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# Shannon Park, Halifax, NS

## Traffic Impact Study

Prepared for:



**CANADA LANDS COMPANY**  
**SOCIÉTÉ IMMOBILIÈRE DU CANADA**

**Final Draft Report**  
**April 14, 2020**

**Project No. 192057**



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**Project Name:** Shannon Park Traffic Impact Study

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Prepared for:

Canada Lands Company

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## Executive Summary

The Canada Lands Company (CLC) has plans to redevelop Shannon Park to include a mixed use residential and commercial development. The traffic impact study was completed to support the development application for Shannon Park. The traffic impact study evaluates the impact of the development during the weekday morning and afternoon peak hours of traffic and identifies road network improvements required to accommodate the development.

### Study Area

Shannon Park is located south of Princess Margaret Boulevard in Dartmouth, Nova Scotia. Shannon Park is uniquely located with established transportation network connections to multiple key corridors in HRM including the MacKay Bridge, Highway 111, and Windmill Road.

The study area for the traffic impact study, includes Windmill Road between Victoria Road and Albro Lake Road and Princess Margaret Boulevard. Nine intersections within the study area were included in the analysis, the study intersections include:

- Princess Margaret Boulevard & BIO Access
- Princess Margaret Boulevard & MacKay Bridge (Halifax)
- Princess Margaret Boulevard & Baffin Boulevard
- Princess Margaret Boulevard & MacKay Bridge (Dartmouth)
- Princess Margaret Boulevard & Iroquois Drive
- Windmill Road & Victoria Road
- Windmill Road & Princess Margaret Boulevard
- Windmill Road & Nootka Avenue
- Windmill Road & Albro Lake Road

### Shannon Park Development Proposal

The proposed Shannon Park development will include approximately 3,000 residential units and 150,000 square feet of commercial space. The residential will include a mixture of mid-rise and high-rise residential buildings. The commercial space will include restaurants and neighbourhood type retail land uses.

The development concept includes two access points on Princess Margaret Boulevard, including a new access, referred to as “Main Street”, across from the Dartmouth-bound MacKay Bridge off-ramp and the reconfiguration of the existing access at Iroquois Drive, referred to as “Collector B”, one access point on Windmill Road through the existing access at Nootka Avenue, and one access point on Baffin Boulevard.

The Millbrook First Nation (Millbrook) owns approximately 3.65 hectares (9 acres) of land at Tufts Cove, adjacent to the CLC property. The development of the CLC lands will extend public roadways and infrastructure to the Millbrook property enabling its development. No specific land uses or density have been included for the Millbrook property in this traffic impact study.

### Weekday Morning and Afternoon Peak Hour Transportation Demand Projections

**Existing Traffic Volumes:** Weekday traffic data was collected during the morning (7:00am to 9:00am) and afternoon (4:00pm to 6:00pm) peak periods of traffic on a typical weekday in August 2016 and July 2019.

The traffic counts were used to determine the peak traffic hours for the study area. The peak hours were determined to be 7:15am to 8:15am and 4:00pm to 5:00pm. The traffic volumes were adjusted using HRM's average annual weekday traffic (AAWT) conversion factors to account for day-of-week and month of data collection. To develop base traffic volumes for the study area, the traffic volumes throughout the corridor were balanced according to the 2019 traffic counts.

**Background Traffic Forecasts:** To develop future traffic forecasts for the study horizon (2027), a background growth was applied to the base volumes. The traffic volumes were factored using a background traffic growth rate of 1.0 percent per year to reflect normal increases in traffic on the study area road network.

To provide a complete outlook of future conditions for the study timeframes, other developments in the study area were also included in the background traffic forecasts. The adjacent developments include:

- 396-400 Windmill Road
- Bedford Institute of Oceanography (BIO)

**Shannon Park Development:** Transportation forecasts for the proposed residential development were estimated using the traditional four-step model: trip generation, modal split, trip distribution and traffic assignment. The weekday peak hour trip generation estimates for the residential and commercial land uses were quantified using trip generation rates from the *Trip Generation Manual* (10<sup>th</sup> edition) published by the Institute of Transportation Engineers (ITE).

The trip generation estimates were adjusted to account for internal trips, modal split and pass-by trips.

On a typical weekday, the Shannon Park development is expected to generate 1111 vehicle trips (375 entering/736 exiting) during the morning peak hour and 1268 vehicle trips (789 entering/479 exiting) during the afternoon peak hour; all of which would be considered new or primary trips.

Trips associated with the Shannon Park development were distributed to the study area road network using the following trip distribution:

- 25% to/from Halifax via the MacKay Bridge,
- 15% to/from Bedford and areas to the north via Windmill Road,
- 25% to/from Dartmouth and areas south via Windmill Road, and
- 35% to/from the rest of the metro area via Highway 111.

Trips associated with the Shannon Park development were assigned to the three access points using the following trip assignment:

- 60 percent to/from "Main Street",
- 15 percent to/from "Collector B", and
- 25 percent to/from Nootka Avenue.

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## Weekday Morning and Afternoon Peak Hour Traffic Analysis

The performance of the study intersections was evaluated during the weekday morning and afternoon peak hours under five scenarios to quantify the impact of the proposed development on the study area road network. The assessment scenarios included:

- Scenario 1 – Existing Conditions (2019)
- Scenario 2 – Background Growth and Adjacent Developments (2027)
- Scenario 3 – Shannon Park Development (2027)
- Scenario 4 – Future Development Conditions with Improvements (2027)
- Scenario 5 – Five-Year timeframe after Shannon Park Development (2032)

**Scenario 1 – Existing Conditions (2019):** The Existing Conditions (2019) scenario provides an assessment of the existing operations in the study area based on existing traffic volumes, lane configurations and signal timing plans. The existing conditions show that the study intersections generally experience no congestion to light congestion during the weekday morning and afternoon peak hours. The overall performance of all study intersections is acceptable (Level of Service ‘D’ or better) during both weekday peak hours. However, there are individual movements at the intersections of Princess Margaret Boulevard & MacKay Bridge (Dartmouth) and Windmill Road & Victoria Road which experience longer delays and/or queues.

**Scenario 2 – Background Growth and Adjacent Developments (2027):** The Background Growth and Adjacent Developments (2027) scenario provides an assessment of future operations in the study area without the proposed development based on the projection of normal traffic growth to the year 2027 and the projected traffic volumes associated adjacent developments. The future background conditions show that congestion levels will increase throughout the study area. Traffic growth and adjacent developments will contribute to the deterioration of existing operational problems at the intersections of Princess Margaret Boulevard & MacKay Bridge (Dartmouth) and Windmill Road & Victoria Road.

**Scenario 3 – Shannon Park Development (2027):** The Shannon Park Development (2027) scenario provides an assessment of future operations in the study area with the proposed development in place based on background traffic volumes and the projected traffic volumes associated with the Shannon Park development. The scenario is used to determine the impact of the proposed development and identify if improvements are required to accommodate the proposed development.

The Shannon Park development will contribute to the deterioration of existing/background operational problems and create operational problems at a number of intersections. Operational problems will be observed at seven of the nine study intersections, including:

- Princess Margaret Boulevard & MacKay Bridge (Halifax-bound)
- Princess Margaret Boulevard & Baffin Boulevard
- Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)/ “Main Street”
- Princess Margaret Boulevard & “Collector B”
- Windmill Road & Victoria Road
- Windmill Road & Princess Margaret Boulevard
- Windmill Road & Nootka Avenue

Queue lengths at intersections along Princess Margaret Boulevard will affect operations at the MacKay Bridge toll plaza and the at-grade CN rail crossing on Princess Margaret Boulevard. Road network improvements are required to mitigate the impact of the development and improve conditions throughout the study area.

**Scenario 4 – Future Development Conditions with Improvements (2027):** The Future Development Conditions with Improvements (2027) scenario provides an assessment of future operations in the study area with road network improvements required to accommodate the proposed development. The following road network improvements are included in the scenario:

- **Princess Margaret Boulevard & MacKay Bridge (Halifax-bound):** New lane configuration on the southbound approach (MacKay Bridge) to provide a left turn storage lane.
- **Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)/ “Main Street”:** Intersection upgraded to a single lane roundabout with a right turn by-pass on the eastbound approach (Princess Margaret Boulevard) to accommodate the right turn movement into the Shannon Park development.
- **Princess Margaret Boulevard & “Collector B”:** New lane configuration on the westbound approach (Princess Margaret Boulevard) to provide a left turn storage lane. The “Collector B” approach should be constructed to include left turn storage lane.
- **Windmill Road & Princess Margaret Boulevard:** New lane configuration on the eastbound approach (Princess Margaret Boulevard) to provide a left turn storage lane and extend the right turn storage lane. New lane configuration on the southbound approach (Windmill Road) to provide a right turn storage lane.
- **Windmill Road & Nootka Avenue:** New lane configuration on the westbound approach (Nootka Avenue) to provide a left turn storage lane.

Operations at the five intersections where improvements are proposed will be improved. The improvements ensure that the intersection operations will not impact operations at the MacKay Bridge toll plaza or the at-grade CN rail crossings on Princess Margaret Boulevard and Nootka Avenue.

**Scenario 5 – Five-Year timeframe after Shannon Park Development (2032):** The Five-Year timeframe after Shannon Park Development (2032) scenario provides an assessment of future operations in the study area based on the projection of normal traffic growth five-years after full build out of the Shannon Park development. The five-year timeframe confirms that the proposed road network improvements will accommodate the proposed development and allow rooms for future traffic growth.

### **Princess Margaret Boulevard Corridor Analysis**

The intersection performance analysis identified a number of road network improvements required along Princess Margaret Boulevard to mitigate the impact of the Shannon Park development. Under existing conditions, traffic flows freely along the entire length of the Princess Margaret Boulevard corridor until the signalized intersection at Windmill Road. The proposed improvements include changes to intersection controls along the corridor which will introduce delay and queues along the corridor.

The intersections along Princess Margaret Boulevard are closely spaced making it important to identify interactions between adjacent intersections. Different types of software were used to model the intersections based on the type of intersection control. While the queue length results from the various analyses are a good indicator of intersections between adjacent intersections, a supplemental corridor analysis was completed along Princess Margaret Boulevard using PTV Vissim software to confirm the results of the intersection performance analysis.

The study area for the corridor analysis was limited to the section of Princess Margaret Boulevard from the ramps to the MacKay Bridge toll plaza to Windmill Road. Five study intersections were included in the analysis:

- Princess Margaret Boulevard & MacKay Bridge (Halifax-bound)
- Princess Margaret Boulevard & Baffin Boulevard
- Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)
- Princess Margaret Boulevard & Iroquois Drive
- Princess Margaret Boulevard & Windmill Road

The performance of the study intersections during the weekday morning and afternoon peak hours was reevaluated under two of the previous scenarios:

- **Scenario 1 – Existing Conditions (2019):** The results of the Vissim corridor analysis are consistent with the intersection performance analysis results; all intersections operate at acceptable levels of service.
- **Scenario 5 – Five-Year timeframe after Shannon Park Development (2032):** The results of the Vissim analysis are consistent with the intersection performance analysis results. All intersections will operate at acceptable levels of service during the morning peak hour. During the afternoon peak hour, operational issues will occur for the side street movements at Princess Margaret Boulevard & MacKay Bridge (Halifax-bound) and Princess Margaret Boulevard & ‘Collector B’. Queues on the MacKay Bridge ramps will not impact the toll plaza. All other intersections will operate at acceptable levels of service and the queue lengths on the Princess Margaret Boulevard will not impact the at-grade CN rail crossing.

The corridor analysis confirms that the proposed road network improvements will be sufficient to accommodate the proposed development during the weekday peak hours and confirms that the Shannon Park development will not impact the MacKay Bridge toll plaza or the CN rail crossing.

### Road Network Improvements

A number of road network improvements are required to mitigate the impact of the Shannon Park development during the weekday peak hours. The improvements include:

1. **Princess Margaret Boulevard & MacKay Bridge (Halifax-bound):** A left turn storage lane (60 metres) should be provided on the southbound approach (MacKay Bridge).
2. **Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)/ “Main Street”:** The intersection of Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound) should be upgraded to a single lane roundabout. The single lane roundabout will require a right turn by-pass



on the eastbound approach (Princess Margaret Boulevard) to accommodate the right turn movement into the Shannon Park development. The roundabout design should maintain the adjacent left storage turn lane into Baffin Boulevard.

Improvements to the intersection are required to improve existing and future background operations at the intersection and to accommodate the main access to the Shannon Park development. The roundabout will need to be constructed on both the CLC lands and HRM property.

3. **Princess Margaret Boulevard & “Collector B” (formerly Iroquois Drive):** A left turn storage lane (25 metres) should be provided on the westbound approach (Princess Margaret Boulevard). The “Collector B” approach should be constructed to include a left turn storage lane (50 metres).
4. **Windmill Road & Princess Margaret Boulevard:** The intersection should be widened to accommodate new lane configurations on the eastbound (Princess Margaret Boulevard) and southbound (Windmill Road) approaches.

The existing right turn storage lane should be extended (50 metres) and a left turn storage lane (70 metres) should be provided on the eastbound approach. A right turn storage lane (40 metres) should be provided on the southbound approach.

5. **Windmill Road & Nootka Avenue:** A left turn storage lane (25 metres) should be provided on the westbound approach (Nootka Avenue).

The total cost of the roadway infrastructure improvements is estimated at \$1,650,000. The cost estimates do not include allowances for engineering, property acquisitions, utility relocations or harmonized sales tax (HST).

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## 1.0 Introduction and Understanding

Harbourside Transportation Consultants and DesignPoint Engineering and Surveying Ltd. were retained by the Canada Lands Company (CLC) to prepare a traffic impact study to support the development application for the redevelopment of Shannon Park in Dartmouth, Nova Scotia.

CLC has plans to redevelop Shannon Park to include a mixed use residential and commercial development. The proposed development will include approximately 3,000 residential units and 150,000 square feet of commercial space. The traffic impact study evaluates the impact of the development during the weekday morning and afternoon peak hours of traffic and identifies road network improvements required to accommodate the development.

The Millbrook First Nation (Millbrook) owns approximately 9 acres of land at Tufts Cove, adjacent to the CLC property. Development of the CLC lands will extend public roadways and infrastructure to the Millbrook property enabling its development. At this time, no detailed plans for the development of the Millbrook property have been made public; however, general indications are that the development could include a mix of residential and commercial land uses similar to the proposed development for the CLC lands. The traffic impact study does not include land uses or density for the Millbrook property.

### 1.1 Project Scope and Objectives

The scope of the traffic impact study was discussed and confirmed with the Halifax Regional Municipality (HRM) and the Nova Scotia Transportation Infrastructure Renewal (NSTIR).

The objectives of the traffic impact study include:

- An assessment of the existing road network intersections in the study area during both the morning (AM) and afternoon (PM) peak traffic periods on a typical weekday.
- Establishing the trip generation rates for the proposed development.
- Establishing the trip distribution patterns for the proposed development.
- An assessment of the anticipated traffic conditions of the study area streets and intersections with the proposed development reflecting normal growth rates to the full build-out time horizon.
- Identifying the impacts of the proposed development on the study area streets and intersections during both the AM and PM peak traffic periods.
- Identifying any required improvements to the study area streets and intersections that may be required to accommodate the proposed development.
- A review of the development concept plan's internal road network.
- A review of previous transportation studies in the study area including the 2006 Wrights Cove Land Use and Transportation Plan.

### 1.2 Methodology

The traffic study was completed in accordance with HRM's *Guidelines for the Preparation of Transportation Impact Studies (8<sup>th</sup> revision)*. The methodology for the traffic impact study is outlined below:

1. Project Initiation and Information Gathering
2. Stakeholder Meetings
3. Traffic Operations Analysis
  - a) Establish the context for the TIS (horizon year, time periods for analysis, growth rate, etc.)
  - b) Estimate traffic volumes that will be generated by the development (trip generation, mode split adjustments and trip distribution)
  - c) Establish existing traffic conditions and background traffic conditions
  - d) Evaluate the impacts of the site-generated traffic and identify any improvements required to mitigate the effects of the proposed development.
4. Public Transit
5. Active Transportation
6. Draft Report Documentation
7. Final Report Documentation

After HRM's initial review of the first draft report, HRM required that a corridor analysis be completed using PTV Vissim to supplement the analysis and confirm results. The corridor analysis was not included in the initial scope developed and agreed upon with HRM and are not typically required as part of a traffic impact study.

## **2.0 Study Context**

### **2.1 Study Area Description**

Shannon Park is located south of Princess Margaret Boulevard in Dartmouth, Nova Scotia. Shannon Park is uniquely located with established transportation network connections to multiple key corridors in HRM including the MacKay Bridge, Highway 111, and Windmill Road. The study area for the traffic impact study, shown in Figure 1, includes Windmill Road between Victoria Road and Albro Lake Road and Princess Margaret Boulevard.

Windmill Road is a collector roadway that runs from downtown Dartmouth to Burnside Park, Windmill Road becomes an arterial roadway in Burnside Park where it connects to Victoria Road. Victoria Road is an arterial roadway that runs from Burnside Park to downtown Dartmouth. The Windmill Road/Victoria Road corridor provides connections to Bedford/Lower Sackville, the MacKay Bridge, Highway 111 and the MacDonald Bridge making it a key commuting corridor.

In the Burnside Park area, Windmill Road and Victoria Road have a four-lane cross section with turning lanes at key intersections. In the Shannon Park area, Windmill Road has a two-lane cross section with turning lanes at key intersections.

Princess Margaret Boulevard is an east-west local roadway that connects Windmill Road to the MacKay Bridge and Highway 111 and residential areas. Princess Margaret Boulevard has a two-lane cross section with turning lanes at key intersections.



