



**HALIFAX REGIONAL MUNICIPALITY
FUTURE SERVICED COMMUNITIES**

**VOLUME 5: MORRIS LAKE STUDY AREA
REPORT**

June 2, 2025

Prepared for:
Halifax Regional Municipality

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Limitations and Sign-off

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Executive Summary

Stantec Consulting Limited was retained by Halifax Regional Municipality (HRM) to conduct an analysis of four candidate urban growth areas:

- Sandy Lake in Hammonds Plains/Bedford
- Highway 102 Corridor in Halifax [Northwest Mainland]
- Westphal in Cole Harbour/Westphal/Cow Bay
- Morris Lake in Cole Harbour/Eastern Passage.

Stantec's scope was to prepare studies to support decisions on if and how to proceed with further planning initiatives by reviewing the following for each Study Area:

- environmental suitability of the Study Area and portions thereof for development;
- feasibility and costs of transportation network upgrades that are required to connect the Study Area to surrounding communities;
- feasibility and costs of water and wastewater servicing, upstream water infrastructure upgrades, and downstream upgrades; and
- density targets, distribution and thresholds needed to support the efficient use of infrastructure investments.

This volume summarizes the four component studies for the Morris Lake Study Area (Study Area). Please refer to Volume 1: Overall Summary for context for the entire study. The first volume provides background information on the methodology for the study and an overall comparison of the four Study Areas. The remaining four volumes of this report are stand-alone reports for each Study Area.

This report concludes that the Morris Lake lands are a good candidate for urban development. The Study Area has connections to surrounding communities and infrastructure. With further upgrades and investment, the Study Area can contribute significantly to the accommodation of HRM's growing population. The lands most suitable for development are between De Said Lake and Smelt Brook, and Cow Bay River, northwest of Cow Bay Road to the southern shore of Morris Lake. Existing transportation networks within the Study Area will require investment to rebuild the road grade to be above the 100-year flood line.

This growth area would be expected to have an impact on regional infrastructure capacity requirements and their planned upgrades. Connections to local water service is feasible and it should be assumed that the Study Area will ultimately contribute to the sanitary flows downstream of existing pump stations. Existing sanitary sewers within existing residential areas to the southwest along Cow Bay Road are sized to meet only local sanitary contributing flows and are not intended for downstream conveyance of flows from the Study Area. It is assumed that local pump stations will be required at point of discharge to the gravity pressure main and ultimately the downstream Eastern Passage Wastewater Treatment Facility.

Additional infrastructure is expected to be required and anticipated to contribute to the gravity pressure main and conceptual pump station at the Shearwater Trail extension.

The transportation network serving the Study Area and adjoining Westphal Study Area is already at or near capacity and the modelling forecast identified key areas of congestion that will continue to increase as development in the two study areas proceeds. The analysis of modelled travel demand suggests that the proposed Shearwater Connector should enhance the ability to divert traffic from the Caldwell Road and Portland Street corridors, which are expected to be heavily congested. Significant complications beyond typical environmental, community, and fiscal considerations are however anticipated by HRM's Integrated Mobility Plan, which notes that the proximity of the connection to the CFB Shearwater airfield has caused persistent uncertainty concerning its construction.

The concluding section of this report provides recommendations for HRM's consideration in any subsequent planning processes.

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Appendix 5C	Morris Lake Development Servicing Scenario
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Abbreviations

ATPP	Active Transportation Priorities Plan
BRT	Bus Rapid Transit
CFB	Canadian Forces Base
EP WWTF	Eastern Passage Wastewater Treatment Facility
HRM	Halifax Regional Municipality
FF	Fire Flow
FSC	Future Serviced Communities
GIS	Geographic Information System
GLA	Gross leasable area
Ha	Hectare
HGL	Hydraulic Grade Lines
HW	Halifax Water
Hwy	Highway (i.e., Provincial Highway)
IMP	Infrastructure Master Plan
IRP	Integrated Resources Plan
JRTA	Joint Regional Transportation Agency
LID	Low Impact Development
LSA	Land Suitability Analysis
LUB	Land Use By-law
MDD	Maximum Day Demand
MHD	Maximum Hour Demand
MLSA	Morris Lake Study Area

PHD	Peak Hour Demand
PID	Parcel Identification Number
PRV	Pressure Reducing Valves
RDP	Regional Development Plan
RMPS	Halifax Regional Municipal Planning Strategy Regional Plan
ROM	Rough Order of Magnitude
RFP	Request for Proposals
SAR	Species at Risk
SPA	Special Planning Area
Sq. Ft.	Square Feet
SWM	Stormwater management
TP	Total Phosphorus
V/C	Volume to capacity analysis
WESP-AC	Wetland Ecosystem Services Protocol – Atlantic Canada
WIP	Water Infrastructure Plan

1 Overview of the Future Serviced Communities Project

The Halifax Regional Municipal Planning Strategy Regional Plan (RMPS) provides direction on how future settlement should take place in Halifax Regional Municipality (HRM). The RMPS outlines the Urban Settlement Designation areas to be considered as potential Future Serviced Communities; namely, Sandy Lake, Highway 102 West Corridor, Morris Lake Expansion. The Westphal (Akoma) area is identified as Urban Reserve under the RMPS and supported for consideration for urban development through the Road to Economic Prosperity Plan for African Nova Scotia Communities.

Stantec won the Request for Proposals (RFP) issued by HRM and collaborated with the HRM Team to complete all the required background studies for each Future Serviced Community. The next step will be for HRM to review the completed studies and determine if comprehensive neighbourhood planning should be initiated, also known as secondary planning.

The scope of work for Stantec is limited to compiling detailed background information needed to inform future decisions about the potential development of the four Study Areas which includes a review of:

- environmental and cultural constraints and opportunities;
- existing transportation infrastructure assets and constraints using multi-modal analysis; and
- existing water and wastewater services infrastructure capacity and constraints.

Stantec will also provide recommendations concerning the potential development of the four Study Areas based on:

- suitability of each Study Area and portions thereof for development;
- feasibility and costs of transportation network upgrades required to connect each Study Area to surrounding communities;
- feasibility and costs of water and wastewater servicing, upstream and water infrastructure upgrades, and downstream upgrades; and
- density targets, distribution and thresholds needed to support the efficient use of infrastructure investments.

This volume summarizes the four component studies for the Morris Lake Study Area (Study Area). Please refer to Volume 1: Overall Summary for context for the entire study.

2 Overview of the Morris Lake Study Area

Morris Lake is designated as a Special Planning Area (SPA) by the Province of Nova Scotia and is subject to the Future Serviced Communities study along with Sandy Lake, Highway 102 West Corridor, and Westphal.

2.1 Location

The Morris Lake Study Area is located south of Dartmouth between Portland Estates and CFB Shearwater, shown on **Figure 2-1**. The 12 Wing Shearwater Heliport lies to the southwest of the Study Area. The area is roughly bounded by Caldwell Road to the west, Morris Lake to the north, Atholea Drive to the northeast, Cow Bay River to the east and Cow Bay Road/Dyke Road to the south. The established community of Eastern Passage lies to the southwest across Cow Bay Road, the community of Cow Bay lies to the south, and the community of Cole Harbour lies to the northeast.

The Morris Lake Study Area encompasses 1,257 acres. Most of the land within the Study Area is undeveloped. Caldwell Road crosses the northern portion of the Study Area to connect to Atholea Drive, which borders the northwest edge of the Study Area. Kiwanis Centre Beach and Park Morris Lake are located at the northwest corner of the Caldwell Road-Atholea Drive intersection. Single-detached homes accessed from Atholea Drive to the south of Caldwell Road are at the northwestern boundary of the Study Area. After passing through the Study Area, Caldwell Road curves to the south passing De Said Lake to join to Hines Road, which travels eastward, away from the Study Area.

Although there are no other roads within the Study Area, the Shearwater Flyer Trail passes to the south of Hines Road and Caldwell Road before crossing the southern half of the Study Area. In addition, the Cow Bay River runs through the Study Area. It originates from Morris Lake within the Kiwanis Park and flows to Cow Bay Lake and the ocean to the southeast. The beach in Kiwanis Park is a recreational site and is used by Water Ski Wakeboard Nova Scotia for summer water ski programs.

Figure 2-2 shows landowners within the Study Area. The total area of developable lands in the Study Area is estimated to be 243 hectares. Three major landowners in the northern half of the Study Area have declared their intentions to develop their land. Stantec has consulted several additional owners of lands in the southern portion of the Study Area who have less immediate plans for development.

The largest landowner within the Morris Lake Study Area addressed by this report are lands owned and/or planned by Clayton Developments, which operates in the area as Morris Lake Holdings. The company declared its intention to undertake major development on its property and related lands before Halifax Regional Municipality (HRM) issued the Request for Proposals (RFP) for the Future Serviced Communities project. The Clayton/Morris Lake Holdings plan covers the majority of the Study Area, although they do not currently own some lands encompassed by their proposal.



Figure 2-1 Morris Lake Study Area
Source Halifax Regional Municipality

The Development Scenarios in Section 2.3 developed by Stantec also consider the remaining properties within the Study Area, most notably lands owned by A. J. Giles Investments, who have provided a development plan for their holding. Stantec has also interviewed other landowners who have indicated development intentions ranging from interest in possibly rezoning of their properties to specific subdivision development proposals. Brycon Development has provided its own concept plan for lands in their ownership that are covered by the Morris Lake Holdings plan created by Clayton including the quantities of dwelling units and commercial space they anticipate building. Lands owned by others who have not provided specific plans and, in some cases, have not spoken with Stantec representatives, are also accounted for in the scenarios based on Stantec's assessment of their development potential in the context of the overall development expected for the Study Area.

2.1.1 ADJACENT LAND USE

Morris Lake is to the northwest of the Study Area. The lake is relatively large (6.4km) in the context of Dartmouth's many lakes. It runs roughly from the southeast to the northwest and is narrow. It is also home to a variety of wildlife.

The Willowdale neighbourhood, from which Atholea Drive extends, is to the northeast of the Study Area. Shearwater Heliport is to the southwest and Eastern Passage is to the southeast. Cow Bay borders the northeastern edge of Eastern Passage and the southeastern edge of the Study Area. The surrounding communities are well-established. Eastern Passage is an historic fishing village that has grown into a substantial suburban community over the past 30 years. Cow Bay also has a lengthy history in which its attractive beaches have figured prominently but has also been drawn closer to the urbanizing core of HRM as it has attracted new residential development. The two coastal communities and the Willowdale neighbourhood are substantially developed with public schools and parks, as well as commercial and retail uses. Overall, they are predominantly comprised of single-detached homes on large lots with mature trees. Single-detached homes along Atholea Drive to the east and Cow Bay Road to the south are characterized by large lots and front yards that back onto woodlands.

The Shearwater Flyer Trail is a Trans-Canada Active Transportation Greenway that cuts through the southern portion of the Study Area. (The trail is a popular year-round recreational facility for residents and visitors to the area.

2.1.1 SITE BACKGROUND

Although the Morris Lake Study Area is largely undeveloped, it adjoins the Russell Lake West and Colby Village communities. Colby Village is among the company's earliest residential developments with houses dating from the early 1970s. Russell Lake West has been built up since 2006 and is now complete. Russell Lake West, furthermore, abuts Portland Hills, where development began in 2000.

The area surrounding Morris Lake is well-developed. Although housing in Colby Village is predominantly single detached, subsequent developments have a mix of housing including low-rise apartment buildings. There are no high-rise buildings, however.

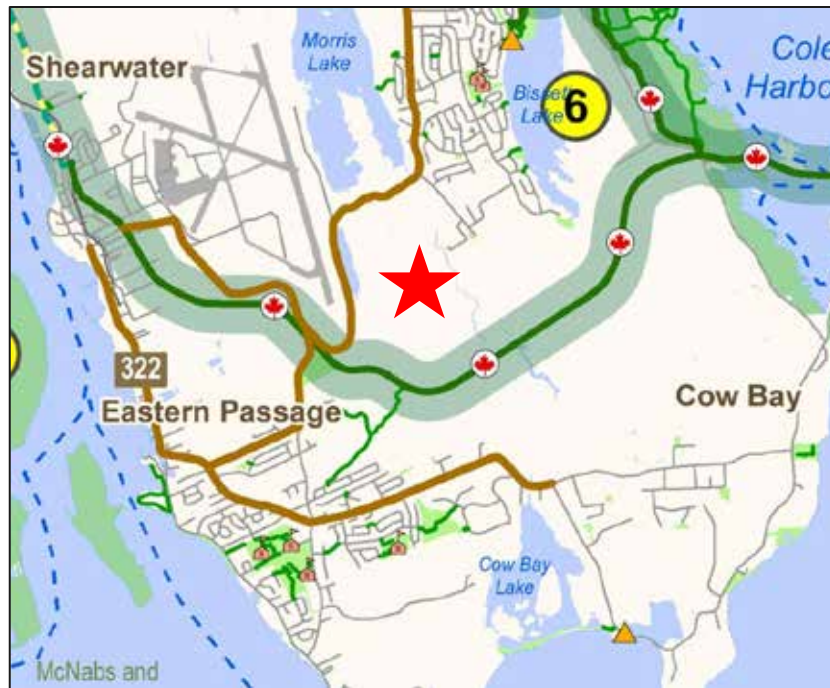


Figure 2-2 Land Ownership Morris Lake

The Study Area generally lies outside the Urban Service Boundary. The peninsula that juts into Morris Lake from Caldwell Road and Caldwell Road itself are designated for connection to municipal water and sewer systems. All abutting areas, however, are connected to both water and sewer, and the scenarios below assume that all development in the Study Area will be connected to services. The potential of the area to accommodate development will also be influenced by transportation improvements expected in the Portland Street Valley as well as the construction of the Shearwater Connector. Furthermore, substantial portions of the Study Area are in floodplains or wetlands that have been delineated and assessed as part of the Future Serviced Communities project.

2.1.2 STAKEHOLDER CONSULTATION

As noted, three major landholders have indicated an immediate interest in developing within the Study Area. Clayton Developments and A. J. Giles Investments are both referenced in the RFP for this assignment. Clayton owns extensive lands within the Study Area under the operating name Morris Lake Holdings (formerly Dartmouth East Holdings). Stantec met with Clayton representatives early in the project to discuss the company's interest in Morris Lake at the same time as we discussed their intentions in Sandy Lake. Clayton provided an older plan for their Morris Lake lands, which they suggested they intend to refine; however, no update was provided over the course of the Future Serviced Communities project.

We contacted Andrew Giles as part of the following outreach to all Study Area landowners. Mr. Giles met with Stantec at that time and presented a plan for his property, which is accessed from Atholea Drive in the northwest corner of the Study Area. He also shared traffic and environmental studies his company commissioned to assess their development proposal.

Several other landowners responded to the same solicitation as Mr. Giles. Most indicated they have limited interest in development in the short term. On the other hand, Brycon Construction, after meeting with Stantec, indicated an interest in preparing a plan for their lands and have done so. Brycon has proposed fewer residential units than the Morris Lake Holdings has incorporated in the roughly equivalent area in their concept but have proposed substantial commercial space where Morris Lake Holdings provided none. In the interest of simplicity, below, we have used residential numbers from the Morris Lake Holdings plan.

Two other owners were interviewed. One owns 4.6 acres directly south of Morris Lake that he uses for recreation and to store equipment used in his fishing business. He has no current interest in development. The other owns 46 acres inherited with family members that abuts the southeastern edge of land Morris Lake Holdings intends to develop. She stated Clayton has approached her family, but they have not yet reached a deal. She suggested they expect to sell when the timing and price of an offer are suitable.

2.2 Development Proposals

2.2.1 A. J. GILES INVESTMENTS LTD.

A. J. Giles Investments Ltd owns approximately 81.1 acres comprised of PID 40400624 (north of Atholea Drive) and PID 40110157 (south of Atholea Drive). The 35.4-acre area north of Atholea Drive, strictly speaking, is outside the Study Area; however, its development is expected to coincide with development proposed by Giles to the south and will rely on the same municipal infrastructure. The area to the south of Atholea Drive covers 45.7 acres. Morris Lake Holdings owns all three properties abutting PID 40110157.

The concept plan prepared by Design Point following discussions between Andrew Giles and Stantec shows a mixed-use community consisting of single-detached homes and multi-unit housing (**Figure 2-3**). No commercial development is proposed. Land to the north of Atholea Drive is largely subdivided for single-detached housing, although three smaller apartment structures are incorporated in the plan. The plan does not provide a summary of unit numbers; however, Stantec counted 202 lots, presumed to be for single-detached homes. The number of units in the apartments structures is not specified either but a count of surface parking spaces suggests they may have up to 16 units each for a total of 48 units, which brings the total north of Atholea Drive to 250 units. We have noted that the concept plan shows two apparent ponds within the area that Design Point has simply portrayed underneath proposed roadways and lots.

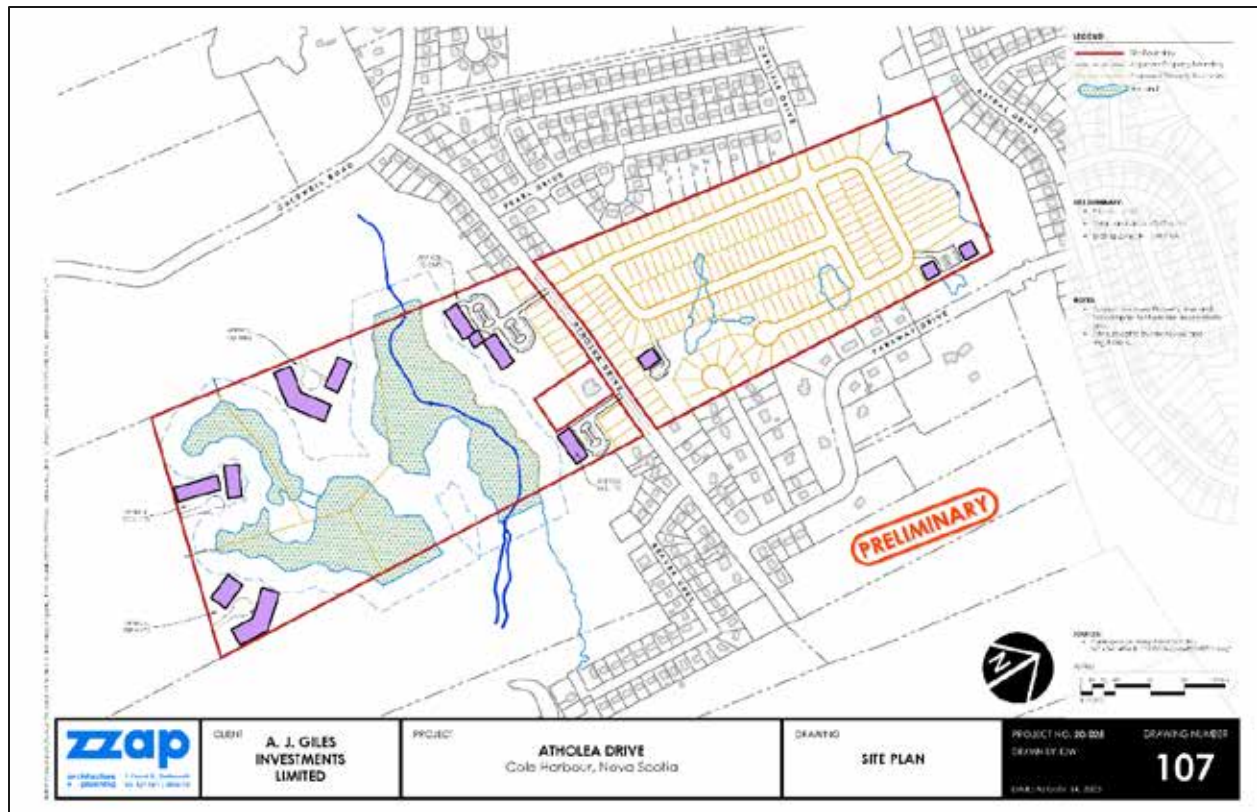


Figure 2-3 A. J. Giles Investments Ltd, Concept

The design is more attentive to environmental features on the south side of Atholea; however, the proposed development is considerably denser than the proposal for the property to the north. Planned structures are largely multi-unit with five groupings of apartment structures providing 372 units. Twelve lots assumed to be for single-detached homes about the south side of Atholea Drive.

