DEVELOPMENT SERVICING SCENARIO – SANDY LAKE

Future Serviced Communities

December 13, 2024

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 comprehensive neighbourhood planning, including 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 Sandy Lake 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.

2.1.1.1 Water Distribution System Design

- Be designed to accommodate the greater of Maximum Day Demand plus Fire Flow demand (MDD + FF), or Peak Hour Demand (PHD).
- Average Day Demand (ADD) 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 water distribution design are noted in the accompanying Stantec report *Halifax Regional Municipality Future Serviced Communities – Sandy Lake 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 design peak 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 0.75 m/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 1.6 m, and maximum cover is 5.0 m 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 – Water Infrastructure Servicing Plan Final Report Volume 2

The following items from the Infrastructure Master Plan (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 (if any).

2.3 Bedford West, Sandy Lake, and Jack Lake Wastewater Infrastructure Area Plan

The *Bedford West, Sandy Lake, and Jack Lake – Wastewater Infrastructure Area Plan Final Report,* dated March 2017, prepared by DesignPoint Engineering & Surveying Ltd. for Halifax Water, was reviewed with updates proposed by DesignPoint in 2023. The review was initiated in anticipation of the development and capital cost requirement for infrastructure, specifically, the wastewater infrastructure in the area to reflect current development of Bedford West as well as future development of Sandy Lake and Jack Lake lands. At the time of preparation of the report, this study reviewed the anticipated wastewater demands from these lands based on the up-to-date development plans as well as the capacity of the existing Hammonds Plains Road Trunk Sewer (HPRTS). Proposed pumping stations (PS) within the study area were also reviewed as part of this study. Treatment plant capacity and the capacity of the Kearney Lake Road Regional Sewer system were not reviewed as part of this study.

The study area included Bedford West (approx. 1,600 acres), Sandy Lake lands (approx. 900 acres), and the Jack Lake lands (approx. 50 acres). The study area was divided into sub sewersheds that corresponded to proposed development and developed areas. Sandy Lake lands included area currently under consideration, identified as SL1 (649.4 acres), with SL2 (173.6 acres) encompassing the existing Farmer's Dairy site, and SL3 (approx. 90.7 acres) representing the partially developed lands east of Farmer's Dairy site. Both SL1 lands and SL2 lands were intended to be serviced via upgraded Farmer's Dairy Pump Station (Twin Cities PS), with a local pump station serving the northerly portion of SL1 lands. The SL3 lands were designated to collect at a local pumping station (likely an upgraded Ben's Pumping Station).

The existing wastewater collection system and transmission system for Sandy Lake Lands (SL1 and SL2 sub-sewershed) currently drains to the Mill Cove Wastewater Treatment Facility (MCWWTF) via Farmer's Dairy Pump Station (Twin Cities PS) at a peak flow rate of 29.7 L/s (as referenced in the 2008 CBCL report, DesignPoint, 2017). However, based on the recommendation of the report, the SL1 and SL2 lands would ultimately be re-routed to the Halifax System via Twin Cities Pump Station & Pump Station #1 to Kearney Lake Regional Trunk, with only SL3 lands tributary to MCWWTF. DesignPoint report estimated the population for the SL1 and SL2 area, to be 17,650 and 6,290, respectively, which combined (23,940) exceeds the high-density development scenario for these lands estimated by Stantec (21,325).

Based on the review of the existing Bedford West Trunk Sewer, DesignPoint concluded that although the existing and proposed 600mm and 675mm trunk sewer are operating at 100% and 108% capacity respectively, the hydraulic grade line (HGL) is not anticipated to have a significant impact on the performance of the overall system.

The proposed wastewater system upgrades to accommodate SL1 and SL2 lands were identified as follows:

- Replace/upgrade Twins Cities Pumps Station – new station to accommodate developed tributary area and collects wastewater from areas including Uplands, Sandy Lake, Bluewater, Peerless, Bedford West). The PS to accommodate 382 L/s to 419 L/s depending on density and including peak wet weather flow. Total estimated costs $8.1M-$8.4M (2017).

- Replace Temporary Pumps Station PS#1 – new station to accommodate developed tributary area. This station located in Bedford west Sub-Area 5 would be sized to accommodate 629 L/s to 663 L/s depending on Sandy Lake population density and including peak wet weather flow. Total estimated costs $9.6M-$9.7M (2017).
- New Twin Cities Pumping Station Force main (dual 500mm). Total estimated costs $3.1M (2017).
- New PS #1 Force main (dual 600mm). Total estimated costs $2.0M (2017).
- Extend 600mm gravity sewer from Bluewater Road to Pumping station #1. Costs were not identified.

2.4 Other Regional Considerations

Halifax Water provided additional comments related to regional infrastructure which must be considered as part of future development and infrastructure planning processes for the Sandy Lake development. HW's comments are presented in the following sub-sections.

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 LARRY UTECK BOULEVARD

Halifax Water identified an existing 1200 mm transmission main in Larry Uteck Boulevard (LUB) between Bluewater Road and Hammonds Plains Road. The Pockwock Transmission main is expected to be twinned for growth and redundancy. There will be a need for a second (minimum size 1200 mm) transmission main in this section of the LUB. Current plans for this area indicate the need for a 400 mm local transmission main along this section of LUB. As well, properties fronting on this section of LUB are to receive sanitary service. At this time, it is not clear whether this entails a sanitary sewer that crosses, or runs parallel to, LUB. Future plans for LUB are unknown. It can be anticipated that the existing ditched cross section of LUB may be upgraded to a widened, curbed cross-section with storm sewers on parts of the street. There may also be a local gas main. It is uncertain whether there has been any overall planning carried out to confirm that all of these services will fit, or can be installed safely, within the existing right-of-way without jeopardizing the single supply main to the city. Utility easements along the certain parts of LUB may be required. **The study to confirm the infrastructure layout and ROW requirements for LUB should be initiated prior to, or concurrently with, the master planning and servicing for Sandy Lake Area.**

2.4.3 HAMMONDS PLAINS ROAD

The existing Hammonds Plains Road (HPR) has a number of sags and crests in its profile. In previous phases of the Bedford West build-out, decisions were made to flatten the road profile for improved traffic flow and safety. In the case of the Sandy Lake and West Bedford Areas 1 and 12, there are plans for water and wastewater mains to be installed in, or across, Hammonds Plains Road. A similar decision on whether to smooth the road profile will need to be made early in the design process so that pipes can be designed with appropriate cover and grade. The redesign of the HPR should take into account infrastructure servicing for the Sandy Lake area to ensure that the road profiles and infrastructure is well coordinated with the future development plans for the area. **It is recommended the Master Servicing Plan for Sandy Lake be completed prior to completing improvements on HPR.**

2.4.4 UPLANDS PARK WWTP DECOMMISSIONING

Recent Wastewater Servicing concept plans for West Bedford Areas 1 and 2 and Sandy Lake show a gravity sewer being extended along Halifax Water's Pockwock transmission main corridor in order decommission the Uplands Park WWTP. Installation of a sewer in this corridor is not acceptable to Halifax Water because it obstructs future plans for twinning the Pockwock Transmission main. Construction of a sewer along the proposed alignment would also pose a risk to the existing transmission main. Previous wastewater servicing plans had indicated that a gravity sewer could be extended along Hammonds Plain Road. This alignment is preferable. The sewer alignment's crossing of the existing and future Pockwock Transmission Mains will need to be resolved. It is possible that the alignment for the Uplands Park outlet should cross the transmission mains further east on LUB as part of a coordinated wastewater servicing strategy for the planning area. **It is recommended that the location of the sanitary sewer related to the decommissioning of the Uplands Park WWTP be completed as part of Master Servicing Plan for Sandy Lake area and take into consideration the location of the HW Pockwock Transmission main including future twinning.**

2.4.5 POCKWOCK TWINNING

Halifax Water is currently carrying out a functional study for the future twinning of the Pockwock Transmission Main. This includes a needs assessment, which is looking at the existing land parcels along the transmission main corridor between the JD Kline Plant and Hammonds Plains Road. It is possible that additional land/easements may be required within the proposed Sandy Lake Development in order to safely construct the future twinned main. It is anticipated that this functional study will be completed by summer 2025. The requirement for additional land/easements along the transmission main within the Sandy Lake development area may impact current concept plans**. It is recommended that the Master Community Development Plan and Master Servicing Plan for Sandy Lake area be coordinated with the functional study and consider the lands/easement requirement associated with the future twinning of the transmission main.**

2.4.6 BEDFORD CONNECTOR

Halifax Water supplies the Bedford-Sackville area via the Bedford Connector, a 750 mm transmission main that passes through the Sandy Lake Development area within an existing easement. The Bedford Connector is the primary feed to Bedford-Sackville and cannot be disrupted for extended periods. The main was installed in the mid-1970s. Based on previous failures along this main, downstream portions of the main have been replaced east of Giles Road. It is Halifax Water's intention to replace the remaining original sections of this main. Halifax Water has had preliminary discussions with the Sandy Lake Development proponents about potentially cost sharing on the 're-alignment' of this main along the future planned road network in the Sandy Lake area. This would provide benefit to both Halifax Water and the developer(s). Any sections of realigned main would need to be fully constructed and commissioned while maintain existing service. The proposed phasing would need to demonstrate that no long shutdowns are required. Discussions on this issue have been preliminary and no details have been finalized to date.

It is unclear from a review of the servicing sketches for the Sandy Lake Development whether the full extent of the Bedford Connector is proposed for replacement. It appears that a new road is proposed along the easement / alignment of the existing Bedford Connector main. As noted above, the existing transmission main cannot be shut down for extended periods. It would need to be demonstrated that the line would be replaced within the existing corridor without risking the integrity of the existing main. If the current concept plan does not contemplate the replacement of the Bedford Connector, construction of a new street on top of an existing transmission main is not appropriate and Halifax Water would not support this approach. Subject to more detailed discussions, it may be more effective to install this section of a re-aligned Bedford Connector along Hammonds Plains Road and Giles Road. **It is noted that the road layout presented in the current study is based on the information provided by landowner(s) and is conceptual only. It is recommended that as part of the development process, the Community Development Plan and Master Servicing Plan be completed, which identifies the proper corridor/alignment for the Beford Connector main, including taking into consideration phasing and cost sharing.**

2.4.7 PROTECTION OF EXISTING TRANSMISSION MAINS

The existing 1350 mm diameter Pockwock Transmission Main and the 750 mm diameter Bedford Connector are Prestressed Concrete Cylinder Pipes (PCCP). PCCP is susceptible to vibratory damage from blasting, construction, and compaction work. As with other areas of development along these mains, all construction activities in close proximity to the existing Pockwock Transmission Main and the Bedford Connector will be required to have approved vibratory and construction restrictions in place. Monitoring of vibratory impacts will also be required. **It is recommended that appropriate draft conditions be put in place as part of the approval for the installation of road and infrastructure works associated with the subdivision work that are to occur within proximity of Pockwock Transmission main and the 750 diameter Bedford Connector.**

2.4.8 SERVICING PLANS AND CONNECTIONS TO EXISTING

Concept plans show an extension of the existing 200 mm water main from the Peerless Pressure Reducing Valve (PRV) on Farmers' Lane. This PRV is an older style confined space chamber that is currently out of service. Subject to additional modeling and relocation of the Bedford Connector, this PRV should be replaced, or its functionality should be relocated closer to the main development area in the northern portion of the site. **It is recommended that the adequacy and details of connecting to the existing PRV on Farmers' Lane should be reviewed as part of the preparation of the Master Servicing Plan for the Sandy Lake development.**

2.4.9 CAPITAL COST CONTRIBUTIONS (CCC)

The current water servicing plans indicate that a 400 mm main proposed along LUB would also service portions of the Sandy Lake Development lands. There is a PRV shown within the Sandy Lake lands supplying this line. This proposed 400 mm main was not included in the original West Bedford Water servicing plan or in the West Bedford CCC. It is required to address high ground along both sides of LUB in relation to Sub-Area 12. The proposed CCC for Sub-Area 12 will need to include a portion of this main and PRV. A portion of the cost of this main and PRV(s) would be attributed to the Sandy Lake Lands. This is subject to further review of the benefits to both areas. **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.**

The 2009 CBCL Greenfield Study that was completed for HRM, noted the requirement for a 3.9ML water storage reservoir within the Sandy Lake development area. The sizing was based on the assumed development densities at that time. The reservoir sizing requirements will need to recalculated based on current growth and build-out projections. **It is recommended that the study should be updated to reflect the projected growth for Sandy Lake area and reflected in Regional Infrastructure Master Plan Update.**

The West Bedford Areas 1 and 12 are within the West Bedford Intermediate Zone and receive fire protection and storage benefit from the recently completed Hemlock Reservoir. The West Bedford Lands contributed to the Hemlock Reservoir through the approved CCC. A significant percentage of the Sandy Lake development lands are to be serviced by the higher Bluewater Intermediate Zone and as such would not receive benefit from the Hemlock Reservoir. It would be Halifax Water's intention to apply the calculated value of required storage for the Sandy Lake Development toward a planned future off-site reservoir (upstream of the Development area) that will serve the Sandy Lake area.

The cost of the applicable portion of reservoir storage, PRVs and main oversizing would form components of a water CCC for the development area. **It is recommended that the specific studies should be updated to reflect the projected growth for Sandy Lake area and reflected in Regional Infrastructure Master Plan Update, as well and the CCC for the development area.**

3 Development Scenarios

Stantec prepared 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 Clayton Development concept and Arsenal Developments.

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 – Sandy Lake (Stantec, 2024)* report. Recognizing that each development area has unique features and environmental constraints, the following methodology was applied 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. 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.

Sandy Lake – Medium (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**
Clayton Development	670	459.6	Ground-based	1,111		14.6%	2,889			
			Commercial	324		4.2%	583			
			Multi-unit	5,596		73.3%	10,073			
			School Site	600		7.9%	1,080			
			All types	**7,631**	**16.6**	**100.0%**	**14,625**	**31.8**	**11.0**	**165,000**
Arsenal Developments	15	10.3	Singles	43		40.2%	112			
			Multi-unit	64		59.8%	115			
			All types	**107**	**10.4**	**100.0%**	**227**	**22.1**	**11.0**	**5,000**
Imad Zebian	3.2	2.2	Singles	12	5.5	100.0%	31	14.2		
Gino Nadalini	2.6	1.8	Multi-unit	300	**168.2**	100.0%	540	302.8		
STUDY AREA	**691**	**473.9**	**All development**	**8,050**	**17.0**		**15,423**	**32.5**	**11.0**	**170,000**

Sandy Lake - 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**
Clayton Development	670	367.7	Singles	616		12.8%	1,602			
			Townhouses	84		1.8%	218			
			Multi-unit	4,096		85.4%	7,372			
			All types	**4,796**	**13.0**	**100.0%**	**9,192**	**25.0**	**11.0**	**105,000**
Arsenal Developments	15	8.2	Ground-based	39		40.2%	101			
			Multi-unit	58		59.8%	105			
			All types	**97**	**11.8**	**100.0%**	**206**	**25.0**	**11.0**	**5,000**
Imad Zebian	3.2	1.8	Singles	17	9.6	100.0%	44	25.0		
Gino Nadalini	2.6	1.4	Ground-based	14	9.6	100.0%	36	25.0		
STUDY AREA	**691**	**379.1**	**All development**	**4,923**	**13.0**		**9,478**	**25.0**	**11.0**	**105,000**

Sandy Lake - High-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**
Clayton Development	670	459.6	Singles	1,386		12.8%	3,604			
			Townhouses	189		1.8%	491			
			Multi-unit	9,216		85.4%	16,588			
			All types	**10,791**	**23.5**	**100%**	**20,683**	**45.0**	**11.0**	**230,000**
Arsenal Developments	15	10.3	Multi-unit	257	25.0	100.0%	463	45.0	11.0	10,000
Imad Zebian	3.2	2.2	Multi-unit	55	25.0	100.0%	99	45.0		
Gino Nadalini	2.6	1.8	Multi-unit	45	25.0	100.0%	80	45.0		
STUDY AREA	**691**	**473.9**	**All development**	**11,147**	**23.5**		**21,325**	**45.0**	**11.0**	**235,000**

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

4 Potable Water Infrastructure

To assess the ability of servicing the Sandy Lake 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 Sandy Lake development, while **Appendix A** contains the full *Halifax Regional Municipality Future Serviced Communities – Sandy Lake Water Servicing Plan – Final Report*.

4.1 Connectivity to Municipal Infrastructure

The proposed Sandy Lake development is located adjacent to the Kingswood High, West Bedford Intermediate, Bedford Intermediate, and Bluewater Intermediate pressure zones. These pressure zones are included in the Pockwock Lake system and are serviced by the J. Douglas Kline Water Treatment Facility.

Table 4-1: Adjacent Pressure Zones Hydraulic Grade Lines

Connection	Pressure Zone	HGL (m)	HGL (ft)
1	Kingswood High	165-169	540-555
2	West Bedford Intermediate	102-108	335-355
3	Bluewater Intermediate	119-128	390-420
4	Bedford Intermediate	93-95	305-312

Halifax Water's current pressure zone map does not show the Bluewater Intermediate zone extending to the south-western portion of the proposed development. However, based on the contours, it is reasonable to assume the Bluewater Intermediate zone can extend to this area.

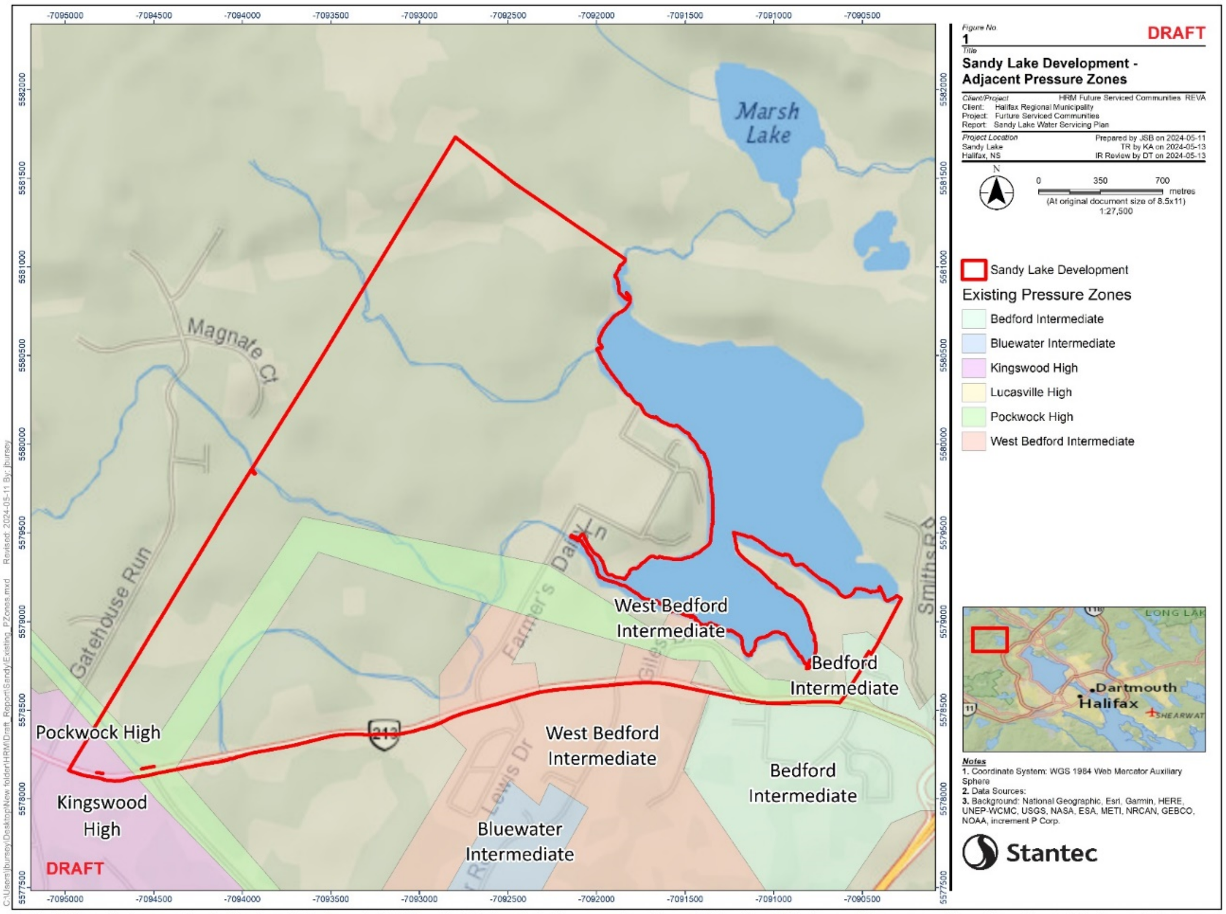

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Figure 4-1: Existing Pressure Zones

Comparing the serviceable range of elevations of the adjacent pressure zones to the proposed development elevation ranges indicate that the proposed re-delineation of the Bluewater Intermediate and West Bedford Intermediate pressure zones can accommodate the development (from a pressure perspective).The proposed pressure zone re-delineation is illustrated in **Figure 4-2**.

