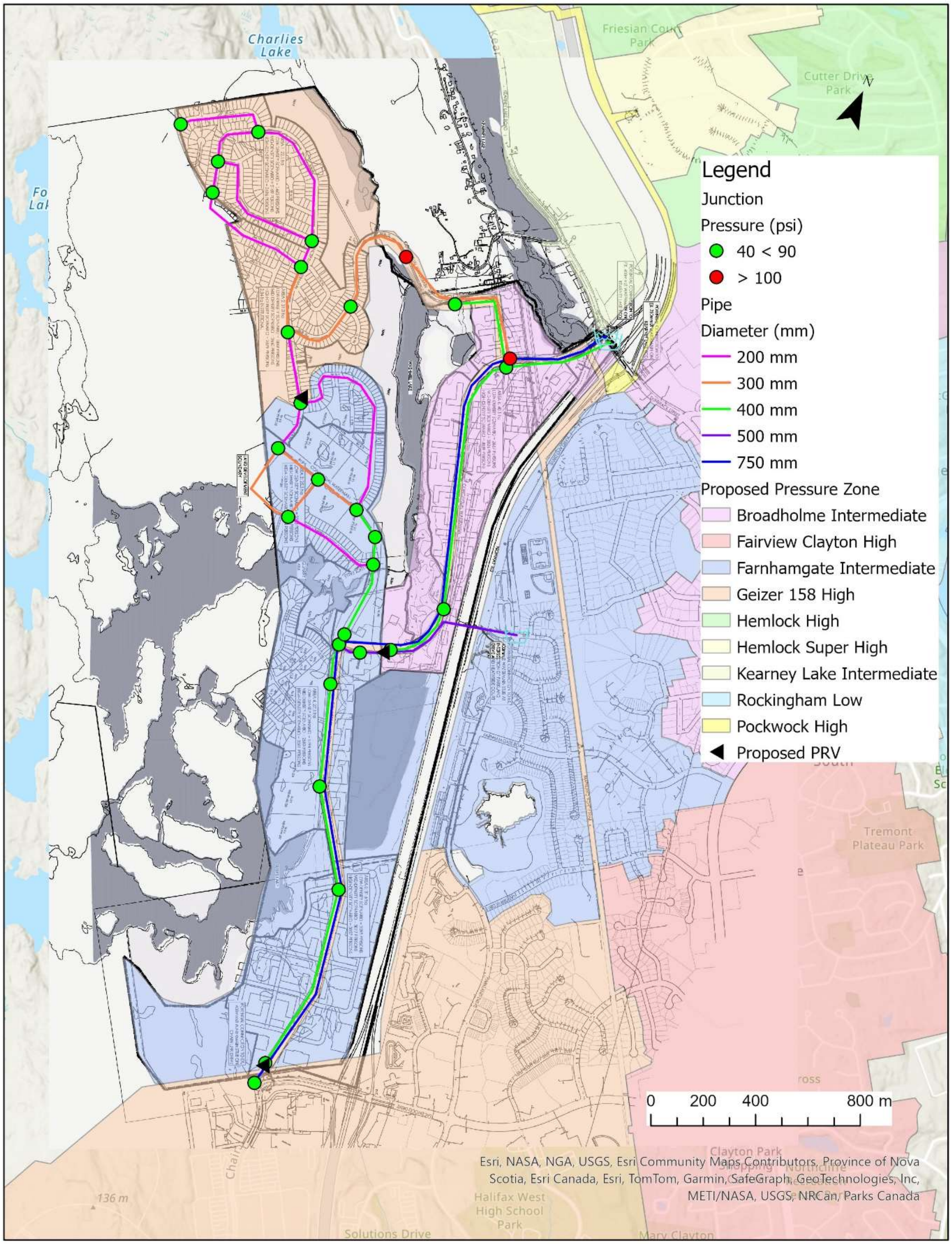


Figure 3-17: Pressure Distribution Under PHD (Low-Density Scenario)

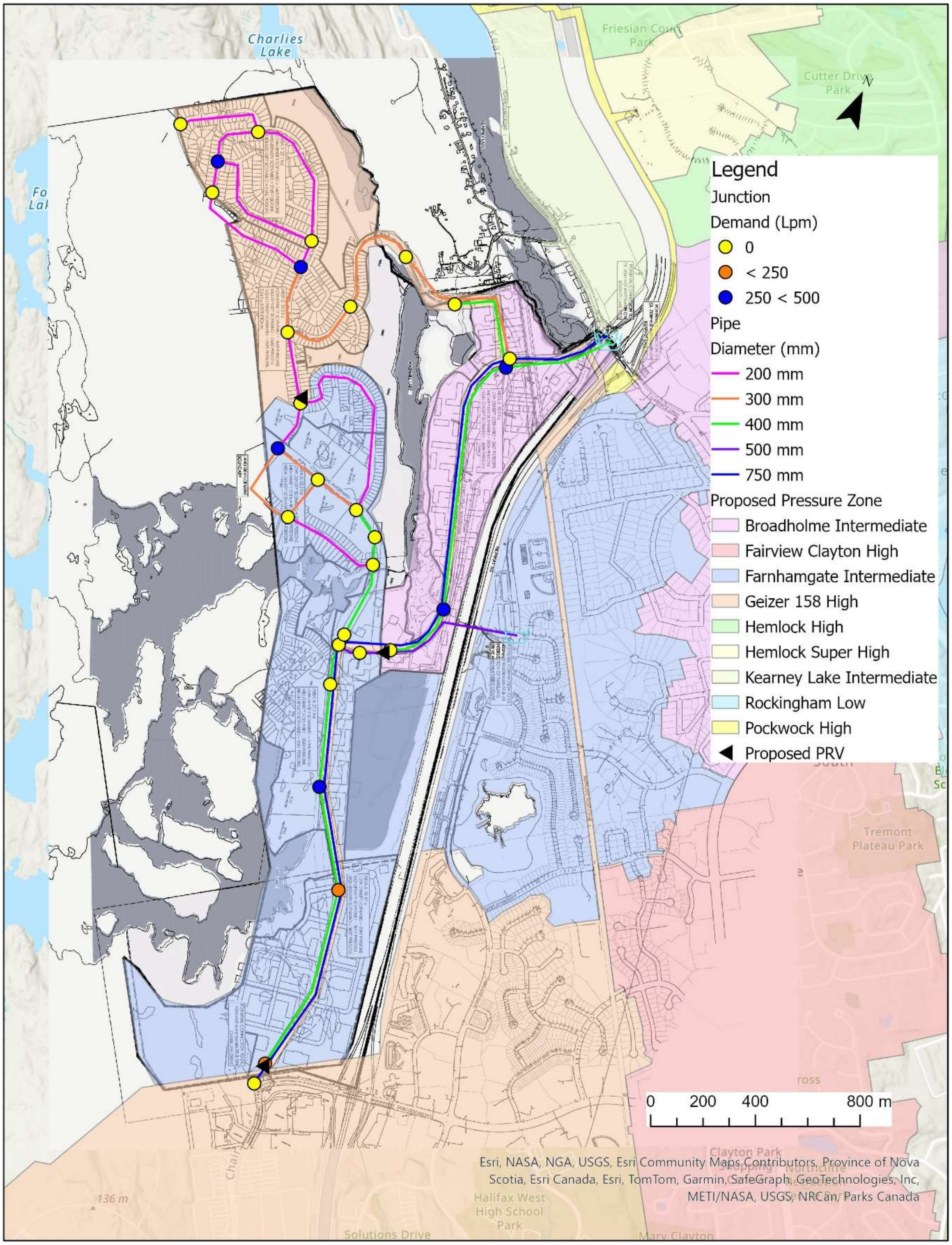


Figure 3-18: MHD Distribution (Low-Density Scenario)