In total, we estimate the A. J. Giles proposal will provide 634 units as presented: 250 units north of Atholea Drive and 384 within the Study Area to the south. There are 214 single-detached units and 420 apartments across the entire proposal. The concept plan as illustrated suggests multi-unit dwellings will have surface parking.

Development within the Study Area is constrained by the Cow Bay River, which runs through the property as well as by other wetlands south of the river area (Griffin Transportation Group Inc, 2020). The concept shows approximately 13.0 acres proposed for development with the remaining 32.7 acres consisting of watercourses and wetlands to be left in their natural state. While two of the apartment clusters access the south side of Atholea Drive, the remaining three are accessed through proposed cul-de-sacs, anticipated on adjacent lands owned by Morris Lake Holdings. Plans submitted by Morris Lake Holdings discussed in the following section do not show any connections to the Giles lands.

The breakdown of the development on the portion of Giles lands within the Study Area (i.e., PID 40110157 south of Atholea Drive) is as follows:

Table 2-1 Development Breakdown A.J. Giles Land Holdings

Use	Total Units	Persons per Unit	Population
Single-detached lots	12	2.6	31
Multi-Unit dwellings	372	1.8	670
Total	384	1.8	701

2.2.2 MORRIS LAKE HOLDINGS LIMITED

Morris Lake Holdings Limited, which was previously known as Dartmouth East Holdings, is a partnership between Clayton Developments and Cresco. The companies are proposing to develop approximately 221 hectares of land west of the Cow Bay River, south of Morris Lake, east of Shearwater Heliport, and north of Cow Bay Road. The existing Shearwater Flyer Trail is integrated within the concept. The proposed development will be a mixed-use community containing lower density, ground-level housing (i.e., single-detached, townhouses, semi-detached) and low-, mid-, and high-rise apartment buildings, as well as retail, commercial, and institutional space (**Figure 2-4**).



The plan incorporates lands currently owned by Bryan Naugle and the Trider family. While the 425 hectare Study Area extends north to the Cow Bay River, the proposed plan avoids approximately 203 acres abutting the west side of the river, which include parts of properties owned by Morris Lake Holdings, Bryan Naugle, the Triders, and others (Clayton Developments Limited , 2019). The area has been set aside for conservation in keeping with an assessment of the Green Network Plan by zzap Consulting. Zzap based their conclusion on summation of ecological open space, working landscapes, and sociocultural values derived from the plan, which were determined to be high along the river. The consultants, however, commented that “after completing field work in these areas, we can confirm the areas are not wetland, but we require the assistance of [HRM staff] to understand why the southern portion is showing potential for socio-cultural value.”

Development is confined within the remaining 221 hectares to the west of this reserved area. The concept plan prepared by Morris Lake Holdings Limited shows that development will proceed through phases. A total of 5,290 residential units have been proposed along with 42,600 square feet of retail/commercial space and 548,856 square feet of institutional space. At 2.6 persons per ground-based unit and 1.8 persons per apartment, the expected total population of the development is estimated to be 11,924.

A breakdown of the development on lands covered by the Clayton plan is as follows:

Table 2-2 Morris Lake Holdings Limited Development Breakdown

Use	Total Units	Persons per Unit	Population
Singles	1,077	2.6	2,800
Townhouse or Semi-detached	1,737	2.6	4,516
Cluster Townhouse	89	2.6	231
Fourplexes	100	2.6	260
Mid-rise Multi-Unit (3-10 storeys)	1,003	1.8	1,805
High-rise Multi-Unit (>10 storeys)	1,284	1.8	2,311
Total	5,290		11,924
Commercial Area	42,600 sq. ft.		
Institutional Area	12.6 acres		

2.2.3 BRYCON DEVELOPMENT

Brycon Development owns 39 hectares in the approximate middle of Clayton’s concept plan area corresponding roughly to the lands occupied by their proposed Phases 7, 8, 12, and 13). The land is registered in the name of Bryan Naugle, who is the founder of Brycon. The Clayton plan for the area references Naugle in relation to two areas designated Park.

Brycon, as noted, has prepared a plan for their lands independent of the Morris Lake Holdings concept. In their assessment, approximately 64% of their 39-hectare holding or 25 hectares is developable, the

remainder of the land contains the Cow Bay River and its watercourse buffer. They have investigated the height permitted in the Shearwater flight path and determined they can build to ten storeys.

The Brycon scheme is illustrated in **Figure 2-5**. Their plan indicates they intend to build 887 dwelling units comprised of 55 singles on individual lots, 158 semi-detached units on 79 lots, and 640 apartments in eight apartment buildings. Stantec calculates the units will accommodate 1,706 residents based on 2.6 occupants in each of the 213 ground-based unit and 1.8 in each of the 640 apartments. By contrast, Phases 8, 12, and 13 in the Morris Lake Holdings Plan, which occupy essentially the same lands, will provide 997 dwelling units or 12.4% more units occupied by 2,127 residents (24.7% more).

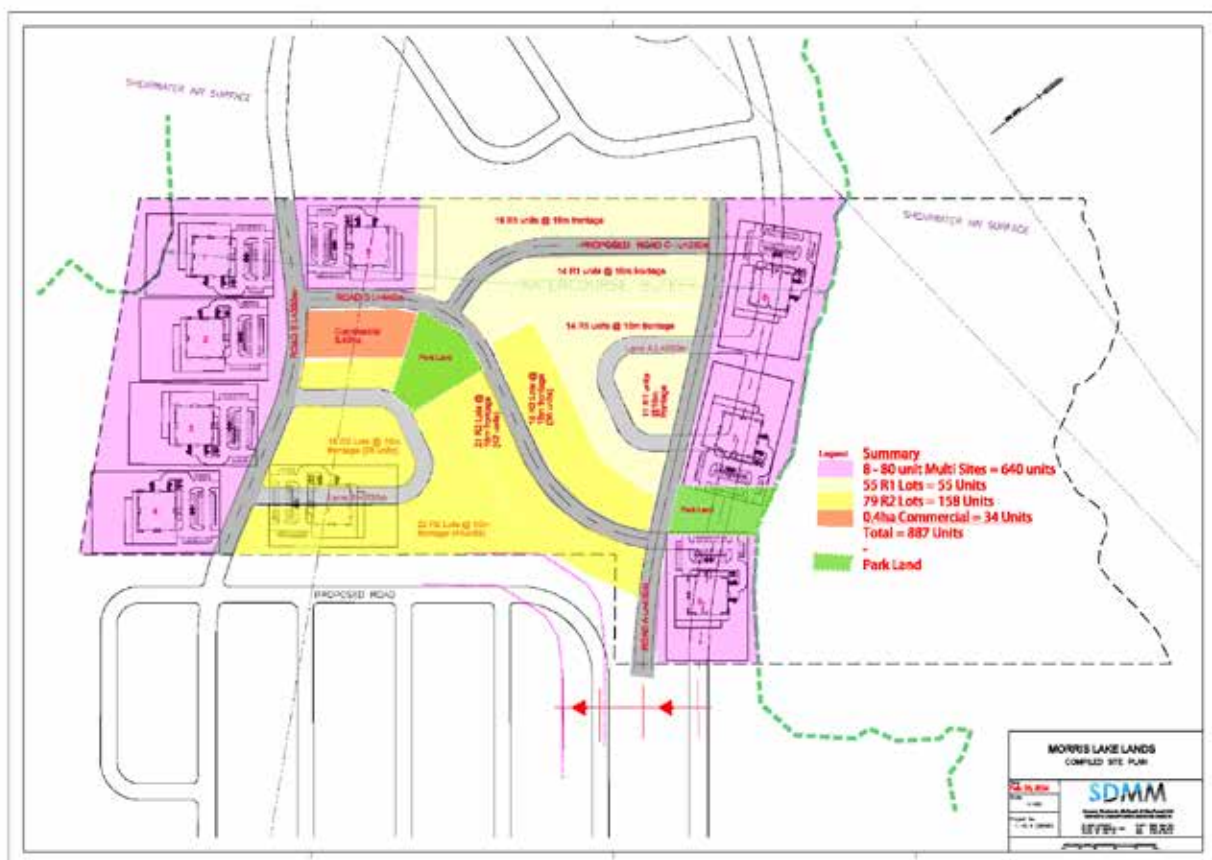


Figure 2-5: Brycon Development Concept

2.2.4 REMAINING LANDS

Stantec received no indication of immediate interest in development from other landowners within the Study Area; however, HRM staff asked that we also consider the development potential of remaining properties to assess the full impact of development in the Study Area. The lands outside the areas for

which plans were submitted are on the north and south edges of the Study Area. The key property to the north is the peninsula jutting into the southern end of Morris Lake from the north side of Caldwell Road, which consists of three properties owned by Oknah Realty. It is abutted on its western edge at the base of the peninsula by property owned by Lakeport Excavating that also has frontage on the north side of Caldwell Road. The Lakeport property, furthermore, faces land owned by Craig Hartlen across Caldwell Road that extends to the east side of De Said Lake. In the south, the primary property is 5 hectares registered to 3312544 Nova Scotia Limited. Abutting its southwest corner is a 0.36-hectare lot owned by Diana McPhee.

Although the Oknah, Lakeport, and Hartlen lands cover 37 hectares or just over 8.4% of the Study Area, significant portions of the Oknah and Lakeport properties are on Morris Lake and roughly half of the western edge of the Hartlen property is on De Said Lake requiring imposition of a 30-metre watercourse buffer in all three cases. All three properties also include significant wetlands with the Hartlen land designated as a “Special Wetland Area” in provincial records. Combining these environmental constraints with a 20% allocation for arterial and collector roads, we estimate the total developable area of the combined properties at just 16.6 hectares. The two properties in the south end of the Study Area do not touch any watercourses and records do not indicate wetlands are present; however, we have applied general rules assuming 21% of all land is wetland and 20% will be required for arterial roads, leaving roughly 3.2 hectares for development.

2.2.5 SUMMARY OF ALL DEVELOPER PROPOSALS

The concept plans prepared by A. J. Giles Investments Limited and Morris Lake Holdings Limited will create approximately 5,674 residential units and accommodate 12,625 residents in the Study Area. The concepts show reserved land for conservation on either side of the Cow Bay River. The Shearwater Flyer Trail is integrated into the new community. We recognize that Brycon has an alternative concept for their lands, which we have listed separately below. While their proposal, which they have stated they intend to pursue, would supplant a portion of the Morris Lake Holdings scheme, it would change the number of units moderately with a negligible effect on environmental impacts or the service requirements that are the subject of this study.

Table 2-3 Summary of Developer Proposals

Developer Proposals	Total Number of Residential Units	Total Population	Commercial Space (square feet)
A. J. Giles Investments Limited	384	701	0
Morris Lake Holdings Limited	5,290	11,924	42,600
Total	5,674	12,625	42,600
Brycon Developments	887	1,706	74,000
Remaining Lands	338	838	8,044

Below, we have chosen to use the complete Morris Lake Holdings plan as the basis for the development scenarios given that Brycon's estimate of residential units on their land is less than the Morris Lake Holdings plan presents. On the other hand, we note that Brycon's commercial space estimate aligns

better with commercial space proposals for other Study Areas being assessed for the Future Serviced Communities project and supports increases to commercial space expectations incorporated in the development scenarios below.

Estimates for the Giles property are based on their submission. For the remaining lands, we employed assumptions described in the following Development Scenarios section that, in the case of the lands owned by Oknah and related properties in the north, are tied to expectations of low-density development and in the south reflect our assumption that the lands will be developed in a pattern similar to the Morris Lake Holdings plan.

2.3 Development Scenario Methodology

The RFP for this assignment specified that the consultant would assess the Study Area in terms of three scenarios described as follows:

- **Low-density Scenario:** Based on the analysis outlined in Appendix A (of the RFP), the amount of development needed to avoid costly infrastructure or environmental tipping points that also supports the function of a multimodal transportation system to/from and within the proposed community.
- **Developer-requested Density Scenario:** 3,000 dwellings units, as proposed by the developer.
- **High-Density Scenario:** Based on the analysis outlined in Appendix A (of the RFP), the maximum amount of development that can be accommodated within the lands identified as being suitable for development from an ecological and cultural perspective that respects HRM's goal of creating complete communities, that are connected by efficient multimodal transportation systems and managing impacts on transportation connections outside of the Study Area.

Stantec developed three scenarios for each Study Area: a “developer-requested” scenario and two alternatives. The approach to defining development scenarios is the same for all four Study Areas addressed by the Future Serviced Communities study. The developer-requested scenario in each case is based on plans provided by landowners who expressed an interest in developing lands within each Study Area. In most cases plans are formal depictions of proposed construction on developer landholdings, like the plans provided for the Morris Lake Study Area by A. J. Giles, Brycon Development, and Clayton/Morris Lake Holdings. The methodology for creating the Development Scenarios is explained in Volume 1. The scenarios have departed from the RFP specifications based on information gathered and available at the time of preparing this Development Scenarios Report. Most notably, developer proposals for the Study Area determined through interviews and plans submitted by the developers significantly exceed 3,000 dwelling units.

Alternative scenarios are based on assumed densities suggested by HRM staff for this analysis. The proposed densities are applied to the developable area of each landholding for each scenario to obtain the estimated population in each case. We then developed a profile of dwelling units by type aligned with

the breakdowns in developer proposals using approaches outlined in the “Development Scenario Methodology” section of our Volume 1 Summary Report to arrive at dwelling unit profiles presented below.

Estimates of all alternatives reflect indicated developer preferences as nearly as possible. In all scenarios, we assumed the 41 developable acres on the Oknah, Lakeport, and Hartlen properties would be developed with single-detached homes only, given the significant constraints on those lands. We assumed, on the other hand, that the 3312544 Nova Scotia and McPhee properties in the south would most likely be developed in a similar pattern to the Morris Lake Holdings lands and, therefore, applied the unit breakdown for the lands covered by the Morris Lake Holdings plan to the developable land calculated for those properties.

We generally derived commercial development requirements for each Study Area based on the ratio of commercial space to resident population reflected in each developer-requested scenario. All commercial area estimates are rounded up to the nearest 5,000 square feet. In the case of Morris Lake, HRM staff judged that the ratio of commercial space to population proposed by the developers was insufficient based on their experience and comparison with submissions for the other Study Areas and Stantec increased it accordingly to 9.6 square feet person for all scenarios including the developer-requested scenario.

The three scenarios created for the Morris Lake Study Area as discussed are:

1. **Developer-requested Density Scenario** – As discussed above, Morris Lake Holdings Limited and A.J. Giles Investments own the bulk of the lands south of Caldwell Road within the Study Area. Both companies provided plans showing graphically and/or in table form the number and type of residential units they propose to develop on their lands. The Morris Lake Holdings plan provided for a relatively modest amount of commercial space to complement the residential development, and the Giles plan included no commercial development. A higher per person commercial space estimate similar to the standard applied for other Future Serviced Communities study areas was applied at the direction of HRM staff. Stantec applied an average household size of 2.6 persons per dwelling for ground-based units and 1.8 for apartments based on the 2021 Census Profile for HRM to the dwelling units proposed by each company to determine expected population density.
2. **Low-Density Scenario** – The low-density scenario reduced the anticipated number of dwelling units from the developers’ proposals to provide a basis for comparing decreased density in the Study Area. The approach applies low and medium-low-density housing typologies such as single-detached dwellings and townhouses. Stantec again applied an average household size of 2.6 persons per dwelling for ground-based units and 1.8 for apartments to the dwelling units anticipated to determine expected population density within the Study Area.
3. **High-Density Scenario** – The high-density scenario applies a higher density than proposed by the developer requested scenario. The scenario mixes high proportions of multi-unit apartments with low- to medium-density housing forms such as single-detached, semis, duplexes, and row

housing. Stantec applied the same average household sizes for ground-based units and apartments as for the other two scenarios to determine expected population density.

In the Water Quality analysis only, a fourth “areal” development scenario was created as a sensitivity test to assess water quality impacts from a smaller built-up land area. This scenario was developed by reducing the footprint of the developed area by 20%, leaving the anticipated population the same as the high-density scenario. The intent of this scenario is to model a new community built more compactly and leave more land in an undeveloped/vegetated condition.

2.3.1 DEVELOPER-REQUESTED DENSITY SCENARIO

The developer-requested density scenario combines the A.J. Giles Investments Limited and Morris Lake Holdings Limited proposals outlined in the preceding sections as well as allocations to remaining properties within the Study Area that are not covered by either formal plan. A. J. Giles has proposed 384 residential units within the Study Area and Morris Lake Holdings has proposed another 5,290 units.

We assumed exclusively single-detached units would be developed on the Oknah, Lakeport, and Hartlen properties resulting in a population of 654 people in 252 homes at a density of 16 ppa. For the 3312544 Nova Scotia and McPhee lands to the south, we assumed the same density as the Morris Lake Holdings plan with the same mix of ground-based and apartment unit types resulting in another 184 residents in 86 total units.

Altogether, the Study Area will accommodate 13,462 in 5,964 proposed in a mixture of residential unit types.

A. J. Giles Investments Limited does not propose commercial space in their concept. While Morris Lake Holdings has proposed approximately 42,000 square feet of commercial space, which equates to 3.3 square feet per resident. As this is considerably less commercial space than is provided with development concepts for other Study Areas, Stantec increased the expected gross leasable floor area to 9.6 square feet per person at the request of HRM staff. The resulting overall expected commercial development estimate of 125,000 square feet shown in **Table 2-4** below aligns fairly closely with the combined total commercial space provided by Morris Lake Holdings and Brycon.

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Table 2-4 Developer-requested Scenario

Developer	Land Area (ac.)		Dwelling Units				Estimated Population		Commercial GLA (sq. ft.)	
	Total	Developable	Unit Type	Unit Numbers	Density	Share by Type	Residents	Density	Per Resident	Total Area
Oknah Realty	119	60.7	Ground-based	252	4.2	100.0%	655	10.8	9.6	10,000
A. J. Giles	46	23.4	Singles	12		3.1%	31			
			Multi-unit	372		96.9%	670			
			All types	384	16.4	100.0%	701	30.0	9.6	10,000
Morris Lake Holdings	1,000	511.9	Singles	1,077		20.4%	2,800			
			Townhouses	1,737		32.8%	4,516			
			Cluster Towns	89		1.7%	231			
			4-plexes	100		1.9%	260			
			Mid-rise Multi	1,003		19.0%	1,805			
			High-rise Multi	1,284		24.3%	2,311			
			All types	5,290	10.3	100.0%	11,924	23.3	9.6	115,000
Remainder	7	3.6	Singles	8		20.4%	20			
			Townhouses	14		36.4%	36			
			Multi-unit	16		43.2%	29			
			All types	38	10.3	100.0%	85	23.3	9.6	5,000
STUDY AREA	1,171	599.7	All development	5,964	9.9		13,365	22.3	9.6	130,000

2.3.2 LOW-DENSITY SCENARIO

HRM recommended that Stantec develop a Low-Density Scenario based on densities for traditional suburban development comprised entirely of single-detached housing as seen in East Dartmouth neighbourhoods like Bel Ayr Park and Forest Hills, which are near the Morris Lake Study Area. The style of development is reflected by Pattern C in the Pattern Book. It is associated with an average density of 16 persons per acre (ppa).

Applying 16 ppa to the 13 developable acres within the Study Area owned by Giles, the 547 developable acres covered by the Morris Lake Holdings plan, and the remaining acreages in the north (Oknah) and south (3312544 Nova Scotia) equates to a total Study Area population of 9,594.

The representation of Pattern C in the Pattern Book suggests that this population will be housed exclusively in ground-based dwelling units. Based on our assumption of 2.6 persons per dwelling for ground-based units and 1.8 for apartments, the overall count of dwelling units is 3,690. As the only ground-based units shown on the Giles plan are single-detached homes, we have assumed all 80 dwellings on the property will be singles as we have for the units expected on the Oknah lands in this low-density scenario. For Morris Lake Holdings and the 3312544 Nova Scotia lands, we assumed the variety of ground-based units shown in the Morris Lake Holdings plan and applied the breakdown of ground-based housing types in that plan to arrive at the numbers for each category shown in **Table 2-5**.

Applying the assumed commercial space requirement of 9.6 square feet of gross leasable area to the total expected Study Area population of 9,749 yields a total floor area requirement over 90,000 square feet, which we have rounded up to 95,000 square feet.

2.3.1 HIGH-DENSITY SCENARIO

For the high-density scenario, we assumed a density of 36 ppa based on the RFP specification that it should reflect *“the maximum amount of development that can be accommodated within the lands”*. This scenario is based on blending settlement Patterns E (Suburban Mid Density) and F (Urban Mid Density) from the HRM Pattern Book. Housing depicted for Patterns E and F includes row housing and other higher density ground-based types as well as apartment structures.