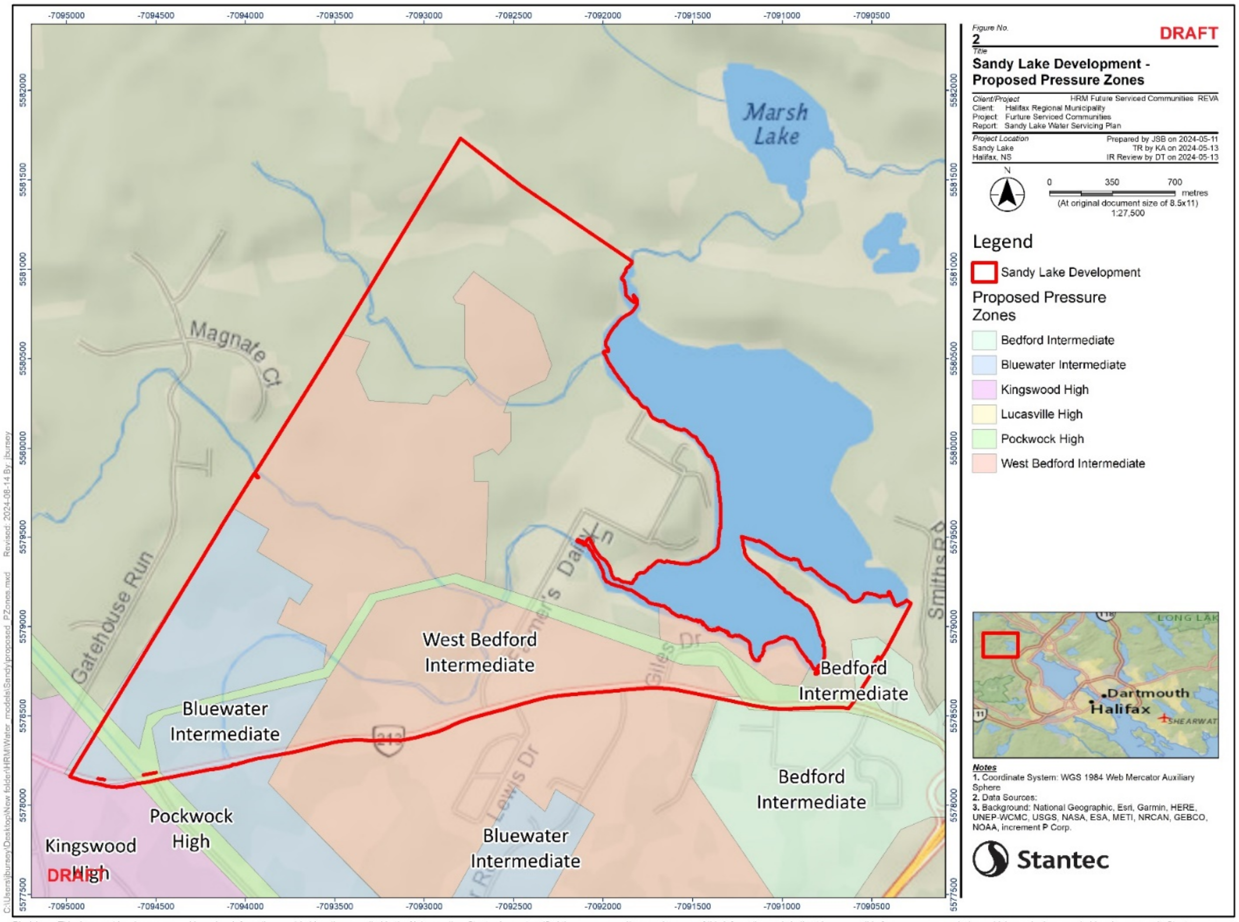

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Figure 4-2: Sandy Lake Development - Proposed Pressure Zone Re-Delineation

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 Bluewater Intermediate and West Bedford Intermediate pressure zones. The low end of each given HGL range was assumed. 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 model was used to estimate pipe diameters and pressure zone delineation to achieve the level of service. Proposed watermain sizes which range from 200 mm to 400 mm diameter, with the majority of the pipe proposed as 200 mm diameter.

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 48 psi (at a dead end main near Hammonds Plain Road and the divide between proposed Bluewater Intermediate and West Bedford Intermediate pressure zones divide) to 97 psi (which is slightly above the prescribed range for PHD) near the northern end of Farmers Dairy Lane. Some locations have pressures greater than that specified in the Design Specification, in these instances pressure reducing valves installed on the water service lines (in accordance with Halifax Water's Supplementary Standard Specifications) should be considered. The available fire flow range is approximately 4,500 Lpm to 27,500 Lpm, which meets, or exceeds, the required flow for MDD+FF.

Additional modeled scenarios are available for review within the *Halifax Regional Municipality Future Serviced Communities – Sandy Lake 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 using 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
MDD High Density	51 – 98	< 1.5	N/A
PHD High Density	48 – 97	< 1.5	N/A
MHD High Density	52 – 92	< 1.5	N/A
MDD + FF High Density	> 22	< 2.4	4,500 – 27,500*
MDD Low Density	52 – 99	< 1.5	N/A
PHD Low Density	52 – 99	< 1.5	N/A
MHD Low Density	52 – 99	< 1.5	N/A
MDD + FF Low Density	> 22	< 2.4	4,500 – 27,900*

* 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.

Since the maximum pressures for each scenario exceed the range presented in Halifax Water's Design Specification, pressure reducing valves installed on the water service lines (in accordance with Halifax Water's Supplementary Standard Specifications) should be considered in those locations.

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.

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.

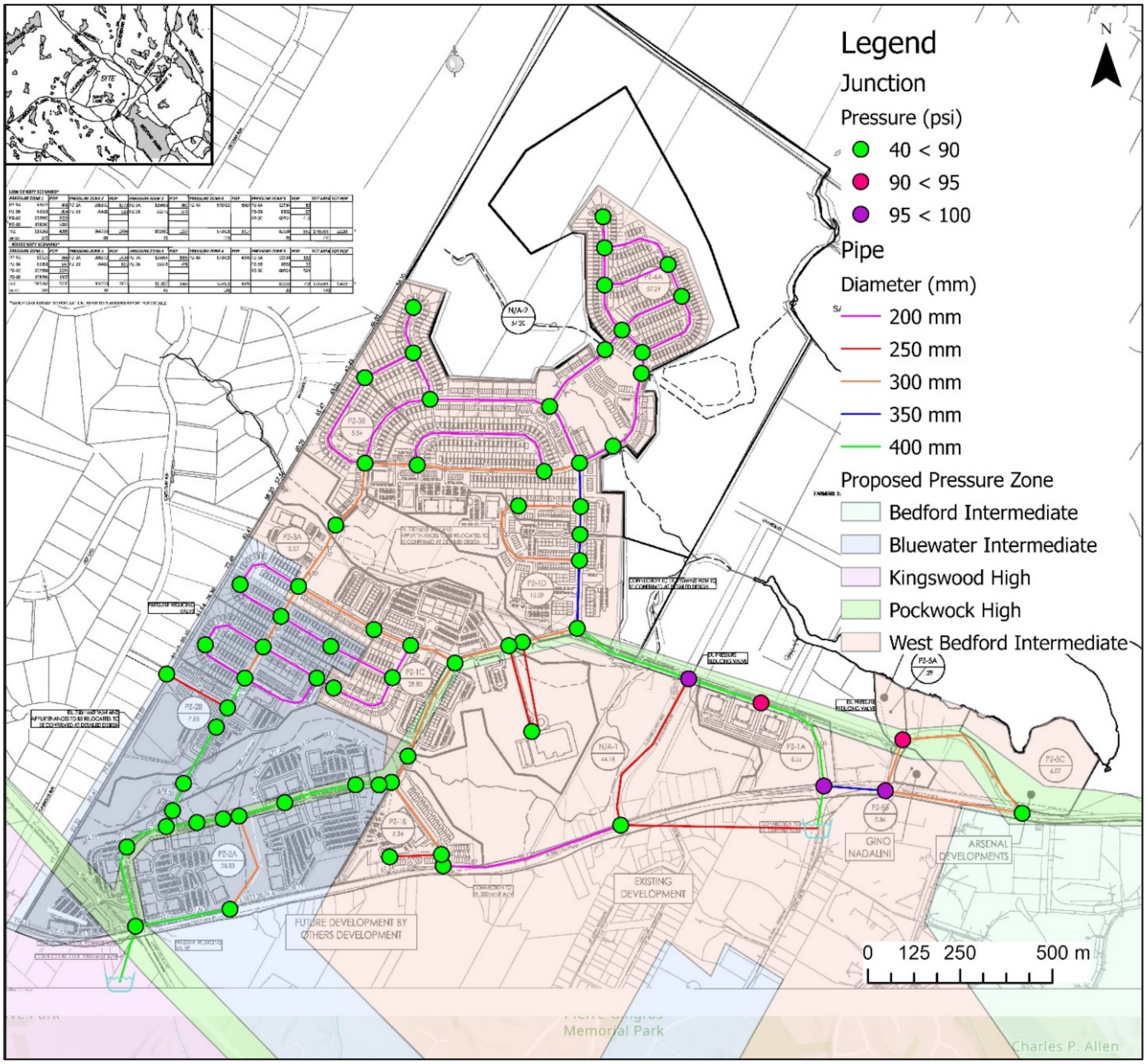

Figure 4-3: Pressure Distribution Under PHD (High-Density Scenario)

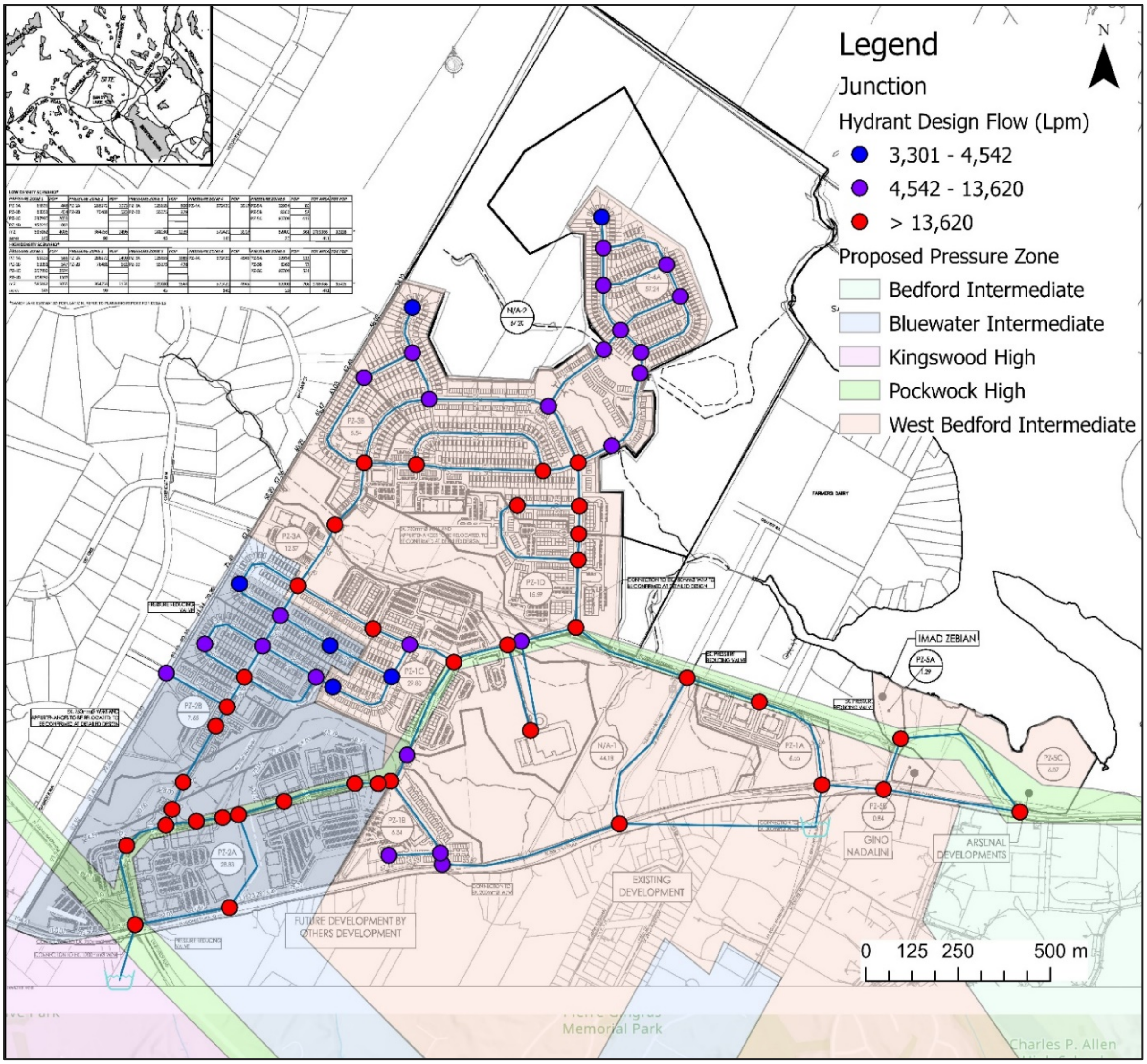

Figure 4-4: Available Fire Flow @ 22 psi under MDD (High-Density Scenario)

5 Wastewater Infrastructure

The development of the wastewater strategy for Sandy Lake area was not part of the scope of the current study. However, based on the *Bedford West, Sandy Lake and Jack Lake - Wastewater Infrastructure Area Plan Final Report* by DesignPoint, (2017), a high-level wastewater servicing plan was prepared to identify regional wastewater improvements for the broader area and accommodate the Sandy Lake Development (**Section 2.3**). Based on feedback received by the developer, Clayton Developments, the wastewater concept plan prepared by DesignPoint (2023) was provided. The concept wastewater plan contemplates a new Pump Station 1 servicing Sandy Lake Development and accommodating the existing flows from the Twin City Pump Station. A local pump station servicing northerly lands and tributary to the Main Pump Station is also proposed (Refer to the Sanitary Schematic in **Appendix B**). This generally aligns with the previous study by DesignPoint (2017) with some notable differences:

- The Main Pump Station 1 is a new Pump Station located east of the Twin City Pump Station, whereas DesignPoint (2017) proposed Twin City Pump Station to be upgraded.
- The Main Pump Station 1 identifies flows at 213.2 L/s vs. 419 L/s DesignPoint (2017), which appears to be sized for only Sandy Lake (SL1) area and Existing Twin City PS flows (29.7 L/s), and not for a larger area encompassing areas SL1, SL2, BW12, PL1, BW1A, B1, U1, U2 per previous study.
- The I/I allowance of 0.24 l/s/ha was used to calculate I/I loading, which deviates from the DesignPoint (2017) and prescribed Halifax guidelines.
- Forcemain connection is proposed to be connection at the west of the BW12 lands instead of east end along the Hammond Plains Road.
- No narrative has been provided with regards to the downstream infrastructure improvements and upgrades.

The existing wastewater collection system and transmission system, for Sandy Lake Lands (SL1 and SL2 sub-sewershed) currently drains to the MCWWTF via Farmer's Dairy Pump Station (Twin Cities PS) at a peak flow rate of 29.7 L/s (as referenced in the 2008 CBCL report, DesignPoint, 2017). However, based on the recommendation of the report, the SL1 and SL2 lands would ultimately be re-routed to the Halifax System via Twin Cities Pump Station & Pump Station #1 to Kearney Lake Regional Trunk, with only SL3 lands tributary to MCWWTF. DesignPoint report estimate of the population for the SL1 and SL2 area, was 17,650 and 6,290, respectively, which combined exceeds the high-density development scenario for these lands 23,940 (DesignPoint) vs. 21,325 (Stantec, 2024).

An estimated peak sanitary discharge from the Sandy Lake 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	9478	0.98	153.42	166.1
Medium / Developer Requested	15423	1.58	191.78	240.0
High	21325	2.18	191.78	298.1

It is of note that the developer requested scenario peak sanitary discharge exceeds that demonstrated by DesignPoint within recent (2023) sanitary schematics due to variance in anticipated developable land and differing allowance for infiltration noted on accompanying drawings.

Peak discharge from the upgraded Twin Cities PS is expected to accommodate discharge from the Sandy Lake development area in addition to areas U1, U2, undeveloped portions of SL2, BW12, PL1, B1, and BW1A (**Figure 5-1**) per the 2017 Infrastructure Area Plan.

As anticipated by the 2023 sanitary schematic, preliminary grading plans included on **Drawing GP-1** (**Appendix C**) identify the potential need for a smaller internal lift station to service lands within the Sandy Lake area north of the unknown watercourse crossing at the extension of Granter Road. This low-density residential area would otherwise require local sanitary sewers in excess of 6m in depth when following existing topography of the lands north of Johnson Brook.

Based on the evident deviation from the original study by DesignPoint (2017), it is recommended that the Bedford West, Sandy Lake, and Jack Lake Wastewater Infrastructure Area Plan be updated as part of the Master Servicing Study for Sandy Lake Area.