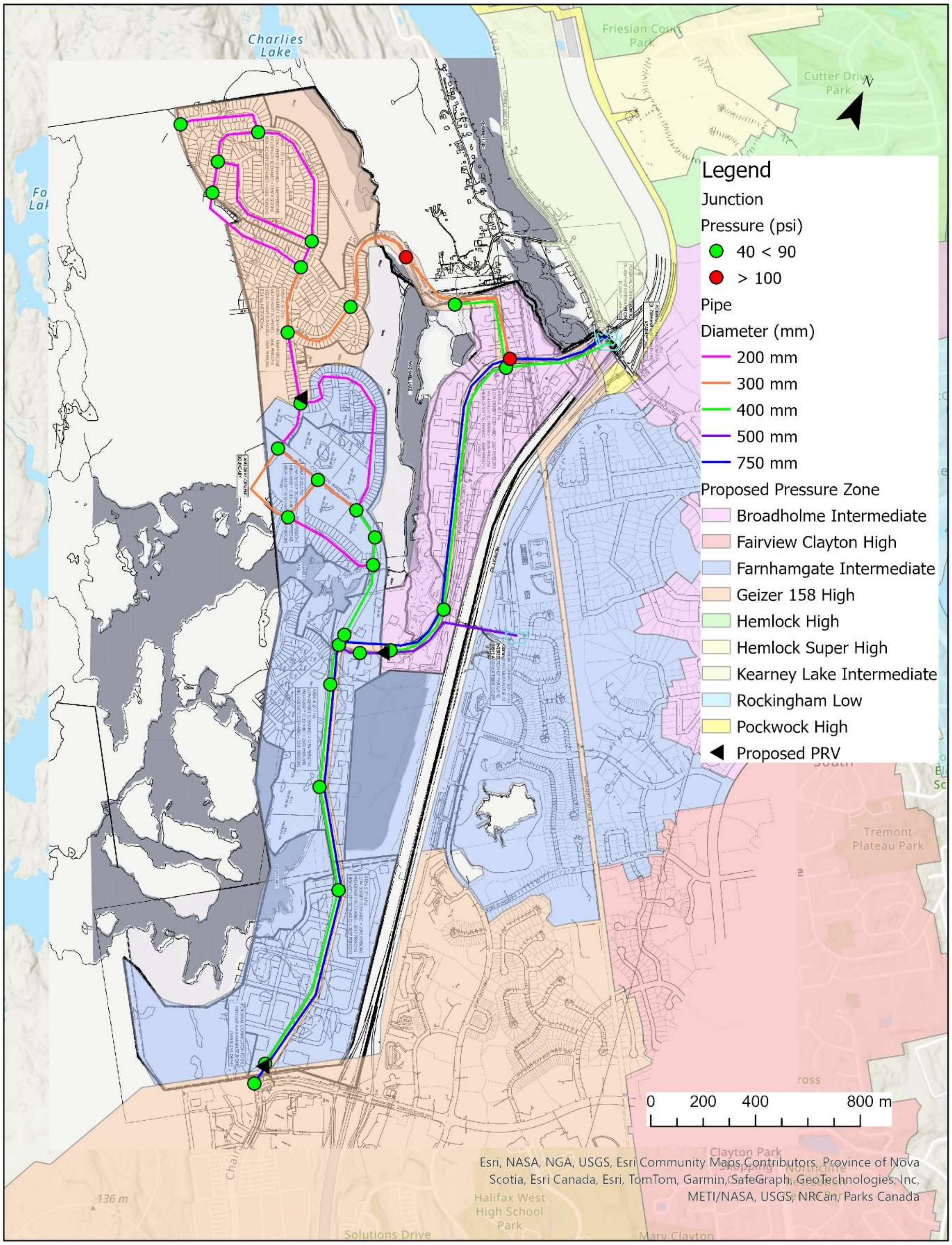


Figure 3-19: Pressure Distribution Under MHD (Low-Density Scenario)

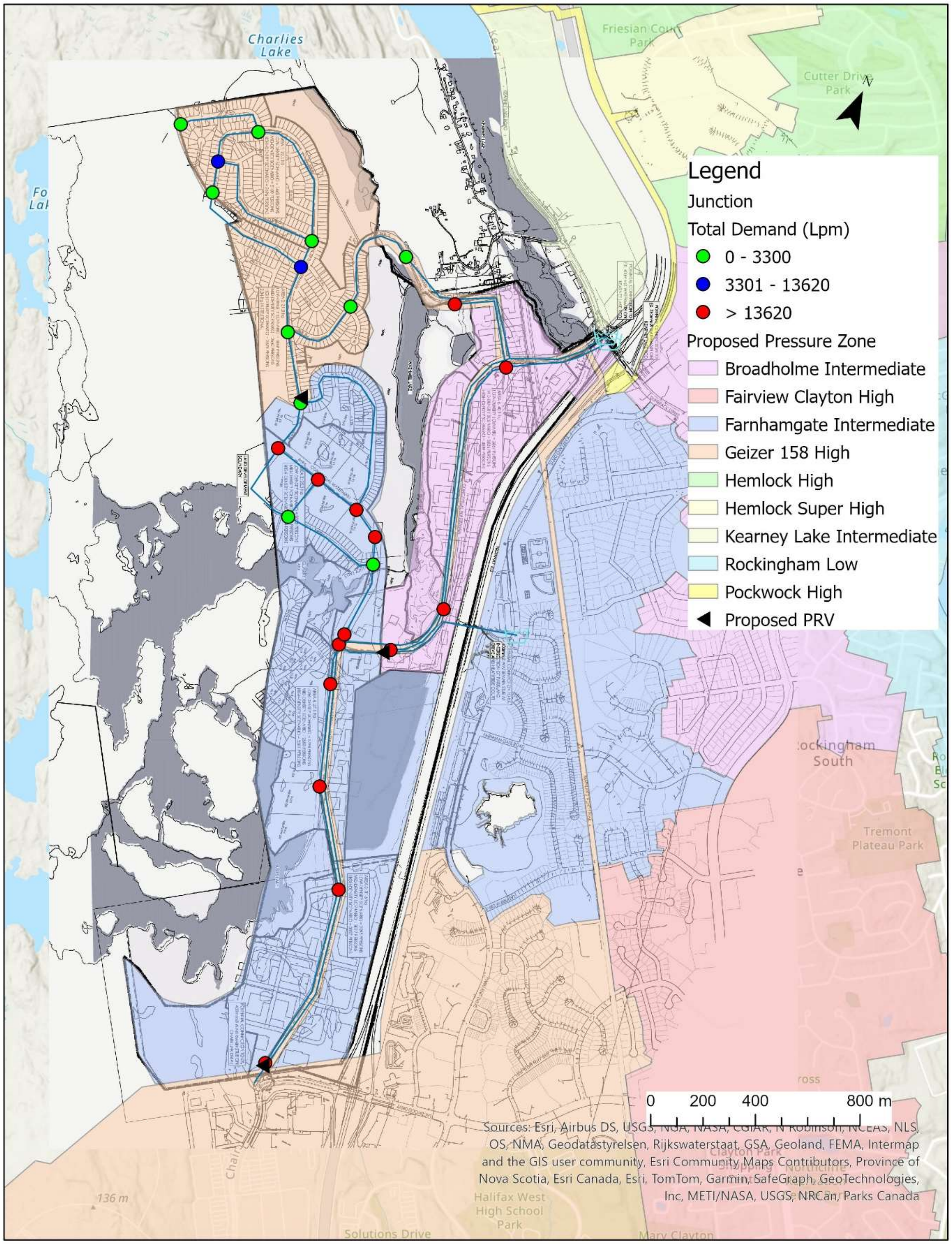


Figure 3-20: Total MDD + FF Demands (Low-Density Scenario)

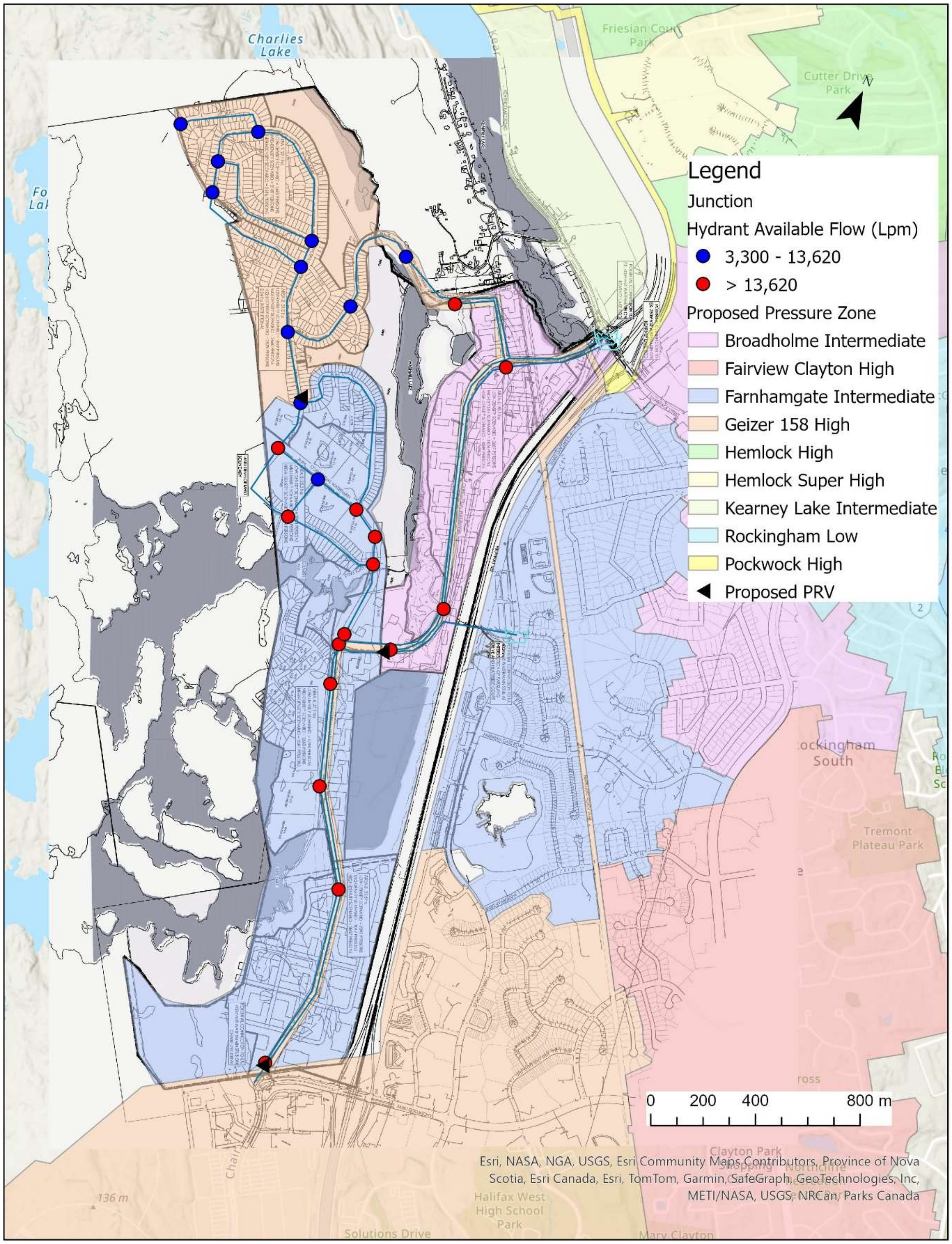


Figure 3-21: Available Hydrant Flow (Low-Density Scenario)