We applied the 36 ppa assumption to the Giles land, all lands within the Morris Lakes Holdings plan, and the 3312544 Nova Scotia and McPhee properties. For the Oknah, Lakeport, and Hartlen lands we assumed 16 ppa accommodated exclusively in single-detached homes. The total population of 17,909 is 56.9% more than the Developer-requested Scenario. Calculations of dwelling unit requirements indicate a total of 11,673 will be required with 155,000 square feet of commercial space, as shown in **Table 2-6**.

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Table 2-5 Low-Density Scenario

	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
Oknah Realty	119	60.7	Ground-based	373	6.2	100.0%	971	16.0	9.6	10,000
A. J. Giles	46	23.4	Ground-based	144	6.2	100.0%	374	16.0	9.6	5,000
Morris Lake Holdings	1,000	511.9	Ground-based	3,150	6.2	100.0%	8,191	16.0	9.6	80,000
Remainder	7	3.6	Ground-based	22	6.2	100.0%	58	16.0	9.6	5,000
STUDY AREA	1,171	599.7	All development	3,690	6.2		9,594	16.0	9.6	95,000

Table 2-6 High-Density Scenario

	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
Kiel Development	262	182.8	Singles	161		3.2%	418			
			Townhouses	799		15.9%	2,078			
			Multi-unit	4,054		80.9%	7,297			
			All types	5,014	27.4	100.0%	4,571	25.0	8.6	40,000
Akoma Holdings	318	221.8	Singles	121		4.3%	314			
			Townhouses	442		15.6%	1,150			
			Multi-unit	2,267		80.1%	4,081			
			All types	2,830	12.8	100.0%	5,545	25.0	8.6	50,000
Annada Properties	217	151.2	Singles	23		1.2%	60			
			Townhouses	569		31.0%	1,480			
			Multi-unit	1,245		67.8%	2,242			
			All types	1,837	12.1	100.0%	3,781	25.0	8.6	35,000
Jim Morash Construction	14	9.9	Ground-based	96	9.6	100.0%	249	25.0		
Remainder	216	150.6	Singles	55		2.9%	142			
			Townhouses	385		20.3%	1,002			
			Multi-unit	1,456		76.8%	2,620			
			All types	1,896	12.6	100.0%	3,764	25.0	8.6	35,000
STUDY AREA	1,028	716.4	All development	11,673	16.3		17,909	25.0	8.6	155,000

2.3.2 CUMULATIVE EFFECTS

The lands within the Morris Lake Study Area are largely undeveloped. Proposed development could create significant development opportunities but will place pressures on the environment and available infrastructure. As discussed in the Westphal Development Scenario Report the two Study Areas will share components of local infrastructure between them and with existing and potential development in the surrounding area. Most notably, both Study Areas will rely on the same trunk wastewater network.

Additional new development can also be expected within and adjacent to the Morris Lake Study Area. Most obviously, A. J. Giles intends to develop lands north of Atholea Drive on the north edge of the Study Area. Other surrounding communities such as Eastern Passage and Russell Lake are continuing to develop additional housing and other land uses that will draw on road and water and sewer capacity within many of the same networks as Morris Lake will depend on. Finally, some property owners within the Study Area are not ready to develop their lands or lack the capability to do so but will likely be attracted to the possibility of proceeding with development or selling to development interests.

3 Summary of Key Findings from the Background Studies

3.1 Morris Lake Land Suitability Analysis

The land suitability analysis (LSA) for the Morris Lake Study Area (MLSA) involved both desktop and field evaluations, supplemented by regional and local studies provided by other organizations. The desktop review included data from various sources such as the Atlantic Canada Conservation Data Centre, Nova Scotia Department of Natural Resources and Renewables, and Halifax Regional Municipality. Despite valuable information from these studies, additional desktop and field work was necessary to fill gaps, particularly in wetland functional assessments and forest inventory. Field surveys were conducted from spring to fall 2023 aimed to gather further environmental data and assess cultural significance through an Archaeological Resource Impact Assessment.

Final analysis covered wetland habitat, watercourses, water quality, forest habitat, species at risk, landscape connectivity, geology, topography. Suitability for development was ranked from low (1) to high (3), with lower scores indicating higher ecological function and suitability for conservation and higher scores indicating relatively lower suitability for development. The study also identifies potential contaminated sites and areas with elevated archeological potential, recommending further investigations to manage risks prior to development. The full LSA report can be found in **Appendix 5A**.

Wetland habitat was a significant focus, with 26 wetlands identified in the MLSA. Of these, 13 wetlands were evaluated using the Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC) method. The analysis revealed that most wetlands scored high for ecological condition and wetland risk, indicating their importance for conservation. Stantec recommends that planners and developers engage with Nova Scotia Environment and Climate Change as early as possible to discuss potential wetland impacts (direct

or indirect), the permitting process, and compensation requirements (e.g., potential opportunities for wetland restoration, enhancement, or creation). Full analysis of wetlands desktop and field data can be found in Section 3.2 in **Appendix 5A**.

Stantec recommends the following steps when development decisions related to wetlands need to occur. The first step in the sequence (and the priority) is avoidance. This option involves avoiding alteration to wetlands, forcing the consideration of alternative options for the project that may result in fewer impacts on wetlands. If no other alternative option exists, minimization is recommended, meaning that any unavoidable impacts to the wetland be managed in such a way that adverse impacts are reduced. This can be accomplished through specific techniques, materials, and/or site choice. Compensation is required for any permanent loss of wetland area or function. Compensation can be in the form of restoration, enhancement, creation and/or expansion of a wetland ecosystem. The amount of compensation necessary is determined by NSECC and ranges from 1 to 4 ha for every 1 ha of wetland altered, depending on the compensation approach and the relative ecological/social value.

The analysis of watercourses and water quality identified two mapped watercourses and one mapped waterbody. The MLSA is located within the Shore direct and Cow Bay River watershed. Morris Lake is located on the northeast border of the MLSA and drains into Cow Bay River, which flows along the eastern border of the MLSA before reaching Cow Bay. De Said Lake is located along the northwestern border of the MLSA and drains into Smelt Brook, which flows along the western side of the MLSA before entering Cow Bay.

Water quality sampling in these watercourses indicated generally low levels of suspended sediments and concentrations of phosphorous indicative of oligotrophic conditions. Bacteria concentrations were occasionally noted to exceed Health Canada's guidelines for recreational water quality. The study highlights the importance of protecting riparian zones and maintaining buffer zones around watercourses to preserve aquatic habitats and water quality. Areas within 30 m of a watercourse were considered to have low suitability for development. Areas between 30 m and 100 m from a watercourse were considered to have moderate suitability for development, while areas greater than 100 m from a watercourse were considered to have higher suitability for development. Additional consideration was taken when scoring wetlands to manually adjust the weighting of policy-protected constraints including established environmental buffers such as a 30 m wetland setback for wetlands intersected by watercourses. Prior to the development of lands within the MLSA, it is recommended that dedicated fish habitat assessments be conducted to determine the use of habitats by fish and provide data to fulfill applicable regulatory requirements at the time of construction. Full analysis and study details of watercourses and water quality can be found in Section 3.2 of the LSA report in **Appendix 5A**.

Forest habitats and species at risk were assessed using the Nova Scotia Forest Ecosystem Classification system and data from the Atlantic Canada Conservation Data Centre. The study identified several forest types typically associated with habitats for species at risk, including mature and potential old-growth forests. The analysis underscores the ecological value of these habitats and the need for careful planning to balance development with conservation. Forest habitat and species at risk are the focus of Section 3.4 in the LSA in **Appendix 5A**. Stantec recommends establishing wildlife corridors along the Cow Bay River and Smelt Brook to connect isolated habitat patches and support wildlife movement. It is advised to

modify existing corridors by extending the Halifax Green Network Important Corridor to include more wetland complexes and connect different corridors for enhanced effectiveness. Implementing 30-meter buffer zones around watercourses and wetlands is recommended to protect these habitats from development impacts. Additionally, using existing roads and utility corridors for new developments is suggested to potentially reduce disturbance to wildlife corridors. These measures aim to preserve biodiversity and maintain ecological connectivity in the MLSA (see Figure 3.11 in Section 3.5 of the MLSA LSA report **Appendix 5A**) The report also addresses landscape connectivity, proposing wildlife corridors to link habitat patches and facilitate species movement (Section 3.5 **Appendix 5A**).

The LSA report concludes with two summaries for the culmination of biological and geological/topographical land suitability analysis. Areas with higher ecological function, such as wetlands, mature forests, and potential habitats for species at risk, are generally deemed less suitable for development and more suitable for conservation. Conversely, areas with lower ecological function are considered more suitable for development (**Figure 3-1**). Geological and Topographical mapping highlights potential constraints relating to steeper slopes and potential for acid rock drainage (**Figure 3-2**). The study provides a framework for future planning and decision-making, emphasizing the need for ongoing evaluations and stakeholder engagement to promote sustainable development in the Morris Lake Study Area. The LSA and mapping can be found in **Appendix 5A** of this report.

The foregoing analysis of potential land suitability based on forest habitat and species at risk should only be viewed as a preliminary tool to assist in planning for future development in the Study Area. Responsible land development depends on many factors including those described above, and no one factor, or group of factors should be considered determinative. Rankings are meant to be indicative, and to lay the groundwork for future, site specific investigations to be conducted if planning proceeds.

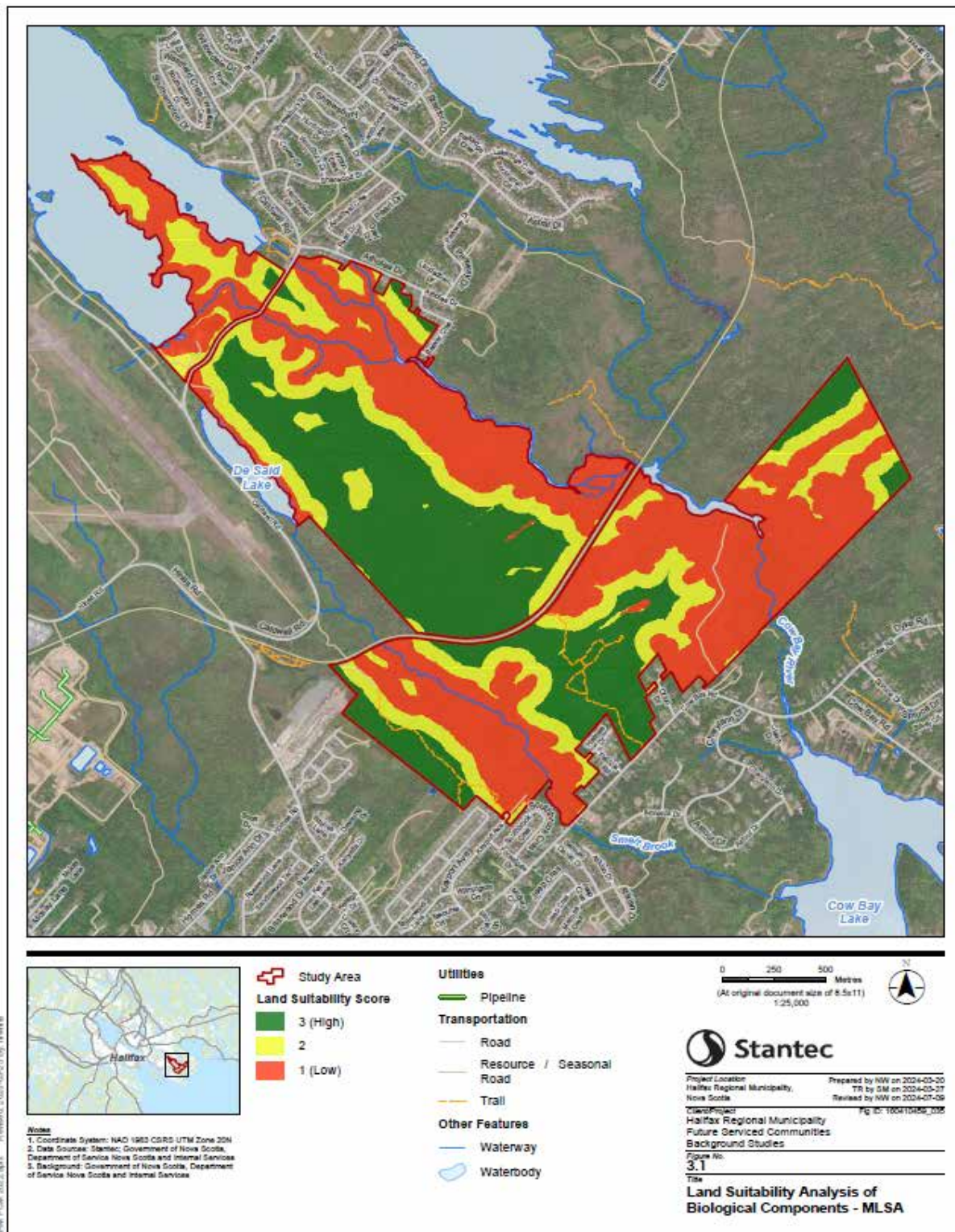


Figure 3-1 Land Suitability Analysis Biological Components

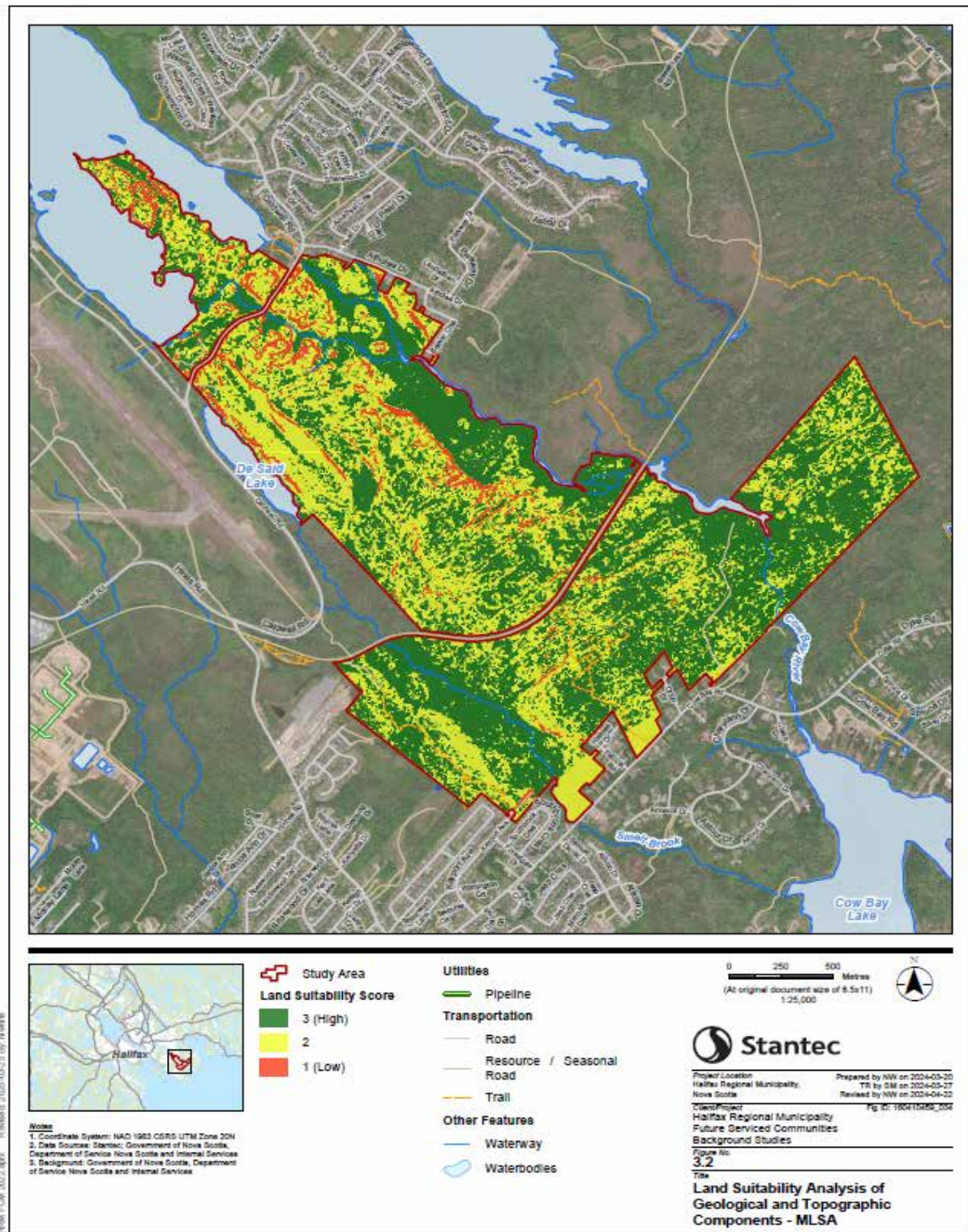


Figure 3-2 Land Suitability Analysis - Geological and Topographic Components

3.2 Morris Lake Watershed and Stormwater Study

The Morris Lake Study Area (MLSA) covers approximately 465.8 hectares. Much of the land within the Study Area is undeveloped and is located within three watersheds that drain into Cow Bay (Morris Lake, an unnamed watercourse, and De Said Lake/Smelt Brook). Morris Lake is located along the north border of the MLSA. It has a surface area of 140 ha with a maximum depth of 10 m and drains into the Cow Bay River. The Kiwanis Centre Beach and Park Morris Lake, which provide public recreational water access, including swimming, is at the southeast end of the lake. Cow Bay River flows from Morris Lake within the park and then along the eastern border of the MLSA before reaching Cow Bay and the Atlantic Ocean to the southeast.

An unnamed watercourse is between Cow Bay River and Smelt Brook, to the southeast of the MLSA boundary, crossing Cherylann Drive. The watercourse is approximately 0.40 km long and drains into Cow Bay Lake. It runs roughly from the northeast to east and is narrow.

De Said Lake is located along the northwestern border of the MLSA and has a surface area of 6 ha. De Said Lake drains into Smelt Brook, which flows along the western side of the MLSA before entering Cow Bay.

3.2.1 WATER QUALITY FINDINGS

The Morris Lake Watershed and Stormwater Study, prepared by Stantec Consulting Ltd. for HRM, assessed both the water quality impacts and stormwater runoff quantity impacts of proposed land developments within the Study Area and its contributing watershed. The water quality study focused on three key contaminants: phosphorus, fecal coliform, and sediment, which are known to adversely affect water bodies and watercourses, while the conceptual stormwater management plan focused on developing stormwater management measures to restrict post-development peak flows from the Study Area to pre-development levels up to and including the 100-year storm.

The objective of the Watershed Study is to determine water quality impacts to sensitive or natural receptors within or downstream of the Study Area. The focus of the water quality study is on sourcing and quantifying contaminant loadings of total phosphorus (TP), fecal coliforms, and sediment due to impacts of land use change to the MLSA and its contributing watershed area from proposed development scenarios. These specific contaminants were selected because of their documented adverse effects on waterbodies throughout the HRM.

In the Watershed Study, contaminant loading models for three land development scenarios (Low-density, Mid-density, and High-density/Developer-requested density) were evaluated to understand the potential water quality effects resulting from each scenario. In addition to the three development scenarios a fourth “areal” scenario incorporates the same housed population as the Developer-requested scenario; however, this scenario covers 20% less land area compared to the Developer-requested scenario. This additional scenario was evaluated to assess impacts of development on the watershed when forested area is conserved within the watershed.