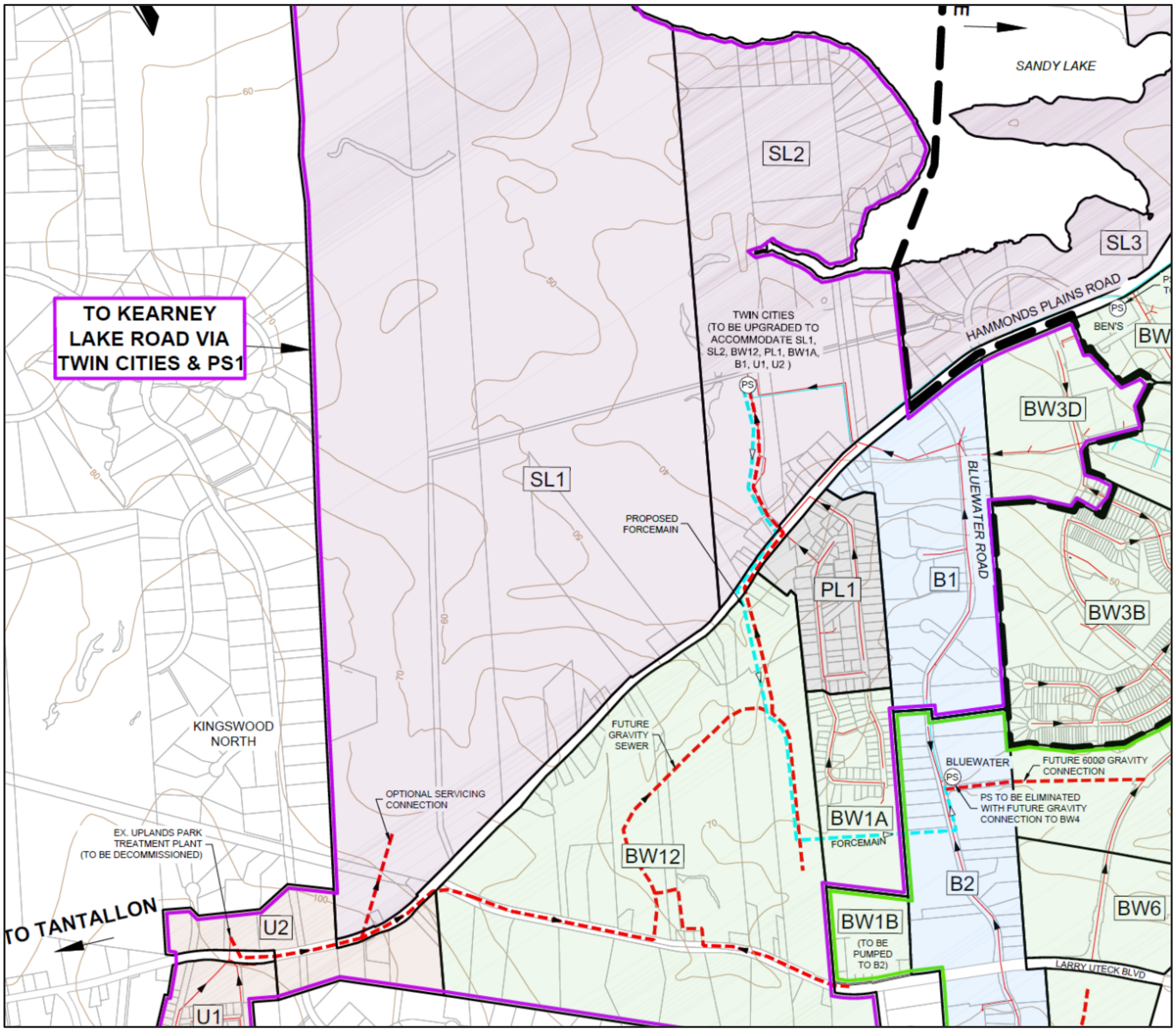

Figure 5-1: Wastewater Infrastructure Area Plan (DesignPoint, 2017)

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 – Sandy Lake Watershed Study and Stormwater Management Plan – Final Report* dated December 2024).

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% where possible 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 *Sandy Lake 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 Sandy Lake development steeply sloped areas are noted under existing conditions in proximity to the centrally located watercourses. Additionally, steep tie in grades are necessary along Bluewater Road and to properties fronting onto Gatehouse Run to meet existing conditions. It is likely that retaining walls will be required in proximity to these locations to facilitate development and tie-in to surrounding roadways without heavy deviation from existing elevations. However, even with the incorporation of these measures, areas of significant fill are noted between major system outlets and Farmer's Dairy lane to elevate proposed residential areas above anticipated floodplain elevations. 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 *Sandy Lake Study Area Summary Report* and coordinated with the transportation conclusions.

APPENDICES

Appendix A Potable Water Infrastructure

HALIFAX REGIONAL MUNICIPALITY FUTURE SERVICED COMMUNITIES - SANDY LAKE WATER SERVICING PLAN

Final Report

November 4, 2024

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	2024-08-16				
2	Final	JB	2024-11-04	JS	2024-11-06	DT	2024-11-21

The conclusions in the Report titled Halifax Regional Municipality Future Serviced Communities - Sandy Lake 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 report outlines the results from the review of the potable water servicing within the Sandy Lake 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	3300	1.5	1
Two Family Dwellings	3300	1.5	1
Townhouse	4542	1.75	1
Multi-unit high rise	13620	3	3
Commercial	13620	3	3
Industrial	13620	3	3
Institutional	13620	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, 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 (if any)

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 Sandy Lake Development is in the northwest area of Halifax Regional Municipality (HRM), within the community of Hammonds Plains, near the intersection of Hammonds Plains Road and Farmers Dairy Lane. The proposed development area borders Sandy Lake to the east and Hammonds Plains Road to the south and is approximately 370 hectares of largely undeveloped land.

3.2 Adjacent System Description

The proposed Sandy Lake development is located adjacent to the Kingswood High, West Bedford Intermediate, Bedford Intermediate, and Bluewater 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**.

Table 3-1: Adjacent Pressure Zones Hydraulic Grade Lines

Pressure Zone	HGL (ft)	HGL (m)
Kingswood High	540 - 555	165 - 169
West Bedford Intermediate	335 - 355	102 - 108
Bluewater Intermediate	390 - 420	119 - 128
Bedford Intermediate	305 - 312	93 - 95

Halifax Water’s current pressure zone map does not show the Bluewater Intermediate zone extending to the south-western portion of the proposed development. However, based on the contours, it is reasonable to assume the Bluewater Intermediate zone can extend to this area.

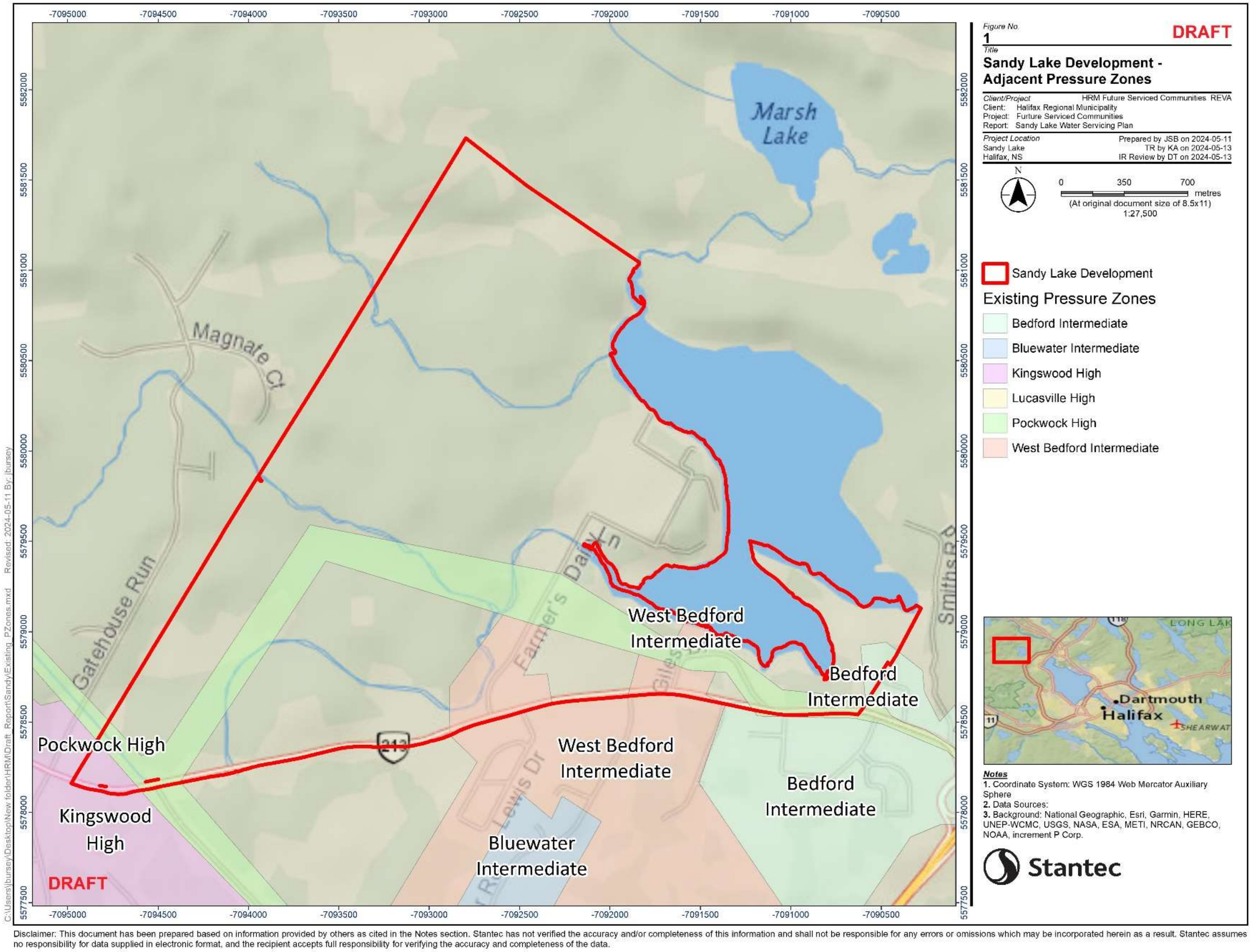


Figure 3-1: Sandy Lake Development - Adjacent Pressure Zones

3.3 Proposed Development

3.3.1 GRADING

The proposed grading plan (street level) for the Sandy Lake development ranges from approximately 35 m near the southeast to 85 m near the southwest extents of the development (**Figure 3-2**).

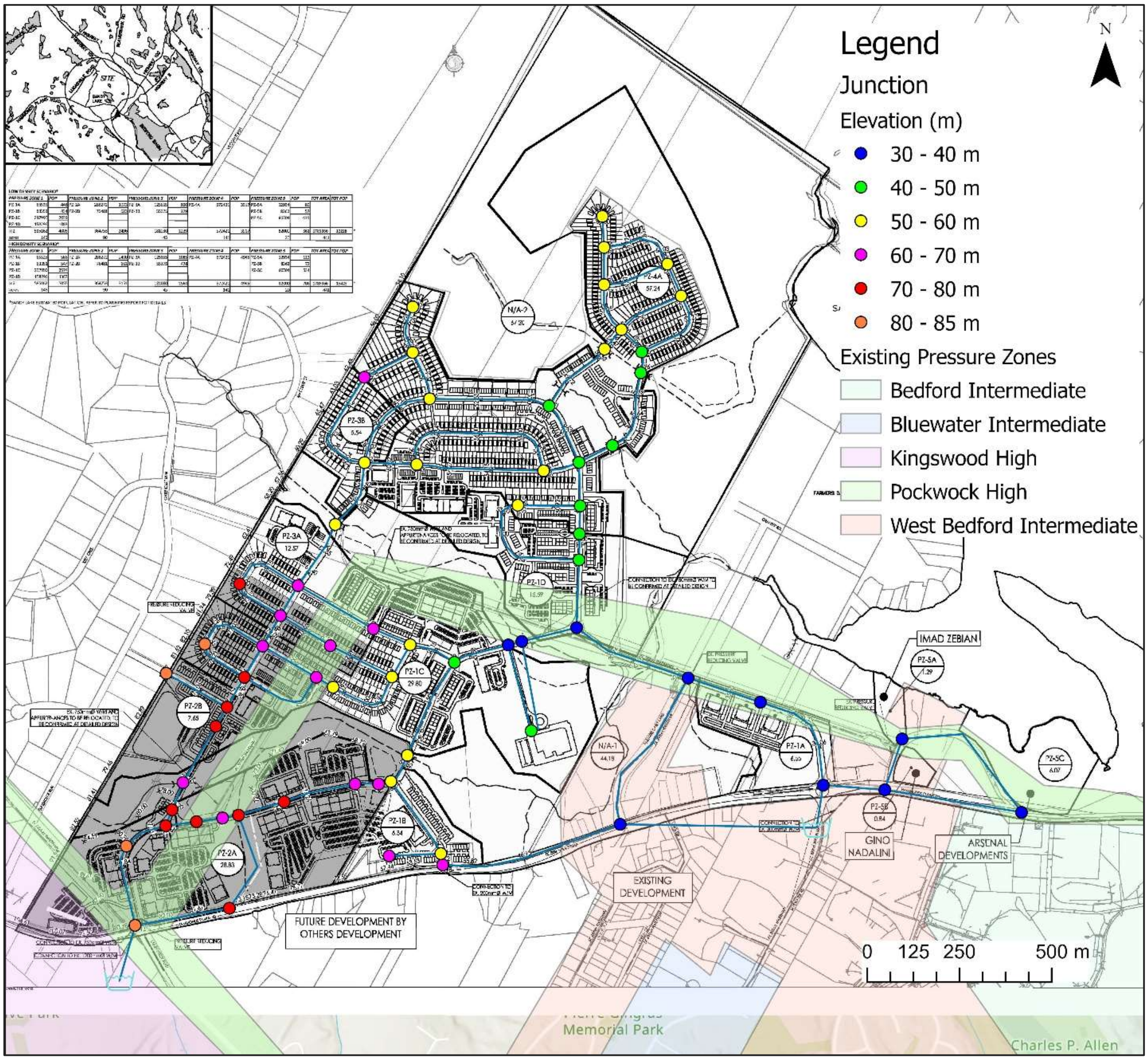


Figure 3-2: Proposed Site Grading

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 Bluewater Intermediate and West Bedford Intermediate pressure zones can accommodate the development, from a pressure perspective. Since the serviceable elevation range for the Kingswood High pressure zone is higher than the elevations in the proposed grading plan, connecting to the Kingswood High pressure zone would require a new pressure zone created by a pressure reducing valve (PRV). The Sandy Lake Design Report – Water Servicing by DesignPoint Engineering & Surveying Ltd. suggested connecting a 400 mm watermain to the existing 1200 mm transmission main at the intersection of Hammond Plains Road and Larry Uteck Blvd, followed by a PRV to match the Bluewater Intermediate HGL.

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

Pressure Zone	HGL (m)	Serviceable Elevation (m)*	
		Low	High
Kingswood High	165 - 169	102 – 106	137 - 141
West Bedford Intermediate	102 - 108	39 – 45	74 - 80
Bluewater Intermediate	119 - 128	56 – 65	91 - 100
Bedford Intermediate	93 - 95	30 - 32	65 - 67

* Neglecting friction loss

The pressure zone connections will depend on construction/development phasing. For instance, the eastern portion of the development can connect to existing West Bedford Intermediate infrastructure immediately. However, new watermain is required from the Bluewater Intermediate pressure zone to Sandy Lake development to service the western portion of the development, or a new PRV connected to the Kingswood High zone to reduce the HGL to match that of Bluewater Intermediate, as suggested in the Sandy Lake Design Report – Water Servicing by DesignPoint Engineering & Surveying Ltd. The proposed pressure zone re-delineation is illustrated in **Figure 3-3**.

A hydrant flow test was conducted on Hammonds Plains Road near Farmers Dairy Lane and Lewis Drive to confirm the static pressure of the West Bedford Intermediate zone near the proposed connection point. The test results are presented in **Appendix A**. The static pressure reported during the test was 88 psi (62 m pressure head). The ground elevation at the test location is approximately 40 m, resulting in a HGL of 102 m at the proposed connection point. As shown in the table above, a HGL of 102 m for the West Bedford Intermediate pressure zone aligns with the existing HGL. A hydrant flow test to the Kingswood High pressure zone was not conducted, as any potential connection to this zone will require a PRV to match the Bluewater Intermediate HGL (as described above).

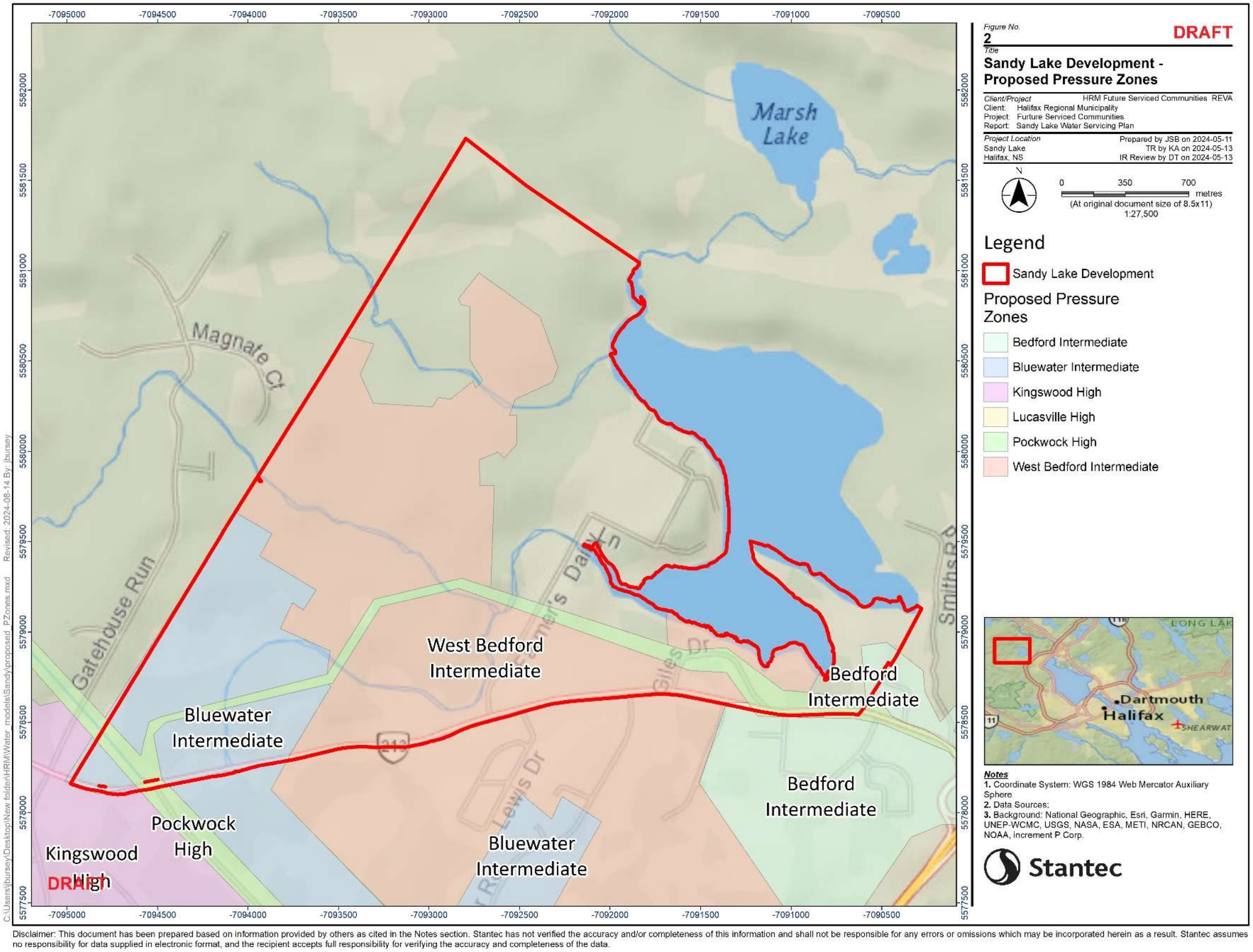


Figure 3-3: Sandy Lake Development - Proposed Pressure Zone Re-Delineation

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: Sandy Lake Area* report and presented in **Table 3-3**. The corresponding demands are presented in **Table 3-4**. Peaking factors per Halifax Water's Design Specification (**Table 2-4**) 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 3-3: Population Estimates

Scenario	Population
High Density	21,325
Low Density	9,478

Table 3-4: Proposed Demands

Scenario	ADD (Lpm)	MHD (Lpm)	MDD (Lpm)	PHD (Lpm)
High Density	5,554	4,417	7,844	13,886
Low Density	2,469	1,963	3,487	6,173

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 Bluewater Intermediate and West Bedford Intermediate pressure zones. The low end of each given HGL range was assumed. 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 two 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 used to maintain the pressure boundaries. 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.

