
EXHIBITION PARK DEVELOPMENT AREA

Municipal Servicing - Design Brief

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Prepared for

Meghan Maund,
Planner III

Halifax Regional Municipality

PO Box 1749
Halifax, Nova Scotia
A1A 1A1

Submitted By

Fathom Studios
40 King Street
Dartmouth, NS
B2Y 2R4



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1.0 INTRODUCTION AND CONTEXT

Exhibition Park located at 200 Prospect Road in Goodwood, Nova Scotia, currently serves as a prominent venue for a variety of events including agricultural fairs, trade shows, concerts, and other community gatherings throughout the year. The space is versatile, catering to both large-scale exhibitions and smaller intimate events. Some of its notable events include trade shows like the Halifax RV Show, the Halifax International Boat Show, and the Spring Ideal Home Show, which draw significant crowds and offer specialized product showcases.

To support the developments traffic, three access roads will connect to Prospect Road, which currently serves as the primary access point to the site. The project will feature a blend of residential, commercial, and recreational spaces, with plans for significant infrastructure upgrades and enhancements to support the growing community.

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1.2 — Existing Conditions

Exhibition Park is currently connected to existing sanitary (shown in **ORANGE** in the figure below), storm sewer networks (shown in **GREEN**), and domestic and fire water services (shown in **CYAN** and **BLUE**). The RED lines in the figure show the approximate boundaries of the development lands.

Water and Sanitary services extend south from the St. Margarets Bay Road and Ragged Lake Business Park area, while stormwater services are rural in nature and therefore local to the site. These existing services run along Prospect Road and enter the site at two distinctly different locations as shown.

The site also includes various paved roads and expansive parking lots. The northern portion of the site hosts several businesses, such as Tim Hortons, a gas station, and car wash. While these establishments are expected to remain, future detailed design work will determine if these services will be reconnected to new municipal roadway infrastructure, or remain in their current arrangement.

The existing Exhibition Centre, centrally located within the development site, is slated for demolition to facilitate new construction, though various options for development phasing may be pursued that may allows the Centre to continue operations alongside early stages of development. Again, phasing of development will dictate the need for new services, maintenance of existing services and the eventual decommissioning of the existing utilities servicing the Exhibition Centre.



2.0 SANITARY SEWER

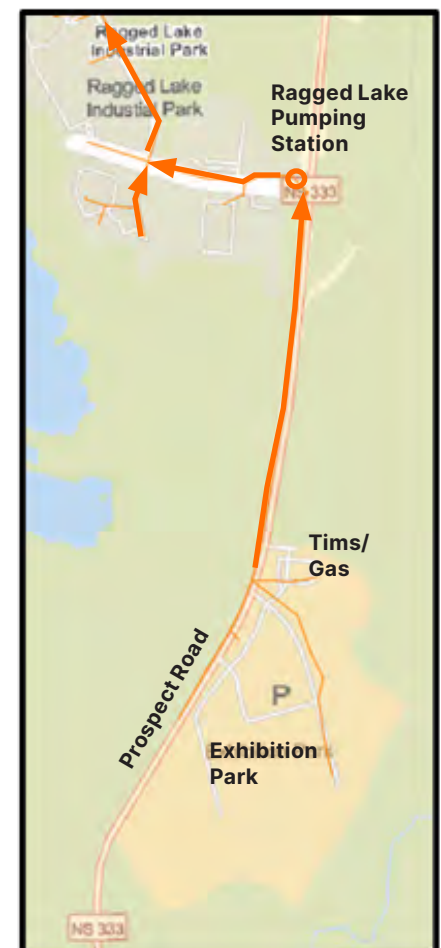
2.1 — Existing Conditions

The development area is serviced by a existing 375 mm PVC sanitary main on Prospect Road that was installed in about 1996 and is operated and maintained by Halifax Water. Exhibition Park is currently serviced by a 200 mm PVC pipe that connects to the Prospect Road main and was installed in 2020. The first section of this pipe within the road right-of-way is identified as being owned and operated by Halifax Water, with the remaining pipe extending into the development being identified as a private sanitary network. Despite the relatively low elevations of the Exhibition Park building, the pipes are graded to accommodate gravity flows to the connection point on Prospect Road.

The Tim Hortons and gas station in the northern part of the site are connected to the same Prospect Road sanitary main via a 150 mm PVC pipe installed in 2022 during construction of the commercial site. Similar to the Exhibition Park connection, pipe sections within the road ROW are owned by Halifax Water with the remaining sections being privately owned and maintained.

The sanitary sewer network on Prospect Road flows downstream for approximately 1,150 meters from Exhibition Park to the Ragged Lake Business Park pumping station through the 375 mm PVC pipe. From the Ragged Lake station, sewage is pumped upgrade along Rocky Lake Boulevard to Grassy Lake Drive where it again flows by gravity into Bayers Lake through 525 and 600mm pipes.

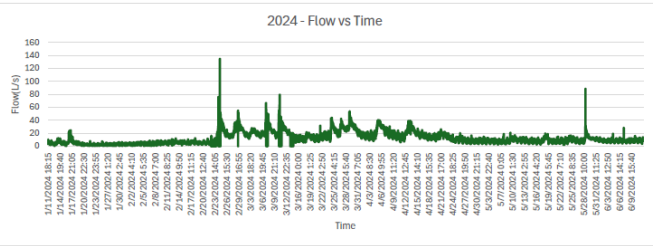
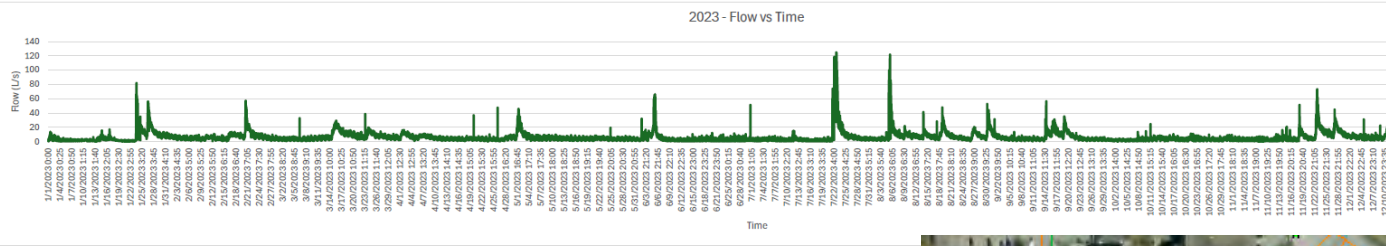
These downstream network components are discussed in greater detail in the Downstream Wastewater Analysis section of this report.



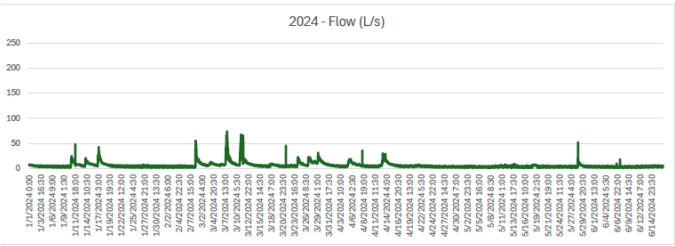
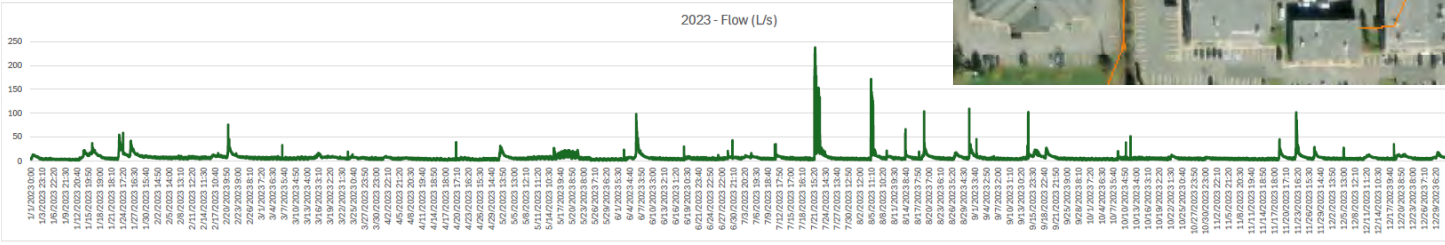
Existing Flow Monitoring Data

A request was submitted to Halifax Water for flow meter data from the following locations: FG459, FG161, FG656, and FG194. Halifax Water indicated that flow meters FG194 and FG161 (just upstream of the Ragged Lake pumping station) have been removed from service. However, data was provided for flow meters FG459 and FG656, both located near the Bayers Lake Pumping Station well downstream of Exhibition Park. FG656 is located on the sanitary mains carrying flows from the Exhibition Park and Ragged Lake areas, and FG459 is located just downstream of FG656 where flows connect with a larger Bayers Lake sewershed. The below figures show the flow vs time graphs for 2023 and part of 2024.

- **FG459:** Located on Chain Lake Drive, just before the inverted siphon in Bayers Lake. This flow meter has recorded an average flow of 7.9 L/s.



- **FG656:** Near Chain Lake Drive, average flow of 6.9 L/s.



Note* The high peak flows observed in the 2023 flow data graphs occurred between July and August 2023. These peaks are believed to have been caused by the 1:100-year rainstorm event on July 21, 2023, which resulted in 250 mm of rain over a 24-hour period. Other major peak periods are associated with other significant rainfall events. All major events show relatively quick recovery periods suggesting the majority of peak flows is associated with directly inflow into the pipe network as opposed to longer term infiltration.

2.2 — Future Conditions

Exhibition Park can be divided into four distinct sewersheds (A to D) as shown in the figure on the following page. Due to the topography of the lands, the sanitary network will require three pumping stations along with the installation of sewer mains and all building services. It is anticipated that all piping will be PVC with a minimum diameter of 250 mm in accordance with the “Halifax Water Specifications” (Section 4.2.2.4). Pipe sizes may be increased as needed during the future detailed design process. Below is a description of the preliminary design flows for each sewer shed and associated infrastructure, including wet weather allowances.

Sewer Shed A (Northern Area)

- Residential Units: 160
- Estimated Design Flow: 6.47 L/s
- Sewer Pipe: 150 mm PVC pipe
- Capacity at Peak Flow: 37%
- Connection: The sewer lateral for this shed will connect directly to the 375 mm sanitary sewer main located along Prospect Road.