Each scenario was modeled to predict the following changes in contaminant loadings and the resulting impacts on water quality:

- **Phosphorus Loading:** Area and concentration-based TP loadings within the three watersheds (Morris Lake, unnamed watercourse, De Said Lake/Smelt Brook) that include the MLSA are largely generated by anthropogenic sources, namely low-density residential and roadways. These two land uses contributed approximately 85% of the loading to Morris Lake for the existing condition and development scenarios. TP loads from residential land use are mitigated in the existing condition and development scenarios by municipal wastewater services and centralized wastewater treatment, which remove these additional loads from the watershed. The existing condition annual TP loading was calculated to be 1,629 kg/year. For the proposed development scenarios, the areal land use scenario resulted in the lowest increase in Total P loading for both event-based and annual loading calculations. This is primarily due to its reduced development footprint compared to the other three scenarios, resulting in the retention of more naturally vegetated areas. Other scenarios could be amended to further reduce the development footprint while retaining the housing supplied to reduce the loss of vegetated areas. The low-density, developer requested, and high-density development scenarios resulted in an increase in Total P load of less than 7% for the annual and storm-event models. Future development for the MLSA should consider the conservation of natural forested area, rather than the expansion of development within the watershed. A mix of higher density, smaller footprint housing may mitigate the loss of forested areas within the watershed. The implementation of mitigation measures will be required for developments to reduce TP loads to match existing or background conditions.
- **Fecal Coliform:** The EMC-based model results, area, and concentration-based FC loadings within the WSA are largely generated by residential developments, commercial developments, and undeveloped/grassed areas for the existing conditions and development scenarios. Predicted increases in annual fecal coliform loading range from 7.1% to 9.8%, primarily due to increased high density residential development, with the high-density scenario contributing the most significant increase.
- **Sediment Loading:** Sediment load modelling using MUSLE and RUSLEFAC calculations for the low-density, developer requested, and high-density development scenarios resulted in sediments loads of 1,245 tonnes/year on an annual basis and 361 tonnes per storm-event. This equates to an increase in annual sediment loading of 5% from existing conditions. The areal land use scenario resulted in sediment loads of 1,233 tonnes/year on an annual basis and 358 kg per storm event. The storm-event loading represents approximately 29% of the total annual sediment load. Baseline sediment loading was estimated to be 1,186 tonnes per year, with approximately 344 tonnes deposited during a storm event. The addition of roads, and disturbance of soils during construction of the development scenarios have the potential to increase sediment loading in the watershed. Therefore, the implementation and design of mitigation measures will be required to reduce loads to equal existing conditions. These calculations were performed conservatively, without considering any erosion and sedimentation control measures.

Full analysis and study details of the Watershed Study are included in **Appendix 5B**.

The Watershed Study outlines a number of approaches to reduce the impacts of new urban development on the watercourses in the Study Area. These include:

- Land use management practices - promotion of green space creation or conservation of naturally forested areas, minimizing impermeable surfaces;
- Low-impact design technologies - infiltration trenches, porous pavement, wet pond or wet detention basin;
- Public education initiatives - public education on pet droppings, risk of swimming in areas where wildlife congregates; and
- Ongoing water quality monitoring.

The study underscores the need for careful planning and implementation of mitigation measures during subsequent stages of the planning for future development. The findings highlight the importance of balancing urban growth with environmental stewardship to ensure the long-term health of the watershed.

3.2.2 EXISTING FLOOD RISK FINDINGS

Existing policies and regulations provide direction to limit development in flood risk areas. The Province of Nova Scotia has adopted a Statement of Provincial Interest Regarding Flood Risk Areas. The goal of the statement is to protect public safety and property, and to reduce the requirement for flood control works and flood damage restoration in floodplains.

Much of the Study Area is located within two provincial secondary watersheds that drain into Cow Bay; Cow Bay River and Shore Direct (refer to **Figure 3-3**). Morris Lake, which is located along the north border of the Study Area, drains into the Cow Bay River, which borders the eastern boundary from north to south and ultimately discharges into Cow Bay and the Atlantic Ocean. Bisset Lake, which is located north-east of the Study Area, also drains into the Cow Bay River. Smelt Brook borders the western boundary of the Study Area from De Said Lake at the north end to ultimately discharge into Cow Bay and the Atlantic Ocean. The floodplain extents along the Cow Bay River and Smelt Brook significantly impact the development constraints in the Study Area. Preliminary flood lines (i.e., subject to change) were provided by HRM from the on-going Regional Flood Mapping Delineation project and were used to estimate boundary conditions for the hydraulic/hydrologic model during various return periods and to delineate preliminary floodplain extents as shown in **Figure 3-3**.

The Statement of Provincial Interest Regarding Flood Risk Areas outlines that planning documents must identify *Flood Risk Areas* consistent with the Canada-Nova Scotia Flood Damage Reduction Program mapping and any locally known floodplain. For *Flood Risk Areas* that have been mapped under the Canada-Nova Scotia Flood Damage Reduction Program, planning documents must be reasonably consistent with a number of guidelines that explain what is permitted and what is prohibited within floodways and floodway fringe areas. The Statement also outlines that there are other areas in the Province that are subject to flooding which have not been mapped under the Canada-Nova Scotia Flood Damage Reduction Program. In these areas, the limits of potential flooding have not been scientifically

determined. However, where local knowledge or information concerning these floodplains is available, planning documents should reflect this information and this statement. The Statement does permit development contrary to the Statement provisions, provided a hydrotechnical study carried out by a qualified person shows the proposed development will not contribute to upstream or downstream flooding or result in a change to flood water flow patterns. Given that the Study Area is within the preliminary floodplains of two watercourses (i.e., the Cow Bay River and Smelt Brook), the provisions outlined in the Statement of Provincial Interest Regarding Flood Risk Areas should be met.

The Regional Municipal Planning Strategy (RMPS) and Land Use By-law (LUB) for Eastern Passage/Cow Bay contain recommendations to establish floodplain zones for the Cow Bay River and Smelt Brook, as well as policies and regulations regarding watercourse and coastal area setbacks and buffers, and development restrictions within the floodplain. While this project does not include floodplain mapping for the Cow Bay River or Smelt Brook, the policies and regulations included in the municipal standards should be considered for the Morris Lake Study Area through future planning reviews.

The PCSWMM software was used to create an existing drainage condition model that includes the existing watercourses, runoff contribution from external drainage areas and two existing culvert crossings, as identified from the HRM Open data source with the objective of estimating existing peak flows along the watercourses and establishing target peak flows for the post development conditions. As shown in **Figure 3-3**, there are two existing culvert crossings along the Cow Bay River branches at Caldwell Road. Results from the existing condition stormwater model suggest that both culverts appear to be undersized and will need to be upgraded. However, without finalizing development plans or calibrating the hydrologic/hydraulic model to confirm design water levels and peak flows, upsizing of these culverts was not completed as part of this conceptual design. It is recommended that further hydraulic analyses be completed at the detailed design stage of these culvert upgrades, if the upgrades are considered prudent, to assess flooding impacts downstream and to reduce the risk of exposing future residents in the area to flooding risks. Culvert sizing as a whole should be confirmed during later stages of planning and design.

Please refer to **Appendix 5B** for details on the existing condition hydrologic/hydraulic modeling exercise.

Figure 3-3 illustrates existing drainage conditions along with preliminary floodplain extents for the 20-year and 100-year storm including climate change impacts.

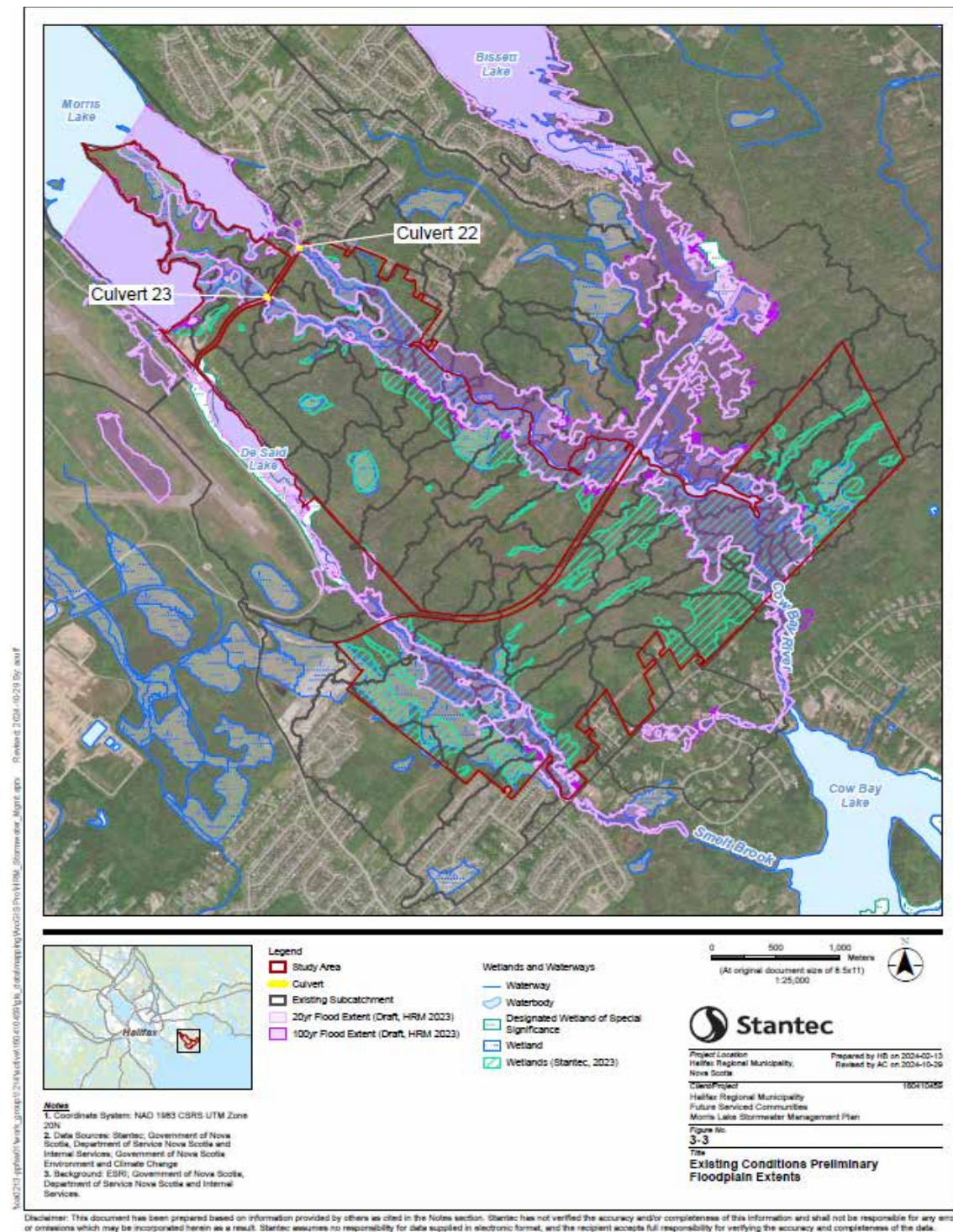


Figure 3-3 Morris Lake Preliminary Floodplain Extents

3.2.3 CONCEPTUAL STORMWATER MANAGEMENT PLAN

To assess stormwater management (SWM) measures and best practices, Stantec developed a conceptual grading plan for the Study Area, based on the road and development concept plans provided by the landowners. This conceptual grading plan will likely change with any subsequent phases of community planning as the concepts evolve. The High-density Scenario, which results in larger impermeable surfaces, was used for planning, with a focus on maintaining existing drainage patterns and incorporating stormwater management measures. It should be noted that the SWM strategies for the High-density Scenario will also be applicable and effective for the Low and Mid-density Scenarios.

Post development sub-catchments were developed based on existing topography, proposed grading, and the High-density Scenario concept plan. A hydrologic/hydraulic modeling exercise was completed in PCSWMM for different return periods based on estimated boundary conditions from the preliminary HRM flood lines to size required storm drainage infrastructure and outline resulting SWM strategies. Please refer to **Appendix 4B** for details on the conceptual SWM plan.

The conceptual SWM plan illustrates conceptual trunk storm sewers at key locations, sized to convey the 5-year storm under free flow conditions. The SWM plan also shows conceptual SWM pond locations and overall drainage areas to the proposed SWM ponds. The final number, location, and size of the SWM dry ponds is to be confirmed based on best engineering principles and detailed floodplain mapping for the area, including flow monitoring and model calibration.

To restrict post-development peak flows to pre-development levels up to the 100-year storm event, thirteen dry ponds are proposed. The location and sizing of dry ponds presented in this study provide an estimate of storage volumes required to mitigate post development peak flows, based on the information available at the time. However, the pond locations are in close proximity to the estimated flood extents and will require revisions to avoid flooding risks and backwater effects in the ponds and associated stormwater infrastructure (see **Figure 3-4**).

Minor portions of the proposed development lie within the floodplain. Minor portions of sub-catchments C131A, C141A, C304A, C410A, C504A, and C601A are within the preliminary flood limits. In order to minimize the risk of flooding and ensure the proposed roads are safe for traffic during emergency conditions, it is recommended that the proposed roads within these areas be relocated outside of flood prone areas, or if it cannot be avoided, raised above the 100-year flood line. Similarly, it is recommended that future development be restricted within the 100-year floodplain in consistency with municipal by-laws and the Nova Scotia Statement of Provincial Interest Regarding Flood Risk Areas.

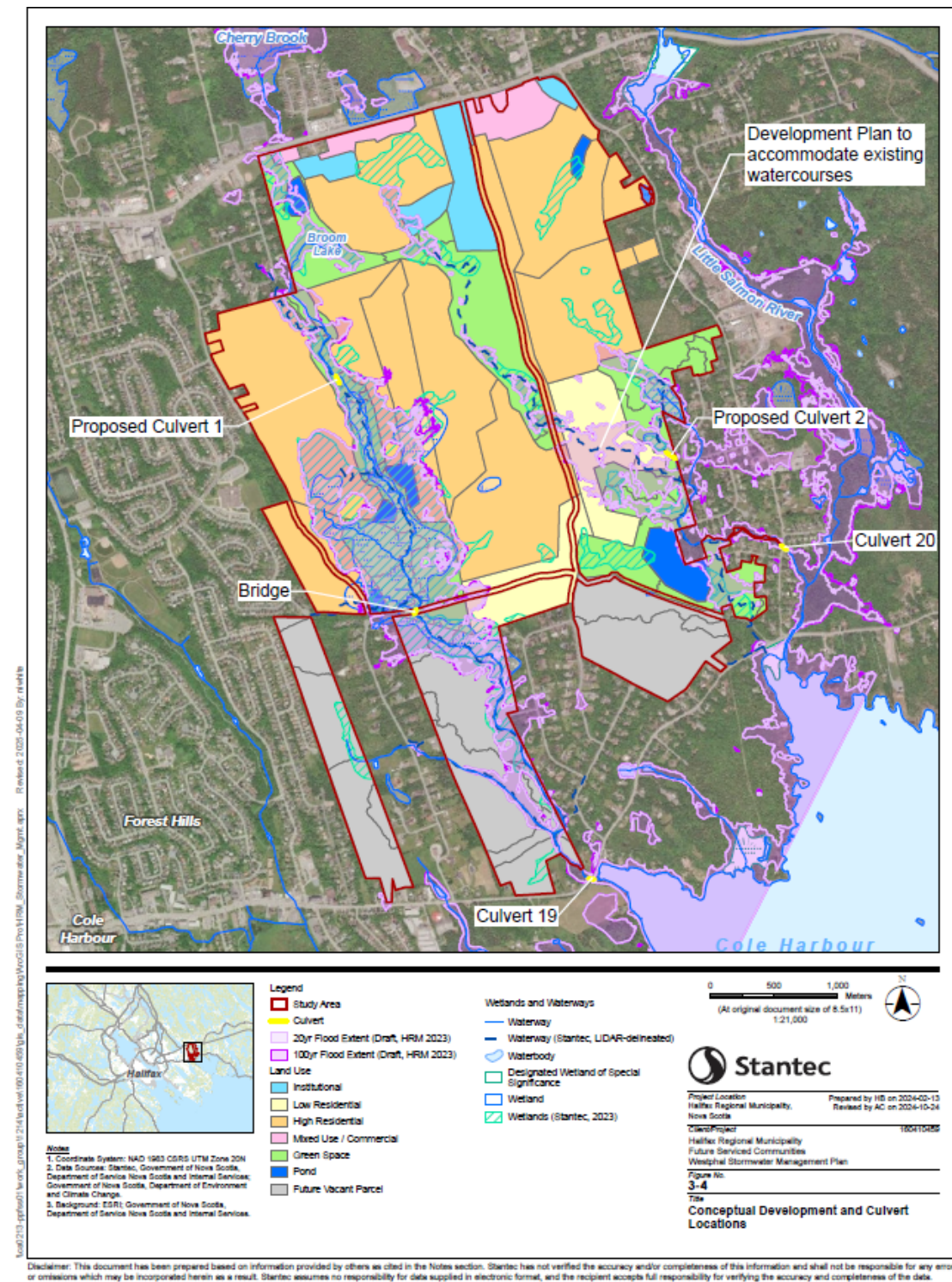


Figure 3-4 Proposed Sub-catchments and Culvert Locations

Given that Halifax Water currently does not have a mandate for water quality and cannot devote a budget for this purpose, quality control of runoff for the Study Area is to be provided by land developers through different techniques as follows:

Best Management Practices (BMPs):

- Lot-Level Measures: Directing residential roof runoff to vegetated surfaces and introducing vegetated swales.
- Low Impact Development (LID) Measures: Infiltration trenches, bioswales, and other measures to filter and infiltrate runoff before it reaches watercourses.

Green Infrastructure:

- Vegetated Filter Strips and Swales: Designed to process and reduce runoff from impervious surfaces.
- Native Species Plantings: To absorb stormwater, decrease runoff, enhance water quality, and support biodiversity.

Erosion and Sedimentation Control:

- Implementing measures to prevent sediment from entering watercourses during construction activities.

The following is a summary of key points concluded from the stormwater analysis:

- The stormwater management plan for the Morris Lake Study Area includes storm sewers sized for the 5-year storm at 80% full flow pipe capacity, overland flow routing to end-of-pipe SWM facilities and thirteen (13) SWM dry ponds designed to restrict post-development peak flows to existing watercourses to pre-development levels for up to and including the 100-year storm. However, the analysis has identified important limitations and vulnerabilities in the layout provided by the developer. Although this layout was used to assess the feasibility of controlling post-development peak flows, it requires further consideration of key elements. The proposed development layout and associated stormwater management require a thorough revision based on further analysis of the land use distribution and the siting of SWM ponds, as well as detailed hydraulic modeling, to confidently mitigate risks of flooding and reduce risks of degradation to the natural assets within the Study Area. High density land uses can potentially reduce the footprint of development and help to maintain development and stormwater management infrastructure away from flooding risk areas.
- No proposed watercourse crossings have been identified.
- Small portions of the current development plans infringe on the preliminary 100-year floodplain extents. It is recommended that proposed development plans be updated such that all proposed development falls outside the 100-year floodplain.

Based on the discussion provided in this report, the following is a summary of stormwater recommendations:

- The conceptual development plan should be revised to accommodate existing wetlands, unless otherwise specified in future environmental assessments.
- Flow monitoring in the watercourses and lakes, followed by model calibration be completed to determine lake water levels, confirm regulatory floodplain limits, determine culvert sizing, and proposed pond sizes and locations.
- No active development should be permitted within the limits of the 100-year regulatory floodplain. Some reduced risk uses may be considered in agreement with HRM by-laws and the Nova Scotia Statement of Provincial Interest Regarding Flood Risk Areas. 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.
- A detailed geotechnical investigation is recommended to be completed at the detailed design stage. Geotechnical recommendations should be provided for the proposed Stormwater Management (SWM) ponds, grade-raise restrictions, and the feasibility of Low Impact Developments (LIDs) in the area.
- A revision of land use distribution to increase high-density uses, reduce development footprint and allow the location of the proposed ponds is advised to inform the design of an effective and sustainable stormwater management plan.
- The development concept plan be revisited to ensure SWM Ponds are located outside of the confirmed 100-year floodplain and/or delineated wetlands, to maximize the use of natural areas considering the recommendations of the Land Suitability Assessment, to consider high-density land uses that reduce sprawl to achieve this purpose, and to inform the revision of the proposed development layout and stormwater management plan to reduce risk of flooding and degradation to natural assets in the Study Area. The current layout includes SWM ponds located in or close to areas under risks of flooding.
- Future development phasing should start in higher areas outside of the identified preliminary floodplain and detailed floodplain mapping be completed to confirm floodplain extents and associated development setbacks.
- In future stages of planning and development of the site, the development plan should be revised to relocate residential development and SWM ponds that are currently close to or within the potential floodplain. By pulling back the development, and potentially adding density to the remaining area, the population/development yield of the site could remain similar, and it could reduce the potential risks associated with flooding. The Land Suitability Report outlines that areas within 30 m of a watercourse have low suitability for development. Minimum setbacks to the watercourses in excess of the 30 m identified in the Land Suitability Report and as specified in the draft Regional Plan must be studied on a site-specific basis during subsequent area planning.

