Victoria Square Boulevard Schedule C Municipal Class Environmental Assessment

Environmental Study Report

Woodbine Avenue (north connection) to Woodbine Avenue (south connection)

City of Markham

June 14, 2018

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Executive Summary

Introduction

The City of Markham completed a Municipal Class Environmental Assessment (EA) study to review potential improvements to the Victoria Square Boulevard corridor from Woodbine Avenue (south connection) to Woodbine Avenue (north connection). The study was conducted in accordance with the planning and design process for Schedule 'C' projects, as outlined in the Municipal Engineers Association's ***Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011 and 2015)***.

Background and Study Purpose

Victoria Square Boulevard (formerly Woodbine Avenue prior to the construction of the Woodbine Bypass, which is now referred to as Woodbine Avenue), is for the most part a 2-lane rural roadway with a posted speed limit of 50 km/h. Ownership of the road was transferred from the Region of York to the City of Markham during the course of this EA study.

The purpose of the Class EA study is to determine specific transportation improvements to the Victoria Square corridor from Woodbine Avenue (south connection) to Woodbine Avenue (north connection), inclusive of all intersections, and to address short term and long term transportation needs for pedestrians, cyclists, transit users and motorists.

Study Area

The study area encompasses the entire length of Victoria Square Boulevard, approximately 3 km in length, between Woodbine Avenue (south connection) in the south and Woodbine Avenue (north connection) to the north as illustrated in **Exhibit A**. Elgin Mills Road intersects the corridor approximately mid-way between the north and south gateways. The study area street network is further described in **Section 3.1.1** of this document. The study area is further divided into six character areas based on the City of Markham's *Victoria Square Heritage Conservation District Study*, dated December 2014, as illustrated in **Exhibit B**.

Existing land use in the area consists mainly of low-rise residential with small pockets of low rise mixed-use around the north and south connections with Woodbine Avenue, and mid-rise residential around the Cathedral Town Precinct. Additional residential development is anticipated along the study corridor and in neighbouring areas (such as the North Markham Future Urban Area).

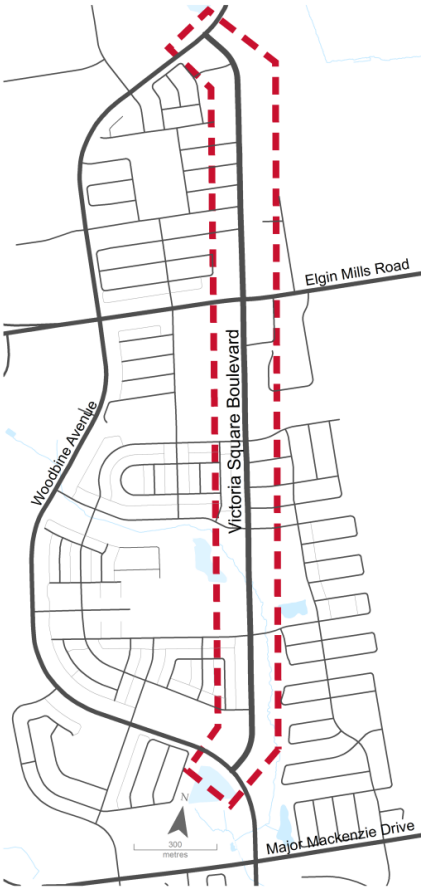

Exhibit A: Study Area

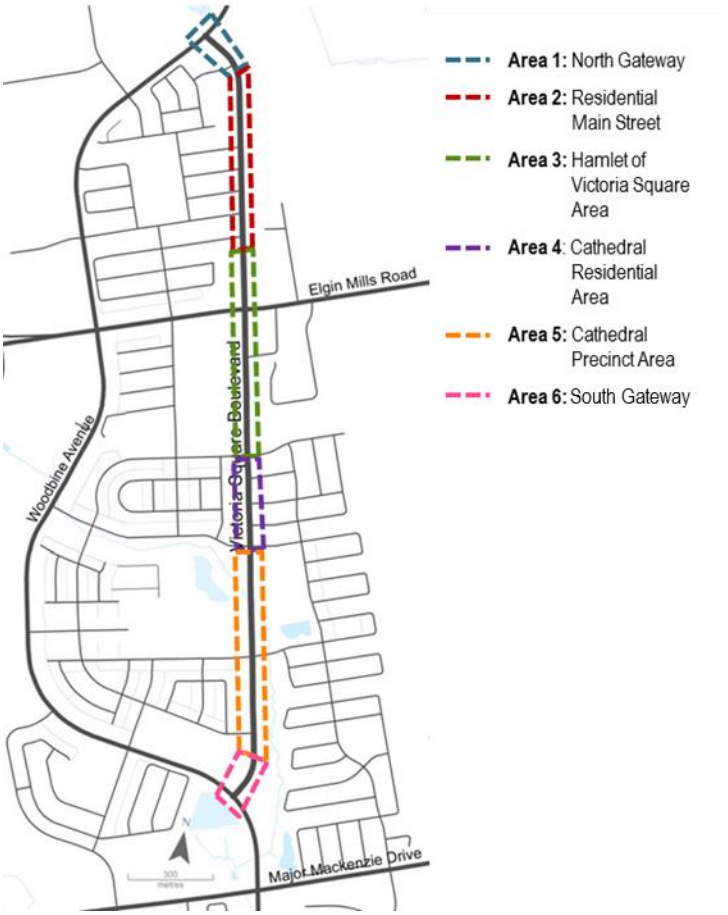

Exhibit B: Study Area Segments

Needs Assessment

The needs assessment involves the identification and evaluation of current and future needs of the transportation network with respect to accommodating all users (pedestrians, cyclists, transit users, and motorists), network capacity, traffic safety, and design and operation. The purpose of the Needs Assessment is to identify and define future capacity, safety, and operational needs along the Victoria Square Boulevard study corridor. A summary of the transportation needs in the Victoria Square Boulevard corridor is summarized as follows:

- Additional lanes of through traffic have been deemed unnecessary along Victoria Square Boulevard
- The need for the addition and enhancement of active transportation (cyclist and pedestrian) facilities has been identified
- Existing transit facilities should be maintained. An assessment of existing and planned transit routes along and in the vicinity of the Victoria Square Boulevard corridor is to be addressed as part of a separate study.

- Presently, there is no immediate requirement for additional signalized intersections within the Victoria Square Boulevard corridor; however, approaching the horizon year (2031), monitoring is recommended at the north and south connections to Woodbine Avenue, as well as at the Elgin Mills Road intersection to determine the need for localized operational improvements at these intersections.

Problem and Opportunity Statement

The Problem and Opportunity Statement was developed with consideration to existing conditions, deficiencies, and the future needs of the study corridor. The Problem and Opportunity Statement provides the foundation for transportation improvements for Victoria Square Boulevard, consistent with the City's vision for the corridor and other official documents.

The study area is made up of mixed land uses and characteristics that are unique to each of the six segments. There are specific opportunities within each of the six study area segments. Overall, there are opportunities to:

- Create a complete community by increasing travel options, safety and accessibility for users of all modes, ages and abilities.
- Enhance connections to future urban areas and the regional transportation network, keeping all road users in mind. This includes increasing connectivity between the community, core areas, facilities, and open spaces, and developing the north and south ends of the road corridor as major Gateways to the street.
- Preserve and enhance natural and cultural heritage features, including the addition or enhancement of streetscaping features along the corridor.
- Provide continuity and efficiency in drainage infrastructure.

Problems and opportunities along the study corridor are summarized as follows:

Problem	Opportunity
Limited and discontinuous cycling and pedestrian facilities	Consider additional, continuous cycling and pedestrian facilities to provide a continuous network
Limited parking available	Consider on-street parking where space permits to meet the needs of the adjacent townhouses
Discontinuous installation of curb and gutter, watermains, and sewers	Consider a continuous urban roadway section with curb and gutter in lieu of rural ditches
The study area is comprised of six distinct areas with unique characteristics	Preserve and enhance community character, through consideration of streetscaping and gateway features

Public, Agency, and Aboriginal Group Consultation

Public input is an important part of the Victoria Square Boulevard Class EA and a number of public and stakeholder consultation activities were held to provide

opportunities to participate in the planning process. An overview of the key consultation milestones is provided as follows:

Consultation Event	Date
Notice of Commencement	April 2016
Public Open House #1	June 13, 2016
Public Open House #2	June 14, 2017
Notice of Completion	June 14, 2018

Public outreach was conducted in a variety of methods, including: advertisements in local newspapers, direct mail, email notifications, mobile signs located at both ends of the study area, project website updates, and public open houses.

As part of the EA process, individual meetings and conference calls were held with agencies and stakeholders such as the Toronto Region Conservation Authority (TRCA) and multiple developers.

Aboriginal Group representatives were included in the mailing list for the project, and were contacted via study notices throughout the study (including the Notice of Commencement, Notice of Public Open Houses, and Notice of Completion). The project team followed up with those groups that had not provided input, to ensure they had no concerns about the project. The mailing list was updated periodically as the study progressed to reflect additional Aboriginal Group representatives or update contact information as needed.

Alternative Solutions

Alternative solutions are functionally different ways of approaching and addressing a problem or opportunity. These alternatives range in complexity, cost, and their ability to address the identified Study Area issues. The following alternative solutions were considered to address the problems and opportunities identified for the Victoria Square Boulevard study:

Alternative Solutions No.	Title	Description
1	Do Nothing	Maintain Existing Conditions. This alternative does not address the problems and opportunities of the study corridor.
2	Multi-Modal Approach	Accommodate all road users including the provision of continuous active transportation facilities for cyclists and pedestrians, on-street parking, intersection improvements, urbanization for improved drainage, additional landscaping opportunities, and consideration for a continuous centre-left turn lane where feasible and warranted within the ROW. This alternative solution adequately addresses the problems and opportunities of the study corridor while minimizing impacts, and is therefore the recommended alternative solution.

3	Multi-Modal Approach and Road Widening	Provide two continuous travel lanes in each direction, in addition to the multi-modal approach described in Alternative #2. This alternative solution accommodates all road users and adequately addresses the problems and opportunities of the study corridor; however, the additional travel lanes are not required to accommodate the projected future vehicular demand and may result in traffic infiltration onto Victoria Square Boulevard. In addition, this option requires a wider roadway platform, which may result in property acquisition and increased impacts, as well as a higher cost. Therefore, this alternative is not recommended.

Design Alternatives

Design alternatives were developed for each of the six character areas (road segments) with consideration for the accommodation of on-street parking, pedestrian and cyclist facilities, streetscaping, left-turn lanes at intersections, and a continuous centre left-turn lane within the existing right-of-way (ROW). Multiple iterations of design alternatives were developed through consultation with the public and stakeholders, including the various departments at the City of Markham. Details related to the various alternatives and iterations considered, and the process to arrive at the preferred design alternative for each of the road segments, are included in **Section 6** of the ESR.

Following the various iterations of assessment and stakeholder and public consultation, the preferred alternative design contains the following key elements:

- Provide a continuous urban cross-section, replacing roadside drainage ditches with curb and gutter subsurface drainage system.
- Maintain existing number of through lanes (one in each direction, as there is no proposed widening for additional through lanes).
- Provide a continuous two way centre left turn lane through areas 2, 4, and 5 to facilitate more efficient turning movements. A two way centre left turn lane within segment 3 due to the constrained right-of-way availability through the village.
- Continuous multi-use paths on both sides of Victoria Square Boulevard, through the entire study corridor, to accommodate pedestrians and cyclists in a dedicated, shared active transportation facility.
- On-street parking on one side of the street for portions of areas 2, 4, 5, and 6, to facilitate access to the adjacent townhomes and municipal parks.
- Provide gateway features at the north and south connections with Woodbine Avenue.
- Provide boulevard landscaping where sufficient space is available.

Preferred Design

The preferred design for Victoria Square Boulevard was chosen after consideration of transportation service for all road users (motorists, pedestrians, cyclists, and transit users) and impacts to the natural environment, cultural heritage, and socio-economic environment, safety, aesthetics, drainage, driveway access, property requirements, and capital construction and maintenance costs. The preferred design for each segment is one that best reflects the goals of the EA and balances the infrastructure improvements with the anticipated impacts. The preferred design was developed and refined through extensive consultation with agencies, stakeholders, and the public.

Roadway

The preferred design consists of providing a continuous urban cross-section, replacing roadside drainage ditches with curb and gutter subsurface drainage system. The proposed cross-section will maintain the existing two lanes of traffic, and a continuous centre left-turn lane is proposed to be added through areas 2, 4, and 5. The proposed design aims to follow the existing horizontal and vertical alignment.

Transit

The study area is currently serviced by regular and seasonal bus routes operated by both the Toronto Transit Commission (TTC) and York Region Transit (YRT). No dedicated transit facilities are included in the proposed Victoria Square Boulevard design.

Cycling and Pedestrian Facilities

The preferred design incorporates multi-use path (MUP) on both sides of Victoria Square Boulevard along the entire study corridor.

Intersections

North and south of the study corridor, the proposed road design will match into the existing Woodbine Avenue intersections. In general, existing intersection configurations, including the number of signalized intersections, will be maintained with the exception of one proposed all-way stop with crosswalk at the Betty Roman Boulevard/ Stony Hill Boulevard intersection. Future intersections will be coordinated with developers to determine requirements for traffic signals or stop controls.

Access Locations

Existing access locations within the study area will be maintained. Proposed entrance locations for future developments, such as the Cathedraltown Piazza (located on the west side of Victoria Square Boulevard north of Pope John Paul II Boulevard) and the Eaton Square development (located on the east side of Victoria Square Boulevard north of Bruce Thomson Boulevard), have been accommodated. Driveway access locations

for existing properties have not been impacted as a result of the road improvements; however, some driveways may need profile adjustments.

Illumination

Full illumination is proposed along Victoria Square Boulevard. Details will be based on City of Markham standards and will be confirmed during detailed design. Illumination will consider the roadway profile, the urban cross-section, and active transportation requirements along the study corridor. During detailed design, illumination design will consider the type and location of poles and luminaires.

Streetscaping and Landscaping

The preferred design considered maximizing the available boulevard space for tree plantings and other landscaping within the corridor. Landscaping zones are provided between the MUP and curb, or within the MUP and property line, with the exception of constrained areas, and vary in width between 1.0 m to 7.3 m. Wherever there is sufficient space, opportunities for tree planting are considered. At locations with more constrained space, other streetscaping features can be incorporated. Streetscaping details along each segment of the corridor will be confirmed during detailed design, and coordinated with City of Markham and developers as required.

Property Requirements

The proposed improvements along Victoria Square Boulevard can be accommodated within the existing ROW and do not require property acquisition. In order to minimize property requirements, grading is proposed to stay within the existing ROW; however, along properties known to be undergoing development, the development is expected to match the recommended grading for Victoria Square Boulevard.

At the northwest quadrant of the Victoria Square Boulevard and Elgin Mills Road intersection, there is an area of undeveloped property. If this property develops in the future, the City will acquire the necessary property for a daylighting triangle in order to improve sightlines at this intersection.

Culverts and Structures

Within the EA Study limits, one culvert replacement is proposed at the Carlton Creek watercourse crossing, approximately 200 m south of Betty Roman Boulevard.

Drainage and Stormwater Management Plan

Victoria Square Boulevard will be modified to an urban roadway cross-section which includes concrete curb and gutter and storm sewers. Overall, the existing drainage patterns and locations will not be altered with the proposed roadway improvements.

Stormwater management (water quality) measures within the study limits will be designed to provide “Enhanced” protection (Level 1), to augment, as a minimum, the

increased pavement area project-wide. The storm sewer system for the ultimate roadway configuration is to be designed to the 5-year design storm event based on City of Markham standards.

The proposed stormwater management strategy will maintain the existing drainage pattern and provide quality and quantity control as well as erosion protection for the 4.64 hectares pavement area via the existing five stormwater management ponds. In addition, a proposed storm sewer system integrated with an oil grit separator and infiltration gallery will provide supplemental stormwater treatment to a 0.45 hectare ROW area.

To assess the applicability of the proposed SWM strategy, the existing stormwater management ponds should be further investigated during detail design to ensure that the stormwater objectives are effectively addressed. Low impact development stormwater best management practices are to be explored during detail design.

Utilities

The proposed improvements aim to minimize impacts with utilities where possible; however, relocation will be required along the corridor due to several existing conflicts including the utility poles affected by the alignment of the proposed MUP. Where utilities are located within the proposed landscaping zones, suitable placement and plant sizing can be confirmed during detailed design to avoid conflict with overhead utilities. For instance, where utility lines do not provide adequate vertical clearance, hydro form tree species may be planted to avoid conflicts.

Preliminary Cost Estimate

Based on preliminary cost estimates, the cost of the recommended improvements is estimated at **$11.7 million**. This preliminary cost estimate includes costs for road work, drainage, utility relocation, streetlights and traffic control, culvert replacement, channel works, landscaping, and engineering services. Potential property acquisition costs are not included in the estimate. The extent of cost sharing with developers and the City of Markham will be confirmed during detailed design. These preliminary cost estimates are to be reviewed and confirmed during detailed design.

Environmental Effects and Mitigation

Anticipated impacts to the natural, socio-economic, and cultural environments together with proposed mitigation measures were identified to address the implementation of the preliminary preferred design. Socio-economic analysis considers property impacts, development impacts, noise, and air quality. Natural environment impacts consider aquatic habitat and fisheries, vegetation and vegetation communities, wildlife and wildlife habitat, and contamination. Cultural impacts consider built heritage and cultural heritage landscape features, and archaeology.

In general, impacts associated with the proposed Victoria Square Boulevard improvements are minor in nature and can be mitigated. Further information on environmental effects and mitigation can be found in **Section 8** of the ESR.

Timing of Implementation and Future Commitments

Timing of improvements is to be confirmed during detailed design. At this time, it is anticipated that detailed design will commence in Summer 2018. Construction is anticipated to start after detailed design is completed pending funding and approval by City Council. The ESR identifies specific items to be reviewed and confirmed during detailed design. Some of these commitments will address specific concerns raised by property owners and review agencies during the EA process and are provided in **Section 9.2** of the ESR.

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1 Introduction

1.1 Purpose of the Project and the Environmental Study Report

The City of Markham completed a Municipal Class Environmental Assessment (EA) Study to review potential improvements to Victoria Square Boulevard from Woodbine Avenue (north connection) to Woodbine Avenue (south connection) (Victoria Square Boulevard corridor).

To further assess current and future needs within the Victoria Square Boulevard corridor, the City of Markham retained HDR to conduct the Victoria Square Boulevard Class EA. This study is being conducted in accordance with the planning and design process for Schedule 'C' projects, as outlined in the Municipal Engineers Association's ***Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011 and 2015)***. The process includes public and agency consultation, an evaluation of alternative solutions and design concepts, an assessment of the effects of the proposed improvements, and development of measures to reduce potential impacts.

The purpose of the Class EA study is to determine specific transportation improvements to the Victoria Square Boulevard corridor from Woodbine Avenue (north connection) to Woodbine Avenue (south connection). The Environmental Assessment Study will:

- Review existing conditions and future transportation needs along Victoria Square Boulevard;
- Identify the need and justification for the proposed undertaking;
- Identify opportunities for improvement and offer possible planning solutions;
- Identify and evaluate alternative solutions and alternative design concepts to address the transportation needs and opportunities for the corridor;
- Select the preferred design concept, and assess potential impacts and mitigation measures;
- Collect, document, and assess input and feedback from residents and affected groups with an interest in the study;
- Document the decision making rationale and study process in an Environmental Study Report (ESR).

1.2 Study Area

The study area encompasses the entire length of Victoria Square Boulevard (formerly Woodbine Avenue prior to the construction of the Woodbine Bypass, which is now referred to as Woodbine Avenue), approximately 3 km in length, between Woodbine Avenue (south connection) in the south and Woodbine Avenue (north connection) to the north as illustrated in **Exhibit 1-1**. Elgin Mills Road intersects the corridor approximately mid-way between the north and south gateways. The study area street network is further described in **Section 3.1.1** of this document. The study area is further divided into six character areas based on the City of Markham's *Victoria Square Heritage Conservation District Study*, dated December 2014, as illustrated in **Exhibit 1-2**.

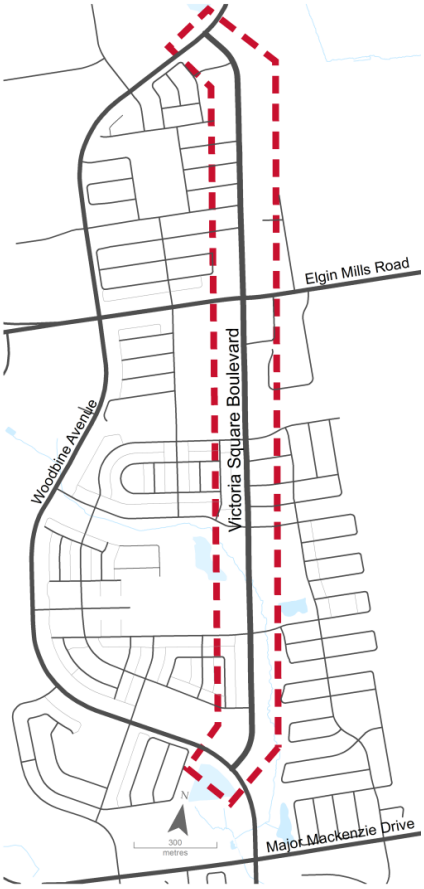


Exhibit 1-1: Study Area

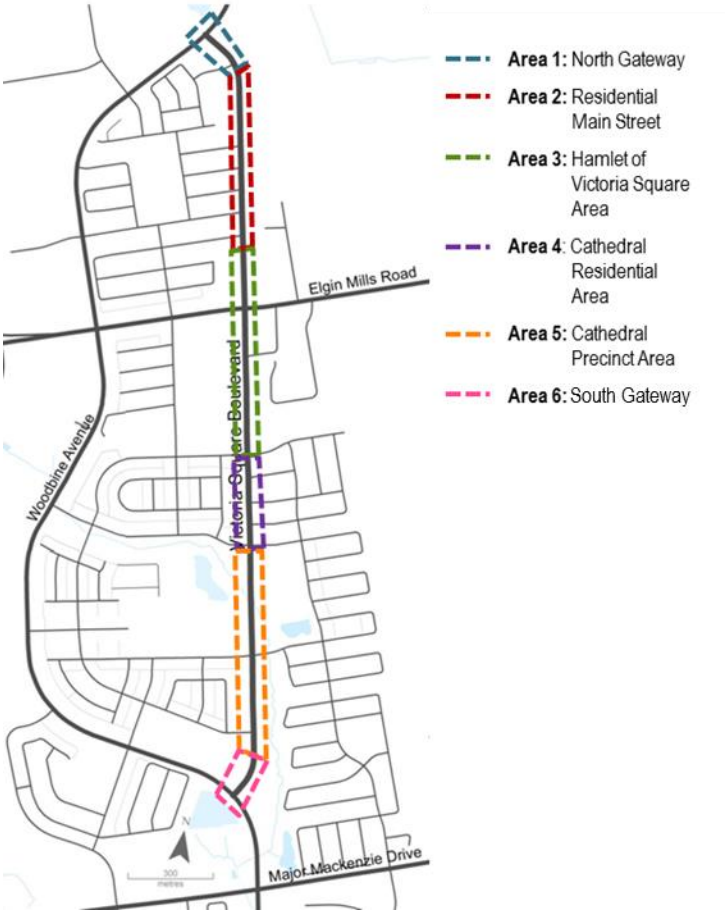


Exhibit 1-2: Study Area Segments

1.3 Study Organization

1.3.1 The City of Markham Project Team

The City of Markham Project Team consisted of:

Alberto Lim	Project Manager
Alice Lam	Former Manager, Infrastructure and Capital Projects
Marija Ilic	Manager, Infrastructure and Capital Projects

1.3.2 The Consultant Team

The Consultant Team consisted of the following staff:

Anthony Reitmeier	Project Manager, HDR
Tara Erwin	Deputy Project Manager and Environmental Coordinator, HDR
Veronica Restrepo	Project Coordinator, Public Consultation Development and Logistics, HDR
Carl Wong	Traffic Engineering / Traffic Operations, HDR
Jonathan Chai	Active Transportation, HDR
Masoud Sivandian	Roadway Design, HDR
Alex Yablochnikov	Signals and Illumination, HDR
Michelle Li	Drainage and Stormwater Management, HDR
Tham Shanmugarajah	Topographic and Legal Survey, Tham Surveying Ltd.
Lisa Coyne	Geotechnical Engineering, Hydrogeology and Contamination, Golder Associates Inc.
Richard Booth	Natural Heritage, Golder Associates Inc.
Joe Tomaselli	Noise and Air Quality, Golder Associates Inc.
Carla Parslow	Archaeology and Built Heritage, Golder Associates Inc.
Elizabeth Howson	Land Use and Community Planning, Macaulay Shiomi Howson
James McWilliam	Landscaping, McWilliam and Associates

1.4 Study Process

1.4.1 Municipal Class Environmental Assessment (MCEA)

The Municipal Class Environmental Assessment (MCEA) process is a provincially legislated process under the Ontario Environmental Assessment Act, 1990 (OEAA). It is a pre-approved process that municipalities in Ontario must follow when undertaking municipal infrastructure projects including roads, water, and wastewater. The Class EA process is a planning tool to consider alternative solutions and evaluate their impact on various criteria (e.g. technical, environmental, socio-economic, and capital cost). Evaluating alternative solutions and developing mitigation measures results in the arrival of a preferred alternative to address the problem statement. The Class EA process involves a rigorous public consultation component that includes various provincial and municipal agencies, Aboriginal communities, and the public at each of the project phases.