Sewer Shed B (Northeastern Area)

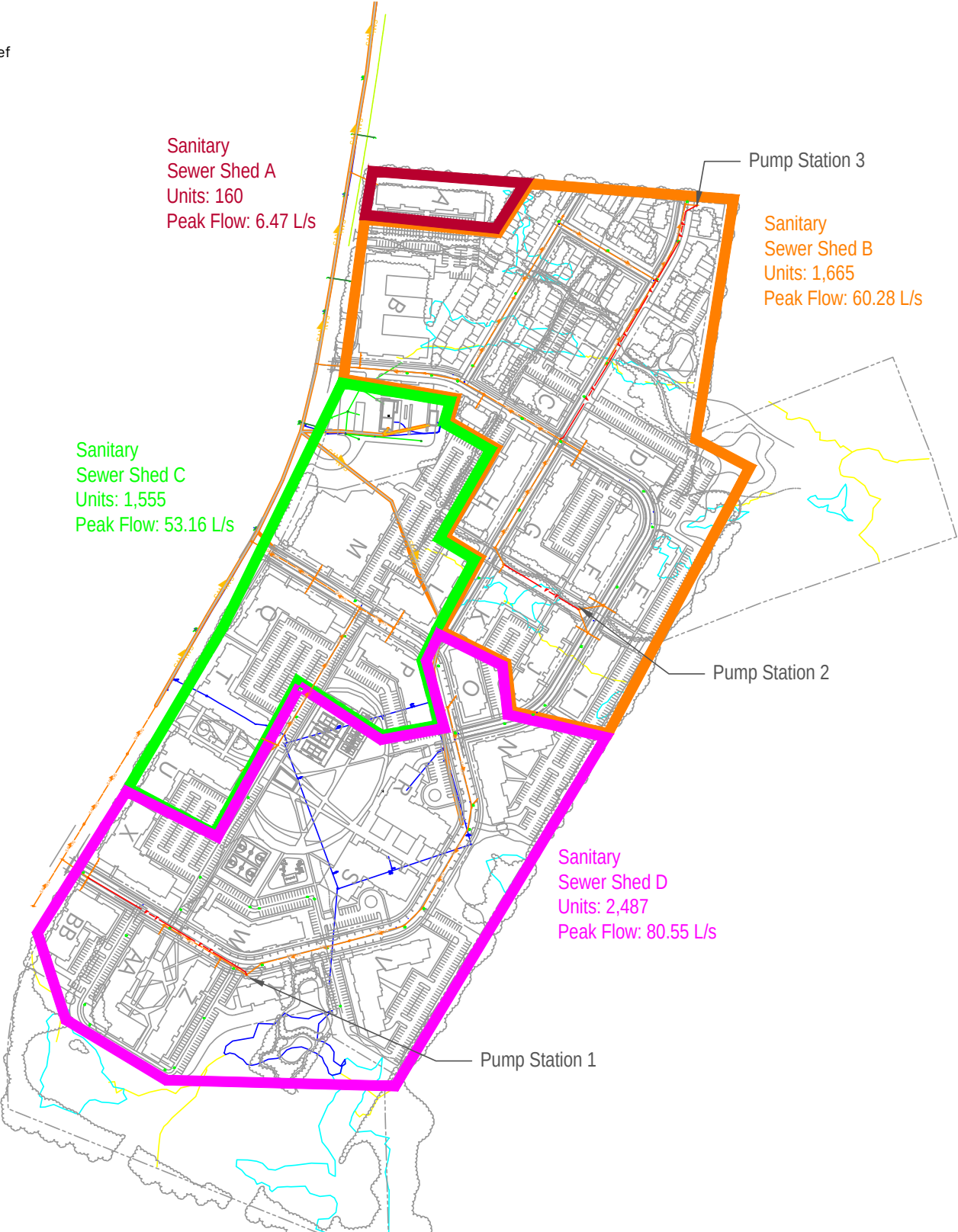
- Residential Units: 1,665
- Estimated Design Flow: 60.28 L/s
- Sewer Pipe: 250 mm PVC pipe
- Capacity at Peak Flow: 87%
- Pumping Station: Two pumping stations, PS-2 and PS-3, will be required to service this sewer shed. PS-3 will collect sewage from roads NS-2, N-Cross, and the northern end of NS-1. Located at the north end of road NS-1, it will pump sewage southward to a manhole (SAN MH603) located on Second Loop Street. From there, it will be gravity-fed to the 375 mm Prospect Road sewer main. Pumping Station 2 will collect sewage from buildings E, F, I, and J. It will pump the sewage to NS-1, from where it will be gravity-fed to Second Loop and discharged into the Prospect Road sewer main.

Sewer Shed C (Central West Area)

- Residential Units: 1,555
- Estimated Design Flow: 53.16 L/s
- Sewer Pipe: 250 mm PVC pipe
- Capacity at Peak Flow: 77%
- Connection: This sewer shed will be gravity-fed and will discharge directly into the Prospect Road sewer main.

Sewer Shed D (Southern Area)

- Residential Units: 2,487
- Estimated Design Flow: 80.55 L/s
- Sewer Pipe: 300 mm PVC pipe
- Capacity at Peak Flow: 72%
- Pumping Station: The entire sewer shed will be gravity-fed to Pumping Station 1, located adjacent to building “Y”. From Pumping Station 1, the sewage will be discharged into the Prospect Road sewer main.



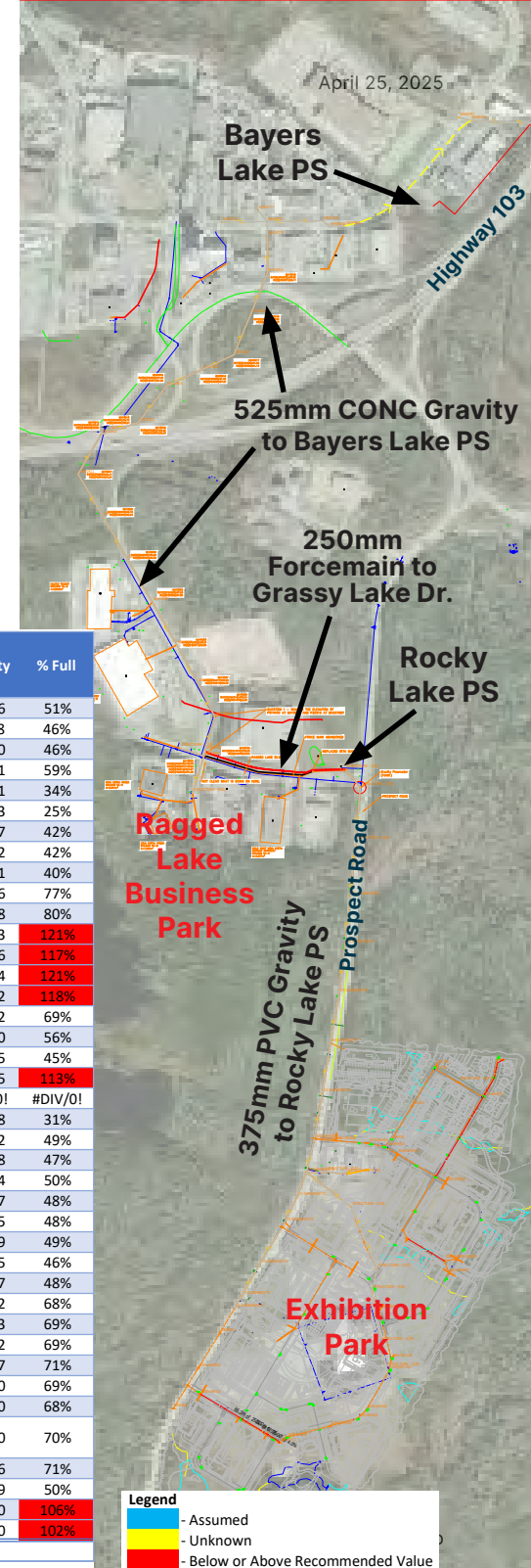
2.3 — Downstream Wastewater Analysis

The table below summarizes the detailed calculations for the downstream sanitary sewer analysis and the figure to the right shows the extent of the downstream analysis as requested by Halifax Water. This network extends from Exhibition Park, through the Ragged Lake Business Park, across Highway 103 and to the Bayers Lake Pumping Station, located on the south side of Chain Lake Drive about 500 meters east of Lakelands Boulevard in the Park.

Key findings from the downstream wastewater analysis include:

1. The existing PVC pipes along Prospect Road were installed in 1996 and the concrete pipes through Ragged Lake were installed in 1989 indicated that the pipes are relatively early in their life cycle and should be in adequate conditions for the foreseeable future. No CCTV video was provided at this stage of the development to confirm conditions, and it is recommended that CCTV video be obtained prior to detailed design.