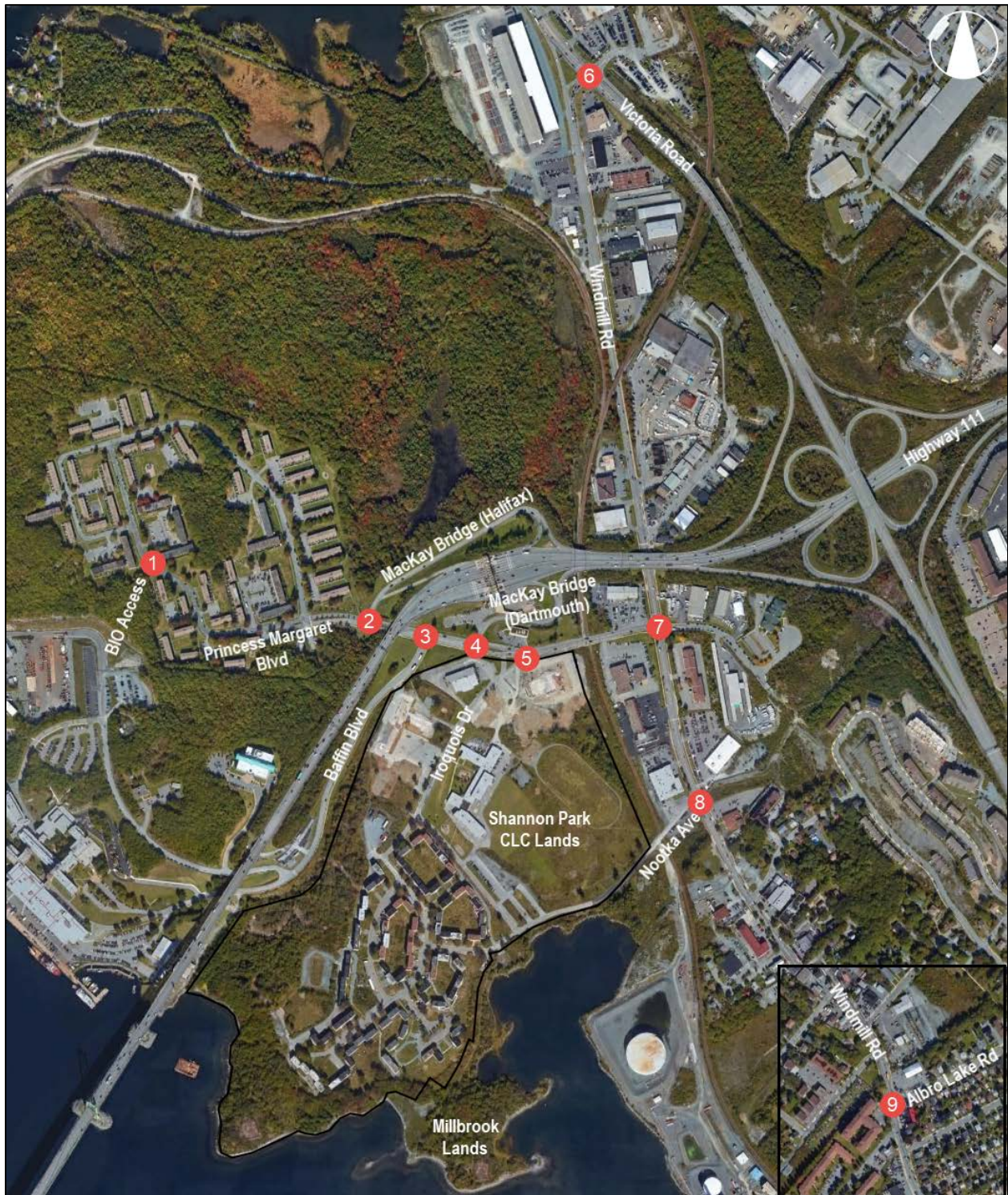


Figure 1: Study Area

Nine intersections within the study area were included in the analysis, the study intersections include:

- Princess Margaret Boulevard & BIO Access
- Princess Margaret Boulevard & MacKay Bridge (Halifax-bound)
- Princess Margaret Boulevard & Baffin Boulevard
- Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)
- Princess Margaret Boulevard & Iroquois Drive
- Windmill Road & Victoria Road
- Windmill Road & Princess Margaret Boulevard
- Windmill Road & Nootka Avenue
- Windmill Road & Albro Lake Road

## **2.2 Site Visit and Sight Distance Review**

A site visit was conducted on August 17<sup>th</sup>, 2016 to document existing conditions. Existing intersections, transit stops, pedestrian crossings, and active transportation (AT) connections were documented.

The sight distance at the study intersections was reviewed against the sight distance requirements set out by the Transportation Association of Canada (TAC) in the Geometric Design Guide for Canadian Roads.

For a two-lane roadway posted to a speed of 50 km/h, 100m of sight distance is required for crossing movements and vehicles turning left across vehicles approaching from the left. For turning movements with vehicles approaching in the intended direction of travel 100m of sight distance is required for vehicles to turn left without being overtaken by a vehicle approaching from the right or to turn right without being overtaken by a vehicle approaching from the left. For a four-lane roadway posted to a speed of 60 km/h, 130m of sight distance is required for vehicles turning left across vehicles approaching from the left. For turning movements with vehicles approaching in the intended direction of travel, 125m of sight distance is required for vehicles to turn left without being overtaken by a vehicle approaching from the right or to turn right without being overtaken by a vehicle approaching from the left.

The minimum sight distance is adequate at all study intersections. At Windmill Road/Nootka Avenue and Windmill Road/Albro Lake Road, trees are present within the sight lines and reduce visibility. Sight lines should be kept clear of vegetation.

## **2.3 Collision History**

Collision data for the study area was obtained from HRM for 2013 to 2016. These data indicate 12 collisions at the intersection of Windmill Road/Princess Margaret Boulevard, of which 10 were without injury and 2 with injury. A collision with no injury was also reported at Princess Margaret Boulevard/MacKay Bridge Ramp (Dartmouth bound).

The collision data obtained from police departments lacks the detail required to perform safety reviews of individual intersections. The data could not be used to perform safety analyses and only used for a high-level review of potential issues. Given the high volumes observed at the intersection, twelve collisions with no details over more than three years does not appear to be problematic.



## 2.4 Existing Traffic Volumes

Manual traffic counts were collected during the morning and afternoon peak periods of traffic in August 2016 at eight study intersections.

- Princess Margaret Boulevard & MacKay Bridge (Halifax-bound)
- Princess Margaret Boulevard & Baffin Boulevard
- Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)
- Princess Margaret Boulevard & Iroquois Drive
- Windmill Road & Victoria Road
- Windmill Road & Princess Margaret Boulevard
- Windmill Road & Nootka Avenue
- Windmill Road & Albro Lake Road

The new access to the Bedford Institute of Oceanography was constructed in 2019, affecting travel patterns on Princess Margaret Boulevard. Traffic counts were collected/updated during the morning and afternoon peak periods of traffic at the following intersections to reflect changes in travel patterns caused by the new BIO Access on Princess Margaret Boulevard:

- Princess Margaret Boulevard & BIO Access
- Princess Margaret Boulevard & MacKay Bridge (Halifax-bound)
- Princess Margaret Boulevard & Baffin Boulevard

Weekday traffic data was collected at the using Miovision 'Scout' video data collection devices. Turning movement counts were collected during the morning (7:00am to 9:00am) and afternoon (4:00pm to 6:00pm) peak periods of traffic on a typical weekday in July, 2019. Traffic volumes (categorized as 'light' and 'other' vehicles) and pedestrians were recorded in 15-minute intervals. The traffic count data can be found in Appendix A.

The weekday peak hour traffic volumes from the 2016 counts at these intersections were found to be higher than the traffic volumes observed in the updated 2019 counts. Additional afternoon peak period counts were processed at the following intersections to confirm the trend throughout the study area:

- Windmill Road & Victoria Road
- Windmill Road & Princess Margaret Boulevard
- Windmill Road & Albro Lake Road

The traffic counts were used to determine the peak hours for the study area; the peak hours were 7:15am to 8:15am and 4:00pm to 5:00pm. The traffic volumes were adjusted using HRM's average annual weekday traffic (AAWT) conversion factors to account for day-of-week and month of data collection. The weekday peak hour traffic volumes from the 2016 counts were found to be higher than the traffic volumes observed in the updated 2019 counts. To develop base traffic volumes for the study area, the traffic volumes throughout the corridor were balanced according to the 2019 traffic counts.

## 2.5 Background Traffic Forecasting

The Shannon Park development is expected to be constructed by 2027. To develop future traffic forecasts for the study horizon, a background growth rate was applied to the base volumes. While a comparison of 2016 and 2019 traffic volumes at some of the study intersections showed decreases in traffic volumes along the corridor, the timeframe is insufficient to conclude that there is no growth in the study area. Therefore, to remain conservative, the base traffic volumes were factored using a background traffic growth rate of 1.0 percent per year to reflect normal increases in traffic on the study area road network. To provide a complete outlook of future conditions for the study timeframes, other developments in the study area were also included in the background traffic forecasts.

### 2.1 Modal Split

The modal split for the Shannon Park area was developed using 2006 Census data. While not the most recent Census data available, discussions with Halifax Transit indicated that 2006 Census data was considered more reliable in terms of reflecting HRM data for transit ridership. Three areas of Halifax believed to represent similar conditions to those anticipated for the Shannon Park development were identified: Portland Hills and Montebello areas in Dartmouth, and the area north of Larry Uteck Boulevard in Bedford. The 2006 modal split for these areas are noted in Table 1. After discussions with HRM, a transit, walk, bike and 'other' split of 10%, 4%, 1% and 0.5% respectively was assumed for Shannon Park, for total model split of 15.5% for sustainable transportation modes in the study area.

Table 1: Census 2006 Mode Split

Mode Split	Portland Hills	Montebello	Larry Uteck
Vehicle	83.1%	88.9%	84.4%
Transit	11.5%	6.7%	9.7%
Walk	4.4%	2.6%	4.1%
Bike	0.7%	1.3%	0.4%
Other	0.4%	0.6%	1.3%

## 3.0 Stakeholder Consultation

A series of stakeholder meetings were conducted was to confirm the scope of work with approval agencies and identify future development and planned changes to the transportation network in the study area. Meetings/interviews were held with HRM, Halifax Transit, NSTIR, Halifax Harbour Bridges (HHB), BIO and Canadian National Railway (CN).

### 3.1 Halifax Regional Municipality

A meeting was held with Halifax Development, Traffic and Transit on August 25, 2016. HRM confirmed the study scope.

A few items of note from the meeting include:

- HHB is in the process of studying options for replacing the MacKay Bridge;
- BIO is looking at access road upgrades to their facility and are in the preliminary stages of discussing with the Municipality having their private road taken over by the Municipality;

- HRM staff present at the meeting did not believe that HRM's Centre Plan has any significant items pertaining to traffic that may impact this project;
- No additional developments in the surrounding areas have been identified that may impact the traffic study;
- HRM is working on an Integrated Mobility Plan, it is not anticipated that there will be any major items in the plan that will identify the project's study area.

A second meeting was held with Halifax Active Transportation, Transit, Transportation and Planning. The meeting consisted of a preliminary discussion on preferred active transportation routes through the site. HRM would like to see a main route through the site that includes bike lanes. There are plans to install a painted bike lane on Windmill Road but it is not a high priority due to the low demand in the area. Once Shannon Park is built, demand in the area will likely increase. At this point, HRM would be looking at either Windmill Road bike lane or an AT path that runs along the harbourfront. It was also noted that the MacKay Bridge upgrade may include pedestrian/bike facilities which would add to increased demand for the area.

### **3.2 Nova Scotia Transportation and Infrastructure Renewal**

A phone interview was conducted with Dwayne Cross of NSTIR on August 19, 2016. NSTIR confirmed the study scope and indicated that they would require not additional analysis than what was being proposed to HRM.

### **3.3 Halifax Harbour Bridges**

A meeting was held with Ahsan Chowdhury (Chief Engineer) and Gord Helm (Operations Manager) on August 24, 2016. They outlined their future plans at the MacKay Bridge, which included removal of the toll plaza and the need to replace the deck. The deck replacement may result in the construction of a new bridge. HHB is in the process of studying options for replacing the MacKay bridge. One of the options being considered is building a new bridge parallel to the existing bridge. Both the north and south sides are being assessed as options. The future plans for HHB have no impact on the scope of this study.

### **3.4 Bedford Institute of Oceanography**

A meeting was held with Jeff Hilchey (Project Engineer) on August 30, 2016 to discuss their new access road project. Pending HRM review, they are planning to tender the project in 2016 and begin construction in 2016. The majority of the construction will take place in 2017. The project will provide a new connection into the BIO site and upgrade their driveway to HRM standards, before the road becomes the property of HRM.

### **3.5 Canadian National Railway**

A phone interview was conducted with Raymond Beshro of CN Rail on September 16, 2016. CN indicated that the study needs to take into account Transport Canada's Grade Crossing Standards (2014) and address any requirements. CN has some concern regarding queues from adjacent intersections spilling back onto existing crossings. CN will need to review the capacity analysis.

The capacity analysis shows that with certain improvements in place, the development will not impact the CN track and at-grade crossings located within the study area. A memo summarizing the results of the analysis has been sent to CN for comment. At this time, no comment has been received.

The Nootka Avenue crossing currently does not have a gate system and CN does not believe the site generated traffic will be enough to warrant gates. However, it must be ensured that adequate sightlines for the track operating speed are maintained at the crossing. The track currently operates at a maximum speed of 25 mph. Therefore, when re-designing Nootka Avenue, the road design will need to meet HRM and CN requirements.

CN provided a document with guidelines regarding new development near existing tracks. Guidelines include the following:

- Residential buildings should be set back a minimum of 15m from the railway right-of-way in conjunction with a safety berm.
- In the absence of a safety berm, sensitive uses such as residential development should be set back at least 60m from the railway right-of-way.
- The document states that the owner/developer must have a noise analysis completed and evaluate ground-borne vibration transmission.
- The owner must install and maintain a chain link fence along the mutual property line.
- Clauses to be inserted in all development agreements, offers to purchase, and agreements of Purchase and Sale or Lease of each dwelling unit within 300 m of the railway right-of-way.
- Any alterations to existing drainage pattern affecting railway property must receive prior concurrence by CN and be substantiated by a drainage report.
- In addition, CN will be seeking registration on title of a railway noise and vibration covenant and will provide standard wording for this in due time.

#### **4.0 Shannon Park Development Proposal**

The proposed redevelopment of Shannon Park will include a mixed use residential and commercial development. The preferred development concept for Shannon Park is shown in Figure 2 and the land use plan is shown in Figure 3. The proposed development will include approximately 3,000 residential units and 150,000 square feet of commercial space. The residential will include a mixture of mid-rise and high-rise residential buildings. The commercial space will include restaurants and neighbourhood type retail land uses.

The development concept includes two access points on Princess Margaret Boulevard, including a new access, referred to as “Main Street”, across from the Dartmouth-bound MacKay Bridge ramp to and the reconfiguration of the existing access at Iroquois Drive, referred to as “Collector B”; one access point on Windmill Road through the existing access at Nootka Avenue; and one access point on Baffin Boulevard.

The Millbrook First Nation (Millbrook) owns approximately 9 acres of land at Tufts Cove (Block 27), adjacent to the CLC property. The development of the CLC lands will extend public roadways and infrastructure to the Millbrook property enabling its development. No specific land uses or density have been included for the Millbrook property in this traffic impact study.





Figure 2: Preferred Development Concept

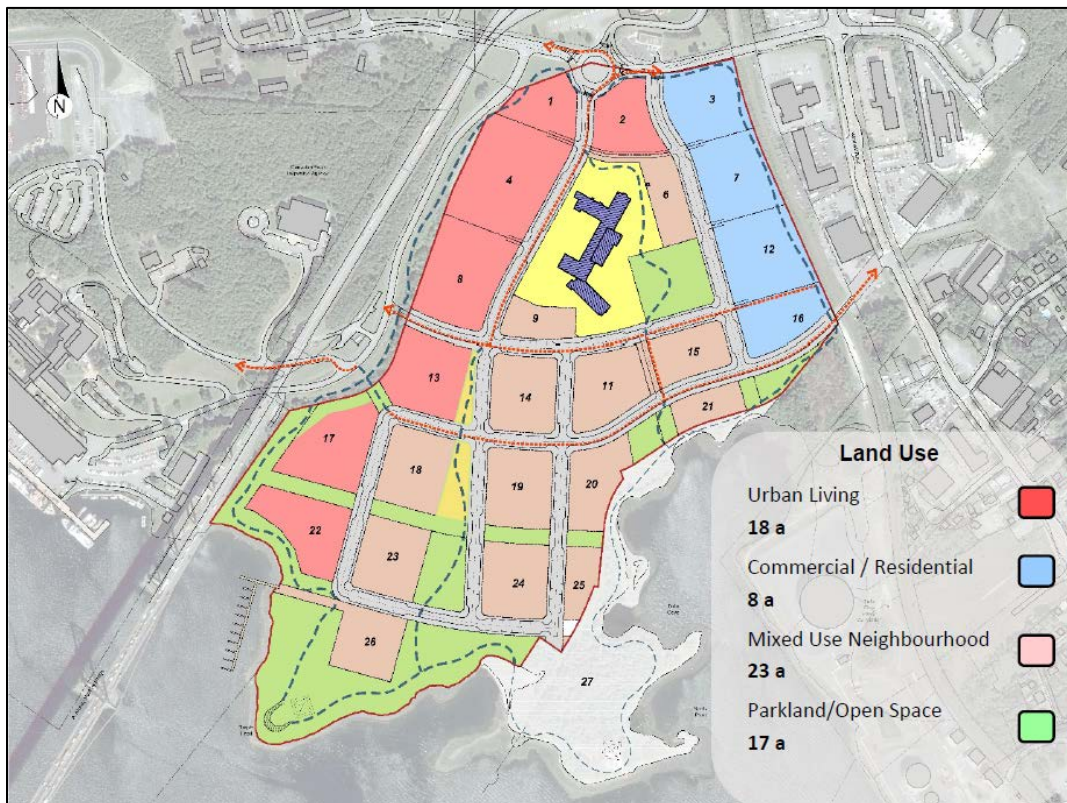


Figure 3: Development Land Use Plan



## 5.0 Adjacent Development Proposals

Other developments in the study area anticipated to coincide with the Shannon Park development's timeframe were identified through stakeholder interviews. The development proposals were reviewed and confirmed by HRM. The adjacent developments are identified in Figure 4 and described in the following sections.



Figure 4: Adjacent Developments

### 5.1 Bedford Institute of Oceanography

The new access to the Bedford Institute of Oceanography was constructed in 2019. A traffic impact study completed in August 2016 to support the access indicated that the facility will grow by 200 employees by 2021 (BIO currently number of employees is approximately 800), resulting in 200 new trips to the study area. The study anticipated that up to 42 percent of the vehicles accessing the BIO campus would use the new access in Wallace Heights.

### 5.2 396, 398, 400 Windmill Road

The Harbour East and Marine Drive Community Council has approved the development agreement to enable the redevelopment of the Ship Victory Restaurant and Lounge site for a 10 storey mixed-use building consisting of two towers on a two-storey podium. The development agreement allows for a maximum gross floor area of 14,800 square feet of commercial use and 121,363 square feet of residential use. In addition, 50% of the residential units must contain two or more bedrooms.