The MCEA process (October 2000, as amended in 2007, 2011 and 2015) is maintained by the Municipal Engineers Association (MEA). Due to the type of project, anticipation for potential effects, and estimated capital costs (> $2.4 million), the Victoria Square Boulevard Class EA is defined as a Schedule 'C' project. A Schedule 'C' project involves either the construction of new facilities or major modifications to existing facilities. Modifications to existing facilities could include a road widening, adjustments, and operational improvements where identified.

The MCEA process is separated into five phases, leading to project implementation, as shown in **Exhibit 1-3**. The phases for this study are described as follows:

- **Phase 1 (Problem and Opportunity)** – Identify the problem, document existing conditions, and develop a problem/opportunity statement;
- **Phase 2 (Alternative Solutions)** – Identify alternative solutions to address the problem/opportunity statement, taking into account the existing natural/socio-economic environment and accounting for public consultation input;
- **Phase 3 (Alternative Design Concepts for the Preferred Solution)** – Identify the preferred alternative based on existing environmental conditions and public/agency review input, develop methods of minimizing negative impacts and maximizing positive effects;
- **Phase 4 (Environmental Study Report)** – Document in an Environmental Study Report (ESR) a summary of the planning and design process, and consultation process for the project. The ESR shall be placed on the public record for a minimum of 30 days for review, along with an issued notice of completion. The

notice will advise on where the ESR can be reviewed, how to submit comments, and the public and other stakeholders' right to request a Part II Order.

Phase 5 (Implementation) involving detailed design and the preparation of contract/tender documents followed by construction, operation, and monitoring, is not within the scope of the study.

The ESR provides information on the study background and planning process including alternative solutions, arriving at a preferred design alternative and mitigation measures, followed by information on the public consultation process.

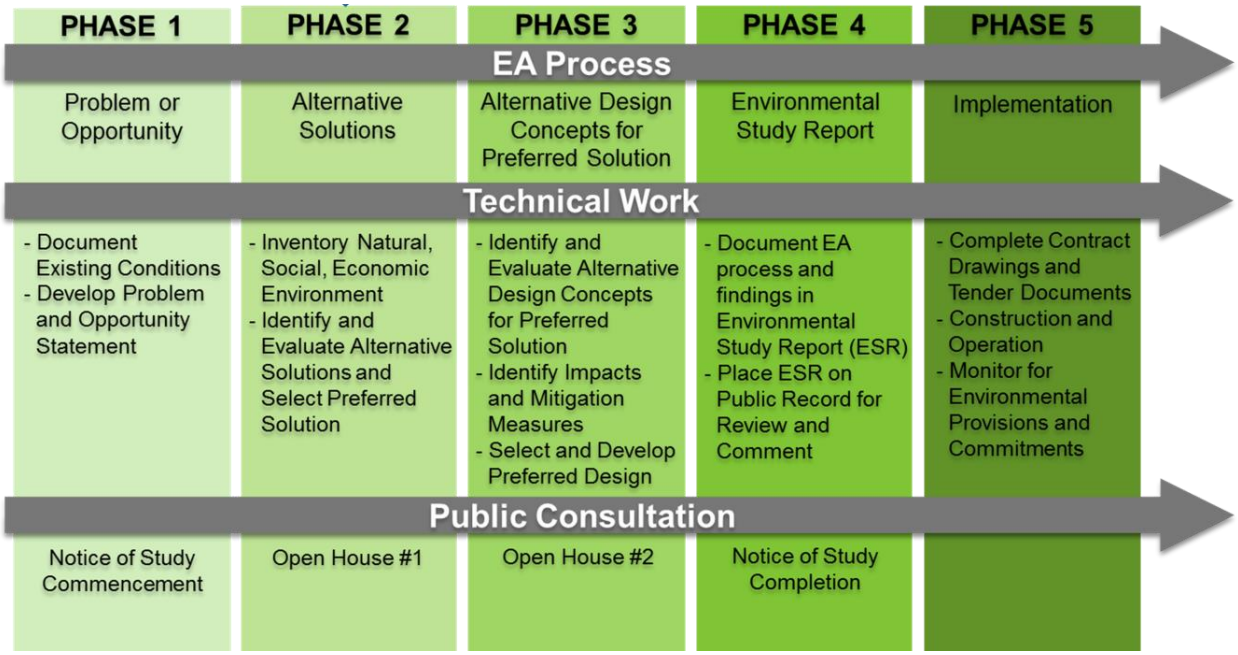


Exhibit 1-3: Municipal Class Environmental Assessment Process

1.4.2 Part II Orders

Under the *OEAA,* members of the public, interest groups, agencies, and other stakeholders reserve the right to submit a written request to the Minister of the Environment and Climate Change, proposing that the project be 'bumped up' to an individual environmental assessment based on the proposed impacts, referred to as a Part II Order.

The request for a Part II Order must also be copied to the proponent (The City of Markham) and the Director, Environmental Assessment and Permissions Branch at the Ministry of the Environment and Climate Change at the same time it is submitted to the Minister. Written requests for a Part II Order must be submitted to the Minister within the minimum 30 calendar day review period. The Minister will review the Environmental Study Report to ensure that the MEA Schedule 'C' Class EA process has been followed

and that the proposed impacts are justified. At the onset of a Part II Order request, the requestor and the proponent will have opportunities to discuss and resolve the issues raised. Once the requestor's concerns have been addressed by the proponent, the requestor can withdraw the Part II Order Request.

If the proponent and requestor are unable to resolve the concerns, the Minister will formally make a decision on the Part II Order:

1. Refer the matter to mediation before making a decision under the provisions of subsection 16(6) of the *OEAA;*
2. Deny the request for an order and inform the proponent and the requestor of the decision and rationale;
3. Deny the request but impose conditions for the proponent;
4. Require the proponent to comply with Part II of the *OEAA* subsequently requiring a Terms of Reference and the beginning of an individual environmental assessment.

The Minister's decision on a Part II Order request is final.

1.4.3 Canadian Environmental Assessment Act (CEAA)

Under the *Canadian Environmental Assessment Act, 2012 (CEAA 2012),* a federal environmental assessment study may be required if the *proposed* work for the project involves physical activities designated under the *Regulations Amending the Regulations Designating Physical Activities, 2013.* The project list ensures that federal environmental assessments are focused on major projects that fall within federal jurisdiction and that have the greatest potential for significant adverse environmental impacts.

The Victoria Square Boulevard EA Study does not trigger CEAA 2012 as it does not constitute a 'designated project' under the *Regulations Amending the Regulations Designating Physical Activities, 2013.* Although the project is not subject to a federal environmental assessment under CEAA 2012, the Minister of the Environment and Climate Change upholds the authority to order an EA even if a project is not considered 'designated', where there may be adverse environmental effects to federal jurisdiction.

1.5 Regional, Local and Provincial Planning Context

1.5.1 Provincial Planning Policies

The following provincial planning policy documents were reviewed to identify their relevance in the Victoria Square Boulevard EA study:

- Provincial Policy Statement (2014)

- Oak Ridges Moraine Conservation Plan (2017)
- Greenbelt Plan (2017)
- Growth Plan for the Greater Golden Horseshoe, 2017
- The Big Move – Transforming Transportation in the Greater Toronto and Hamilton Area (2008)

A synopsis of each of these individual policies is included in **Appendix L**. In general, these policies provide direction on land use planning and development to manage growth in the province, while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment. These policies promote the use of active transportation and connectivity among transportation modes, and stress the importance of protecting sensitive natural areas, significant built heritage resources and significant cultural heritage landscapes. Although the majority of these provincial policies are applicable to the study area, the Victoria Square EA study corridor falls outside of the Oak Ridges Moraine Conservation Plan Area boundaries and the Greenbelt Plan Area boundaries.

1.5.2 York Region Planning Policies & Related Studies

The following Regional planning policy documents were reviewed to identify their relevance in the Victoria Square Boulevard EA study:

- York Region Official Plan (YROP), 2013
- York Region Strategic Plan (Vision 2051)
- 2016 to 2019 Strategic Plan from Vision to Result
- York Region's Sustainability Strategy 2007
- York Region Transportation Master Plan Update, 2009
- York Region Pedestrian and Cycling Master Plan, 2008
- York Region Transit 2016 Annual Service Plan
- York Region's Towards Great Regional Streets, 2008
- York Region New Community Guidelines (2013)

A synopsis of each of these individual policies is included in **Appendix L**. The following summarizes the key directions related to the Study Corridor with respect to York Region planning policies and related studies:

- Study Corridor YROP Designations: The Regional Official Plan does not identify Victoria Square Boulevard as part of the Regional Cycling or Transit Network. It is identified as a Regional Street with specified planned right-of-way (ROW)

widths of between 36 and 43 metres. However, Victoria Square Boulevard was transferred to the City of Markham during the course of this EA study.

- Other Study Corridor Directions:
    - Pedestrian and Cycling Master Plan indicates that the lands in the Study Corridor are part of the City of Markham Pedestrian Zone and should have "enhanced pedestrian infrastructure" including sidewalks on one side of the street along Victoria Square Boulevard and on both sides of Elgin Mills Road from Leslie Street easterly to Victoria Square Boulevard.
    - York Region Transit 2016 Annual Service Plan identifies the restructuring of the transit route along Woodbine Avenue in the vicinity of the Study Corridor, including consolidating and rerouting a number of Woodbine Avenue routes onto Victoria Square Boulevard.
- General Relevant Policy Directions: The Regional policy framework does not provide specific direction with respect to Victoria Square Boulevard; however, it does establish general directions with respect to transportation which are relevant to the consideration of any improvements in the Study Corridor. In particular the focus for the Regional network development is to reduce automobile dependence and to promote walking, cycling, and transit use such that corridors like Victoria Square Boulevard are built to accommodate all modes of transportation. As part of this direction there is a need to integrate land use planning with urban design and infrastructure planning. Other relevant Regional planning direction requires protection of heritage streetscapes such as those found in the Victoria Square Hamlet Area.

1.5.3 City of Markham Planning Policies & Related Studies

The following Municipal planning policy documents were reviewed to identify their relevance in the Victoria Square Boulevard EA study:

- City of Markham Official Plan (1987)
- City of Markham Official Plan (2014) (pending approval)
- Victoria Square Hamlet Secondary Plan – Official Plan Amendment (OPA) 182 (2011)
- Cathedral Secondary Plan – OPA 49 & 123 (1997, 2004)
- 404 North Secondary Plan – OPA 113 & 149 (2005, 2008)
- City of Markham Cycling Master Plan (2010)
- City of Markham Pathways and Trails Master Plan (2009)

- East Cathedral Community Design Plan (2002)
- Cathedral Community Design Plan (2005, Amended 2009)
- 404 North Open Space and Streetscape Master Plan (2008)
- Vetmar Neighbourhood Design Brief (2009)
- Kylemore Victoria Square Community Design Plan (2014)
- Victoria Square Building and Property Inventory (2010)
- Trees for Tomorrow Streetscape Design Guidelines (2009)
- Public Art Policies for Markham Municipal Projects (2012)

A synopsis of each of these individual policies is included in **Appendix L.** The following summarizes the key directions related to the Study Corridor with respect to City of Markham planning policies and related studies. Regard should be given to the dates of the different documents as the status of Victoria Square Boulevard changes from an arterial road in the earlier plans to a minor collector road in the more current plans:

- Study Corridor Official Plan Designations: There are a range of Official Plan and Secondary Plans which are applicable to the Study Corridor. The key conclusion in reviewing all the documents is that the status of Victoria Square Boulevard changes from an arterial road (2002 Cathedral Design Plan) in the earlier plans to a minor collector road in the more current plans (new 2014 Official Plan, pending approval). This change in approach impacts on the weight which should be given to the various related policies and guidelines as part of the Environmental Assessment including road widening and requirements for sidewalks and landscaping, particularly in respect to policies established prior to the designation of the road as a minor collector.
- Other Study Corridor Directions: Similar to the Official Plan policies, many of the other relevant plans were developed before the establishment of the minor collector designation for Victoria Square Boulevard and their directions should be considered in that context:
    - The Cycling Master Plan does not identify Victoria Square Boulevard as part of the Cycling Network although a number of streets which connect or cross it are shown as part of the Cycling Network (e.g. Elgin Mills, Stony Hill).
    - The Pathways and Trails Plan identifies Victoria Square Boulevard from Major Mackenzie Drive to an area south of Betty Roman Boulevard as High Priority and the intersection with Major Mackenzie is identified as “On Road/Off Road Access Point” as it connects to an off road boulevard trail.

Other roads in the vicinity and the Hydro One Transmission line are also identified as part of the plan.

- East Cathedral Community Design Plan from 2002 identifies Victoria Square Boulevard as an arterial road and the central spine of the Cathedral Community. It states that the southerly portion of the road will be widened to four lanes but will remain two lanes through Victoria Square Hamlet (area 3). The Plan also provides direction with respect to landscaping along the road.
- Cathedral Community Design Plan from 2009 identifies Victoria Square Boulevard as a Collector Road – a community collector road and a local road between Victoria Square and Major Mackenzie Drive. Specific directions are given with respect to streetscape design including landmark locations and parking.
- Vetmar Neighbourhood Design Brief and Kylemore Victoria Square Neighbourhood Design Brief provide only limited direction with respect to Victoria Square Boulevard. In particular, these studies identify Victoria Square Boulevard as a Potential Cyclist Route and identify on-street parking opportunities.

- General Relevant Policy Directions:
  - In addition to the specific directions with respect to the Study Corridor, the City's policy framework also establishes general directions with respect to transportation which are relevant to the consideration of any improvements in the Study Corridor. In particular, like the Region, the focus of all the policies and studies is to reduce automobile dependence and to promote walking, cycling, and transit use such that corridors like Victoria Square Boulevard accommodate all modes of transportation.
  - The transportation network is also seen as having an important and defining placemaking function. A complete streets philosophy is to be applied to all future development of the City's road network – the coordination of land use planning, transportation planning and urban design is to be strengthened to emphasize this place-making role by making people, and not vehicles, the focus of street activity.

2 Public and Stakeholder Consultation

2.1 Public Consultation

Public input is an important part of the Victoria Square Boulevard Class EA and the public was presented opportunities to participate in the planning process through a number of public and stakeholder consultation activities. An overview of the key consultation milestones is provided in **Table 2-1**.

Table 2-1: Key Consultation Milestones

Consultation Event	Date
Notice of Commencement	April 2016
Public Open House #1	June 13, 2016
Public Open House #2	June 14, 2017
Notice of Completion	June 14, 2018

More information about each public consultation milestone, including notifications, material presented, and a summary of comments received throughout the study are included in **Appendix B**.

2.1.1 Public Open House #1

The first Public Open House was held on June 13, 2016 at the Victoria Square Community Centre. Notice for this consultation event was provided through the following:

- Mailing of notices to residents and property owners in close proximity to the Victoria Square Boulevard corridor, including those on the project contact list (agency contacts, Aboriginal Group representatives, and other stakeholders)
- Two (2) mobile signs located at both ends of the study area
- Project Study Web site
- Local newspaper advertisement in the Markham Economist and Sun on June 2, 2016, and June 9, 2016.

The meeting was organized as a drop-in Open House from 6:00 pm to 8:30 pm. During this time, community residents and stakeholders had an opportunity to review project background, a summary of the needs assessment, and alternative planning solution displays, and discuss their opinions and concerns with the project team, which included representatives from the City of Markham and HDR. Attendees were also provided with a Comment Form to fill out and return to the project team by June 27, 2016. A total of

116 people signed in at the June 13, 2016 Open House. No media representation was in attendance, and the City Councillor representing this area attended the Open House.

The purpose of Public Open House #1 was to present the preliminary findings of Environmental Assessment Phases 1 and 2 (Problem & Opportunity and Alternative Solutions) for the entire study area to the public and stakeholders, and request their feedback.

More details relating to Public Open House #1, including key messages heard and the project team's responses, are included in **Appendix B**.

2.1.2 Public Open House #2

The second Public Open House was held on June 14, 2017 at the Victoria Square Community Centre. Notice for this consultation event was provided through the following:

- Mailing of notices to residents and property owners in close proximity to the Victoria Square Boulevard corridor, and all others on the project contact list (including agency contacts, First Nations representatives, and other stakeholders)
- Two (2) mobile signs located at both ends of the study area
- Project Study Web site
- Local newspaper advertisement in the Markham Economist & Sun on June 1, 2017 and June 8, 2017.

The meeting was organized as a drop-in Open House from 6:00 pm to 8:30 pm. During this time, community residents and stakeholders had an opportunity to review project background, a summary of the work completed to date including alternative design concepts, and discuss their opinions and concerns with the project team, which included representatives from the City of Markham and HDR. Attendees were also provided with a Comment Form for them to fill out and return to the project team by June 28, 2017. A total of 111 people signed in at the June 14, 2017 Open House. No media representation was in attendance, and one City Councilor attended the Open House.

The purpose of Public Open House #2 was to share the evaluation of alternative design concepts and the preferred design as per Phase 3 (Alternative Design Concepts for the Preferred Solution) for the entire study area with the public and stakeholders, and request their feedback on the preferred design.

More details relating to Public Open House #2, including key messages heard and the project team's responses, are included in **Appendix B**.

2.2 Agency and Stakeholder Consultation

As part of the EA process, multiple technical staff from the City of Markham and partner agencies, as well as representatives from developer groups in the area and other stakeholders, were consulted on a regular basis.

The following is a summary of the agencies and stakeholders contacted:

- Canadian Environmental Assessment Agency
- City of Markham Internal Staff
- Environment Canada
- Fisheries and Oceans Canada
- Infrastructure Ontario
- Metrolinx / GO Transit
- Ministry of the Environment and Climate Change
- Ministry of Housing
- Ministry of Indigenous Relations and Reconciliation
- Ministry of Municipal Affairs
- Ministry of Natural Resources and Forestry
- Ministry of Tourism, Culture, and Sport
- Ministry of Transportation
- Ontario Provincial Police
- Regional Municipality of York
- Toronto and Region Conservation Authority
- Transport Canada – Ontario Region
- York Region Catholic District School Board
- York Region District School Board
- York Region Emergency Medical Services Branch
- York Regional Police
- York Region Transit
- 407ETR

These agencies, stakeholders, and staff members were provided the opportunity to review and provide input on all aspects of the study process including: the problem and opportunity statement, evaluation criteria, development and evaluation of alternatives and the preferred alternatives for the segments of road within the Study Corridor. Comments and concerns were incorporated or acknowledged throughout the study and agency correspondence consisted of letters, emails, phone calls, exchanges of information, and meetings.

In addition to consultation with the above mentioned agencies, consultation was held with

- King David Inc. – Land owner and developer of the lands surrounding the Cathedral of the Transfiguration, abutting the Study Area

- Eaton Square Development, related to the lands abutting the east side of the Study Area south of Woodbine Avenue (north connection)
- Bishop's Gate Subdivision developers, related to lands abutting the Study Area

Agency-specific correspondence, including minutes from key meetings, is included in **Appendix C.**

2.3 Aboriginal Group Consultation

The Aboriginal consultation program for the EA study involved representatives from the following groups (based on direction from the Ministry of Indigenous Relations and Reconciliation, formerly the Ministry of Aboriginal Affairs), who may have an interest in the study:

- Aamjiwnaang First Nation
- Alderville First Nation
- Algonquins of Pikwakanagan
- Association of Iroquois and Allied Indians
- Aundeck Omni Kaning
- Beausoleil First Nation
- Bkejwanong Territory (Walpole Island)
- Caldwell First Nation
- Chiefs of Ontario
- Chippewas of Georgina Island
- Chippewas of Kettle and Stony Point First Nation
- Chippewas of Nawash Unceded First Nation
- Chippewas of Rama First Nation
- Chippewas of the Thames First Nation
- Curve Lake First Nation
- Haudenosaunee Confederacy
- Hiawatha First Nation
- Huron-Wendat Nation
- Kawartha Nishawbe First Nation
- M'Chigeeng First Nation
- Metis Nation of Ontario (Credit River Council)
- Mississaugas of Scugog Island First Nation
- Mississaugas of the New Credit
- Mohawks of Akwesasne
- Mohawks of the Bay of Quinte
- Moose Deer Point First Nation
- Moravian of the Thames
- Munsee-Delaware Nation
- Nipissing First Nation
- Oneida Nation of the Thames
- Peel Aboriginal Network
- Saugeen First Nation
- Sheguiandah First Nation

- Seshegwaning First Nation
- Six Nations of the Grand River
- Union of Ontario Indians
- Wikwemikong First Nation
- Williams Treaties First Nations
- Zhiibaahaasing First Nation

Aboriginal community representatives were included in the mailing list for the project, and were contacted via study notices throughout the study (including the Notice of Commencement, Notice of Open Houses, and Notice of Completion). The mailing list was updated to add Aboriginal community representatives or update their contact information as requested throughout the study, including the addition of contacts for the Metis Nation of Ontario (Head Office), following consultation with the Ministry of Indigenous Relations and Reconciliation. All of those on the mailing list at the time of each notice were included in the notice distribution.

Representatives from the following Aboriginal communities contacted the project team to acknowledge receipt of notices that were sent to them, expressing interest in the study findings and recommendations, and requesting to continue to receive project updates:

- Hiawatha First Nation
- Huron-Wendat First Nation
- Six Nations Council
- Mississaugas of the New Credit First Nation

Representatives from the following Aboriginal communities contacted the project team advising that they have no interest in the project or concerns regarded the proposed undertaking, and requested to be removed from the project contact list:

- Aundeck Omni Kaning First Nation

Correspondence with Aboriginal community representatives is included in **Appendix D.**

3 Existing Conditions

The following section documents current conditions including existing transportation facilities, the socio-economic environment, natural environment and existing infrastructure along the study corridor.

3.1 Existing Transportation Facilities

The current road, transit, cyclist, and pedestrian network for the Victoria Square Boulevard study area are described in the subsequent sections.

3.1.1 Street Network

Victoria Square Boulevard is for the most part a 2-lane rural roadway with a posted speed limit of 50 km/h. Ownership of the road was transferred from the Region of York to the City of Markham during the course of this EA study. There are seventeen existing intersections along the length of the corridor, two of which are signalized – one at the South Gateway at Woodbine Avenue (south connection) and a second at Elgin Mills Road, both under York Region jurisdiction. The street terminates to the north where it meets Woodbine Avenue (north connection) at an unsignalized intersection.

3.1.2 Existing Truck Restrictions

Prior to the road transfer to the City of Markham, according to a field visit and discussions with York Region there were currently no general trucking or weight restrictions on Victoria Square Boulevard. Victoria Square Boulevard, as a City-owned road, is subject to spring load restrictions of a maximum 5 tonnes per axel between March 1 and April 30 per By-law 2012-53.

3.1.3 Transit Service

The study area is served by regular and seasonal bus routes operated by both the Toronto Transit Commission (TTC) and York Region Transit (YRT). TTC route 224 (Victoria Park North) provides a semi-frequent weekday transit connection to the Allstate Parkway and Woodbine stations on the Viva Pink and Viva Purple Bus Rapid Transit (BRT) lines on Highway 7. The route continues south to Don Mills Station on the Sheppard subway line. YRT operates route 224B-Woodbine, which is nearly parallel to TTC route 224. YRT route 80 (Elgin Mills) provides a seven-day east-west connection between Bathurst in the west and Woodbine in the east, connecting to the future Yonge Street Viva rapidway (opening late 2018). YRT also operates two seasonal school shuttle services – route 452 (serving Richmond Green High School) and route 418 (serving Pierre Elliot Trudeau High School) – connecting local students to educational

facilities outside the study area. A number of privately operated school buses operate along the corridor as well, with a number of stops along Victoria Square Boulevard itself.