4 Conclusions and Recommendations

4.1 Conclusions

The Highway 102 development is proposed west of Highway 102 in southwestern area of HRM. A range of development scenarios were assessed to estimate high- and low-density population projections. These scenarios were used to estimate ADD, MDD, MHD and PHD for the development. The demands were then used to assess the requirements for servicing the development with potable water from Halifax Water's existing water system network.

Level of service and design criteria from Halifax Water's Design Specifications (2023) were used to assess the proposed servicing scheme.

A review of the adjacent pressure zones, proposed system improvements, and proposed site grading suggests the development can be serviced with potable water from the existing Farnhamgate Intermediate, Broadholme Intermediate and Geizer 158 High pressure zones. A water system model was developed using InfoWater Pro to estimate the development distribution system requirements to achieve the level of service set out in Halifax Water's Design Specifications. The model development assumes that the connection to each existing pressure zone is a constant HGL with unlimited flow (i.e. the connections are modelled as fixed head reservoirs). This assumption does not reflect the actual system, however, in the absence of a full system model it is a reasonable assumption for analysis.

The proposed watermain sizes range from 200 mm to 500 mm diameter, and a 750 mm new Geizer 158 transmission main through the proposed Highway 102 development. It is assumed that the northwestern portion of the development can be serviced by connecting to the new Geizer 158 transmission main, assuming the HGL will be the same as the Geizer 158 High zone.

The water model results indicate the following:

Flow Scenario	Pressure Range (psi)	Max Velocity (m/s)	Available Fire Flow (Lpm)
MDD High Density	51 – 82*	< 1.5	N/A
PHD High Density	50 – 79*	< 1.5	N/A
MHD High Density	51 – 84*	< 1.5	N/A
MDD + FF High Density	> 22	< 2.4	4,100 – 24,600**
MDD Low Density	51 – 84*	< 1.5	N/A
PHD Low Density	51 – 82*	< 1.5	N/A
MHD Low Density	51 – 85*	< 1.5	N/A
MDD + FF Low Density	> 22	< 2.4	4,500 – 26,300**

* With the exception of the low-lying elevations along the proposed street servicing the northwest and the connection to the new Geizer 158 transmission main. However, there are no planned serviced lots in these areas.

** Based on the assumptions of a constant HGL at the connections to the existing pressure zones. Therefore, the values for available fire flow should be considered with a low level of confidence.

Pressure reducing valves installed on the water service lines (in accordance with Halifax Water's Supplementary Standard Specifications) should be considered in those locations identified with pressure above the range identified in the Design Specification.

4.2 Recommendations

The presented subdivision plan is preliminary and subject to change, therefore the MHD, MDD, PHD and required FF demands presented in this report may change resulting in changes to proposed water distribution preliminary design. It is recommended that the level of service and distribution system requirements be reassessed during subsequent design stages. Also, during the next stages of design the sizing and placement of regional water infrastructure should be considered.

In the absence of a full system model the effect of the proposed development on the level of service of the remaining system could not be assessed. Also, the effect of potential restrictions within the existing system on the proposed development could not be assessed. In Halifax Water's 2019 IMP it was recommended that an all-pipe hydraulic model be developed. An all-pipe model can be used to assess fire flow objectives at each property or node in the system. It is recommended that the proposed development be incorporated in the all-pipe model to perform a more refined fire flow level of service assessment for the development.

As noted in **Section 3.3.2** the northwest portion of the development can also be serviced by connecting to the Pockwock High pressure zone (rather than the Geizer 158 zone). The Pockwock High HGL is higher than the Geizer 158 HGL. Therefore, pressures presented for the various population densities and demand scenarios (**Section 3.3.4**) would be greater when serviced by the Pockwock High zone. It is recommended that servicing the northwest area via the Pockwock High pressure zone be examined during subsequent design stages.

The scope of the water and wastewater servicing analysis included in the Future Serviced Communities Study does not include wastewater treatment facilities or water treatment plants. Halifax Water has a well-established strategy for water and wastewater infrastructure planning as it relates to asset renewal, compliance, and growth. The Integrated Resource Plan (IRP) shapes Halifax Water's capital program by identifying resource and finance needs. There are three major plans contained within the IRP, those being the Asset Management Plan, Compliance Plan, and Infrastructure Master Plan (IMP). The IRP aims to provide regional water and wastewater infrastructure needed to support planned growth.

The IMP is a comprehensive infrastructure master plan for both water and wastewater that supports growth. As part of the IRP approach, the plan is updated at regular intervals to ensure the consolidated long-term program remains current. Halifax Regional Municipality supplies Halifax Water with growth projections to be considered within the IRP, in this case, the Future Serviced Communities Studies:

Sandy Lake, Highway 102 Corridor, Eastern Passage (referred to as Morris Lake in the RFP) Expansion, and Westphal will be incorporated into the upcoming review of the latest iteration of the IRP. Growth projections are used as input to analysis, such as water and wastewater models, which aid in determining preferred servicing strategies.

Appendix A Hydrant Flow Test

TURNER STACEY | FIRE PROTECTION |

Water Flow Test Summary

230 Lacewood Drive
Stantec

Type of Test: Flow Test

Test # : 1

Location: See Below

Tested By: Matt Eisan

Municipality: HRM

Date: August 22, 2024

***SYSTEM DATA**

Size of Main: **16"** Dead Ends: **X** Grid: Loop:

Source Reliable: Yes (CITY) If No - Explain

Comments: All flows are in USGPM

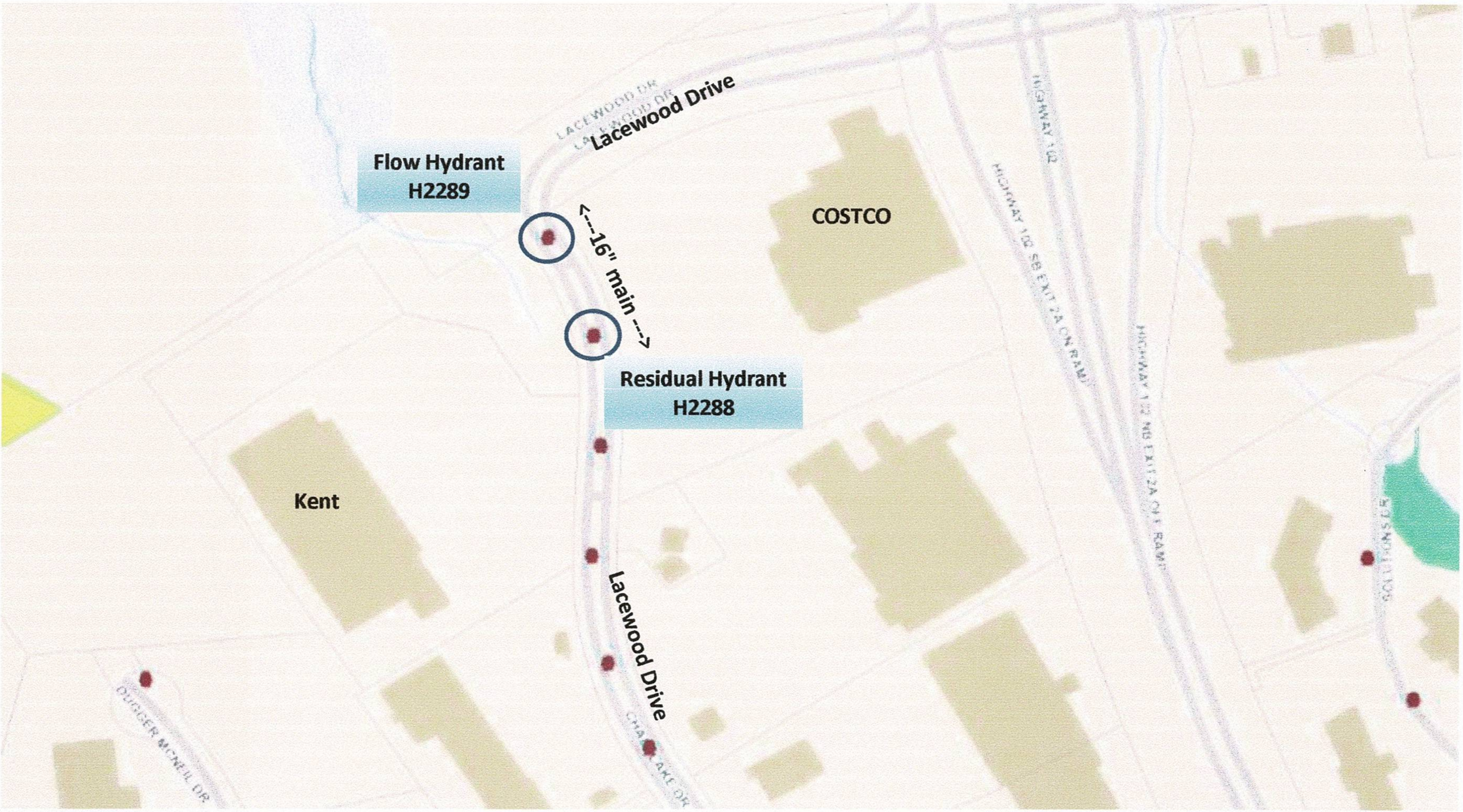
***TEST DATA**

Location of Hydrants: Residual: Hydrant H2288 - next hydrant - in front of COSTCO