### 5.3 Millbrook First Nations

The Millbrook First Nation (Millbrook) owns approximately 9 acres of land at Tufts Cove, adjacent to the CLC property. Development of the CLC lands will extend public roadways and infrastructure to the Millbrook property enabling its development. No detailed plans for the development of the Millbrook property have been made public, however, general indications are that the development could include a mix of residential and commercial land uses similar to the proposed development for the CLC lands.

### 5.4 Wallace Heights

The existing development in Wallace Heights, also known as Ocean Breeze Estates, consists of approximately 400 units in 50 buildings. The development includes a variety of apartment sizes and townhouses spanned over 67 acres of land.

The proposed Centre Plan Package A, which is currently under review by Regional Council, places this site in the Higher Order Residential Designation and Zone. As part of the review of Centre Plan documents, on June 25<sup>th</sup>, 2019, Regional Council provided direction to allow an increased amount of development on the site by changing the proposed zoning to HR-2 with a 38 metre height limit (12 storeys).

HRM planning staff are currently processing a subdivision application to subdivide the existing buildings onto separate lots. HRM is not aware of any specific development proposals at this time, but anticipate future interest in new multi-unit buildings given the proposed HR-2 zoning and subdivision activity.

### 5.5 Windmill Road Area (including the Shannon Plaza)

The portion of Windmill Road adjacent to the Shannon Park site will be considered as part of the Centre Plan Package B planning process. While the 2017 Centre Plan document identifies this area as “Employment Intensive” (industrial/commercial uses), the Centre Plan Package A that is currently under review by Regional Council identifies Windmill Road from Fernhill Road south as a “Corridor” (mixed use) with maximum building heights of 20 metres (4 storeys). It is unclear at this time which designation and zone will be applied to the portion of Windmill Road located adjacent to Shannon Park.

While increased development interest in the area is expected given the potential community stadium and planned redevelopment of Shannon Park, further reviews and consultation with property owners is needed to clarify the development potential of the area and the planning policies and zones that should be applied through the Centre Plan Package B planning process.

## 6.0 Transportation Demand Projections

Transportation forecasts for the proposed residential development were estimated using the traditional four-step model: trip generation, modal split, trip distribution and traffic assignment. Demand projections were developed for the weekday morning and afternoon peak hours of adjacent street traffic.

### 6.1 Trip Generation and Modal Split

The weekday peak hour trip generation estimates for the residential and commercial land uses were quantified using trip generation rates from the *Trip Generation Manual* (10<sup>th</sup> edition) published by the Institute of Transportation Engineers (ITE). The trip generation rates used to quantify the trip generation estimates are summarized in Table 2.

Table 2: Trip Generation Rates

Land Use	Units	AM Peak Hour			PM Peak Hour		
		Rate <sup>1</sup>	In	Out	Rate	In	Out
ITE LUC 221 - Multifamily Housing (Mid-Rise)	Units	0.36	26%	74%	0.44	61%	39%
ITE LUC 222 - Multifamily Housing (High-Rise)	Units	0.31	24%	76%	0.36	61%	39%
ITE LUC 715 - General Office Building	1000 ft <sup>2</sup>	1.16	86%	14%	1.15	16%	84%
ITE LUC 814 - Variety Store	1000 ft <sup>2</sup>	3.18	57%	43%	6.84	52%	48%
ITE LUC 851 - Convenience Market	1000 ft <sup>2</sup>	62.54	50%	50%	49.11	51%	49%
ITE LUC 899 - Liquor Store	1000 ft <sup>2</sup>	0.00	0%	0%	16.37	50%	50%
ITE LUC 911 - Walk-In Bank	1000 ft <sup>2</sup>	0.00	0%	0%	12.13	44%	56%
ITE LUC 918 - Hair Salon	1000 ft <sup>2</sup>	1.21	50%	50%	1.45	17%	83%
ITE LUC 925 - Drinking Place	1000 ft <sup>2</sup>	0.00	0%	0%	11.36	66%	34%
ITE LUC 930 - Fast Casual Restaurant	1000 ft <sup>2</sup>	2.07	67%	33%	14.13	55%	45%
ITE LUC 931 - Quality Restaurant	1000 ft <sup>2</sup>	0.73	50%	50%	7.80	67%	33%
ITE LUC 932 - High-Turnover (Sit-Down) Restaurant	1000 ft <sup>2</sup>	9.94	55%	45%	9.77	62%	38%
ITE LUC 933 - Fast-Food Restaurant without Drive-Through	1000 ft <sup>2</sup>	25.10	60%	40%	28.34	50%	50%
ITE LUC 936 - Coffee/Donut Shop without Drive-Through	1000 ft <sup>2</sup>	101.14	51%	49%	36.31	50%	50%
Notes:							
1. Trip generation rates are in 'vehicles per hour per unit'.							

The weekday morning and afternoon peak hour trip generation estimates and adjustments for the Shannon Park development are summarized in Table 3. The trip estimates were adjusted to reflect internal trips and modal split:

- **Internal trips:** Internal trips are trips generated by a mixed-use development that both begin and end within the development. The internal captures were calculated using the National Cooperative Highway Research Program's (NCHRP) methodology outlined in *Report 684 Enhancing Internal Trip Capture Estimation for Mixed Use Developments*. This methodology is the recommended practice in the *ITE Trip Generation Handbook* (3rd edition).
- **Modal Split:** The trip estimates were reduced by a modal split of 15.5% to account for trips made using non-auto transportation modes such as transit and active transportation. The modal split was developed in the original traffic impact study based on census data from three areas of HRM, Portland Hills, Montebello and Larry Uteck, believed to represent similar conditions to those anticipated for the Shannon Park development and discussions with HRM.



Table 3: Shannon Park Development Trip Generation Estimates

Land Use	Units		AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Phase 1 – Blocks 1, 2, 3, 4, 8, 11, 13, 14, 20, 21, 25								
221 - Multifamily Housing (Mid-Rise)	165	Units	60	16	44	73	45	28
222 - Multifamily Housing (High-Rise)	1,215	Units	377	90	287	438	267	171
715 - General Office Building	23.50	1000 ft <sup>2</sup>	27	23	4	27	4	23
814 - Variety Store	14.50	1000 ft <sup>2</sup>	47	27	20	100	52	48
925 - Drinking Place	5.50	1000 ft <sup>2</sup>	0	0	0	62	41	21
931 - Quality Restaurant	19.00	1000 ft <sup>2</sup>	0	0	0	148	99	49
932 - High-Turnover (Sit-Down) Restaurant	5.00	1000 ft <sup>2</sup>	50	28	22	49	30	19
933 - Fast-Food Restaurant w/o DT	3.00	1000 ft <sup>2</sup>	0	0	0	85	43	42
933 - Fast-Food Restaurant w/o DT	2.00	1000 ft <sup>2</sup>	50	30	20	57	29	28
Phase 2 – Blocks 13, 14, 18, 19, 24								
221 - Multifamily Housing (Mid-Rise)	82	Units	30	8	22	37	23	14
222 - Multifamily Housing (High-Rise)	455	Units	142	34	108	164	100	64
814 - Variety Store	9.25	1000 ft <sup>2</sup>	29	17	12	63	33	30
851 - Convenience Market	3.00	1000 ft <sup>2</sup>	188	94	94	147	75	72
899 - Liquor Store	6.00	1000 ft <sup>2</sup>	0	0	0	98	49	49
911 - Walk-In Bank	5.00	1000 ft <sup>2</sup>	0	0	0	61	27	34
930 - Fast Casual Restaurant	3.00	1000 ft <sup>2</sup>	6	4	2	42	23	19
931 - Quality Restaurant	10.00	1000 ft <sup>2</sup>	7	4	3	78	52	26
Phase 3 – Blocks 17, 22, 23, 24, 26								
221 - Multifamily Housing (Mid-Rise)	133	Units	48	12	36	59	36	23
222 - Multifamily Housing (High-Rise)	950	Units	295	71	224	342	209	133
814 - Variety Store	10.25	1000 ft <sup>2</sup>	33	19	14	70	36	34
918 - Hair Salon	11.00	1000 ft <sup>2</sup>	13	7	6	16	3	13
930 - Fast Casual Restaurant	3.00	1000 ft <sup>2</sup>	6	4	2	42	23	19
931 - Quality Restaurant	10.00	1000 ft <sup>2</sup>	7	4	3	78	52	26
936 - Coffee/Donut Shop w/o DT	2.00	1000 ft <sup>2</sup>	202	103	99	73	37	36
Total Trips Generated			1617	595	1022	2409	1388	1021
Internal Trips			182	91	91	778	389	389
External Trips			1435	504	931	1631	999	632
Reduction for non-auto modes (15.5 percent)			222	78	144	253	155	98
Adjusted Vehicle Trips			1213	426	787	1378	844	534
Pass-by Trips			102	51	51	110	55	55
Primary Trips			1111	375	736	1268	789	479

On a typical weekday, the Shannon Park development is expected to generate 1213 vehicle trips (426 entering/787 exiting) during the morning peak hour and 1378 vehicle trips (844 entering/534 exiting) during the afternoon peak hour. The site-generated vehicle trip estimates were further refined to account for different trip types, such as commercial pass-by trips and primary trips:

- **Pass-by trips:** A pass-by trip is a trip made as an intermediate stop on a primary trip and therefore does not consist of a new trip added to the adjacent street traffic. It was assumed that 25 percent of commercial vehicle trips (after adjustments) would consist of pass-by trips.
- **Primary trips:** The remaining trips are considered primary trip, which are new trips added to the adjacent street traffic. Of the total site-generated trips, 1111 vehicle trips (375 entering/736 exiting) during the morning peak hour and 1268 vehicle trips (789 entering/479 exiting) during the afternoon peak hour are expected to be primary trips.

The weekday morning and afternoon peak hour trip generation estimates and adjustments for the adjacent developments are summarized in Table 4. The trip estimates were adjusted to reflect modal split. On a typical weekday, the adjacent developments are expected to generate 206 vehicle trips (188 entering/18 exiting) during the morning peak hour and 210 vehicle trips (19 entering/191 exiting) during the afternoon peak hour.

Table 4: Adjacent Developments Trip Generation Estimates

Land Use	Units		AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
396-400 Windmill Road								
221 - Multifamily Housing (Mid-Rise)	72	Units	26	7	19	32	20	12
715 - General Office Building	14.8	1000 ft²	17	15	2	17	3	14
BIO								
New Employees	200	Jobs	200	200	0	200	0	200
Total Trips Generated			243	222	21	249	23	226
Reduction for non-auto modes (15.5 percent)			37	34	3	39	4	35
Adjusted Vehicle Trips			206	188	18	210	19	191

## 6.2 Trip Distribution and Assignment

Trips associated with the Shannon Park development and adjacent developments were distributed to the study area road network using the following trip distribution:

- 25% to/from Halifax via the MacKay Bridge,
- 15% to/from Bedford and areas to the north via Windmill Road,
- 25% to/from Dartmouth and areas south via Windmill Road, and
- 35% to/from the rest of the metro area via Highway 111.

The trip distribution was used in the previous Shannon Park Traffic Study; the distribution is based on previous studies completed in the area including: the BIO Transportation Review and the Wrights Cove Land Use and Transportation Plan.

Trips associated with the Shannon Park development were assigned to the three access points using the following trip assignment:

- 60 percent to/from “Main Street”,
- 15 percent to/from “Collector B”, and
- 25 percent to/from Nootka Avenue.

The trip assignment was developed based on the development concept and location of access points relative to the gateways in and out of the study area. The distribution and assignment of the vehicle trip estimates associated with the Shannon Park development and adjacent developments at the study intersections are shown diagrammatically in Appendix B.

## 7.0 Intersection Performance Analysis

### 7.1 Measures of Effectiveness

The performance of an intersection can be evaluated using a number of measures of effectiveness (MOEs), including level of service (LOS), delay, volume-to-capacity ratio (v/c) and vehicle queuing.

Level of service is a qualitative measure used to describe the level of performance of an intersection in terms of traffic movement. Level of service for intersections is defined in terms of delay, which is a measure of driver discomfort, frustration and increased travel time. The quality of traffic movement is divided into six levels ranging from A to F, where level of service A represents the best quality of traffic where the driver has the freedom to drive with free flow speed and level of service F represents the worst quality of traffic where the level of congestion is considered unacceptable to most drivers. The level of service criteria for intersections (Table 5) are stated in terms of average control delay per vehicle.

Table 5: Level of Service Criteria

Level of Service	Description	Signalized Intersection Control Delay	Unsignalized Intersection Control Delay
A	No congestion; most vehicles do not stop. <b>(Excellent)</b>	≤ 10 sec/veh	≤ 10 sec/veh
B	Very light congestion; some vehicles stop. <b>(Very Good)</b>	10-20 sec/veh	10-15 sec/veh
C	Light congestion; most vehicles stop. <b>(Good)</b>	20-35 sec/veh	15-25 sec/veh
D	Noticeable congestion; vehicles must sometimes wait through more than one red light. No long-standing queues are formed. <b>(Satisfactory)</b>	35-55 sec/veh	25-35 sec/veh
E	Congestion; vehicles must sometimes wait through more than one red light. Long-standing queues are formed. <b>(Unsatisfactory)</b>	55-80 sec/veh	35-50 sec/veh
F	Severe congestion; demand exceeds the capacity of the intersection. <b>(Unacceptable)</b>	≥ 80 sec/veh	≥ 50 sec/veh

The volume-to-capacity (v/c) ratio is a measure of how the peak hour traffic volume on an approach to an intersection compares to the theoretical maximum volume that could be accommodated on that intersection approach. As the v/c ratio approaches 1.0, the movement has reduced ability to accommodate any additional volume of traffic.

The 95<sup>th</sup> percentile queue (95th% queue) is the estimated length in metres of a queue of vehicles stopped on an intersection approach which is only exceeded five percent of the time. Since a stopped vehicle occupies approximately seven metres of queue length, a 95th% queue of 14 metres indicates that less than five times out of 100 the queue may exceed two vehicles on the approach. The 95th% queue is typically used to determine if sufficient vehicle storage is available to maintain efficient traffic flow.

## 7.2 Analysis Software

The Synchro Studio 10 software package was used to complete the intersection performance analysis for signalized and unsignalized intersections. The software package includes two modelling applications: Synchro, a macroscopic analysis and optimization application, and SimTraffic, a microsimulation and animation application. The two applications allow the analyst to analyze the intersections using two different approaches.

Synchro is used to analyze network intersections based on the methodology of the *Highway Capacity Manual* (6th edition) published by the Transportation Research Board. Synchro analyzes each intersection in isolation, while SimTraffic analyzes the network as a whole by simulating individual vehicles traversing the network. SimTraffic identifies interactions between adjacent intersections such as spillbacks from upstream and/or downstream intersections.

The Junctions 8 ARCADY software was used to complete the intersection performance analysis for roundabouts. ARCADY uses an empirical model based on the application of statistical regression of a large data set of observed roundabout operations in the United Kingdom.

## 8.0 Weekday Morning and Afternoon Peak Hour Analysis

The performance of the study intersections during the weekday AM and PM peak hours was evaluated under five scenarios to quantify the impact of the proposed development on the study area road network. The assessment scenarios included:

- Scenario 1 – Existing Conditions (2019): A scenario reflecting the existing conditions in the study area. This scenario provides an assessment of current operations based on existing traffic volumes, lane configurations and signal timing plans.
- Scenario 2 – Background Growth and Adjacent Developments (2027): A projection of normal traffic growth to the year 2027 and the projected traffic volumes associated adjacent developments. This scenario provides an assessment of future operations without the proposed development.
- Scenario 3 – Shannon Park Development (2027): A projection of background traffic volumes (from Scenario 2) and the projected traffic volumes associated with the Shannon Park development. This scenario provides an assessment of future operations with the proposed development in

place which is used to identify if improvements are required to accommodate the proposed development.

- Scenario 4 – Future Development Conditions with Improvements (2027): A projection of future background and development traffic volumes (from Scenario 3) with the proposed improvements. This scenario provides an assessment of future operations with the proposed improvements.
- Scenario 5 – Five-Year timeframe after Shannon Park Development (2032): A projection of normal traffic growth five-years after full build out of the Shannon Park development.

The following sections summarize the results of the weekday peak hour intersection performance analysis. The traffic volumes used in each scenario are shown diagrammatically in Appendix B.

### 8.1 Scenario 1 - Existing (2019)

Scenario 1 is an analysis of existing conditions throughout the study area. The traffic volumes for this scenario correspond to the peak one-hour period of traffic from the weekday morning (7:15 to 8:15 am) and afternoon peak periods (4:00 to 5:00pm).

The AM and PM traffic volumes used in this scenario and the Synchro level of service conditions are shown diagrammatically in Figure 5. A summary of the MOE results including delay, level of service, volume-to-capacity ratio and 95<sup>th</sup> percentile queue lengths can be found in Appendix C. The detailed Synchro and SimTraffic reports can be found in Appendix D.

Under existing conditions, all study intersections generally experience no congestion to light congestion during the weekday morning and afternoon peak hours. A few individual movements at the intersections of Princess Margaret Boulevard & MacKay Bridge (Dartmouth) and Windmill Road & Victoria Road experience longer delays and/or queues, however, the overall performance of all study intersections is acceptable during both weekday peak hours. The operations at each of the study intersections are described below:

- **Princess Margaret Boulevard & BIO Access:** The unsignalized intersection experiences no congestion (LOS A) during the peak hours; all movements operate at acceptable levels of service.
- **Princess Margaret Boulevard & MacKay Bridge (Halifax):** The unsignalized intersection experiences no congestion (LOS A) during the peak hours; all movements operate at acceptable levels of service.
- **Princess Margaret Boulevard & Baffin Boulevard:** The unsignalized intersection experiences no congestion (LOS A) during the peak hours; all movements operate at acceptable levels of service.
- **Princess Margaret Boulevard & MacKay Bridge (Dartmouth):** The unsignalized intersection experiences no congestion (LOS A) during the morning peak hour; all movements operate at acceptable levels of service.

The intersection experiences light congestion (LOS C) during the afternoon peak hour. The southbound movements (MacKay Bridge) operate at LOS F in Synchro; however, the SimTraffic analysis indicates that the southbound movements operate at acceptable levels of service.

- **Princess Margaret Boulevard & Iroquois Drive:** The unsignalized intersection experiences no congestion (LOS A) during the peak hours; all movements operate at acceptable levels of service.
- **Windmill Road & Victoria Road:** The signalized intersection experiences light congestion (LOS C) during the morning peak hour. The northbound left movement (Windmill Road) operates at LOS E in Synchro; however, the SimTraffic analysis indicates that the movement operates at an acceptable level of service.

The intersection experiences light congestion (LOS C) during the afternoon peak hour; all movements operate at acceptable levels of service.