The connection to the Bluewater Intermediate zone was modeled as a 400 mm diameter watermain near the intersection of Hammond Plains Road and Larry Uteck Blvd, which assumes the design as proposed by DesignPoint. For the connection to the West Bedford Intermediate zone, it was assumed that the new watermain would connect to the existing 300 mm diameter watermain at the intersection of Bluewater Road and Hammond Plains Road. While not included in the model, it is noteworthy that the existing 750 mm diameter transmission main will need to be realigned to accommodate the proposed new development layout. Assumed points of connection to the existing pressure zones are presented in **Figure 3-4**.

3.3.4.1 High-Density Population Scenario

Figure 3-4 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 3-5** presents the anticipated corresponding pressures throughout the development during MDD, which range from 51 psi (at a dead end main near Hammonds Plain Road and the divide between proposed Bluewater Intermediate and West Bedford Intermediate pressure zones divide) to 98 psi (at the northern end of Farmers Dairy Lane). **Figure 3-5** also illustrates the proposed watermain sizes which range from 200 mm to 400 mm diameter, with the majority of the pipe proposed as 200 mm diameter.

The distribution of PHD is illustrated in **Figure 3-6**, and the results of the PHD analysis are presented in **Figure 3-7**. Pressures under the PHD scenario range from approximately 48 psi (at a dead end main near Hammonds Plain Road and the divide between proposed Bluewater Intermediate and West Bedford Intermediate pressure zones divide) to 97 psi near the northern end of Farmers Dairy Lane. 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 3-8** and **Figure 3-9**, respectively. Pressures under the MHD scenario range from approximately 52 psi to 99 psi.

As shown for the MHD, MDD and PHD, some locations have pressures greater than that specified in the Design Specification in these instances pressure reducing valves installed on the water service lines (in accordance with Halifax Water’s Supplementary Standard Specifications) should be considered.

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 3-10**. The total MDD + FF demand at each node is presented in **Figure 3-11**, and the results of the fire analysis are presented in **Figure 3-12**. The available fire flow range is approximately 4,500 Lpm to 27,500 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). 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.

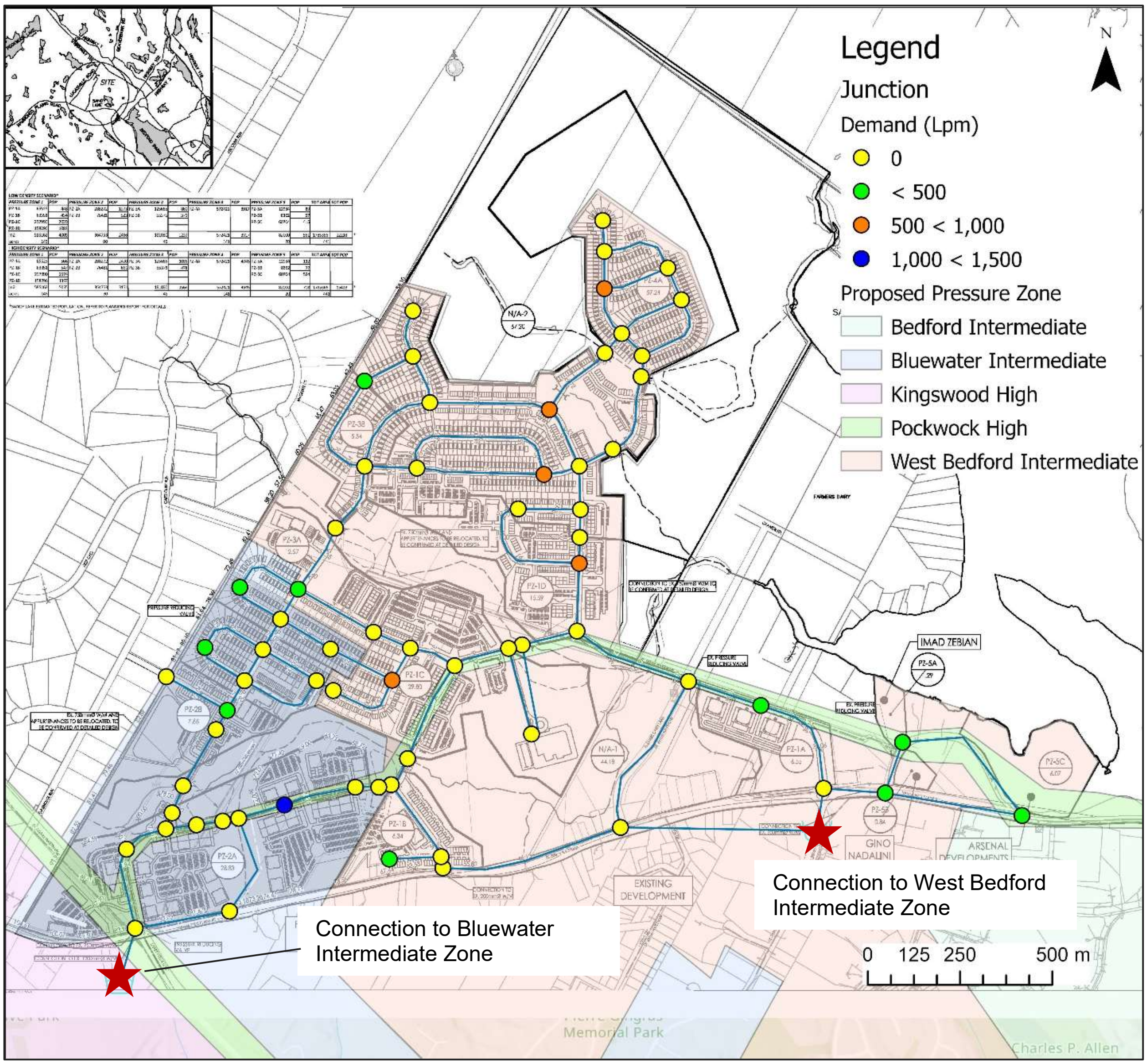


Figure 3-4: MDD Distribution (High-Density Scenario)

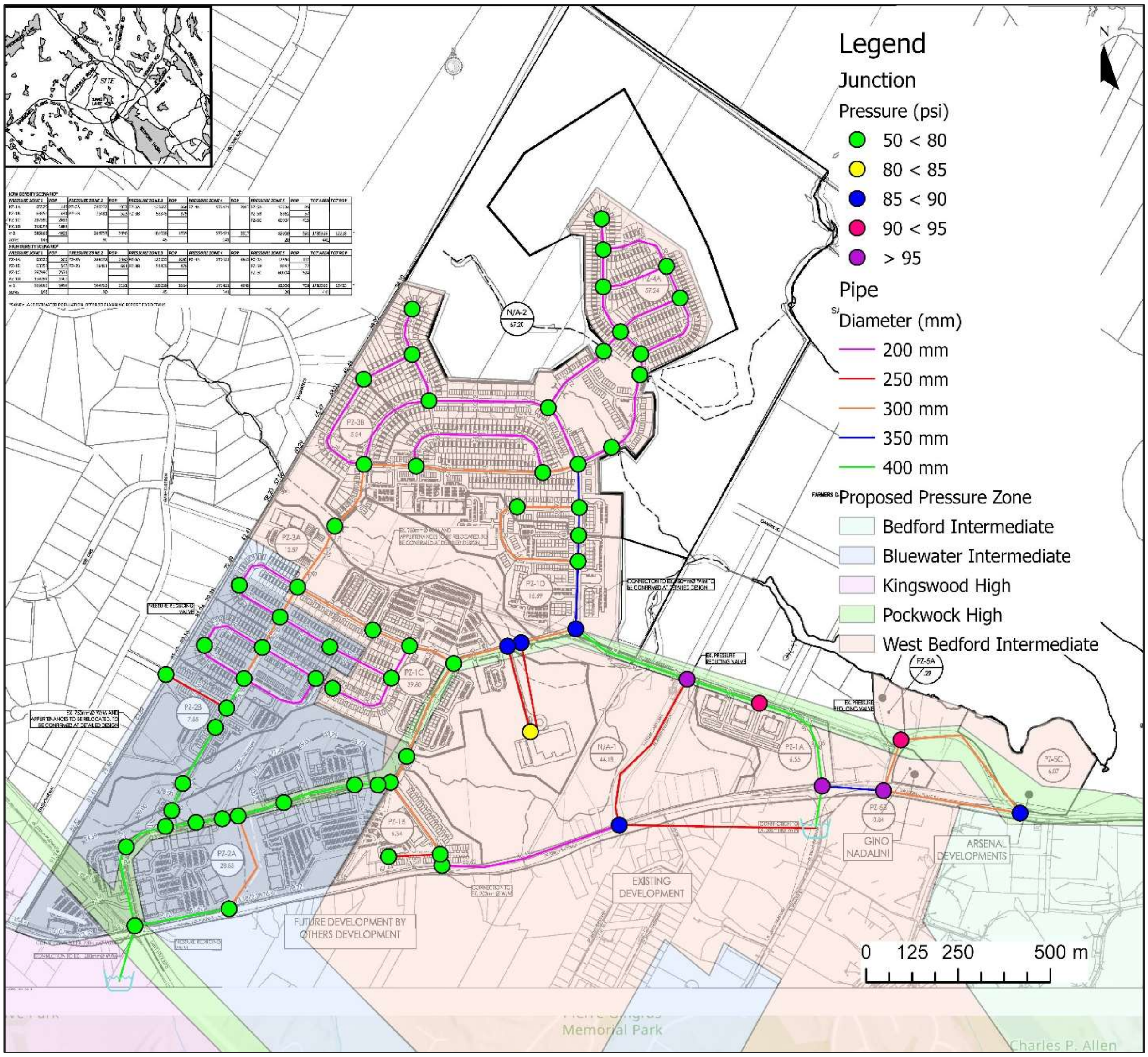


Figure 3-5: Pressure Distribution Under MDD (High-Density Scenario)

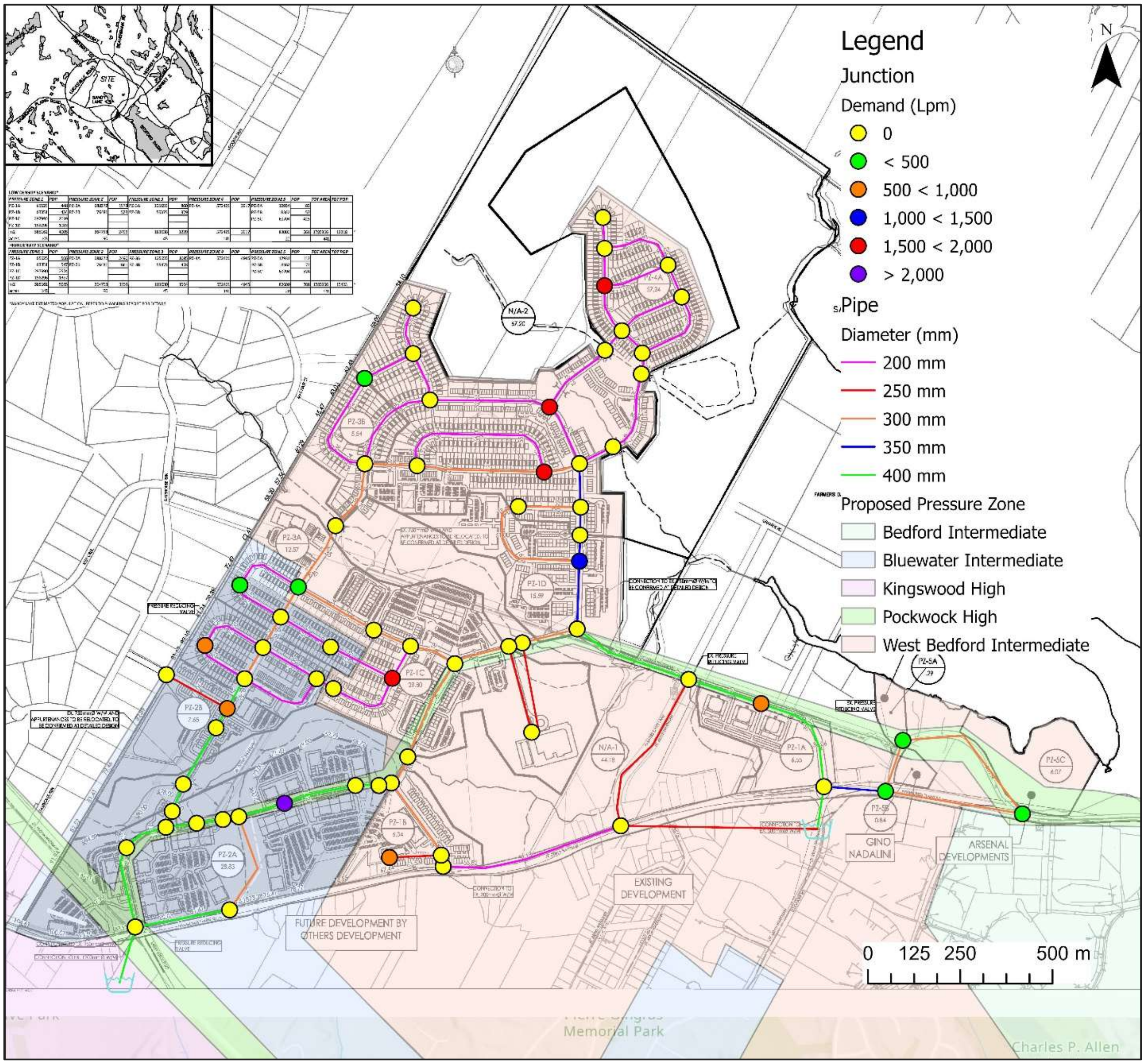


Figure 3-6: PHD Distribution (High-Density Scenario)

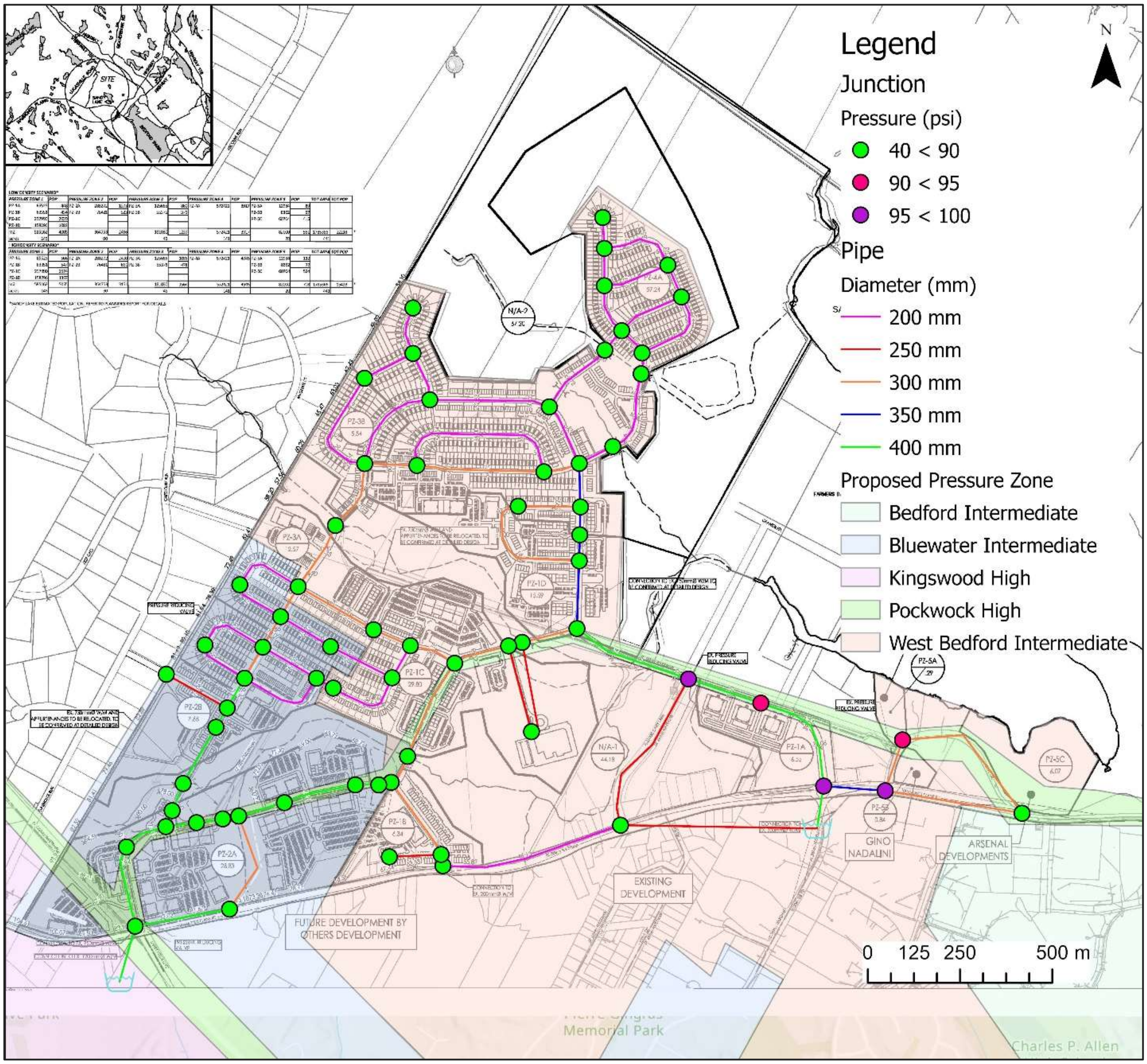


Figure 3-7: Pressure Distribution Under PHD (High-Density Scenario)

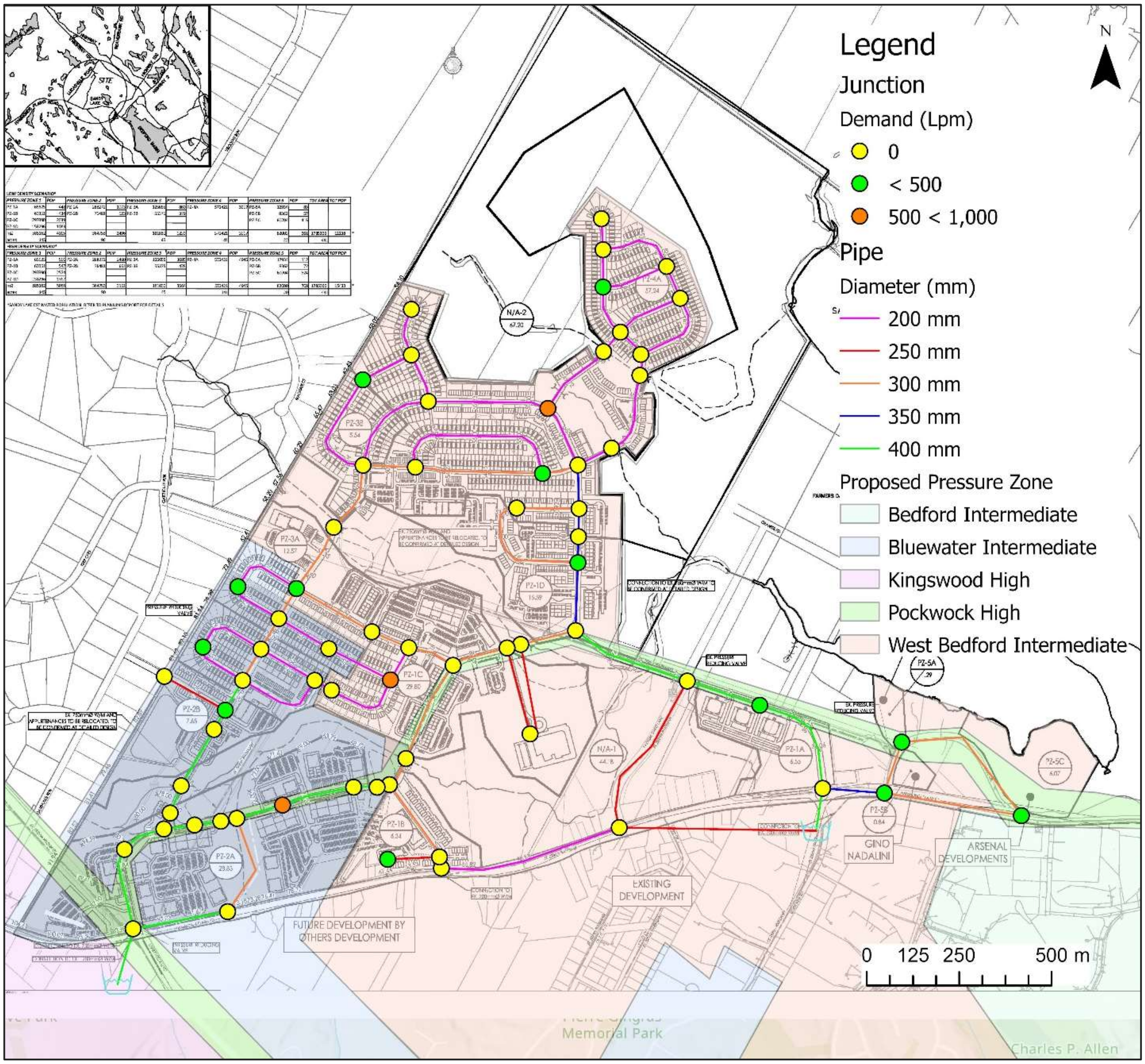


Figure 3-8: MHD Distribution (High-Density Scenario)