In terms of transit infrastructure, existing bus stops along Victoria Square are equipped with concrete bus platforms and are located, from north to south, at the following locations, as illustrated in **Exhibit 3-1** .

- Elgin Mills Road
- Reflection Road / Rinas Avenue
- Betty Roman Boulevard/Stony Hill Boulevard
- Donald Buttress Boulevard / Vine Cliff Boulevard
- Murison Drive
- Woodbine Avenue (south connection)

3.1.4 Existing Access Locations

The spacing and number of private accesses onto Victoria Square Boulevard range from intermittent in certain sections of the corridor to frequent in others. Within the Hamlet of Victoria Square (Area 3), private driveways are frequent. Additionally, newer street-facing residential developments north of Elgin Mills (Area 2) were designed with a number of private accesses to Victoria Square Boulevard. In contrast, newer residential development in the Cathedral Precinct Area (Area 5) and the Cathedral Residential Area (Area 4) were designed as street-facing residential, with driveway access via a laneway system at the rear.

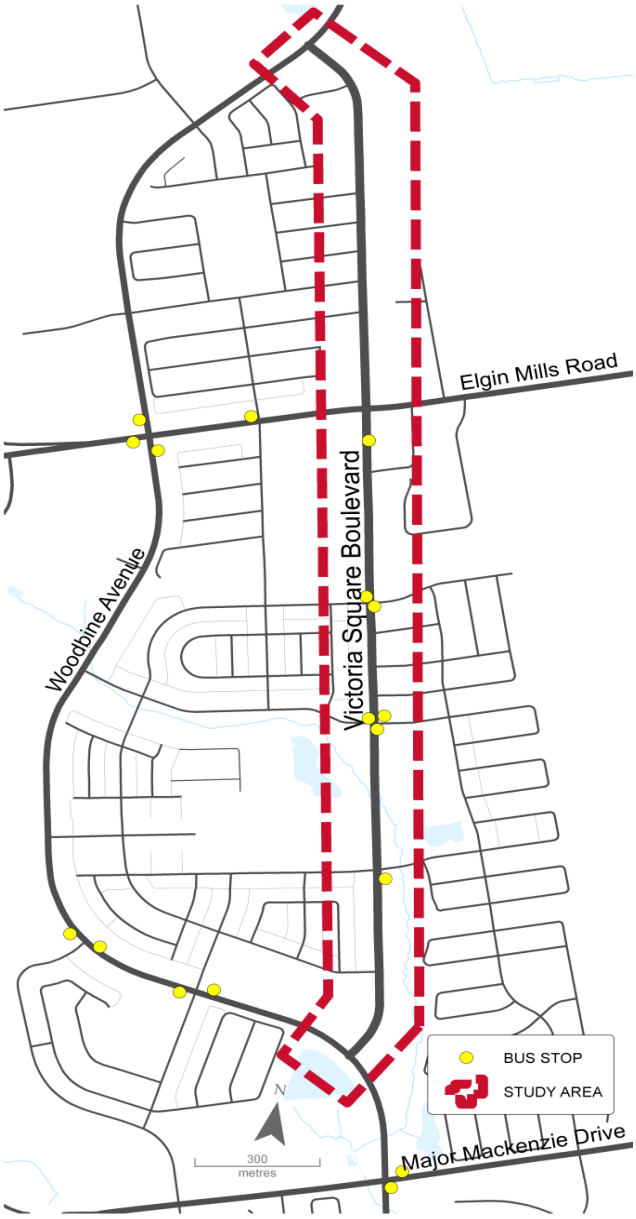


Exhibit 3-1: Bus Stops in and around the study area

3.1.5 Right-of-Way Characteristics

The existing Victoria Square Boulevard right-of-way varies along the corridor's length. In the "Cathedral Precinct Area" (Area 5), the right-of-way ranges between 34 and 36 metres. In contrast, in the historic "Hamlet of Victoria Square" (Area 3), the right of way is 20 metres at its narrowest point. Approximate right-of-way dimensions along the study corridor are illustrated in **Exhibit 3-2**.

3.1.6 Pedestrian Facilities

Pedestrian facilities, in the form of sidewalks, generally occur on the west side of the street, with a few exceptions. The facilities are not continuous throughout the corridor, with a number of significant gaps in the network. Gaps occur on both sides of Victoria Square Boulevard between:

- Vine Cliff Boulevard and Betty Roman Boulevard
- Reflection Road / Rinas Avenue through Elgin Mills Road to just south of Edward Roberts Drive
- Just north of Duke of Cornwall Drive to south of Vetmar Road

Pedestrians have also been observed to use the existing paved shoulders along Victoria Square Boulevard, which are discontinuous and of varying widths.

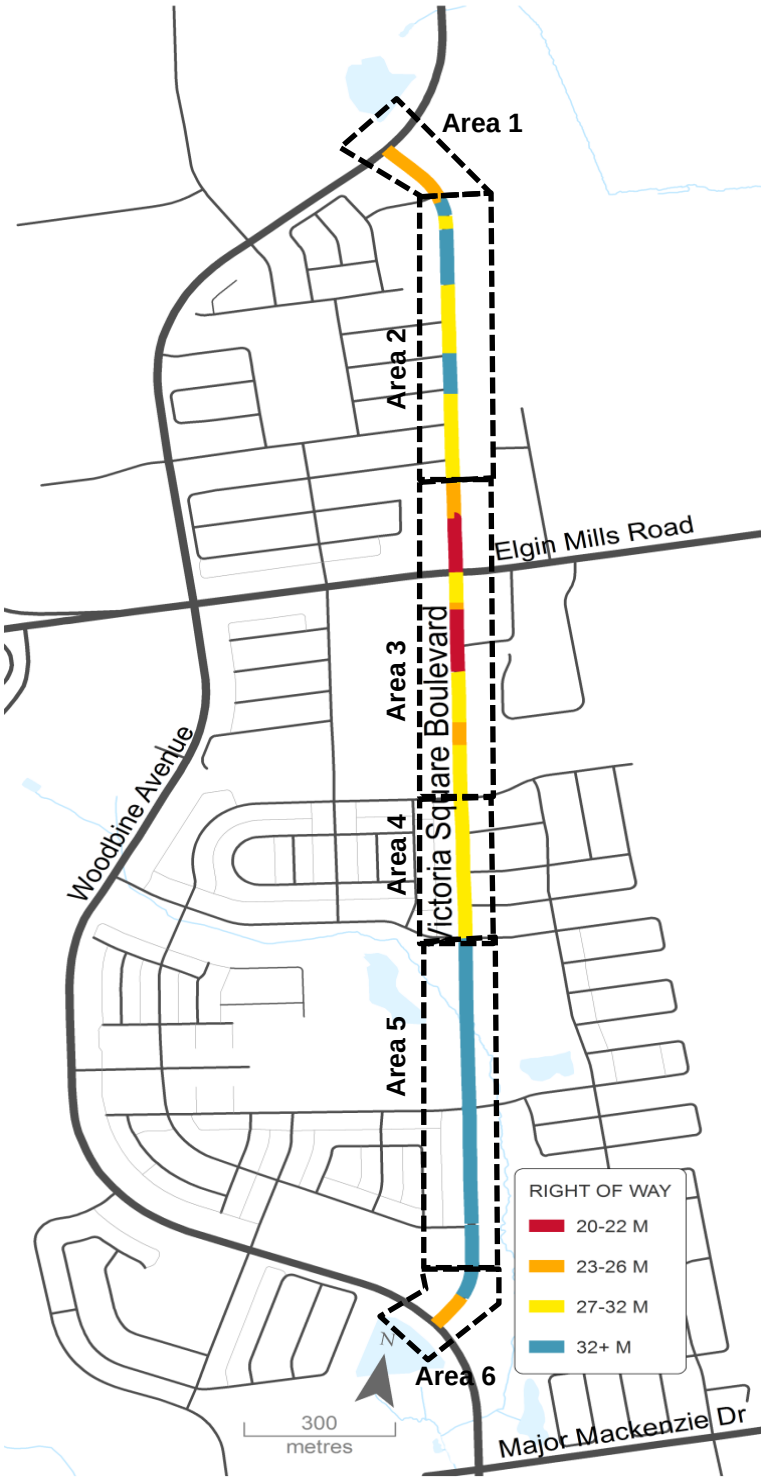


Exhibit 3-2: Right-of-way widths

3.1.7 Cycling Facilities

Cycling facilities on Victoria Square Boulevard consist of a 300 metre on-road painted bike lane on both sides of the street between Edward Roberts Drive and Duke of Cornwall Drive. The remainder of the street is served by paved shoulders of varying widths and quality.

A number of cycling facilities connect to Victoria Square Boulevard, including recently installed bike lanes on Murison Drive, Pope John Paul II Square, Betty Roman Boulevard, and Prince of Whales Drive. The street also connects to the Woodbine Avenue multi-use path at the southern intersection with Woodbine Avenue (south connection) in the Southern Gateway (Area 6).

Cycling facilities in the study area are illustrated in **Exhibit 3-3.**

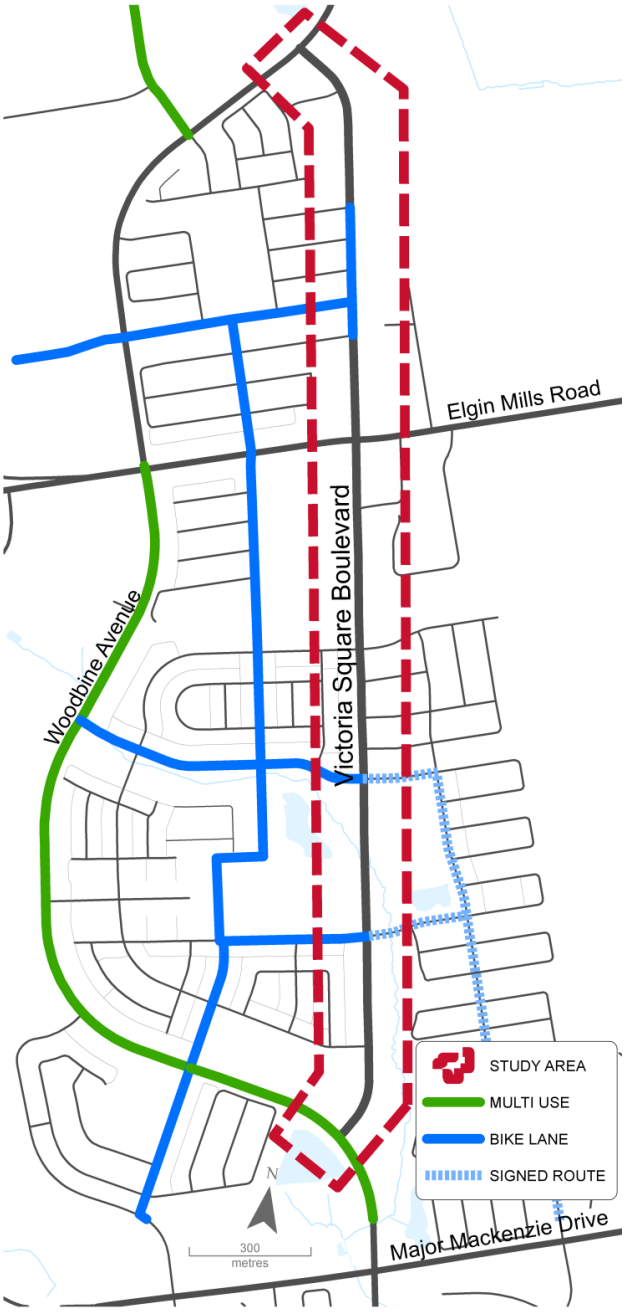


Exhibit 3-3: Existing cycling facilities

3.1.8 Network Connectivity and Continuity

With the construction of the Woodbine Avenue (formerly referred to as Woodbine Bypass), the function of Victoria Square Boulevard (formerly referred to as Woodbine Avenue) changed significantly. Officially, the street's classification was changed from 'Regional Road' to 'Collector.' In addition to the vehicular collector function, Victoria Square Boulevard serves as the principle 'Main Street' in the communities through which it traverses, but specifically through the Hamlet of Victoria Square (Area 3). With the construction of Woodbine Avenue, the 'Main Street' function is elevated over its previously predominant thoroughfare function.

3.1.9 Parking Facilities

A number of parking restriction signs are posted intermittently throughout the corridor; however, the extents of these restrictions are unclear. There are street-side parking restrictions on both sides of the street north of Edward Roberts Drive to the Northern Gateway (Areas 1 and 2). This is either implicit with the presence of bike lanes, or explicit with posted 'no parking' signage. Observations from field visits would suggest these restrictions are rarely enforced, with a high number of observed parking violations where the curb lane is used for parking.

City-wide parking restrictions are summarized in the City of Markham Parking Control By-Law (2005-188), which specifies an overnight parking ban between 2:30 AM and 6:00 AM, among other restrictions not requiring a sign.

3.1.10 Road Geometry

Victoria Square Boulevard is predominantly tangent, with large radius curves to connect to Woodbine Avenue (north and south connections) via T-intersections at the north and south limits of the study corridor. The existing vertical geometry meets current geometric design standards (Transportation Association of Canada Geometric Design Guide for Canadian Roads, 2017 Edition). Victoria Square Boulevard is currently a 2 lane roadway with a predominantly rural cross-section. Where development has occurred there has been discontinuous installations of curb and gutter, sidewalks, watermains, and sewers. In addition, there are discontinuous shoulders of varying widths and surface treatments along the study corridor.

3.1.11 Signage

There are approximately 70 traffic signs along the study corridor. A full inventory is included in **Appendix E.**

3.2 Socio-Economic Environment

3.2.1 Existing Land Use

According to the 2014 City of Markham Official Plan (**Exhibit 3-4**), existing land use in the area consists mainly of low-rise residential with small pockets of low rise mixed-use around the north and south gateways, and mid-rise residential around the Cathedral Town Precinct. More details are provided as follows for each of the six character areas within the study area (refer to **Exhibit 1-2**).

Area 1 is the northern gateway to the community and contains a small retail cluster (gas station, restaurant) and a large parcel of land where the former Woodbine Avenue ROW was situated prior to the construction of the bypass. At this time the west side of Victoria

Square Boulevard is flanked by vacant land. The east side of the intersection area is occupied by a residence.

Area 2 is a predominantly residential area with neighbourhoods on both sides of Victoria Square Boulevard.

Area 3 contains the Hamlet of Victoria Square and is home to the Victoria Square Community Centre (including a park and two baseball fields), two cemeteries in close proximity to the road right-of-way, the Victoria Square United and Wesleyan Methodist Church, P&F Meat Products Limited (local historic butcher since 1972), a commercial/ business facility in a heritage building close to the road right-of-way, and Cathedral (King David) Park (including trails, green space, play structures, etc.).

Area 4 is lined by townhouses on the west side and single-detached homes on the east side. There are four estate homes that front onto Victoria Square Boulevard. There is also a heritage home (Reads Corner).

Area 5 is home to the prominent architectural landmark known as the Cathedral of Transfiguration of our Lord that has been closed as a place of worship since 2006. There are two elementary public schools in this area: Sir John A MacDonald on the west side and Sir Wilfrid Laurier (French immersion) on the east side.

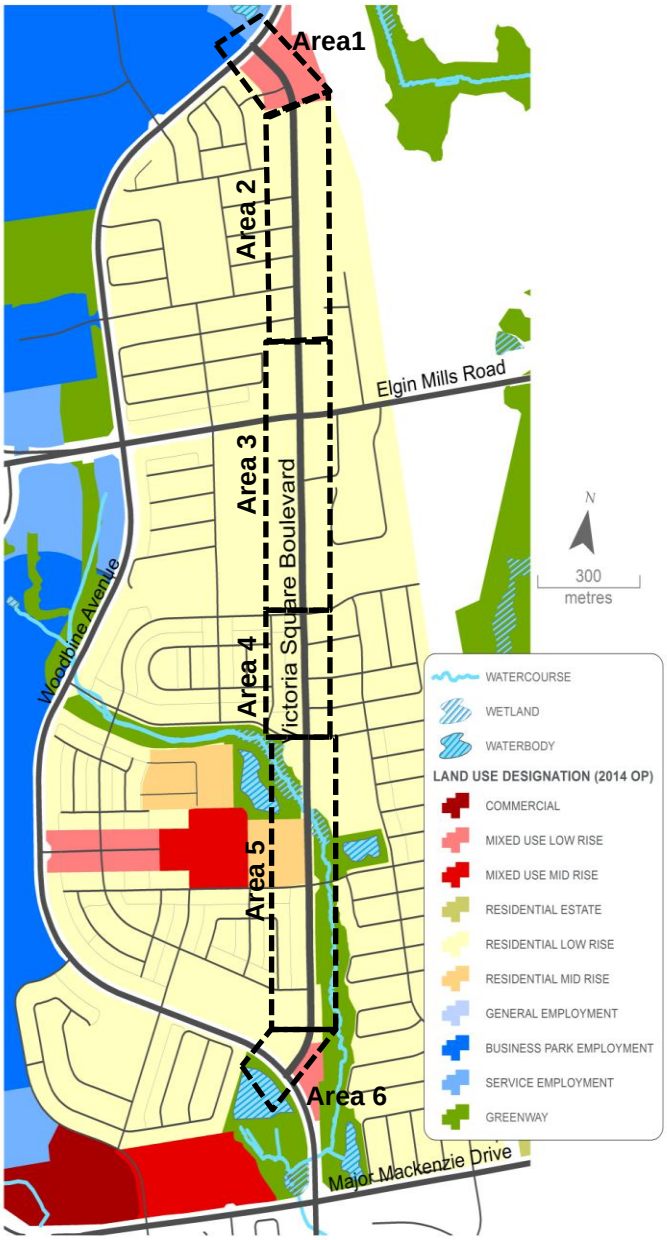


Exhibit 3-4: Land use map (2014 OP)

Area 6 is the southern gateway to the community with a new community park on the west side by Frisbee Development and Victoria Square Montessori School on the east side. Similar to Area 1, there is a large parcel of land where the former Woodbine Avenue ROW was situated prior to the construction of the bypass.

3.2.2 Archaeology

A Stage 1 archaeological assessment was conducted for the Victoria Square Boulevard study corridor. It determined that 17 archaeological sites have previously been registered within one kilometer of the study area. A review of physiography and local nineteenth century land use of the study area suggests that archaeological site potential exists, for Pre and Post-Contact Aboriginal archaeological resources as well as Euro-Canadian archaeological resources. Eight of the previously identified sites are located within 300m of the study corridor and are shown in **Table 3-1**. Six of the previously registered archaeological sites within 300 m of the study corridor (AlGu-462; AlGu-463; AlGu-464; AlGu-237; AlGu-322; AlGu-303) were fully assessed as part of several previous archaeological assessments stemming from residential developments. Limited information is available on the remaining two sites from the Ministry of Tourism, Culture, and Sport (MTCS). It is presumed that both of these sites have been completely assessed as part of previous residential subdivision development, but further documentation is required.

Table 3-1: Archaeological Sites within 300 m Proximity of Study Corridor

Borden Number	Site Name	Site Type	Time Period
AlGu-462	Peach 1	Homestead	Euro-Canadian
AlGt-463	Peach 2	Homestead	Euro-Canadian
AlGu-464	Peach 3	Homestead	Euro-Canadian
AlGu-237	AlGu-237	Findspot	Pre-Contact
AlGu-301	Carver	Dump Site	Euro-Canadian
AlGu-304	The Carlton Creek Site	Scatter	Pre-Contact
AlGu-302	Dietzmann	Homestead	Euro-Canadian
AlGu-305	Carlton Creek Northeast	Findspot	Pre-Contact, Middle Archaic

The Stage 1 property inspection determined that much of the study corridor was found to be previously disturbed due to previous construction and grading. There are also pockets within the study corridor that have been identified as being undisturbed, mainly in relation to the older 19th and 20th century homes in the vicinity of the intersection of Victoria Square Boulevard and Elgin Mills Avenue. These areas contain manicured lawns adjacent to previously disturbed roadway infrastructure. The study corridor however, is considered to possess some archaeological potential. The areas of manicured lawns adjacent to previously disturbed roadway infrastructure were recommended for Stage 2 Archaeological Assessment by test-pit survey at five-meter intervals and pedestrian survey at five-meter intervals, as appropriate, prior to ground disturbance activities.

In addition, there are two cemeteries adjacent to the study corridor, which are recommended to undergo Stage 3 Archaeological Assessment to determine if any grave shafts or burials are present.

The stage 2 archaeological assessment was completed and resulted in the recovery of twenty-seven 19th century historical artifacts. Due to the confined nature of the study corridor, and the presence of subterranean infrastructure in close proximity to the excavated test pits, intensification of the test pits was deemed to be unsafe due to the presence of gas lines and potential Bell and cable infrastructure.

Given the issues encountered during the Stage 2 test pit survey, including evidence of numerous subsurface utilities in the area, the MTCS was consulted as to how best to approach Stage 3 archaeological assessment required for the cemetery locations. Based on the correspondence with the MTCS, it was suggested to complete the Stage 3 archaeological assessment during the detailed design phase where locations of private and public utilities could be identified such that numerous one-metre square test units could be identified and excavated. During the course of public and private utilities locates, if it is determined there is no safe area for the excavation of Stage 3 test units, the Stage 3 assessment will need to be conducted during the construction phase, in tandem with the removal of the utilities in this area, ahead of road improvements.

More details on the Stage 1 and 2 Archaeological Assessment are provided in **Appendix J.**

3.2.3 Built Heritage Resources and Cultural Heritage Landscapes

A Heritage Impact Assessment consisting of background research, data collection and field review, determined that the study area retained a number of nineteenth and twentieth century cultural heritage resources that would potentially be impacted by the proposed improvements on Victoria Square Boulevard. The heritage impact assessment revealed that thirty-one cultural heritage resources are located within 100 m or adjacent to the Victoria Square Boulevard study area. Of the identified cultural heritage resources, twenty-six properties are built heritage resources (BHR) and one property is identified as a cultural heritage landscape (CHL). Most of the identified heritage resources within the study corridor are located within the hamlet of Victoria Square.

The historic townscape of Victoria Square is designated as the CHL within the study area in accordance to the Provincial Planning Statement (PPS) 2014, further defined as an evolved landscape in the MTCS *Heritage Resources in the Land Use Planning Process.* The boundaries of the CHL were approved by the City of Markham in its discussion on heritage conservation district boundaries and evaluated under *O.Reg 9/06.*

More details on the Heritage Impact Assessment are included in **Appendix K.**

3.2.4 Noise

The background noise levels in the vicinity of the study area have been described based on a review of publicly available information. The background noise levels represent the existing conditions. As there were limited Study Area-specific quantitative noise studies available, the review of available information was limited to a review of aerial imagery and experience of similar environments.

It is expected that the background noise levels in the study corridor are made up of road traffic noise from other major roadways in the vicinity of the study corridor, existing traffic along Victoria Square Boulevard. The background noise levels are expected to be similar to other urbanized environments across Ontario with elevated levels during the daytime period and quieter levels during the nighttime period. When anthropogenic activities are minimal, it is further expected there will be periods where the background levels are made up of sounds of nature.

More details on the Noise Assessment are included in **Appendix M.**

3.2.5 Air Quality

Indicator Compounds

The assessment of background air quality is focused on criteria air contaminants (CACs), compounds that are expected to be released from mobile sources, and Volatile Organic Compounds (VOCs) for which relevant air quality criteria exist, and which are generally accepted as indicative of changing air quality. These compounds result from fuel combustion, brake wear, tire wear and fugitive dust emitted from the movement of vehicles on roadways. The indicator compounds include:

- particulate matter, including suspended particulate matter (SPM), particles nominally smaller than 10 micrometres (µm) in diameter (PM10), and particles nominally smaller than 2.5 µm in diameter (PM2.5);
- nitrogen dioxides (NOx) (expressed as nitrogen dioxide [NO2]);
- carbon monoxide (CO); and
- Volatile Organic Compounds (including acrolein, acetaldehyde, 1,3- butadiene, benzene and formaldehyde which are typically associated with road traffic).

Existing Conditions

The background air quality in the area around the study corridor has been described by considering regional concentrations, based on publicly available monitoring data. The background air quality represents the existing condition. Sources include roadways,

long range trans-boundary air pollution, small regional sources and large industrial sources.

In Ontario, regional air quality is monitored through a network of air quality monitoring stations operated by the MOECC and Environment Canada National Air Pollution Surveillance (NAPS) Network. These stations are operated under strict quality assurance and quality control procedures. Existing air quality was characterized using background air concentrations from monitoring data sources in the study area. For this assessment, data from 2015 was used, which is the most recent year for which all data is complete and Quality Assured by Environment Canada.