Input Flow	Pipe #	Location Street	MH From	MH To	From Invert (m)	To Invert (m)	Length (m)	Pipe Size (mm)	Pipe Area (m ²)	Wetted Perimeter (m)	Hydraulic Radius	Pipe Slope (%)	Pipe Material	Manning "n"	Peak Wet Weather Flow (L/s)	Cum Peak Wet Flow (L/s)	Velocity (m/s)	Pipe Capacity (L/s)	% Full
D	SAN PIPE 100	Main Loop	SAN MH100	SAN MH5001	107.560	107.410	31.550	375	0.110	1.178	0.09375	0.48%	PVC	0.010	80.55	80.55	1.42	157.16	51%
-	SAN PIPE 5001	Prospect	SAN MH5002	SAN MH5002	106.320	105.780	90.590	375	0.110	1.178	0.09375	0.60%	PVC	0.010	0.00	80.55	1.59	175.98	46%
-	SAN PIPE 5002	Prospect	SAN MH5002	EX SANMH50769	105.750	105.200	91.410	375	0.110	1.178	0.09375	0.60%	PVC	0.010	0.00	80.55	1.60	176.80	46%
-	EX P509946	Prospect	EX SANMH50769	EX SANMH50770	105.190	105.080	30.220	375	0.110	1.178	0.09375	0.36%	PVC	0.010	0.00	80.55	1.25	137.51	59%
-	EX P509947	Prospect	EX SANMH50770	EX SANMH50771	104.880	104.060	74.140	375	0.110	1.178	0.09375	1.11%	PVC	0.010	0.00	80.55	2.17	239.71	34%
-	EX P509948	Prospect	EX SANMH50771	SAN MH5003	104.030	102.290	87.820	375	0.110	1.178	0.09375	1.98%	PVC	0.010	0.00	80.55	2.90	320.83	25%
C	san pipe 5004	Prospect	SAN MH5003	EX SANMH50772	102.280	102.060	11.470	375	0.110	1.178	0.09375	1.92%	PVC	0.010	53.16	133.71	2.86	315.67	42%
-	EX P509949	Prospect	EX SANMH50772	EX SANMH50773	102.040	100.910	57.610	375	0.110	1.178	0.09375	1.96%	PVC	0.010	0.00	133.71	2.89	319.22	42%
-	EX P509950	Prospect	EX SANMH50773	EX SANMH50774	100.880	99.760	52.850	375	0.110	1.178	0.09375	2.12%	PVC	0.010	0.00	133.71	3.00	331.81	40%
-	EX P509951	Prospect	EX SANMH50774	EX SANMH50775	98.950	98.590	62.450	375	0.110	1.178	0.09375	0.58%	PVC	0.010	0.00	133.71	1.57	173.06	77%
-	SAN Pipe 5005	Prospect	EX SANMH50775	SAN MH5005	98.560	98.520	7.400	375	0.110	1.178	0.09375	0.54%	PVC	0.010	0.00	133.71	1.52	167.58	80%
B	EX P509952	Prospect	SAN MH5005	EX SANMH50776	98.470	98.010	93.670	375	0.110	1.178	0.09375	0.49%	PVC	0.010	60.28	193.99	1.45	159.73	121%
-	EX P509953	Prospect	EX SANMH50776	EX SANMH50777	97.980	97.430	103.490	375	0.110	1.178	0.09375	0.53%	PVC	0.010	0.00	193.99	1.50	166.16	117%
A	EX P509954	Prospect	EX SANMH50777	EX SANMH50778	97.400	96.850	103.390	375	0.110	1.178	0.09375	0.53%	PVC	0.010	6.47	200.45	1.51	166.24	121%
-	EX P509955	Prospect	EX SANMH50778	EX SANMH50779	96.820	96.270	98.960	375	0.110	1.178	0.09375	0.56%	PVC	0.010	0.00	200.45	1.54	169.92	118%
-	EX P509956	Prospect	EX SANMH50779	EX SANMH50780	96.240	94.650	98.890	375	0.110	1.178	0.09375	1.61%	PVC	0.010	0.00	200.45	2.62	289.02	69%
-	EX P509957	Prospect	EX SANMH50780	EX SANMH50781	94.620	91.860	112.000	375	0.110	1.178	0.09375	2.46%	PVC	0.010	0.00	200.45	3.24	357.80	56%
-	EX P509958	Prospect	EX SANMH50781	EX SANMH50766	91.830	87.680	109.490	375	0.110	1.178	0.09375	3.79%	PVC	0.010	0.00	200.45	4.02	443.75	45%
RL - A	EX P509913	Ragged Lake	EX SANMH50766/762 (Pumping St		87.330	87.050	45.990	375	0.110	1.178	0.09375	0.61%	PVC	0.010	1.05	201.50	1.61	177.85	113%
-	EX P509916	Ragged Lake	T762 (Pumping St	EX SANMH50768				250	0.049	0.785	0.0625	#DIV/0!	PVC	0.010	0.00	201.50	#DIV/0!	#DIV/0!	#DIV/0!
RL - B	EX P514476	Grassy Lake Dr	EX SANMH50768	EX SANMH10906		100.910	71.900	600	0.283	1.885	0.15	1.10%	Concrete	0.013	1.03	202.53	2.28	643.98	31%
-	EX P29316	Grassy Lake Dr	EX SANMH10906	EX SANMH10907	100.040	99.330	75.620	525	0.216	1.649	0.13125	0.94%	Concrete	0.013	0.00	202.53	1.93	416.72	49%
-	EX P29317	Grassy Lake Dr	EX SANMH10907	EX SANMH10908	99.290	98.380	89.160	525	0.216	1.649	0.13125	1.02%	Concrete	0.013	0.00	202.53	2.01	434.48	47%
RL - C	EX P29325	Grassy Lake Dr	EX SANMH10908	EX SANMH10909	98.310	97.380	100.240	525	0.216	1.649	0.13125	0.93%	Concrete	0.013	3.54	206.07	1.91	414.24	50%
RL - D	EX P29326	Grassy Lake Dr	EX SANMH10909	EX SANMH10910	97.290	96.290	99.720	525	0.216	1.649	0.13125	1.00%	Concrete	0.013	1.76	207.83	1.99	430.67	48%
-	EX P29343	Grassy Lake Dr	EX SANMH10910	EX SANMH10921	96.240	95.240	100.330	525	0.216	1.649	0.13125	1.00%	Concrete	0.013	0.00	207.83	1.98	429.35	48%
-	EX P29344	Grassy Lake Dr	EX SANMH10921	EX SANMH10911	95.190	94.210	100.260	525	0.216	1.649	0.13125	0.98%	Concrete	0.013	0.00	207.83	1.96	425.19	49%
-	EX P29335	HWY 103	EX SANMH10911	EX SANMH10912	94.110	93.090	92.810	525	0.216	1.649	0.13125	1.10%	Concrete	0.013	0.00	207.83	2.08	450.85	46%
-	EX P29336	HWY 103	EX SANMH10912	EX SANMH10913	93.010	92.810	20.130	525	0.216	1.649	0.13125	0.99%	Concrete	0.013	0.00	207.83	1.98	428.67	48%
-	EX P29337	HWY 3 RAMP	EX SANMH10913	EX SANMH10914	92.760	92.460	58.980	525	0.216	1.649	0.13125	0.51%	Concrete	0.013	0.00	207.83	1.42	306.72	68%
-	EX P29327	HWY 3 RAMP	EX SANMH10914	EX SANMH10915	92.420	91.960	94.010	525	0.216	1.649	0.13125	0.49%	Concrete	0.013	0.00	207.83	1.39	300.83	69%
-	EX P29328	HWY 3 RAMP	EX SANMH10915	EX SANMH10916	91.910	91.510	80.890	525	0.216	1.649	0.13125	0.49%	Concrete	0.013	0.00	207.83	1.40	302.42	69%
-	EX P29329	HWY 3 RAMP	EX SANMH10916	EX SANMH10917	91.460	91.130	70.290	525	0.216	1.649	0.13125	0.47%	Concrete	0.013	0.00	207.83	1.36	294.67	71%
-	EX P29330	HWY 3 RAMP	EX SANMH10917	EX SANMH10918	91.050	90.610	88.990	525	0.216	1.649	0.13125	0.49%	Concrete	0.013	0.00	207.83	1.40	302.40	69%
-	EX P29331	HWY 3	EX SANMH10918	EX SANMH10919	90.560	90.110	90.180	525	0.216	1.649	0.13125	0.50%	Concrete	0.013	0.00	207.83	1.40	303.80	68%
-	EX P29332	Chain Lake Dr Easement	EX SANMH10919	EX SANMH10775	90.060	89.690	76.700	525	0.216	1.649	0.13125	0.48%	Concrete	0.013	0.00	207.83	1.38	298.70	70%
-	EX P29043	Chain Lake Dr	EX SANMH10775	EX SANMH10774	89.660	89.530	27.900	525	0.216	1.649	0.13125	0.47%	Concrete	0.013	0.00	207.83	1.36	293.56	71%
-	EX P29042	Chain Lake Dr	EX SANMH10774	EX SANMH10776	89.380	88.320	112.590	525	0.216	1.649	0.13125	0.94%	Concrete	0.013	0.00	207.83	1.93	417.29	50%
L - FG45	EX P5413074	Chain Lake Dr	EX SANMH10776	EX SANMH59804	88.260	88.160	18.640	525	0.216	1.649	0.13125	0.54%	Concrete	0.013	125.00	332.83	1.46	315.00	106%
-	EX P5413075	Chain Lake Dr	EX SANMH59804	EX SANMH59805	88.100	87.920	31.460	525	0.216	1.649	0.13125	0.57%	Concrete	0.013	0.00	332.83	1.50	325.30	102%
Sum															332.83				



2. With the full development added to the network, the existing 375 mm sanitary main between Exhibition Park and the Ragged Lake Pumping Station exceeds capacity. This primarily occurs in pipe sections that have been installed with minimal slopes (between 0.36% and 0.58% based on Halifax Water records) as shown in the table on the previous page. It is noted that pipes with slopes greater than about 1% appear to have adequate capacity to accommodate the developments full contributions.
3. It is understood from discussions with Halifax Water that the Bayers Road pumping station is in good conditions and is not expected to require upgrades to accommodate the development.
4. After being pumped to Grassy Lake Drive about 300 meters west of the Ragged Lake PS, flows enter a 525mm concrete main (note that Halifax Water records show 1 section of 600mm pipes at the start of this run). Capacity utilization from Grassy Lake to this pipe runs connection to Chain Lake Drive remains below capacity for all pipes sections.
5. The analysis shows that following the connection point between the Bayers Lake catchment area and the Ragged Lake catchment, there is about 50 meters of 525 concrete pipe that exceeds capacity (102/106% capacity utilization) immediately upstream of the Bayers Lake PS.
6. The primary capacity constraint from an Exhibition Park redevelopment perspective is therefore the sections of 375mm PVC pipe along Prospect Road.
7. Based on the preliminary downstream calculations, the existing 375mm pipe can accommodate between about 3300 units or about 7700 people before reaching capacity, which represents about 55% of the full proposed development.
8. Additional development past this point would require some form of capacity upgrade to the downstream network between Exhibition Park and the existing 525mm pipes on Grassy Lake Drive.
9. Up-sizing the existing 375 pipe is 1 options to increase capacity, through would be costly, severely impact traffic flow on Prospect Road, and would be eliminating, or parallelling the existing pipe that is presumably in relatively good condition.
10. The more logical upgrade appears to be constructing a secondary adjacent sanitary pipe along the future roadway networks proposed in the Ragged Lake Business Park. A route between the Lake and Prospect Road has long been envisioned for the Park as an extension of Long Lake Drive, immediately opposite Grassy Lake Drive. It is been identified in this study, the associated Mobility Analysis for Exhibition Park, and in work that CBCL is currently undertaking for the Province addressing capacity concerns on Prospect Road. This option provides a wide variety of benefits including providing future sanitary connection opportunities for future builds in the Business Park.
11. Given the likely time frames for construction of the Exhibition Park development, Ragged Lake build-out, potential new Highway 103 connections, it appears that at least 50% of the Exhibition Park development could be constructed with existing available capacity. Development of the final phases of Exhibition Park could then proceed once additional capacity is added either through up-sizing infrastructure or construction of the above noted Ragged Lake route.

3.0 DOMESTIC AND FIRE WATER

3.1 — Existing Conditions

Exhibition Park is currently supplied by a 450 mm ductile iron transmission water main that was installed in 1999 and is operated and maintained by Halifax Water. The main connects north along Prospect Road running into Ragged Lake Business Park with the main transmission corridor traveling along St. Margarets Bay road to the east, and through the existing Public Works yard to the west and into Bayers Lake Business Park.

The Exhibition Park site is serviced through two water main connections: one on the north side and one on the south side.

Northern Lateral: The northern lateral is privately owned and consists of a 100 mm pipe that currently supplies Tim Hortons, a gas station, and a car wash.

Southern Water Main: The southern water main connection is also privately owned and consists of a 250 mm pipe extending from Prospect Road to the Halifax Exhibition Centre. From there, the 250 mm water main branches into a 200 mm pipe that runs along the perimeter of the Exhibition Centre. Several service laterals are connected to the 200 mm water main, supplying potable water, the building's sprinkler system, and outdoor hydrants.

It is anticipated that the northern lateral supplying Tim Hortons and the gas station will remain in place. However, the southern water main connection is planned to be excavated and replaced due to conflicts with the proposed building locations. Similar to the sanitary sewer connections, the timing and phasing of such replacements will depend on the construction phasing of the development as a whole.



Hydrant Flow Tests

A hydrant flow test was conducted by Aqua Data Atlantic on July 16, 2024, along Prospect Road, near Exhibition Park. As illustrated in the figure to the right, Hydrant 1 served as the flow hydrant, and Hydrant 2 served as the residual hydrant. The results of the test are as follows:

- Normal Pressure: 70 psi (482.6 kPa)
- Residual Pressure (Test 2): 64 psi (441.3 kPa)
- Total Flow (Test 2): 1,706 GPM (107.63 L/s)
- Elevation Head: 100.4 m
- Corresponding Hydraulic Head: 145.4 m

The table below shows the results obtained by Aqua Data Atlantic. These results provide critical data for evaluating the capacity and pressure of the water distribution system in the area under future development conditions.

Test No.	No. of Outlets	Orifice Size (IN)	Pilotless Nozzle Reading (PSI)	Equivalent Flow (US GPM)	Total Flow (US GPM)	Residual Pressure (PSI)
1	1	2.5"	32	946	946	70
2	2	2.5"	26 / 26	853 / 853	1706	64
3						



3.2 — Future Conditions

Domestic Demand

Preliminary calculations have been conducted to estimate the water demand for the development, including the average day demand, maximum day demand with fire flow (FF), minimum hour demand, and design flow for each building type and townhouse. These calculations are based on the 2023 Halifax Water Design Specifications & Supplementary Standard Specifications.