- **Windmill Road & Princess Margaret Boulevard:** The signalized intersection experiences very light congestion (LOS B) during the peak hours; all movements operate at acceptable levels of service.

The 95th% queue lengths for the eastbound right movement (Princess Margaret Boulevard) indicate that existing queues exceed the storage capacity of the right turn lane during the afternoon peak hour.

- **Windmill Road & Nootka Avenue:** The unsignalized intersection experiences no congestion (LOS A) during the peak hours; all movements operate at acceptable levels of service.
- **Windmill Road & Albro Lake Road:** The signalized intersection experiences no congestion (LOS A) during the peak hours; all movements operate at acceptable levels of service.

The 95th% queue lengths for the southbound left movement (Windmill Road) indicate that existing queues exceed the storage capacity of the left turn lane during the afternoon peak hour.

## 8.2 Scenario 2 – Background Growth and Adjacent Developments (2027)

Scenario 2 is an analysis of future conditions throughout the study area without the proposed development. The traffic volumes for this scenario reflect to the existing traffic volumes from Scenario 1 factored using a growth rate of 1.0 percent per year over eight years (2019-2032) to account for background traffic growth and the projected traffic volumes associated with adjacent developments in the study area, including BIO and 396-400 Windmill Road.

The AM and PM traffic volumes used in this scenario and the Synchro level of service conditions are shown diagrammatically in Figure 6. A summary of the MOE results including delay, level of service, volume-to-capacity ratio and 95<sup>th</sup> percentile queue lengths can be found in Appendix C. The detailed Synchro and SimTraffic reports can be found in Appendix D.

Under future background conditions, congestion levels increase throughout the study area. Background traffic growth and adjacent developments contribute to the deterioration of existing operational problems at the intersections of Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound) and Windmill Road & Victoria Road. The operations at each of the study intersections are described below:

- **Princess Margaret Boulevard & BIO Access:** The unsignalized intersection will experience no congestion (LOS A) during the peak hours; all movements will continue to operate at acceptable levels of service.

- **Princess Margaret Boulevard & MacKay Bridge (Halifax-bound):** The unsignalized intersection will experience no congestion (LOS A) during the peak hours; all movements will continue to operate at acceptable levels of service.
- **Princess Margaret Boulevard & Baffin Boulevard:** The unsignalized intersection will experience no congestion (LOS A) during the peak hours; all movements will continue to operate at acceptable levels of service.
- **Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound):** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour; all movements will continue to operate at acceptable levels of service.

The intersection will experience severe congestion (LOS F) during the afternoon peak hour. The southbound movements (MacKay Bridge) will continue to operate at LOS F in Synchro. The southbound approach will be over capacity and experience 95<sup>th</sup> percentile queues greater than 150 metres. However, the SimTraffic analysis indicates that the southbound movements will operate at LOS E with 95<sup>th</sup> percentile queues under 100 metres.

- **Princess Margaret Boulevard & Iroquois Drive:** The unsignalized intersection will experience no congestion (LOS A) during the peak hours; all movements will continue to operate at acceptable levels of service.
- **Windmill Road & Victoria Road:** The signalized intersection will experience noticeable congestion (LOS D) during the morning peak hour. The northbound left movement (Windmill Road) will continue to operate at LOS E and the eastbound through movement (Windmill Road) will be over capacity and operate at LOS E in Synchro. The SimTraffic analysis indicates that these movements will operate at acceptable levels of service, but the southbound through movement (Lynch Estates Court) will operate at LOS E.

The intersection will experience light congestion (LOS C) during the afternoon peak hour; all movements will continue to operate at acceptable levels of service.

- **Windmill Road & Princess Margaret Boulevard:** The signalized intersection will experience very light (LOS B) congestion during the morning peak hour; all movements will continue to operate at acceptable levels of service.

The signalized intersection will experience light congestion (LOS C) during the afternoon peak hour; all movements will continue to operate at acceptable levels of service.

The 95th% queue lengths for the eastbound right movement (Princess Margaret Boulevard) will continue to exceed the storage capacity of the right turn lane during the afternoon peak hour and be nearing the capacity of the right turn lane during the morning peak hour. The 95th% queue lengths for the northbound left movement (Windmill Road) will exceed the storage capacity of the left turn lane during the afternoon peak hour.

- **Windmill Road & Nootka Avenue:** The unsignalized intersection will experience no congestion (LOS A) during the peak hours; all movements will continue to operate at acceptable levels of service.
- **Windmill Road & Albro Lake Road:** The signalized intersection will experience no congestion (LOS A) during the morning peak hour; all movements will continue to operate at acceptable levels of service.

The intersection will experience very light congestion (LOS B) during the afternoon peak hour; all movements will continue to operate at acceptable levels of service.

The 95th% queue lengths for the southbound left movement (Windmill Road) will continue to exceed the storage capacity of the left turn lane during the afternoon peak hour.



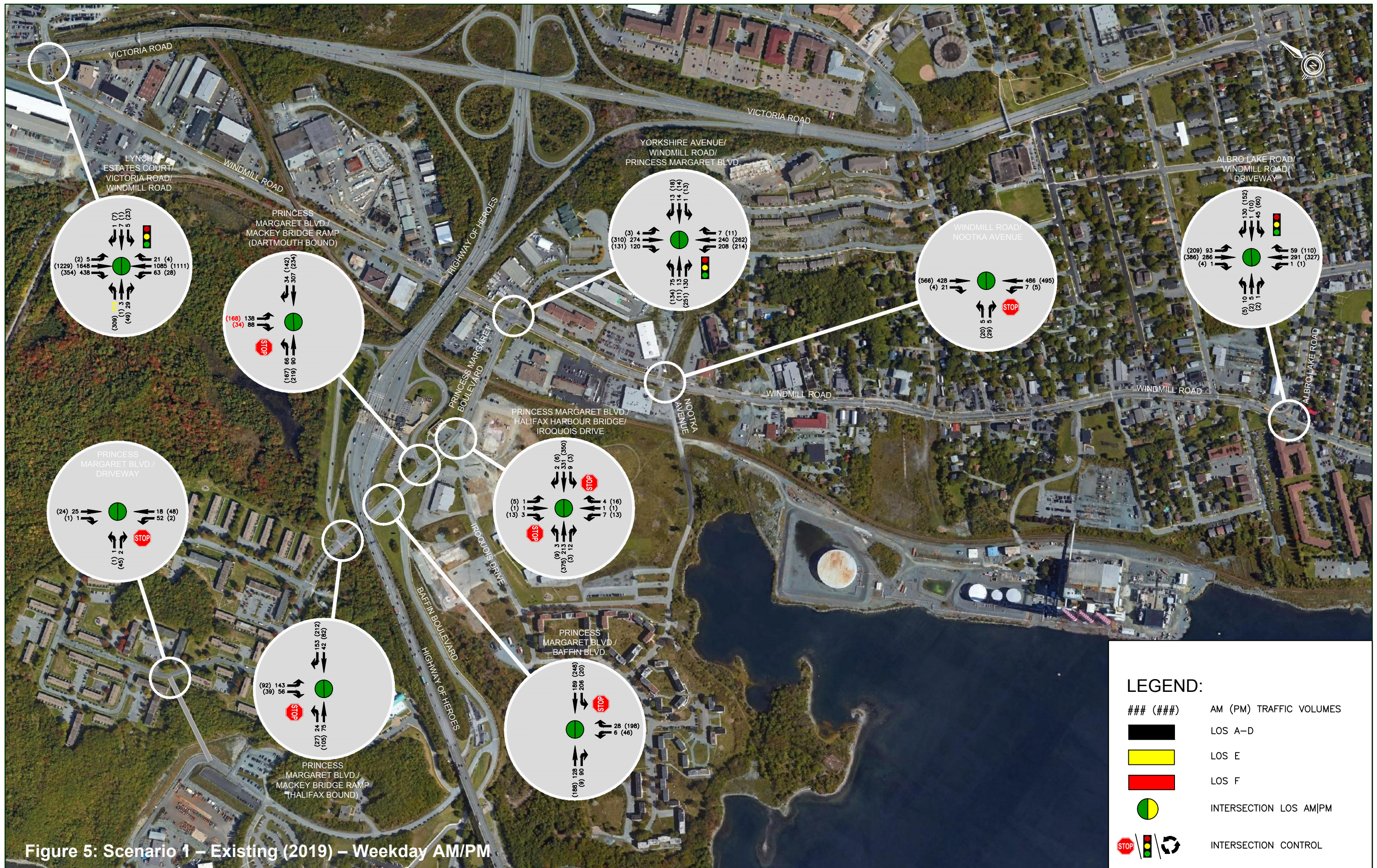


Figure 5: Scenario 1 – Existing (2019) – Weekday AM/PM

**LEGEND:**

### (###)	AM (PM) TRAFFIC VOLUMES
	LOS A–D
	LOS E
	LOS F
	INTERSECTION LOS AM PM
	INTERSECTION CONTROL



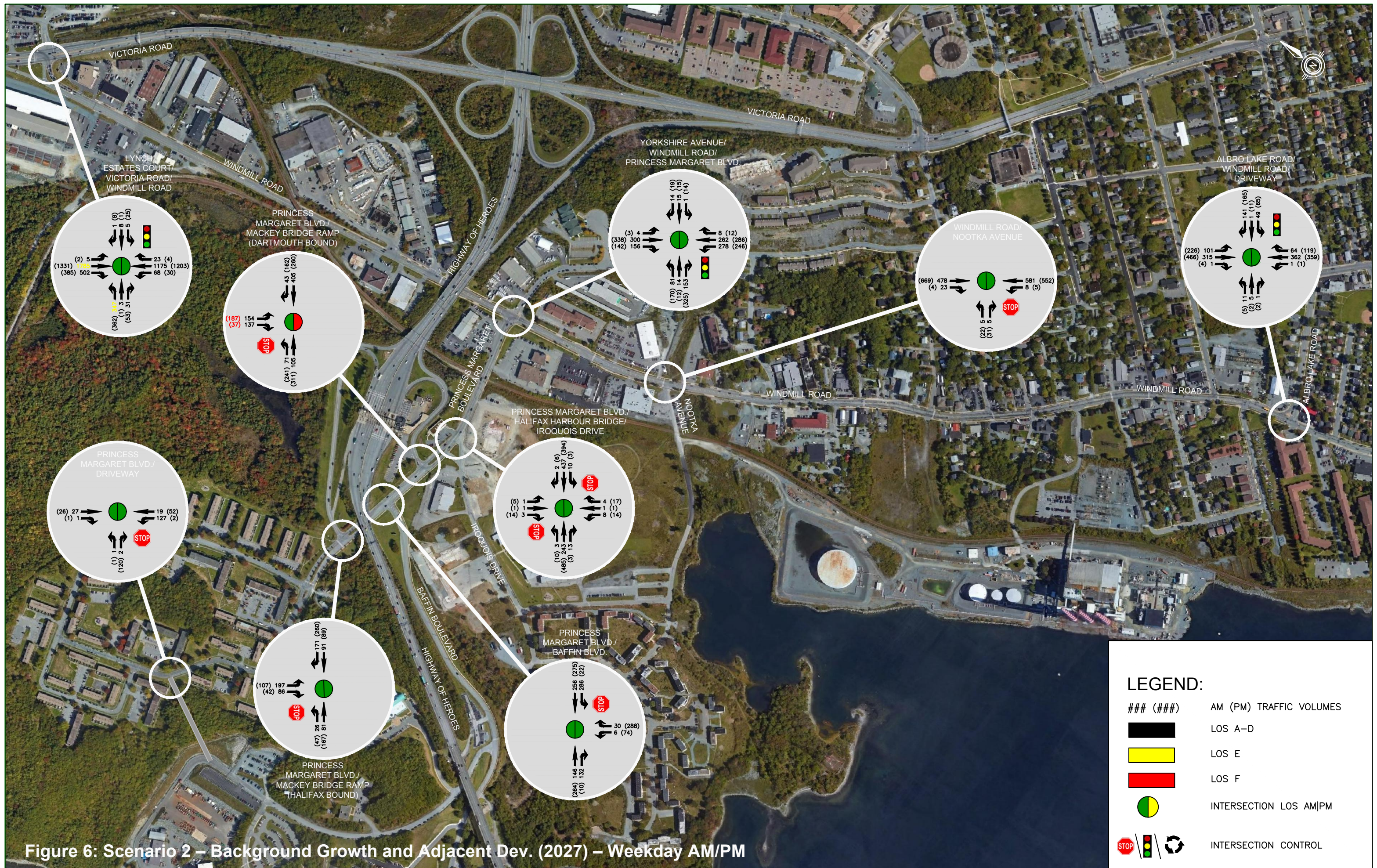


Figure 6: Scenario 2 – Background Growth and Adjacent Dev. (2027) – Weekday AM/PM



### 8.3 Scenario 3 – Shannon Park Development (2027)

Scenario 3 is an analysis of future conditions throughout the study area with the full build-out of the Shannon Park development. The traffic volumes for this scenario reflect the future background traffic volumes from Scenario 2 and the projected traffic volumes associated with the Shannon Park development.

The AM and PM traffic volumes used in this scenario and the Synchro level of service conditions are shown diagrammatically in Figure 7. A summary of the MOE results including delay, level of service, volume-to-capacity ratio and 95<sup>th</sup> percentile queue lengths can be found in Appendix C. The detailed Synchro and SimTraffic reports can be found in Appendix D.

The Shannon Park development contributes to the deterioration of existing operational problems and creates operational problems with individual movements at all study intersections with the exception of Princess Margaret Boulevard & BIO Access and Windmill Road & Albro Lake Road. The impacts of the development on operations at each of the study intersections are discussed below:

- **Princess Margaret Boulevard & BIO Access:** The unsignalized intersection will experience no congestion (LOS A) during the peak hours; all movements will continue to operate at acceptable levels of service.
- **Princess Margaret Boulevard & MacKay Bridge (Halifax-bound):** The unsignalized intersection will experience very light congestion (LOS B) during the morning peak hour; all movements will continue to operate at acceptable levels of service.

The intersection will experience severe congestion (LOS F) during the afternoon peak hour. The development will cause the southbound movements (MacKay Bridge) to operate at LOS F in Synchro. The southbound approach will be over capacity and experience 95<sup>th</sup> percentile queues greater than 150 metres. However, the SimTraffic analysis indicates that the southbound movements will operate at acceptable levels of service with 95<sup>th</sup> percentile queues under 100 metres.

- **Princess Margaret Boulevard & Baffin Boulevard:** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour. The northbound left movement (Baffin Boulevard) will operate at LOS E in Synchro; however, the SimTraffic analysis indicates that the movement will operate at an acceptable level of service.

The intersection will experience light congestion (LOS C) during the afternoon peak hour. The northbound movements (Baffin Boulevard) will operate at LOS F in Synchro; however, the SimTraffic analysis indicates that the movements will operate at acceptable levels of service.

The 95<sup>th</sup> percentile queue lengths for the northbound left movement will exceed the storage capacity of the left turn lane during the afternoon peak hour.

- **Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound) / "Main Street":** The main access to the development will become the fourth leg to the unsignalized intersection. The development will deteriorate existing operational problems at the intersection. The unsignalized

intersection will experience severe congestion (LOS F) during the morning and afternoon peak hours. The development will cause the northbound movements ("Main Street") and southbound movements (MacKay Bridge) to be over capacity and operate at LOS F during both peak hours. The southbound approach will experience 95<sup>th</sup> percentile queues that will back up onto the MacKay Bridge toll plaza.

- **Princess Margaret Boulevard & "Collector B" (formerly Iroquois Drive):** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour. The development will cause the northbound movements ("Collector B") to operate at LOS F in Synchro; however, the SimTraffic analysis indicates that the northbound movements will operate at acceptable levels of service.

The intersection will experience light congestion (LOS C) during the afternoon peak hour. The development will cause the northbound movements ("Collector B") to be over capacity and operate at LOS F in Synchro; however, the SimTraffic analysis indicates that the northbound movements will operate at acceptable levels of service.

- **Windmill Road & Victoria Road:** The signalized intersection will experience noticeable congestion (LOS D) during the morning peak hour. The northbound left movement (Windmill Road) and the eastbound through movement (Windmill Road) will continue to operate at LOS E; the development will cause the northbound through and right movements to operate at LOS E in Synchro. However, the SimTraffic analysis continues to indicate that these movements will operate at acceptable levels of service.

The intersection will experience light congestion (LOS C) during the afternoon peak hour; all movements will continue to operate at acceptable levels of service

- **Windmill Road & Princess Margaret Boulevard:** The signalized intersection will experience light congestion (LOS C) during the morning peak hour; all movements will continue to operate at acceptable levels of service.

The intersection will experience noticeable congestion (LOS D) during the afternoon peak hour. The development will cause the northbound left movement (Windmill Road) to be over capacity and operate at LOS F in Synchro. However, the SimTraffic analysis indicates that the movement will operate at an acceptable level of service, but the southbound left and through movements (Windmill Road) will operate at LOS E.

The 95<sup>th</sup> queue lengths for the eastbound right movement (Princess Margaret Boulevard) and the northbound left movement (Windmill Road) will exceed the storage capacity of the turning lanes during both peak hours.

- **Windmill Road & Nootka Avenue:** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour. The development will cause the eastbound movements (Nootka Avenue) to operate at LOS E in Synchro; however, the SimTraffic analysis indicates that the eastbound movements will operate at acceptable levels of service.

The intersection will experience light congestion (LOS C) during the afternoon peak hour. The development will cause the eastbound movements (Nootka Avenue) to be over capacity and operate at LOS F in Synchro. However, the SimTraffic analysis indicates that the eastbound left movement will operate at LOS E while the eastbound right movement will operate at an acceptable level of service.

- **Windmill Road & Albro Lake Road:** The signalized intersection will experience no congestion (LOS A) during the morning peak hour; all movements will continue to operate at acceptable levels of service.

The intersection will experience very light congestion (LOS B) during the afternoon peak hour; all movements will continue to operate at acceptable levels of service.

The 95th% queue lengths for the southbound left movement (Windmill Road) will continue to exceed the storage capacity of the left turn lane during the afternoon peak hour and be nearing the capacity of the left turn lane during the morning peak hour.

#### 8.4 Scenario 4 – Shannon Park Development with Improvements (2027)

Scenario 4 is an analysis of future conditions throughout the study area with the full build-out of the Shannon Park development with road network improvements in place to mitigate the impact of the development. The traffic volumes for this scenario reflect the future background traffic volumes and the projected traffic volumes associated with the Shannon Park development from Scenario 3.