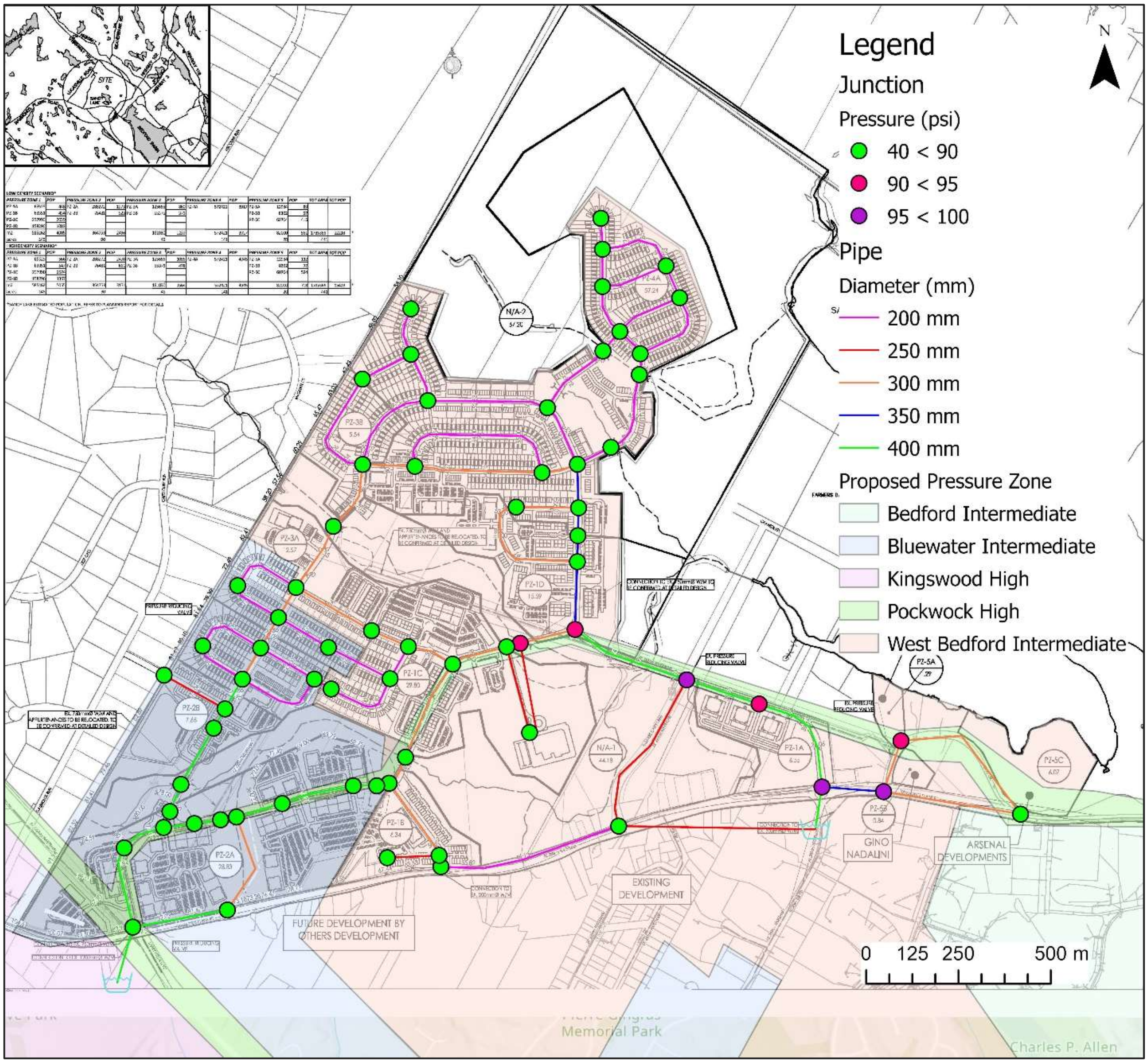


Figure 3-9: Pressure Distribution Under MHD (High-Density Scenario)

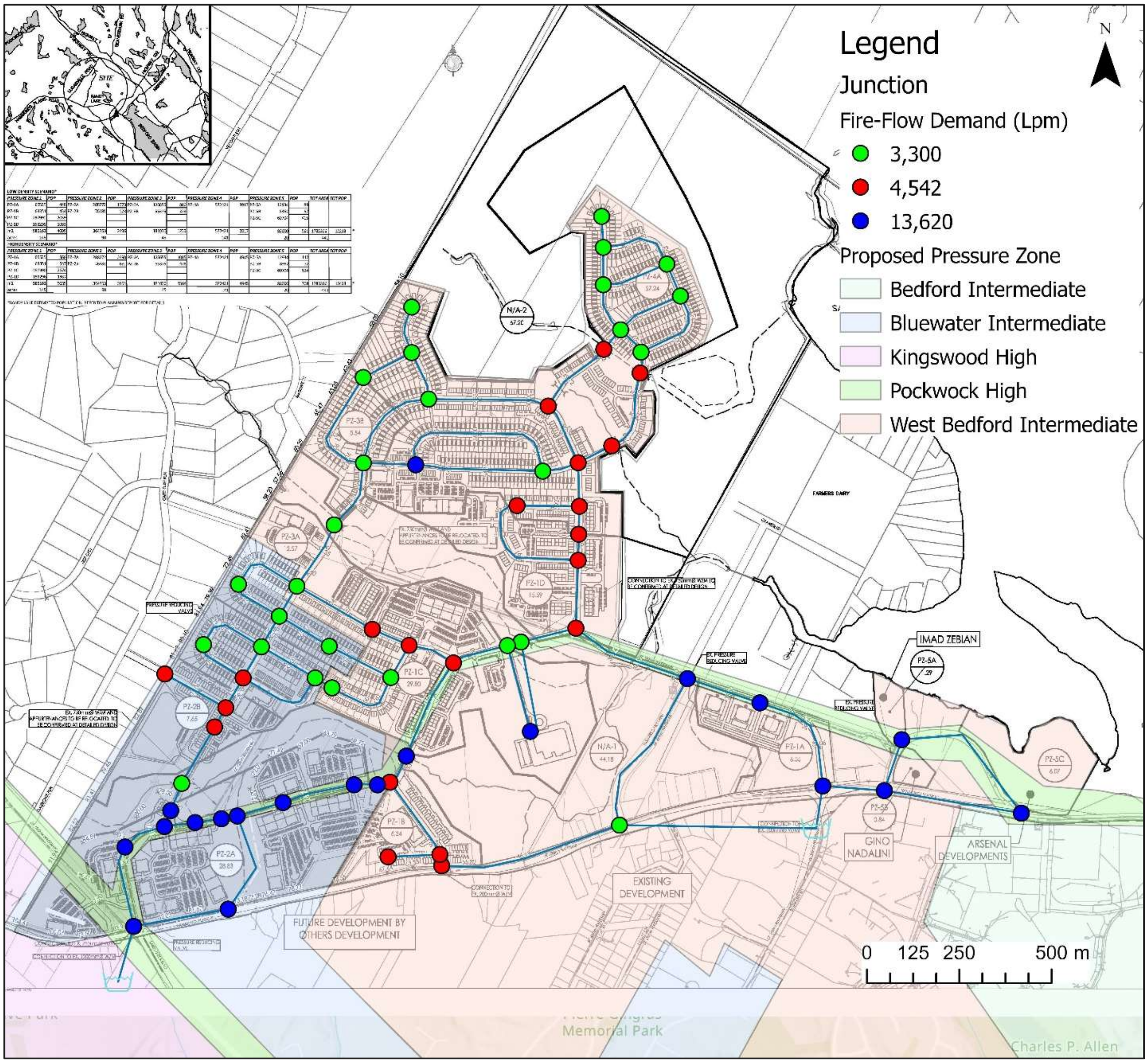


Figure 3-10: Required Fire Flow

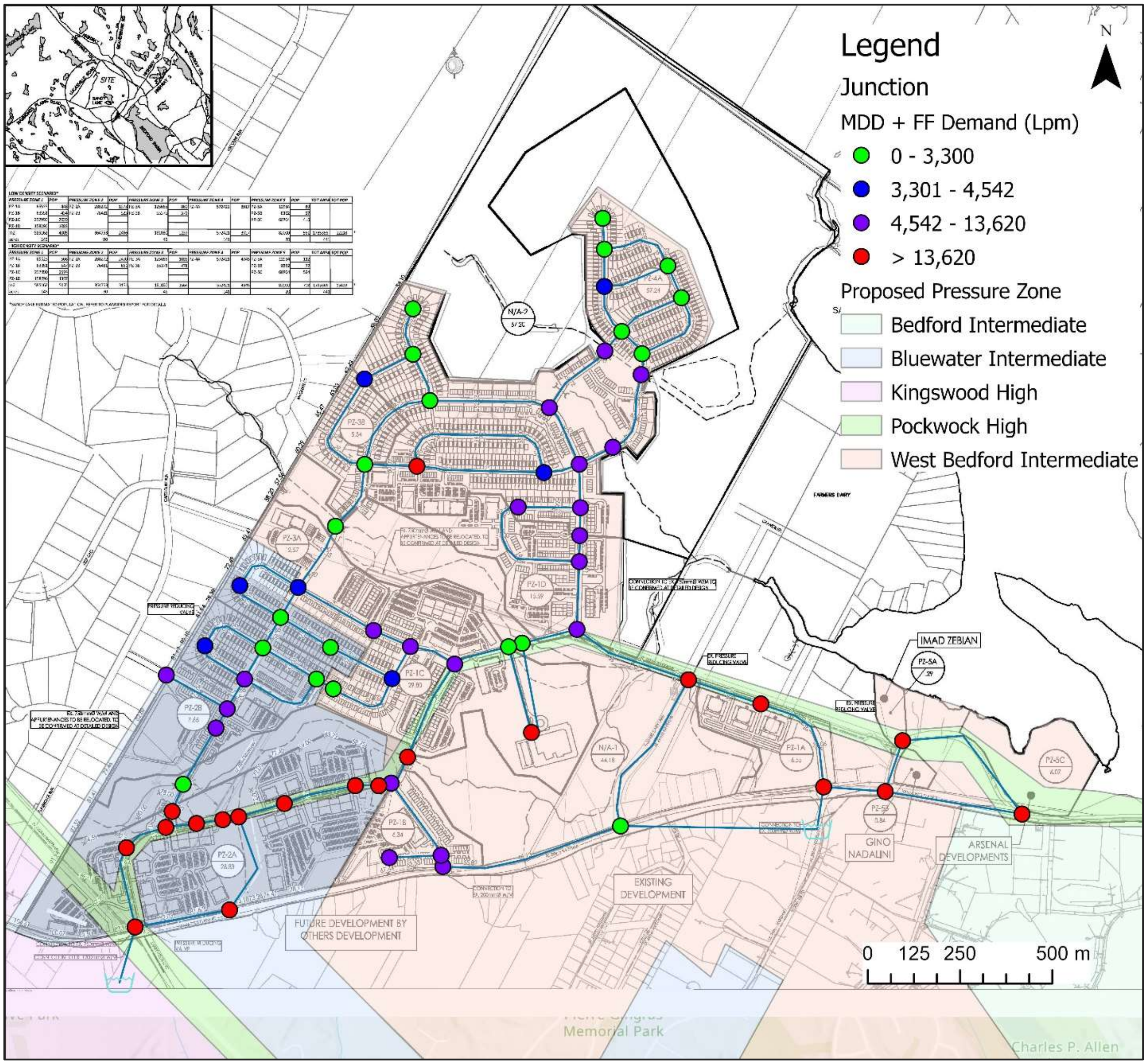


Figure 3-11: Total MDD + FF Demands (High-Density Scenario)

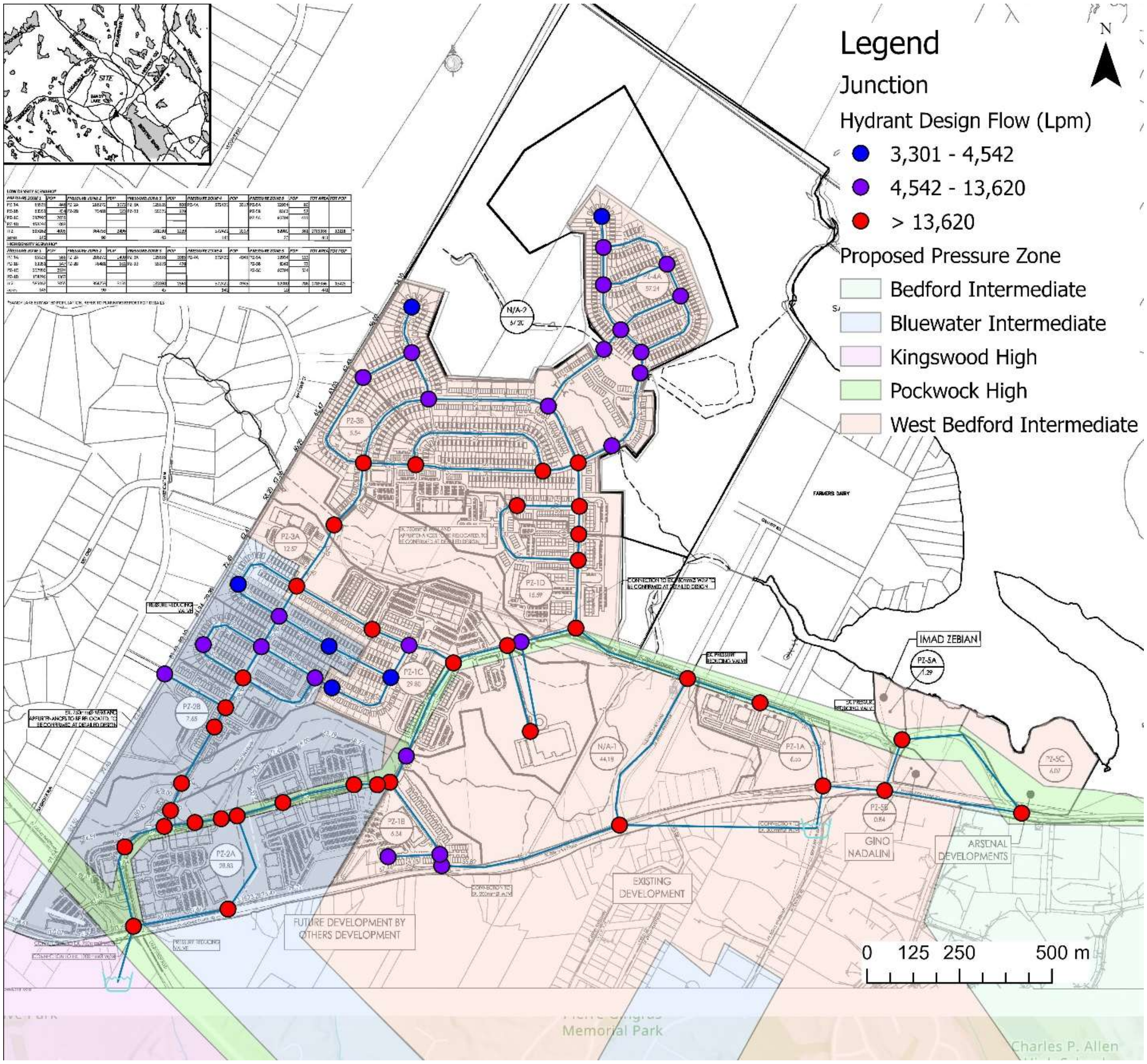


Figure 3-12: Available Hydrant Flow (High-Density Scenario)

3.3.4.2 Low-Density Population Scenario

Figure 3-13 illustrates the distribution of MDD for the low-density scenario throughout the model. As with the high-density scenario, the demands were distributed as described in **Section 3.3.4.1**. **Figure 3-14** presents the anticipated corresponding pressures at each node, which range from 52 psi to 99 psi.

The distribution of PHD for the low-density scenario are presented in **Figure 3-15** and the resulting pressures are shown in **Figure 3-16**. Pressures under the PHD scenario range from approximately 52 psi in the northeastern area to 99 psi near Hammond Plains Road. 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 3-17** and **Figure 3-18**, respectively. Pressures under the MHD scenario range from approximately 52 psi to 99 psi.

As shown for the MHD, MDD and PHD, some locations have pressures greater than that specified in the Design Specification in these instances pressure reducing valves installed on the water service lines (in accordance with Halifax Water's Supplementary Standard Specifications) should be considered.

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 3-10**. The total MDD + FF demand at each node is presented in **Figure 3-19**, and the results of the fire analysis are presented in **Figure 3-20**. The available fire flow range is approximately 4,500 Lpm to 27,900 Lpm. As stated previously, without a full system model, it is unknown if the system can 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. Hence the pressures and available fire flows presented in the report should be considered preliminary.