Flow: Hydrant H2289 - on the bend of Lacewood in front of COSTCO

Normal Pressure: **84 psi** Time: **10:00 PM**

Test #	# of Outlets	Oriface Size	Pitot Reading (PSIG)	Equivelent Flow (GPM)	Total Flow (GPM)	Residual Pressure (PSIG)	Comments
0	0					84	Used 2 1/2" Hose Monster
1	1	2 1/2"	38	1040	1040	82	
2	2	2 1/2"	30	924	1800	78	
		2 1/2"	27	876			



Flow Hydrant
H2289
Residual Hydrant
H2288
<---16" main --->
Lacewood Drive
Lacewood Drive
COSTCO
Kent
LACEWOOD DR
HIGHWAY 102
HIGHWAY 102 SB EXIT 2A ON RAMP
HIGHWAY 102 NB EXIT 2A OFF RAMP
DUGGER MCNEIL DR

TURNER STACEY
| FIRE PROTECTION |

Water Flow Test Summary

366 Lacewood Drive
Stantec

Type of Test:	Flow Test	Test # :	1
Location:	See Below	Tested By:	Matt Eisan
Municipality:	HRM	Date:	August 22, 2024

***SYSTEM DATA**

Size of Main: **16"** Dead Ends: **X** Grid: ______ Loop: ______

Source Reliable: Yes (CITY) If No - Explain ______

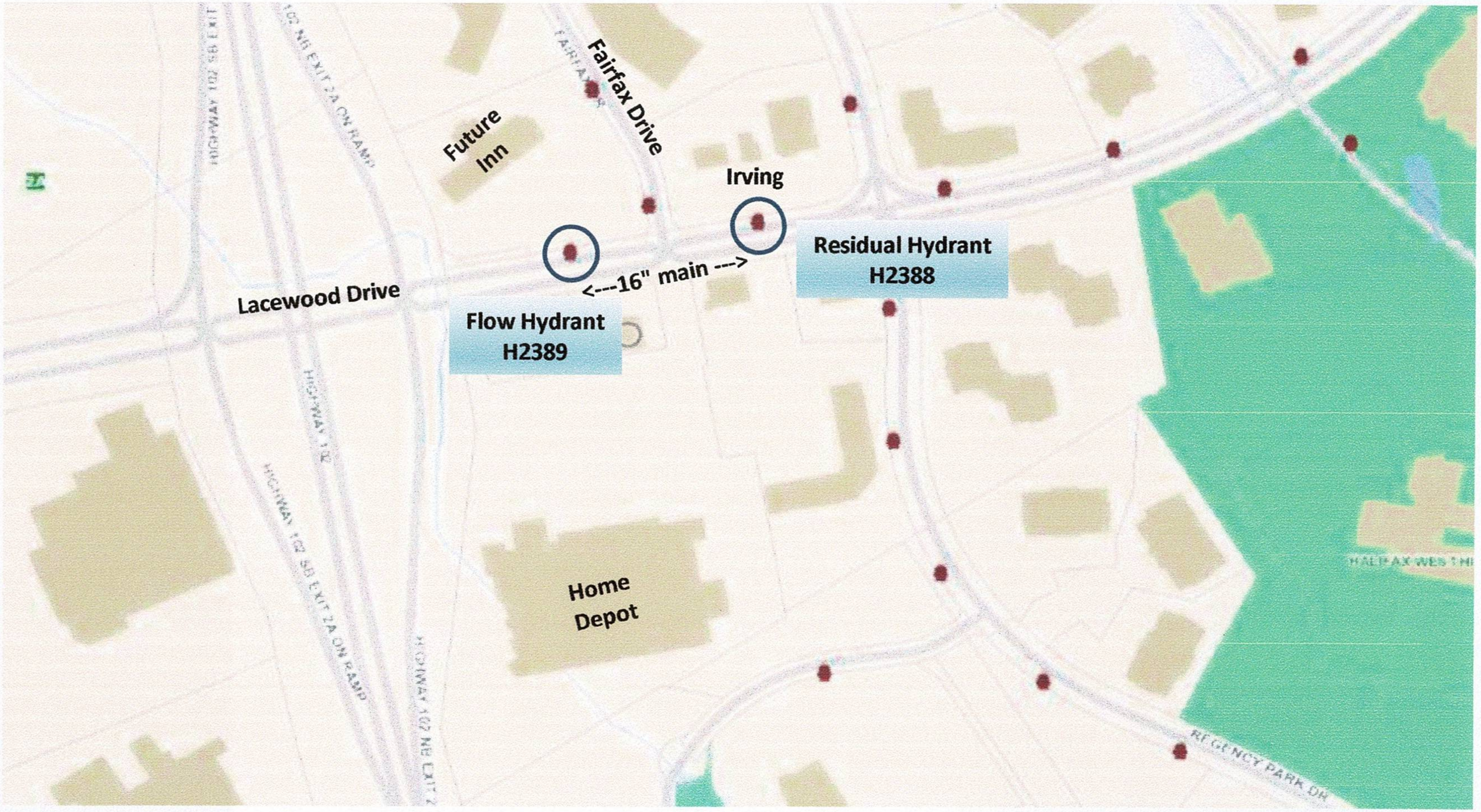
Comments: All flows are in USGPM

***TEST DATA**

Location of Hydrants:
Residual: Hydrant H2388 - in front of Irving
Flow: Hydrant H2389 - in front of Future Inn

Normal Pressure: **74 psi** Time: **10:32 PM**

Test #	# of Outlets	Oriface Size	Pitot Reading (PSIG)	Equivelent Flow (GPM)	Total Flow (GPM)	Residual Pressure (PSIG)	Comments
0	0					74	Used 2 1/2" Hose Monster
1	1	2 1/2"	32	954	954	72	
2	2	2 1/2"	30	924	1784	70	
		2 1/2"	26	860			



Fairfax Drive
Future Inn
Irving
Residual Hydrant
H2388
<---16" main --->
Lacewood Drive
Flow Hydrant
H2389
Home Depot
HIGHWAY 102 SB EXIT 2A ON RAMP
HIGHWAY 102
HIGHWAY 102 NB EXIT 2
102 NB EXIT 2A ON RAMP
REGENCY PARK DR

TURNER STACEY
| FIRE PROTECTION |

Water Flow Test Summary

Parkland / Heathside
Stantec

Type of Test: Flow Test

Test # : 1

Location: See Below

Tested By: Matt Eisan

Municipality: HRM

Date: August 22, 2024

***SYSTEM DATA**

Size of Main: **16"** Dead Ends: ______ Grid: **X** Loop: ______

Source Reliable: Yes (CITY) If No - Explain ______

Comments: All flows are in USGPM

***TEST DATA**

Location of Hydrants:
Residual: Hydrant H2399 - corner of Heathside and Gorsebud
Flow: Hydrant H2398 - on Parkland between Heathside and Carlina

Normal Pressure: **85 psi** Time: **10:55 PM**

Test #	# of Outlets	Oriface Size	Pitot Reading (PSIG)	Equivelent Flow (GPM)	Total Flow (GPM)	Residual Pressure (PSIG)	Comments
0	0					85	Used 2 1/2" Hose Monster
1	1	2 1/2"	40	1067	1067	80	
2	2	2 1/2"	30	924	1848	79	
		2 1/2"	30	924			

Gorsebud Close
Heathside Crescent
Residual Hydrant
H2399
Flow Hydrant
H2398
Carlina Court
Parkland Drive

Appendix B Sanitary Sewer Peak Flow Estimates

Stantec

SUBDIVISION:

HRM - Highway 102 Study Area
High-Density Scenario

DATE: 2/13/2025
REVISION: 3
DESIGN BY: WAJ
CHECKED BY: DCT

SANITARY SEWER DESIGN SHEET
(Halifax)