- Retaining native and existing ground cover be prioritized where possible to preserve ecosystem service function, reduce volume of runoff discharged into watercourses/waterbodies, promote infiltration and provide an opportunity for evapotranspiration.
- Implementing structural LID measures within public property to reduce contaminant loads for the development area to achieve contaminant loads of existing conditions.
- Implementing erosion and sedimentation control measures to mitigate effects from development during construction, as well as implementing construction sequencing to minimize the quantity of soil exposed at any given time to prevent erosion.

3.3 Morris Lake Development Servicing Scenario

The Morris Lake Development Servicing Scenario is detailed in **Appendix 5C**. The report addresses the following with respect to the Morris 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.

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The Wastewater Infrastructure Plan (WIP) noted growth in this region has been considered to be largely tributary to the gravity pressure trunk sewer to the Eastern Passage WWTF, and potentially via the Caldwell Road PS. Recommendations were made to install new pump out stations at low points in the gravity pressure sewer, at least one of which occurs immediately adjacent to the Study Area.

Morris-Russell Lake Water Service Master Plan

The *Morris-Russell Lake Water Service Master Plan*, completed in 2000 by Vaughan Engineering, analyzed servicing the development around Morris Lake, considering options to improve serviceability to the Eastern Passage/Woodside Low pressure zone, with the aim to provide a secondary source of supply and improve fire flow in Eastern Passage/Woodside Low zone. The study recommended providing a reservoir at the high point, east of Caldwell Road, where the ground elevation is approx. 40 – 42 m. The report suggested a 72 ft (22 m) diameter reservoir with a top water level of approx. 236 ft (72 m). The 2000 report did not consider the development of the Study Area to be part of the Future Serviced Communities project. The proposed servicing arrangement is presented in **Figure 3-5**.

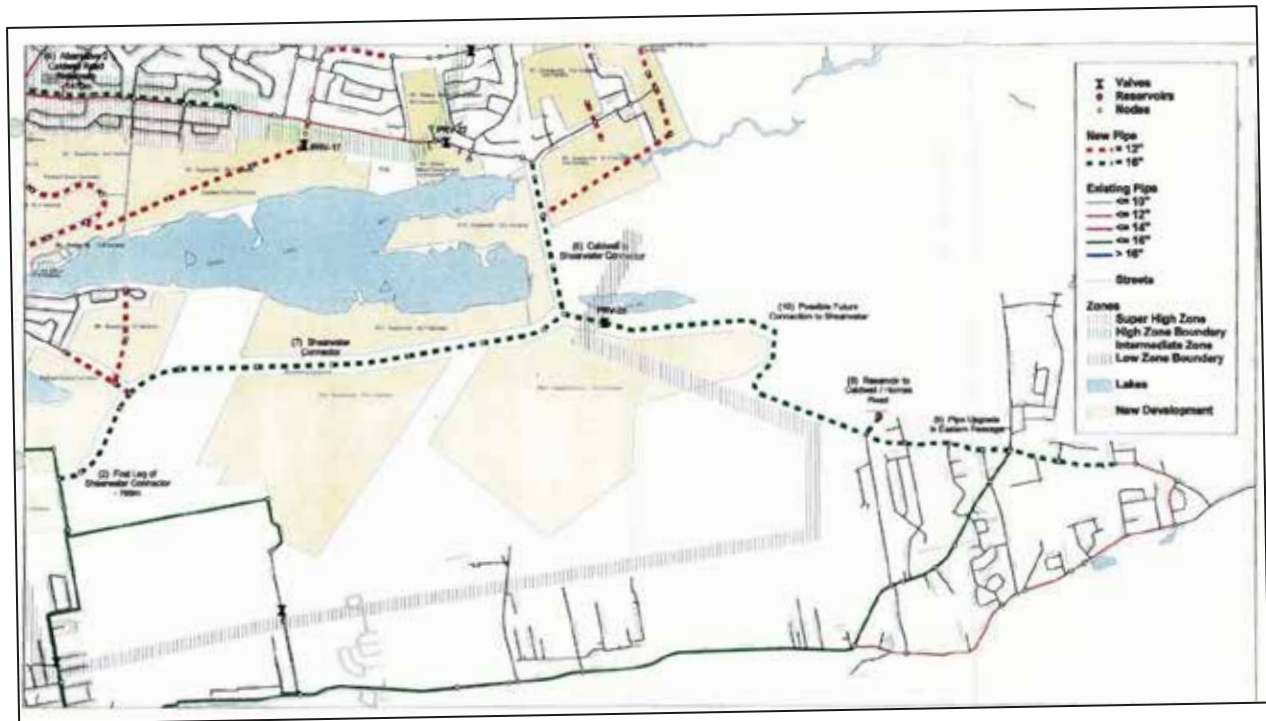


Figure 3-5 Morris-Russell Lake Water Servicing Plan (2000)

3.3.2 Wastewater

The Study Area is expected to have impacts on the conveyance upgrades identified in the 2020 WIP, concerning the pressure-gravity system. This system collects flow from a large area and several pump stations before discharging downstream towards the Eastern Passage Wastewater Treatment Facility (EP WWTF).

This consideration merits the use of the Halifax Water's updated hydraulic model assessed in context of regional servicing needs within the framework of the Infrastructure Master Plan (IMP). This includes alternative evaluations to determine a preferred regional servicing and infrastructure upgrades strategy that best accommodates the broader needs and goals of HRM and HW. This note is also applicable to the Westphal Study Area and the cumulative impact of both these growth areas.

It is further recommended that HW and HRM revisit the technical and financial evaluations of the servicing strategy for the EP WWTF. A cost-benefit analysis would enhance the confidence that the implemented servicing strategies to come are best aligned with HW and HRM priorities, while maintaining (or enhancing) service to existing residents and proactively planning those infrastructure upgrades required to maintain this same level of service to future growth areas. Such an analysis would align well within the context and scope of an IMP update.

3.3.1 Potable Water

The 2019 IMP did not consider the Study Area as a planned growth area. Therefore, the need for regional water system improvements to service the Study Area was not previously identified. However, the IMP did recommend a new 400 mm diameter transmission main and PRV through the Study Area to improve serviceability to the Eastern Passage/Woodside Low pressure zone. The IMP also noted that the Lake Major system supply does not have sufficient capacity to accommodate expected growth to the year 2046. It was estimated that by 2031 75% of the supply capacity will be used and by 2041 demand will reach 90% of the supply capacity, triggering the need for a new supply source. These proposed timelines did not include servicing the Study Area (see **Figure 3-6** taken from the 2019 IMP). The IMP noted that it is not possible to increase the withdrawal permit from Lake Major, and that there is little, or no, opportunity to cost effectively develop a new source near the Lake Major network. However, there is a possibility of alleviating some of the demand on Lake Major by a system connection from the Pockwock network.

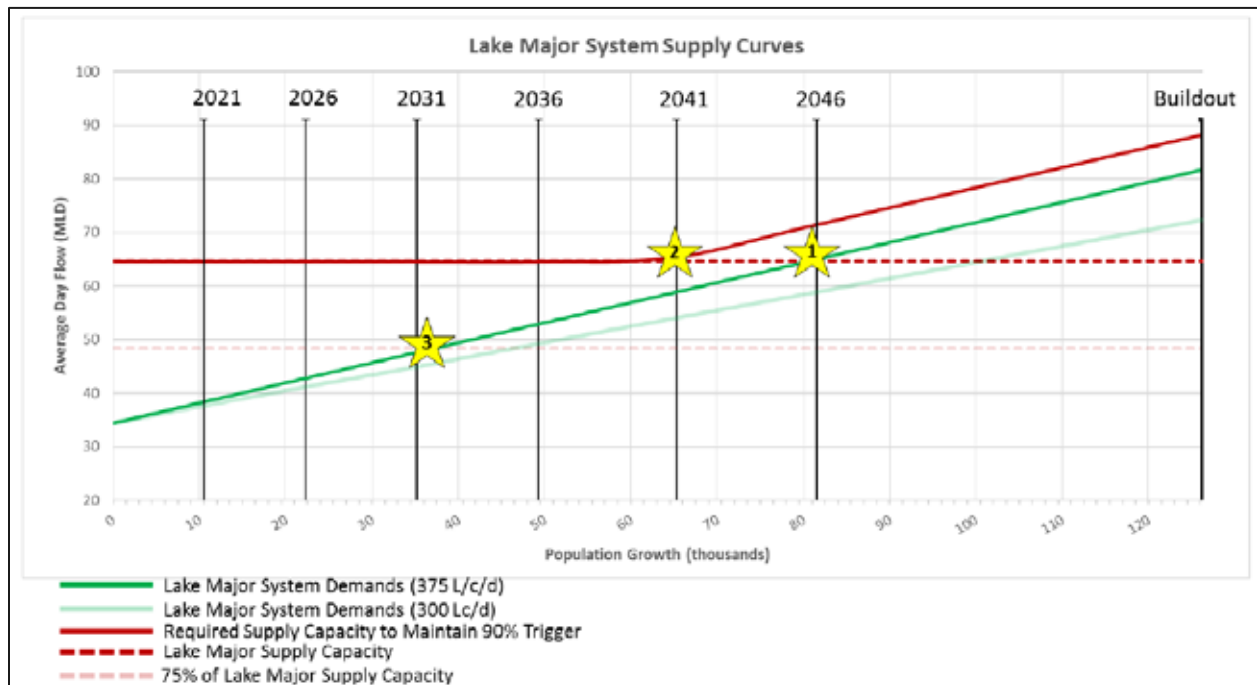


Figure 3-6 Supply Analysis for Lake Major System (taken from 2019 IMP)

3.3.1.1 Potential Regional Water Infrastructure Improvements

Given the relatively small diameter watermain in Caldwell Road (250 and 300 mm), Atholea Drive (250 mm) and Cow Bay Road (250 mm) it is suspected that the full regional water model will identify the need for improvements to existing infrastructure to service the Study Area. This should be confirmed through the development of the new IMP.

The previously identified new transmission main to improve serviceability to Eastern Passage/Woodside Low pressure zone may also benefit the Study Area. In particular, the transmission main may improve the achievable fire flows in the new development. However, given the proposed 400 mm main would be connected to a 300 mm diameter main in Caldwell Road, there may still be large head losses in the 300 mm. The 2019 IMP noted that additional capacity could be achieved by upsizing the watermain in Colby Drive and Deerbrook Drive.

The following infrastructure improvements should be analyzed in the regional hydraulic model to further assess the serviceability of the Study Area in addition to improving Eastern Passage/Woodside Low pressure zone (illustrated in **Figure 3-7**).

- New 400 mm watermain through Caldwell Road from existing 350 mm diameter near Deerbrook Drive to Atholea Drive.
- New 400 mm watermain in Colby Drive and Deerbrook Drive from the existing 400 mm diameter in Colby Drive near Delta Drive to Caldwell Road.
- New 400 mm watermain through the Study Area from Caldwell Road to Cow Bay Road.
- New 400 mm watermain in Cow Bay Road from the Study Area to the existing 400 mm diameter in Cow Bay Road near Heritage Hills Drive.
- New PRV on the new 400 mm watermain through the Study Area near the intersection of Caldwell Road and Atholea Drive.

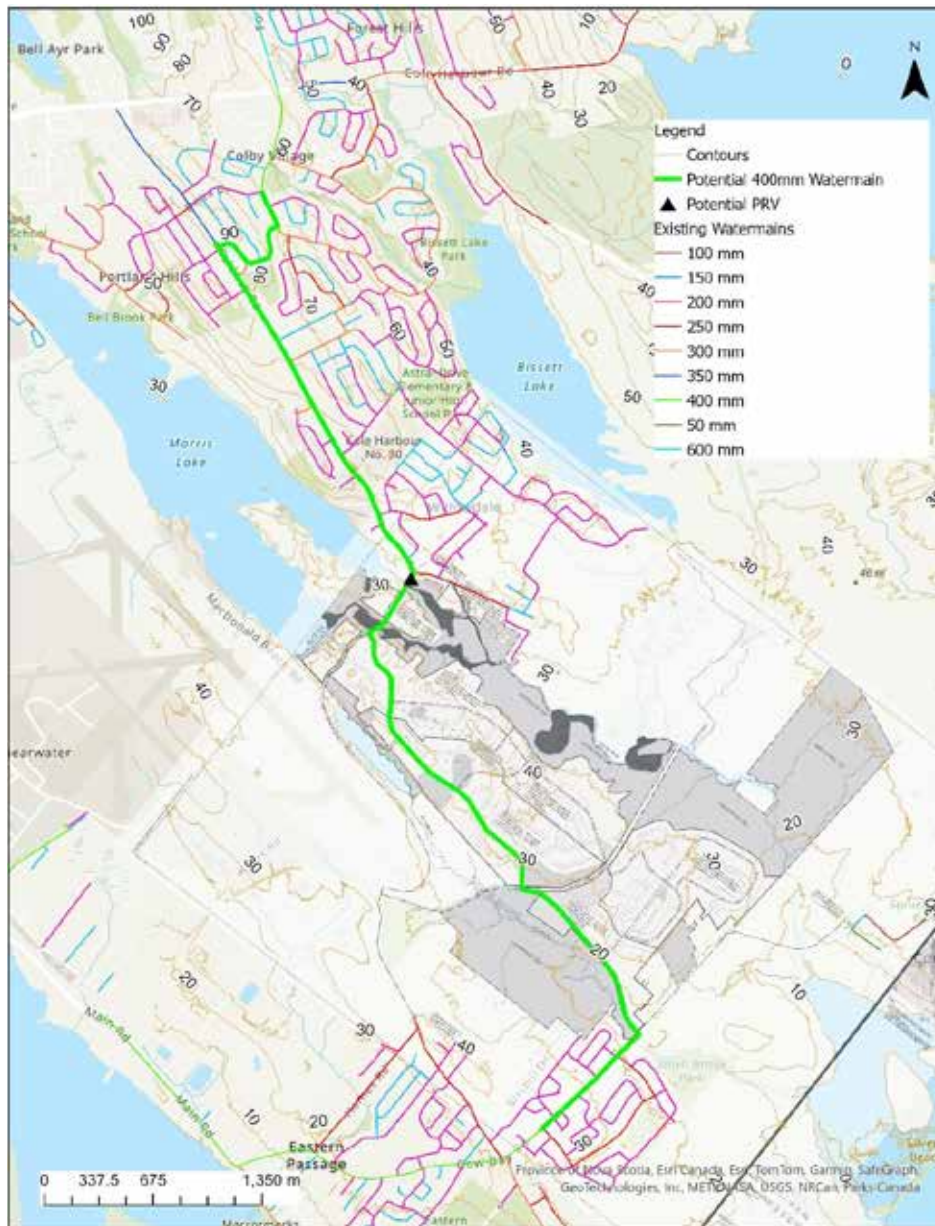


Figure 3-7 Potential Regional Improvements

Connectivity to Municipal Infrastructure

The Study Area is located adjacent to the Eastern Passage/Woodside Low, Atholea Low, and 24 East High-pressure zones. These pressure zones are included in the Lake Major system and are serviced by the Lake Major Water Treatment Facility.

The hydraulic grade lines (HGL) of the adjacent pressure zones are summarized in the following table and illustrated in **Table 3-1** and **Figure 3-8**:

Table 3-1 Adjacent Pressure Zones Hydraulic Grade Lines

Pressure Zone	HGL (m)	HGL (ft)
Eastern Passage / Woodside Low	78-81	255-265
Atholea Low	81-82	265-270
24 East High	116-119	380-390

Comparing the serviceable elevation ranges of the adjacent pressure zones to the development elevation ranges indicate that the re-delineation of the Atholea Low and Eastern Passage/Woodside Low zones can accommodate the development from a pressure perspective. The proposed pressure zone redelineations are illustrated in **Figure 3-9**.