The station identified as being most relevant to the proposed study corridor is located at Eagle Street and McCaffrey Road in Newmarket (the Newmarket Station). The Newmarket Station is located approximately 18 km from the Study Corridor and is also near Highway 404. The monitoring data for this station is therefore anticipated to be appropriate to represent the combined effect of emissions from local sources, as well as the effect of emissions transported into the region.

Overall, the monitoring data indicates that background air quality concentrations are below the Ambient Air Quality Criteria (AAQC) for all indicator compounds. AAQC are typically an indicator of good air quality, and therefore air quality in the Study Area may be classified as good. Furthermore, in 2015, the Newmarket Station had an Air Quality Health Index of “low” 89.8% of the year, with only 0.1% of the year classified as “high” (MOECC, 2016). The Air Quality Health Index is a risk-based scale designed to help classify the quality of the air and its impact on health. A number from 1 to 10 is identified by Environment Canada to indicate the level of health risk associated with local air quality. Therefore a “Low” rating indicates a “low” risk to health.

Local Emission Sources

The Study Corridor is located in a relatively residential area; as a result there are no industrial facilities within a 2km radius of the study corridor that reported to the National Pollutant Release Inventory in 2015 for the indicator compounds (ECCC, 2016). The main source of emissions close to the study corridor is anticipated to be Highway 404, which has annual average daily traffic of over 100,000 vehicles, approximately 5 times greater than the existing traffic volumes on Victoria Square Boulevard.

More details on the Air Quality Assessment are included in **Appendix M.**

3.3 Geotechnical and Pavement Investigation

The following summarizes the findings from the Geotechnical and Pavement investigation report.

The borehole investigation program was carried out from December 11 to 14, 2017, and included advancing a total of 20 boreholes through the existing pavement structure on Victoria Square Boulevard, within the project limits. Fifteen boreholes were advanced to a depth of approximately 2 m below the ground surface, four boreholes were advanced to a depth of approximately 5 m below ground surface, and one borehole was advanced to a depth of approximately 10 m below ground surface at the Carlton Creek culvert location. A standpipe piezometer was installed at three of the borehole locations to permit the measurement of the stabilized groundwater levels.

A pavement visual condition inspection was completed in December 2017 by a Pavement and Materials Engineer. The section of Victoria Square Boulevard south of Elgin Mills Road mainly has a rural cross section with ditches for drainage. The section north of Elgin Mills Road has a combination of rural and urban cross sections. Along the rural sections ditches are used for drainage and in the urban sections a curb and gutter and storm sewer/ditches system is used for drainage. The existing ditches are often very shallow and filled with overgrown vegetation.

The pavement on a short section of Victoria Square Boulevard from Vetmar Road to Woodbine Avenue (north connection) appears to have been recently rehabilitated and is in good condition with few, slight transverse cracks. Victoria Square Boulevard south of Vetmar Road is generally in fair condition. The following distresses were identified:

- Intermittent, slight to moderate fatigue cracking;
- Throughout, slight to moderate transverse cracking;
- Throughout, slight to severe opening and deterioration of the longitudinal construction joint; and
- Frequent, slight ravelling.

Localized and lane width patching has been carried out; however, the reasons for the patching were unclear at the time of the visual condition inspection. The lane width patching was noted to be in good condition, but the age of the patches was not evident. Crack sealing has been carried out but is no longer effective.

Detailed findings from the geotechnical investigation are documented in **Appendix G.**

3.4 Source Water Protection

Based on correspondence from TRCA, the Victoria Square Boulevard EA study area is located in the *Toronto and Region Source Protection Area* and transects the following vulnerable areas identified under the *Clean Water Act, 2006* (as illustrated in **Exhibit 3-5**):

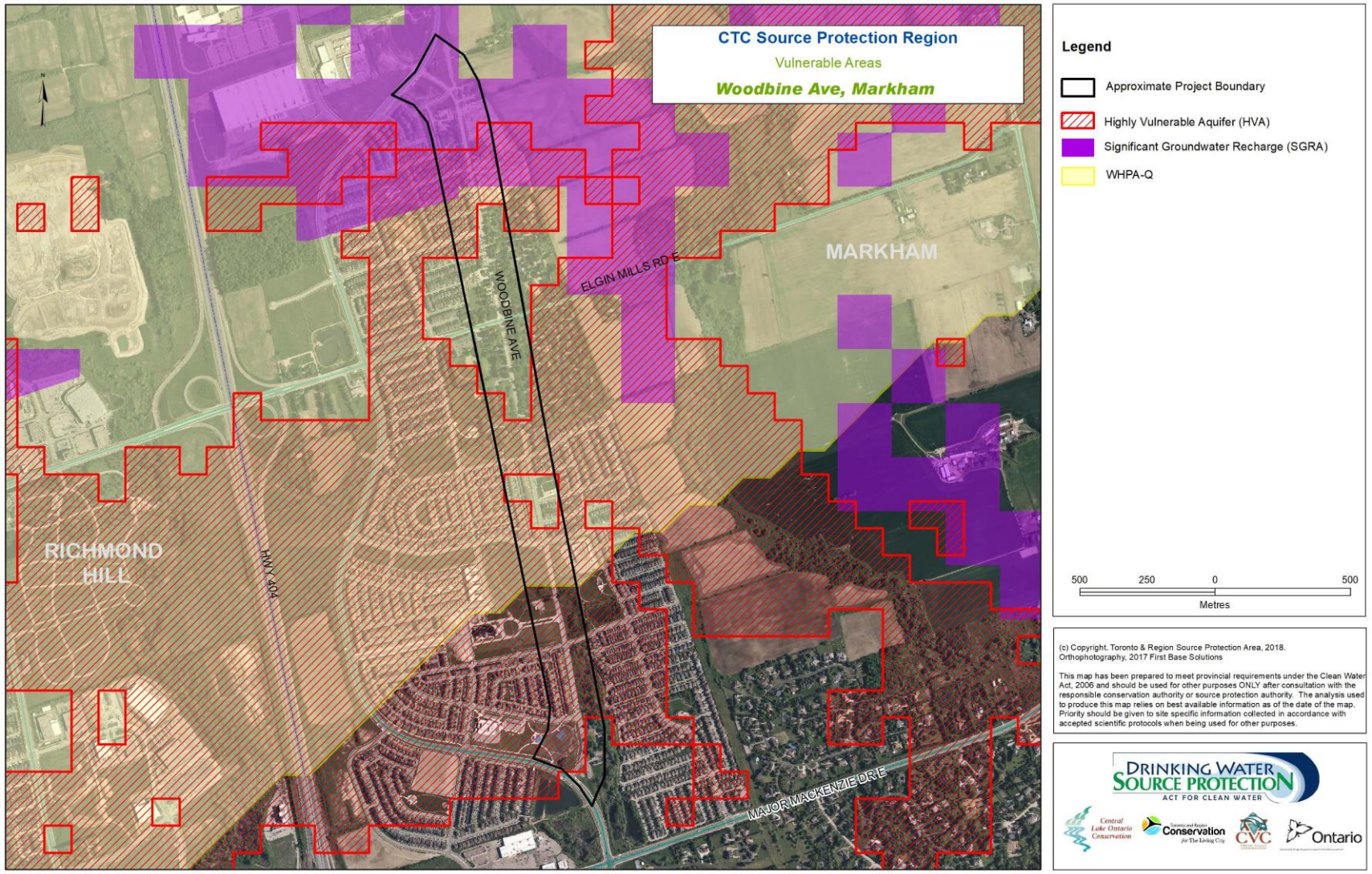
- Wellhead Protection Area (Quantity)

- Significant Groundwater Recharge Area (SGRA)
- Highly Vulnerable Aquifers (HVA)

Potential threats associated with the Victoria Square Boulevard roadway improvements, per the *Clean Water Act, 2006*, include:

- The establishment, operation, or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage (limited to stormwater runoff)
- The application of road salt
- The storage of snow (limited to roadway clearing operations only)

Mitigation strategies to minimize impacts associated with these potential threats are described in **Section 8.7**.



Source: TRCA

Exhibit 3-5: Source Protection Information in the Vicinity of the Study Area

3.5 Contamination Overview Study

A contamination overview study was conducted to identify potential subsurface chemical contamination issues within the study area based on a desktop review of available sources. Based on existing land use and information obtained from the contamination overview study and field investigation, there are a limited number of properties which would require further environmental investigation to assess the potential presence of subsurface impacts if a land transfer or property acquisition is required. In general, properties currently or historically developed as service garages, gas stations, vehicle sales centres, auto body repair shops, manufacturing facilities, industrial properties and construction yards represent issues of potential environmental concern and impacts may be encountered during road improvements in the vicinity of these properties.

Properties which require further background investigation include properties that appear to be vacant or newly occupied, but which had previously been developed for different uses. Any agricultural properties with active farming infrastructure (i.e., barns, sheds, livestock pens) within 50m of the ROW have the potential for impacts associated with petroleum hydrocarbon, pesticide storage, and nutrients; however, cultivated fields would not typically have these issues.

Based on the preliminary information obtained to date and the windshield reconnaissance, the study area contains twelve properties with issues of potential environmental concern. These areas are shown in **Exhibit 3-6.**

Of the twelve properties identified, the following is a breakdown of the recommended additional environmental assessment program based on the information obtained to date:

- Priority Level 1 (none of the twelve identified properties): Properties are not anticipated to have subsurface impacts (i.e., no further environmental assessments are recommended);
- Priority Level 2 (ten of the twelve properties, identified as properties # 1, 2, 3, 4, 5, 6, 7, 8, 10, and 11): Properties require further assessment to determine whether subsurface investigations would be warranted (i.e., a Phase I ESA is recommended); and,
- Priority Level 3 (two of the twelve properties, identified as properties # 9 and 12): Properties require subsurface environmental investigation to determine whether soil and/or groundwater impacts exist at the properties.

More details relating to the Contamination Overview Study can be found in **Appendix I**.

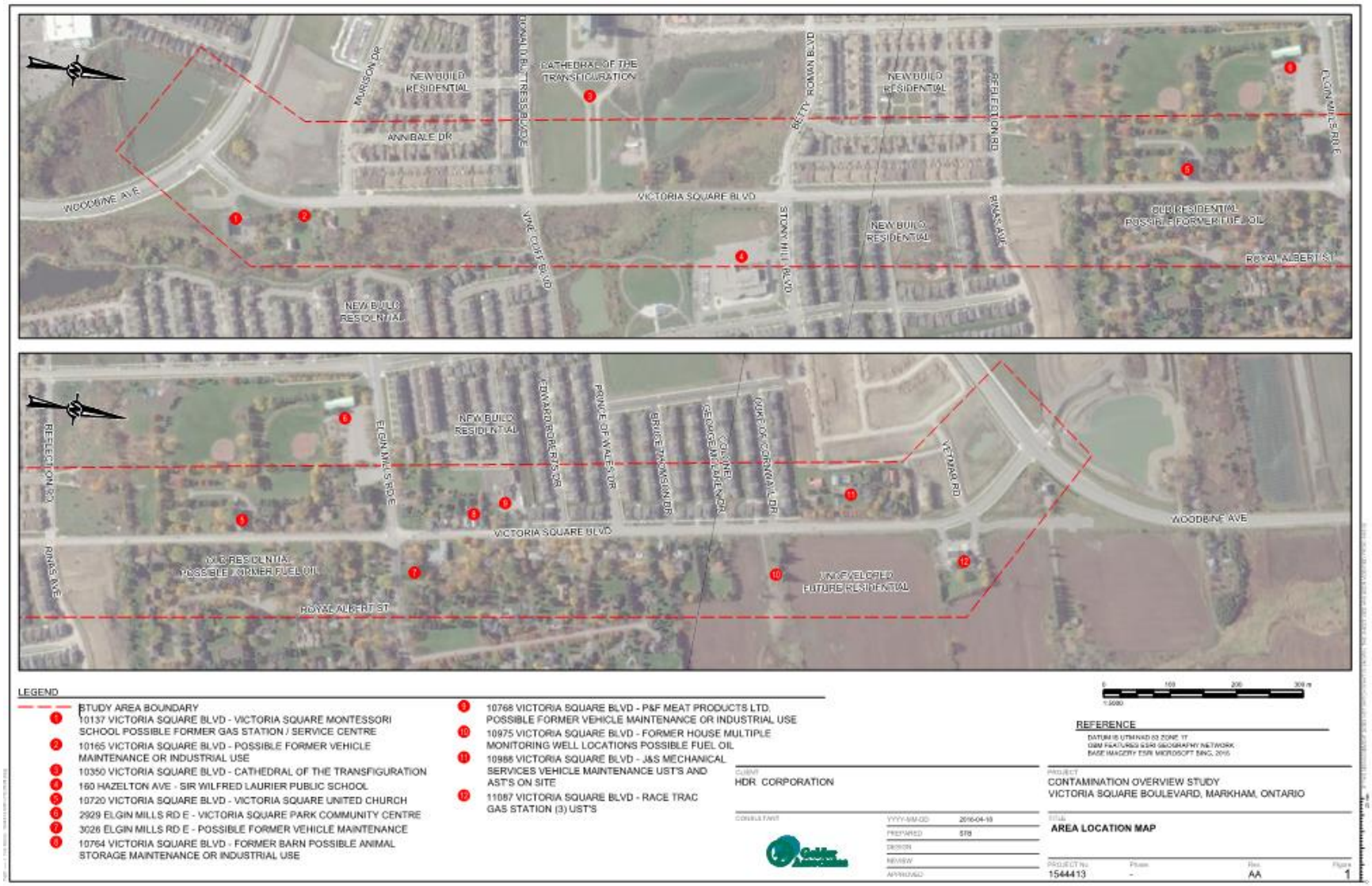


Exhibit 3-6: Properties in the Study Area with Potential for Environmental Concern

3.6 Natural Heritage

The study area is located within a developed setting, consisting primarily of residential properties, public parks, and some commercial and institutional land uses. The residential areas are a mixture of low-density residential with treed lots, and other areas of densely packed, subdivision-style townhouses. Municipal parks, including Victoria Square Park, and Vine Cliff Park, exist along Woodbine Avenue. Two naturalized stormwater management ponds occur east and west of Woodbine Avenue, south of Betty Roman Blvd/ Stony Hill Ave.

Two tributaries to Berzcy Creek (the East and West Branches of Carlton Creek) occur in the study area, in addition to a number of treed areas, marsh and open space. These tributaries and their associated riparian communities have potential to support wildlife habitat, and Berzcy Creek has been identified as an occupied or recovery reach for Redside Dace (DFO 2015). The marsh, located along the Carlton Creek East Branch, west of Woodbine Avenue and south of Betty Roman Blvd, is designated as an unevaluated wetland (LIO 2016). The stormwater ponds may provide suitable habitat for turtles, and the other naturalized areas, including municipal parks, may support other wildlife species.

The study area also contains landscaped boulevard trees and manicured lawns, particularly within the residential areas. The riparian and valleyland areas associated with the tributaries in the study area are identified as part of the Natural Heritage Network and Other Greenway System Lands within the City of Markham's Greenway System (City of Markham 2014). The woodland located west of Woodbine Avenue and north of Major Mackenzie Drive is designated as Woodland under the Greenway System (City of Markham 2014). The study area is also located within the Cathedral district, which has area and site specific policies under the Markham Official Plan (City of Markham 2014). None of the City-designated features are designated significant or occur within special policy management areas.

The following species included in the Species at Risk Act have been identified locally within the past fifty years and have potential to occur within the study area:

- Western chorus frog (*Pseudacris triseriata*) – Threatened
- Blanding's turtle (*Emydoidea blandingii*) – Threatened
- Snapping turtle (*Chelydra serpentina*) – Special Concern
- Eastern ribbonsnake (*Thamnophis sauritius*) – Special Concern
- Barn swallow (*Hirundo rustica*) – Threatened
- Chimney swift (*Chaetura pelagica*) – Threatened

- Eastern wood-pewee (*Contopus virens*) – Special Concern
- Red-headed woodpecker (*Melanerpes erythrocephalus*) – Threatened
- Little brown myotis (*Myotis lucifugus*) – Endangered
- Northern myotis (*Myotis septentrionalis*) – Endangered
- Tri-colored bat (*Perimyotis subflavus*) – Endangered
- Butternut (*Juglans cinerea*) – Endangered
- Redside dace (*Clinostomus elongatus*) – Endangered
- Monarch (*Danaus plexippus*) – Special Concern

A preliminary summary of natural environment features and constraints is illustrated in **Exhibit 3-7**.

Detailed findings from the natural environment investigation are documented in **Appendix H.**

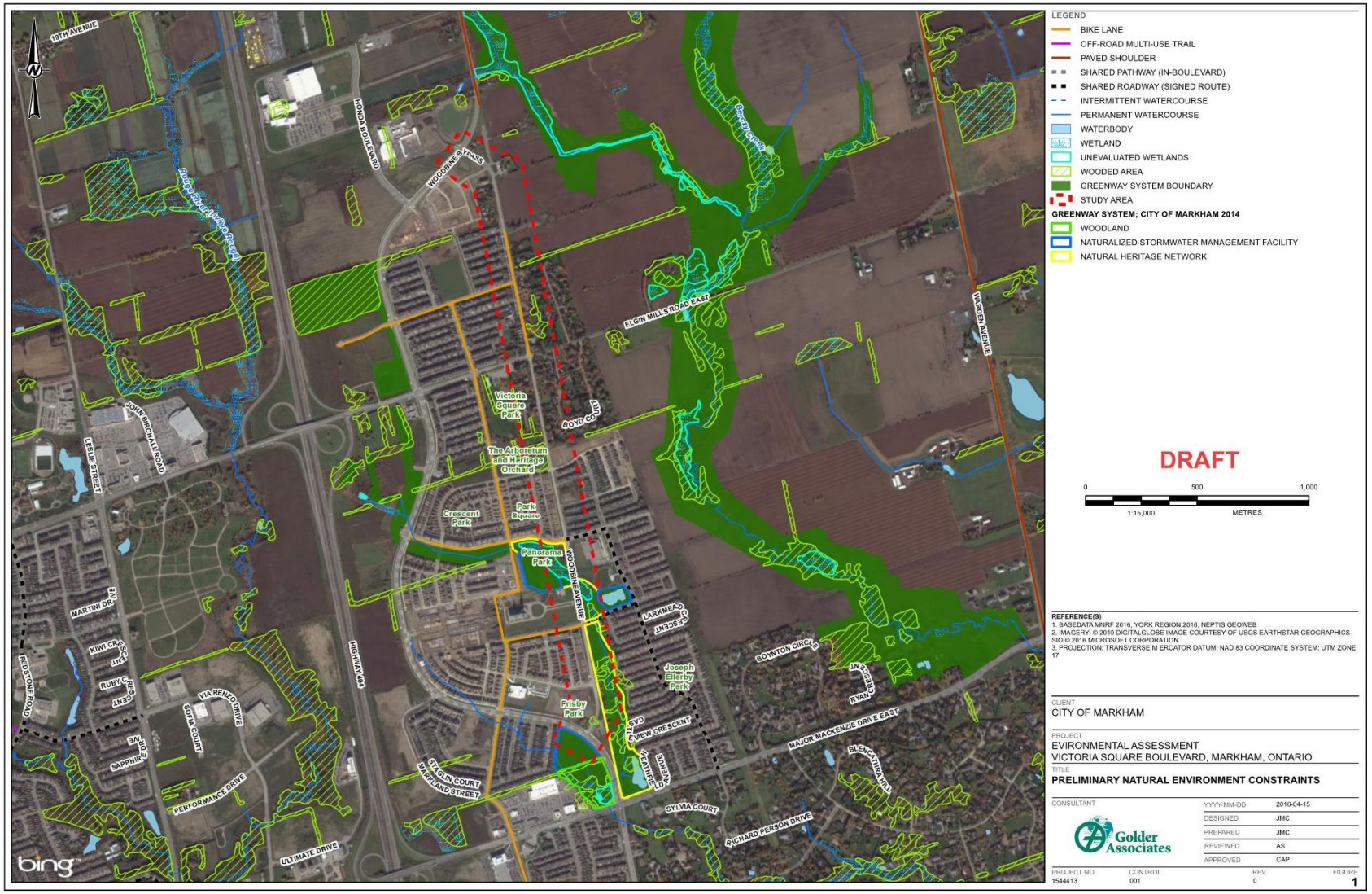


Exhibit 3-7: Natural Environment Features and Constraints

3.7 Drainage

Victoria Square Boulevard is presently a predominantly rural roadway that is drained by roadside ditches and culverts to tributaries of Carlton Creek. Just north of Major Mackenzie Drive, an intermittent stream (West Branch of Carlton Creek) located on the west side of Woodbine Avenue, discharges from a stormwater management facility. A permanently flowing stream (East Branch of Carlton Creek) crosses from the east side of Woodbine Avenue via a culvert and confluences with the West Branch just north of Major Mackenzie Drive. The East Branch receives drainage from several off-line stormwater management facilities that drain the Cathedral community.

The East Branch of Carlton Creek crosses Victoria Square Boulevard via a 1.25 m by 1.25 m concrete box culvert approximately mid-block between Major Mackenzie Drive and Elgin Mills Road. This is the only exposed culvert that crosses Victoria Square Boulevard within the project limits.

There is an existing culvert under Elgin Mills Road, approximately 600 metres west of Victoria Square Boulevard that conveys drainage from the northeast quadrant of the Highway 404 and Elgin Mills Road interchange southerly to the East Branch of Carlton Creek.

Victoria Square Boulevard drains predominantly from north to south within the study corridor. There is, however, a high point that splits the drainage towards the north and this is located just north of Elgin Mills Road. North of this high point, Victoria Square Boulevard drains towards an intermittent swale that ultimately conveys the drainage to Berczy Creek.

Victoria Square Boulevard is currently a two-lane roadway with a predominately rural cross-section. Where development has occurred, there has been discontinuous installation of curb and gutter, watermains, and sewers. Opportunities exist to convert Victoria Square Boulevard to a continuous urban roadway section to meet the drainage needs of the area.

Further details on drainage and stormwater management are included in **Appendix F**.

3.8 Streetscape Design

This section provides an overview of landscape opportunities along the corridor based on existing conditions. **Table 3-2** summarizes the opportunities broken down by the six character areas (per **Exhibit 1-2**).

Table 3-2: Landscaping opportunities

Character Area	Opportunity
Area 1 – North Gateway Area	• Gateway feature (in vacant land or road median) • Boulevard street trees
Area 2 – Residential Main Street Area	• Boulevard street trees • Protection/replacement of existing trees
Area 3 – Hamlet of Victoria Square	• Boulevard street trees • Protection/replacement of existing mature trees • Intersection improvements at Elgin Mills Road
Area 4 – Cathedral Residential Area	• Boulevard street trees
Area 5 – Cathedral Precinct Area	• Street tree planting • Valleyland restoration • Pedestrian amenity area (views to the valleyland) • Protection of existing trees
Area 6 – Cathedral Community Gateway Area	• Gateway feature (in vacant land or road median) • Restoration of impacts to parkland • Boulevard street trees

3.9 Utilities and Other Services

There are existing utilities within the existing corridor, including a hydro pole line that alternates on the east and west side of Victoria Square Boulevard, a Bell aerial line on the east side of Victoria Square Boulevard and a gasmain along portions of the Victoria Square Boulevard corridor. Where development has occurred, municipal servicing including watermain and sanitary sewer have been constructed. As part of proposed developments adjacent to the study corridor, north of Elgin Mills Road, additional municipal services are expected to be extended along the Victoria Square Boulevard corridor to service these developments. There are a number of active water wells within the study area. The proposed roadway improvements which may include pavement widening, boulevard construction and/or profile correction may conflict with the existing pole lines, wells, or underground services.

3.10 Illumination

All intersections within the study area have some degree of illumination. There is intermittent mid-block illumination with gaps between Rinas Avenue/Reflection Road and the Victoria Square United Church and again in the northern section between Duke of Cornwall Drive and the beginning of the Northern Gateway. Presently, streetlighting focuses on the vehicular travel lanes only. There are opportunities to allow illumination for other road users such as pedestrians and cyclists.

4 Summary of the Needs Assessment and Justification

4.1 Existing Transportation Needs

4.1.1 Traffic Volumes

Existing traffic counts were provided to HDR by York Region. Where counts may not have reflected construction of Woodbine Avenue (previously referred to as Woodbine Bypass), or where counts were not available from the Region, they were performed by Ontario Traffic Inc. on behalf of HDR. The count dates range from 2009 to 2016. Count dates are summarized in **Table 4-1**.