The following road network improvements are included in this scenario:

- **Princess Margaret Boulevard & MacKay Bridge (Halifax):** A left-turn storage lane (60 metres) on the MacKay Bridge approach is recommended to separate the left turn movement and improve operations for the right turn movement.
- **Princess Margaret Boulevard & MacKay Bridge (Dartmouth)/"Main Street":** The intersection experiences poor levels of service and longer queues on the MacKay Bridge approach under existing and future background conditions; these operational problems are further exacerbated when the main entrance to the Shannon Park development is added as a fourth leg to the intersection. The future traffic volumes at the intersection cannot be accommodated by an unsignalized intersection (two-way stop control), a higher form of traffic control is required at the intersection.

Installing a traffic signal at the intersection would improve operations but create significant queues on Princess Margaret Boulevard that would impact the CN at-grade crossing and operations at adjacent intersections. A single-lane roundabout with an eastbound right turn bypass is recommended to improve operations while minimizing queuing on the MacKay Bridge approach and Princess Margaret Boulevard.

- **Princess Margaret Boulevard & "Collector B" (formerly Iroquois Drive):** A left-turn storage lane (25 metres) on the Princess Margaret Boulevard westbound approach is recommended to separate the left turn movement. Westbound queues greater than 90 metres on the Princess

Margaret Boulevard approach would impact the CN at-grade crossing on Princess Margaret Boulevard, the storage lane will reduce queue lengths on the approach. The “Collector B” approach should be constructed with a left-turn storage lane (50 metres) to separate the left turn movement and improve operations for the right turn movement.

- **Windmill Road & Princess Margaret Boulevard:** A left turn storage lane (70 metres) on the Princess Margaret Boulevard eastbound approach is recommended to separate the left turn movement, it is also recommended that the existing right turn storage lane be extended to 50 metres. Eastbound queues greater than 100 metres on the Princess Margaret Boulevard approach would impact the CN at-grade crossing on Princess Margaret Boulevard, the new lane configuration will minimize queue lengths on the approach. A right turn storage lane (40 metres) on the Windmill Road southbound is also recommended to separate the high-volume right turn movement from the through movement and improve operations for both movements.
- **Windmill Road & Nootka Avenue:** A left-turn storage lane (25 metres) on the Nootka Avenue approach is recommended to separate the left turn movement and improve operations for the right turn movement. Queues greater than 75 metres on the Nootka Avenue approach would impact the CN at-grade crossing on Nootka Avenue, the storage lane will minimize queue lengths on the approach.

The AM and PM traffic volumes used in this scenario and the Synchro level of service conditions are shown diagrammatically in Figure 8. A summary of the MOE results including delay, level of service, volume-to-capacity ratio and 95<sup>th</sup> percentile queue lengths can be found in Appendix C. The detailed Synchro and SimTraffic reports can be found in Appendix D.

The proposed improvements improve operations at the five intersections where improvements were proposed. The impacts of the improvements on operations at each of the study intersections are described below:

- **Princess Margaret Boulevard & BIO Access:** No improvements were proposed for the unsignalized intersection, conditions will remain the same during both peak hours. The intersection will continue to experience no congestion (LOS A) during the peak hours; all movements will operate at acceptable levels of service.
- **Princess Margaret Boulevard & MacKay Bridge (Halifax-bound):** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour; all movements will continue to operate at acceptable levels of service. Average delay per vehicle at the intersection will be reduced by approximately 3.0 seconds.

The intersection will experience congestion (LOS E) during the afternoon peak hour. The new lane configuration on the southbound approach (MacKay Bridge) will improve operations for the southbound right movement to an acceptable level of service while the left movement will continue to be over capacity and operate at LOS F in Synchro. Average delay per vehicle at the intersection will be reduced by approximately 14.5 seconds. The SimTraffic analysis continues to indicate that the southbound left movement will operate at an acceptable level of service.

- **Princess Margaret Boulevard & Baffin Boulevard:** No improvements were proposed for the unsignalized intersection, conditions will remain the same during both peak hours. The unsignalized intersection will continue experience no congestion (LOS A) during the morning peak hour and light congestion (LOS C) during the afternoon peak hour, with operational issues on Baffin Boulevard during both peak hours.
- **Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)/" Main Street":** The roundabout will experience no congestion (LOS A) during the morning and afternoon peak hours; all movements will operate at acceptable levels of service with 95<sup>th</sup> percentile queues lengths under 15 metres on all approaches.
- **Princess Margaret Boulevard & "Collector B" (formerly Iroquois Drive):** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour. The new lane configuration on the northbound approach ("Collector B") will improve operations for the northbound through and right movements to acceptable levels of service while the northbound left movement will continue to operate at LOS F in Synchro. Average delay per vehicle at the intersection will be reduced by approximately 3.0 seconds. The SimTraffic analysis continues to indicate that the northbound left movement will operate at an acceptable level of service.

The intersection will experience very light congestion (LOS B) during the afternoon peak hour. The new lane configuration will improve operations for the northbound through and right movements to acceptable levels of service while the northbound left movement will continue to operate at LOS F in Synchro. The northbound movements will no longer be over capacity. Average delay per vehicle at the intersection will be reduced by approximately 10.0 seconds. The SimTraffic analysis continues to indicate that the northbound left movement will operate at an acceptable level of service.

The 95<sup>th</sup> percentile queue lengths on the Princess Margaret westbound approach indicate that the intersection queues will not impact the at-grade CN rail crossing. It should be noted that there will be residual capacity at the roundabout at the "Main Street" access to accommodate additional traffic volumes should left turning traffic at the "Collector B" access redistribute to "Main Street" to avoid delays.

- **Windmill Road & Victoria Road:** No improvements were proposed for the signalized intersection, conditions will remain the same during both peak hours. The intersection will continue to experience noticeable congestion (LOS D) during the morning peak hour with operational issues for the eastbound and northbound movements and light congestion (LOS C) during the afternoon peak hour.
- **Windmill Road & Princess Margaret Boulevard:** The signalized intersection will experience very light congestion (LOS B) during the morning peak hour; all movements will continue to operate at acceptable levels of service. Average delay per vehicle at the intersection will be reduced by approximately 7.5 seconds.

The intersection will experience very light congestion (LOS B) during the afternoon peak hour; all movements will operate at acceptable levels of service. Average delay per vehicle at the intersection will be reduced by approximately 21.5 seconds.

The 95<sup>th</sup> percentile queue lengths on the Princess Margaret eastbound approach indicate that intersection queues will not impact the at-grade CN rail crossing.

- **Windmill Road & Nootka Avenue:** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour. The new lane configuration on the eastbound approach (Nootka Avenue) will improve operations for the eastbound right movement to an acceptable level of service while the eastbound left movement will operate at LOS F in Synchro. The SimTraffic analysis continues to indicate that the eastbound left movement will operate at an acceptable level of service. Average delay per vehicle at the intersection will be reduced by approximately 3.4 seconds.

The intersection will experience no congestion (LOS A) during the afternoon peak hour. The new lane configuration will improve operations for the eastbound right movement to an acceptable level of service while the eastbound left movement will continue to operate at LOS F in Synchro. The eastbound movements will no longer be over capacity. The SimTraffic analysis indicates that the eastbound left movement will operate at LOS E. Average delay per vehicle at the intersection will be reduced by approximately 9.5 seconds.

The 95<sup>th</sup> percentile queue lengths on the Nootka Avenue approach indicate that intersection queues will not impact the at-grade CN rail crossing.

- **Windmill Road & Albro Lake Road:** No improvements were proposed for the signalized intersection, conditions will remain the same during both peak hours. The signalized intersection will continue to experience no congestion (LOS A) during the morning peak hour and very light congestion (LOS B) during the afternoon peak hour; all movements will operate at acceptable levels of service.



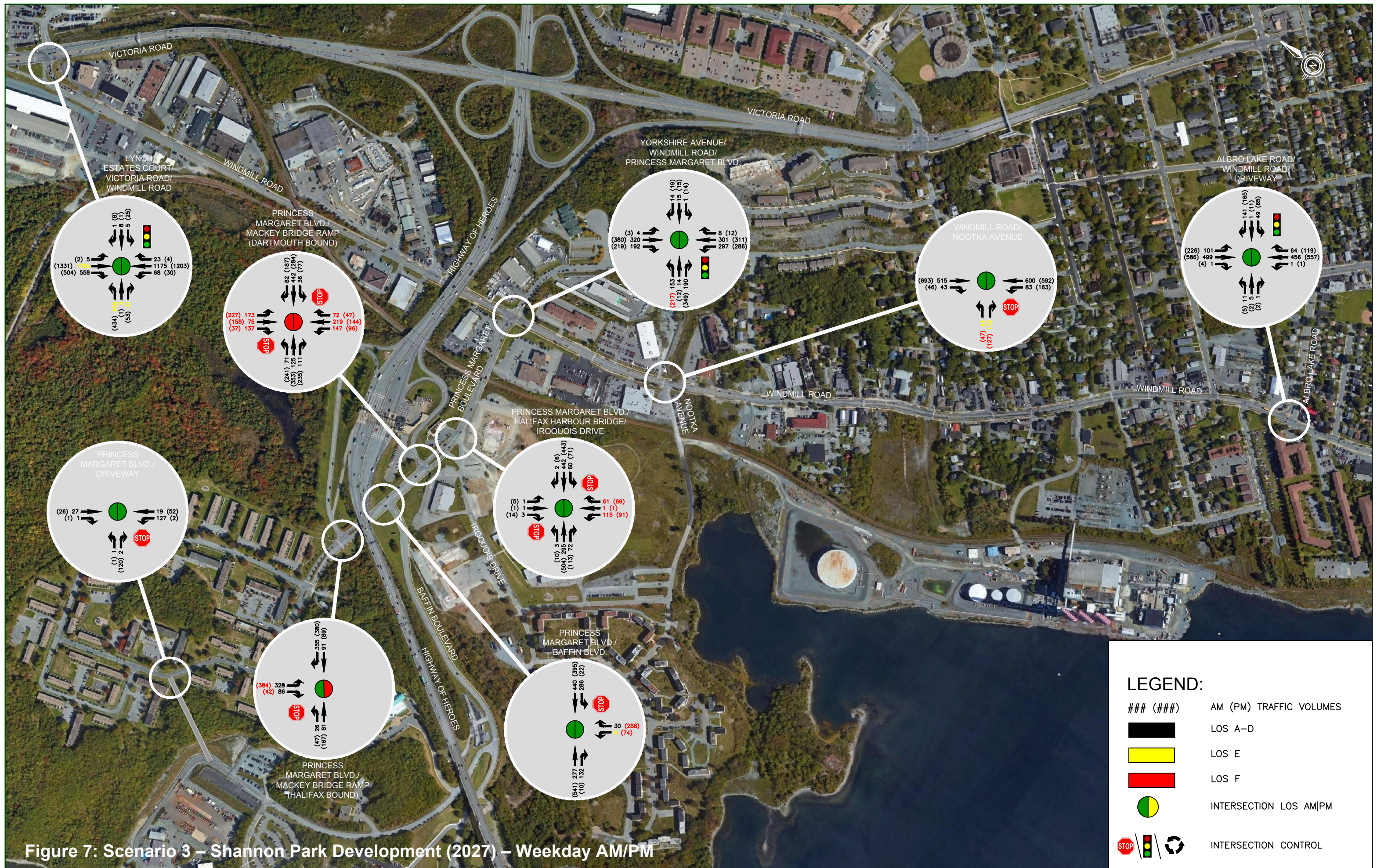
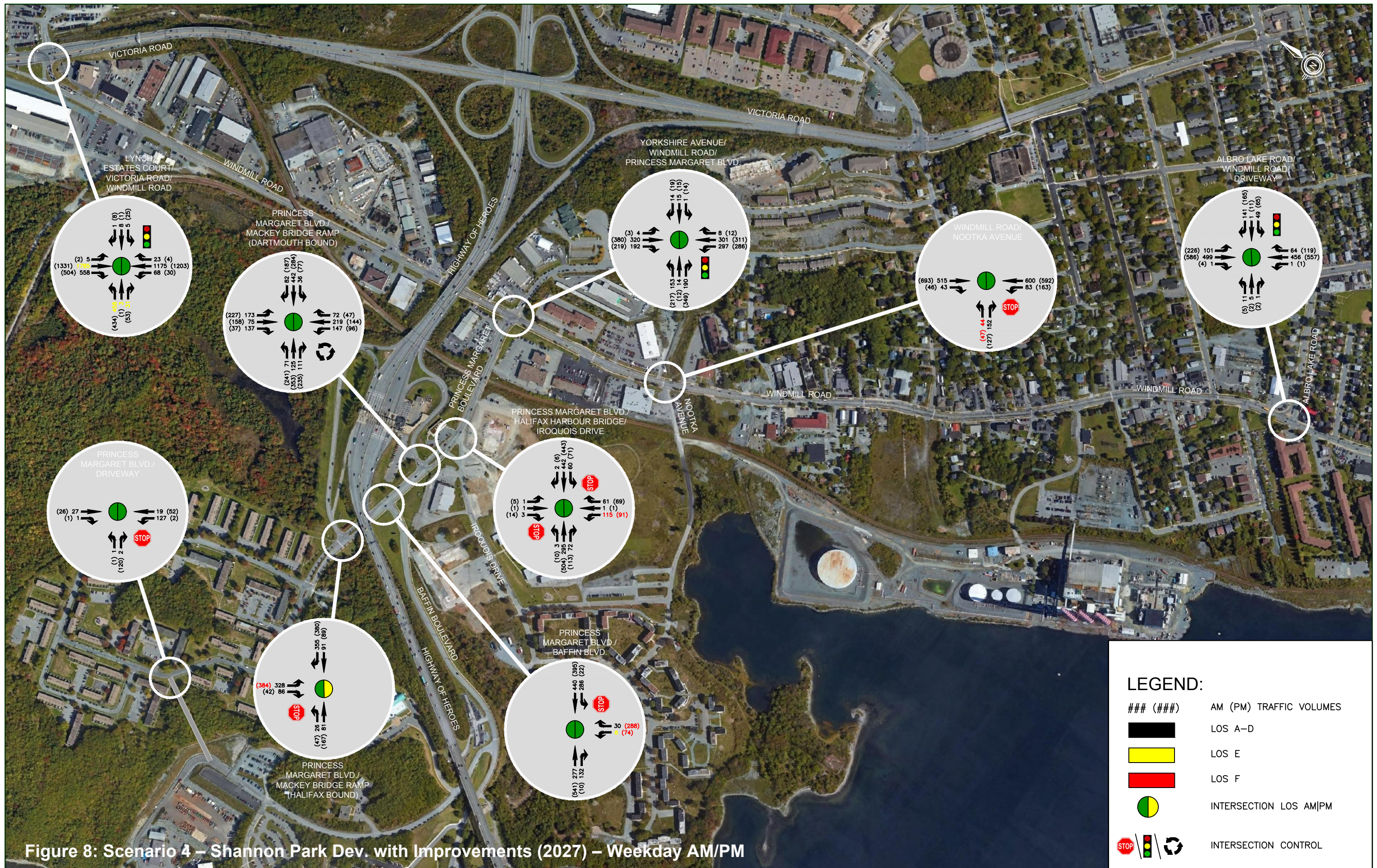


Figure 7: Scenario 3 – Shannon Park Development (2027) – Weekday AM/PM







### 8.5 Scenario 5 – Five-year Timeframe after Shannon Park Development (2032)

Scenario 5 is an analysis of future conditions throughout the study area five years after the full build-out of the Shannon Park development. The traffic volumes for this scenario reflect the future background traffic volumes and the projected traffic volumes associated with the Shannon Park development from Scenario 3 factored using a growth rate of 1.0 percent per year over five years (2027-2032) to account for background traffic growth. The road network reflects the proposed improvements from Scenario 4.

The AM and PM traffic volumes used in this scenario and the Synchro level of service conditions are shown diagrammatically in Figure 9. A summary of the MOE results including delay, level of service, volume-to-capacity ratio and 95<sup>th</sup> percentile queue lengths can be found in Appendix C. The detailed Synchro and SimTraffic reports can be found in Appendix D. Traffic growth will increase congestion levels throughout the study area and contribute to the deterioration of operational problems with individual movements. The operations at each of the study intersections are described below:

- **Princess Margaret Boulevard & BIO Access:** The unsignalized intersection will experience no congestion (LOS A) during the peak hours; all movements will continue to operate at acceptable levels of service.
- **Princess Margaret Boulevard & MacKay Bridge (Halifax-bound):** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour; all movements will continue to operate at acceptable levels of service.

The intersection will experience severe congestion (LOS F) during the afternoon peak hour. The southbound left movement (MacKay Bridge) will continue to be over capacity and operate at LOS F in Synchro. The SimTraffic analysis continues to indicate that the movement will operate at an acceptable level of service.

- **Princess Margaret Boulevard & Baffin Boulevard:** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour. The northbound left movement (Baffin Boulevard) will deteriorate to LOS F in Synchro; however, the SimTraffic analysis continues to indicate that the movement will operate at an acceptable level of service.

The intersection will experience light congestion (LOS C) during the afternoon peak hour. The northbound movements (Baffin Boulevard) will continue to operate at LOS F in Synchro; the right movement will be over capacity. The SimTraffic analysis indicates that the northbound right movement will operate at an acceptable level of service and the northbound left movement will operate at LOS E. The 95<sup>th</sup> percentile queue lengths for the northbound left movement will continue to exceed the storage capacity of the left turn lane during the afternoon peak hour.

- **Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)/"Main Street":** The roundabout will experience no congestion (LOS A) during the morning and afternoon peak hours; all movements will continue to operate at acceptable levels of service with 95<sup>th</sup> percentile queues lengths under 30 metres on all approaches.
- **Princess Margaret Boulevard & "Collector B" (formerly Iroquois Drive):** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour. The northbound

left movement ("Collector B") will continue to operate at LOS F in Synchro. The SimTraffic analysis continues to indicate that the movement will operate at an acceptable level of service.

The unsignalized intersection will experience light congestion (LOS C) during the afternoon peak hour. The northbound left movement ("Collector B") will be over capacity and continue to operate at LOS F in Synchro. The SimTraffic analysis continues to indicate that the movement will operate at an acceptable level of service. The 95<sup>th</sup> percentile queue lengths on the Princess Margaret westbound approach continue to indicate that intersection queues will not impact the at-grade CN rail crossing.

- **Windmill Road & Victoria Road:** The signalized intersection will experience congestion (LOS E) during the morning peak hour. The northbound movements (Windmill Road) will continue to operate at LOS E and the eastbound through movement (Windmill Road) will deteriorate to LOS F in Synchro. The SimTraffic analysis continues to indicate that these movements will operate at acceptable levels of service.

The intersection will experience light congestion (LOS C) during the afternoon peak hour; all movements will continue to operate at acceptable levels of service.