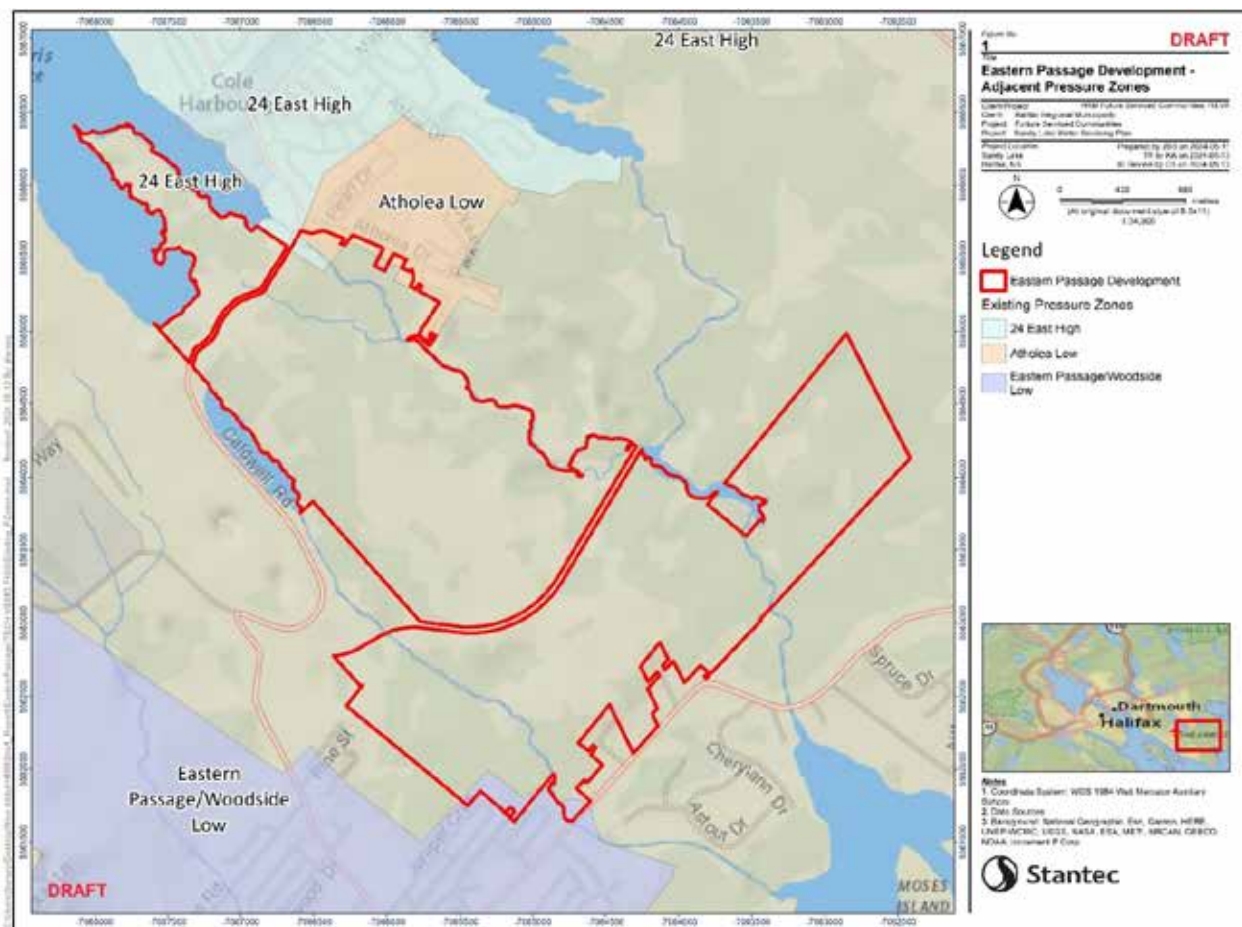


Figure 3-8 Existing Pressure Zones

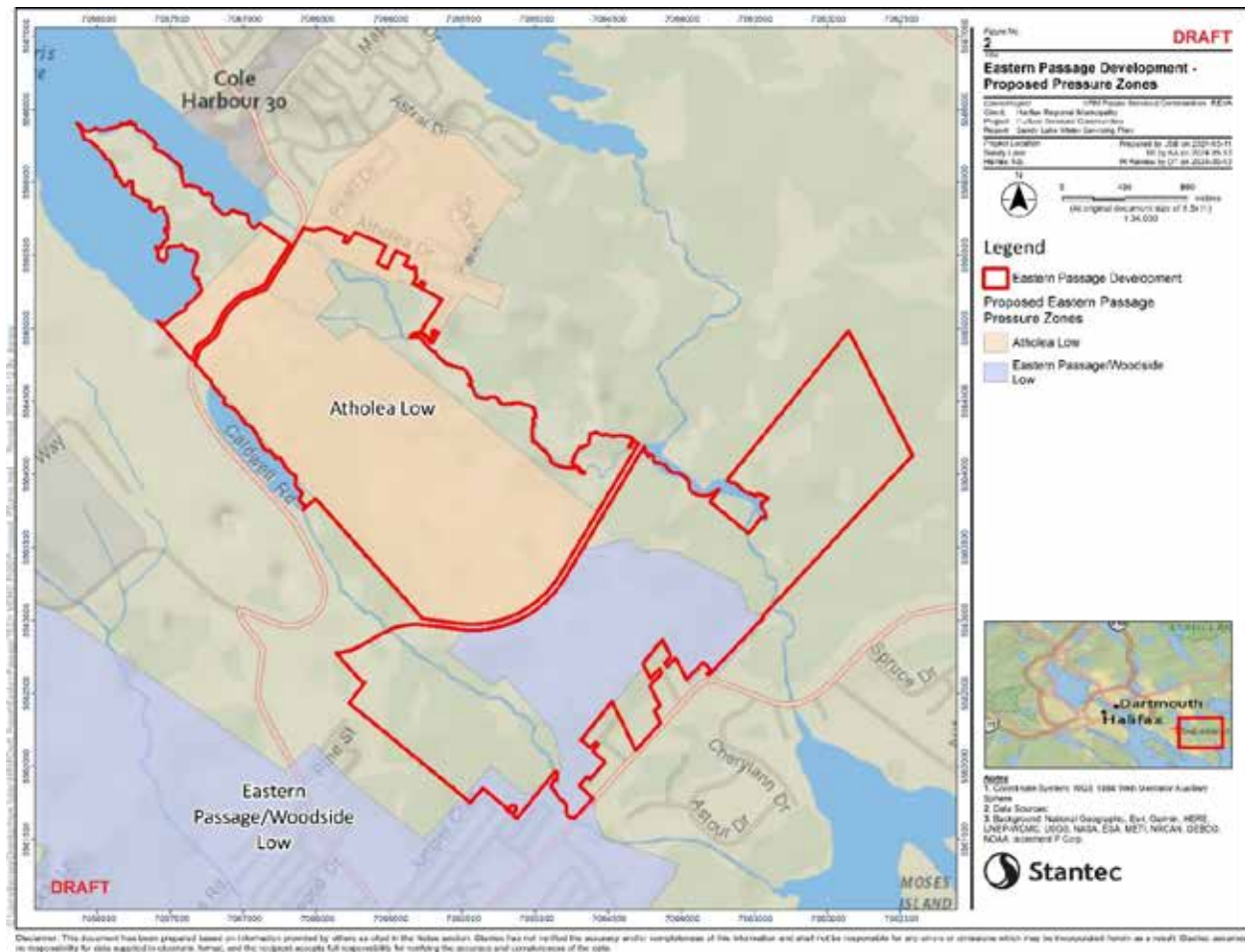


Figure 3-9 Proposed Pressure Zone Re-Delineation

3.3.1 Water Model

A steady state water network model of the Study Area 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 Atholea Low and Eastern Passage/Woodside Low pressure zones. It is noted that modelling the existing system in this manner does not reflect the actual system, as it assumes the connecting points are always at a constant HGL regardless of demand scenario and that there is an unlimited supply of water from the zone. However, in the absence of a full system model it is a reasonable assumption.

Currently, the 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 and/or pressure reducing valves (PRV) 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 resultant pressures in consideration of the PHD for the high-density scenario are presented in **Figure 3-10** and available fire flows under MDD and the high-density scenario are shown in **Figure 3-11**. Pressures under the PHD scenario range from approximately 36 psi to 81 psi (36 psi being slightly below the range specified in the DS and SSS). The available fire flow range is approximately 1,500 Lpm to 7,900 Lpm and does not meet the MDD + FF demands.

In the absence of a full regional water model, the water model development assumed 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.

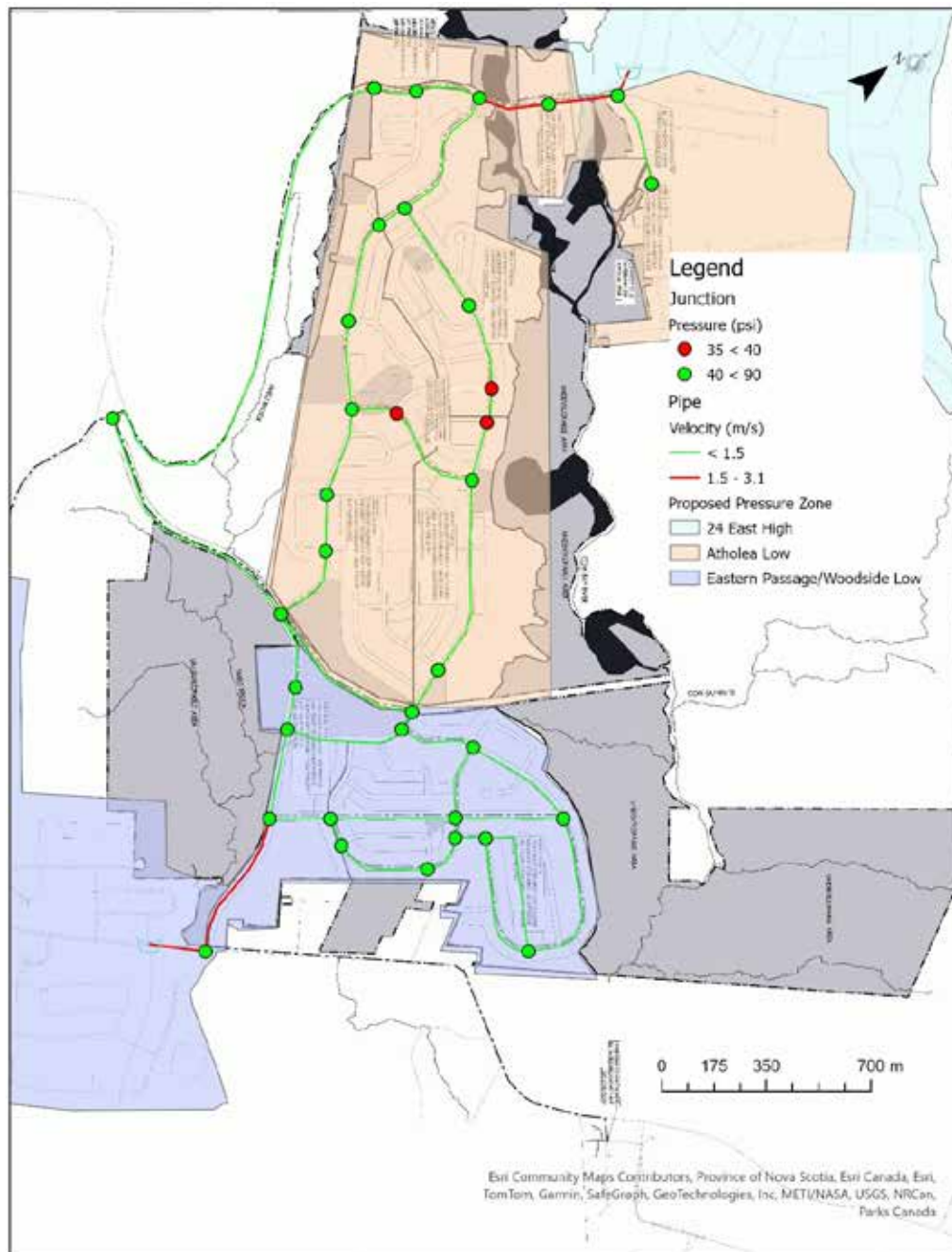


Figure 3-10 Pressure Distribution Under PHD (High-Density Scenario)

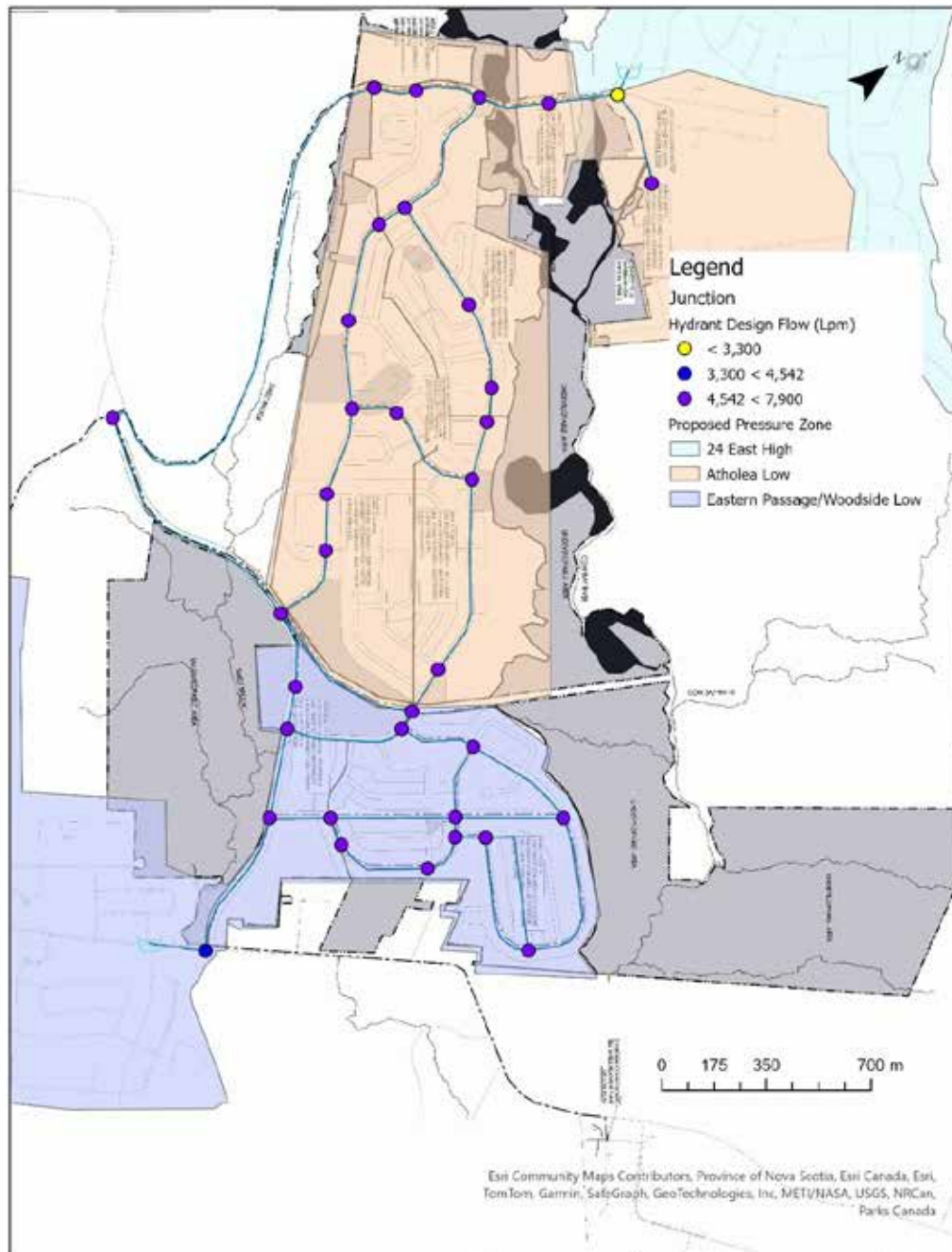


Figure 3-11 Available Hydrant Flow (High-Density Scenario)

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	49 – 83	1.9	N/A
PHD High Density	36 - 81	3.1	N/A
MHD High Density	55 - 84	< 1.5	N/A
MDD + FF High Density	> 22	< 2.4	1,500 - 7,900*
MDD Low Density	55 - 84	< 1.5	N/A
PHD Low Density	52 – 84	< 1.5	N/A
MHD Low Density	57 - 85	< 1.5	N/A
MDD + FF Low Density	> 22	< 2.4	4,400 - 9,200*

* 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.

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

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

3.3.1 Wastewater Infrastructure

Although not directly indicated in the East Region Wastewater Infrastructure Plan (GM BluePlan, 2019), it is assumed that the Study Area will ultimately contribute sanitary flows to the gravity pressure main downstream of the Bissett Lake PS. Existing sanitary sewers within existing residential areas to the southwest along Cow Bay Road are sized to meet only local sanitary contributing flows, and are not intended for downstream conveyance of flows from the Study Area. It is assumed that local pump stations will be required at point of discharge to the gravity pressure main and ultimately the downstream EP WWTF.

In review of preliminary grading for the development area, it was identified that sufficient grade exists to permit construction of network of gravity sewers for the majority of the development contributing area (northern two-thirds to three-quarters of the development) to a low point adjacent to Smelt Brook where the gravity pressure main makes a northward bend. A new pump station has been demonstrated in this area, as well as at the northerly limit of the development to service lands effectively separated by the alignment of the existing gravity pressure main. Additional small lift stations are anticipated to be required to service trapped low areas south of the Shearwater Trail (Areas R106A, R207A, R110A, and R210A on Drawing SA-1 in the Servicing Report). These minor lift stations are anticipated to contribute to the gravity pressure main and conceptual pump station at the Shearwater Trail extension.

Due to grading constraints in areas adjacent to existing watercourses (particularly on the western boundaries of the Study Area), sanitary sewer depths may exceed the maximum permissible sewer cover of 5.0m. A local sanitary sewer may be proposed at detailed design to run parallel to the deeper sewer segments to service adjacent residential areas.

Implications & Master Plan Alignment

The Wastewater Infrastructure Plan (GM Blue Plan, 2020) identified infrastructure needs to maintain the level-of-service goals for Halifax's existing residents and interests, as well as to maintain this as identified growth occurs. The implications of the FSC growth areas on the Wastewater Infrastructure Plan (WIP) recommendations are thus of interest as these growth areas are in addition to those considered in the 2020 WIP. The Study Areas represent a significant increase in the service area considered within the planned growth horizon at the time of the completion of the 2020 WIP. As a result, the additional growth areas to be accommodated would be expected to have an impact on regional infrastructure capacity requirements and their planned upgrades - most notably, the gravity trunk sewer and the EP WWTP.

The 2020 WIP identified several upgrades (Strategy 1c: Enhanced Conveyance) in the collection system upstream of the EP WWTF. These are summarized in **Table 3-2** and shown on **Figure 3-12** as taken from the 2020 WIP report.

Table 3-2 Eastern Passage Required Projects (taken from 2020 WIP Tables 24 and 25)

Project	Year	Description
Install new pressure-gravity sewer with pump out stations	2020	Required immediately as main capacity restriction in sewershed and triggered by growth.
RDII Reduction Program	2020-2036	Long-term program expected. RDII reduction was started in the Eastern Passage and Loon Lake areas, as it impacts upgrades to Pumping Stations. RDII

Project	Year	Description
		reduction in the Cole Harbour area is delayed due to staggering the program and no growth in the area. However, RDII reduction in Cole Harbour area is scheduled to occur before upgrades to Bisset Lake PS are initiated.
Upgrades to Quigley's Corner Pumping Station and Pumping Station Optimization	2021-2026	Required after RDII Reduction program is completed in EP area, as it will reduce flows to Quigley's Corner PS and upgrades required to remove spills.
Upgrades to Memorial Drive Pumping Station	2031-2036	Required after RDII Reduction program is completed in Loon Lake area, as it will reduce flows to Memorial Drive PS and upgrades required to remove spills.
Linear upgrades (Forest Hills Parkway, Colby Drive and Caldwell Road)	2031-2046	Local linear upgrades are predominantly to resolve existing issues flagged in the wastewater hydraulic model; however, field verification should be completed to determine how soon these projects will be required.
Upgrades to Beaver Crescent Pumping Stations	2036-2041	Upgrades to Beaver Crescent Pumping Station forcemain were underway in 2020. Initiate after upgrades on Beaver Crescent PS forcemain are complete and new pressure-gravity sewers are

Project	Year	Description
		installed with forcemains reconnected.
Upgrades to Caldwell Road Pumping Station	2039	Required after upgrades along Caldwell Road to remove flow restrictions upstream of the Pumping Station and triggered by growth in the Morris Lake development.
Upgrades to Bissett Lake Pumping Station	2041	Upgrades to Bissett Lake pumping are impacted by numerous projects, including the installation of the pressure-gravity sewers downstream to remove flow restrictions and RDII reduction in catchments upstream of the Pumping Station.
Decommission asbestos pressure-gravity sewer	2043	Decommissioned after new pressure-gravity sewer is installed and operational.



Figure 3-12 Eastern Passage East Region Preferred Servicing Strategy

Source: (GM BluePlan, 2020)

Conveyance Impacts

The most significant impact from the Morris Lake lands on the conveyance upgrades identified in the 2020 WIP would be on the pressure-gravity system. This system collects flow from a large area and a number of pump stations before discharging downstream towards the EP WWTF. It will be important to confirm that added flow from the Study Area can be accommodated within the existing and planned configurations for the pressure-gravity system. We estimate that the design wet weather flow from the Study Area reach upwards of 560L/s. Combined with the design wet weather flow from the Westphal Study Area (655L/s), an additional 1,108-1,215L/s can be expected.

This consideration merits the use of Halifax Water's updated hydraulic model assessed in context of Regional servicing needs within the framework of the IMP. This includes alternatives evaluations to determine a preferred regional servicing and infrastructure upgrades strategy that best accommodates the broader needs and goals of the HRM and HW. This note is also applicable to the Westphal Study Area and the cumulative impact of both these growth areas should be considered.

Pump Station and WWTF Impacts

The Study Area will need to be serviced by 4 pumping stations within the study's service area, but they are not expected to impact the conveyance to any of the existing pump stations within HRM (**Figure 3-13**). The internal Morris Lake land pump stations will lift the sewage into the pressure-gravity system and convey directly to the EP WWTF. As such, the planned upgrade of the gravity-pressure sewer and infrastructure at the EP WWTF should be revisited to ensure it can accommodate the additional flow from the Study Area. We estimate that the design peak daily dry weather flow from Morris Lake reach upwards of 500L/s. Combined with the design peak daily dry weather flow from the Westphal Study Area (580L/s), an additional 970-1,080L/s can be expected.

Additional Wastewater Servicing Strategies of Note

The conveyance and pump station / WWTF impacts presented explore how the Study Area could integrate into the wastewater servicing strategy that was recommended in the 2020 WIP. Other servicing strategies exist however that merit consideration. The 2020 WIP explored several high-level approaches.

The assessed strategies included replacing the pressure-gravity servicing strategy with a range of large trunk sewer tunnelling alignments. These tunnelling alternatives provide the benefit of allowing several existing pumping stations to be ultimately decommissioned in the sewershed upstream of the EP WWTF. Other items of note with the tunnelling strategies include the mitigation of existing identified odour issues that accompany the pressure-gravity system, as well as potential mitigation of required storage volume expansions and prescribed pumping station capacity upgrades. A transition from pressure-gravity to a deeper tunnel could also be implemented in a phased approach, where the trigger to proceed would consider the ability to expand/upgrade existing infrastructure.