FILE NUMBER: 160410459

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	375 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	60,000 l/ha/day	MAXIMUM VELOCITY	4.50 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.35	INSTITUTIONAL	60,000 l/ha/day	MINIMUM COVER	1.60 m
PERSONS / TOWNHOME	3.35	INFILTRATION	0.28 l/s/Ha	HARMON CORRECTION FACTOR	1.00
PERSONS / MULTI-UNIT	2.25				

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)	SINGLE	UNITS TOWN	MULTI	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
R22A	22	21	31.61	0	0	0	3857	31.61	3857	3.35	56.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	31.61	31.61	8.8	64.9	354.4	250	PVC	SDR 35	2.50	95.9	67.68%	1.93	1.81
	21	20	0.00	0	0	0	0	31.61	3857	3.35	56.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	31.61	8.8	64.9	390.0	300	PVC	SDR 35	0.60	74.4	87.25%	1.06	1.07
	20	19	0.00	0	0	0	0	31.61	3857	3.35	56.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	31.61	8.8	64.9	98.9	300	PVC	SDR 35	0.60	74.4	87.25%	1.06	1.07
R19A	19	18	27.05	0	0	0	3301	58.66	7158	3.10	96.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	27.05	58.66	16.4	112.6	313.9	375	PVC	SDR 35	0.60	125.7	89.60%	1.19	1.22
	18	17	0.00	0	0	0	0	58.66	7158	3.10	96.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	58.66	16.4	112.6	401.2	375	PVC	SDR 35	1.60	205.3	54.87%	1.95	1.71
	17	15	0.00	0	0	0	0	58.66	7158	3.10	96.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	58.66	16.4	112.6	127.5	375	PVC	SDR 35	1.60	205.3	54.87%	1.95	1.71
R39A	39	38	22.09	0	0	0	2696	22.09	2696	3.48	40.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	22.09	22.09	6.2	46.9	81.3	300	PVC	SDR 35	0.60	74.4	63.09%	1.06	0.97
	38	37	0.00	0	0	0	0	22.09	2696	3.48	40.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	46.9	46.7	300	PVC	SDR 35	0.60	74.4	63.09%	1.06	0.97
	37	36	0.00	0	0	0	0	22.09	2696	3.48	40.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	46.9	146.2	300	PVC	SDR 35	0.60	74.4	63.09%	1.06	0.97
	36	35	0.00	0	0	0	0	22.09	2696	3.48	40.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	46.9	46.7	300	PVC	SDR 35	0.60	74.4	63.09%	1.06	0.97
	35	34	0.00	0	0	0	0	22.09	2696	3.48	40.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	46.9	75.2	300	PVC	SDR 35	0.60	74.4	63.09%	1.06	0.97
	34	33	0.00	0	0	0	0	22.09	2696	3.48	40.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	46.9	164.7	300	PVC	SDR 35	0.60	74.4	63.09%	1.06	0.97
	33	32	0.00	0	0	0	0	22.09	2696	3.48	40.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	46.9	229.8	300	PVC	SDR 35	0.60	74.4	63.09%	1.06	0.97
R32A	32	31	17.81	0	0	0	2174	39.90	4870	3.26	68.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	17.81	39.90	11.2	80.0	185.9	300	PVC	SDR 35	1.00	96.0	83.31%	1.36	1.36
	31	30	0.00	0	0	0	0	39.90	4870	3.26	68.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	39.90	11.2	80.0	81.9	300	PVC	SDR 35	2.00	135.8	58.91%	1.93	1.74
	30	29	0.00	0	0	0	0	39.90	4870	3.26	68.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	39.90	11.2	80.0	87.6	300	PVC	SDR 35	3.00	166.3	48.10%	2.36	2.00
R44A	44	43	5.78	0	0	0	705	5.78	705	3.89	11.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	5.78	5.78	1.6	13.5	130.7	200	PVC	SDR 35	0.50	23.7	57.00%	0.75	0.66
	43	42	0.00	0	0	0	0	5.78	705	3.89	11.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	5.78	1.6	13.5	44.4	200	PVC	SDR 35	0.50	23.7	57.00%	0.75	0.66
	42	41	0.00	0	0	0	0	5.78	705	3.89	11.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	5.78	1.6	13.5	163.0	200	PVC	SDR 35	0.50	23.7	57.00%	0.75	0.66
	41	40	0.00	0	0	0	0	5.78	705	3.89	11.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	5.78	1.6	13.5	51.0	200	PVC	SDR 35	0.50	23.7	57.00%	0.75	0.66
	40	29	0.00	0	0	0	0	5.78	705	3.89	11.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	5.78	1.6	13.5	95.9	200	PVC	SDR 35	0.50	23.7	57.00%	0.75	0.66
I29A	29	28	0.00	0	0	0	0	45.68	5575	3.20	77.5	0.00	0.00	0.00	0.00	0.00	0.00	2.33	2.33	0.00	0.00	1.6	2.33	48.01	13.4	92.5	291.0	300	PVC	SDR 35	2.35	147.2	62.85%	2.09	1.91
	28	27	0.00	0	0	0	0	45.68	5575	3.20	77.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	48.01	13.4	92.5	68.3	300	PVC	SDR 35	1.20	105.2	87.96%	1.49	1.51
	27	26	0.00	0	0	0	0	45.68	5575	3.20	77.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	48.01	13.4	92.5	104.1	300	PVC	SDR 35	1.20	105.2	87.96%	1.49	1.51
R26A	26	25	30.36	0	0	0	3704	76.04	9279	2.99	120.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	30.36	78.37	21.9	143.9	363.4	300	PVC	SDR 35	3.50	179.6	80.08%	2.55	2.51
	25	24	0.00	0	0	0	0	76.04	9279	2.99	120.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	78.37	21.9	143.9	143.2	450	CONCRETE	100D	0.60	232.8	61.78%	1.42	1.29
	24	23	0.00	0	0	0	0	76.04	9279	2.99	120.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	78.37	21.9	143.9	186.5	450	CONCRETE	100D	0.60	232.8	61.78%	1.42	1.29
	23	15	0.00	0	0	0	0	76.04	9279	2.99	120.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	78.37	21.9	143.9	252.1	450	CONCRETE	100D	0.60	232.8	61.78%	1.42	1.29
	15	14	0.00	0	0	0	0	134.69	16437	2.74	195.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	137.02	38.4	235.3	208.0	450	CONCRETE	100D	2.50	475.3	49.51%	2.90	2.48
R14A	14	13	40.07	0	0	0	4889	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	40.07	177.09	49.6	294.1	93.6	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
	13	12	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	124.1	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
	12	11	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	456.3	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
	11	10	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	365.5	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
	10	9	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	93.2	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
	9	8	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	147.1	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
	8	7	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	223.7	525	CONCRETE	100D	0.80	405.6	72.52%	1.81	1.73
	7	6	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	171.7	525	CONCRETE	100D	0.80	405.6	72.52%	1.81	1.73
	6	5	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	182.2	525	CONCRETE	100D	1.60	573.5	51.28%	2.57	2.22
	5	4	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	287.5	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
	4	3	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	192.1	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
	3	2	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	116.4	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
	2	1	0.00	0	0	0	0	174.76	21326	2.62	242.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	294.1	28.5	525	CONCRETE	100D	0.60	351.2	83.74%	1.57	1.57
																												525							

Stantec

SUBDIVISION:

HRM - Highway 102 Study Area
Medium-Density Scenario

DATE: 2/13/2025
REVISION: 3
DESIGNED BY: WAJ
CHECKED BY: DCT

SANITARY SEWER DESIGN SHEET
(Halifax)