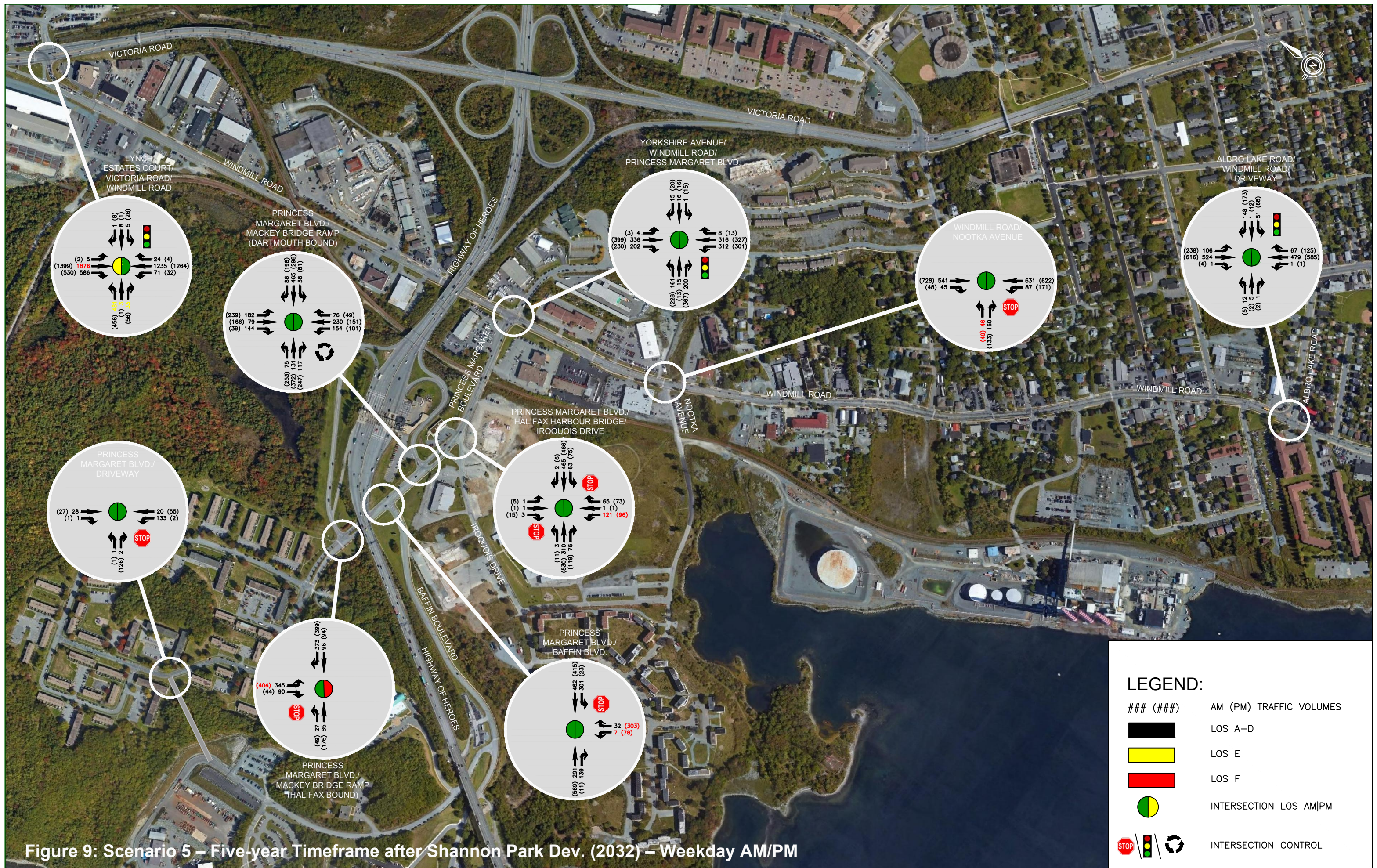
- **Windmill Road & Princess Margaret Boulevard:** The signalized intersection will experience very light congestion during the morning peak hour; all movements will continue to operate at acceptable levels of service. The 95<sup>th</sup> percentile queue lengths on the Princess Margaret eastbound approach continue to indicate that intersection queues will not impact the at-grade CN rail crossing.
- **Windmill Road & Nootka Avenue:** The unsignalized intersection will experience no congestion (LOS A) during the morning peak hour. The eastbound left movement (Nootka Avenue) will continue to operate at LOS F in Synchro. The SimTraffic analysis continues to indicate that the movement will operate at an acceptable level of service.

The unsignalized intersection will experience no congestion (LOS A) during the afternoon peak hour. The eastbound left movement (Nootka Avenue) will continue to operate at LOS F in Synchro. The SimTraffic analysis continues to indicate that the movement will operate at LOS E. The 95<sup>th</sup> percentile queue lengths on the Nootka Avenue approach continue to indicate that intersection queues will not impact the at-grade CN rail crossing.

- **Windmill Road & Albro Lake Road:** The signalized intersection will experience no congestion (LOS A) during the morning peak hour; all movements will continue to operate at acceptable levels of service.

The intersection will experience very light congestion (LOS B) during the afternoon peak hour; all movements will continue to operate at acceptable levels of service in Synchro. The SimTraffic analysis indicates that the southbound left movement (Windmill Road) will operate at LOS E. The 95<sup>th</sup> percentile queue lengths for the southbound left movement will continue to exceed the storage capacity of the left turn lane during the afternoon peak hour.







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## 9.0 Princess Margaret Boulevard Corridor Analysis

The intersection performance analysis identified a number of road network improvements required along Princess Margaret Boulevard to mitigate the impact of the Shannon Park development. Under existing conditions, the Princess Margaret Boulevard corridor includes unsignalized intersections with minor street stop control; traffic flows freely along the entire length of the corridor until the signalized intersection at Windmill Road. The proposed improvements include changes to intersection controls along the corridor, such as roundabout at the Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)/ 'Main Street' intersection, which will introduce delay and queues along the corridor.

The intersections along Princess Margaret Boulevard are closely spaced making it important to identify interactions between adjacent intersections. Different types of software were used to model the intersections based on the type of intersection control. While the queue length results from the various analyses are a good indicator of intersections between adjacent intersections, a supplemental corridor analysis was completed along Princess Margaret Boulevard to confirm the results of the intersection performance analysis completed using Synchro and Arcady. PTV Vissim was used to complete the corridor analysis PTV Vissim is a microscopic multi-modal traffic flow simulation software.

The study area for the corridor analysis was limited to the section of Princess Margaret Boulevard from the ramps to the MacKay Bridge toll plaza to Windmill Road. Five study intersections were included in the analysis:

- Princess Margaret Boulevard & MacKay Bridge (Halifax-bound)
- Princess Margaret Boulevard & Baffin Boulevard
- Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)
- Princess Margaret Boulevard & Iroquois Drive
- Princess Margaret Boulevard & Windmill Road

The performance of the study intersections during the weekday AM and PM peak hours was reevaluated under two of the previous scenarios to evaluate the interactions between adjacent intersections (unsignalized, signalized and roundabout), identify any potential impacts to the at-grade rail crossing on Princess Margaret Boulevard and confirm the proposed improvements. The assessment scenarios included:

- Scenario 1 – Existing (2019)
- Scenario 5 – Five-Year timeframe after Shannon Park Development (2032)

The Vissim models were developed from the MacKay Bridge toll model provided by HHB. It should be noted that the models do not include dynamic assignment.

The following sections summarize the results of the weekday peak hour corridor analysis. The traffic volumes used in each scenario correspond to the traffic volumes used in the intersection performance analysis for each scenario, the volumes shown diagrammatically in Appendix B.

### 9.1 Scenario 1 – Existing (2019)

Scenario 1 is an analysis of existing conditions on Princess Margaret Boulevard. The traffic volumes for this scenario correspond to the peak one-hour period of traffic from the weekday morning (7:15 to 8:15 am) and afternoon peak periods (4:00 to 5:00pm).

The MOE results including delay, level of service and queue lengths are summarized in Table 6. The detailed Vissim outputs can be found in Appendix E. The results of the Vissim analysis are consistent with the Synchro/SimTraffic results; all intersections operate at acceptable levels of service.

### 9.2 Scenario 5 – Five-Year Timeframe after Shannon Park Development (2032)

Scenario 5 is an analysis of future conditions on Princess Margaret Boulevard five years after the full build-out of the Shannon Park development. The traffic volumes for this scenario reflect the future background traffic volumes and the projected traffic volumes associated with the Shannon Park development factored using a growth rate of 1.0 percent per year over five years (2027-2032) to account for background traffic growth.

The road network reflects the proposed road network improvements, including:

- Left turn lane on the MacKay Bridge (Halifax-bound) approach
- Single lane roundabout at Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)
- Left turn lane on Princess Margaret Boulevard at 'Collector B'
- Lane reconfiguration at Princess Margaret Boulevard & Windmill Road

In addition, the MacKay Bridge ramps were modelled as merge lanes to a free-flow highway to represent the future automated toll system.

The MOE results including delay, level of service and queue lengths are summarized in Table 7. The detailed Vissim outputs can be found in Appendix E. The results of the Vissim analysis are consistent with the Synchro/SimTraffic results for the morning peak hour; all intersections will operate at acceptable levels of service.

The results of the Vissim analysis are consistent with the Synchro/SimTraffic results for the afternoon peak hour:

- Princess Margaret Boulevard & MacKay Bridge (Halifax): Higher delays (LOS F) and queues will be observed on the MacKay Bridge (Halifax) ramp. The queue lengths will not impact the toll plaza.
- Princess Margaret Boulevard & 'Collector B': Higher delays (LOS E) will be observed on 'Collector B' for the northbound left turn movement.

All other intersections will operate at acceptable levels of service. The queue lengths on the Princess Margaret Boulevard will not impact the at-grade CN rail crossing and the queue lengths on the MacKay Bridge ramps will not impact the toll plaza.

Table 6: Scenario 1 – Existing (2019) Weekday AM/PM Corridor Analysis

Scenario 1 - Existing (2019)		PTV Vissim							
Intersection		Weekday AM Peak Hour				Weekday PM Peak Hour			
		Delay (s/veh)	LOS	Average Queue (m)	Max Queue (m)	Delay (s/veh)	LOS	Average Queue (m)	Max Queue (m)
<b>Princess Margaret Boulevard &amp; MacKay Bridge (Halifax)</b>		<b>3.9</b>	<b>A</b>			<b>2.5</b>	<b>A</b>		
Princess Margaret Boulevard	EB-L	2.4	A	0.0	8.2	3.0	A	0.1	9.4
	EB-T	0.0	A	0.0	0.0	0.0	A	0.0	0.5
	WB-T	1.0	A	0.0	0.0	1.2	A	0.0	0.0
	WB-R	0.6	A	0.0	0.0	0.8	A	0.0	0.0
MacKay Bridge (Halifax)	SB-L	9.1	A	2.9	34.1	8.1	A	1.7	24.6
	SB-R	7.3	A	3.3	35.7	6.5	A	1.9	26.1
<b>Princess Margaret Boulevard &amp; Baffin Boulevard</b>		<b>1.3</b>	<b>A</b>			<b>3.1</b>	<b>A</b>		
Princess Margaret Boulevard	EB-T	0.8	A	0.0	0.0	0.9	A	0.0	0.0
	EB-R	0.5	A	0.0	0.0	0.5	A	0.0	0.0
	WB-L	2.1	A	0.2	19.0	1.6	A	0.0	6.5
	WB-T	0.1	A	0.0	3.2	0.1	A	0.0	0.0
Baffin Boulevard	NB-L	8.5	A	0.3	12.5	7.7	A	2.8	32.6
	NB-R	6.1	A	0.5	17.5	8.2	A	4.4	37.7
<b>Princess Margaret Boulevard &amp; MacKay Bridge (Dartmouth)</b>		<b>3.1</b>	<b>A</b>			<b>3.4</b>	<b>A</b>		
Princess Margaret Boulevard	EB-L	2.6	A	0.1	11.0	3.7	A	0.5	21.9
	EB-T	0.2	A	0.0	0.0	0.4	A	0.1	10.4
	WB-T	0.1	A	0.0	0.0	0.1	A	0.0	1.6
	WB-R	0.0	A	0.0	0.0	0.0	A	0.0	1.6
MacKay Bridge (Dartmouth)	SB-L	9.7	A	2.9	27.7	15.7	C	4.3	41.4
	SB-R	8.1	A	4.4	33.1	11.6	B	5.6	46.7
<b>Princess Margaret Boulevard &amp; Iroquois Drive</b>		<b>1.1</b>	<b>A</b>			<b>1.5</b>	<b>A</b>		
Princess Margaret Boulevard	EB-L	1.9	A	0.0	0.0	2.7	A	0.0	7.2
	EB-T	1.6	A	0.0	0.0	1.4	A	0.0	0.0
	WB-L	1.3	A	0.0	7.7	3.1	A	0.0	2.5
	WB-T	0.3	A	0.0	2.5	0.4	A	0.0	0.0
	WB-R	0.1	A	0.0	2.5	0.0	A	0.0	0.0
Iroquois Drive	NB-L	8.8	A	0.1	9.1	9.7	A	0.3	13.7
	NB-T	9.2	A	0.1	11.0	10.3	B	0.4	15.6
	NB-R	7.2	A	0.3	17.9	9.8	A	0.6	22.5
HHB	SB-L	10.5	B	0.1	18.4	12.2	B	0.3	21.2
	SB-T	10.8	B	0.1	18.4	10.8	B	0.3	21.2
	SB-R	7.2	A	0.1	21.1	6.9	A	0.4	23.9
<b>Iroquois Drive</b>		<b>2.8</b>	<b>A</b>			<b>2.0</b>	<b>A</b>		
Princess Margaret Boulevard	EB-R	6.3	A	0.1	9.3	6.2	A	0.0	9.2
Iroquois Drive	NB-T	1.8	A	0.0	0.0	1.7	A	0.0	0.0
	SB-T	0.1	A	0.0	0.0	0.1	A	0.0	0.0
<b>Windmill Road &amp; Princess Margaret Boulevard</b>		<b>11.3</b>	<b>B</b>			<b>14.2</b>	<b>B</b>		
Princess Margaret Boulevard	EB-L	30.9	C	4.2	41.1	27.9	C	6.2	67.7
	EB-T	30.3	C	4.2	41.1	29.6	C	6.2	67.7
	EB-R	2.2	A	4.2	41.1	3.1	A	6.2	67.7
Yorkshire Avenue	WB-L	30.2	C	0.6	13.5	33.7	C	1.3	19.3
	WB-T	31.2	C	0.6	13.5	30.0	C	1.3	19.3
	WB-R	3.3	A	1.5	22.9	7.6	A	2.9	28.7
Windmill Road	NB-L	9.7	A	2.2	46.6	14.0	B	3.8	52.6
	NB-T	5.6	A	1.9	41.5	9.5	A	3.8	54.4
	NB-R	0.5	A	0.0	0.0	1.7	A	0.0	0.6
	SB-L	13.8	B	8.2	73.9	14.7	B	13.2	74.6
	SB-T	15.2	B	8.2	73.9	19.3	B	13.2	74.6
	SB-R	10.7	B	8.2	73.9	15.1	B	13.2	74.6

Table 7: Scenario 5 – Five-Year Timeframe (2032) Weekday AM/PM Corridor Analysis

Scenario 5 - Five-Year Timeframe (2032)		PTV Vissim							
Intersection		Weekday AM Peak Hour				Weekday PM Peak Hour			
		Delay (s/veh)	LOS	Average Queue (m)	Max Queue (m)	Delay (s/veh)	LOS	Average Queue (m)	Max Queue (m)
<b>Princess Margaret Boulevard &amp; MacKay Bridge (Halifax)</b>		<b>8.0</b>	<b>A</b>			<b>25.4</b>	<b>D</b>		
Princess Margaret Boulevard	EB-L	1.4	A	0.0	4.1	1.5	A	0.4	13.5
	EB-T	0.1	A	0.0	0.0	3.0	A	0.3	8.3
	WB-T	0.7	A	0.0	0.0	0.9	A	0.0	3.9
	WB-R	0.9	A	0.0	0.0	1.1	A	0.0	3.9
MacKay Bridge (Halifax)	SB-L	19.7	C	11.4	54.9	65.1	F	89.0	252.6
	SB-R	8.9	A	16.2	62.1	52.0	F	95.5	259.1
<b>Princess Margaret Boulevard &amp; Baffin Boulevard</b>		<b>1.9</b>	<b>A</b>			<b>8.8</b>	<b>A</b>		
Princess Margaret Boulevard	EB-T	0.2	A	0.0	0.0	3.0	A	4.2	42.5
	EB-R	0.5	A	0.0	0.0	3.2	A	4.2	42.5
	WB-L	5.9	A	2.1	49.2	5.0	A	0.1	7.3
	WB-T	0.4	A	0.0	0.0	0.3	A	0.0	0.0
Baffin Boulevard	NB-L	9.4	A	0.3	14.0	20.2	C	15.6	64.4
	NB-R	6.6	A	0.6	19.4	27.9	D	19.3	69.8
<b>Princess Margaret Boulevard &amp; MacKay Bridge (Dartmouth)</b>		<b>1.9</b>	<b>A</b>			<b>6.9</b>	<b>A</b>		
Princess Margaret Boulevard	EB-L	0.9	A	0.0	7.7	9.0	A	4.0	61.4
	EB-T	0.6	A	0.0	7.7	5.4	A	4.0	61.4
	EB-R	0.4	A	0.0	8.9	2.7	A	2.1	61.4
	WB-L	2.1	A	0.6	43.8	4.7	A	6.5	54.1
	WB-T	2.3	A	0.6	43.8	6.8	A	6.5	54.1
	WB-R	1.7	A	0.6	43.8	7.1	A	6.5	54.1
Shannon Park	NB-L	2.1	A	0.2	29.3	15.7	C	5.5	45.9
	NB-T	1.6	A	0.2	29.3	14.9	B	5.5	45.9
	NB-R	1.3	A	0.2	29.3	11.9	B	5.5	45.9
MacKay Bridge (Dartmouth)	SB-L	2.8	A	0.7	30.7	5.7	A	0.7	38.4
	SB-T	2.3	A	0.7	30.7	3.2	A	0.7	38.4
	SB-R	2.9	A	0.7	30.7	2.5	A	0.7	38.4
<b>Princess Margaret Boulevard &amp; Iroquois Drive</b>		<b>2.4</b>	<b>A</b>			<b>6.8</b>	<b>A</b>		
Princess Margaret Boulevard	EB-L	4.6	A	0.0	12.5	2.7	A	0.1	32.2
	EB-T	0.3	A	0.0	5.8	0.5	A	0.1	21.9
	EB-R	0.0	A	0.0	5.8	0.1	A	0.1	21.9
	WB-L	1.8	A	0.1	14.5	5.3	A	0.5	27.0
	WB-T	0.2	A	0.0	1.5	5.9	A	13.7	82.3
	WB-R	0.5	A	0.0	1.5	1.8	A	13.7	82.3
Iroquois Drive	NB-L	13.8	B	2.8	31.3	47.1	E	7.3	37.3
	NB-T	13.2	B	3.2	34.0	12.6	B	7.8	40.0
	NB-R	9.3	A	3.2	33.3	18.1	C	7.8	39.3
HHB	SB-L	14.4	B	0.1	18.2	17.5	C	0.5	19.9
	SB-T	12.3	B	0.1	19.6	14.4	B	0.5	21.3
	SB-R	8.4	A	0.1	20.5	17.8	C	0.6	22.2
<b>Windmill Road &amp; Princess Margaret Boulevard</b>		<b>13.1</b>	<b>B</b>			<b>19.2</b>	<b>B</b>		
Princess Margaret Boulevard	EB-L	33.0	C	8.7	52.0	30.7	C	12.2	76.3
	EB-T	26.4	C	1.8	21.2	23.1	C	4.7	35.6
	EB-R	7.9	A	4.2	28.9	10.9	B	8.3	43.3
Yorkshire Avenue	WB-L	12.9	B	0.7	15.0	36.9	D	1.9	25.3
	WB-T	28.8	C	0.7	15.0	39.4	D	1.9	25.3
	WB-R	5.2	A	1.6	24.5	12.4	B	3.7	34.8
Windmill Road	NB-L	12.8	B	5.3	63.0	33.1	C	18.0	89.5
	NB-T	7.5	A	3.5	57.2	10.9	B	6.0	77.0
	NB-R	1.4	A	0.0	0.0	3.4	A	0.0	0.5
	SB-L	19.7	B	11.2	74.1	15.7	B	17.2	80.9
	SB-T	19.1	B	11.2	74.1	23.3	C	17.2	80.9
	SB-R	0.9	A	0.0	8.9	6.9	A	2.9	27.4