Future detailed design is expected to be governed by the maximum day demand plus fire flow (FF). The results of the preliminary calculations are as follows:

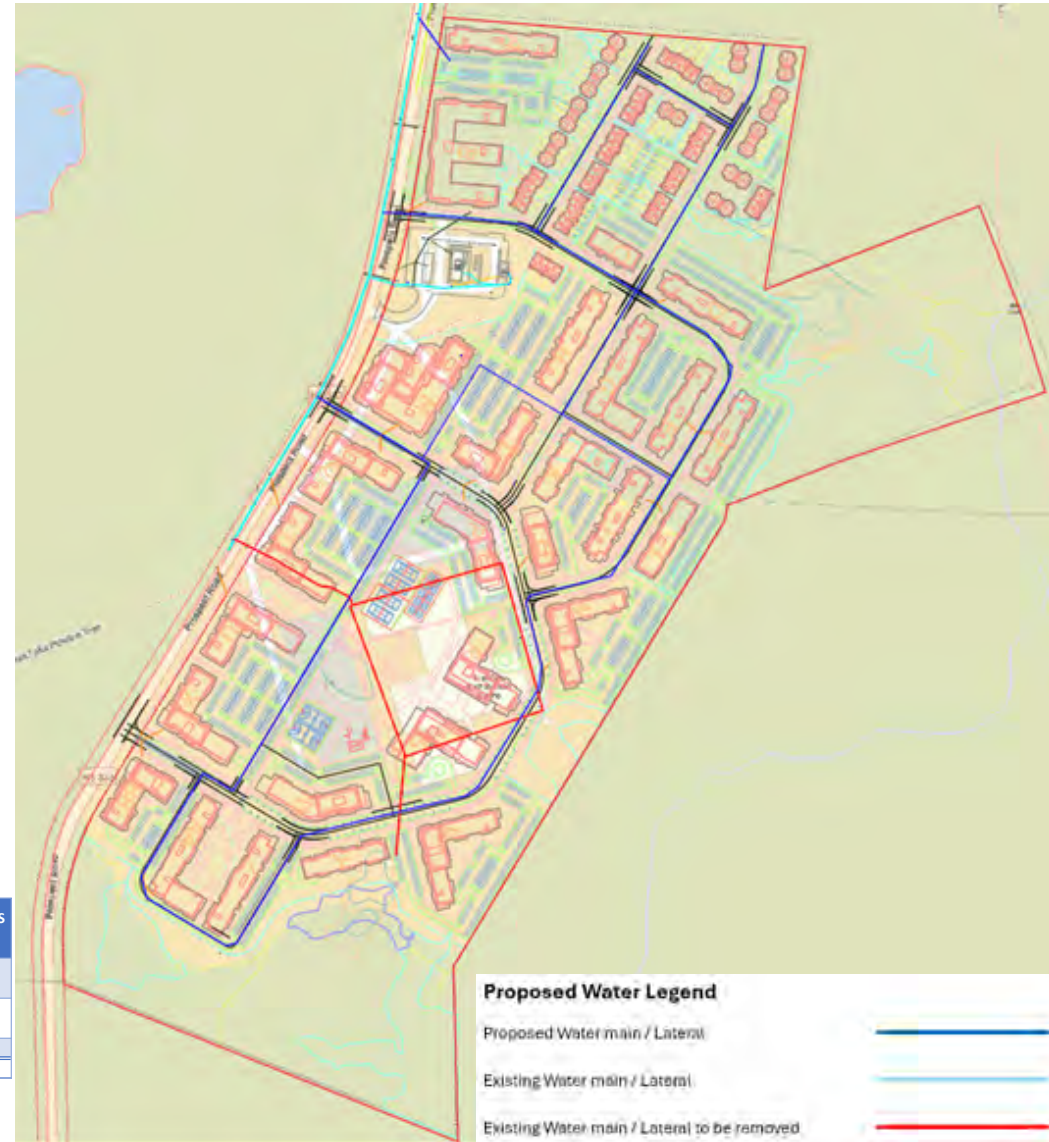
- Multi-Unit Buildings: 299.63 L/s
- Townhouses & Stacked Townhomes: 5.31 L/s
- Existing Commercial: 1.08 L/s

In total, it is estimated that the development will require a water supply capacity of 306.02 L/s. The table below shows the calculated water demands:

Water Demands								
Building Type	Units	People	Average Day Demand + ICI (L/s)	Max Day Demand + FF + ICI (L/s)	Max Hour Demand + ICI (L/s)	Min Hour Demand + ICI (L/s)	Design Flow (L/s)	Design Flow US GPM
Semi Detached & Townhouse	146	489	2.12	3.50	5.31	1.49	5.31	84.12
Multi Unit Dwellings	5,721	12,872	55.87	299.63	139.67	46.93	299.63	4,749.22
Commercial	0	0	0.90	0.99	1.08	0.76	1.08	17.17
Total	5,867	13,361	58.89	304.13	146.06	49.17	306.02	4,850.51

Fire Flow Demand

Fire flow demands for the site were based on general guidance provided in the Halifax Water Design Specifications for Multi-Unit dwelling suggesting a fire flow of 13,620 L/m or about 227 L/s. While maintaining a residual system pressure of 150 kPa (22 psi), with maximum pipe velocity of 2.4 m/s. It is acknowledged that further fire flow analysis will be necessary as the development progresses into the detailed design phases. However, the values presented in this report are sufficient for the preliminary evaluation of the adequacy of the future water network conditions.



3.3 — Modeling Results

The existing and future water network conditions were analyzed using the EPANET platform. A network model was developed to include all pipes and connections proposed in the Exhibition Park development. The model was executed using reservoir and pump configurations at the Prospect Road hydrant test location to simulate the existing water supply, pressure, and elevation conditions. The proposed water network and intersection nodes were incorporated into the model, serving as the foundation for future water modeling scenarios. These scenarios included Average Day Demand, Maximum Day Demand, Maximum Day + Fire Flow Demand, Maximum Hour Demand, and Minimum Hour Demand. The Maximum Day + Fire Flow scenario was performed multiple times, with fire flow applied at various locations to ensure the water service remained compliant with Halifax Water specifications.

The table to the right provides an overview of the development's water pipes, including their lengths, diameters, and locations. Pipe sizes range from 100–150 mm for the existing service connections, 200–300 mm for the proposed local distribution mains, and 450 mm for the existing feeder main. Additionally, the table below outlines Halifax Water's specifications for maximum and minimum pressures, as well as velocity, under various scenarios. These specifications ensure that the water distribution system within the development meets the required performance standards.

HW Requirements		
Pressure	kPa	m
Max Pressure	620	63
Min Pressure	275	28
Min Pressure With FF	150	15
Average Day Pressure Range	350 to 550	36 to 56

Velocity	m/s
Max Velocity	1.5
Max Velocity With FF	2.4

Link - Node Table				
Link ID	Start Node	End Node	Length (m)	Diameter (mm)
23	I-J	E-F	108.73	200
37	G-H-K	CD	129.10	250
41	E-F	CD	230.33	200
43	T-U	L-P	194.57	200
44	N-O	I-J	88.43	200
45	N-O	R-S	140.76	300
46	R-S	V-Y	145.19	300
47	V-Y	W-Z	93.89	250
9	CD	NS-1	185.71	200
11	N-Cross	NS-1	55.6	200
12	M-Q	L-P	119.13	300
15	B	NS-2-S	152.4	300
16	NS-2-S	CD	113.5	250
17	NS-2-S	NS-2-N	213.52	200
18	NS-2-N	N-Cross	55.6	200
1	B	Pros@Tims	64.09	450
2	M-Q	Pros@Tims	127.76	450
3	Pros@Tims	Tims	132.34	100
4	B	1	195.31	450
7	1	A	51.47	150
8	M-Q	T-U1	34.78	450
10	T-U1	T-U	123.87	200
13	x-BB	AA	61.71	250
14	AA	W-Z	79.05	250
19	T-U	AA	198.33	250
20	L-P	4	81.14	300
21	4	N-O	87.34	300
22	G-H-K	4	120.56	250

Average Day Demand

The average day demand refers to the total amount of water used by all consumers in a specific area during a typical 24-hour period. The demand varies depending on factors such as population, climate, season, industrial activity, and the presence of other specific water-intensive practices.

The average day demand for exhibition park is calculated as follows:

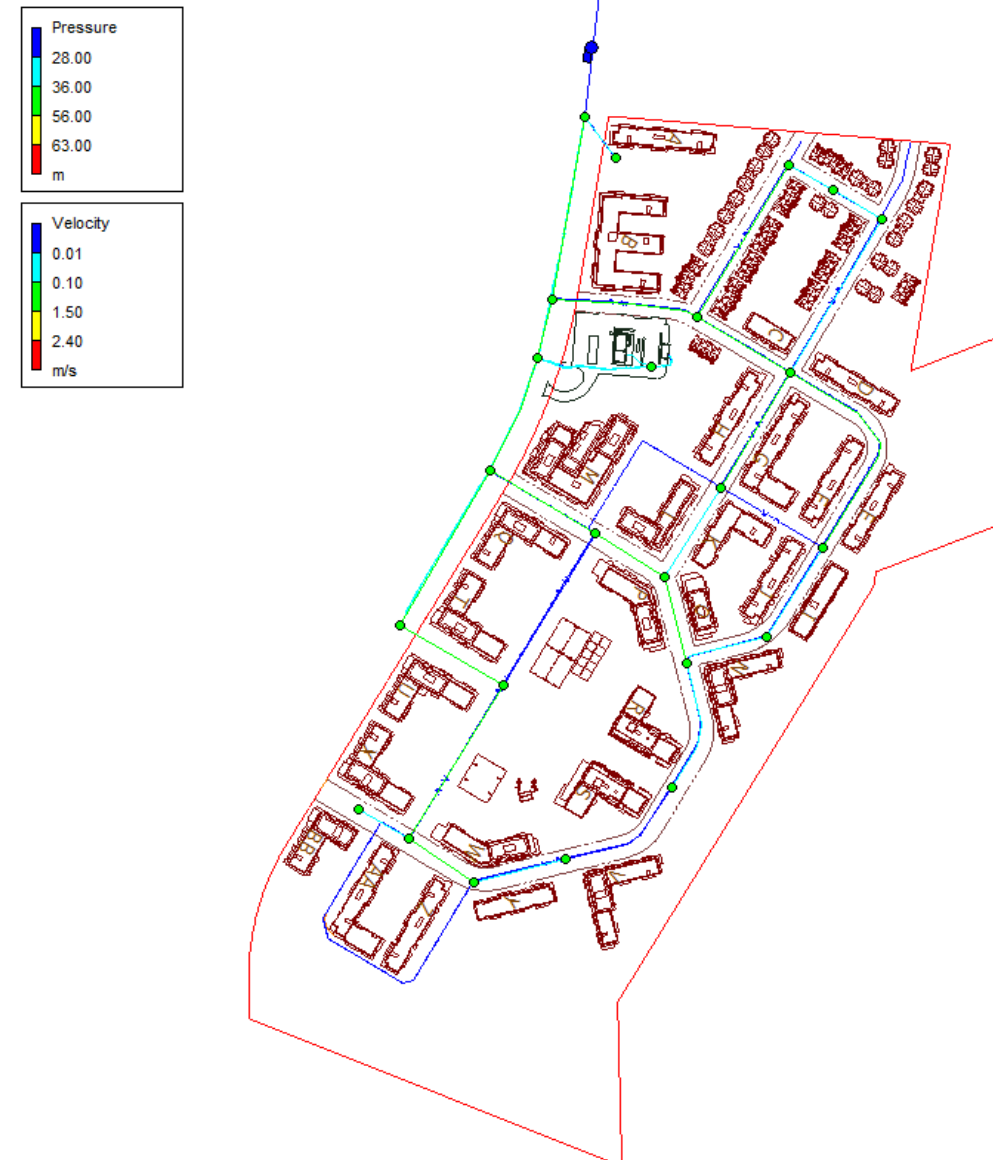
- 2.12 L/s for the townhouses
- 55.87 L/s for the multi-unit buildings
- 0.90 L/s for the existing commercial buildings (eg. Tim Hortons, Gas Station, car wash)

This results in a total demand of 58.89 L/s. The table below outlines the expected pressure and velocity for the water distribution system under the average day scenario, ensuring compliance with design standards and system performance requirements.