Table 4-1: Traffic Count Details

Intersection with Victoria Square Boulevard		Date	Intersection with Victoria Square Boulevard		Date
1	Woodbine Avenue (north connection)	11-28-2012	10	Reflection Road	10-21-2009
2	Vetmar Road	04-05-2016	11	Campus Close	01-21-2015
3	Duke of Cornwall Drive	01-28-2015	12	Cecil Nichols Avenue	10-13-2015
4	Colonel George McLaren Drive	01-27-2015	13	Church View Avenue	01-22-2015
5	Bruce Thomson Drive	01-20-2015	14	Stony Hill Boulevard	09-14-2011
6	Prince of Wales Drive	01-21-2015	15	Vine Cliff Boulevard	09-18-2014
7	Edward Roberts Drive	04-15-2015	16	Murison Drive	09-22-2011
8	Elgin Mills Road East	12-06-2014	17	Woodbine Avenue (south connection)	04-05-2016
9	Royal Albert Street	04-08-2015			

As a result of the Woodbine Avenue construction in November 2010 and construction of new homes that has been occurring in recent years, the magnitude of the traffic volumes along Victoria Square Boulevard as well as the travel patterns have changed drastically. Counts obtained before 2010 have much higher through volumes along Victoria Square Boulevard prior to the construction of the bypass, and a comparison of counts at Elgin Mills Road shows that patterns have shifted drastically after construction of the bypass.

Historic aerials show significant development occurring between 2009 and 2012 as shown in **Exhibit 4-1**. The 2009 aerial also shows that the bypass had not yet been constructed north of Elgin Mills Road. Major development areas are circled in red.

Based on the extent of development that has occurred along the Victoria Square corridor, the traffic volumes were reviewed for balancing. Turning movement volumes to and from local roadways were generally maintained, while through volumes along Victoria Square Boulevard were the focus of adjustment. Major adjustments were applied to traffic counts performed prior to 2012. The most significant change was

applied to the Reflection Road intersection by reducing through volumes along Victoria Square Boulevard and estimating westbound approach volumes to account for homes built after 2009 on the east side of Victoria Square Boulevard.

Although there are also development areas on the east side of Woodbine Avenue that may not be captured in the 2011 count, they generally have direct access to Woodbine Avenue and are not anticipated to have significant impact to Victoria Square Boulevard in terms of volume or traffic patterns when considering the timeframe between 2011 and 2015. Future development beyond 2015 will be discussed in **Section 4.2.1**.

Balanced weekday peak hour north-south *approach* volumes are shown in **Table 4-2**.

Table 4-2: Volume Balancing Summary

Intersection with Victoria Square Boulevard	Weekday AM Peak Hour Volumes				Weekday PM Peak Hour Volumes			
	Northbound		Southbound		Northbound		Southbound	
	Before	After	Before	After	Before	After	Before	After
Woodbine Avenue (north connection)	42	70	-	-	86	116	-	-
Vetmar Road	65	65	95	95	109	109	39	39
Duke of Cornwall Drive	68	68	80	90	122	122	42	37
Colonel George McLaren Drive	60	70	101	101	129	129	49	49
Bruce Thomson Drive	55	70	96	106	123	138	37	57
Prince of Wales Drive	77	77	92	112	162	162	49	59
Edward Roberts Drive	90	78	163	133	174	184	78	73
Elgin Mills Road East	181	161	163	163	240	240	92	72
Royal Albert Street	147	152	305	305	241	241	95	95
Reflection Road	194	149	817	302	720	250	156	96
Campus Close	144	144	343	343	256	256	89	114
Cecil Nichols Avenue	168	133	424	354	291	251	103	128
Church View Avenue	107	122	329	369	182	282	61	141
Stony Hill Boulevard	183	168	318	368	352	352	122	142
Vine Cliff Boulevard	139	179	259	399	276	400	237	137
Murison Drive	206	186	396	401	411	411	182	122
Woodbine Avenue (south connection)	-	-	408	408	-	-	130	130

The resulting weekday AM and PM peak hour traffic volumes adjusted and balanced to existing 2015 traffic conditions are shown in **Exhibit 4-2** and **Exhibit 4-3**, respectively.

Exhibit 4-1: Development Comparison of September 2009 [left] vs. October 2012 [right]

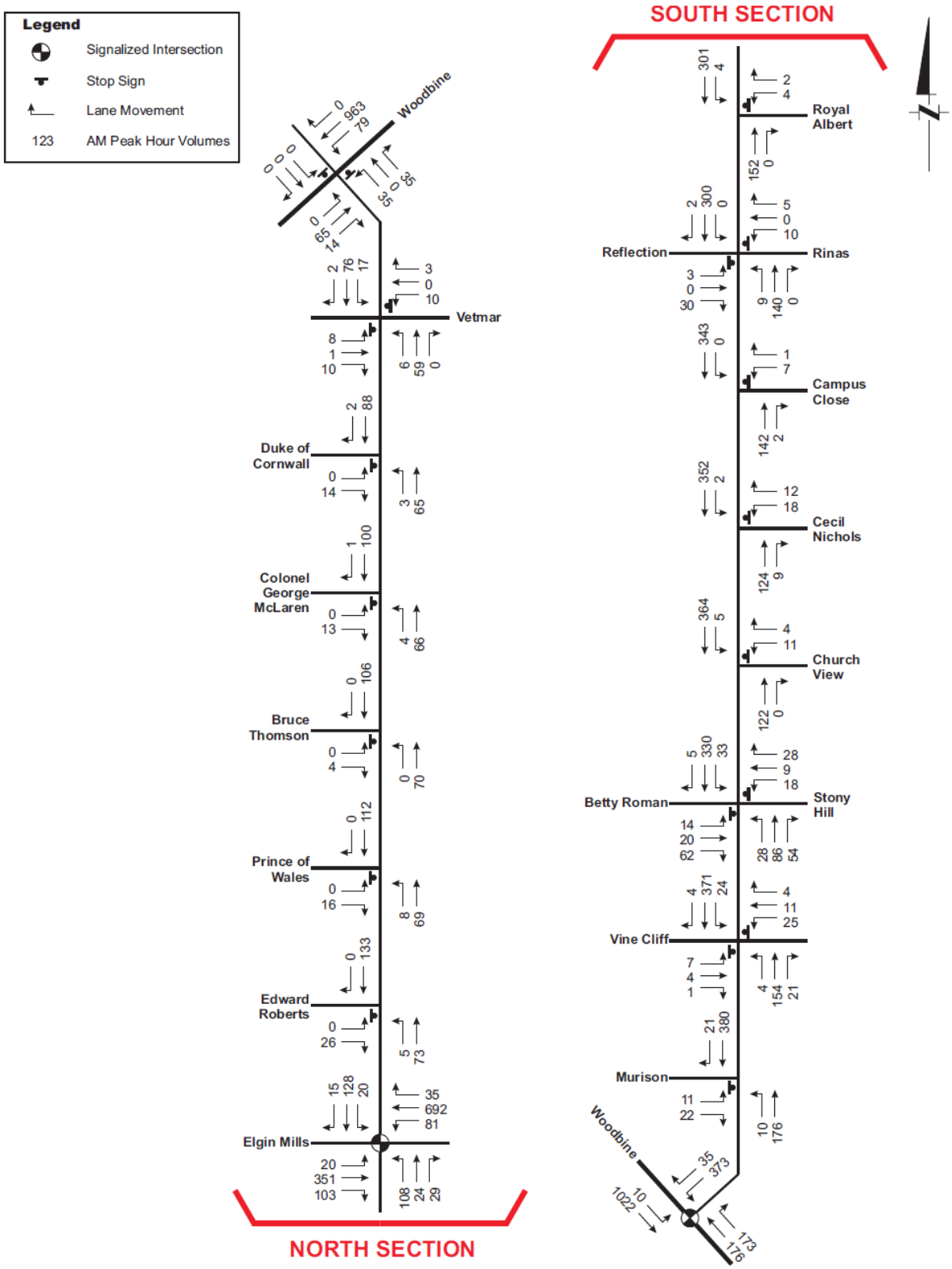


Exhibit 4-2: Existing Weekday AM Peak Hour Traffic Volumes

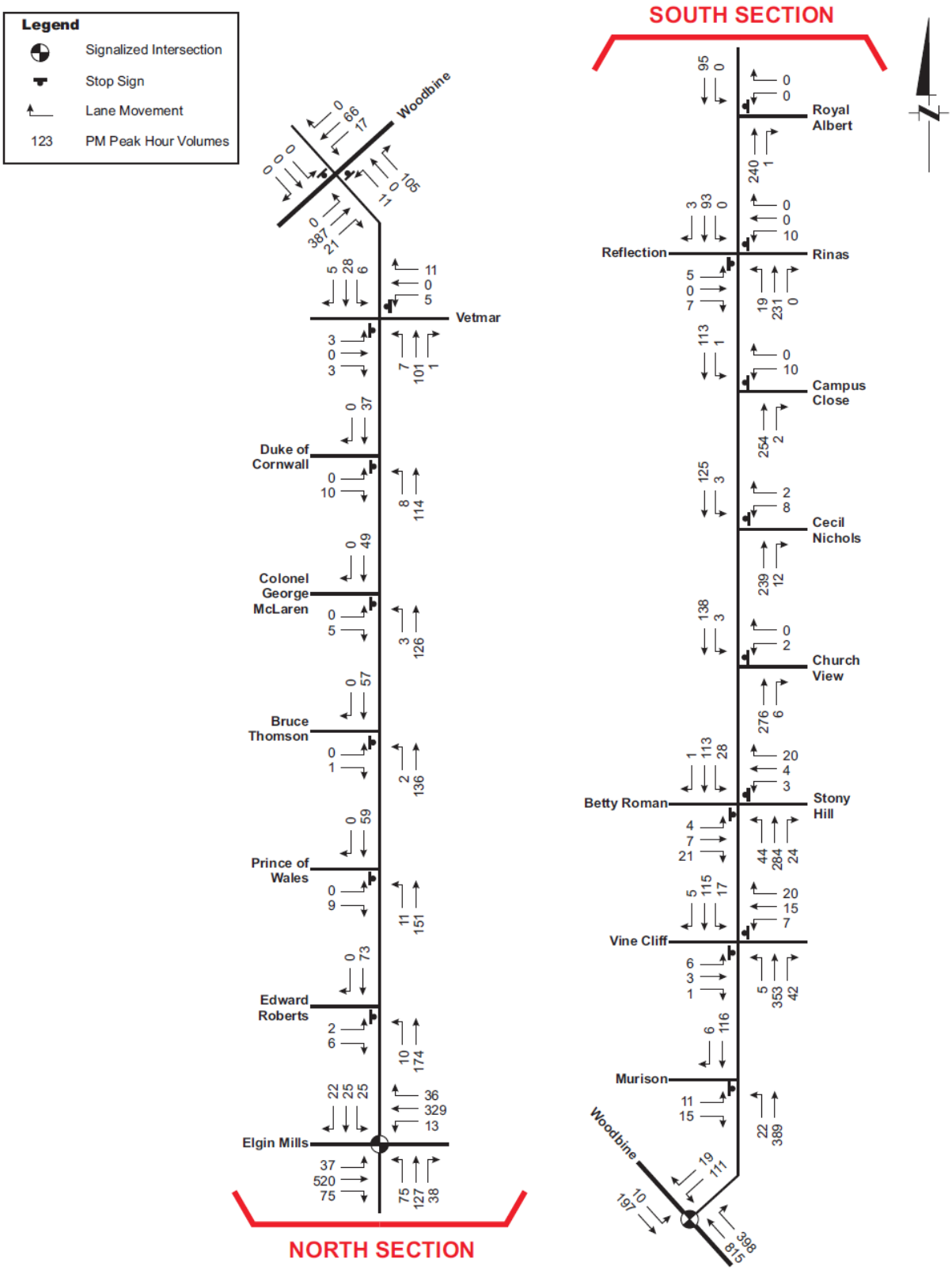


Exhibit 4-3: Existing Weekday PM Peak Hour Traffic Volumes

Within the study area there are no major traffic generators with the exception of the two schools: Sir Wilfred Laurier Public School and Sir John A. McDonald Public School.

Local side street peak hour volumes are generally low (less than 30 vehicles in one direction). Collector roadways (Betty Roman Boulevard/Stony Hill Boulevard) and major roadways (i.e. Elgin Mills Road) have higher volumes because they provide access to Woodbine Avenue.

4.1.2 Intersection Operations

The analysis concentrated on the weekday AM and PM peak hours since these align with peak residential traffic flows. Signal timing was provided to HDR from York Region.

Intersection operations were assessed using Synchro 7 (Build 773, Rev 8) Traffic Signal Coordination Software, which employs methodology from the Highway Capacity Manual (HCM 2000) published by the Transportation Research Board National Research Council. Synchro can analyze both signalized and unsignalized intersections in a road corridor or network taking into account the spacing, interaction, queues and operations between intersections. The signalized intersection analysis considers two separate measures of performance:

- The capacity of all intersection movements, which is based on a volume to capacity ratio (v/c); and
- The level of service (LOS) for all intersection movements, which is based on the average control delay per vehicle for each of various movements through the intersection, and for the overall intersection.

Level of service is based on the average control delay per vehicle for a given movement. Delay is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between ‘A’ and ‘F’, with ‘F’ being the longest delay. The volume to capacity (v/c) ratio is a measure of the degree of capacity utilized at an intersection.

HCM delays, v/c ratios, and corresponding letter grades are identified in **Table 4-3**.

Table 4-3: Level of Service Descriptions

Level of Service (LOS)	Control Delay per Vehicle (s)	Volume to Capacity (v/c) Ratio	Operating Condition
A - C	≤ 10 to ≤ 35	Less than 0.85	Free-flow, very little to moderate delay.
D - E	> 35 to ≤ 80	Between 0.85 and 0.99	Approaching or at capacity, users experience delays and queuing.
F	> 80	Greater than 1.00	Over capacity, severe delays and queuing.

Note: LOS derived from HCM 2000

Existing traffic operations are summarized in **Table 4-4** and **Table 4-5** for signalized and unsignalized intersections, respectively, based on the balanced volumes and the

existing road network. Detailed Synchro reports are included in **Appendix E**. Victoria Square Boulevard has one lane per direction, with exclusive turn lanes provided at some intersections. Exclusive turn lanes are generally not provided at intersections with minor local roads on either the major or minor approaches.

Table 4-4: Existing Signalized Intersection Operations

Intersection with Victoria Square Boulevard & Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
	v/c Ratio	LOS	v/c Ratio	LOS
Woodbine Ave (south connection)	0.62	C	0.36	B
Westbound Left-turn	0.85	D	0.25	C
Westbound Right-turn	0.02	C	0.01	C
Northbound Through	0.09	A	0.40	B
Northbound Right-turn	0.12	A	0.27	B
Southbound Left-turn	0.02	A	0.03	A
Southbound Through	0.52	B	0.10	A
Elgin Mills Rd	0.61	C	0.54	D
Eastbound Left-turn	0.16	B	0.18	C
Eastbound Through-right	0.54	C	**1.01**	**E**
Westbound Left-turn	0.25	B	0.19	C
Westbound Through-right	0.81	C	0.61	C
Northbound Left-through	0.33	C	0.25	B
Northbound Right-turn	0.02	C	0.02	B
Southbound Left-through	0.23	C	0.07	B
Southbound Right-turn	0.01	C	0.01	B

All movements at signalized study intersections are operating with acceptable level of service and with residual capacity, with one exception. The eastbound through-right turn movement at Victoria Square Boulevard and Elgin Mills Road is operating at capacity with a volume to capacity ratio of 1.01 and level of service E during the weekday PM peak hour.

Table 4-5: Existing Unsignalized Intersection Operations

Intersection with Victoria Square Boulevard & Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
	v/c Ratio	LOS	v/c Ratio	LOS
Murison Dr				
Eastbound Left-turn	0.04	B	0.02	B
Eastbound Right-turn	0.04	B	0.02	B
Northbound Left-turn	0.01	A	0.02	A
Northbound Through	0.12		0.23	
Southbound Through	0.25		0.07	
Southbound Right-turn	0.01		0.00	
Vine Cliff Blvd				
Eastbound Left-through-right	0.03	B	0.02	B
Westbound Left-turn	0.07	C	0.02	B
Westbound Through-right	0.03	B	0.07	B
Northbound Left-turn	0.00	A	0.00	A
Northbound Through-right	0.11		0.24	
Southbound Left-turn	0.02	A	0.02	A
Southbound Through-right	0.23		0.07	

Intersection with Victoria Square Boulevard & Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
	v/c Ratio	LOS	v/c Ratio	LOS
Stony Hill Dr				
Eastbound Left-turn	0.07	C	0.02	C
Eastbound Through-right	0.23	B	0.05	B
Westbound Left-turn	0.12	C	0.01	C
Westbound Through-right	0.08	B	0.05	B
Northbound Left-turn	0.03	A	0.04	A
Northbound Through-right	0.11		0.22	
Southbound Left-turn	0.03	A	0.03	A
Southbound Through-right	0.27		0.08	
Reflection Rd				
Eastbound Left-through-right	0.06	B	0.02	B
Westbound Left-through-right	0.03	B	0.02	B
Northbound Left-through-right	0.01	A	0.01	A
Southbound Left-through-right	0.00		0.00	
Church View Ave				
Westbound Left-right	0.03	B	0.00	B
Northbound Through-right	0.08		0.19	
Southbound Left-through	0.00	A	0.00	A
Cecil Nichols Ave				
Westbound Left-right	0.05	B	0.02	B
Northbound Through-right	0.08		0.16	
Southbound Left-through	0.00	A	0.00	A
Campus Close				
Westbound Left-right	0.02	B	0.02	B
Northbound Through-right	0.09		0.17	
Southbound Left-through	0.00		0.00	A
Royal Albert St				
Eastbound Left-through-right	0.00	A	0.00	A
Westbound Left-through-right	0.01	B	0.00	A
Northbound Left-through-right	0.00		0.00	
Southbound Left-through-right	0.00	A	0.00	
Edward Roberts Dr				
Eastbound Left-right	0.03	A	0.01	A
Northbound Left-through	0.00	A	0.01	A
Southbound Through-right	0.10		0.04	
Prince of Wales Dr				
Eastbound Left-turn	0.08	C	0.04	C
Eastbound Right-turn	0.08	C	0.04	A
Northbound Left-through	0.01	A	0.01	
Southbound Through-right	0.08		0.04	
Bruce Thomson Dr				
Eastbound Left-through-right	0.00	A	0.00	A
Westbound Left-through-right	0.00	A	0.00	A
Northbound Left-through-right	0.00		0.00	A
Southbound Left-through-right	0.00		0.00	
Colonel George McLaren Dr				
Eastbound Left-through-right	0.01	A	0.01	A
Westbound Left-through-right	0.00	A	0.00	A
Northbound Left-through-right	0.00	A	0.00	A
Southbound Left-through-right	0.00		0.00	

Intersection with Victoria Square Boulevard & Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
	v/c Ratio	LOS	v/c Ratio	LOS
Duke of Cornwall Dr				
Eastbound Left-right	0.02	A	0.01	A
Northbound Left-through	0.00	A	0.01	A
Southbound Through-right	0.06		0.03	
Woodbine Ave (north connection)				
Eastbound Left-through-right	0.00	A	0.00	A
Westbound Left-turn	0.12	C	0.03	B
Westbound through-right	0.03	A	0.14	B
Northbound Left-turn	0.00		0.00	
Northbound Through	0.02		0.12	
Northbound Right-turn	0.01		0.01	
Southbound Left-turn	0.05	A	0.02	A
Southbound Through	0.29		0.02	
Southbound Right-turn	0.00		0.00	
Vetmar Dr				
Eastbound Left-through-right	0.02	A	0.01	A
Westbound Left-through-right	0.02	A	0.02	A
Northbound Left-through-right	0.00	A	0.00	A
Southbound Left-through-right	0.01	A	0.00	A

All movements at all unsignalized study intersections are operating with acceptable level of service and with residual capacity during both the weekday AM and PM peak hours.

4.1.3 Transit Use and Mode Share

Mode share data was extracted from the 2011 Transportation Tomorrow Survey for the study area. The study area is intersected by four GTA06 traffic zones (2377-2380) and the following results represent a summary of all four zones together. Transit trips (including trips made on a school bus) accounted for 8% of all trips starting in the study area. This is approximately 3% lower than the City-wide transit mode share of 11%. Looking at other modes, all modes are lower than the City-wide rates, with the exception of driving trips, which accounted for 74% of trips in the study area compared to a City-wide average of 67% (see **Exhibit 4-4**).

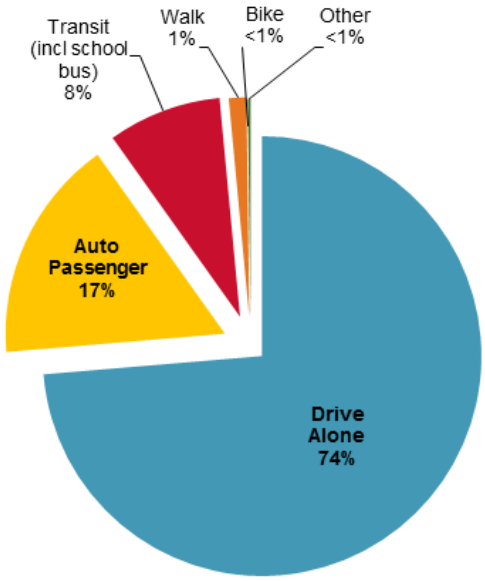


Exhibit 4-4: Mode Share within the Study Area

4.1.4 Pedestrian and Cyclist Activity

Cyclist and pedestrian activity in the study area is low according to the available traffic counts. This is intuitive considering the surrounding land uses and built form of Victoria Square Boulevard. Total pedestrian and cyclist volumes as identified in the traffic counts for study intersections are summarized in **Table 4-6**.

Table 4-6: Pedestrian and Cyclist Volumes

Intersection with Victoria Square Boulevard	Count Duration	Total # Pedestrians	Total # Cyclists
Woodbine Avenue (north connection)	8 hours	0	0
Vetmar Road	11 hours	6	1
Duke of Cornwall Drive	8 hours	1	0
Colonel George McLaren Drive	8 hours	1	0
Bruce Thomson Drive	8 hours	6	1
Prince of Wales Drive	8 hours	10	0
Edward Roberts Drive	8 hours	11	11
Elgin Mills Road East	8 hours	25	1
Royal Albert Street	8 hours	2	0
Reflection Road	8 hours	2	0
Campus Close	8 hours	4	1
Cecil Nichols Avenue	8 hours	1	2
Church View Avenue	8 hours	10	0
Stony Hill Boulevard	8 hours	64	0
Vine Cliff Boulevard	8 hours	25	12
Murison Drive	8 hours	21	0
Woodbine Avenue (south connection)	11 hours	31	0

The highest pedestrian volumes are observed at the intersections nearest to existing public schools (Sir Wilfred Laurier Public School and Sir John A. McDonald Public School). A closer review of the pedestrian volumes confirms that the peak pedestrian volume occurs during the afternoon, generally between 4:00pm and 5:00pm when schools finish, with no clear morning peak in terms of pedestrian traffic. Cyclist volumes appear to be distributed throughout the count duration.

4.2 Future Transportation Needs

4.2.1 Future Land Use Assumptions

Development fronting and immediately adjacent to the study corridor is well underway and will continue into the near to medium term. Of specific note, the Cathedraltown development, currently about half-way through its build out, will continue to grow, adding a number of low and mid-rise residential units to the immediate area. Further north, the Eaton Square development is currently under construction east of Victoria Square Boulevard. Additional development applications have been submitted for lands in the vicinity of the study corridor; however, these were still under review and not yet approved at the time of ESR filing.

Beyond the study corridor, is the large stretch of land between Woodbine Avenue and Highway 404 that is currently designated for Business Park Employment, Commercial, and Service Employment uses. This will significantly increase the number of employees in the immediate vicinity of the study area.

The North Markham Future Urban Area (FUA) planning process is currently underway and predicts the area in and around the study area to accommodate approximately 38,000 persons and 19,000 jobs to 2031.

4.2.2 Future Travel Demand

The future travel demand on Victoria Square Boulevard was established through coordination with a parallel City of Markham study (North Markham Future Urban Area Transportation Study).

Due to the fact that the north-east quadrant of Elgin Mills Road and Victoria Square Boulevard will become a large employment block and the south-east quadrant will become a medium-to-low density residential area, the majority of horizon year traffic will be generated from the FUA development. As a result, the horizon year demand for the Victoria Square Boulevard traffic analysis will rely on preliminary results provided by the City available at the time.