## 10.0 Roadway Infrastructure Improvements

### 10.1 Proposed Improvements

A number of road network improvements are required to mitigate the impact of the Shannon Park development. The improvements include:

1. **Princess Margaret Boulevard & MacKay Bridge (Halifax-bound):** A left turn storage lane (60 metres) should be provided on the southbound approach (MacKay Bridge).
2. **Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)/ “Main Street”:** The intersection of Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound) should be upgraded to a single lane roundabout. The single lane roundabout will require a right turn by-pass on the eastbound approach (Princess Margaret Boulevard) to accommodate the right turn movement into the Shannon Park development. The roundabout design should maintain the adjacent left storage turn lane into Baffin Boulevard.

Improvements to the intersection are required to improve existing and future background operations at the intersection and to accommodate the main access to the Shannon Park development. The roundabout will need to be constructed on both the CLC lands and HRM property.

3. **Princess Margaret Boulevard & “Collector B” (formerly Iroquois Drive):** A left turn storage lane (25 metres) should be provided on the westbound approach (Princess Margaret Boulevard). The “Collector B” approach should be constructed to include left turn storage lane (50 metres).
4. **Windmill Road & Princess Margaret Boulevard:** The intersection should be widened to accommodate new lane configurations on the eastbound (Princess Margaret Boulevard) and southbound (Windmill Road) approaches.

The existing right turn storage lane should be extended (50 metres) and a left turn storage lane (70 metres) should be provided on the eastbound approach. A right turn storage lane (40 metres) should be provided on the southbound approach.

5. **Windmill Road & Nootka Avenue:** A left turn storage lane (25 metres) should be provided on the westbound approach (Nootka Avenue).

Concept plans for the proposed improvements can be found in Appendix F.

### 10.2 Cost Estimates

High level cost estimates were developed for the proposed improvements. The cost estimates do not include allowances for engineering, property acquisitions, utility relocations or harmonized sales tax (HST). The costs associated with the improvements are summarized in Table 8. The total cost of the roadway infrastructure improvements is estimated at \$1,650,000.

Table 8: Costs Associated with Improvements

Intersection	Improvement	Estimated Cost
Princess Margaret Boulevard & MacKay Bridge (Halifax-bound)	Left turn lane (MacKay)	\$150,000
Princess Margaret Boulevard & MacKay Bridge Ramp (Dartmouth-bound)/ "Main Street"	Single-lane roundabout	\$1,000,000
Princess Margaret Boulevard & "Collector B"	Left turn lane (PMB)	\$50,000
Windmill Road & Princess Margaret Boulevard	Lane reconfiguration and widening	\$400,000
Windmill Road & Nootka Avenue	Left turn lane	\$50,000
<b>Total Estimated Cost</b>		<b>\$1,650,000</b>

### 10.3 Implementation Plan

An implementation plan was developed for the proposed roadway infrastructure improvement based on the phasing of the development. The improvement plan is summarized in Table 9.

The improvements at the three Shannon Park access points should be implemented with the first phase of the development. The total cost of the Phase 1 roadway infrastructure improvements is estimated at \$1,100,000.

The improvements at the intersections of Princess Margaret Boulevard & MacKay Bridge (Halifax-bound) and Windmill Road & Princess Margaret Boulevard should be implemented with the third phase of the development. The total cost of the Phase 3 roadway infrastructure improvements is estimated at \$550,000.

The intersections should be monitored and the improvements implemented prior to Phase 3 if traffic patterns show the following problems:

- Princess Margaret Boulevard & MacKay Bridge (Halifax-bound): High delays and/or significant queues occur on the MacKay Bridge ramp.
- Windmill Road & Princess Margaret Boulevard: Eastbound queues on Princess Margaret Boulevard extend close to the CN rail crossing.

Table 9: Implementation Plan

Phase 1 Improvements	Estimated Cost
Princess Margaret Boulevard & MacKay Bridge Ramp (Dartmouth-bound)/ "Main Street"	\$1,000,000
Princess Margaret Boulevard & "Collector B"	\$50,000
Windmill Road & Nootka Avenue	\$50,000
<b>Phase 1 Total Estimated Cost</b>	<b>\$1,100,000</b>
Phase 3 Improvements	Estimated Cost
Princess Margaret Boulevard & MacKay Bridge (Halifax)	\$150,000
Windmill Road & Princess Margaret Boulevard	\$400,000
<b>Phase 3 Total Estimated Cost</b>	<b>\$550,000</b>

## 11.0 Concept Plan Review

The preferred development concept plan and proposed development block plan were reviewed, the following commentary applies:

**Access:** The development plan shows an access to the development on Baffin Boulevard. Baffin Boulevard serves as an access to BIO and this connection would mainly be of use to employees of BIO living in the Shannon Park development. However, the access creates a shortcut between Baffin Boulevard and Windmill Road, there is concern that employees of BIO travelling to and from Windmill Road will use the development to by-pass Princess Margaret Boulevard.

**Internal Road Layout:** The internal road network appears to provide connectivity within the development. There are no cul-de-sacs, with the exception of the access to the Millbrook lands. The internal road network consists of two-lane roadways, with the majority of streets having on street parallel parking on both sides.

**Curb Extensions:** The concept plan shows the use of curb extensions (bulb outs) throughout the development at intersections and midblock locations adjacent to green space (potential trail crossings). Curb extensions are not included in the HRM Red Book; however, they are being introduced by HRM on existing roads including North Park Street and Spring Garden Road. They are typically used as a traffic calming feature to enhance pedestrian safety and streetscape character. A few advantages and disadvantage of curb extensions are listed below.

### Advantages:

- Increased pedestrian visibility through improved sightlines at intersections,
- Reduced crossing distances for pedestrians,
- Reduced vehicle turning speeds by narrowing the roadway,
- Increased pedestrian waiting space,
- Additional space for street furnishings,
- Reduced illegal parking at corners, crosswalks and bus stops, and
- Facilitated ability to provide two curb ramps per corner.
- Aesthetics

### Disadvantages:

- More expensive to construct and maintain,
- More difficult for snow removal,
- Reduced flexibility of the roadway in construction routing, and
- Reduced flexibility in making changes to the location of bus zones, roadway lane layout or crosswalks.

Overall, the concept plan appears to provide a well-connected road network and feature some elements of a complete street approach creating an environment that is intended to be attractive to vulnerable road users.

## 11.1 Roadway Classification

The internal roadways were classified according to the HRM Red Book street classes. The characteristics of the street classes are detailed in Table 10.

Using the rule of thumb that the afternoon peak hour traffic volumes represent approximately 10 percent of daily traffic volumes, daily traffic volumes were estimated for the development's three main roadways. Based on full build out traffic volumes the following daily traffic volumes are expected:

- "Main Street": approximately 7600 vehicle per day
- "Collector B": approximately 3500 vehicle per day
- Nootka Avenue: approximately 3800 vehicle per day

Based on the projected traffic volumes "Main Street", "Collector B" and Nootka Avenue are expected to be classified as minor collector streets. All other roadways within the development are expected to be classified as local streets.

Table 10: Characteristics of Street Classes

Characteristic	Arterial	Collector		Local Industrial	Local
		Major	Minor		
1. Traffic service function	First consideration	Traffic movement first consideration, land access second consideration	Traffic movement of equal importance with land access, parking permitted	Traffic movement second consideration with land access first consideration, parking permitted	Traffic movement second consideration with land access first consideration, parking permitted
2. Land access function	Limited access with no parking				
3. Design daily traffic volume	More than 20,000	More than 12,000	Up to 12,000	Less than 3,000	Less than 3,000
4. Traffic flow	Uninterrupted flow except at signals; with pedestrian overpasses	Uninterrupted flow except at signals and crosswalks	Interrupted flow	Interrupted flow	Interrupted flow
5. Avg running speed off-peak conditions	50-70 km/h	40-60 km/h	30-50 km/h	15-30 km/h	15-30 km/h
6. Vehicle types	All types	All types but trucks may be limited	All types with truck limitation	All types	Passenger vehicles and service vehicles; large vehicles restricted
7. Connects to	Expressways, arterials, major/minor collectors	Expressways, arterials, major/minor collectors, some locals	Arterials, major/minor collectors, locals	Some major collectors, minor collectors, locals	Some major collectors, minor collectors, locals

## 11.2 Emergency Response

Emergency response to the Shannon Park will be provided by Halifax Region Fire & Emergency Station 12 located in Highfield Park. The CN Rail line is located between Shannon Park and Station 12. Halifax Fire has indicated that the Nootka Avenue and “Collector B” cannot be consider viable access points as emergency vehicles travelling from Windmill Road would need to cross the rail line. “Main Street” and the access on Baffin Boulevard will be accessible at all times through Highway 111 and the MacKay Bridge toll plaza.

Approximate travel times for each route obtained from Google Maps are summarized in Table 11. The travel time range represent travel times for off-peak and morning/afternoon peak hours. The travel times indicate that the Highway 111 route will provide the best response times.

Table 11: Emergency Response Route Travel Time

Route	Distance	Travel Time Range
Highway 111	3.2 km	5-7 minutes
Windmill Road (South)	3.4 km	6-12 minutes
Windmill Road (South)	3.7 km	6-9 minutes

## 12.0 CN Rail Crossing Review

In 2014, Transport Canada published new standards for at-grade crossings. A seven-year period was granted by Transport Canada after the regulations came into force for railway companies and road authorities to upgrade all existing grade crossings to meet new standards set forth in the document.

Currently, the new safety standards must be met at all new crossings built after November 27, 2014 or at any existing grade crossings at which major modifications occur. Major modifications would include such things as adding a traffic lane or an increase in road or railway traffic speeds.

The road network improvements required to accommodate the Shannon Park development identified in the traffic impact study do not include major modifications to the crossings. Thus, the two rail crossings in the study area will need to be reviewed against the new standards and upgraded accordingly, prior to the end of the seven-year period (November 2021). At the time of this report, it remains unknown which authority (CN or HRM) has ownership of these crossings.

### 12.1 Requirements for Pedestrian and Cycling Crossings

According to the Transport Canada Grade Crossing Standards (2014) the following requirements apply to pedestrian and cycling crossings.

- A sidewalk, path, or trail with its centerline more than 3.6 m from a Railway Crossing sign supporting post beside a road approach for vehicle traffic must have separate rail crossing signs.
- The maximum gradients for road approaches must not exceed the following:
  - 2% within 5 m of the nearest rail at a sidewalk, path or trail and
  - 1% within 5 m of the nearest rail at a sidewalk, path or trail designated by the road authority for use by persons using assistive devices.



- The specifications for a grade crossing for a sidewalk, path or trail where a warning system is required are as follows:
  - The sidewalk, path or trail is outside the island circuit of an adjacent warning system, and
  - The railway design speed is more than 50 mph.
- The specifications for a grade crossing for a sidewalk, path or trail where a warning system with gates is required are as follows:
  - The sidewalk, path or trail is outside the island circuit of an adjacent warning system,
  - The railway design speed is more than 15 mph, and
  - There are two or more lines of railway.

At the existing crossing on Nootka Avenue, there is no existing pedestrian or cycling crossings. Sidewalk is present on one side of Princess Margaret Boulevard; the sidewalk is less than 3.6 m from the crossing sign. The sidewalk leading up to the tracks on both sides appear to meet the maximum gradient standard.

### 13.0 Active Transportation

In December 2017, Regional Council Approved Halifax's "Integrated Mobility Plan" (IMP). This plan outlines a strategy to shift the modal split in the municipality towards more sustainable forms of transportation. Shannon Parks falls within the municipality's Regional Centre, where active transportation (including cycling) has a mode share target of at least 37%.

Reliable and convenient active transportation infrastructure is required to make the decision to choose active transportation is more appealing to users and enable this shift. With the appropriate infrastructure in place, active transportation offers an alternative to avoid network congestion and parking challenges.

#### 13.1 Pedestrians

Existing pedestrian infrastructure in the surrounding area includes sidewalks on Windmill Road as well as Princess Margaret Boulevard and Baffin Boulevard (Figure 10). The intersection of Windmill Road and Princess Margaret Boulevard/Yorkshire Avenue is signalized with pedestrian crossings. There are three (3) RA-4 crosswalks located on this section of Windmill Road- one to the south of the project area at the intersection of Fernhill Drive, one at the intersection with Nootka Avenue, and a mid-block crossing located between Nootka Avenue and Princess Margaret Boulevard.

Following the development of the Shannon Park lands, a warrant analysis should be completed of these crosswalks, specifically the one located at Nootka Avenue, for potential upgrade to an RA-5 overhead crosswalk. The proposed upgrades to the Nootka intersection include the addition of a left turn storage lane which will increase the crossing distance, which combined with increased pedestrian and vehicular volumes, will increase the need for a crosswalk upgrade.



Figure 10: HRM Sidewalks Map

### 13.2 Cycling

The IMP identified routes for a proposed All Ages and Abilities (AAA) bicycle network (Figure 11). The IMP's proposed network does not extend to connect to Shannon Park; however, Windmill Road was identified as a candidate for on-street bike lanes in the 2014-19 Active Transportation Priorities Plan (Figure 12). The on-street bike lanes would offer a connection for confident cyclists but would not be considered comfortable for All Ages and Abilities. The additional demand created by the Shannon Park development may shift the pressures of this area and foster a demand to construct a AAA facility on Windmill Road.

An alternative option to on-street facilities could also be pursued. While it does not appear as a candidate route on any of the municipality's strategic plans, there was previously some high-level discussion about the construction of a multi-use active transportation trail along the harbour following the existing Halifax Water sewer route (similar to the collaboration that currently exists with Halifax Water and the Chain of Lakes Trail).



Figure 11: HRM Proposed Bicycle Network

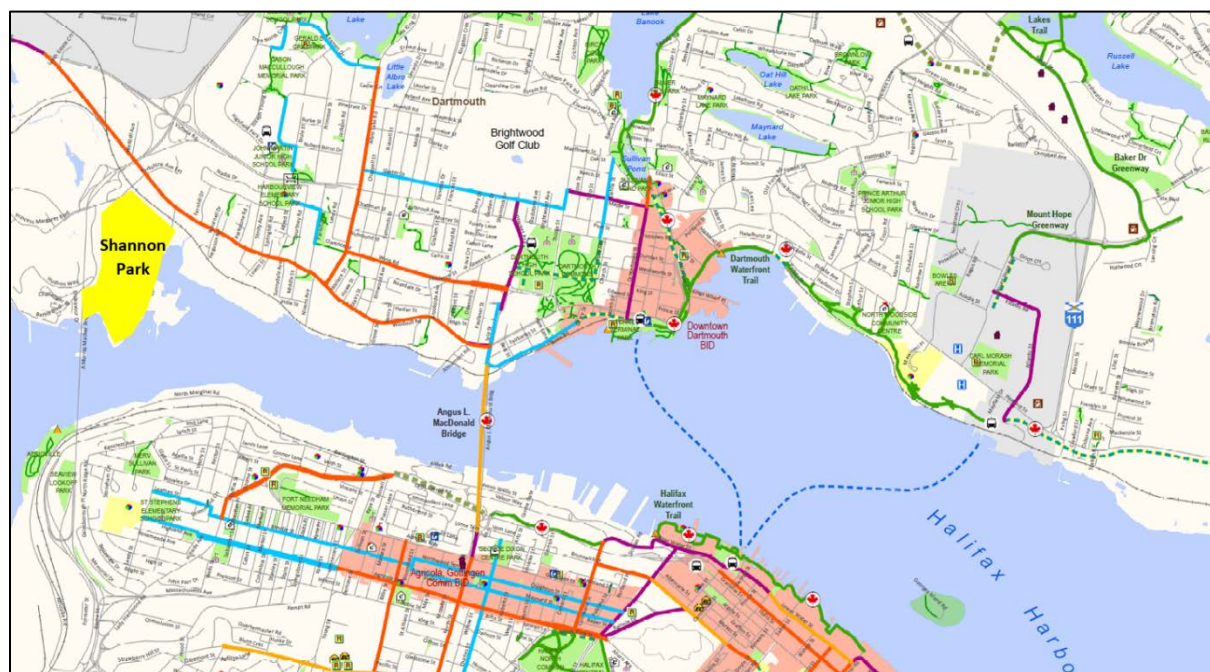


Figure 12: HRM Candidate Bikeway Routes and Greenway Network

### 13.3 Proposed Active Transportation Route

To encourage cycling as a viable option to access the development, cycling facilities should be provided within the development site. A main route should be identified within the development to serve as the spine that supports active transportation throughout the development. The proposed route is shown in Figure 13, this route also aligns with the proposed transit route through the site. Cycling facilities should



be provided along the active transportation route. Cycling connections should be provided to adjacent on-street or off-street facilities. A cycling connection should be provided from the main active transportation route to the waterfront greenspace. Bike storage facilities should be provided throughout the development. Storage facilities should be considered not only in terms of volume but also quality of facility, in a location where users feel comfortable to leave their bikes locked up.