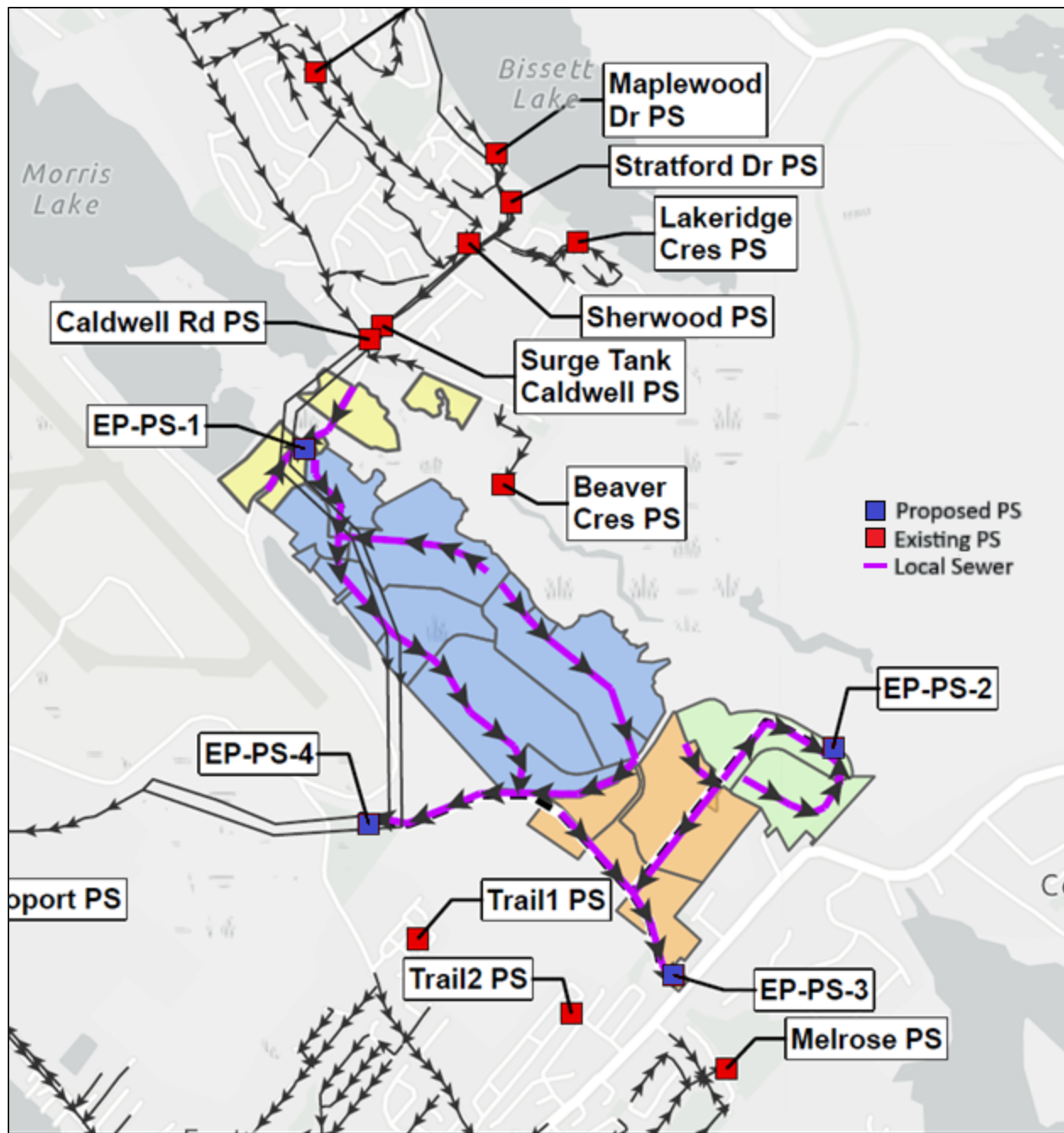


Figure 3-13 Morris Lake Wastewater Servicing

Specific to the Study Area, it is possible that a tunnel alternative could be introduced at a deeper alignment that would remove (or significantly reduce) the requirements for pump stations to service the growth area. There are a range of tunnel alignments that were considered feasible in the 2020 WIP, and

these included options that saw the tunnel cross through the Shearwater DND property. The evaluation of preferred tunnelling alignment warrants renewed consideration considering the extent of the upstream growth considered in this study. The cost effectiveness and benefits of such a solution could potentially be enhanced when considering a potential need to accommodate servicing within both the Morris Lake and Westphal Study Areas.

We recommend that HW and HRM revisit the technical and financial evaluations of the servicing strategy for the EP WWTF. A cost-benefit analysis would enhance the confidence that the implemented servicing strategies to come are best aligned with HW and HRM priorities, while maintaining (or enhancing) service to existing residents and proactively planning those infrastructure upgrades required to maintain this same level of service to future growth areas. Such an analysis would align well within the context and scope of an IMP update.

3.4 Morris Lake Transportation Study

The scope of work for each Study Area includes compiling detailed background information needed to inform future decisions about potential development, encompassing transportation infrastructure assets and constraints using multi-modal analysis. Analysis results in recommendations for each Study Area based on induced needs related to the introduction of new residents and commercial activity within the Study Area as well as the feasibility of transportation network and service enhancements that are required to connect the Study Area to surrounding and regional destinations.

3.4.1 Investigation and Consideration of Development Impacts

Connectivity and Access

Stantec developed a GIS-based analytical tool for examination of levels of public and active transportation connectivity to inform investment in transportation infrastructure and services. The tool assesses the quality of pedestrian and transit access to key services and amenities from a neighborhood in various scenarios. The tool identified connectivity deficiencies for the future residents of the proposed Morris Lake development area for 14 key service and amenity categories.

The assessment considers proximity and future resident connectivity to health care (Hospital, Doctor, Pharmacy), transportation (Public Transport, Train Station), education (Primary Education, Higher Education), daily needs (Supermarket, Local Shops), leisure (Entertainment, Park Land, Natural Space, Sports), and places of worship with and without action taken to diversify land use within the development site.

Outputs indicate that if certain destination types are not located within the new development or served by frequent and rapid transit, the entirety of the newly settled population would not be able to access health care, local services, pharmacy, groceries, or higher education opportunities via walking/public transit within 30 minutes. If shopping and entertainment along with basic health care options are included in the commercial portions of the proposed development, connectivity improves in important categories.

Connectivity analysis outputs further indicate that the greatest access benefits realized by the integration of commercial and service destinations within the development site are related to basic daily and medical needs. Average active transportation travel time for new residents to a school, doctor's office, a pharmacy, local retail, and entertainment options drop significantly from over an hour to approximately 20-25 minutes. Land use and siting decisions not only bring daily destinations closer to affected populations but also reinforce the value of local active transportation networks for short trips.

Detailed Transportation Modelling

The JRTA and HRM have completed a new activity-based travel demand model named the Joint Regional Transportation Simulator. The model provides the ability to interpret development impacts on the regional transportation network through the model's innovative Agent Based Model (ABM) process of simulating where, how, and when people travel. These processes are modeled using an ABM framework, which captures the behavior of individual travelers or households, allowing for a more precise representation of travel demand and network effects at the regional level.

The ABM is a flexible and policy-sensitive tool. A regional-scale travel demand model examines the interactions of population, employment, land use, and mobility options, and allows the testing of different possible futures, estimating the future need for travel, and assesses the impact and benefit of different modes of transportation that will be required to serve the region in the future.

To assess the infrastructure requirements for the Morris Lake Study Area, an interim 2031 model has been developed as a baseline. The interim model provides a more focused assessment baseline, as the 2045 model incorporates a broader range of infrastructure schemes intended to support wider development, potentially overestimating infrastructure capacity at the time of new development buildout, and underestimating impacts. This model includes a reduced level of committed infrastructure compared to the 2045 baseline model. Notwithstanding the reduced levels of traffic demand growth, the 2031 forecast year is still deemed as being highly sensitive in trip reassignment when adding Future Serviced Communities development site contributions.

An analysis of forecasted transportation network constraints in a 2031 baseline scenario identifies key areas of congestion prior to development of Future Serviced Communities sites. Peak period congestion is visible on corridors proximate to the Morris Lake development site, including Caldwell Road as it approaches Portland Street / Cole Harbour Road. To the west, capacity analysis shows volume nearing capacity along Main Road due to the forecast background increase in overall regional population. Modelling additionally shows heavy congestion in a non-development baseline scenario along Portland Street / Highway 207 from the area near the Portland Hills Terminal west to Highway 111.

In summary, the following roadway corridors experience appreciable levels of congestion within the 2031 baseline:

- Caldwell Road – Between Deerbrooke Drive / Cherrywood Drive and Portland Street / Cole Harbour Road
- Portland Street / Highway 207 – Between Portland Hills Drive and the Highway 111 Interchange

- Main Road – Between Norah Lane and Hines Road

Transit demand versus capacity analysis of the baseline scenario highlights several routes that would operate at or near capacity, particularly along Portland Street west of the Study Area and Pleasant Street near the oil terminals in Eastern Passage. Analysis further indicates that most corridors near the Morris Lake Study Area would operate far from maximum capacity as the currently available transit service is expected to be able to absorb baseline demand increases.

External and internal trip mode share analysis describes the projected variance of modal choice by trip purpose. Walking trips comprise over 16% of trips anticipated to remain within the Morris Lake Study Area compared with under 5% of external trips. Combined walk, bicycle, and transit mode share across all trips fall short of the Integrated Mobility Plan goals for this location.

The Morris Lake development is expected to add to dominant traffic patterns on the surrounding highway network. As this and other development projects introduce new residential, commercial, and educational facilities, the resulting increase in travel demand will have direct implications for highway capacity, congestion, and overall traffic flow. Distribution of external trips by new residents and visitors to the Morris Lake development area highlights the diffusion of auto trips on the highway network during peak periods and reflects heavy demand along the Caldwell Road and Portland Street / Highway 207 corridors to access Highway 111, Highway 107, and points north. Also noteworthy is sizable trip distribution from southern development access along Cow Bay Road, Marine Drive, and Main Road into central Dartmouth and Downtown Halifax.

Large increases in peak hourly volume are seen along Caldwell Road, other parallel routes to reach Cole Harbour Road, the Cole Harbour Road / Portland Street corridor itself, and Cow Bay Road. Lesser increases are observed on Main Road along the harbour following alternating directions in the AM and PM peak periods.

Joint impacts resulting from the introduction of both the Morris Lake and Westphal developments forecast heavy added demand on the Cole Harbour Road corridor from multiple approaches including non-traditional access routes along local streets. Cole Harbour Road near the southern access to the Westphal development site may experience additional peak period demands while segments of Caldwell Road may be required to accommodate large added volumes during peak periods.

Model results predict intensification of initial issues identified in the baseline scenario. Congestion will worsen along Portland Street, northern segments of Caldwell Road, and portions of Main Road nearer the Harbour. Volumes above capacity accompany the introduction of development along previously uncongested segments of Caldwell Road near the northern access point of the Morris Lake development as well as portions of Cumberland and Colby Drives. Additionally, combined effects related to the simultaneous introduction of other developments create volume above capacity conditions on Cole Harbour Road near the southern access to the Westphal site.

The 2014 RMPS and draft updates include a municipal project connecting Caldwell Road at the northwest corner of the Morris Lake development area and Mount Hope Avenue near its interchange with Highway

111. The proposed Shearwater Connector is intended to accommodate future land development in the Morris-Russell Lake master plan area and relieve traffic congestion on Portland Street.

Predicted traffic analysis shows bi-directional demand for vehicular travel along Portland Street / Highway 207 greatly exceeding capacity during the peak hour, suggesting mitigation is necessary. The analysis includes trip distribution from the new Morris Lake development attempting to use Caldwell Road and Portland Street as well as other routes north of Portland Street to access and return from Highway 111. A synthesis of these factors suggests sizable local benefits along Caldwell Road, Portland Street, and Main Road for the Shearwater Connector in alleviating traffic pressure immediately adjacent and attributable to the new Morris Lake development, which will exacerbate expected capacity constraints that already exist further west along Portland Street prior to the introduction of new residents, commercial opportunities, and travel demands.

Modelled transit ridership and capacity impacts associated with the introduction of the Morris Lake development indicate increases in demand originating from the development site during peak periods. Modelled transit distribution from the new development indicates that most new ridership is destined to and returns from the direction of the Woodside Ferry Terminal and destinations further north and west. The transit demand model attributes most activity to the Cow Bay Road / Main Road corridor connecting directly to the Woodside Ferry Terminal via local Route 6C.

3.4.2 Conclusions

Travel modelling indicates that segments of Caldwell Road, Portland Street, and Main Road will approach capacity by 2031, characterized by noticeable congestion before the Morris Lake development is introduced. Mitigation measures should ideally be implemented before or in parallel with the development of the Study Area to mitigate further negative effects of congestion. On buildout of the Morris Lake development, sections of the Caldwell Road are expected to experience intensification of congestion to a degree that causes notable vehicle volumes to spill into adjacent neighborhoods to the east in an effort to access Cole Harbour Road and Portland Street.

The analysis of modelled travel demand makes clear that the proposed Shearwater Connector possesses benefit and ability to divert traffic from the Caldwell Road and Portland Street corridors, which are expected to be heavily congested. Predicted traffic analysis shows possibilities to alleviate traffic pressure immediately adjacent and attributable to the new Morris Lake development that exacerbates baseline expected capacity constraints. Significant complications exist however, beyond typical environmental, community, and fiscal considerations. HRM's Integrated Mobility Plan notes challenges associated with the connection's proximity to the CFB Shearwater airfield that result in persistent uncertainty regarding the ability to construct the Shearwater Connector.

Although the Shearwater Connection would be helpful from a network connectivity perspective, the development could go ahead. It will exacerbate congestion on the various existing corridors, which can be compensated by modal shift to transit, improved active transportation, and thoughtful community planning to ensure that new residents are served by making local trips within the community for daily services.

The proposed BRT Red Line has a role to play in contributing to the handling of increased travel demand in the Portland Street / Cole Harbour Road corridor. While transit services closest to the Morris Lake development are projected to absorb most incremental transit demand with the exception of routes currently only served by commuter service, transit service increases and potential extension of the BRT system eastward are necessary to alleviate overall travel demand pressure from new development sites.

3.4.3 Recommendations

The needs summarized in the conclusions correspond to specific transportation infrastructure and service implementation recommendations. Transportation corridors that carry general traffic and transit vehicles, parallel active transportation opportunities, and intersections expected to experience significant increases in use form a sub-network of routes and nodes that require enhancements. As the proximity of the Morris Lake and Westphal developments compounds analysis factors related to recommendations, the Westphal Transportation Plan restates recommendations related to traffic impact mitigation and transit service increases for the Portland Street / Cole Harbour Road corridor but does not imply duplication of actions and associated costs. The Morris Lake Transportation Plan otherwise limits facility and service recommendations to locations south of Cole Harbour Road / Portland Street.

Roadways

While the Integrated Mobility Plan revisited the Shearwater Connector and noted challenges associated with its location and feasibility uncertainty, modelling demonstrates a need to reduce heavy congestion in a non-development baseline scenario along Portland Street from the area near the Portland Hills Terminal west to Highway 111. Relief in that corridor was presented as a direct intention of the implementation of the Shearwater Connector over twenty years ago.

With or without the Morris Lake development, predicted volume approaches capacity on Caldwell Road leading to the intersection with Portland Street / Cole Harbour Road. Greatly increased traffic demand in the multiple development scenario implies a need for greater person movement capacity. Right-of-way constraints and/or compatibility with completed and future phases of the Caldwell Road Active Transportation & Street Improvement Project may preclude any changes to roadway dimensions, even for the purpose of establishing transit priority, further highlighting the utility of a potential Shearwater Connector as demand along Caldwell Road ultimately headed west is forced to funnel into Portland Street.

Main Road from Cow Bay Road to Hines Road represents a situation better suited to future monitoring related to travel capacity stress. Modelling of the development scenario shows vehicular volume of the dominant movement just below capacity during peak periods. The proposed improvements are showing in **Figure 3-14**.

Transit

As proposed, the BRT Red Line will terminate at Portland Hills Terminal, south and west of the Westphal development area, along a corridor that experiences heavy traffic congestion in background projections. Extending the BRT Red Line east to Caldwell Road would align the Red Line terminus with a node

expected to experience heavy travel demand contributions from both the Westphal and Morris Lake Future Serviced Communities. The proposed route's 10-minute frequency and use of larger articulated buses will provide a significant share, but not all, of the person moving capacity needed to absorb vehicular demand above capacity in the Portland Street corridor.

An increase in regular bus frequency and implementation of transit priority measures Caldwell Road and Cole Harbour Road represents an alternative solution to accommodate the anticipated increase in general travel demand. Combining traffic and transit demand as well as traffic and transit capacity at the corridor level allows for a more holistic determination of transportation needs.

Analysis designed to absorb overall directional travel demand finds needs for increased transit service along the Caldwell Road corridor between the Morris Lake development and Portland Street / Cole Harbour Road as well as the Cole Harbour Road corridor between the Westphal development and Portland Hills Terminal or any future terminus of the Red Line BRT.

Absorbing the 2031 combined development scenario travel demand volume over capacity in the Caldwell Road corridor would require 7 to 8 additional buses during the AM peak hour, 8 to 10 additional buses during the PM peak hour, and 4 to 5 additional buses per hour during non-peak periods. Employing articulated buses can reduce the number of additional buses needed to handle travel demand during the PM Peak to 5, assuming 80 passengers per vehicle. This still represents more than doubling bus traffic along a corridor where geometry constrains the ability to add transit priority measures, pointing again to the need for implementation of the proposed Shearwater Connector to contribute to dispersal of travel demand across the transportation network.

Comparatively, transit access to the Westphal development via the Cole Harbour Road corridor requires 3 additional buses during the AM peak hour, 6 to 7 additional buses during the PM peak hour, and 2 to 3 additional buses per hour during non-peak periods.

Active Transportation

Consistent with the Active Transportation Priorities Plan (ATPP), the study team identified a need for active transportation enhancements in the Cow Bay Road corridor. In addition, the plan calls for bicycle lanes or a paved shoulder along Caldwell Road south of the development site and Hornes Road. Technical and practical considerations related to curb/sidewalk presence and other right-of-way reassignment factors may dictate facility type selection.

To better serve people walking, sidewalks along Cow Bay Road should be extended to primary southern access to the new development. As concept plans split the primary southern access between Orion Drive and a new roadway directly intersecting Cow Bay Road, pedestrian facilities should be added along those roadways. As roadway traffic volumes are better understood, primary access roadways should also feature dedicated cycling facilities to link new development gateways to new dedicated cycling facilities along Cow Bay and Caldwell Roads.

The integration of newly realized and proposed active transportation facilities leading to and bordering the development site with those to be programmed within the Morris Lake study area creates a localized network with strong regional connections. The degree of interconnectivity and the ability to provide

seamless and safe travel, especially for cyclists, is essential to attract higher usage rates. People who walk and cycle seek accessibility and the usefulness of connections in their decision to use active modes of transportation for reasons other than recreation.

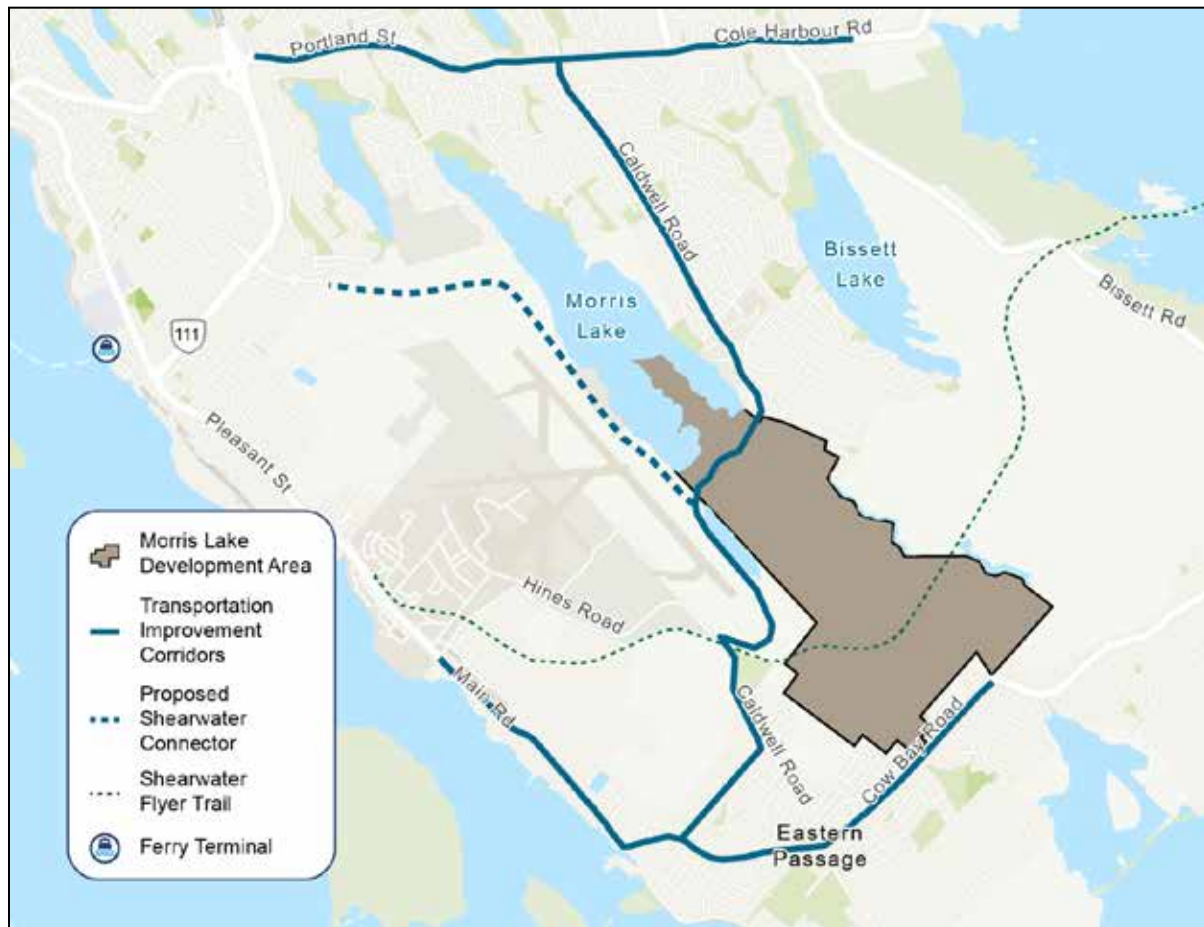


Figure 3-14 Transportation Improvements Spatial Representation

3.5 Infrastructure Costing

The order of magnitude costs of providing the conceptual servicing are shown in the following **Table 3-3**. The cost estimates are Class E Estimates. A Class E cost estimate is typically used in the early stages of a project to provide a rough order of magnitude (ROM) estimate. This type of estimate is based on limited information and is often used for initial screening and feasibility studies. It helps in making preliminary decisions about whether to proceed with a project and provides a basis for comparing different project options. The various infrastructure requirements in this report have not been studied to a functional level of design that will occur in future planning processes.