Exhibit 4-5 illustrates the 2031 AM traffic demand generated from the FUA study. It is noted that the FUA study was completed subsequent to the traffic analysis for the Victoria Square Boulevard EA; however, it is understood that the final FUA information did not change significantly from the preliminary findings available at the time of the

Victoria Square Boulevard EA traffic analysis, and as such, it is not expected that the recommendations documented herein need to be revisited.

The link volumes for the EA study area will be based on the following interpretation of data based on the volumes shown (See **Exhibit 4-5, Table 4-7,** and **Table 4-8**).

Any increase of link volumes compared to existing approach volumes will be applied to through movements along Victoria Square Boulevard. Since no PM travel demand is available, the AM forecast will be relied upon to determine future needs.

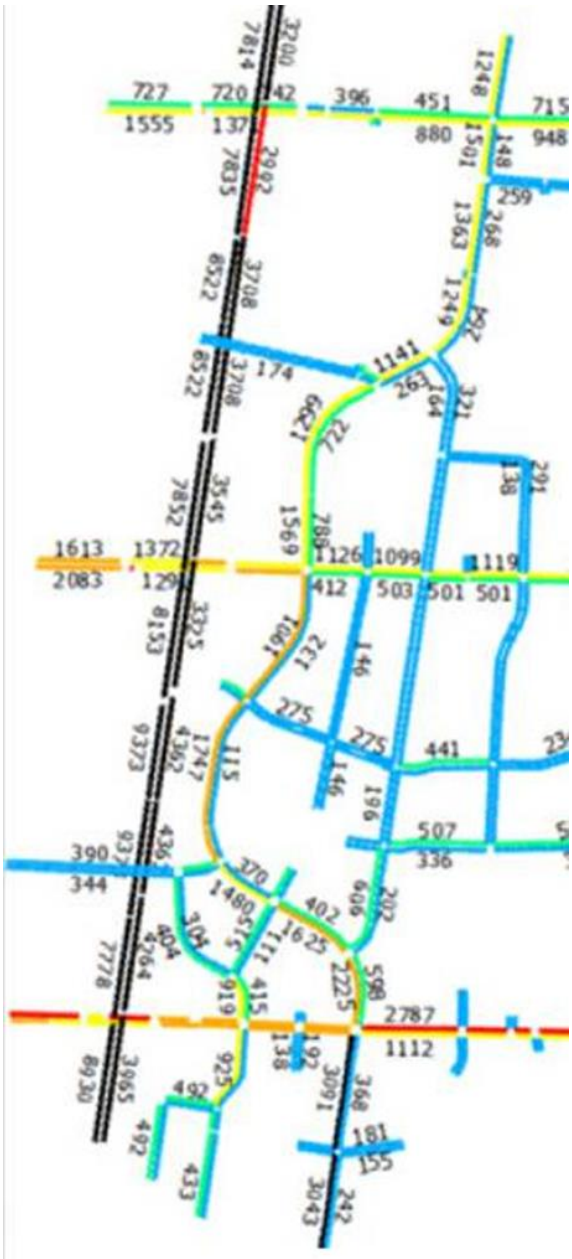


Exhibit 4-5: 2031 AM Travel Demand on Victoria Square Blvd (Source: City of Markham)

Table 4-7: 2031 AM Peak Link Volumes (Woodbine Ave & Victoria Square Blvd)

Segment	Southbound	Northbound
Woodbine Avenue north of Victoria Square Blvd (north connection)	1249	264
Woodbine Avenue south of Victoria Square Blvd (north connection)	1141	263
Woodbine Avenue north of Victoria Square Blvd (south connection)	1625	402
Woodbine Avenue south of Victoria Square Blvd (south connection)	2225	598
Victoria Square Boulevard south of Elgin Mills Rd	164	321
Victoria Square Boulevard north of Elgin Mills Rd	606	202

In addition to adjusting traffic volumes along Victoria Square Boulevard and Woodbine Avenue, some adjustments have been made to side-street traffic volumes at the locations summarized in **Table 4-9,** to account for growth along these roadways.

A new connection is shown running north-south parallel to Victoria Square Boulevard from Elgin Mills Road and connecting to Victoria Square Boulevard. For the purposes of this analysis a connection at Duke of Cornwall Drive is assumed.

Table 4-8: 2031 AM Peak Link Volumes (Other Roadways)

Segment	Westbound	Eastbound
Vine Cliff Boulevard east of Victoria Square Boulevard	507	336
Stony Hill Boulevard east of Victoria Square Boulevard	441	n/a
Elgin Mills Road east of Victoria Square Boulevard	1119	501
Elgin Mills Road west of Victoria Square Boulevard	1099	503
New Roadway (Duke of Cornwall Drive) east of Victoria Square Boulevard	291	136

These link volumes were used to inform the development of the future 2031 AM peak hour traffic volumes and were used as guides. The resulting links volumes calculated from the projected turning movement counts will therefore not exactly match those listed in **Table 4-7** and **Table 4-8**.

Growth to the east on Rinas Avenue was estimated since link volumes were not available. Some traffic volumes on the east side of Victoria Square Boulevard were reassigned to Stony Hill Boulevard from Vine Cliff Boulevard since Stony Hill Boulevard is a collector roadway with access to Woodbine Avenue (via Betty Roman Boulevard). It also results in better overall operations at Victoria Square Boulevard and Vine Cliff Boulevard, which will be discussed in more detail in **Section 4.2.3**.

The future 2031 AM peak hour traffic volumes are shown in **Exhibit 4-6**.

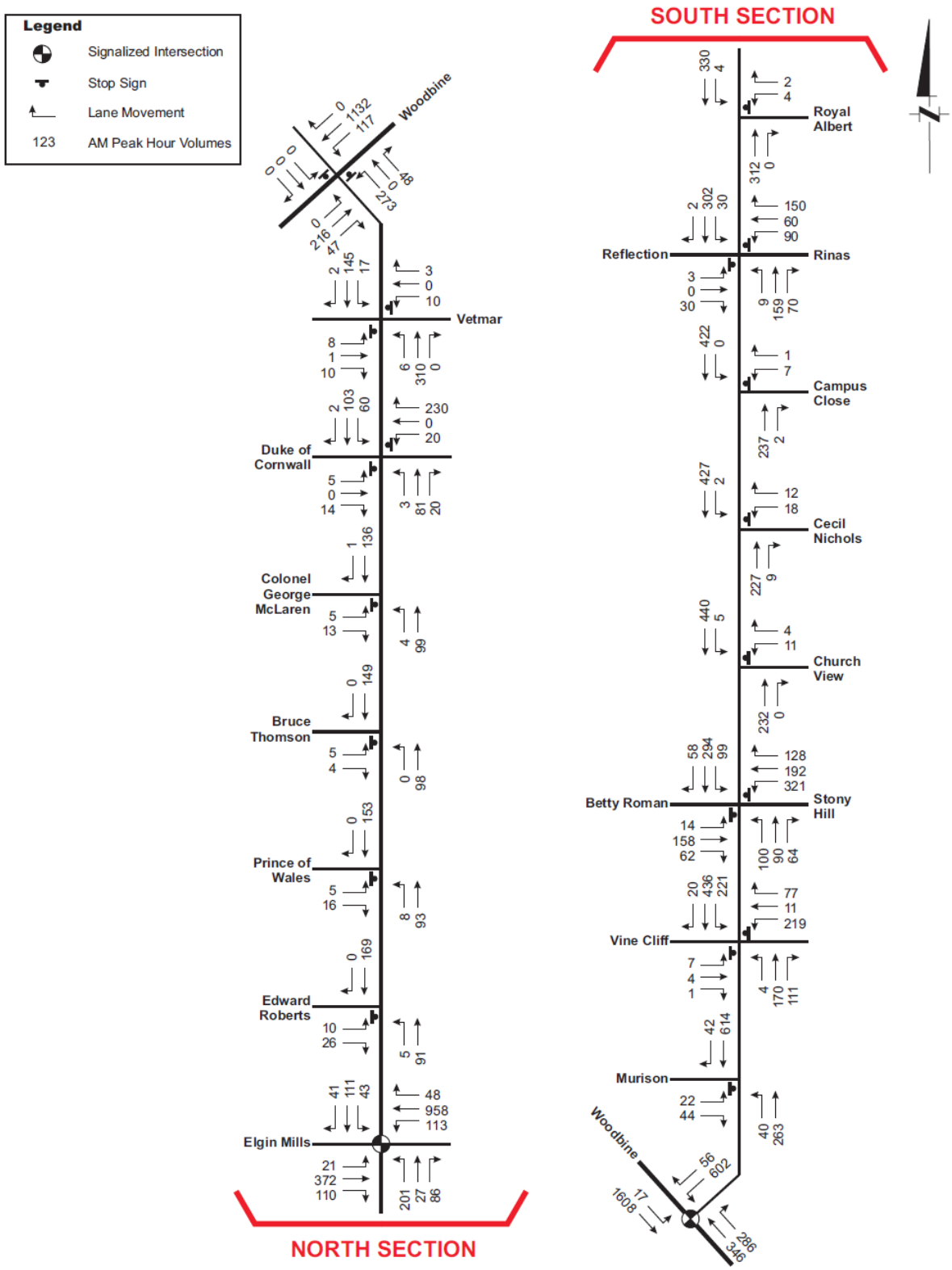


Exhibit 4-6: 2031 Weekday AM Peak Hour Traffic Volumes

4.2.3 Future Road Network

There are several road network changes on the record that may have some impact to the study area. Of specific note and per the York Region Transportation Master Plan (TMP) Update (2009), two mid-block crossings are planned over Highway 404 connecting Woodbine Avenue and Leslie Street – one between Major Mackenzie Drive and Elgin Mills Road and the second between Elgin Mills Road and 19th Avenue. The Region's TMP also identifies Woodbine Avenue as an "Arterial Road Improvement for Capacity" and is within the Five Year Road Network Improvements list.

New road connections to Victoria Square Boulevard are anticipated as residential development continues along the corridor into the future. As future development applications are submitted, new road connections between planned subdivisions and Victoria Square Boulevard are to be reviewed. This EA study considers a new connection between Victoria Square Boulevard and Elgin Mills Road, running north-south to the east of Victoria Square and north of Elgin Mills. Additional lanes of traffic have been deemed unnecessary for the Victoria Square Boulevard EA study corridor.

4.2.4 Future Pedestrian Needs

The City of Markham Pathways and Trails Master Plan (2009) identifies Victoria Square Boulevard, from Woodbine Avenue in the south to just south of Betty Roman Boulevard, as High Priority for improvements. The York Region Pedestrian and Cycling Master Plan (2008) recommends the City include the lands in the study corridor in the City of Markham Pedestrian Zone where enhanced pedestrian infrastructure should be provided. The Plan also proposes sidewalks along one side for the length of Victoria Square Boulevard in the long term pedestrian system.

4.2.5 Future Cycling Needs

The York Region Pedestrian and Cycling Master Plan (2008) does not identify Victoria Square Boulevard for improved cycling infrastructure; however, Woodbine Avenue is intended to form part of the Regional cycling network, with in-boulevard cycling facilities currently installed on the east side of the road to Elgin Mills Road. This will ultimately connect to planned cycling facilities on Major Mackenzie Drive just south of the study area. The City of Markham Cycling Master Plan (2010) similarly does not show Victoria Square Boulevard itself as part of the future cycling network although a number of streets which connect or cross it are shown as part of the network (e.g. Elgin Mills, Stony Hill, etc.)

4.2.6 Future Transit Service

The York Region Transit 2016 Annual Service Plan contains several recommendations relevant to the study area. Specifically, the Plan recommends consolidating TTC and YRT services, with specific mention of merging YRT Route 224B and a number of TTC

routes into a single route to be named 24-Woodbine. The Region has communicated with the project team that it is considering re-routing 224B (or its planned successor, 24-Woodbine) to become a bi-direction north-south line running along Victoria Square Boulevard. The Woodbine Avenue corridor is also included on the YRT Frequent Transit Network, with 15 minute or better rush hour frequencies planned for 2019. These changes could potentially result in the removal of some routes from Victoria Square Boulevard itself onto Woodbine Avenue. Stop locations could be reviewed as part of the planned transit route consolidation.

4.2.7 Future Intersection Operations

Future 2031 intersection operations have been assessed based on the weekday AM peak hour since this period generally reflects higher traffic volumes throughout the study road network. This analysis provides an indication of where capacity deficiencies will be observed, with the understanding that individual movements which may be operating near or at capacity may differ between the weekday AM and PM peak hours.

The future 2031 weekday AM peak hour traffic volumes were developed by applying growth factors to the existing traffic volumes and attempting to match the link volumes shown in **Exhibit 4-5**. These growth factors were calculated by comparing the link volumes taken from the North Markham Future Urban Area Transportation Study to the existing link volumes used in the weekday AM peak hour analysis. The future 2031 volumes were manually balanced.

For a conservative analysis some growth was applied to minor street approaches in addition to those discussed in **Section 4.2.2,** depending on potential future growth locations and to improve balancing. Along Victoria Square Boulevard, growth has been applied to north-south through-movements only. At the study area boundary intersections with Woodbine Avenue at the north and south ends of the study area, growth has also been applied to the through movements along Woodbine Avenue, as well as to turning movements into and out of Victoria Square Boulevard. Growth was also applied to all approaches at Victoria Square Boulevard and Elgin Mills Road since this is a major-major intersection.

Future 2031 traffic operations are summarized in **Table 4-9** for signalized intersections and in **Table 4-10** for unsignalized intersections. Detailed Synchro reports are included in **Appendix E**. The analysis includes the existing weekday AM peak hour operations for comparison purposes. Signal timings at the two signalized study intersections have been optimized for this analysis, but no geometric improvements have been made.

Table 4-9: Future Signalized Intersection Operations

Intersection with Victoria Square Boulevard & Movement	Existing AM Peak Hour		2031 AM Peak Hour	
	v/c Ratio	LOS	v/c Ratio	LOS
Woodbine Ave (south connection)	0.62	C	**0.97**	**D**
Westbound Left-turn	0.85	D	**0.96**	**E**
Westbound Right-turn	0.02	C	0.05	C
Northbound Through	0.09	A	0.21	B
Northbound Right-turn	0.12	A	0.20	B
Southbound Left-turn	0.02	A	0.04	B
Southbound Through	0.52	B	**0.97**	**D**
Elgin Mills Rd	0.61	C	**0.90**	**C**
Eastbound Left-turn	0.16	B	0.38	C
Eastbound Through-right	0.54	C	0.48	B
Westbound Left-turn	0.25	B	0.27	B
Westbound Through-right	0.81	C	**0.94**	**D**
Northbound Left-through	0.33	C	0.80	E
Northbound Right-turn	0.02	C	0.06	C
Southbound Left-through	0.23	C	0.41	D
Southbound Right-turn	0.01	C	0.04	C

The future conditions signalized intersection analysis indicates that during the weekday AM peak hour the study area boundary intersection at Victoria Square Boulevard and Woodbine Avenue (south connection), as well as at the intersection of Elgin Mills Road and Victoria Square Boulevard, will be operating at or near capacity with overall volume to capacity ratios of 0.97 and 0.90, respectively. Some movements will be operating with volume to capacity ratios of 0.94 and higher, and with level of service D and E.

Table 4-10: Future Unsignalized Intersection Operations

Intersection with Victoria Square Boulevard & Movement	Existing AM Peak Hour		2031 AM Peak Hour	
	v/c Ratio	LOS	v/c Ratio	LOS
Murison Dr				
Eastbound Left-turn	0.04	B	0.11	C
Eastbound Right-turn	0.04	B	0.11	C
Northbound Left-turn	0.01	A	0.05	A
Northbound Through	0.12		0.17	
Southbound Through	0.25		0.40	
Southbound Right-turn	0.01		0.03	
Vine Cliff Blvd				
Eastbound Left-through-right	0.03	B	0.09	D
Westbound Left-turn	0.07	C	**1.67**	**F**
Westbound Through-right	0.03	B	0.18	B
Northbound Left-turn	0.00	A	0.00	A
Northbound Through-right	0.11		0.17	
Southbound Left-turn	0.02	A	0.18	A
Southbound Through-right	0.23		0.28	
Stony Hill Dr				
Eastbound Left-turn	0.07	C	N/A	N/A
Eastbound Through-right	0.23	B	**1.60**	**F**
Westbound Left-turn	0.12	C	N/A	N/A
Westbound Through-right	0.08	B	**1.99**	**F**
Northbound Left-turn	0.03	A	0.13	A
Northbound Through-right	0.11		0.12	

Intersection with Victoria Square Boulevard & Movement	Existing AM Peak Hour		2031 AM Peak Hour	
	v/c Ratio	LOS	v/c Ratio	LOS
Southbound Left-turn	0.03	A	0.10	A
Southbound Through-right	0.27		0.28	
Reflection Rd				
Eastbound Left-through-right	0.06	B	0.07	B
Westbound Left-through-right	0.03	B	0.68	D
Northbound Left-through-right	0.01	A	0.01	A
Southbound Left-through-right	0.00		0.03	A
Church View Ave				
Westbound Left-right	0.03	B	0.04	B
Northbound Through-right	0.08		0.16	
Southbound Left-through	0.00	A	0.00	A
Cecil Nichols Ave				
Westbound Left-right	0.05	B	0.06	B
Northbound Through-right	0.08		0.14	
Southbound Left-through	0.00	A	0.00	A
Campus Close				
Westbound Left-right	0.02	B	0.02	C
Northbound Through-right	0.09		0.15	
Southbound Left-through	0.00		0.00	
Royal Albert St				
Eastbound Left-through-right	0.00	A	0.00	A
Westbound Left-through-right	0.01	B	0.01	B
Northbound Left-through-right	0.00		0.00	
Southbound Left-through-right	0.00	A	0.00	A
Edward Roberts Dr				
Eastbound Left-right	0.03	A	0.05	A
Northbound Left-through	0.00	A	0.00	A
Southbound Through-right	0.10		0.11	
Prince of Wales Dr				
Eastbound Left-turn	0.08	C	0.02	A
Eastbound Right-turn	0.08	C	0.02	A
Northbound Left-through	0.01	A	0.01	A
Southbound Through-right	0.08		0.11	
Bruce Thomson Dr				
Eastbound Left-through-right	0.00	A	0.01	A
Westbound Left-through-right	0.00	A	0.00	A
Northbound Left-through-right	0.00		0.00	
Southbound Left-through-right	0.00		0.00	
Colonel George McLaren Dr				
Eastbound Left-through-right	0.01	A	0.02	A
Westbound Left-through-right	0.00	A	0.00	A
Northbound Left-through-right	0.00	A	0.00	A
Southbound Left-through-right	0.00		0.00	
Duke of Cornwall Dr				
Eastbound	0.02	A	0.03	B
Westbound	-	-	0.30	B
Northbound Left-through-right	0.00	A	0.00	A
Southbound Left-through-right	0.06		0.04	A
Woodbine Ave (north connection)				
Eastbound Left-through-right	0.00	A	0.00	A
Westbound Left-turn	0.12	C	**1.00**	**F**
Westbound through-right	0.03	A	0.05	A
Northbound Left-turn	0.00		0.00	

Intersection with Victoria Square Boulevard & Movement	Existing AM Peak Hour		2031 AM Peak Hour	
	v/c Ratio	LOS	v/c Ratio	LOS
Northbound Through	0.02		0.06	
Northbound Right-turn	0.01		0.03	
Southbound Left-turn	0.05	A	0.09	A
Southbound Through	0.29		0.34	
Southbound Right-turn	0.00		0.00	
Vetmar Dr				
Eastbound Left-through-right	0.02	A	0.03	B
Westbound Left-through-right	0.02	A	0.03	B
Northbound Left-through-right	0.00	A	0.00	A
Southbound Left-through-right	0.01	A	0.01	A

Some movements at the intersections of Victoria Square Boulevard at Vine Cliff Boulevard and Victoria Square Boulevard at Stony Hill Drive will be operating with volume to capacity ratios exceeding 1.60 and with level of service F. Since this is the weekday AM peak hour it is the westbound movements operating poorly as residents leave the neighbourhoods east of Victoria Square Boulevard, likely destined to Highway 404 and bound to the south. The westbound approach at Victoria Square Boulevard at Stony Hill Drive will also be operating with level of service F, meaning that it will be over capacity and experiencing severe delays and queuing. Stony Hill Boulevard is a collector roadway with access to Woodbine Avenue, which explains the poor westbound operations.

The westbound left-turn movement at the intersection of Victoria Square Boulevard and Woodbine Avenue (north connection) will also be at capacity and will be operating with level of service F.

This analysis reflects the weekday AM peak period only. Monitoring of operations in the future should include the weekday PM peak period to determine if separate improvements are necessary to accommodate both peak periods. This analysis does however provide a good indication of where improvements will be needed and to what degree – **widening does not appear to be needed, but localized intersection improvements will likely be needed to mitigate the above deficiencies**.

The future conditions analysis indicates that during the weekday AM peak hour there will be capacity deficiencies at the study area boundary intersections as well as at the intersection of Elgin Mills Road – all three intersections are major-major intersections, two of which are signalized. The deficiencies are at the gateway intersections to the study area. There are no capacity deficiencies or movements with poor level of service at major-minor intersections identified during the AM peak hour.

This indicates that overall operations will continue to be acceptable and widening along Victoria Square Boulevard should not be required. However, improvements to the gateway intersections will likely be required in the future. This analysis reflects the weekday AM peak period only. Monitoring of operations in the future should include the

weekday PM peak period to determine if separate improvements are necessary to accommodate both peak periods.

Victoria Square Boulevard at Woodbine Avenue (north connection) may benefit from signalization. A traffic signal warrant analysis should be undertaken based on future traffic volumes as the intersection critical movements approach capacity. This intersection is constrained by the northbound left-turn movement from Victoria Square Boulevard onto Woodbine Avenue southbound, but it is possible that drivers will opt for another route with greater capacity facilitated by existing traffic signals (Elgin Mills Road or the intersection of Victoria Square Boulevard and Woodbine Avenue south connection). This movement will be operating at capacity with a volume to capacity ratio of 1.12. Monitoring is recommended at this location.

Victoria Square Boulevard at Woodbine Avenue (south connection) will not be operating with any movements at capacity, however, the southbound through movement along Woodbine Avenue and the left-turn from Victoria Square Boulevard to Woodbine Avenue southbound will be operating near capacity with volume to capacity ratios greater than 0.90. Although these movements may be approaching capacity by 2031, operations should be monitored to determine if improvements are needed.

Victoria Square Boulevard at Elgin Mills Road will be operating with an overall volume to capacity ratio of 1.12. The westbound through-right and the northbound left-through will both be operating at capacity with volume to capacity ratios of 1.12 and 1.11, respectively. Both will operate with high delays (level of service F). Minor geometric improvements such as separation of the left- and right-turn lanes would improve operations. Furthermore, left-turn advance phases would also provide large improvements. Monitoring to determine when the improvements are needed is recommended.

4.2.8 Summary of Future Transportation Needs

Based on the transportation assessment presented in **Section 4.2**, the needs of the corridor from a transportation perspective are summarized as follows:

- Additional lanes of through traffic have been deemed unnecessary along Victoria Square Boulevard
- The need for the addition and enhancement of active transportation (cyclist and pedestrian) facilities has been identified
- Existing transit facilities should be maintained. An assessment of existing and planned transit routes along and in the vicinity of the Victoria Square Boulevard corridor is to be addressed as part of a separate study.
- Presently, there is no immediate requirement for additional signalized intersections within the Victoria Square Boulevard corridor; however,

approaching the horizon year (2031), monitoring is recommended at the north and south connections to Woodbine Avenue, as well as at the Elgin Mills Road intersection to determine the need for localized operational improvements at these intersections.

4.3 Operational and Geometric Needs

4.3.1 Driveway and Access Management

Driveways and other accesses to Victoria Square Boulevard can have an impact on operations and be impacted by improvements to the study corridor. Driveway and access to existing land uses is to be maintained. Future accesses to proposed developments will be coordinated with the developers during later phases of this study. Where temporary access restrictions are required during construction, access management plans will be developed in consultation with the landowners or affected stakeholders.

4.3.2 Vertical and Horizontal Alignment

The existing vertical and horizontal alignment along Victoria Square Boulevard are described in **Section 3.1.10**.

When reviewing geometric deficiencies, the project team considered the requirements for the conversion from a rural roadway section to an urban roadway section to meet the drainage needs without causing significant roadside impacts. While a rural roadway relies on the rainwater to shed along the crossfall to roadside ditches to create a water-free driving platform, an urban roadway requires that there is enough running profile to move the water longitudinally along the profile in the gutters to reach the catch basins before draining away. Geometric guidelines allow for flatter slopes on rural roadways, so when a rural road is converted to an urban road, often the profile needs to be reconstructed to introduce slightly higher or rolling profile grades.