The remainder of the development will be constructed with a focus on providing pedestrian friendly infrastructure, sidewalks are proposed along both sides of each roadway.

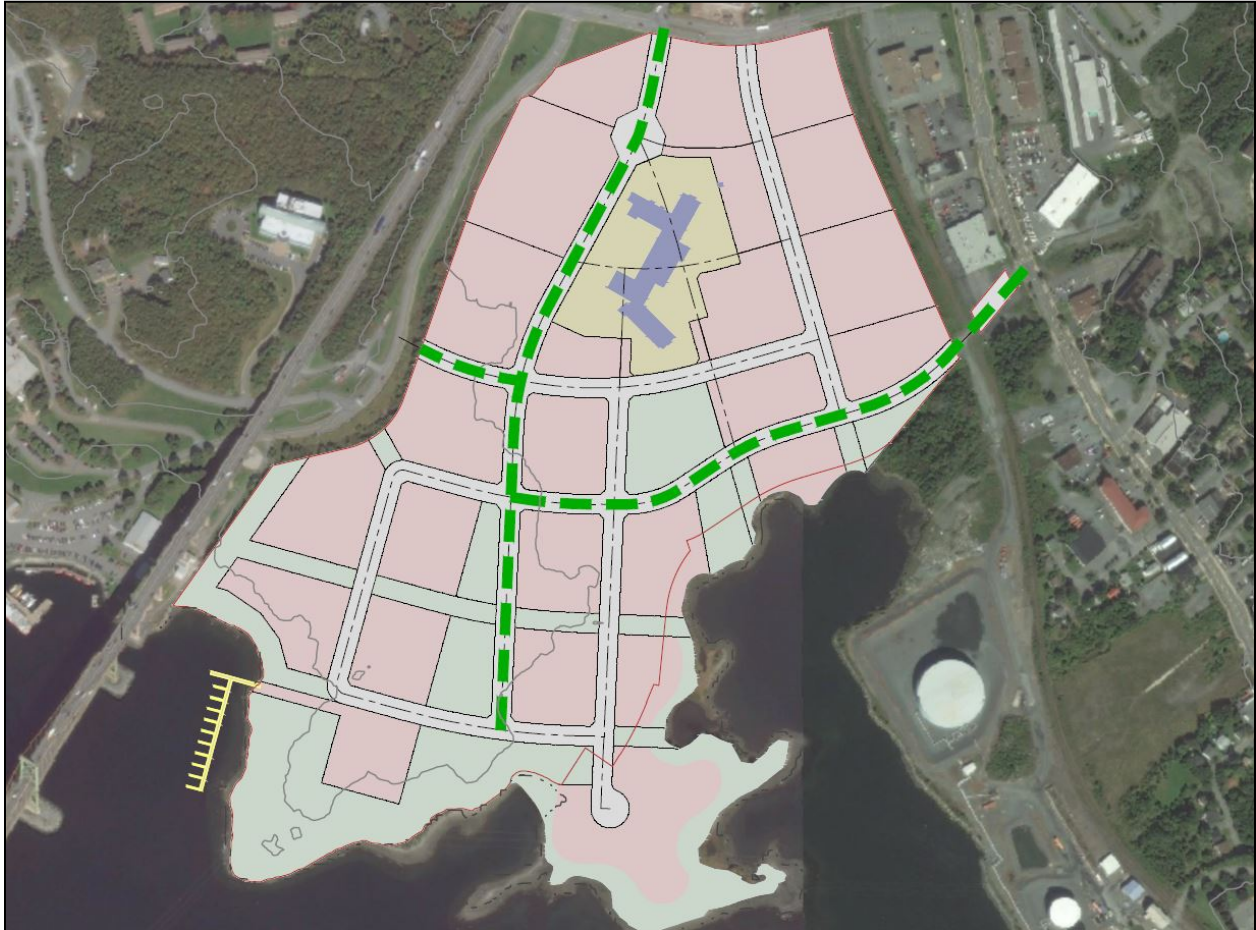


Figure 13: Shannon Park AT Route (shown in green dashed line)

## 14.0 Transit

Team members met with Halifax Transit and reviewed the ideas in the “Moving Forward Together” 5-year Halifax Transit Strategic Plan to assess how transit and the re-development of Shannon Park can be best integrated to offer sustainable transportation options for residents both living within the future development and those coming to the area for work or commercial attractions.

The Halifax Transit 5-year strategic plan “Moving Forward Together” looks to overhaul the existing transit network servicing the Municipality. The four principles included in the 5-year strategic plan include: increasing the proportion of resources allocated towards services with high ridership numbers; building a

simplified transfer-based system; the investment in quality service and service reliability; and increasing transit priority in the existing and proposed transportation network. The proposed Shannon Park Development is located in the urban transit service boundary, which puts it within the zone that HRM has identified for transit improvements. Currently, this area isn't a top priority for increased transit service in the plan, but with developments such as Shannon Park on the horizon and its location in the Regional Centre, priority on increased service is likely.

Shannon Park is currently serviced by one local bus route (51 Windmill) which connects to the Bridge Terminal and Burnside. The route currently taken by the 51 Windmill is shown in blue on in Figure 14, with the dashed lines represented the extended service during peak hour.

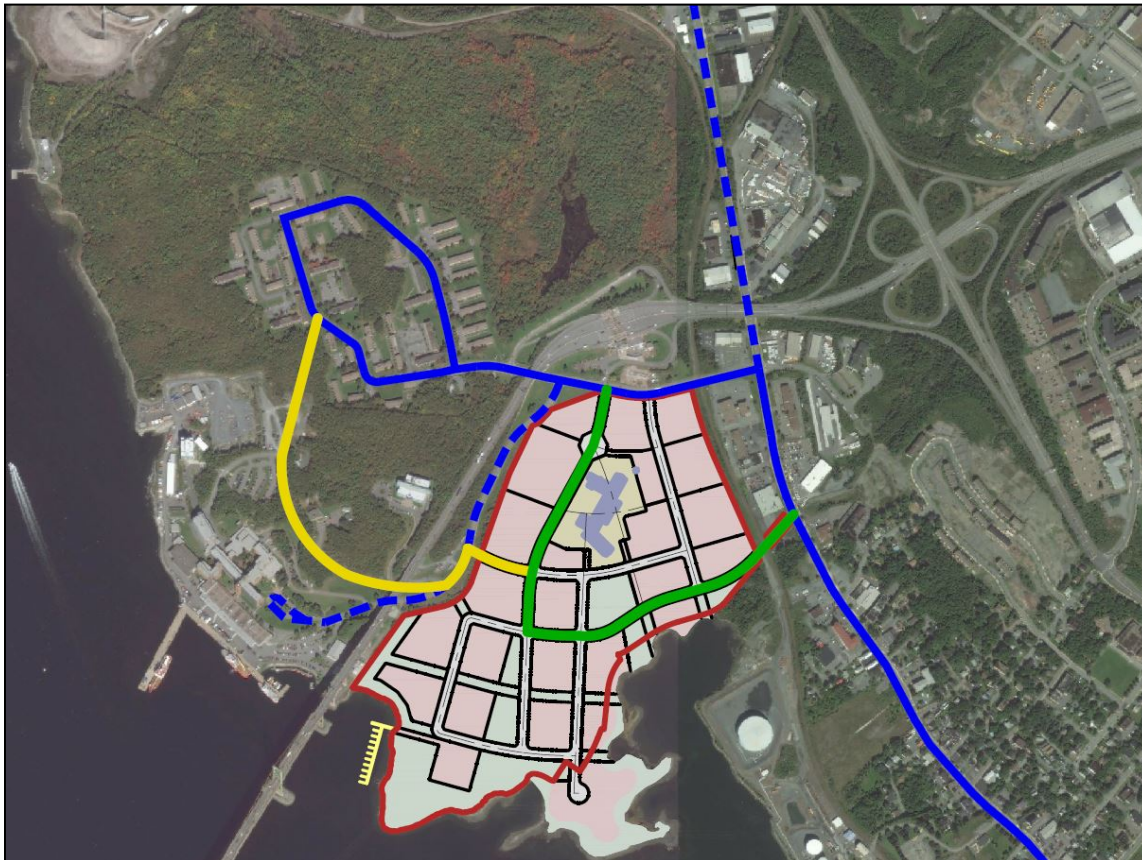


Figure 14: Existing and Proposed Transit Routes

The increase of density in this area will be supplemented by an improved road network to facilitate a more desirable transit route. In planning transit routes, stops that require a bus to drive in, turn around, and come out the same road are inefficient in terms of reaching the greatest number of people and decreasing the total travel time for all users of the service. The proposed road layout offers a route that buses will be able to loop through the development to pick users up without having to double back on itself. This proposed route is shown in as the green line in Figure 14, and came from discussion with Halifax Transit. This route follows the same route as the main active transportation connection through the site creating connections between these complimentary modes of transportation. Improving pedestrian and bicycle

connections to transit services is one of the goals recommended in Halifax Transit's *Moving Forward Together* plan as it pertains to new developments.

The new access to BIO and the re-development of Shannon Park will also complement each other. Currently, the 51 Windmill stops at the BIO parking lot for a short peak demand period at the beginning and end of the work day. This restricted schedule is due to the configuration of the stop creating a "drive in-drive out" scenario, undesirable for the reasons described above. Halifax Transit has expressed a desire to have this stop on the regular routing of the 51 Windmill if the driveway improvements were to be completed, which would offer a looped route (as shown in yellow in Figure 14). The proposed road network for the Shannon Park re-development creates a smooth and desirable connection with this routing.

Part of the Moving Forward Together plan includes the construction of a new Wrights Cove Terminal in Burnside. This terminal is tentatively slated for construction in 2020, located on Bancroft Lane near the intersection with Windmill Road. The proximity of this terminal to the Shannon Park lands will create a major transit connection for all residents coming to and from Shannon Park. Along with creating a hub for numerous local routes, the Wrights Cove terminal will also be serviced by four express routes- the 182 First Lake Express, 185 Millwood Express, 183 Springfield Express, and 189 Beaver Bank Express. The short and simple connection to these express routes position Shannon Park as a convenient and desirable working location.

As part of a Transit Priority Measures (TPM) report completed by WSP for HRM in March 2016, a number of intersections within Halifax Transit's network were identified for improvements to establish TPMs and create improved transit routes. This study identified three intersections on Windmill Road, of which two (Windmill Road/Seapoint Road, and Windmill Road/Victoria Road) were ranked highest out of thirteen to prioritize for implementation. These priority measures on Windmill Road will work to improve the transit network surrounding Shannon Park.

The other item of note expected from HRM's Integrated Mobility Plan is the discussion of potential ferry terminal locations. The area to the north of the MacKay Bridge has been identified as a potential candidate, which would be furthered by the construction of the Wrights Cove Terminal as well as the construction of Shannon Park itself and the increase in density and demand this would create.

## 15.0 Conclusions and Recommendations

The Canada Lands Company (CLC) has plans to redevelop Shannon Park to include a mixed use residential and commercial development. The redevelopment scenario includes approximately 3,000 residential units and 150,000 square feet of commercial space.

The traffic impact study was completed to investigate the impacts of the development scenario for Shannon Park. The study evaluates the impact of the development scenario during the weekday morning and afternoon peak hours of traffic.

Shannon Park is located south of Princess Margaret Boulevard in Dartmouth, Nova Scotia. Shannon Park is uniquely located with established transportation network connections to multiple key corridors in HRM including the MacKay Bridge, Highway 111, and Windmill Road. The study area for the traffic impact study,



includes Windmill Road between Victoria Road and Albro Lake Road and Princess Margaret Boulevard. Nine intersections within the study area were included in the analysis, the study intersections include:

- Princess Margaret Boulevard & BIO Access
- Princess Margaret Boulevard & MacKay Bridge (Halifax-bound)
- Princess Margaret Boulevard & Baffin Boulevard
- Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)
- Princess Margaret Boulevard & Iroquois Drive
- Windmill Road & Victoria Road
- Windmill Road & Princess Margaret Boulevard
- Windmill Road & Nootka Avenue
- Windmill Road & Albro Lake Road

Traffic volumes gathered in 2016 and updated counts at 6 study area intersections collected in 2019 were used to develop the base traffic volumes for the analysis. Background traffic forecast were developed using a growth rate of 1.0 percent per year and trip estimates for adjacent proposed developments including the anticipated growth at the Bedford Institute of Oceanography and the redevelopment of the Ship Victory site on Windmill Road.

**Transportation Demand Projections:** Demand projections were developed for the weekday morning and afternoon peak hours of adjacent street traffic. The weekday peak hour trip generation estimates for the residential and commercial land uses were quantified using trip generation rates from the Trip Generation Manual (10th edition) published by the Institute of Transportation Engineers (ITE).

The trip generation estimates were adjusted to account for internal trips, modal split, and pass-by trips. On a typical weekday the Shannon Park development is expected to generate 1111 vehicle trips (375 entering/736 exiting) during the AM peak hour and 1268 vehicle trips (789 entering/479 exiting) during the PM peak hour; all of which would be considered new or primary trips.

Trips associated with the Shannon Park development and adjacent developments were distributed to the study area road network using the following trip distribution:

- 25% to/from Halifax via the MacKay Bridge,
- 15% to/from Bedford and areas to the north via Windmill Road,
- 25% to/from Dartmouth and areas south via Windmill Road, and
- 35% to/from the rest of the metro area via Highway 111.

**Weekday Peak Hour Analysis:** The performance of the study intersections during the weekday morning and afternoon peak hours was evaluated under five scenarios to quantify the impact of the proposed development on the study area road network. The assessment scenarios included:

- Scenario 1 – Existing Conditions (2019): A scenario reflecting the existing conditions in the study area. This scenario provides an assessment of current operations based on existing traffic volumes, lane configurations and signal timing plans.

- **Scenario 2 – Background Growth and Adjacent Developments (2027):** A projection of normal traffic growth to the year 2027 and the projected traffic volumes associated adjacent developments. This scenario provides an assessment of future operations without the proposed development.
- **Scenario 3 – Shannon Park Development (2027):** A projection of background traffic volumes (from Scenario 2) and the projected traffic volumes associated with the Shannon Park development. This scenario provides an assessment of future operations with the proposed development in place which is used to identify if improvements are required to accommodate the proposed development.
- **Scenario 4 – Future Development Conditions with Improvements (2027):** A projection of future background and development traffic volumes (from Scenario 3) with the proposed improvements. This scenario provides an assessment of future operations with the proposed improvements.
- **Scenario 5 – Five-Year timeframe after Shannon Park Development (2032):** A projection of normal traffic growth five-years after full build out of the Shannon Park development.

Under existing and background conditions, there are operational issues at the intersections of Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound) and Windmill Road & Victoria Road during the peak hours.

The Shannon Park development will contribute to the deterioration of existing operational problems and creates operational problems with individual movements at all study intersections with the exception of Princess Margaret Boulevard & BIO Access and Windmill Road & Albro Lake Road.

**Road Network Improvements:** Based on the weekday peak hour intersection analysis, a number of road network improvements are required to mitigate the impact of the Shannon Park development during the weekday peak hours. The improvements include:

1. **Princess Margaret Boulevard & MacKay Bridge (Halifax-bound):** A left turn storage lane (60 metres) should be provided on the southbound approach (MacKay Bridge).
2. **Princess Margaret Boulevard & MacKay Bridge (Dartmouth-bound)/“Main Street”:** The intersection of Princess Margaret Boulevard & MacKay Bridge (Dartmouth) should be upgraded to a single lane roundabout. The single lane roundabout will require a right turn by-pass on the eastbound approach (Princess Margaret Boulevard) to accommodate the right turn movement into the Shannon Park development. The roundabout design should maintain the adjacent left storage turn lane into Baffin Boulevard.  
Improvements to the intersection are required to improve existing and future background operations at the intersection and to accommodate the main access to the Shannon Park development. The roundabout will need to be constructed on both the CLC lands and HRM property.
3. **Princess Margaret Boulevard & “Collector B” (formerly Iroquois Drive):** A left turn storage lane (25 metres) should be provided on the westbound approach (Princess Margaret Boulevard). The “Collector B” approach should be constructed to include left turn storage lane (50 metres).

4. **Windmill Road & Princess Margaret Boulevard:** The intersection should be widened to accommodate new lane configurations on the eastbound (Princess Margaret Boulevard) and southbound (Windmill Road) approaches.  
The existing right turn storage lane should be extended (50 metres) and a left turn storage lane (70 metres) should be provided on the eastbound approach. A right turn storage lane (40 metres) should be provided on the southbound approach.
5. **Windmill Road & Nootka Avenue:** A left turn storage lane (25 metres) should be provided on the westbound approach (Nootka Avenue).

The total cost of the roadway infrastructure improvements is estimated at \$1,650,000. The cost estimates do not include allowances for engineering, property acquisitions, utility relocations or harmonized sales tax (HST).

**Princess Margaret Boulevard Corridor Analysis:** The intersection performance analysis identified a number of road network improvements required along Princess Margaret Boulevard to mitigate the impact of the Shannon Park development. Under existing conditions, traffic flows freely along the entire length of the Princess Margaret Boulevard corridor until the signalized intersection at Windmill Road. The proposed improvements include changes to intersection controls along the corridor which will introduce delay and queues along the corridor.

The intersections along Princess Margaret Boulevard are closely spaced making it important to identify interactions between adjacent intersections. Different types of software were used to model the intersections based on the type of intersection control. While the queue length results from the various analyses are a good indicator of intersections between adjacent intersections, a supplemental corridor analysis was completed along Princess Margaret Boulevard using PTV Vissim software to confirm the results of the intersection performance analysis.

The study area for the corridor analysis was limited to the section of Princess Margaret Boulevard from the ramps to the MacKay Bridge toll plaza to Windmill Road, the section includes five study intersections. The performance of the study intersections during the weekday morning and afternoon peak hours was reevaluated under two of the previous scenarios: Scenario 1 – Existing Conditions (2019) and Scenario 5 – Five-Year timeframe after Shannon Park Development (2032).

The results of the Vissim analysis are consistent with the intersection performance analysis results. The corridor analysis confirms that the proposed road network improvements will be sufficient to accommodate the proposed development during the weekday peak hours and confirms that the Shannon Park development will not impact the MacKay Bridge toll plaza or the CN rail crossing.