FILE NUMBER: 160410459

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	375 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	60,000 l/ha/day	MAXIMUM VELOCITY	4.50 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.35	INSTITUTIONAL	60,000 l/ha/day	MINIMUM COVER	1.60 m
PERSONS / TOWNHOME	3.35	INFILTRATION	0.28 l/s/Ha	HARMON CORRECTION FACTOR	1.00
PERSONS / MULTI-UNIT	2.25				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS MULTI	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
R22A	22	21	31.61	0	0	0	2234	31.61	2234	3.55	34.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	31.61	31.61	8.8	43.2	354.4	250	PVC	SDR 35	2.50	95.9	45.11%	1.93	1.60
	21	20	0.00	0	0	0	0	31.61	2234	3.55	34.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	31.61	8.8	43.2	390.0	300	PVC	SDR 35	0.60	74.4	58.15%	1.06	0.94
	20	19	0.00	0	0	0	0	31.61	2234	3.55	34.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	31.61	8.8	43.2	98.9	300	PVC	SDR 35	0.60	74.4	58.15%	1.06	0.94
R19A	19	18	27.05	0	0	0	1912	58.66	4146	3.32	59.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	27.05	58.66	16.4	76.1	313.9	375	PVC	SDR 35	0.60	125.7	60.57%	1.19	1.08
	18	17	0.00	0	0	0	0	58.66	4146	3.32	59.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	58.66	16.4	76.1	401.2	375	PVC	SDR 35	1.60	205.3	37.09%	1.95	1.51
	17	15	0.00	0	0	0	0	58.66	4146	3.32	59.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	58.66	16.4	76.1	127.5	375	PVC	SDR 35	1.60	205.3	37.09%	1.95	1.51
R39A	39	38	22.09	0	0	0	1561	22.09	1561	3.67	24.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	22.09	22.09	6.2	31.0	81.3	250	PVC	SDR 35	0.60	47.0	66.07%	0.95	0.88
	38	37	0.00	0	0	0	0	22.09	1561	3.67	24.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	31.0	46.7	250	PVC	SDR 35	0.60	47.0	66.07%	0.95	0.88
	37	36	0.00	0	0	0	0	22.09	1561	3.67	24.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	31.0	146.2	250	PVC	SDR 35	0.60	47.0	66.07%	0.95	0.88
	36	35	0.00	0	0	0	0	22.09	1561	3.67	24.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	31.0	46.7	250	PVC	SDR 35	0.60	47.0	66.07%	0.95	0.88
	35	34	0.00	0	0	0	0	22.09	1561	3.67	24.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	31.0	75.2	250	PVC	SDR 35	0.60	47.0	66.07%	0.95	0.88
	34	33	0.00	0	0	0	0	22.09	1561	3.67	24.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	31.0	164.7	250	PVC	SDR 35	0.60	47.0	66.07%	0.95	0.88
	33	32	0.00	0	0	0	0	22.09	1561	3.67	24.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	22.09	6.2	31.0	229.8	250	PVC	SDR 35	0.60	47.0	66.07%	0.95	0.88
R32A	32	31	17.81	0	0	0	1259	39.90	2820	3.47	42.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	17.81	39.90	11.2	53.6	185.9	250	PVC	SDR 35	1.00	60.6	88.37%	1.22	1.24
	31	30	0.00	0	0	0	0	39.90	2820	3.47	42.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	39.90	11.2	53.6	81.9	250	PVC	SDR 35	2.00	85.7	62.49%	1.73	1.58
	30	29	0.00	0	0	0	0	39.90	2820	3.47	42.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	39.90	11.2	53.6	87.6	250	PVC	SDR 35	3.00	105.0	51.02%	2.11	1.83
R44A	44	43	5.78	0	0	0	408	5.78	408	4.00	7.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	5.78	5.78	1.6	8.7	130.7	200	PVC	SDR 35	0.50	23.7	36.69%	0.75	0.58
	43	42	0.00	0	0	0	0	5.78	408	4.00	7.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	5.78	1.6	8.7	44.4	200	PVC	SDR 35	0.50	23.7	36.69%	0.75	0.58
	42	41	0.00	0	0	0	0	5.78	408	4.00	7.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	5.78	1.6	8.7	163.0	200	PVC	SDR 35	0.50	23.7	36.69%	0.75	0.58
	41	40	0.00	0	0	0	0	5.78	408	4.00	7.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	5.78	1.6	8.7	51.0	200	PVC	SDR 35	0.50	23.7	36.69%	0.75	0.58
	40	29	0.00	0	0	0	0	5.78	408	4.00	7.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	5.78	1.6	8.7	95.9	200	PVC	SDR 35	0.50	23.7	36.69%	0.75	0.58
I29A	29	28	0.00	0	0	0	0	45.68	3228	3.42	47.9	0.00	0.00	0.00	0.00	0.00	0.00	2.33	2.33	0.00	0.00	1.6	2.33	48.01	13.4	62.9	291.0	250	PVC	SDR 35	2.35	92.9	67.69%	1.87	1.75
	28	27	0.00	0	0	0	0	45.68	3228	3.42	47.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	48.01	13.4	62.9	68.3	300	PVC	SDR 35	1.20	105.2	59.82%	1.49	1.35
	27	26	0.00	0	0	0	0	45.68	3228	3.42	47.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	48.01	13.4	62.9	104.1	300	PVC	SDR 35	1.20	105.2	59.82%	1.49	1.35
R26A	26	25	30.36	0	0	0	2145	76.04	5374	3.22	75.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	30.36	78.37	21.9	98.6	363.4	300	PVC	SDR 35	3.50	179.6	54.87%	2.55	2.24
	25	24	0.00	0	0	0	0	76.04	5374	3.22	75.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	78.37	21.9	98.6	143.2	375	PVC	SDR 35	0.60	125.7	78.40%	1.19	1.17
	24	23	0.00	0	0	0	0	76.04	5374	3.22	75.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	78.37	21.9	98.6	186.5	375	PVC	SDR 35	0.60	125.7	78.40%	1.19	1.17
	23	15	0.00	0	0	0	0	76.04	5374	3.22	75.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	78.37	21.9	98.6	252.1	375	PVC	SDR 35	0.60	125.7	78.40%	1.19	1.17
	15	14	0.00	0	0	0	0	134.69	9519	2.98	123.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	137.02	38.4	162.9	208.0	375	PVC	SDR 35	2.50	256.6	63.49%	2.43	2.25
R14A	14	13	40.07	0	0	0	2832	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	40.07	177.09	49.6	204.7	93.6	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
	13	12	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	124.1	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
	12	11	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	456.3	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
	11	10	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	365.5	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
	10	9	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	93.2	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
	9	8	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	147.1	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
	8	7	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	223.7	525	CONCRETE	100D	0.80	405.6	50.47%	1.81	1.55
	7	6	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	171.7	525	CONCRETE	100D	0.80	405.6	50.47%	1.81	1.55
	6	5	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	182.2	525	CONCRETE	100D	1.60	573.5	35.69%	2.57	1.97
	5	4	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	287.5	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
	4	3	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	192.1	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
	3	2	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	116.4	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
	2	1	0.00	0	0	0	0	174.76	12351	2.86	153.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6	0.00	177.09	49.6	204.7	28.5	525	CONCRETE	100D	0.60	351.2	58.28%	1.57	1.40
																												525							

Stantec

SUBDIVISION:

HRM - Highway 102 Study Area
Low-Density Scenario

DATE: 2/13/2025
REVISION: 3
DESIGNED BY: WAJ
CHECKED BY: DCT

SANITARY SEWER DESIGN SHEET
(Halifax)