4.4 Traffic Safety Needs

This section provides a high level summary of traffic safety conditions in the study area. The City has provided collision records for the most recent 10 years between 2005 and 2015. Collisions reported with classification of ‘Non-reportable’ are assumed to be ‘Property Damage Only’, as more severe collisions resulting in injury would be classifed as injury collisions. **Exhibit 4-7** presents total collisions by severity and two graphs for distribution of collisions based on time of day and environmental conditions. The distribution by time of day follows the peak period traffic patterns, with the majority of collisions occurring between 8 AM to 9 AM and 5 PM to 6 PM. Out of the total 71 collisions reported during this time period, there are 59 collisions (or 83%) that occurred

under clear conditions, and the remaining collision that occurred under snow or rain conditions.

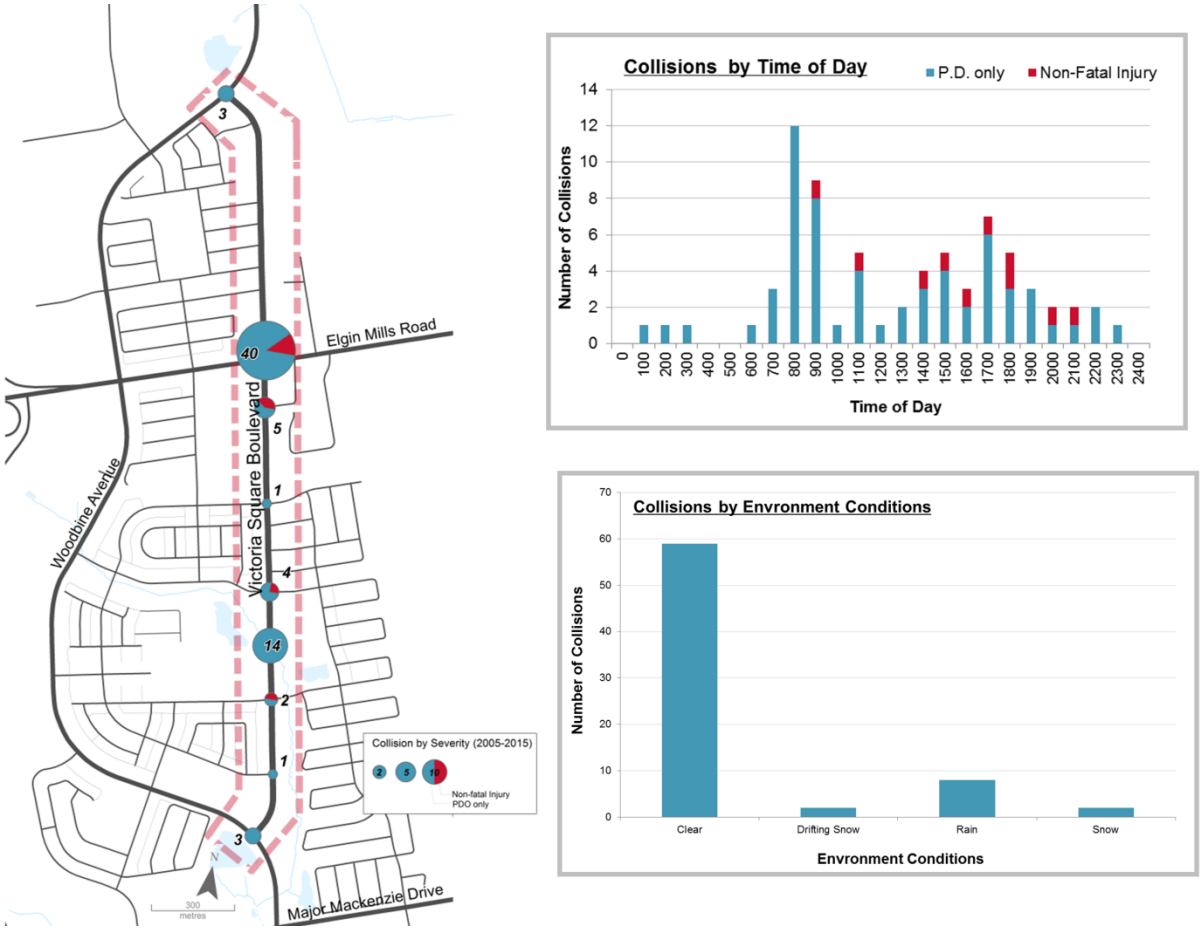


Exhibit 4-7: Collision by Severity, Location and Time of Day

As shown, Victoria Square Boulevard and Elgin Mills Road is the intersection that experienced the highest number of collisions with a total of 40 recorded collisions in the past 10 years. Data also indicates that this intersection had an increase of collisions in 2010 and 2013. The predominant impact types are rear-ends and angles. Sixty-one percent of these rear-end collisions occurred in the eastbound direction. Angle collisions are caused by drivers failing to yield or disobeying traffic signals. Additional data and analysis would be required to determine the causal factors for high angle collisions, but that analysis is beyond the scope of this study.

4.5 Problem and Opportunity Statement

The Problem and Opportunity Statement was developed with consideration to existing conditions, deficiencies, and the future needs of the study corridor (during Phase 1 of the MEA Class EA Process). The Problem and Opportunity Statement provides the foundation for transportation improvements for Victoria Square Boulevard, consistent with the City's vision for the corridor and other official documents. The statement was

reviewed and refined from consultation with agencies, developers, Aboriginal Groups, and the public.

The study area is made up of mixed land uses and characteristics that are unique to each of the six segments. Overall, there are opportunities to:

- Create a complete community by increasing travel options, safety and accessibility for users of all modes, ages and abilities.
- Enhance connections to future urban areas and the regional transportation network, keeping all road users in mind. This includes increasing connectivity between the community, core areas, facilities, and open spaces, and developing the north and south ends of the road corridor as major Gateways to the street.
- Preserve and enhance natural and cultural heritage features, including the addition or enhancement of streetscaping features along the corridor.
- Provide continuity and efficiency in drainage infrastructure.

Specifically, there are opportunities within each of the six study area segments, as follows (refer to **Exhibit 1-2** for location of each of the Areas)

Area 1:

- Create a gateway feature to promote the unique character of the area
- Provide connections for all modes to Woodbine Avenue (north connection), trails, and surrounding employment areas
- Enhance existing retail cluster
- Based on the traffic assessment, the need for signalization at Woodbine Avenue (north connection) was not identified at this time

Area 2:

- Provide access to a new park on the west side of the study area
- Accommodate active transportation facilities which may include enhancement of the existing on street cycling facilities
- Address gaps in pedestrian facilities (the existing sidewalk currently stops just north of Duke of Cornwall Drive)
- Liaise with developers (active subdivision application) on the east side to match grades and provide connectivity to the new subdivision
- Consider on-street parking to meet the needs of the street townhouses under development on the east side

Area 3:

- Provide active transportation connections to parks, community centre and businesses
- Connect discontinuous pedestrian facilities
- Preserve and enhance cultural heritage features

Area 4:

- Consider on-street parking on both sides
- Accommodate cyclists by providing active transportation facilities such as protected cycling lanes or multi-use paths
- Enhance connections to existing pedestrian facilities
- Enhance streetscaping (including treed boulevards to improve aesthetics and reduce vehicle speeds)
- Accommodate additional street furniture including transit shelters, waste receptacles, bike racks, and benches

Area 5:

- Provide new and enhanced connections for all road users
- Improve opportunities to safely cross the intersection in the vicinity of the schools
- Enhance the community safety zone and traffic calming
- Accommodate cyclists by providing active transportation facilities such as protected cycle track, bike lanes, or multi-use paths
- Consider on-street parking on both sides

Area 6:

- Provide pedestrian facilities on the east side
- Create a gateway feature to promote the unique character of the area
- Provide connections for all modes to Woodbine Avenue (south connection) and surrounding areas, including an enhanced multi-modal connection to the planned high-frequency 24-Woodbine bus route as well as higher order cycling facilities on Woodbine Avenue to Major Mackenzie Drive.

The problems and opportunities along the study corridor are summarized in **Table 4-11**.

Table 4-11: Summary of Problems and Opportunities

Problem	Opportunity
Limited and discontinuous cycling and pedestrian facilities	Consider additional, continuous cycling and pedestrian facilities to provide a continuous network
Limited parking available	Consider on-street parking where space permits to meet the needs of the adjacent townhouses
Discontinuous installation of curb and gutter, watermains, and sewers	Consider a continuous urban roadway section with curb and gutter in lieu of rural ditches
The study area is comprised of six distinct areas with unique characteristics	Preserve and enhance community character, through consideration of streetscaping and gateway features

5 Alternative Solutions

5.1 Generation of Alternative Solutions

Alternative solutions (planning alternatives) are functionally different methods of approaching and solving a problem or opportunity. Schedule 'C' projects under the MEA's Class EA process requires documentation and examination of all reasonable alternatives to address the problem; referred to as Alternative Solutions, Phase 2 of the Class EA process.

Based on the needs assessment, a variety of Alternative Solutions were developed for each of the six segments for the study area. These alternatives range in complexity, cost, and their ability to address the identified Study Area issues. **Table 5-1** presents the Alternative Solutions considered to address the problem and opportunities identified for the Victoria Square Boulevard study.

Table 5-1: Alternative Solutions

Alternative Solutions No.	Title	Description
1	Do Nothing	Maintain Existing Conditions
2	Multi-Modal Approach	Accommodate all road users including the provision of continuous active transportation facilities, on-street parking, intersection improvements, urbanization for improved drainage, additional landscaping opportunities, and consideration for a continuous centre-left turn lane where feasible and warranted within the ROW
3	Multi-Modal Approach and Road Widening	Provide two continuous travel lanes in each direction, in addition to the multi-modal approach described in Alternative #2

5.2 Evaluation Criteria

To determine the most appropriate solution for the corridor, the advantages and disadvantages of each of the Alternative Solutions identified in **Section 5.1** were evaluated using the information collected from the existing conditions review. A list of criteria to compare alternatives was developed, and the measure of the alternative's success was its ability to correct, minimize, or mitigate impacts and meet the study objectives.

The evaluation criteria used to compare the Alternative Solutions is listed in **Table 5-2**. It should be noted that the climate change criteria was added following the Open House, based on comments provided by MOECC; however, it does not change the overall outcome of the evaluation.

Table 5-2: Alternative Solutions Evaluation Criteria

Category	Criteria
Socio-Economic Environment	• Minimizes impacts to archaeology / cultural heritage resources • Complies with City's planning policies • Accommodates existing and planned development • Minimizes property acquisition • Improves quality of life • Improves air quality • Minimize effects on climate change
Transportation / Technical Environment	• Supports City's transportation planning strategies • Improves existing / future congestion • Improves road safety • Accommodates all road users, including pedestrians, cyclists and transit users • Addresses problem / opportunity statement • Improves network connectivity
Natural Environment	• Minimizes impacts to and enhances environmentally sensitive areas • Minimizes impacts to wildlife, vegetation, aquatic species and habitat, and species at risk • Provides stormwater management improvements and mitigates erosion
Economic Consideration	• Optimizes capital costs • Optimizes operation/maintenance costs • Optimizes property acquisition costs

5.3 Evaluation of Alternative Solutions

Based on the findings of the traffic analysis from the needs assessment and the evaluation criteria identified in **Section 5.2,** an evaluation was conducted to compare the three Alternative Solutions and determine the recommended alternative. The evaluation is provided in **Table 5-3**.

Table 5-3: Evaluation of Alternative Solutions

Evaluation Criteria	Alternative 1: Do Nothing	Alternative 2: Multi-Modal Approach	Alternative 3: Multi-Modal Approach + Road Widening
Option Description	• Maintain Existing Conditions	• Accommodate all road users, including the provision of continuous active transportation facilities, on-street parking, intersection improvements, urbanization for improved drainage, additional landscaping opportunities, and consideration for a continuous centre-left turn lane where feasible and warranted	• Provide two continuous travel lanes in each direction, in addition to the multi-modal approach described in Alternative #2
Socio-Economic	**Not Preferred**	**Preferred**	**Less Preferred**
Minimizes Impacts to Archaeology / Cultural Heritage Resources	• No impacts	• No anticipated impacts • Despite wider cross-section platform to accommodate parking and active transportation facilities, replacing rural cross-section (ditches) with urban cross-section (curb and gutter) minimizes impacts to adjacent properties and features	• Potential impacts due to wider platform to accommodate additional travel lanes, parking, and active transportation facilities
Complies With City's Planning Policies	• Does not comply with the City's planning policies as it does not support alternative modes of travel	• Complies with the City's planning policies by supporting alternative modes of travel	
Accommodates Existing and Planned Development	• Partially accommodates existing and planned development • Although roadway capacity is sufficient, it does not provide continuous facilities for alternative modes of travel	• Accommodates existing and planned development by providing sufficient roadway capacity and intersection improvements, and promoting active transportation	• Accommodates existing and planned development by providing excess roadway capacity, providing intersection improvements, and promoting active transportation • Additional travel lanes may encourage traffic infiltration onto Victoria Square Boulevard
Minimizes Property Acquisition	• No property acquisition required	• Limited potential for property acquisition required	• Greatest potential for property acquisition required
Improves Quality of Life	• No improvements to Victoria Square Boulevard corridor • Poor active transportation facilities	• Opportunity to provide continuous active transportation facilities, promoting a healthier lifestyle	
Improves Air Quality	• No improvements to Victoria Square Boulevard corridor • Discontinuous active transportation facilities contributes to reliance on automobile, deteriorating air quality	• Opportunity to provide continuous active transportation facilities, discouraging reliance on automobile and thus promoting improvements to air quality • Opportunity for additional landscaping	• Opportunity to provide continuous active transportation facilities, discouraging reliance on automobile and thus promoting improvements to air quality • However, additional travel lanes may encourage reliance on automobile and traffic infiltration onto Victoria Square Boulevard, deteriorating air quality due to increased emissions

Evaluation Criteria	Alternative 1: Do Nothing	Alternative 2: Multi-Modal Approach	Alternative 3: Multi-Modal Approach + Road Widening
			• Limited opportunity for additional landscaping
Minimize effects on climate change	• High reliance on automobiles and increased congestion will result in increased vehicle emissions and worsen effects on climate change • No improvements to study corridor resiliency to climate change	• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Provision of a continuous centre left-turn lane, where feasible, will improve traffic operations, reducing congestion and vehicular idling, thereby reducing vehicle emissions • Opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change	• Road widening for additional vehicular capacity will further increase high reliance on automobiles and result in increased vehicle emissions and worsen effects on climate change • Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Provision of a continuous centre left-turn lane, where feasible, will improve traffic operations, reducing congestion and vehicular idling, thereby reducing vehicle emissions • Opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change
Transportation / Technical	**Not Preferred**	**Preferred**	**Less Preferred**
Supports City's Transportation Planning Strategies	• Does not support the City's transportation planning strategies, which identify the study area and its surroundings as locations where continuous active transportation facilities and connections should be provided	• Supports the City's transportation planning strategies by providing continuous active transportation facilities and connections to adjacent routes	
Improves Existing / Future Congestion	• Congestion is not a major concern along Victoria Square Boulevard; however, some intersections may experience increased delays in the future • This option does not provide any improvements	• Potential for intersection improvements and continuous centre-left turn lane (where feasible and warranted)	• Potential for intersection improvements and continuous centre-left turn lane (where feasible and warranted) • Additional travel lanes may encourage traffic infiltration onto Victoria Square Boulevard
Improves Road Safety	• Does not address existing or potential safety concerns	• Addition of continuous cycling and pedestrian facilities minimizes conflicts with motorized vehicles • Potential for intersection improvements and continuous centre-left turn lane (where feasible and warranted) will provide safety improvements	
Accommodates All Road Users, Including Pedestrians, Cyclists, and Transit Users	• Does not accommodate all road users	• Opportunity to accommodate all road users, including dedicated facilities for cyclists and pedestrians, and addition of transit amenities	
Addresses Problem / Opportunity Statement	• Does not address problem / opportunity statement	• Addresses problem / opportunity statement	
Improves Network Connectivity	• Does not improve network connectivity	• Improves connectivity of cyclist and pedestrian facilities	
Natural Environment	**Less Preferred**	**Preferred**	**Less Preferred**

Evaluation Criteria	Alternative 1: Do Nothing	Alternative 2: Multi-Modal Approach	Alternative 3: Multi-Modal Approach + Road Widening
Minimizes Impacts to and Enhances Environmentally Sensitive Areas	• No impacts • However, no opportunities to enhance natural environment (for example additional landscaping along the corridor)	• No anticipated impacts • Greatest opportunities to enhance natural environment (for example additional landscaping along the corridor)	• No anticipated impacts • Limited opportunities to enhance natural environment (for example additional landscaping along the corridor)
Minimizes Impacts to Wildlife, Vegetation, Aquatic Species and Habitat, and Species at Risk	• No impacts • However, no opportunities to enhance natural environment (for example additional landscaping along the corridor)	• No anticipated impacts • Greatest opportunities to enhance natural environment (for example additional landscaping along the corridor)	• No anticipated impacts • Limited opportunities to enhance natural environment (for example additional landscaping along the corridor)
Provides Stormwater Management (SWM) Improvements and Mitigates Erosion	• No improvements to stormwater management / erosion	• Opportunity to improve stormwater management and minimize erosion through replacement of rural cross-section (ditches) with continuous urban cross-section (curb and gutter)	
Economic	**Preferred**	**Less Preferred**	**Not Preferred**
Optimizes Capital Costs	• No capital costs	• Moderate capital costs due to wider platform to accommodate parking and active transportation facilities	• Highest capital costs due to significantly wider platform and larger drainage facilities to accommodate two travel lanes in each direction, in addition to parking and active transportation facilities
Optimizes Operation / Maintenance Costs	• No change to road maintenance cost	• Marginal increase in road maintenance and snow clearing costs due to addition of parking and active transportation facilities	• Highest increase in road maintenance and snow clearing costs due to addition of two travel lanes, parking, and active transportation facilities
Optimizes Property Acquisition Costs	• No property acquisition cost	• Limited property acquisition cost	• Highest property acquisition cost
Summary	**Not Preferred**	**Preferred**	**Less Preferred**
Comments	• Does not address the problem / opportunity. • Does not accommodate all road users. • Results in no impacts to (but no opportunity to enhance) the natural environment. • Lowest cost.	• Adequately addresses the problem / opportunity. • Accommodates all road users including cyclists and pedestrians, thus promoting active transportation and reduced reliance on automobile. • Maximizes opportunities for improved landscaping. • Moderate cost.	• Adequately addresses the problem / opportunity. • Accommodates all road users including cyclists and pedestrians, thus promoting active transportation and reduced reliance on automobile. • Limited opportunities for improved landscaping. • Additional travel lanes may result in traffic infiltration onto Victoria Square Boulevard. • Highest cost. • May result in property acquisition.
Recommendation	Not Carried Forward for further consideration as part of this study	Carried Forward as the preferred solution	Not Carried Forward for further consideration as part of this study

5.4 Selection of a Preferred Alternative Solution

Based on the evaluation presented, the preferred Alternative Solution consists of:

- Developing Victoria Square Boulevard to include active transportation (cycling and pedestrian) facilities to facilitate a multi-modal approach
- Urbanization for improved drainage and erosion control along the corridor
- Consideration for a continuous-centre left turn where feasible and warranted
- Addition of automobile parking facilities where warranted along the Victoria Square Boulevard corridor

6 Alternative Designs for Preferred Solution

6.1 Screening of Alternative Design Concepts

Before identifying alternative cross-section designs, a series of high-level screening criteria were used to phase out different cross-section elements that did not adhere to the constraints of the study corridor right-of-way (ROW) at each segment. These include on-street parking, pedestrian and cycling facilities, streetscaping, and continuous centre left-turn lane.

6.1.1 On-Street Parking

Exhibit 6-1 demonstrates the screening criteria used to evaluate the feasibility of including on-street parking on one or both sides of the street.

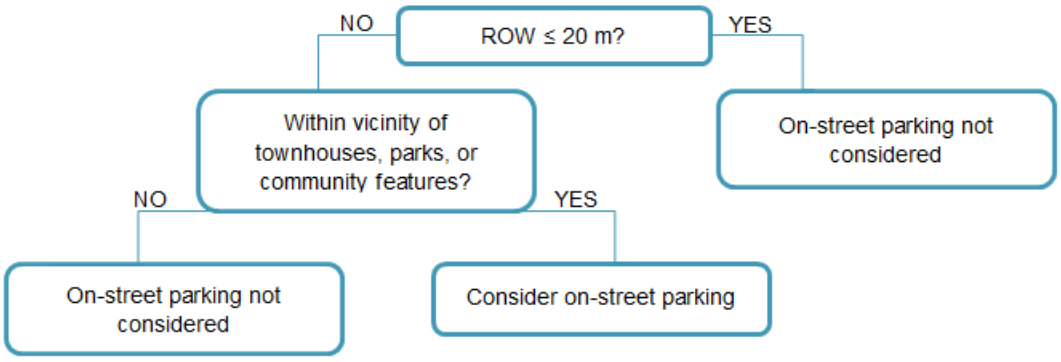
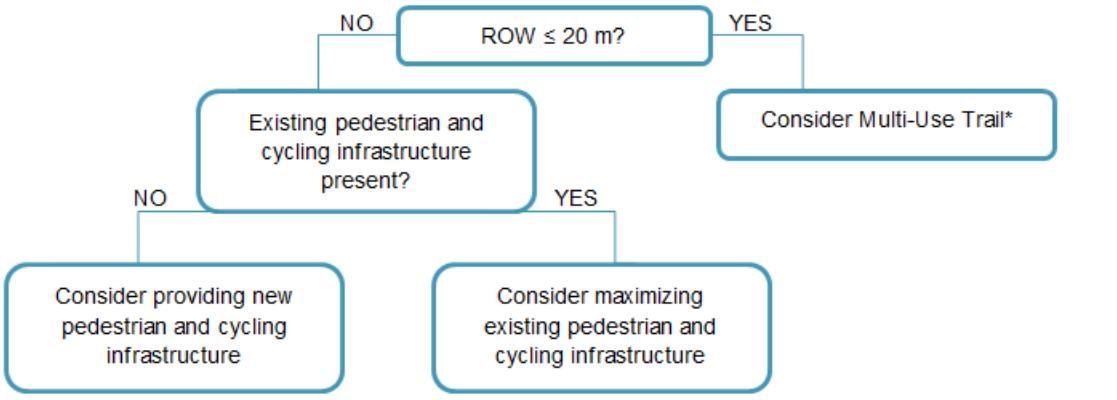


Exhibit 6-1: Screening Criteria for Design Alternatives (ROW and On-Street Parking)

On-street parking was one of the criteria listed as a priority by the public during Public Open House #1 (June 13, 2016). **Exhibit 6-1** describes the screening criteria for the selection of areas within the study corridor to include on-street parking in the typical cross-section. Based on this screening Areas 2, 4, 5, and 6 possessed the appropriate ROW width and features to include on-street parking in the design alternatives. On-street parking alternatives for one-side and both sides were considered. Alternatives for on-street parking on only one side of the street were favored over those including on-street parking on both sides of the street, in order to minimize potential property impacts while still accommodating on-street parking in the vicinity of townhouses, parks, or community features. As Area 3 possesses ROW constraints resulting from several heritage structures existing in proximity to the study corridor, it cannot accommodate on-street parking in its typical cross-section.

6.1.2 Pedestrian and Cycling Facilities

Exhibit 6-2 demonstrates the screening criteria used to evaluate the feasibility of including pedestrian and cycling facilities.



* A Multi-Use Trail is an active transportation facility that accommodates pedestrians and cyclists in a shared space

Exhibit 6-2: Screening Criteria for Design Alternatives (Pedestrian and Cycling Infrastructure)

Promoting active transportation and continuous connectivity in pedestrian and cycling facilities where possible was an objective of the Victoria Square Boulevard EA. **Exhibit 6-2** describes the screening criteria for the type of pedestrian infrastructure to be considered depending on ROW constraints. In the absence of ROW constraints, separated facilities for pedestrians and cyclists were favored in the evaluation process as they provide fewer points of conflict between pedestrians and cyclists and better overall safety. Furthermore, given that the type of cyclist using the facilities along Victoria Square Boulevard will be predominantly recreational and not commuter, it is preferred from a safety standpoint to separate cyclists from vehicular traffic as opposed to providing on-street bike lanes. It was identified that Area 3 would be considered for a multi-use trail due to the ROW constraints in proximity to the Victoria Square Boulevard and Elgin Mills Road East intersection. Areas 4 and 5 currently have existing pedestrian infrastructure and as such, maximizing existing infrastructure is reflected in the design alternatives for both segments.