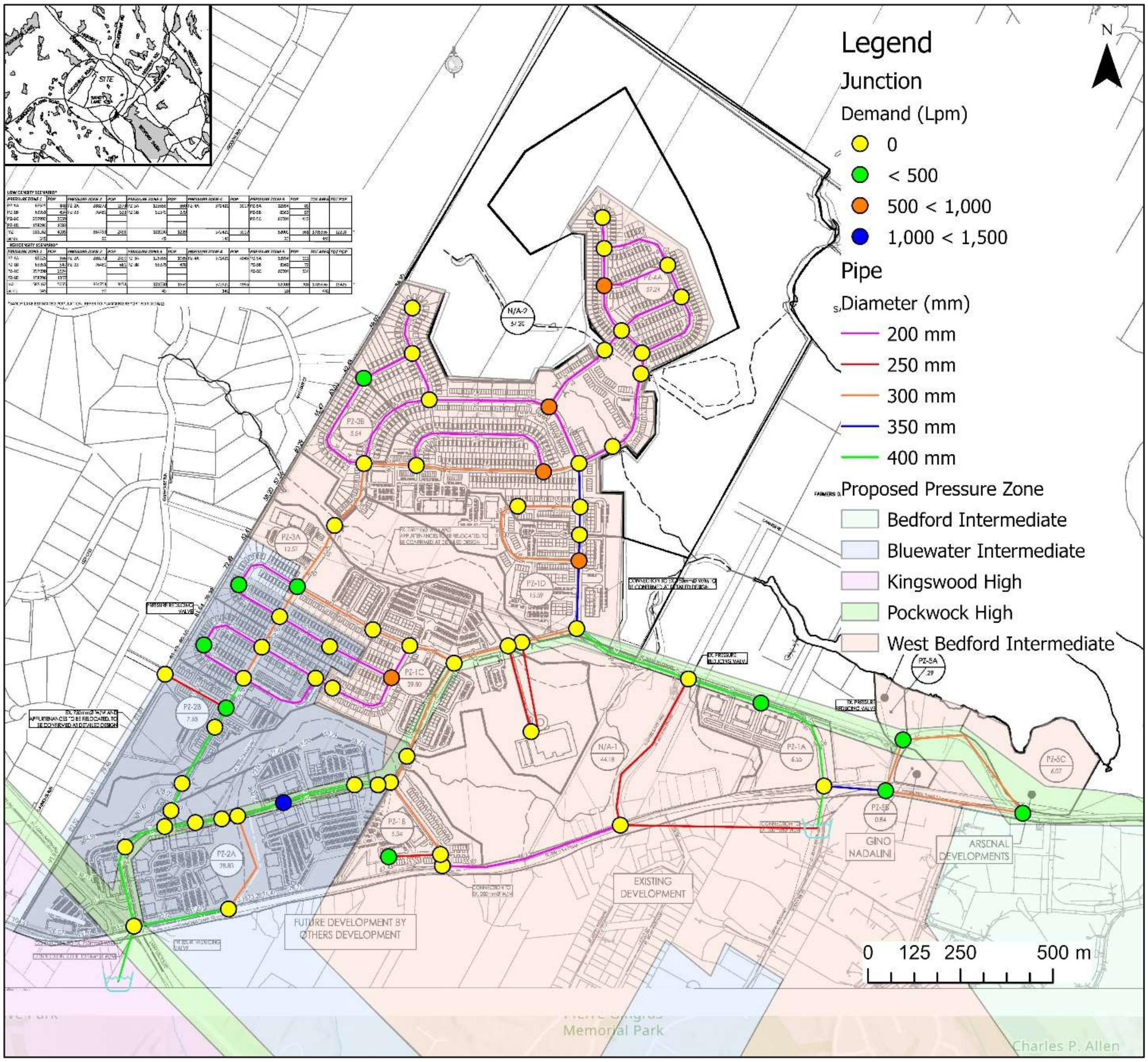


Figure 3-13: MDD Distribution (Low-Density Scenario)

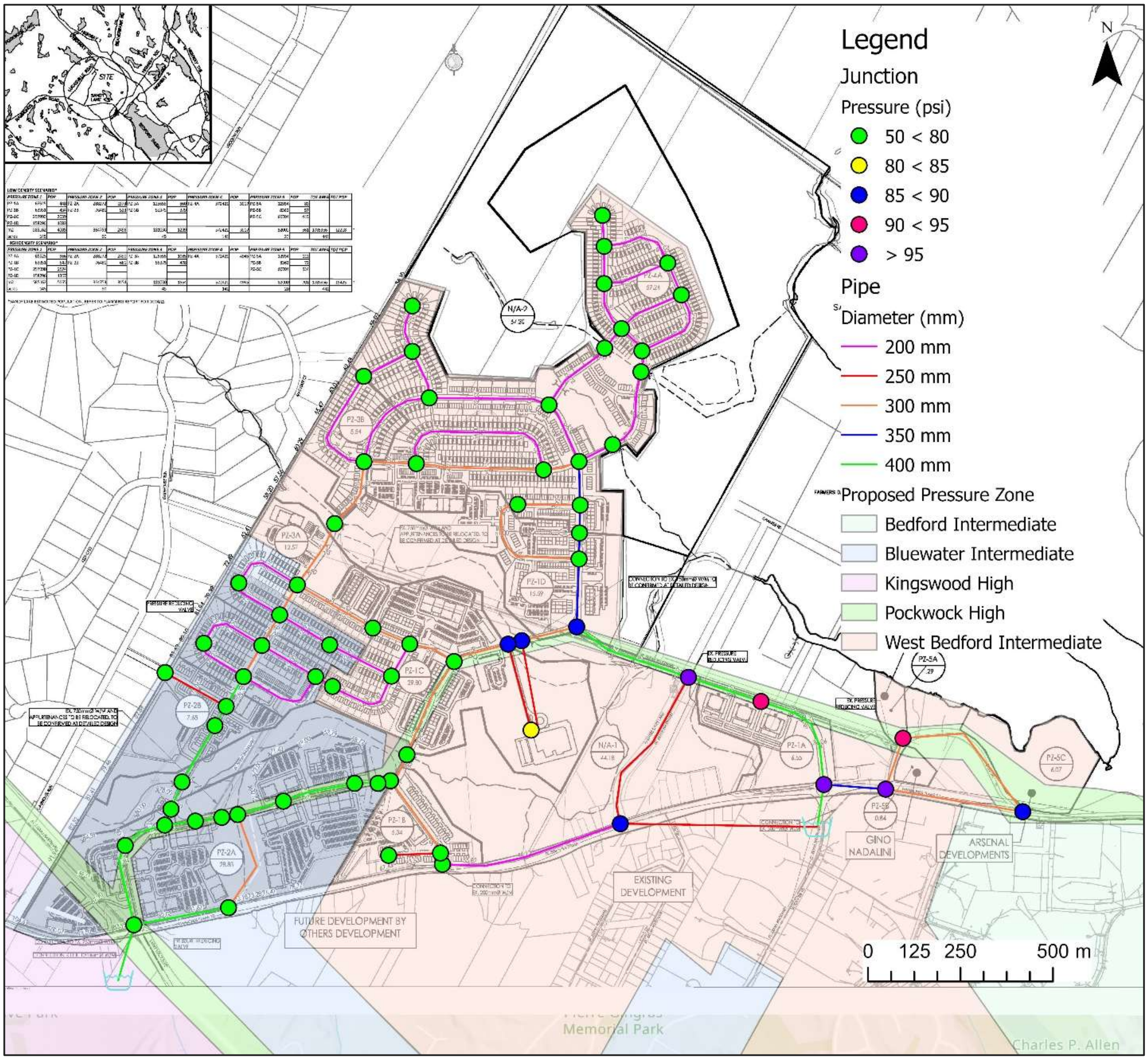


Figure 3-14: Pressure Distribution Under MDD (Low-Density Scenario)

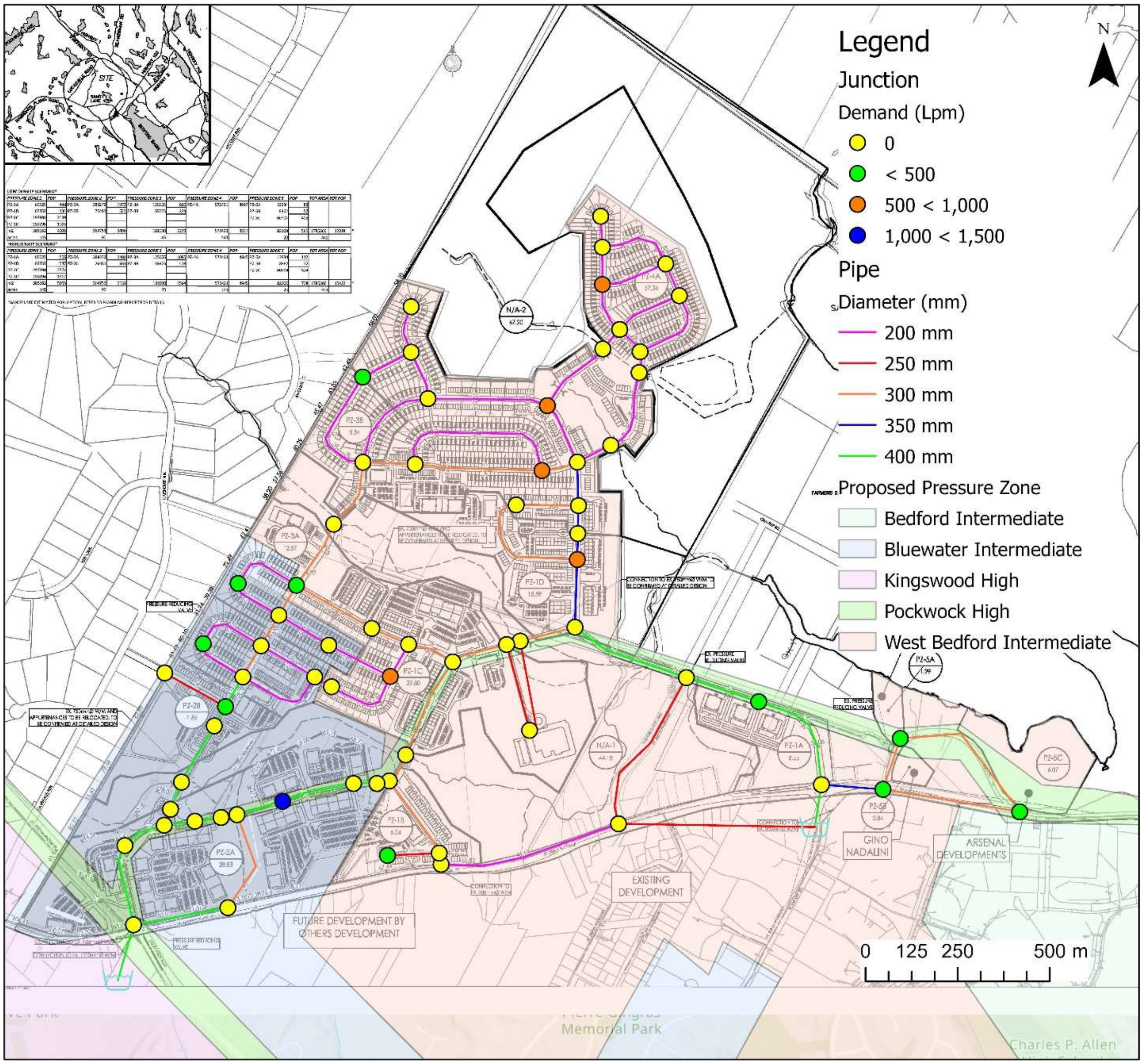


Figure 3-15: PHD Distribution (Low-Density Scenario)

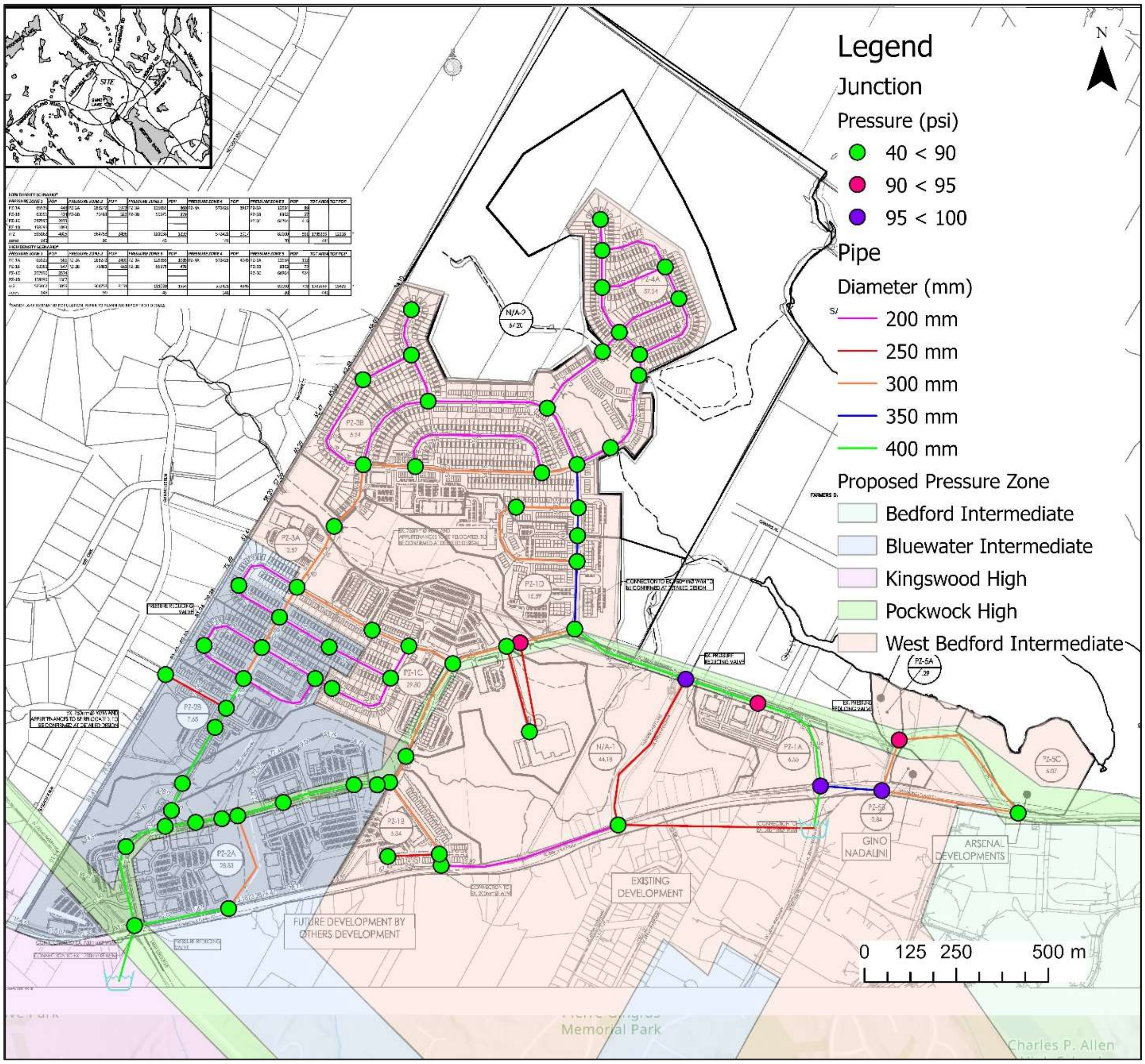


Figure 3-16: Pressure Distribution Under PHD (Low-Density Scenario)

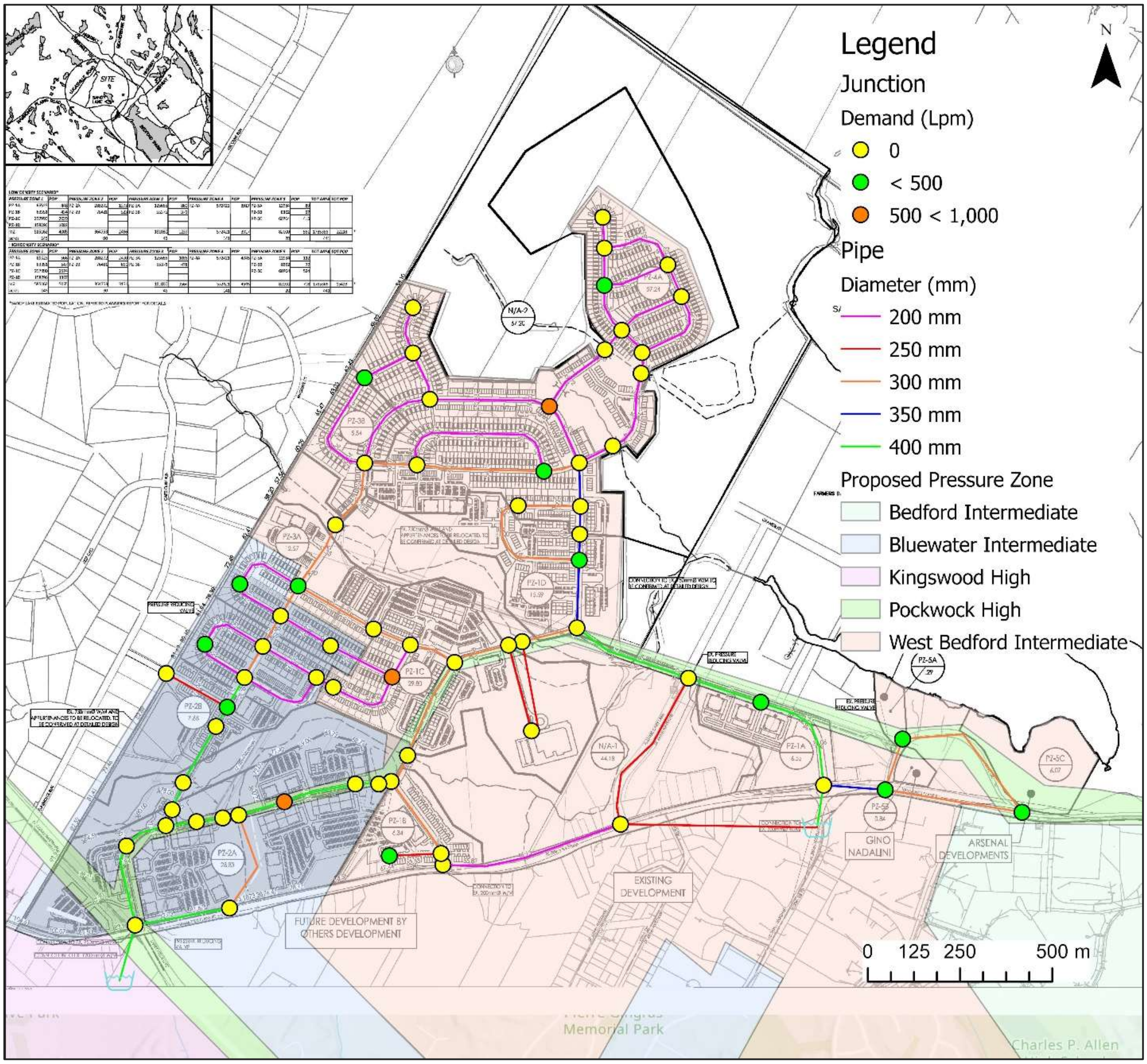


Figure 3-17: MHD Distribution (Low-Density Scenario)