FILE NUMBER: 160410459

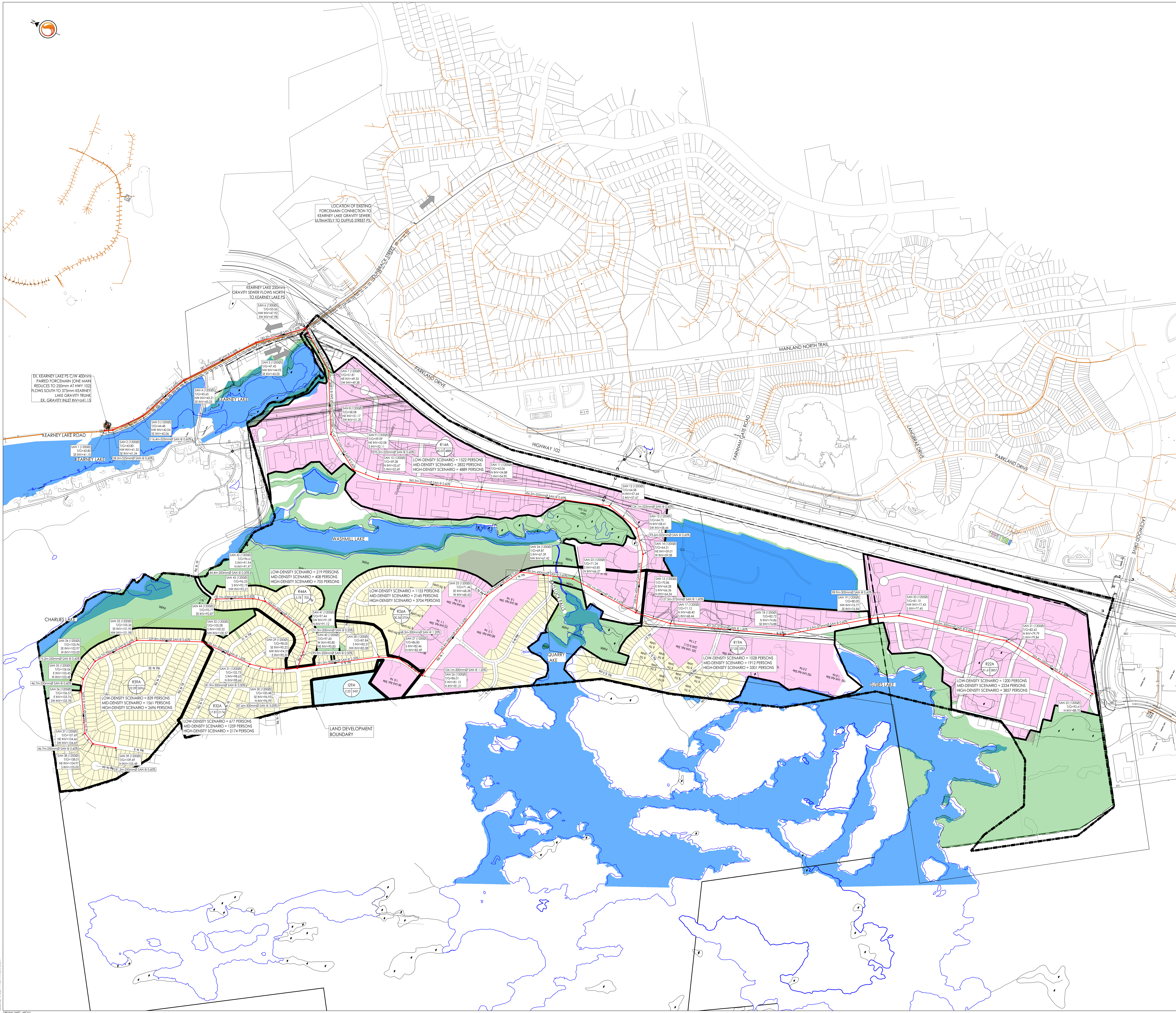
DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	375 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	60,000 l/ha/day	MAXIMUM VELOCITY	4.50 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.35	INSTITUTIONAL	60,000 l/ha/day	MINIMUM COVER	1.60 m
PERSONS / TOWNHOME	3.35	INFILTRATION	0.28 l/s/Ha	HARMON CORRECTION FACTOR	1.00
PERSONS / MULTI-UNIT	2.25				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS MULTI	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)
R22A	22	21	31.61	0	0	0	1200	31.61	1200	3.75	19.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	21	20	0.00	0	0	0	0	31.61	1200	3.75	19.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	20	19	0.00	0	0	0	0	31.61	1200	3.75	19.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
R19A	19	18	27.05	0	0	0	1028	58.66	2228	3.55	34.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	18	17	0.00	0	0	0	0	58.66	2228	3.55	34.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	17	15	0.00	0	0	0	0	58.66	2228	3.55	34.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
R39A	39	38	22.09	0	0	0	839	22.09	839	3.85	14.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	38	37	0.00	0	0	0	0	22.09	839	3.85	14.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	37	36	0.00	0	0	0	0	22.09	839	3.85	14.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	36	35	0.00	0	0	0	0	22.09	839	3.85	14.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	35	34	0.00	0	0	0	0	22.09	839	3.85	14.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	34	33	0.00	0	0	0	0	22.09	839	3.85	14.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	33	32	0.00	0	0	0	0	22.09	839	3.85	14.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
R32A	32	31	17.81	0	0	0	677	39.90	1516	3.68	24.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	31	30	0.00	0	0	0	0	39.90	1516	3.68	24.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	30	29	0.00	0	0	0	0	39.90	1516	3.68	24.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
R44A	44	43	5.78	0	0	0	219	5.78	219	4.00	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	43	42	0.00	0	0	0	0	5.78	219	4.00	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	42	41	0.00	0	0	0	0	5.78	219	4.00	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	41	40	0.00	0	0	0	0	5.78	219	4.00	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	40	29	0.00	0	0	0	0	5.78	219	4.00	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
I29A	29	28	0.00	0	0	0	0	45.68	1735	3.63	27.4	0.00	0.00	0.00	0.00	0.00	0.00	2.33	2.33	0.00	0.00	1.6
	28	27	0.00	0	0	0	0	45.68	1735	3.63	27.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	27	26	0.00	0	0	0	0	45.68	1735	3.63	27.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
R26A	26	25	30.36	0	0	0	1153	76.04	2888	3.46	43.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	25	24	0.00	0	0	0	0	76.04	2888	3.46	43.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	24	23	0.00	0	0	0	0	76.04	2888	3.46	43.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	23	15	0.00	0	0	0	0	76.04	2888	3.46	43.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	15	14	0.00	0	0	0	0	134.69	5116	3.24	71.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
R14A	14	13	40.07	0	0	0	1522	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	13	12	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	12	11	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	11	10	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	10	9	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	9	8	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	8	7	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	7	6	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	6	5	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	5	4	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	4	3	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	3	2	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6
	2	1	0.00	0	0	0	0	174.76	6638	3.13	90.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	1.6

LOCATION			INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
R22A	22	21	31.61	31.61	8.8	28.4	354.4	200	PVC	SDR 35	2.50	52.9	**53.67%**	1.66	1.45
	21	20	0.00	31.61	8.8	28.4	390.0	250	PVC	SDR 35	0.60	47.0	**60.42%**	0.95	0.86
	20	19	0.00	31.61	8.8	28.4	98.9	250	PVC	SDR 35	0.60	47.0	**60.42%**	0.95	0.86
R19A	19	18	27.05	58.66	16.4	50.7	313.9	300	PVC	SDR 35	0.60	74.4	**68.23%**	1.06	0.99
	18	17	0.00	58.66	16.4	50.7	401.2	300	PVC	SDR 35	1.60	121.5	**41.78%**	1.73	1.40
	17	15	0.00	58.66	16.4	50.7	127.5	300	PVC	SDR 35	1.60	121.5	**41.78%**	1.73	1.40
R39A	39	38	22.09	22.09	6.2	20.2	81.3	200	PVC	SDR 35	0.60	25.9	**77.99%**	0.81	0.80
	38	37	0.00	22.09	6.2	20.2	46.7	200	PVC	SDR 35	0.60	25.9	**77.99%**	0.81	0.80
	37	36	0.00	22.09	6.2	20.2	146.2	200	PVC	SDR 35	0.60	25.9	**77.99%**	0.81	0.80
	36	35	0.00	22.09	6.2	20.2	46.7	200	PVC	SDR 35	0.60	25.9	**77.99%**	0.81	0.80
	35	34	0.00	22.09	6.2	20.2	75.2	200	PVC	SDR 35	0.60	25.9	**77.99%**	0.81	0.80
	34	33	0.00	22.09	6.2	20.2	164.7	200	PVC	SDR 35	0.60	25.9	**77.99%**	0.81	0.80
	33	32	0.00	22.09	6.2	20.2	229.8	200	PVC	SDR 35	0.60	25.9	**77.99%**	0.81	0.80
R32A	32	31	17.81	39.90	11.2	35.4	185.9	250	PVC	SDR 35	1.00	60.6	**58.31%**	1.22	1.09
	31	30	0.00	39.90	11.2	35.4	81.9	250	PVC	SDR 35	2.00	85.7	**41.23%**	1.73	1.39
	30	29	0.00	39.90	11.2	35.4	87.6	250	PVC	SDR 35	3.00	105.0	**33.67%**	2.11	1.61
R44A	44	43	5.78	5.78	1.6	5.4	130.7	200	PVC	SDR 35	0.50	23.7	**22.87%**	0.75	0.50
	43	42	0.00	5.78	1.6	5.4	44.4	200	PVC	SDR 35	0.50	23.7	**22.87%**	0.75	0.50
	42	41	0.00	5.78	1.6	5.4	163.0	200	PVC	SDR 35	0.50	23.7	**22.87%**	0.75	0.50
	41	40	0.00	5.78	1.6	5.4	51.0	200	PVC	SDR 35	0.50	23.7	**22.87%**	0.75	0.50
	40	29	0.00	5.78	1.6	5.4	95.9	200	PVC	SDR 35	0.50	23.7	**22.87%**	0.75	0.50
I29A	29	28	2.33	48.01	13.4	42.4	291.0	250	PVC	SDR 35	2.35	92.9	**45.64%**	1.87	1.55
	28	27	0.00	48.01	13.4	42.4	68.3	250	PVC	SDR 35	1.20	66.4	**63.87%**	1.34	1.23
	27	26	0.00	48.01	13.4	42.4	104.1	250	PVC	SDR 35	1.20	66.4	**63.87%**	1.34	1.23
R26A	26	25	30.36	78.37	21.9	66.9	363.4	250	PVC	SDR 35	3.50	113.4	**58.97%**	2.28	2.06
	25	24	0.00	78.37	21.9	66.9	143.2	375	PVC	SDR 35	0.60	125.7	**53.20%**	1.19	1.04
	24	23	0.00	78.37	21.9	66.9	186.5	375	PVC	SDR 35	0.60	125.7	**53.20%**	1.19	1.04
	23	15	0.00	78.37	21.9	66.9	252.1	375	PVC	SDR 35	0.60	125.7	**53.20%**	1.19	1.04
	15	14	0.00	137.02	38.4	111.8	208.0	375	PVC	SDR 35	2.50	256.6	**43.58%**	2.43	2.00
R14A	14	13	40.07	177.09	49.6	141.3	93.6	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
	13	12	0.00	177.09	49.6	141.3	124.1	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
	12	11	0.00	177.09	49.6	141.3	456.3	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
	11	10	0.00	177.09	49.6	141.3	365.5	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
	10	9	0.00	177.09	49.6	141.3	93.2	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
	9	8	0.00	177.09	49.6	141.3	147.1	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
	8	7	0.00	177.09	49.6	141.3	223.7	450	CONCRETE	100D	0.80	268.9	**52.57%**	1.64	1.43
	7	6	0.00	177.09	49.6	141.3	171.7	450	CONCRETE	100D	0.80	268.9	**52.57%**	1.64	1.43
	6	5	0.00	177.09	49.6	141.3	182.2	450	CONCRETE	100D	1.60	380.2	**37.17%**	2.32	1.80
	5	4	0.00	177.09	49.6	141.3	287.5	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
	4	3	0.00	177.09	49.6	141.3	192.1	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
	3	2	0.00	177.09	49.6	141.3	116.4	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
	2	1	0.00	177.09	49.6	141.3	28.5	450	CONCRETE	100D	0.60	232.8	**60.71%**	1.42	1.29
								450							