Node Results				
Node ID	Demand (L/s)	HGL (m)	Pressure Head (m)	Pressure (kPa)
L-P	3.59	148.09	43.72	428.9
x-BB	4.37	148.01	41.07	402.9
W-Z	3.84	148.01	48.35	474.3
N-O	4.71	148.04	46.69	458.0
I-J	2.39	148.04	47.90	469.9
E-F	2.15	148.05	49.72	487.8
CD	1.64	148.10	48.49	475.7
G-H-K	4.84	148.07	45.45	445.9
A	0.90	148.25	48.33	474.1
T-U	5.59	148.05	45.67	448.0
V-Y	3.54	148.02	48.80	478.7
R-S	6.15	148.02	48.27	473.5
B	3.81	148.18	48.34	474.2
M-Q	6.01	148.15	44.19	433.5
N-Cross	0.20	148.11	52.61	516.1
NS-1	0.64	148.11	52.91	519.0
NS-2-S	0.64	148.14	48.32	474.0
NS-2-N	0.64	148.11	52.21	512.2
Pros@Tims	0.00	148.17	46.97	460.8
Tims	0.65	148.15	45.75	448.8
1	0.00	148.26	47.04	461.5
AA	1.69	148.02	44.89	440.4
T-U1	0.00	148.15	40.71	399.4
4	0.00	148.07	46.71	458.2
2	-57.99	0.00	0.00	Reservoir

Link Results			
Link ID	Flow (L/s)	Velocity (m/s)	Headloss (m/km)
23	-2.30	0.07	0.06
37	-7.40	0.15	0.17
41	-4.45	0.14	0.20
43	-4.24	0.14	0.18
44	0.09	0.00	0.00
45	11.62	0.16	0.16
46	5.47	0.08	0.04
47	1.93	0.04	0.01
9	-1.99	0.06	0.04
11	2.63	0.08	0.07
12	21.70	0.31	0.52
15	15.61	0.22	0.28
16	11.49	0.23	0.39
17	3.47	0.11	0.13
18	2.83	0.09	0.09
1	37.67	0.24	0.17
2	-37.02	0.23	0.16
3	0.65	0.08	0.20
4	-57.09	0.36	0.37
7	0.90	0.05	0.05
8	9.32	0.06	0.01
10	9.32	0.30	0.78
13	-4.37	0.09	0.06
14	1.91	0.04	0.01
19	7.97	0.16	0.20
20	13.87	0.20	0.23
21	16.42	0.23	0.31
22	2.56	0.05	0.02
6	57.99	0.00	Pump

Exhibition Park - Average Day Demand



Maximum Day Demand

Maximum day demand refers to the highest total water consumption recorded during a single 24-hour period in a given year. This metric is crucial for designing water supply systems, as it reflects more regular peak usage patterns and ensures the system can meet the most demanding day-to-day conditions.

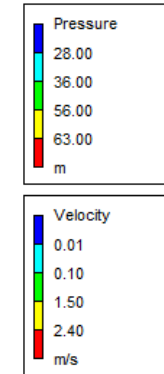
The maximum day demand for exhibition park is calculated as follows:

- 3.50 L/s for the townhouses
- 72.63 L/s for the multi-unit buildings
- 0.99 L/s for the existing commercial buildings (eg. Tim Hortons, Gas Station, car wash)

This results in a total demand of 77.13 L/s. The table below outlines the expected pressure and velocity for the water distribution system under the maximum day scenario, ensuring compliance with design standards and system performance requirements.

Node Results					Link Results			
Node ID	Demand (L/s)	HGL (m)	Pressure Head (m)	Pressure (kPa)	Link ID	Flow (L/s)	Velocity (m/s)	Headloss (m/km)
L-P	4.67	147.05	42.68	418.7	23	-2.94	0.09	0.09
x-BB	5.67	146.92	39.98	392.2	37	-9.44	0.19	0.27
W-Z	4.99	146.93	47.27	463.7	41	-5.73	0.18	0.32
N-O	6.12	146.97	45.61	447.4	43	-5.50	0.18	0.29
I-J	3.11	146.97	46.83	459.4	44	0.17	0.01	0.00
E-F	2.79	146.98	48.65	477.3	45	15.07	0.21	0.26
CD	2.13	147.06	47.45	465.5	46	7.07	0.10	0.06
G-H-K	6.30	147.02	44.40	435.6	47	2.47	0.05	0.02
A	2.03	147.31	47.39	464.9	9	-2.27	0.07	0.06
T-U	7.26	146.99	44.61	437.6	11	3.33	0.11	0.12
V-Y	4.60	146.93	47.71	468.0	12	28.39	0.40	0.85
R-S	8.00	146.94	47.19	462.9	15	20.81	0.29	0.48
B	4.95	147.20	47.36	464.6	16	15.02	0.31	0.64
M-Q	7.81	147.15	43.19	423.7	17	4.73	0.15	0.22
N-Cross	0.34	147.07	51.57	505.9	18	3.67	0.12	0.14
NS-1	1.06	147.07	51.87	508.8	1	49.35	0.31	0.28
NS-2-S	1.06	147.13	47.31	464.1	2	-48.36	0.30	0.27
NS-2-N	1.06	147.08	51.18	502.1	3	0.99	0.13	0.43
Pros@Tims	0.00	147.18	45.98	451.1	4	-75.11	0.47	0.61
Tims	0.99	147.13	44.73	438.8	7	2.03	0.11	0.22
1	0.00	147.32	46.10	452.2	8	12.15	0.08	0.02
AA	2.20	146.93	43.80	429.7	10	12.15	0.39	1.27
T-U1	0.00	147.15	39.71	389.6	13	-5.67	0.12	0.10
4	0.00	147.02	45.66	447.9	14	2.52	0.05	0.02
2	-77.14	0.00	0.00	Reservoir	19	10.39	0.21	0.32
					20	18.22	0.26	0.37
					21	21.36	0.30	0.50
					22	3.14	0.06	0.03
					5	77.14	0.00	-147.32

Exhibition Park - Max Day Demand



Maximum Day + Fire Flow Demand

Maximum day plus fire flow demand refers to the highest water consumption recorded in a single day (max day demand) combined with the additional water required to fight a fire in the service area. This metric is a key consideration in the design and sizing of water supply systems, as it represents the most extreme conditions the system might need to handle.

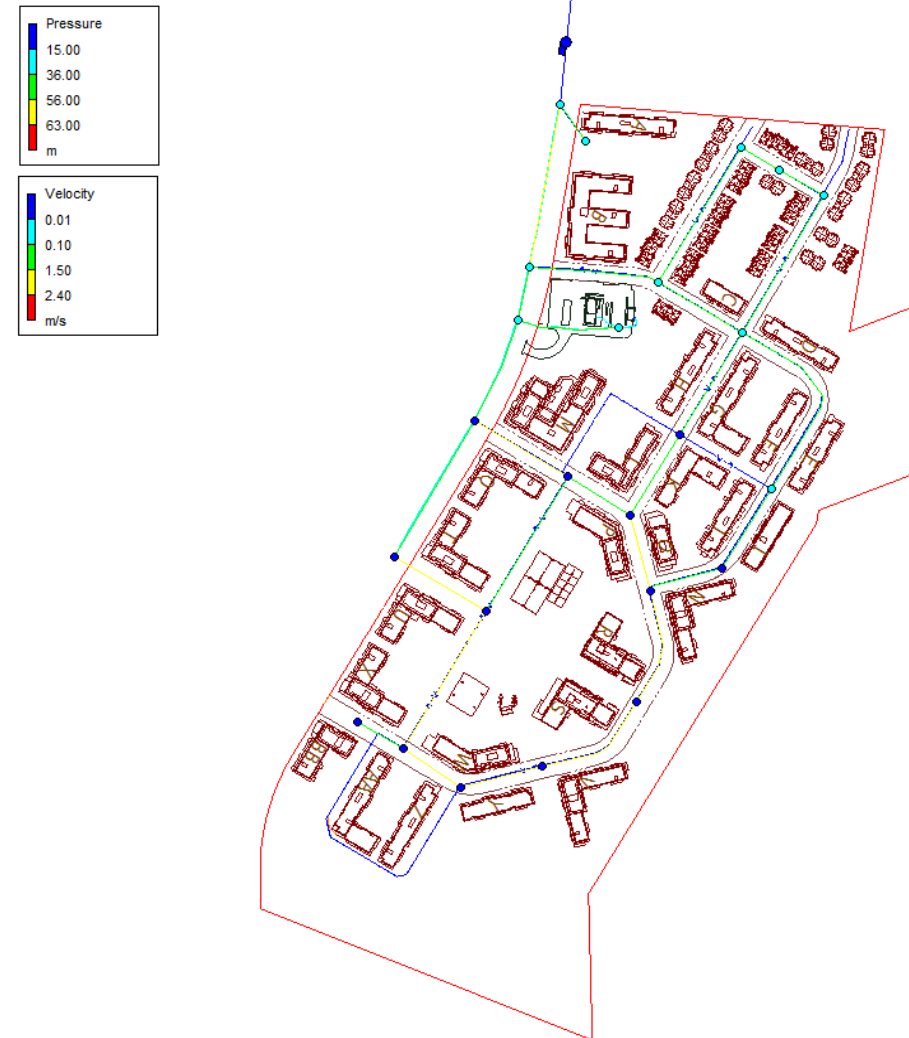
The fire flow requirements were determined based on Table 3.3 of the 2022 Halifax Water specifications. The fire flow for the multi-unit high-rise buildings governed the design, necessitating an additional 227 L/s for the water service. The Maximum Day + Fire Flow demand for Exhibition Park is calculated as follows:

- 3.50 L/s for the townhouses
- 299.63 L/s for the multi-unit buildings
- 0.99 L/s for the existing commercial buildings (Tim Hortons, Gas Station, car wash)
- 304.13 L/s total demand

Multiple models were conducted in EPANET for the Maximum Day + Fire Flow scenario, with fire flow applied at various locations to evaluate system performance. However, the results indicated that the Maximum Day + Fire Flow scenario failed across all tested models due to insufficient pressure, regardless of the fire flow location.

The figure to the right shows a screen shot of the model with the fire flow applied at node V-Y (southeast of the development). The blue nodes in the figure highlight areas where the pressure falls below Halifax Water's design standards. The tables on the following page further highlight areas that do not meet fire flow requirements.

Exhibition Park - Max Day + FF Demand



The two tables below present the expected pressure and velocity for the water distribution system under the Maximum Day + Fire Flow scenario. The table on the left displays the results when the fire flow is applied at the “CD” node, located on the northern side of the development. The table on the right shows the results when the fire flow is applied at the “VY” node, located on the southern side of the development. Areas where the pressure fails to meet the minimum requirements are highlighted in red.

These results suggest external network upgrades will be required in order to support the full development as proposed. Potential improvements are discussed in the discussion sections at the end of this chapter of the report.