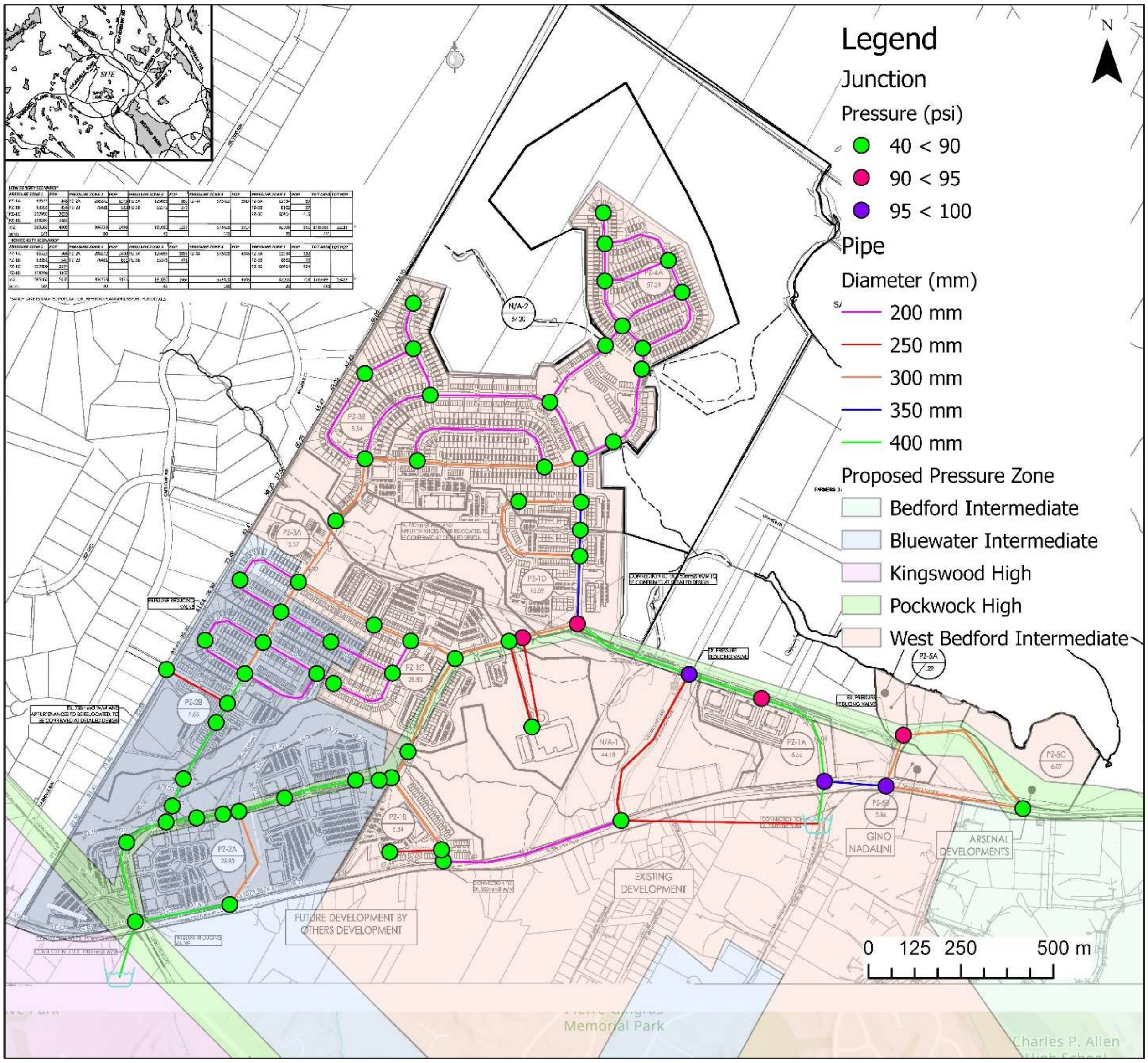


Figure 3-18: Pressure Distribution Under MHD (Low-Density Scenario)

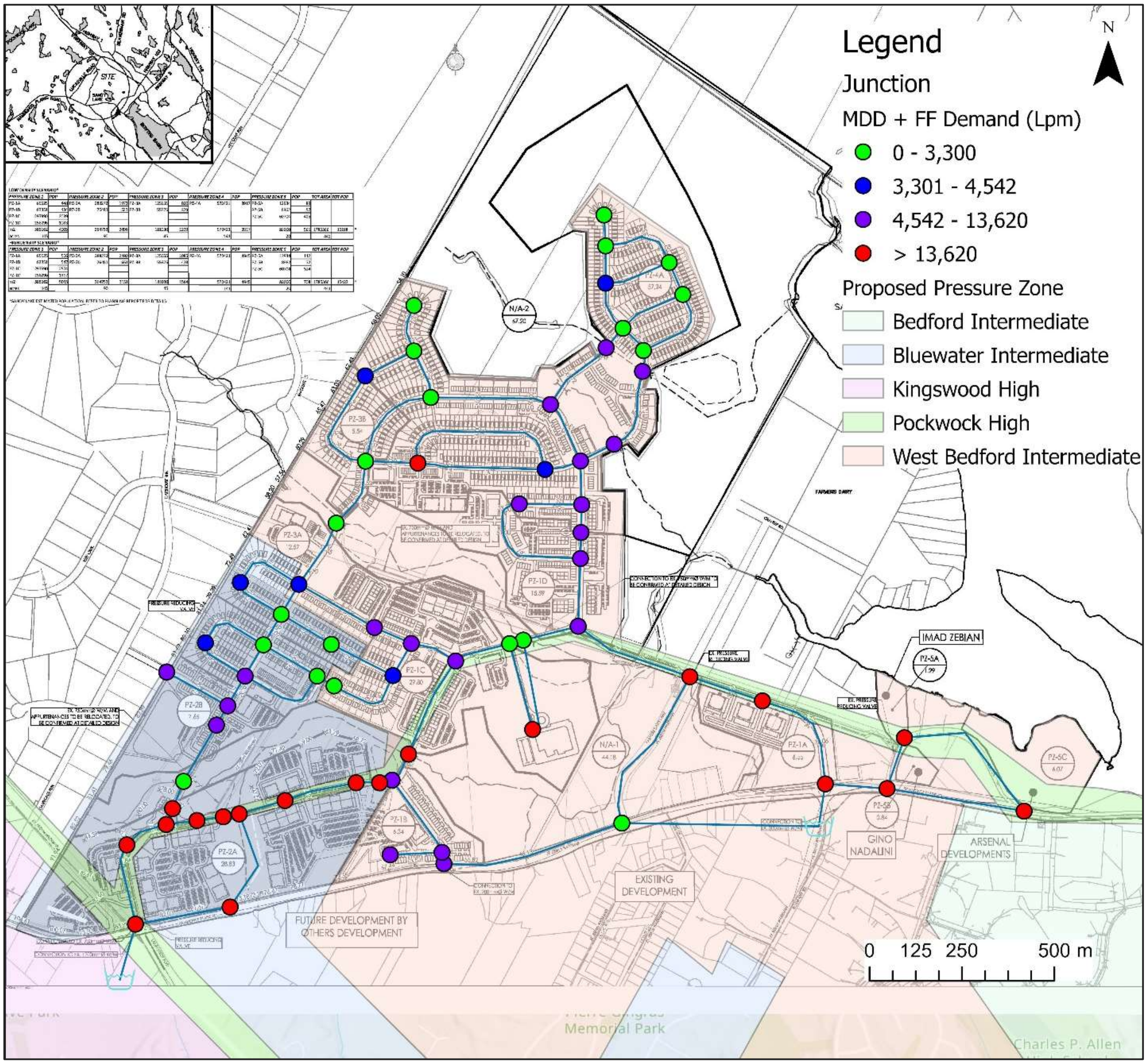


Figure 3-19: Total MDD + FF Demands (Low-Density Scenario)

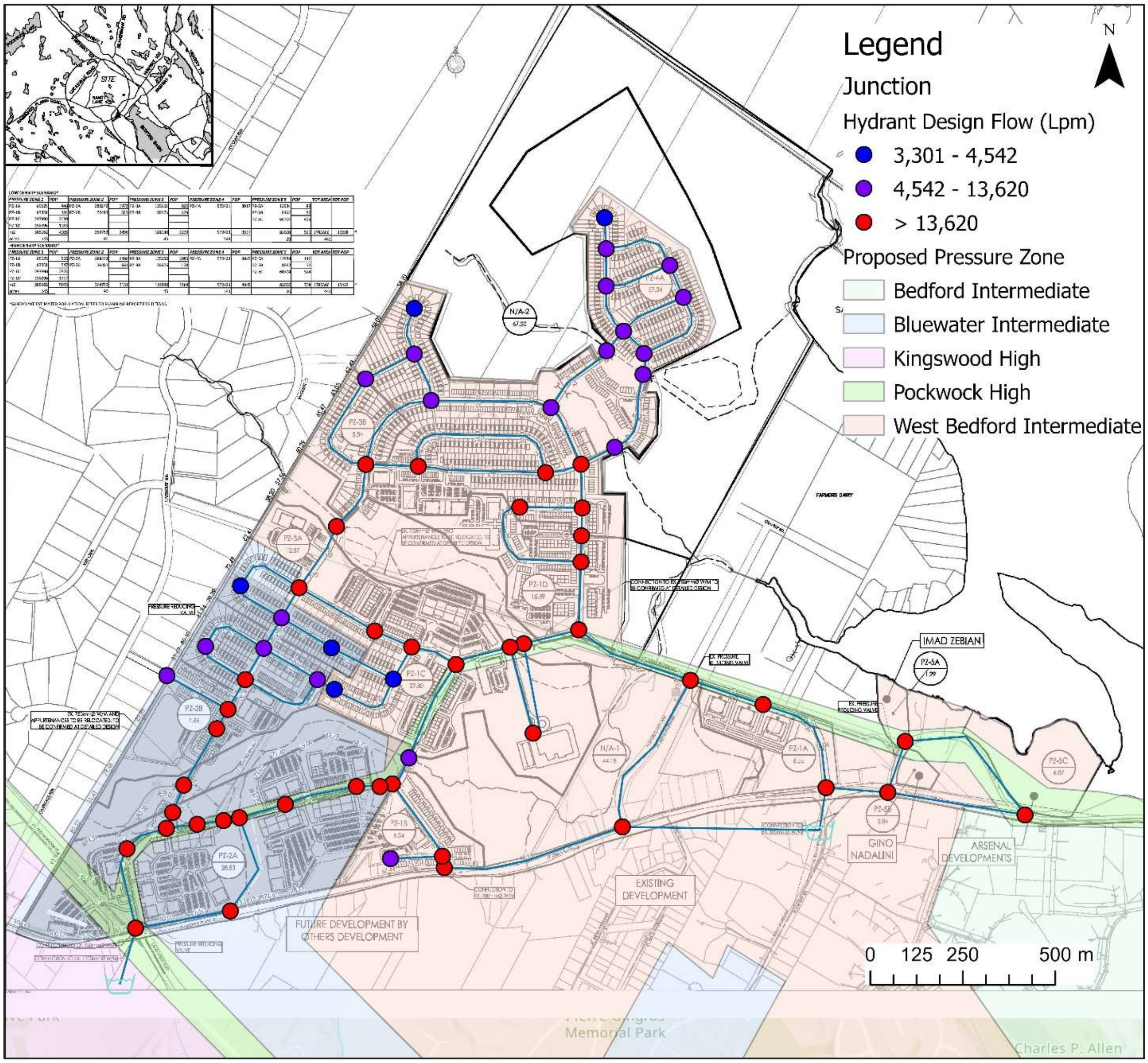


Figure 3-20: Available Hydrant Flow (Low-Density Scenario)

4 Conclusions and Recommendations

4.1 Conclusions

The Sandy Lake development is proposed north of Hammond Plains Road in the northwestern 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, MHD, MDD, 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 and proposed site grading suggests the development can be serviced with potable water from the existing Bluewater Intermediate and West Bedford Intermediate 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 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 proposed watermain sizes range from 200 mm to 400 mm diameter, with the majority being 200 mm diameter.

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 – 98	< 1.5	N/A
PHD High Density	48 – 97	< 1.5	N/A
MHD High Density	52 – 92	< 1.5	N/A
MDD + FF High Density	> 22	< 2.4	4,500 – 27,500*
MDD Low Density	52 – 99	< 1.5	N/A
PHD Low Density	52 – 99	< 1.5	N/A
MHD Low Density	52 – 99	< 1.5	N/A
MDD + FF Low Density	> 22	< 2.4	4,500 – 27,900*

* 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.

Since the maximum pressures for each scenario exceed the range presented in Halifax Water's Design Specification, pressure reducing valves installed on the water service lines (in accordance with Halifax Water's Supplementary Standard Specifications) should be considered in those locations.

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.

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.

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, Morris Lake 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

Hammonds Plains Road at Farmers Dairy
Stantec

Type of Test: Flow Test

Test # : 1

Location: See Below

Tested By: Matt Eisan

Municipality: HRM

Date: August 1, 2024

***SYSTEM DATA**

Size of Main: **8"** Dead Ends: **X** Grid: Loop:

Source Reliable: Yes (CITY) If No - Explain

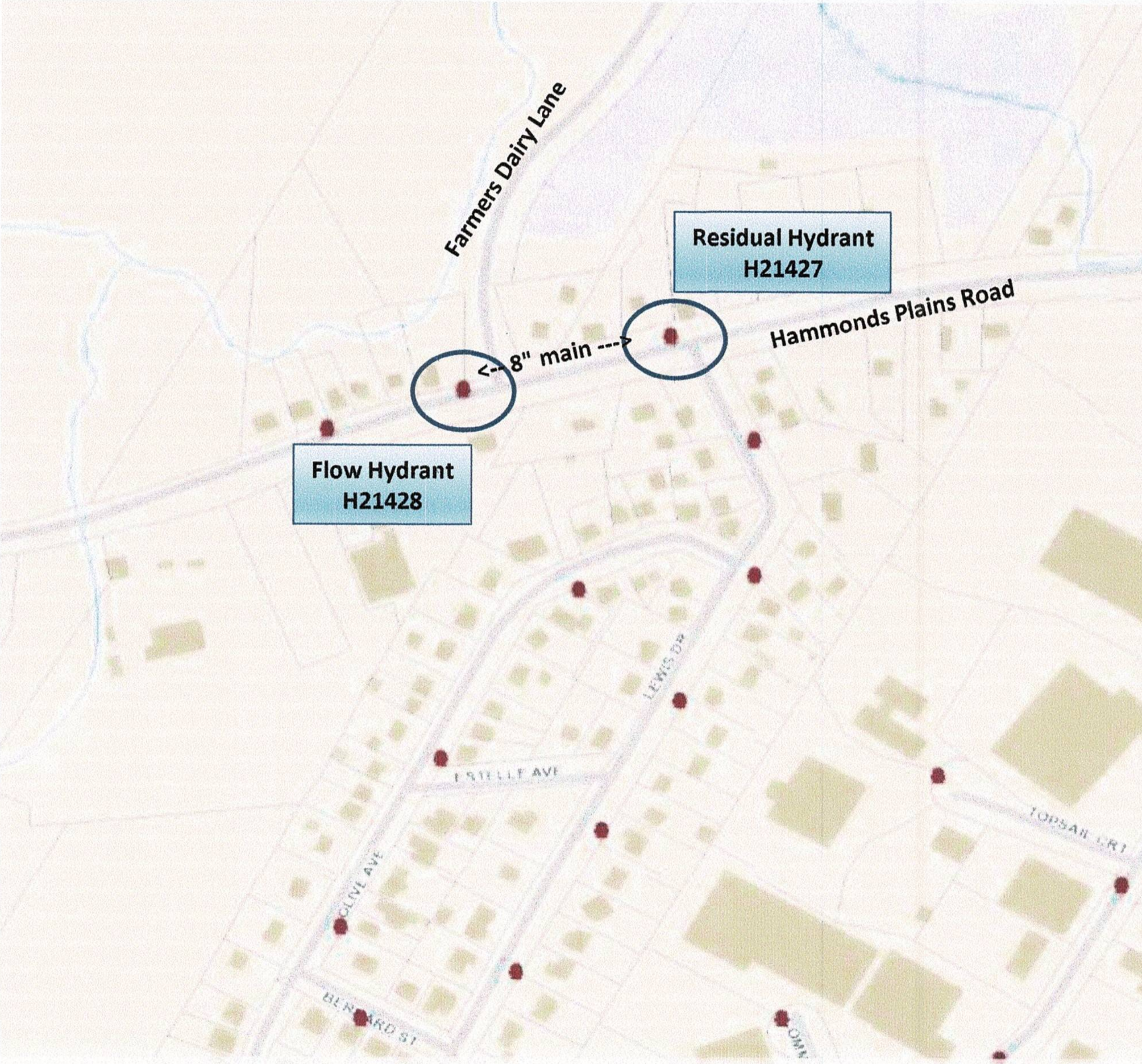
Comments: All flows are in USGPM

***TEST DATA**

Location of Hydrants: Residual: Hydrant # H21427 - end of Lewis Drive
Flow: Hydrant # H21428 - near Farmers Dairy Lane

Normal Pressure: **88 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					88	Used 2 1/2" Hose Monster
1	1	2 1/2"	26	860	860	72	
2	2	2 1/2"	16	675	1391	57	
		2 1/2"	18	716			


Farmers Dairy Lane
Residual Hydrant
H21427
<-- 8" main --->
Hammonds Plains Road
Flow Hydrant
H21428
ESTELLE AVE
LEWIS DR
TOPSAIL CRT
CLIVE AVE

Appendix B Wastewater Infrastructure

SUBDIVISION:

HRM - Sandy Lake Study Area
All Development Scenarios

DATE:	12/13/2024
REVISION:	1
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				

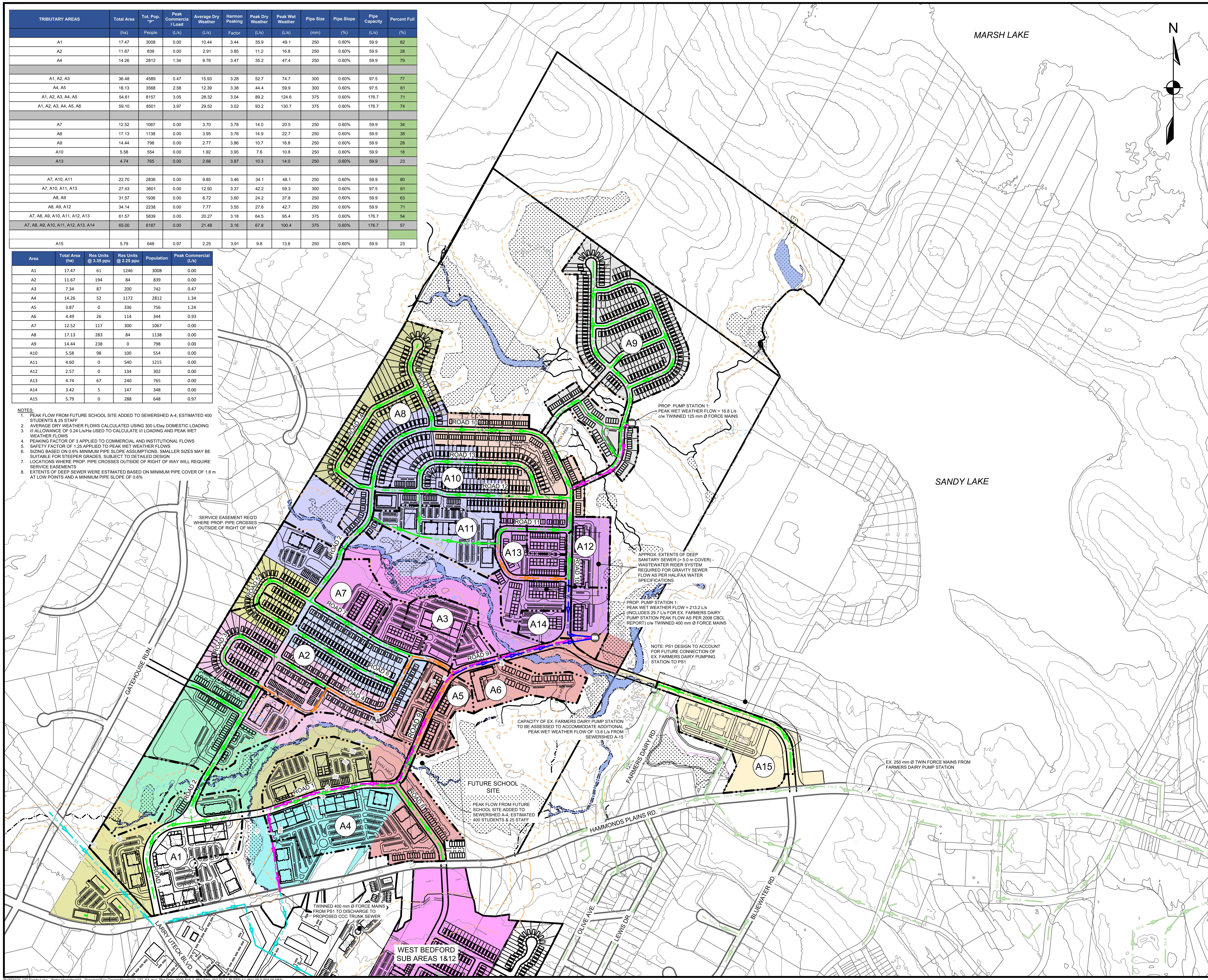
LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS MULTI	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)
High	2	1	189.60	0	0	0	21325	189.60	21325	2.62	242.9	2.18	2.18	0.00	0.00	0.00	0.00
Med - Developer	2	1	190.20	0	0	0	15423	190.20	15423	2.77	185.2	1.58	1.58	0.00	0.00	0.00	0.00
Low	2	1	152.44	0	0	0	9478	152.44	9478	2.98	122.5	0.98	0.98	0.00	0.00	0.00	0.00