Appendix C Drawings

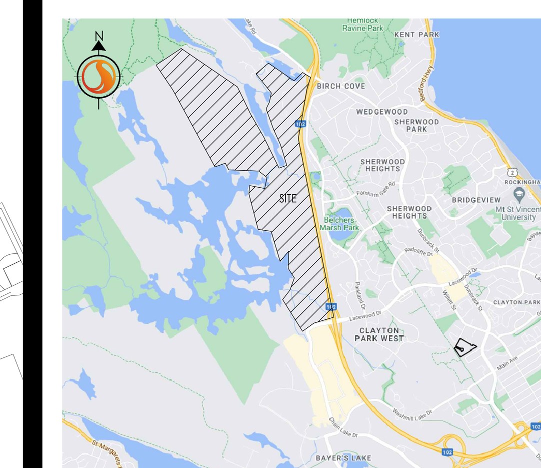


Stantec

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

Legend

- CONCEPTUAL RESIDENTIAL AREA
- CONCEPTUAL INSTITUTIONAL AREA
- CONCEPTUAL LANDSCAPED/PARK AREA
- CONCEPTUAL WATER BODY AREA
- SA24A / 0.38 / 34 — SANITARY DRAINAGE AREA ID#; POPULATION; SANITARY DRAINAGE AREA ha.
- SANITARY DRAINAGE AREA
- PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER
- EXISTING SANITARY SEWER
- EXISTING FORCEMAIN
- EXISTING FLOW DIRECTION
- EXISTING PHASE
- STUDY AREA



KEY PLAN
N.T.S.

Notes

1. TOTAL DEVELOPMENT POPULATIONS PER DRAFT REPORT DEVELOPMENT SCENARIO - HIGHWAY 102 WEST CORRIDOR PREPARED BY STANTEC CONSULTING, AND EVENLY DISTRIBUTED OVER DEVELOPMENT AREA.
   - AVERAGE HOUSEHOLD SIZE = 2.3
   - LOW-DENSITY = 6,638 PERSONS
   - MID-DENSITY = 12,351 PERSONS
   - HIGH-DENSITY (DEVELOPER PROPOSED) = 21,326 PERSONS

Revision		By	Appd.	YY.MM.DD
3	REVISED POPULATION DENSITIES	WAJ	DCT	25.02.13
2	REVISED AS PER CITY COMMENTS	WAJ	AMP	24.10.28
1	ISSUED FOR REVIEW	WAJ	DCT	24.05.17

File Name: 160410459-DB (Hwy 102).dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	WAJ	DCT	WAJ	24.01.25

Permit-Seal

Client/Project
HALIFAX REGIONAL MUNICIPALITY

Future Serviced Communities
Highway 102
Halifax, Nova Scotia

Title
HIGHWAY 102 CONCEPTUAL SANITARY DRAINAGE PLAN

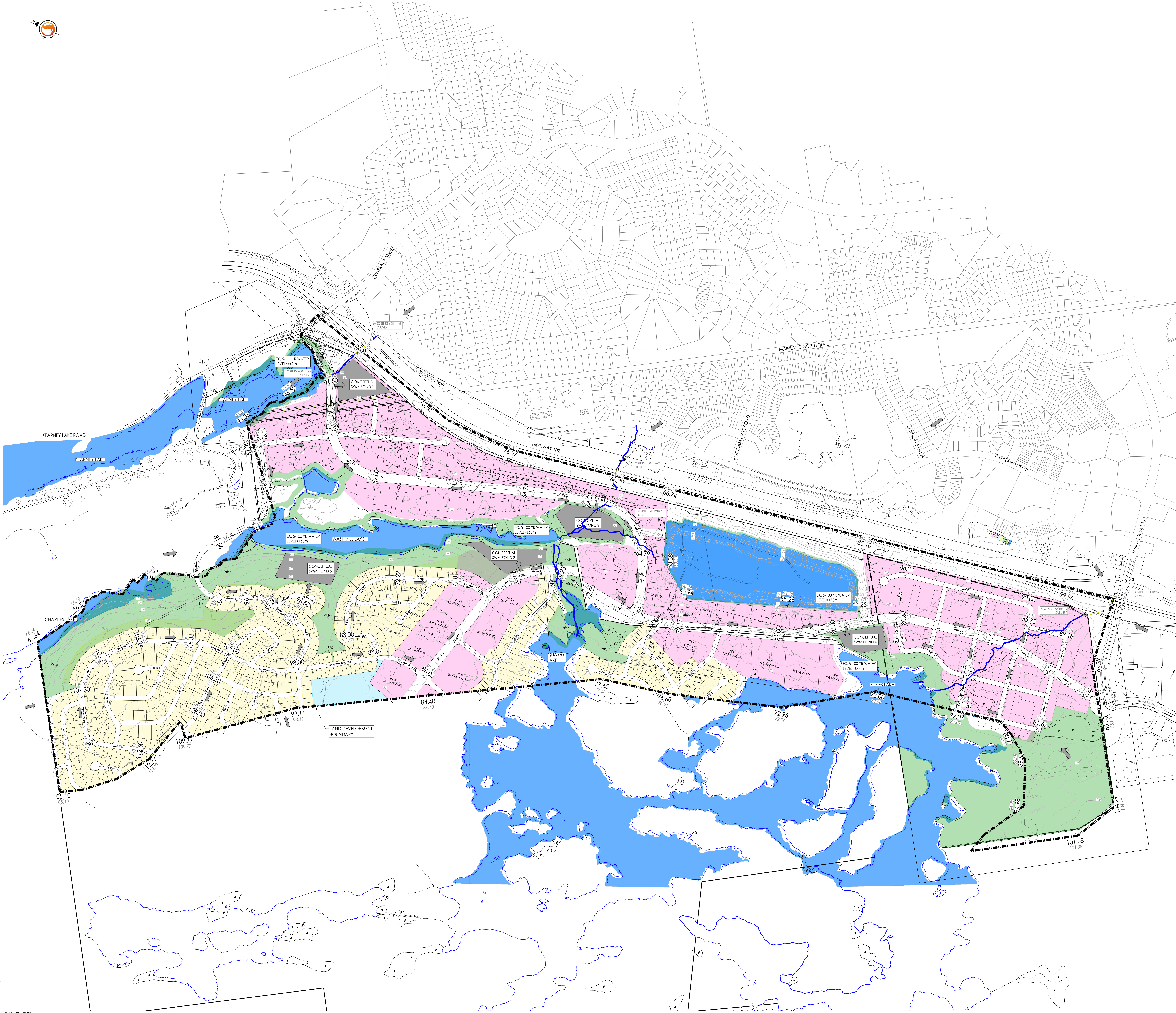
Project No. 160410459

Scale 1:4000 (0 40 120 200m)

Drawing No. SA-1

Sheet 1 of 2

Revision 3



Stantec

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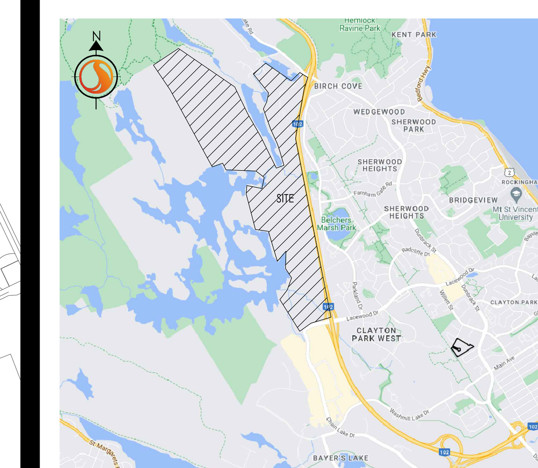
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

Legend

- CONCEPTUAL RESIDENTIAL AREA
- CONCEPTUAL INSTITUTIONAL AREA
- CONCEPTUAL LANDSCAPED/PARK AREA
- CONCEPTUAL WATER BODY AREA
- 99.99 PROPOSED ELEVATION
- 2.0% FLOW DIRECTION AND GRADE
- DIRECTION OF OVERLAND FLOW
- EXISTING MAJOR (10m) CONTOUR
- EXISTING MINOR (5m) CONTOUR
- STUDY AREA



KEY PLAN
N.T.S.

Notes
1. CONTOUR INTERVAL IS 5.0m

Revision		By	Appd.	YY.MM.DD
3	REVISED POPULATION DENSITIES	WAJ	DCT	25.02.13
2	REVISED AS PER CITY COMMENTS	WAJ	AMP	24.10.28
1	ISSUED FOR REVIEW	WAJ	DCT	24.05.17

File Name: 160410459-DB (Hwy 102).dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	WAJ	DCT	WAJ	24.01.25

Permit-Seal

Client/Project
HALIFAX REGIONAL MUNICIPALITY

Future Serviced Communities
Highway 102
Halifax, Nova Scotia

Title
HIGHWAY 102 CONCEPTUAL GRADING PLAN

Project No. 160410459
Scale 1:4000 (0, 40, 120, 200m)

Drawing No. GP-1
Sheet 2 of 2
Revision 3