Node Results				
Node ID	Demand (L/s)	HGL (m)	Pressure Head (m)	Pressure (kPa)
L-P	4.67	117.42	13.05	128.0
x-BB	5.67	116.84	9.90	97.1
W-Z	4.99	116.72	17.06	167.4
N-O	6.12	116.56	15.20	149.1
I-J	3.11	115.86	15.72	154.2
E-F	2.79	115.14	16.81	164.9
CD	229.13	113.87	14.26	139.9
G-H-K	6.30	115.19	12.57	123.3
A	2.03	120.72	20.80	204.0
T-U	7.26	117.40	15.02	147.3
V-Y	4.60	116.61	17.39	170.6
R-S	8.00	116.57	16.82	165.0
B	4.95	119.17	19.33	189.6
M-Q	7.81	118.70	14.74	144.6
N-Cross	0.34	115.12	19.62	192.5
NS-1	1.06	114.82	19.62	192.5
NS-2-S	1.06	116.72	16.90	165.8
NS-2-N	1.06	115.44	19.54	191.7
Pros@Tims	0.00	119.01	17.81	174.7
Tims	0.99	118.95	16.55	162.4
1	0.00	120.73	19.51	191.4
AA	2.20	116.85	13.72	134.6
T-U1	0.00	118.70	11.26	110.5
4	0.00	116.65	15.29	150.0
2	-304.14	0.00	0.00	Reservoir

Link Results			
Link ID	Flow (L/s)	Velocity (m/s)	Headloss (m/km)
23	29.56	0.94	6.60
37	67.30	1.37	10.22
41	26.77	0.85	5.50
43	-2.70	0.09	0.08
44	32.67	1.04	7.95
45	-7.85	0.11	0.08
46	-15.85	0.22	0.29
47	-20.45	0.42	1.13
9	-25.69	0.82	5.09
11	26.75	0.85	5.49
12	111.91	1.58	10.79
15	138.58	1.96	16.02
16	109.37	2.23	25.12
17	28.15	0.90	6.03
18	27.09	0.86	5.62
1	158.58	1.00	2.43
2	-157.59	0.99	2.40
3	0.99	0.13	0.43
4	-302.11	1.90	8.01
7	2.03	0.11	0.22
8	37.87	0.24	0.17
10	37.87	1.21	10.45
13	-5.67	0.12	0.10
14	25.44	0.52	1.69
19	33.31	0.68	2.78
20	104.54	1.48	9.51
21	30.94	0.44	1.00
22	-73.60	1.50	12.06
5	304.14	0.00	-120.73

Node Results				
Node ID	Demand (L/s)	HGL (m)	Pressure Head (m)	Pressure (kPa)
L-P	4.67	116.48	12.11	118.8
x-BB	5.67	111.15	4.21	41.3
W-Z	4.99	109.93	10.27	100.7
N-O	6.12	114.33	12.97	127.2
I-J	3.11	114.76	14.62	143.4
E-F	2.79	115.40	17.07	167.5
CD	2.13	117.04	17.43	171.0
G-H-K	6.30	116.31	13.69	134.3
A	2.03	120.72	20.80	204.0
T-U	7.26	114.80	12.42	121.8
V-Y	231.60	108.62	9.40	92.2
R-S	8.00	111.39	11.64	114.2
B	4.95	119.17	19.33	189.6
M-Q	7.81	118.37	14.41	141.4
N-Cross	0.34	117.51	22.01	215.9
NS-1	1.06	117.39	22.19	217.7
NS-2-S	1.06	118.17	18.35	180.0
NS-2-N	1.06	117.64	21.74	213.3
Pros@Tims	0.00	118.90	17.70	173.6
Tims	0.99	118.84	16.44	161.3
1	0.00	120.73	19.51	191.4
AA	2.20	111.16	8.03	78.8
T-U1	0.00	118.36	10.92	107.1
4	0.00	115.79	14.43	141.6
2	-304.14	0.00	0.00	Reservoir

Link Results			
Link ID	Flow (L/s)	Velocity (m/s)	Headloss (m/km)
1	212.00	1.33	4.16
2	-211.01	1.33	4.12
3	0.99	0.13	0.43
4	-302.11	1.90	8.01
5	304.14	0.00	-120.73
7	2.03	0.11	0.22
8	65.38	0.41	0.47
9	-15.10	0.48	1.90
10	65.38	2.08	28.72
11	16.16	0.51	2.16
12	137.82	1.95	15.86
13	-5.67	0.12	0.10
14	84.46	1.72	15.57
15	85.16	1.20	6.50
16	66.54	1.36	10.01
17	17.56	0.56	2.52
18	16.50	0.53	2.24
19	92.33	1.88	18.36
20	98.94	1.40	8.58
21	141.41	2.00	16.63
22	42.48	0.87	4.36
23	-27.95	0.89	5.95
37	-48.78	0.99	5.63
41	-30.74	0.98	7.10
43	-34.22	1.09	8.66
44	-24.84	0.79	4.78
45	160.13	2.27	20.94
46	152.13	2.15	19.04
47	-79.47	1.62	13.91

Maximum Hour Demand

Maximum hour demand refers to the highest water consumption rate during a single hour within a year. This metric is critical for understanding short-term peak usage patterns and designing water supply systems that can handle extreme demand without a loss of pressure or service quality.

The maximum hour demand for exhibition park is calculated as follows:

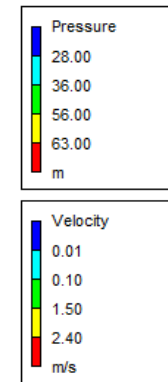
- 5.31 L/s for the townhouses
- 139.67 L/s for the multi-unit buildings
- 1.08 L/s for the existing commercial buildings (eg. Tim Hortons, Gas Station, car wash)

This results in a total demand of 146.06 L/s. The table below outlines the expected pressure and velocity for the water distribution system under the maximum hour scenario, ensuring compliance with design standards and system performance requirements.

Node Results				
Node ID	Demand (L/s)	HGL (m)	Pressure Head (m)	Pressure (kPa)
L-P	8.98	141.28	36.91	362.1
x-BB	10.91	140.85	33.91	332.7
W-Z	9.59	140.87	41.21	404.3
N-O	11.77	141.03	39.67	389.2
I-J	5.98	141.03	40.89	401.1
E-F	5.37	141.07	42.74	419.3
CD	4.10	141.31	41.70	409.1
G-H-K	12.11	141.19	38.57	378.4
A	3.91	142.14	42.22	414.2
T-U	13.96	141.09	38.71	379.7
V-Y	8.84	140.88	41.66	408.7
R-S	15.38	140.91	41.16	403.8
B	9.52	141.79	41.95	411.5
M-Q	15.01	141.61	37.65	369.3
N-Cross	0.51	141.38	45.88	450.1
NS-1	1.60	141.36	46.16	452.8
NS-2-S	1.60	141.55	41.73	409.4
NS-2-N	1.60	141.41	45.51	446.5
Pros@Tims	0.00	141.73	40.53	397.6
Tims	1.08	141.66	39.26	385.1
1	0.00	142.17	40.95	401.7
AA	4.22	140.87	37.74	370.2
T-U1	0.00	141.61	34.17	335.2
4	0.00	141.18	39.82	390.6
2	-146.04	0.00	0.00	Reservoir

Link Results			
Link ID	Flow (L/s)	Velocity (m/s)	Headloss (m/km)
23	-5.74	0.18	0.32
37	-18.48	0.38	0.93
41	-11.11	0.35	1.08
43	-10.59	0.34	0.99
44	0.24	0.01	0.00
45	29.03	0.41	0.89
46	13.65	0.19	0.22
47	4.81	0.10	0.08
9	-4.97	0.16	0.24
11	6.57	0.21	0.41
12	54.24	0.77	2.82
15	39.00	0.55	1.53
16	28.72	0.59	2.11
17	8.68	0.28	0.68
18	7.08	0.23	0.47
1	93.61	0.59	0.92
2	-92.53	0.58	0.90
3	1.08	0.14	0.50
4	-142.13	0.89	1.98
7	3.91	0.22	0.76
8	23.28	0.15	0.07
10	23.28	0.74	4.24
13	-10.91	0.22	0.35
14	4.78	0.10	0.08
19	19.91	0.41	1.07
20	34.67	0.49	1.23
21	41.03	0.58	1.68
22	6.37	0.13	0.13
5	146.04	0.00	-142.17

Exhibition Park - Max Hour Demand



Minimum Hour Demand

Minimum hour demand refers to the lowest water consumption rate during a single hour in a typical day or over a defined period, such as a year. This metric is significant for water system design and operations, particularly in managing system pressure, maintaining water quality, and optimizing pumping schedules.

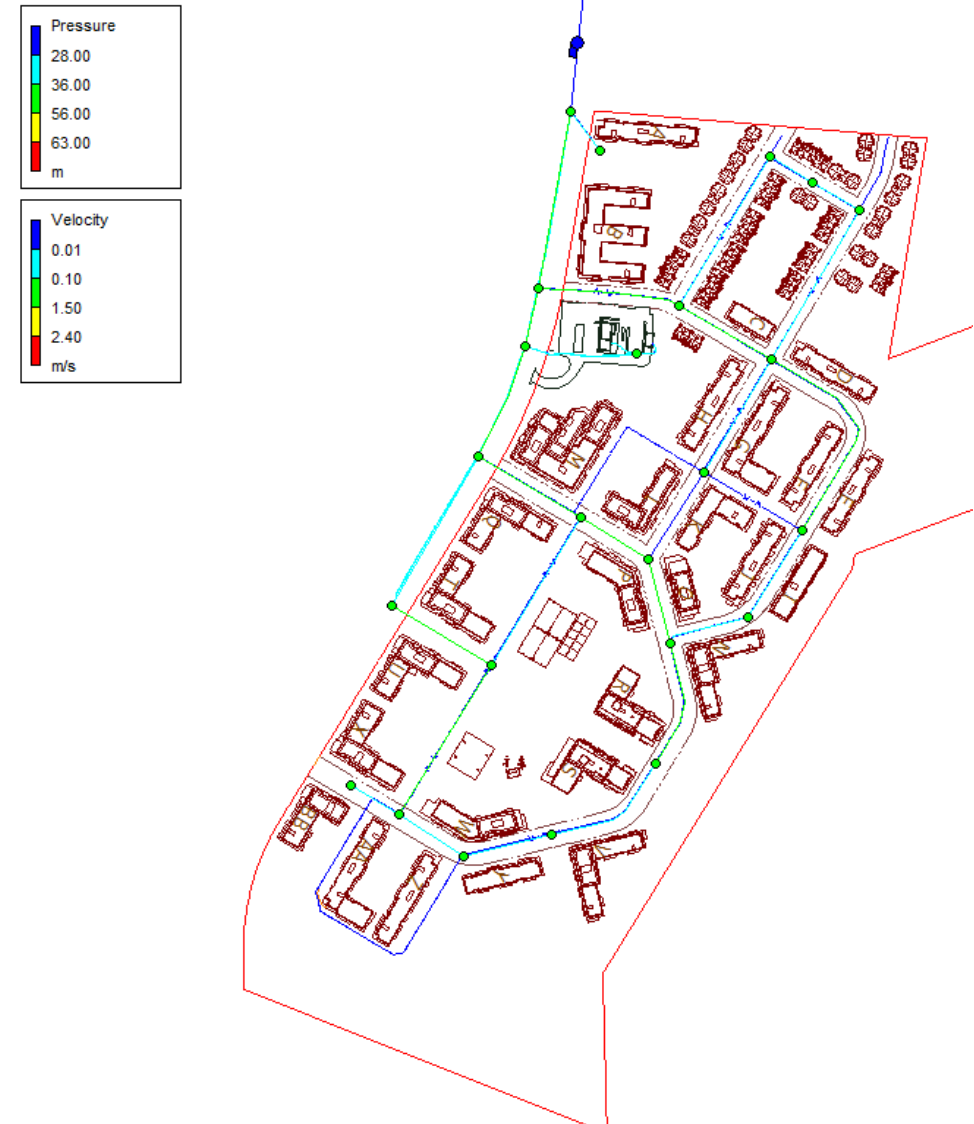
The minimum hour demand for exhibition park is calculated as follows:

- 1.49 L/s for the townhouses
- 46.93 L/s for the multi-unit buildings
- 0.76 L/s for the existing commercial buildings (eg. Tim Hortons, Gas Station, car wash)

This results in a total demand of 49.17 L/s. The table below outlines the expected pressure and velocity for the water distribution system under the minimum hour scenario, ensuring compliance with design standards and system performance requirements.