AREA ID NUMBER	INSTITUTIONAL AREA (ha)	INSTITUTIONAL ACCU. AREA (ha)	GREEN / UNUSED AREA (ha)	GREEN / UNUSED ACCU. AREA (ha)	C+I+I PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
High	0.00	0.00	0.00	0.00	1.5	191.78	191.78	53.7	298.1	354.4	600	CONCRETE	SDR 35	0.50	457.8	**65.13%**	1.57	1.46
Med - Developer	0.00	0.00	0.00	0.00	1.1	191.78	191.78	53.7	240.0	81.3	525	CONCRETE	SDR 35	0.50	320.6	**74.84%**	1.43	1.39
Low	0.00	0.00	0.00	0.00	0.7	153.42	153.42	43.0	166.1	130.7	450	CONCRETE	SDR 35	0.50	213.4	**77.85%**	1.30	1.27

TRIBUTARY AREAS	Total Area	Tot. Pop. "P"	Peak Commercial Load	Average Dry Weather	Harmon Peaking	Peak Dry Weather	Peak Wet Weather	Pipe Size	Pipe Slope	Pipe Capacity	Percent Full
	(ha)	People	(L/s)	(L/s)	Factor	(L/s)	(L/s)	(mm)	(%)	(L/s)	(%)
A1	17.47	3008	0.00	10.44	3.44	35.9	49.1	250	0.60%	59.9	82
A2	11.67	839	0.00	2.91	3.85	11.2	16.8	250	0.60%	59.9	28
A4	14.26	2812	1.34	9.76	3.47	35.2	47.4	250	0.60%	59.9	79
A1, A2, A3	36.48	4589	0.47	15.93	3.28	52.7	74.7	300	0.60%	97.5	77
A4, A5	18.13	3568	2.58	12.39	3.38	44.4	59.9	300	0.60%	97.5	61
A1, A2, A3, A4, A5	54.61	8157	3.05	28.32	3.04	89.2	124.6	375	0.60%	176.7	71
A1, A2, A3, A4, A5, A6	59.10	8501	3.97	29.52	3.02	93.2	130.7	375	0.60%	176.7	74
A7	12.52	1067	0.00	3.70	3.78	14.0	20.5	250	0.60%	59.9	34
A8	17.13	1138	0.00	3.95	3.76	14.9	22.7	250	0.60%	59.9	38
A9	14.44	798	0.00	2.77	3.86	10.7	16.8	250	0.60%	59.9	28
A10	5.58	554	0.00	1.92	3.95	7.6	10.8	250	0.60%	59.9	18
A13	4.74	765	0.00	2.66	3.87	10.3	14.0	250	0.60%	59.9	23
A7, A10, A11	22.70	2836	0.00	9.85	3.46	34.1	48.1	250	0.60%	59.9	80
A7, A10, A11, A13	27.43	3601	0.00	12.50	3.37	42.2	59.3	300	0.60%	97.5	61
A8, A9	31.57	1936	0.00	6.72	3.60	24.2	37.8	250	0.60%	59.9	63
A8, A9, A12	34.14	2238	0.00	7.77	3.55	27.6	42.7	250	0.60%	59.9	71
A7, A8, A9, A10, A11, A12, A13	61.57	5839	0.00	20.27	3.18	64.5	95.4	375	0.60%	176.7	54
A7, A8, A9, A10, A11, A12, A13, A14	65.00	6187	0.00	21.48	3.16	67.8	100.4	375	0.60%	176.7	57
A15	5.79	648	0.97	2.25	3.91	9.8	13.6	250	0.60%	59.9	23

Area	Total Area (ha)	Res Units @ 3.35 ppu	Res Units @ 2.25 ppu	Population	Peak Commercial (L/s)
A1	17.47	61	1246	3008	0.00
A2	11.67	194	84	839	0.00
A3	7.34	87	200	742	0.47
A4	14.26	52	1172	2812	1.34
A5	3.87	0	336	756	1.24
A6	4.49	26	114	344	0.93
A7	12.52	117	300	1067	0.00
A8	17.13	283	84	1138	0.00
A9	14.44	238	0	798	0.00
A10	5.58	98	100	554	0.00
A11	4.60	0	540	1215	0.00
A12	2.57	0	134	302	0.00
A13	4.74	67	240	765	0.00
A14	3.42	5	147	348	0.00
A15	5.79	0	288	648	0.97

NOTES:
1. PEAK FLOW FROM FUTURE SCHOOL SITE ADDED TO SEWERSHED A-4, ESTIMATED 400 STUDENTS & 25 STAFF
2. AVERAGE DRY WEATHER FLOWS CALCULATED USING 300 L/Day DOMESTIC LOADING
3. I/I ALLOWANCE OF 0.24 L/s/Ha USED TO CALCULATE I/I LOADING AND PEAK WET WEATHER FLOWS
4. PEAKING FACTOR OF 3 APPLIED TO COMMERCIAL AND INSTITUTIONAL FLOWS
5. SAFETY FACTOR OF 1.25 APPLIED TO PEAK WET WEATHER FLOWS
6. SIZING BASED ON 0.6% MINIMUM PIPE SLOPE ASSUMPTIONS. SMALLER SIZES MAY BE SUITABLE FOR STEEPER GRADES, SUBJECT TO DETAILED DESIGN
7. LOCATIONS WHERE PROP. PIPE CROSSES OUTSIDE OF RIGHT OF WAY WILL REQUIRE SERVICE EASEMENTS
8. EXTENTS OF DEEP SEWER WERE ESTIMATED BASED ON MINIMUM PIPE COVER OF 1.6 m AT LOW POINTS AND A MINIMUM PIPE SLOPE OF 0.6%



LEGEND

EXISTING SANITARY PIPE	SA-E
PROPOSED 250 mm PIPE	SA
PROPOSED 300 mm PIPE	SA
PROPOSED 375 mm PIPE	SA
PROPOSED 450 mm PIPE	SA
PROPOSED FORCE MAIN	FM
EXISTING FORCE MAIN	FM-E
SEWERSHED ID	A1

PHASING LEGEND

PHASE	YEAR	COLOR CODE
1a	2022	
1b	2023	
2	2024	
3	2025	
4	2026	
5	2027	
6	2028	
7	2029	
8	2030	
9	2031	
11	2032	
12	2033	
13	2034	
14	2035	

CONTOURS BASED ON LIDAR ELEVATION DATA. CONTOUR INTERVAL OF 5 m IS SHOWN

METRES
150 0 150 300
1:5000

ISSUE	DATE	DESCRIPTION
2	FEB. 2, 2023	REVISED SITE LAYOUT & PHASING
1	DEC. 15, 2021	ISSUED FOR REVIEW

CONSULTANT

DESIGNPOINT
engineering • surveying • solutions
902.832.5597 designpoint.ca

PRELIMINARY

CLIENT

SANDY LAKE HOLDINGS LTD.

PROJECT DESCRIPTION

SANDY LAKE

BEDFORD, NOVA SCOTIA

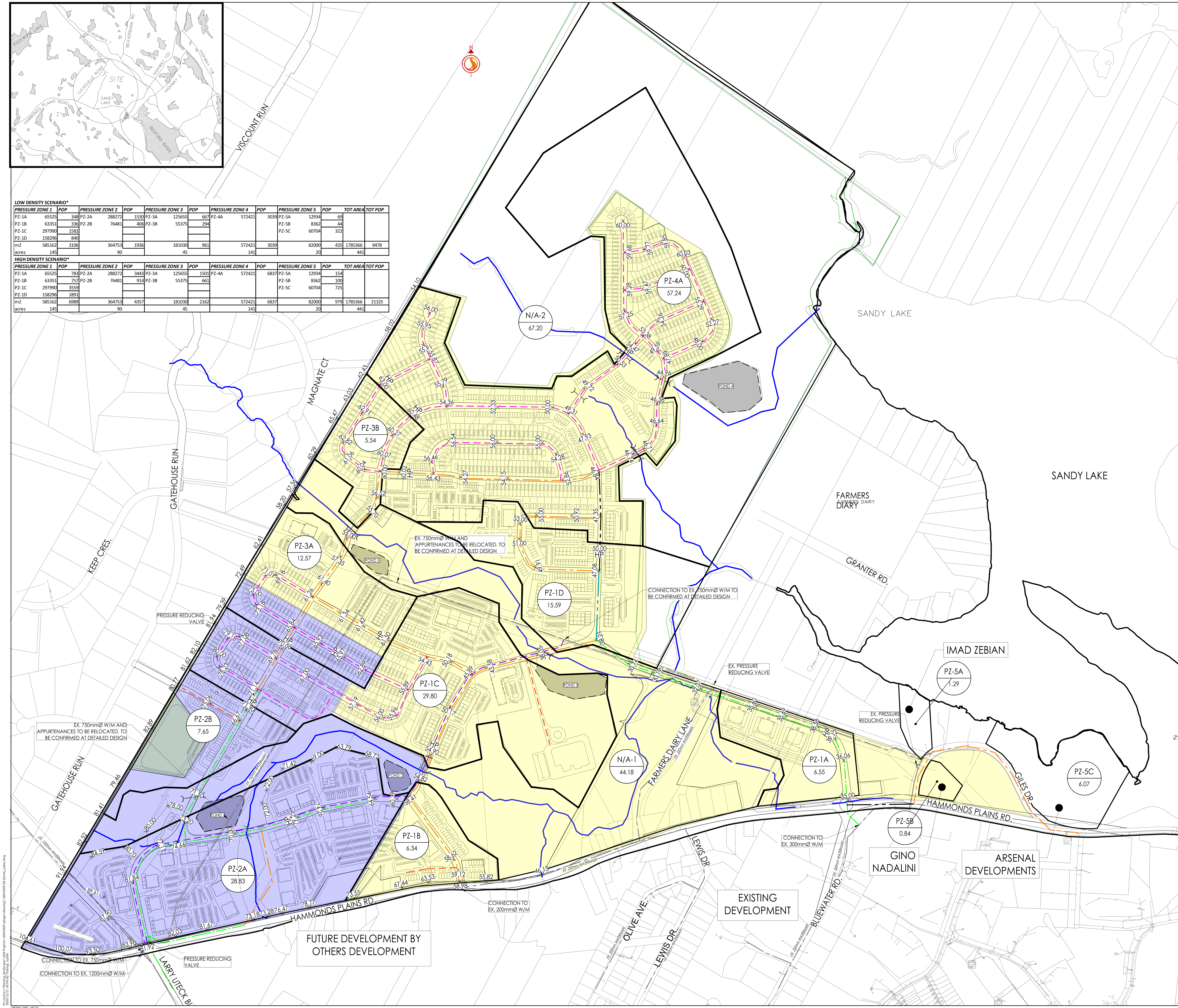
SHEET DESCRIPTION

SANITARY SCHEMATIC

Drawn	Engineer	Project No.	Drawing No.
J. WYATT	L. KING	21-177	SA-01
Scale: 1:5000	Filename: 21-177_SA.dwg		1 OF 1

P:\2021\21-177 Sandy Lake - Water Modelling\01 - Drawings\Eng Design\Sheets\21-177_SA.dwg, Plot Date: 2023-Feb-2, Plot Size: ISO FULL BLEED A1 (841.00 X 594.00 MM)

Appendix C Drawings



LOW DENSITY SCENARIO*

PRESSURE ZONE 1		POP	PRESSURE ZONE 2		POP	PRESSURE ZONE 3		POP	PRESSURE ZONE 4		POP	PRESSURE ZONE 5		POP	TOT AREA	TOT POP
PZ-1A	65525	348	PZ-2A	288272	1530	PZ-3A	125655	667	PZ-4A	572421	3039	PZ-5A	12934	69		
PZ-1B	63351	336	PZ-2B	76481	406	PZ-3B	55375	294				PZ-5B	8362	44		
PZ-1C	297990	1582										PZ-5C	60704	322		
PZ-1D	158296	840														
m2	585162	3106		364753	1936		181030	961		572421	3039		82000	435	1785366	9478
acres	145			90			45			141			20		441	

HIGH DENSITY SCENARIO*

PRESSURE ZONE 1		POP	PRESSURE ZONE 2		POP	PRESSURE ZONE 3		POP	PRESSURE ZONE 4		POP	PRESSURE ZONE 5		POP	TOT AREA	TOT POP
PZ-1A	65525	783	PZ-2A	288272	3443	PZ-3A	125655	1501	PZ-4A	572421	6837	PZ-5A	12934	154		
PZ-1B	63351	757	PZ-2B	76481	914	PZ-3B	55375	661				PZ-5B	8362	100		
PZ-1C	297990	3559										PZ-5C	60704	725		
PZ-1D	158296	1891														
m2	585162	6989		364753	4357		181030	2162		572421	6837		82000	979	1785366	21325
acres	145			90			45			141			20		441	

Stantec

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Ottawa ON
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www.stantec.com

Legend

- 500mm WATERMAIN
- 406mmØ WATERMAIN
- 305mmØ WATERMAIN
- 250mmØ WATERMAIN
- 203mmØ WATERMAIN
- 350mmØ WATERMAIN
- EXISTING WATERMAIN
- RELOCATED 750mm WATERMAIN
- 1 / 0.90 — WATER PRESSURE ZONE AREA ID / WATER PRESSURE ZONE AREA Ha.
- N/A-1 / 0.90 — NON-DEVELOPABLE AREA ID / AREA Ha.
- WATER PRESSURE ZONE BOUNDARY
- WEST BEDFORD INTERMEDIATE
- BLUE WATER INTERMEDIATE

Notes

3	ISSUED FOR REVIEW	JP	DT	24.12.13
2	ISSUED FOR REVIEW	JP	DT	24.05.17
1	ISSUED FOR REVIEW	JP	DT	24.01.24
Revision		By	Appd.	YY.MM.DD

File Name: 16040XXXX-XX	JP	DT	JP	24.01.15
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

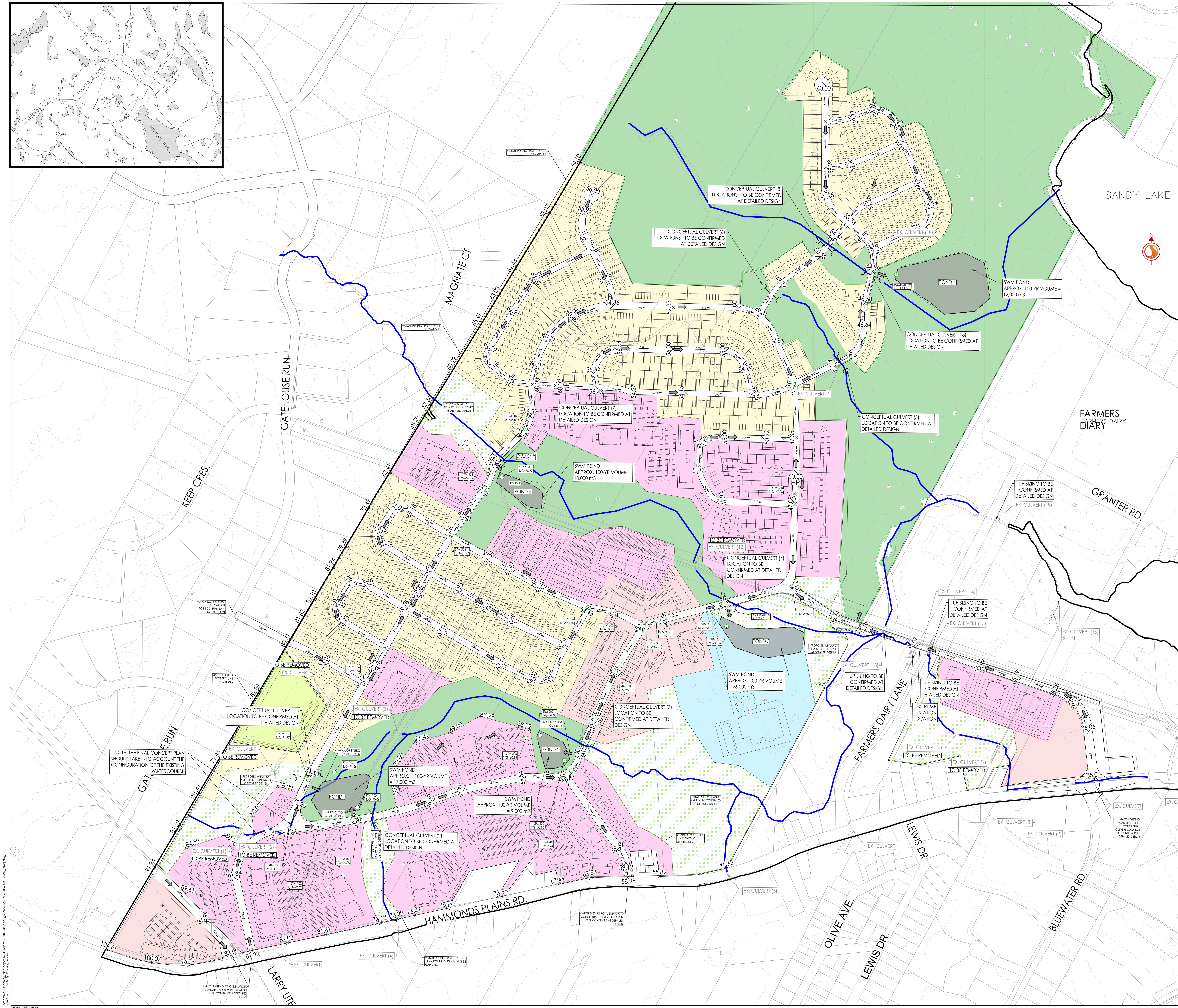
Permit-Seal

Client/Project
HALIFAX REGIONAL MUNICIPALITY

Future Serviced Communities
Sandy Lake
Halifax, Nova Scotia

Title
SANDY LAKE
CONCEPTUAL WATERMAIN LAYOUT PLAN

Project No. 160410459
Scale 1:2500 (0 25 75 125m)
Drawing No. WTR-1
Sheet 1 of 4
Revision 3



Stantec

Stantec Consulting Ltd.
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www.stantec.com

Legend

89.40	EXISTING ELEVATION
89.40	PROPOSED ELEVATION
	MAJOR OVERLAND FLOW ROUTE
6.6%	FLOW DIRECTION AND GRADE
	CONCEPTUAL SWM POND
	EXISTING 100-YR FLOODLINE PRELIMINARY (HRM 2023)
	EXISTING 20-YR FLOODLINE PRELIMINARY (HRM 2023)
	PROPOSED STORM MANHOLE

Notes

1. CONTOUR INTERVAL IS 5.0m,

		By	Appd.	YY.MM.DD
3	ISSUED FOR REVIEW	JP	DT	2024.12.13
2	ISSUED FOR REVIEW	JP	DT	24.05.17
1	ISSUED FOR REVIEW	JP	DT	24.01.24

Revision

File Name: 16040XXXX-XX	JP	DT	JP	24.01.15
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project
HALIFAX REGIONAL MUNICIPALITY

Future Serviced Communities
Sandy Lake
Halifax, Nova Scotia

Title
SANDY LAKE
CONCEPTUAL GRADING PLAN

Project No. 160410459
Scale 1:2500 (0, 25, 75, 125m)
Drawing No. GP-1
Sheet 2 of 4
Revision 3