The relative difference in cost for on-site infrastructure between the three development scenarios will be negligible, since the major earth moving costs to create linear infrastructure will be the same regardless of

development density. All cost estimates that follow are based on the high-density scenario unless stated otherwise. The costs between pipe sizes to accommodate differing population levels are a relatively small portion of the cost. There may be some minor differences in the sizing of storm ponds, but the differences could be erased during detailed planning if high density land uses had a lower impermeable lot coverage.

Table 3-3 Estimated Order of Magnitude Costs for Infrastructure

Servicing Component	Estimated Order of Magnitude Cost¹
Provincial Responsibility	
Not applicable	Not applicable
HRM Responsibility or Halifax Water Responsibility (costs may be shared, in whole or in part, with developers as part of future capital cost contribution programs)	
Shearwater Connector	The cost to build the section of the Shearwater Connector is estimated to be \$26.9 million per Capital Project # CT000016 within the 2024/2025 Capital Plan.
Portland Street: Construction of initial Red Line BRT to Portland Hills Terminal and Extension of Red Line BRT from Portland Hills Terminal to Forest Hills Parkway	Scoped per the 2020 Rapid Transit Strategy \$0.48 million (station) plus \$2.18 million (1.3 km transit priority lanes and intersection enhancements). With inflation that is \$3.82M. \$0.74 million annual (operating) which is \$1.06M with inflation.

¹ Construction inflation estimates are based on Statistics Canada for the Halifax Census Metropolitan Area for Q4. [Building construction price indexes, by type of building and division](#). Note that for the Shearwater Connection, that table does not include data prior to 2017. For the period 2012 to 2017, inflation was calculated using the general Canadian annual inflation rate. From 2017 to 2024, the Building Construction prices index table was used.

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Caldwell Road: Increased person movement capacity from Morris Lake Study Area to Portland Street / Cole Harbour Road	Potential lane addition, transit priority or general purpose – \$13.15 million based on \$3,835,000 per linear kilometre
Cole Harbour Road: Increased person movement capacity from Bissett Road to Coleridge Court	Potential lane additions – \$5.14 million based on \$3,835,000 per linear kilometre
Caldwell Road general corridor Transit service upgrades	\$2.14-2.65 million annual based on \$100.85 operating cost per hour for new service
Cole Harbour Road Transit service upgrades	\$1.11-1.58 million annual based on \$100.85 operating cost per hour for new service
Caldwell Road Active Transportation upgrades: paired one-way cycle tracks from Atholea Drive to Macdonalds Beach Road, bicycle lanes/paved shoulders from Hines Road to Hornes Road, and sidewalks from Hines Road to Hornes Road	\$810,000 excluding design and signal modifications for cycle tracks \$366,000 - \$417,000 for bicycle lanes/paved shoulders dependent on level of pavement marking and paved buffer area \$463,000 for sidewalks based on 1.8m sidewalk width, site prep, minor drainage modification
Hornes Road Active Transportation Upgrades: Protected bicycle lanes from Caldwell Road to Cow Bay Road	\$120,350 for 1.5m lanes + flex bollards in buffer zone at 10m intervals. Includes catch basin leads, signs, pavement markings in existing paved roadway
Cow Bay Road Active Transportation Upgrades: bicycle lanes/paved shoulders from Orion Drive to Samuel Danial Drive, paired one-way cycle tracks from Heritage Hills Drive to Shore Road, and sidewalks from Orion Drive to Samuel Danial Drive	\$319,000 - \$364,000 for bicycle lanes dependent on level of pavement marking and paved buffer area \$1,620,000 for cycle tracks excluding design and signal modifications \$404,000 for sidewalks based on 1.8m sidewalk width, site prep, minor drainage modification
Cole Harbour Road Active Transportation Upgrades: bicycle lanes from Ross Road to Coleridge Court, paired one-way cycle tracks	\$40,000 for signs, pavement markings in existing paved shoulders

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from Ross Road to Bissett Road, and sidewalk from Morash Drive to Coleridge Court	\$1,085,000 for cycle tracks excluding design and signal modifications 482,000 for the sidewalk based on 1.8m width, site prep, minor drainage modification
Orion Drive Active Transportation Upgrades: sidewalks from Morris Lake development access to Cow Bay Road, bicycle Lanes from Morris Lake development access to Cow Bay Road	\$92,600 based on 1.8m sidewalk width, site prep, minor drainage modification \$73,200 for bicycle lanes assumes road reconstruction required for added pavement width
Lake Major System WTP Capacity Upgrades	Not costed. Insufficient information available at this time. Need to be confirmed by Halifax Water
5ML (Low-pop density) to 7ML*(High-pop density) water storage tank/reservoir. Recommend twin elevated storage tanks or relocated to higher elevation with twin reservoirs with pump house.	\$55.2 Million
400mm diameter Watermain along Caldwell Road	\$35.6 Million
Install new gravity pressure sewer to 1050mm with 450mm and 825mm dia. pipelines	\$20.4 Million (Does not include upgrades to 1.7km single large diameter trunk to WWTP)
Install new pump out stations at low point in the gravity pressure sewer (4 stations)	\$2.8 Million (four x \$0.7M)
Developer Responsibility or Shared Responsibility	
PRVs within Morris Lake (3)	\$2.25 Million for three
Development site primary transit corridors	Developer responsibility – not costed

New Wastewater Pump Station EP-1 and forcemain	\$8.5 Million
New Wastewater Pump Station EP-2 and forcemain	\$1.4 Million
New Wastewater Pump Station EP-3 and forcemain	\$5.1 Million
New Wastewater Pump Station EP-4 and forcemain	\$7.0 Million
On-site grading/earthworks and stormwater management works	Developer responsibility – not costed
On-site water distribution and sanitary sewer collection, including temporary pump stations and pressure reducing valves	Developer responsibility – not costed
Roads and primary transit corridor internal to the Study Area	Developer responsibility – not costed

3.6 Considerations for Future Planning

The following are integrated observations from the various reports that elaborate on the principal conclusions above:

Community Design and Development Phasing

The development proposals for Morris Lake are generally more conceptual than those for other Study Areas. As community planning proceeds, HRM should work with the landowners to test higher levels of density across the development areas and seek a broader mix of land uses.

The Morris Lake development, like all Future Serviced Communities, should prioritize the creation of a well-connected multimodal and complete community to ensure its success. Connectivity analysis highlighted the necessity for a more integrated and cohesive community structure in terms of co-located daily needs. Embracing the principles of a complete community, which includes an idealized ratio of residential spaces, commercial spaces, and sustainable transportation modes will be necessary to realize a functional development that reduces the transportation burden of its residents. Current conceptual plans include a low amount of commercial space relative to residential units. Compared to the Westphal

development site, transportation from the Morris Lake Study Area to commercial, educational, and community centres is more distant and difficult.

Major new development should properly site a mobility hub to serve as a transportation anchor in a new community and offer a safe, comfortable, convenient, and accessible space to seamlessly transfer between different travel modes. Assuming that the housing density and commercial offerings of the site are roughly evenly distributed through the process of secondary planning, then it should ideally be centralized. A primary density node that exceeds all others, on-site transit routing, and/or location of a major on-site transit stop could also impact recommended siting. The goal is to create a gateway and transfer junction for first/last km trips to/from residential units and local businesses that is as useful as possible for as many as possible. Costs of mobility hubs are highly variable dependent on the amenities provided, and modes accommodated. Potential co-location at a commercial or transit centre within this and other Future Serviced Community development sites can centrally provide a mix of transportation options to users to reduce car dependence for internal trips within new neighbourhoods.

Clayton, operating here as Morris Lake Holdings, is clearly the primary developer in the Morris Lake Study Area, even though Brycon owns substantial property that overlaps the area for which Clayton is planning. The third developer who has shown an immediate interest in building, Andrew Giles, is only partially within the Study Area and controls a relatively modest area.

Clayton's plan covers nearly all the Study Area from Caldwell Road in the north to Cow Bay Road in the south. Clayton has broken their development into 20 phases. Phases 1 and 2 abut Caldwell Road and progress to the south, although coordination with Brycon and land use conflicts with the abutting Shearwater Heliport may be impediments.

The apparent logical divide within the large area would appear to be the Shearwater Flyer Trail, which divides the Study Area roughly in half. The area south of the Trail includes some lands incorporated in the Clayton plan that the company does not currently own, like the Brycon lands north of the trail, although interviews conducted by Stantec with those owners suggest that Clayton has approached at least some concerning acquisition of their lands. The area to the south does not abut the heliport, although it appears to be in the flight path of the main runway and is likely affected by aircraft noise during what we understand to be occasional takeoffs and landings. Development there will abut subdivisions accessed from Caldwell Road in the northeast corner of Shearwater and may be accessed directly from Caldwell Road and/or through one of those subdivisions.

From an overall phasing perspective, water and wastewater service to the area will come from south to north. Development phasing should ideally coincide with that extension. However, starting in the south will put traffic pressure on Cow Bay Road and Main Road. The one positive that could come from it has to do with concurrent timing of the Westphal development and the bottleneck created by combined effects at Caldwell Road and Portland Street. Phasing from the south would delay the need for full levels of traffic pressure mitigation to the north. That being said, if the landowners in the northern portion of the Morris Land and/or the Westphal study area are motivated to develop early, HRM could enter into discussions with them to advance the analysis and prepare an interim servicing plan, which would include front-ending some of the downstream sanitary conveyance system upgrades.

The development plan for the Study Area will need to accommodate stormwater management (SWM) measures in the form of end-of-pipe SWM dry ponds designed to restrict post-development peak flows to existing watercourses to pre-development levels and will require coordination and further technical investigations to ensure that SWM ponds are located outside of the regulatory 100-year floodplain and/or delineated wetlands. High density land uses can potentially reduce the footprint of development and help to maintain development and stormwater management infrastructure away from flooding risk areas.

Ecology and Water Quality

From an environmental perspective, avoiding lands shown to have low development suitability will improve protection of ecological systems and addresses terrain-based constraints. From a water quality perspective, the number of people living in the Study Area has less impact in comparison to the amount of hard surface coverage created. In other words, the amount of land area left in its natural or unurbanized state will provide a greater service to the maintenance of water quality than converted lands with more extensive impervious areas. Low density development normally has low lot coverage for buildings, and paved areas per hectare, but houses fewer people. Medium and high-density development often result in higher lot coverage and more impervious surface; however, the area of impervious surface per person is usually considerably less than low density developments.

Watercourses should be buffered from development, with these areas preserved in as natural a condition as possible. The LSA recommends that areas within 30 meters of a watercourse should be classified as having low suitability for development. In some cases, setbacks larger than 30 meters may be appropriate to achieve objectives such as maintaining riparian habitats, enhanced water quality protection, or landscape connectivity. Areas of attention include the northern peninsula projecting into Morris Lake, connecting down along the northeastern Study Area boundary edge, and then along the Cow Bay River and along De Said Lake to Smelt Brook. Whenever possible, retaining native or existing vegetation within these buffer zones is crucial to maintaining ecosystem services (e.g., nutrient cycling, soil formation, water purification, and pollination), reducing runoff, promoting infiltration, and enabling evapotranspiration.

No new development should be permitted within the limits of the 100-year regulatory floodplain. Some reduced risk uses may be considered in agreement with HRM by-laws and the Nova Scotia Statement of Provincial Interest regarding Flood Risk Areas. 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. Detailed hydraulic modeling of the watercourses should be completed to better understand flooding risks.

In future stages of planning and development of the site, the development plan should be revised to relocate residential development and SWM ponds that are currently close to or within the potential floodplain. By pulling back the development, and potentially adding density to the remaining area, the population/development yield of the site could remain similar, and it could reduce the potential risks associated with flooding. The Land Suitability Report outlines that areas within 30 m of a watercourse have low suitability for development. In some cases, setbacks larger than 30 m may be appropriate to achieve objectives such as maintaining riparian habitats, enhanced water quality protection, or landscape connectivity.

The proposed development scenarios for the MLSA within the three existing watersheds (Morris Lake, unnamed watercourse, De Said Lake/Smelt Brook), which discharge to Cow Bay Lake present challenges to local water quality as land use change can impact the lake and watershed systems. In 2023, a blue-green algae bloom in Morris Lake was reported to Nova Scotia Environment and Climate Change. Existing TP concentrations in the MLSA are within the oligotrophic and mesotrophic range.

The three development scenarios and the areal land-use scenario evaluated in the water quality component of this study resulted in increased loading of TP, FC, and sediment within the three watersheds that contain the MLSA. Of the three development scenarios evaluated, the low-density scenario resulted in the lowest increase in loading for all key parameters, whereas the areal land-use scenario overall had the lowest increase in loading for all key parameters. The implementation of structural LID measures would be expected to reduce contaminant loads for the development area to achieve contaminant loads matching existing conditions. The recommendation is to limit the amount of increase in contaminant loading from existing conditions. The no-net increase in loading approach should be considered for any development scenario within the Morris Lake Study Area.

Transportation

To adequately meet the mobility study goals of the Future Serviced Communities initiative, HRM and Study Area developers must perform further investigations, analysis, and planning. The Morris Lake development, due primarily to its distance from existing commercial, educational, and civic destinations, is expected to rely more heavily on personal vehicle use. Additional efforts may be necessary to achieve the objectives of HRM policies supporting sustainable transportation modes.

Connectivity analyses will require repetition as different assumptions, particularly the inclusion of specific uses and destinations on site, becoming more concrete. These analyses should consider the distribution of residents throughout the development area and the cumulative effects of new commercial development in tandem with the transportation requirements associated with accessing more distant activity centres.

To fully understand traffic volume and congestion mitigation needs, supplementary analysis focusing on junction performance is necessary to ensure a more complete assessment of network impacts and potential bottlenecks. Additionally, transportation impact study should be revisited that includes the most recent combined development concept plan housing and commercial space estimates.

More detailed transit demand modelling is required to more accurately predict transit mode share for the new development, the associated increased demand for service adjacent to the Study Area, and capacity needs for an on-site route. Needed adjustments relate to the physical arrangement of residential development and inclusion of an example route travelling along primary corridors within the development that provides proximate access for all new residents. Using a more detailed development plan, ideal on-site routing and stop siting for high quality transit service and micromobility options such as CommunAuto and bicycle and scooter rental programs that link to regional destinations should be determined.

Current concept plans do not describe bicycle or pedestrian facilities slated for local roads and intra-development connections, which contributes to difficulties in routing and siting other transportation

enhancements. Future plans should explicitly include intended pedestrian and bicycle circulation pathways.

Noting that current policy direction encourages investment in sustainable modes rather than additional vehicle capacity, automobile transportation system needs persist in the area of the Morris Lake development site based on the magnitude of predicted transportation network capacity stress. HRM may opt for an approach that leans more heavily on other enhancements to person throughput as physical constraints may preclude the addition of general purpose or transit priority lanes.

A deeper understanding of detailed development plans, particularly regarding the inclusion of commercial services, is of primary importance for accurately assessing transportation access. Incorporating shopping, entertainment, and basic healthcare options within the commercial areas of the proposed development reduces the average active transportation travel time for new residents to reach common destinations. Additional site plan details facilitate the evaluation of opportunities to efficiently implement shared mobility services.

Effective on-site transit routing requires that developers determine and specify the right-of-way dimensions of proposed internal roadways. Primary corridors should be conceived and aligned to ensure that all new residents live within 400 metres, or a five-minute walk, of a transit stop. Connectivity analysis outputs indicate that without bus service more closely servicing the development, the average time required to access public transportation will exceed 20 minutes.

Specific locations and typologies of active transportation facilities within the development area should be clarified in future concept plans and supported through any roadway intersections with protected design features. Future plan versions must include detail related to any on-street bicycle facility, sidewalk, and other pedestrian path routing. Omission of active transportation facilities provision along local roads leaves gaps in the active transportation network at the point of origin and destination.

The Caldwell Road corridor north of the development area currently features dedicated facilities for people both walking and cycling. Phase 2 of the Caldwell Road Active Transportation & Street Improvement Project will extend proper protected cycling infrastructure closer to Portland Street / Cole Harbour Road / Dorothea Drive, further enhancing connectivity and safety for cyclists. Comparably, extending a Caldwell Road active travel corridor in the other direction through the study area to Shearwater Flyer Trail access points and on to Eastern Passage would be highly beneficial as the Shearwater Flyer Trail embodies a low-stress long-distance cycling facility connecting to proposed protected infrastructure along Pleasant Street serving the Woodside Ferry Terminal. Finally, portions of Cow Bay Road from southern Morris Lake development access points to Caldwell Road call for the addition of active transportation infrastructure. These connections first portrayed in the Active Transportation Priorities Plan would expand connectivity of the active travel infrastructure network surrounding the new development, supporting the usefulness of active transportation as a mode choice.

Servicing

The most significant impact from the Morris Lake lands on the conveyance upgrades identified in the 2020 WIP would be on the pressure-gravity system. This system collects flow from a large area and a

number of pump stations before discharging downstream towards the EP WWTF. It will be important to confirm that added flow from the Study Area can be accommodated within the existing and planned configurations for the pressure-gravity system. We estimate that the design wet weather flow from the Study Area reach upwards of 560L/s. Combined with the design wet weather flow from the Westphal Study Area (655L/s), an additional 1,108-1,215L/s can be expected.

This consideration merits the use of the City's updated hydraulic model assessed in context of Regional servicing needs within the framework of the IMP. This includes alternatives evaluations to determine a preferred regional servicing and infrastructure upgrades strategy that best accommodates the broader needs and goals of the HRM and HW. This note is also applicable to the Westphal Study Area and the cumulative impact of both these growth areas should be considered.

Financial

Opening the area for development, in Stantec's high-level order of magnitude estimate, requires an investment of approximately \$192.77M from a mix of developer, HRM, Halifax Water, Provincial, Capital Cost Contribution and shared infrastructure investments at the high end of the range of estimates. There are some infrastructure upgrades, particularly for sanitary sewer service, that support both the Westphal and Morris Lake study areas. Should both study areas proceed, the cost of those upgrades could be shared between the two study areas. For the purposes of this study, the full costs are included in both study areas for consistency with how costing portrayed in all FSC study areas.

On a "per door" (total cost divided by the number of estimated housing units), which represents approximately \$55,200 per door for the low-density scenario, approximately \$32,300 per door for the mid-density developer-requested scenario, and approximately \$20,650 a door for the high-density scenario, excluding increased annual operating costs. These per door costs could be lower if infrastructure upgrades that benefit both the Westphal and Morris Lake study area are shared between the two study areas.

The high-density or the developer-requested scenario would be ideal to share infrastructure costs and make transit more viable, provided Halifax Water can address any additional downstream sanitary sewer conveyance concerns.

Next Steps

The next step will be for HRM to review the completed studies and determine if secondary planning, which is also known as comprehensive neighbourhood planning, should be initiated. The secondary planning process should include an updated master servicing study. In any subsequent planning steps, it will be essential for landowners to coordinate servicing strategies with regional infrastructure as noted by Halifax Water and summarized in the detailed Development Servicing Scenario report. This will be a major complexity of confirming the overall density and population for the Study Area. It needs to be carefully integrated with community design since there are significant interdependencies.

APPENDICES