Node Results					Link Results			
Node ID	Demand (L/s)	HGL (m)	Pressure Head (m)	Pressure (kPa)	Link ID	Flow (L/s)	Velocity (m/s)	Headloss (m/km)
L-P	3.02	148.49	44.12	432.8	23	-1.96	0.06	0.04
x-BB	3.67	148.43	41.49	407.0	37	-6.28	0.13	0.13
W-Z	3.22	148.44	48.78	478.5	41	-3.76	0.12	0.14
N-O	3.95	148.46	47.10	462.1	43	-3.56	0.11	0.13
I-J	2.01	148.46	48.32	474.0	44	0.05	0.00	0.00
E-F	1.80	148.46	50.13	491.8	45	9.77	0.14	0.12
CD	1.38	148.50	48.89	479.6	46	4.60	0.07	0.03
G-H-K	4.07	148.48	45.86	449.9	47	1.63	0.03	0.01
A	1.31	148.60	48.68	477.6	9	-1.79	0.06	0.04
T-U	4.69	148.46	46.08	452.0	11	2.24	0.07	0.06
V-Y	2.97	148.44	49.22	482.8	12	18.15	0.26	0.37
R-S	5.17	148.44	48.69	477.6	15	12.91	0.18	0.20
B	3.20	148.56	48.72	477.9	16	9.63	0.20	0.28
M-Q	5.04	148.53	44.57	437.2	17	2.83	0.09	0.09
N-Cross	0.14	148.51	53.01	520.0	18	2.38	0.08	0.06
NS-1	0.45	148.50	53.30	522.9	1	31.75	0.20	0.12
NS-2-S	0.45	148.53	48.71	477.8	2	-30.99	0.19	0.12
NS-2-N	0.45	148.51	52.61	516.1	3	0.76	0.10	0.26
Pros@Tims	0.00	148.55	47.35	464.5	4	-47.86	0.30	0.26
Tims	0.76	148.51	46.11	452.3	7	1.31	0.07	0.10
1	0.00	148.61	47.39	464.9	8	7.80	0.05	0.01
AA	1.42	148.44	45.31	444.5	10	7.80	0.25	0.56
T-U1	0.00	148.53	41.09	403.1	13	-3.67	0.07	0.05
4	0.00	148.48	47.12	462.2	14	1.59	0.03	0.01
2	-49.17	0.00	0.00	Reservoir	19	6.68	0.14	0.14
					20	11.57	0.16	0.16
					21	13.78	0.19	0.22
					22	2.21	0.05	0.02
					5	49.17	Pump	-148.61

Exhibition Park - Min Hour Demand



Water Service Recommendations

All scenarios modeled in EPANET satisfied Halifax Water Guidelines, except for the Maximum Day + Fire Flow scenario, which revealed insufficient water pressure during fire flow conditions. Three factors contribute to these pressure challenges through the site based on the current supply arrangement:

1. The site is serviced by a single water transmission main, which negatively impacts the ability to maintain pressures under high flow conditions and does not provide redundancy in the supply network should a break or water stoppage be required.
2. The density of the development increases the maximum day demand and therefore impacts water available for fire fighting purposes.
3. The height / size of the buildings with high-rise buildings demanding greater pressure and water quantities.

To resolve this issue, three potential options were considered:

Option 1: Add Booster Pumps

A booster pump is an effective solution for increasing water pressure in areas where supply struggles to meet high demand. It ensures stable flow and pressure, compensates for friction and elevation losses, and maintains system performance during peak demand or emergency situations. Proper placement, sizing, and operational characteristics would be critical to ensure pump effectiveness. Given the expected high density of the development, implementing a booster pump may solve the pressure issues, however it does not resolve the single point of supply challenges. Booster pumps may take the form of local, building specific boosters or a larger network pressure booster. Given that static pressures are currently near 70 psi, additional pressurization may not be appropriate in this situation.

Option 2: Phased Development

Under this option, the development could be divided into two (or more) phases, similar to the sanitary sewer recommendations. Modelling results suggest that similar development levels around 50% of the proposed would allow pressures to be maintained with the existing supply. In order to accommodate future phases, an additional water service would be required. In this regard, it would be logical to pursue a similar approach to the sanitary sewer by constructing both sanitary and water services within a new roadway connection Exhibition Park directly to the Ragged Lake Business Park along a new roadway just west of Prospect Road. Again, this is advantageous for the proposed development, as well as any future developments in the Ragged Lake area, would provide redundancy in supply, and would improve network performance with respect to water pressures under critical conditions.

Option 3: Alternate Fire Water Supply

Inadequate water pressure often occurs when the demand exceeds the capacity of the water supply system. Options may be explored to establish an alternate water source for fire fighting purposes, which allows the existing supply to service domestic demands only. This is a challenging option for a development of this size but may be considered as an option in the early design stages of the development.

4.0 STORM WATER

4.1 — Existing Conditions

Topography in the vicinity of Exhibition Park generally creates flow from south to north and west to east, ultimately discharging to Long Lake about 1 kilometre northeast of the Park as shown in the figure to the right. The blue highlighted area represents the larger upstream and downstream storm watersheds within which Exhibition Park is located.

Ragged Lake is located to the northwest of Exhibition Park on the west side of Prospect Road and captures water upstream of the lake outside of the catchment area in the figure to the right. One of the watercourses in this area is the Beaver Dam Brook which flows along the west side of Exhibition Park. Contours from recent LiDAR data indicate that Prospect Road forms a barrier to stormwater, though some limited areas west of Prospect Road collect along the roadside ditch and cross Prospect Road at cross road culverts. Existing stormwater runoff from the Exhibition Park area currently discharges into Beaver Dam Brook, which then flows into Long Lake.

Halifax Water has provided information regarding the existing storm sewer system in the vicinity of the Tim Hortons area, including cross culvert locations. Stormwater is collected via catch basins and is discharged into a ditch along Prospect Road, ultimately flowing into a stream located north of Tim Hortons. The figure below shows an image of Tim Hortons and the existing storm sewage system.



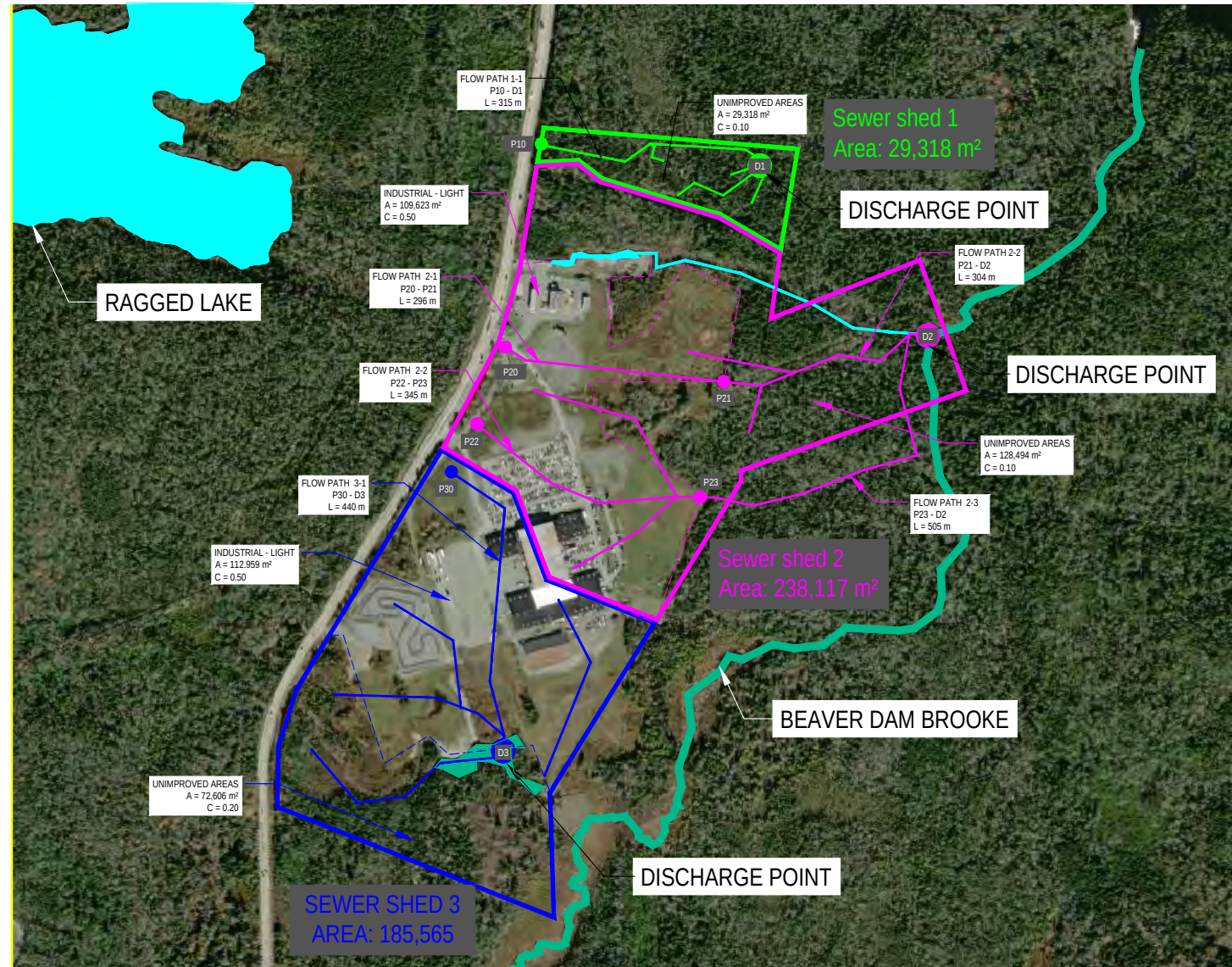
A site visit revealed the presence of an existing storm sewer system around Exhibition Park including a variety of catchbasin and manholes. However, Halifax Water does not have data on this system as it is privately owned. Given that the system interferes with the proposed building locations, it will need to be removed during construction, though detailed design work will further determine when the existing network is removed based on the phasing of the development build-out.

A pre-development stormwater analysis identified three storm sewer sheds on the site.

The figure at the top right illustrates Exhibition Park's pre-development storm sewer sheds. The water flow paths are clearly outlined and color-coded to correspond to their respective sewer sheds. Each path traces the direction of water flow within the shed and leads to its assumed discharge points, providing a visual representation of the stormwater management system prior to development.

Sewer Shed 1: Located north of Tim Hortons, this shed has an area of 2.93 ha. Stormwater is expected to flow east of Prospect Road and discharge to the northeast side of the sewer shed, ultimately flowing towards Beaver Dam Brook. The land in this shed is predominantly forested and classified as an unimproved area.

Sewer Shed 2: This shed covers an area of 23.81 ha. The runoff from this sewer shed is expected to flow east and discharge into the Beaver Dam Brook. Two potential flow paths, both discharging to the same point, were considered in the analysis. The path with the longest time of concentration (Flow Path 2-2) governed the flow calculations.



The land in this storm shed is divided into two areas with different runoff characteristics:

- The west side (10.96 ha) is described as a light industrial area, which is considered a paved area.
- The east side (12.85 ha) is characterized as forested, representing an unimproved area.

Sewer Shed 3: This storm shed has a total area of 18.56 ha. Stormwater is expected to flow in the southeastern direction, eventually discharging into an existing wetland area. The land in this storm shed is also divided into two areas:

- The north side (11.30 ha) is described as a light industrial area, considered paved.
- The south side (7.26 ha) is forested and classified as an unimproved area.

Stormwater Flow Vs Storm Event

The table below displays the stormwater flow for each sewer shed at its discharge point. Flow values have been calculated for various storm events, including 1:5, 1:10, 1:25, 1:50, and 1:100-year storms. This data provides critical insight into the capacity and performance of the pre-development stormwater management system under different rainfall intensities.

Location	Flow (m3/s)	Flow (m3/s)	Flow (m3/s)	Flow (m3/s)	Flow (m3/s)
	1:5	1:10	1:25	1:50	1:100
Sewer Shed 1	0.024	0.029	0.034	0.037	0.041
Sewer Shed 2	0.357	0.451	0.527	0.564	0.621
Sewer Shed 3	1.283	1.401	1.619	1.776	1.954

4.2 — Future Conditions

A preliminary post-development stormwater analysis indicates that the site will have three adjusted storm sub-sewer sheds. The locations and discharge points of these sheds are similar to the pre-development conditions. The figure to the right shows an imagine of the post-development sewer shed and water paths. It is anticipated that a variety of stormwater management practices will be employed on the site during detailed design and will include a number of internal storm water features prior to the ultimate discharge points. Nonetheless, the discharge paths indicated areas that will likely be utilized for larger stormwater retention area to balance pre- and post-development flows.

Sewer Shed 1: Located north of Tim Hortons, this storm-shed has an area of 6.83 ha. Stormwater is expected to flow eastward towards Beaver Dam Brook and discharge to the northeast side of the storm-shed. The proposed land in this area will be divided into two runoff value zones:

- The west area (1.71 ha) will consist of apartment dwellings.
- The east area (5.12 ha) will be designated as residential multi-unit.

Sewer Shed 2: This storm-shed covers an area of 15.56 ha. The runoff from this storm-shed will flow east and is expected to be discharged into Beaver Dam Brook. Similar to Storm-shed 1, this area has two different land use descriptions, which were used to determine the runoff coefficients:

- The west area (10.57 ha) will be developed with apartment dwellings.
- The east area (4.99 ha) will remain forested and classified as an unimproved area.

Sewer Shed 3: This storm-shed has a total area of 22.85 ha. Stormwater is expected to flow in the southeastern direction and discharge into an existing pond. Similar to the other sheds, the area has two different land uses, which were incorporated into the runoff coefficient calculations:

- The north side (17.35 ha) will consist of apartment dwellings.
- The south side (5.50 ha) will remain forested, classified as an unimproved area.



Stormwater Flow and Storm Event

The table to the right shows the storm water flow values for each storm shed at the discharge point for the 1:5, 1:10, 1:25, 1:50, and 1:100-year storms events.

Location	Flow (m ³ /s) 1:5	Flow (m ³ /s) 1:10	Flow (m ³ /s) 1:25	Flow (m ³ /s) 1:50	Flow (m ³ /s) 1:100
Sewer Shed 1	0.771	0.871	0.995	1.120	1.244
Sewer Shed 2	0.570	0.665	0.780	0.856	0.951
Sewer Shed 3	1.568	1.792	2.016	2.240	2.816

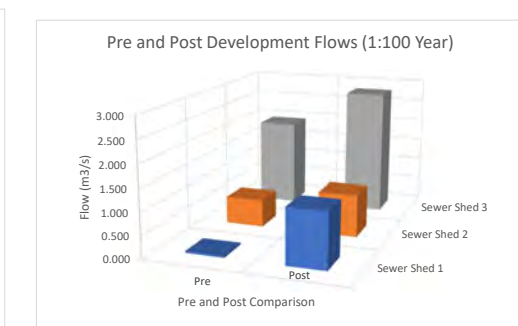
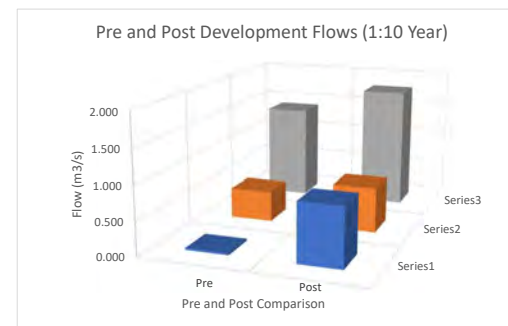
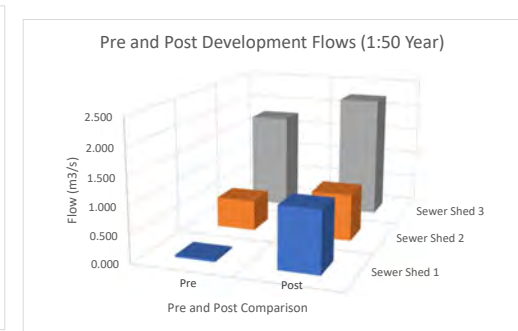
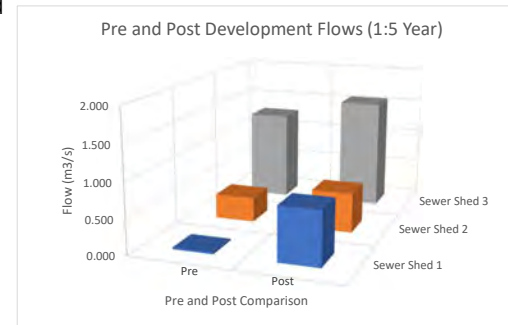
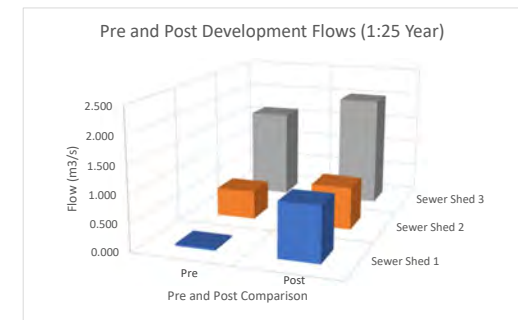
4.3 — Pre and Post Comparison

The charts on the right present a comparison of the flow rates at the discharge points for the 1:5, 1:10, 1:25, 1:50, and 1:100-year storm events. In the charts, blue represents Sewer Shed 1, orange represents Sewer Shed 2, and grey represents Sewer Shed 3.

The data shows similar pre- and post-development flow rates for Sewer Sheds 2 and 3, likely because the majority of the land in these areas is already developed and paved. However, Sewer Shed 1 exhibits a significant difference, with a much higher post-development flow rate. This increase is attributed to the transformation of the existing forested and unimproved land into a residential area with buildings and paved streets. Sewer Shed 1 will likely require a comprehensive water management strategy to balance pre- and post-development flow rates effectively. Implementing such measures will be critical for mitigating potential stormwater impacts, particularly during extreme weather events.

Storm Service Recommendations

Managing pre- and post-development stormwater requires strategies to mitigate increased runoff, prevent flooding, and maintain water quality. These measures ensure that development does not negatively impact natural hydrology or downstream areas. Currently, the majority of stormwater from Exhibition Park flows to Beaver Dam Brook, which feeds into Long Lake. This flow pattern is expected to remain post-development, requiring minimal change to the existing water management regimes provided post-development flows are managed adequately. However, Sewer Shed 1 may necessitate the implementation of more stringent stormwater control measures to reduce the volume, rate, and pollution of runoff, ensuring long term sustainable stormwater management.



5.0 CONCLUSIONS AND RECOMMENDATIONS

This report provides a preliminary summary of the Municipal Servicing Infrastructure requirements necessary to support the proposed Exhibition Park Development, which will consist of approximately 5,870 residential units. The development aims to create synergistic opportunities for the lands in this area, in particular with the Ragged Lake Business Park. The findings of this study are summarized below for Municipal Wastewater, domestic water and fire flows requirements, and stormwater management.

WASTEWATER

The existing sanitary network surrounding the site collects and conveys wastewater to a 375 mm main that runs along Prospect Road to the pump station in the Ragged Lake business park, then to the Bayers Lake Pumping station (limit of this study) and ultimately to the Halifax Wastewater Treatment Facility (Halifax WWTF). As part of the scope for this project, as defined by Halifax Water, an analysis was conducted on the downstream wastewater network, extending from the proposed development to the Bayers Lake Pumping Station.

The design for the proposed development indicates that the majority of wastewater flows will need to be managed through pumping stations and forcemains leading to the Prospect Road main. It is anticipated that the development will require a total of three pumping stations to accommodate these flows.

The existing 375 mm sanitary service leaving Exhibition Park along Prospect Road was assessed and determined to be adequate to accommodate about 55% of the proposed development. To accommodate the remainder of the development, additional wastewater capacity will be required, with the best option appearing to be a parallel adjacent route along a new roadway in the Ragged Lake development extending from Exhibition Park to the existing Long Lake Drive in Ragged Lake. A number of other minor upgrades will also likely be required within the downstream network to accommodate the full build-out of the development.

WATER

The development is served by a single main connection point—a 450 mm transmission main along Prospect Road that supplies water to both the

existing Exhibition Park, the adjoining commercial area (Tim Hortons, gas station), and into the Ragged Lake Business Park.

Preliminary network modeling was conducted using EPANET for five scenarios: Average Day Demand (ADD), Maximum Day Demand (MDD), Maximum Day Demand + Fire Flow (MDD+FF), Maximum Hour Demand (MHD), and Minimum Hour Demand (MinHD). The model failed to meet Halifax Water's minimum pressure requirements during the FF scenarios, suggesting that network improvements will be required to accommodate the full development.

Similar to the Sanitary scenario, the preferred option is to extend a new water main along the same new roadway through Ragged Lake and connecting to Long Lake Drive. The additional connection forms a loop between Ragged Lake Business Park and Exhibition Park improving redundancy, operating pressure under high flow events and directly supports expansion of the Business Park.

STORMWATER

The existing stormwater catchment areas surrounding Exhibition Park is mature and well defined with various wetland areas and watercourses conveying water in the northeast direction to Long Lake, about 1 kilometre north east of Exhibition Park. Existing storm sewer systems are in place near the Tim Hortons commercial area and around the existing Exhibition Park site, capturing storm water and discharging to Beaver Dam Brook just east of the development.

A preliminary pre-development stormwater analysis identified three storm catchment areas on the development site, that translate into three modified catchments for the post development flows. Discharge points in both scenarios are similar indicating minimal impact to the existing stormwater regime, provided pre- and post-development flows are balanced.

The analysis indicates similar flow rates in the post-development scenario for Sewer Sheds 2 and 3 as much of the areas are already hardscaped. However, Sewer Shed 1 exhibits higher flow rates in the post-development scenario, highlighting the need for a more comprehensive stormwater management strategy for this area.