6.1.3 Streetscaping

The City of Markham's streetscape manual, *Trees for Tomorrow (2009),* is a set of design and technical guidelines that outlines the City's commitment to planting a significant number of trees to promote a healthy urban environment. The manual describes spatial requirements for boulevard tree planting, indicating a minimum 2.4 m boulevard width to accommodate tree form. In the evaluation process, alternatives with a designated minimum of 2.4 m for landscaping on both sides were preferred to adhere to the City's streetscaping requirements. The ROW constraints in Area 3 present a

unique challenge to landscaping requirements however, areas in proximity to the ROW are considered to be in a well-vegetated state, negating the need for additional landscaping in the boulevard areas.

6.1.4 Continuous Centre Left-Turn Lane

The existing roadway configuration of Victoria Square Boulevard indicates a large number of side roads and private entrances on both sides of the street. For the purpose of improving traffic and safety conditions, a continuous centre left-turn lane was considered where possible. The provision of a continuous left-turn lane was considered where feasible to minimize the risk of conflicts with turning vehicles.

6.2 Identification of Alternative Design Cross-Sections

The results of the high-level screening from **Exhibit 6-1** and **Exhibit 6-2** were used to develop alternative cross-sections for detailed evaluation.

6.2.1 Area 1: North Gateway

Area 1 consists of a major gateway into the Victoria Square community. There are residential developments on the west side of Victoria Square Boulevard and a single residential property on the east side. The average ROW width for Area 1 is approximately 23 m. Due to ROW constraints and the relatively short length of corridor, Area 1: North Gateway will only consider a single alternative in addition to the do-nothing alternative, illustrated in **Exhibit 6-3**.

Alternative N1: Assuming a 23 m ROW width; curb and gutter, sidewalks, landscaping, utilities and cycle tracks can be provided on both the west and east side of the road. Between the two travel lanes, a northbound left-turn lane will be retained.

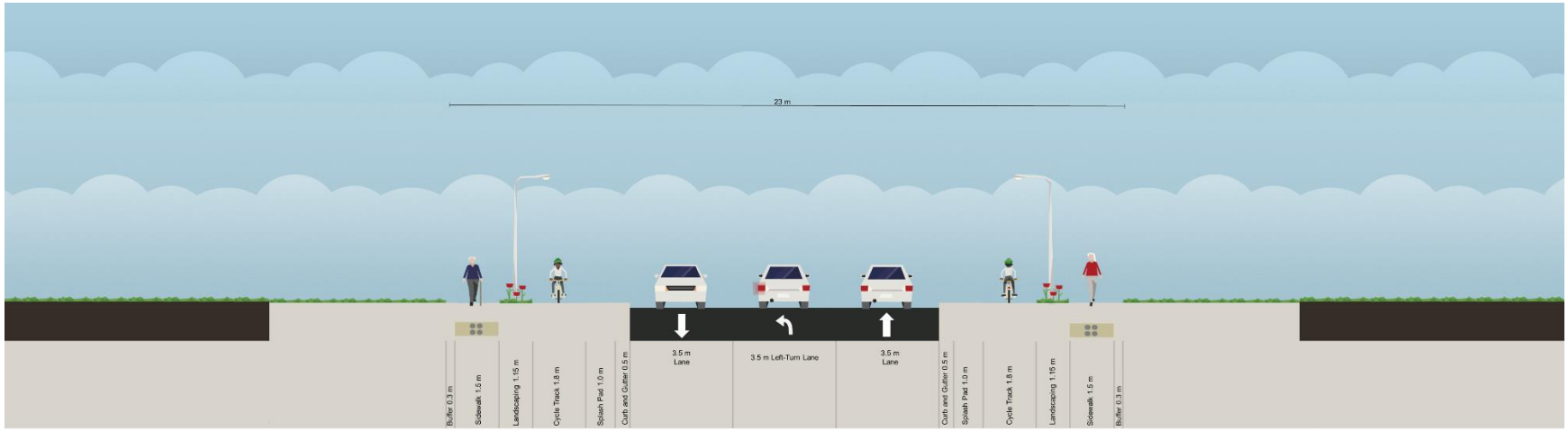


Exhibit 6-3: Alternative N1 Cross-Section

6.2.2 Area 2: Residential Main Street

Area 2 consists of single detached residential properties on the west side with driveways intersecting Victoria Square Boulevard. There is residential development pending approval on the east side of Victoria Square Boulevard. The average ROW width for Area 2 is approximately 30 m, although as narrow as 27 m at some locations. Design Cross-Section alternatives for this area are illustrated in **Exhibit 6-4** and **Exhibit 6-5**.

Alternative RM1: Assuming a 27 m ROW width, curb and gutter, sidewalks, landscaping, utilities, and cycle tracks can be provided on both the west and east sides of the road. Between the two travel lanes, a continuous centre left-turn lane can be provided.

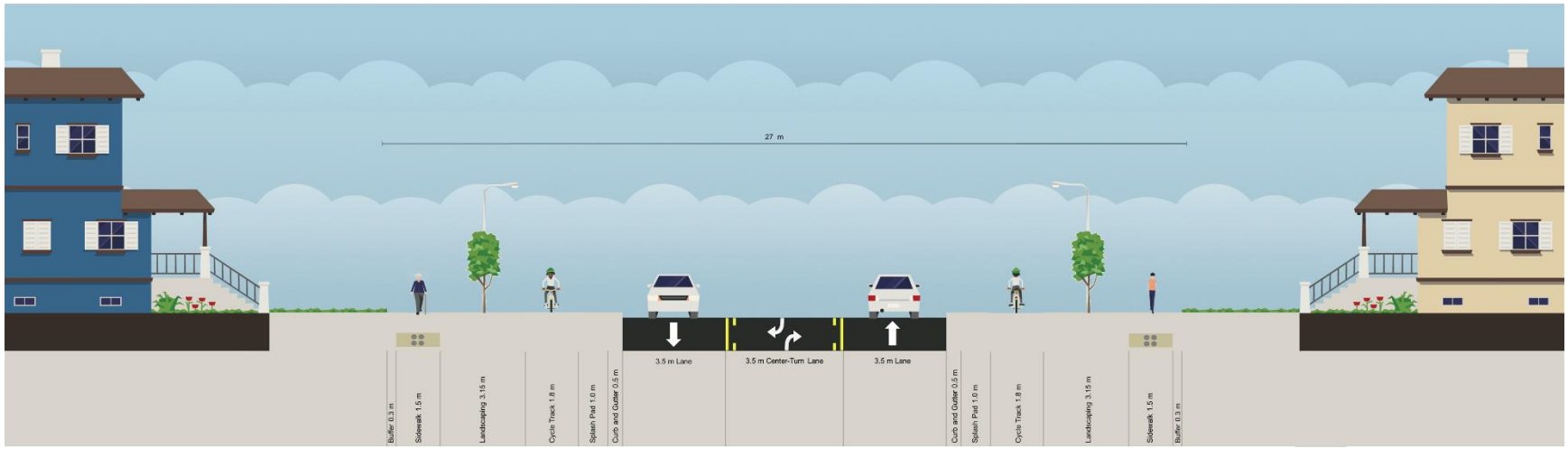


Exhibit 6-4: Alternative RM1 Cross-Section

Alternative RM2: Assuming a 27 m ROW width, curb and gutter, sidewalks, landscaping, utilities and cycle tracks can be provided on both the west and east sides of the road. On-street parking currently exists on the east side of the road, as such, landscaping on the east side of the road would be reduced to accommodate this element. Between the two travel lanes, a continuous centre left-turn lane can be accommodated.

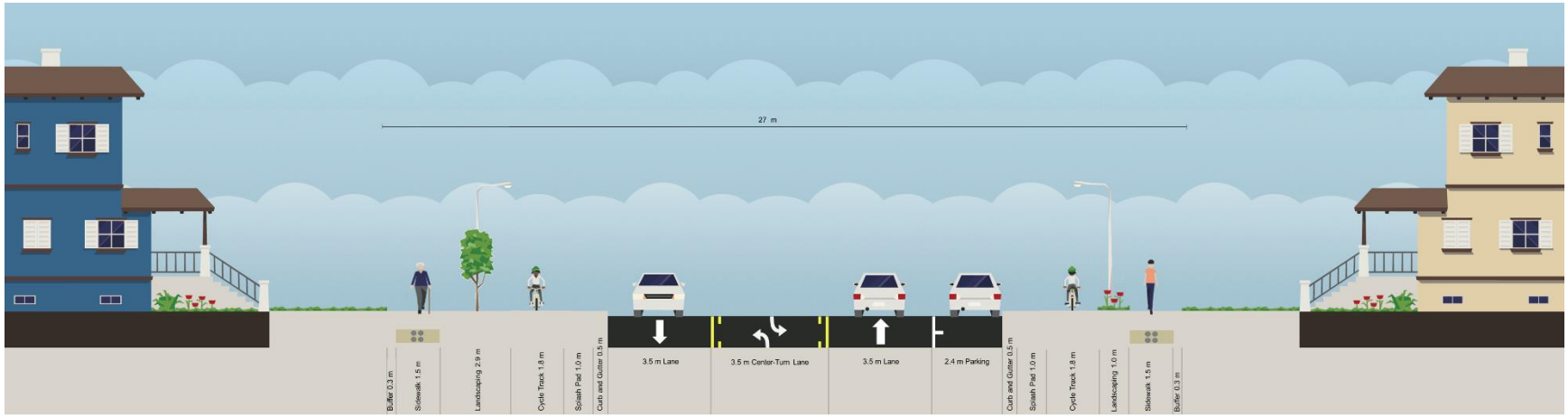


Exhibit 6-5: Alternative RM2 Cross-Section

6.2.3 Area 3: Hamlet

Area 3 consists of several heritage properties and single detached residential properties with driveways accessing the road. Due to their proximity to the road, the ROW in this segment is constrained. The ROW width for Area 3 ranges between 20 – 28 m. Design Cross-Section alternatives for this area are illustrated in **Exhibit 6-6** and **Exhibit 6-7**.

Alternative H1: Assuming a 20 m ROW width; curb and gutter, utilities, sidewalks, and cycle tracks can be provided on both the west and east sides of the road. Due to ROW constraints in this segment, there is minimal opportunity to provide landscaping, and no opportunity to provide continuous centre left-turn lane or on-street parking.

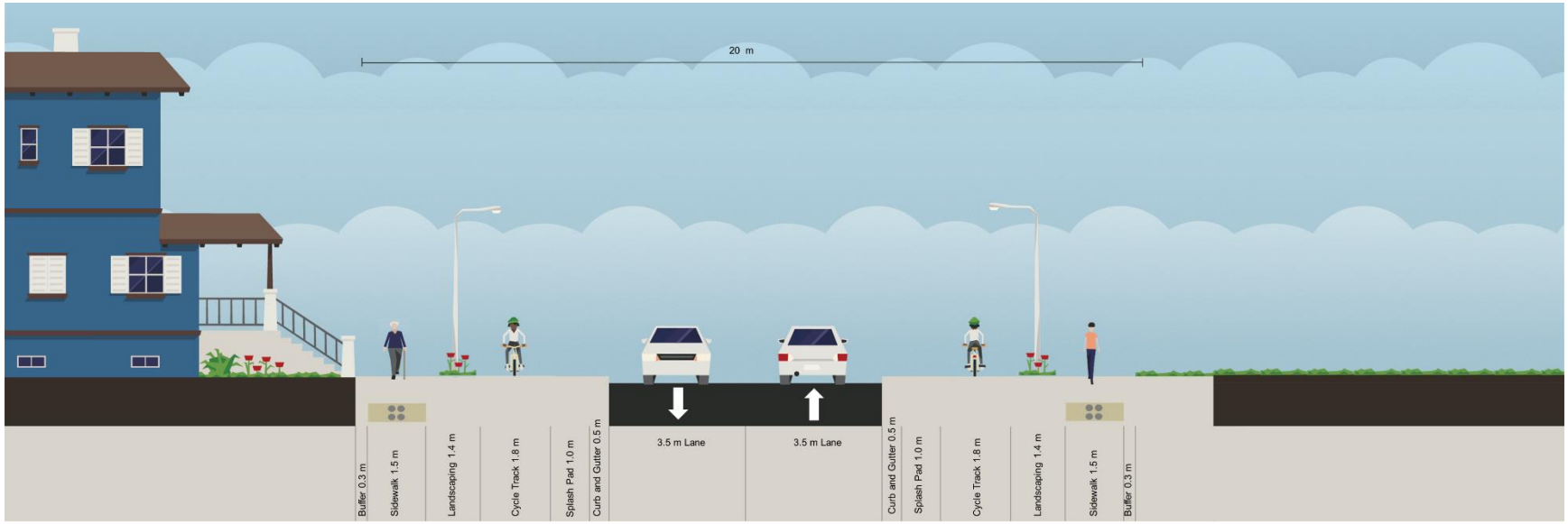


Exhibit 6-6: Alternative H1 Cross-Section

Alternative H2: Assuming a 20 m ROW width; curb and gutter, utilities and a multi-use trail can be provided on both the west and east sides of the road. Between the two travel lanes, a continuous centre left-turn lane would be provided. Due to ROW constraints in this segment, there is no opportunity for landscaping or on-street parking.

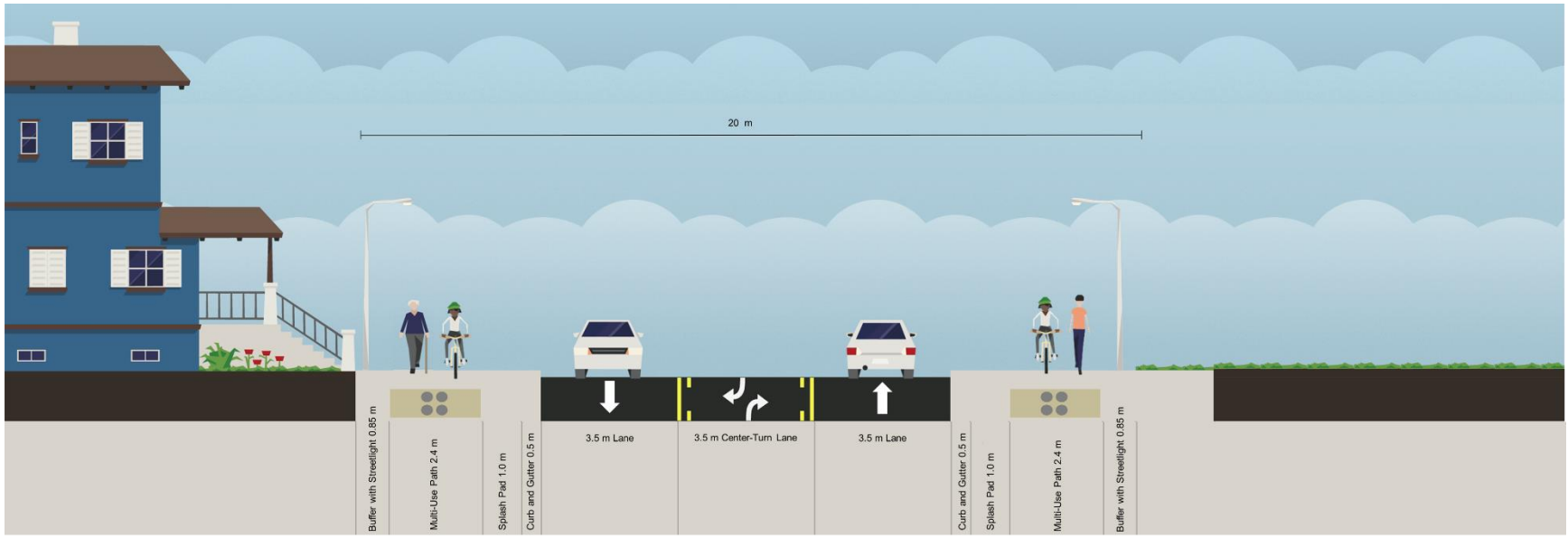


Exhibit 6-7: Alternative H2 Cross-Section

6.2.4 Area 4: Cathedral Residential Area

Area 4 consists of a mix of row townhouses fronting onto Victoria Square Boulevard on the west side and single detached residential properties fronting and siding onto Victoria Square Boulevard on the east side. There is also a community park proposed on the east side of the road, north of Cecil Nichols Avenue. The average ROW width for Area 4 is approximately 30m, but as narrow as 27m at some locations. Design Cross-Section alternatives for this area are illustrated in **Exhibit 6-8** and **Exhibit 6-9**.

Alternative CR1: Assuming a 27m ROW; curb and gutter, sidewalks, minimal landscaping, utilities, cycle tracks, and on-street parking can be provided on both the west and east sides of the road. Between the two travel lanes, a continuous centre left-turn lane can be accommodated.

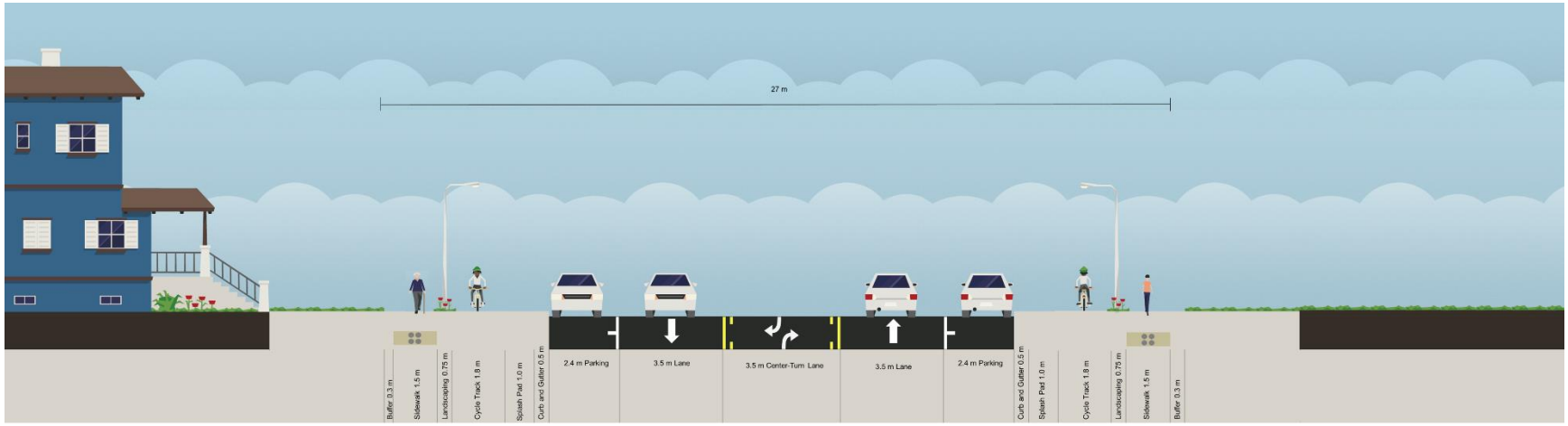


Exhibit 6-8: Alternative CR1 Cross-Section

Alternative CR2: Assuming a 27 m ROW; curb and gutter, sidewalks, landscaping, utilities, and cycle tracks can be accommodated on both the west and east sides of the road. On-street parking would be provided on the west side of the road only to maximize landscaping opportunities on the east side, and landscaping on the west side of the road would be minimal to accommodate on-street parking. Between the two travel lanes, a continuous centre left-turn lane would be provided.

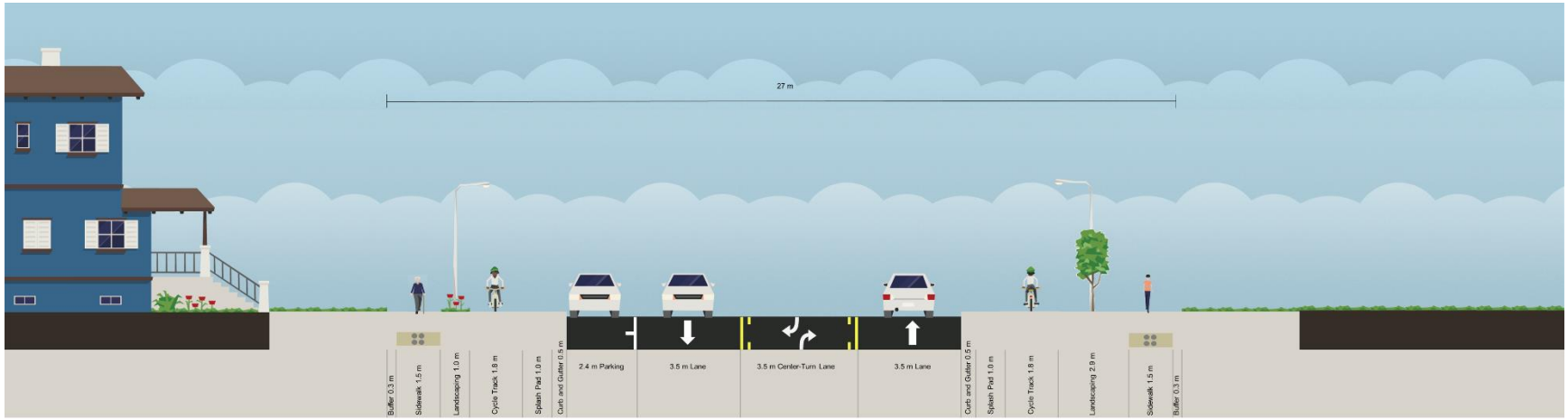


Exhibit 6-9: Alternative CR2 Cross-Section

6.2.5 Area 5: Cathedral Precinct

Area 5 consists of a mix of townhouses fronting onto Victoria Square Boulevard on the west side. There is a school and community park on the east side of the road. Natural Heritage features are present on the east side of the road. The average ROW width for Area 5 is ranges between 32 and 36 m. Design Cross-Section alternatives for this area are illustrated in **Exhibit 6-10** and **Exhibit 6-11.**

Alternative CP1: Assuming a 32 m ROW; curb and gutter, sidewalks, landscaping, utilities, cycle tracks, and on-street parking can be provided on both the west and east sides of the road. Between the two travel lanes, a continuous centre left-turn lane would be accommodated.

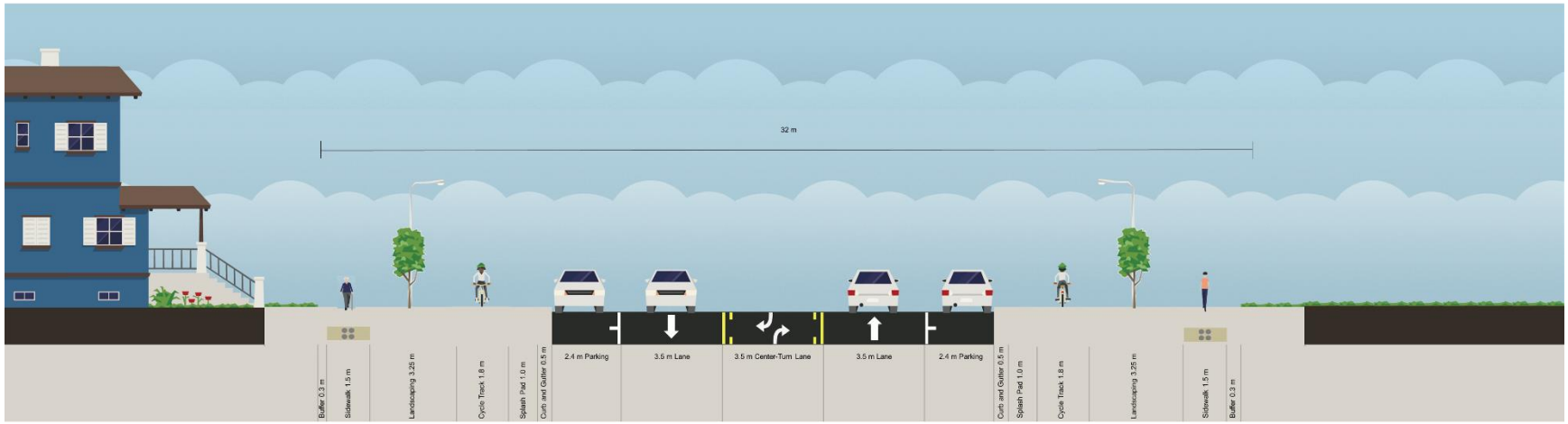


Exhibit 6-10: Alternative CP1 Cross-Section

Alternative CP2: Assuming a 32 m ROW; curb and gutter, sidewalks, landscaping, utilities, and cycle tracks can be provided on both the west and east sides of the road. On-street parking would be accommodated on the west side of the road only to maximize landscaping opportunities on the east side, and landscaping on the west side of the road would be reduced to accommodate on-street parking. Between the two travel lanes, a continuous centre left-turn lane can be accommodated.

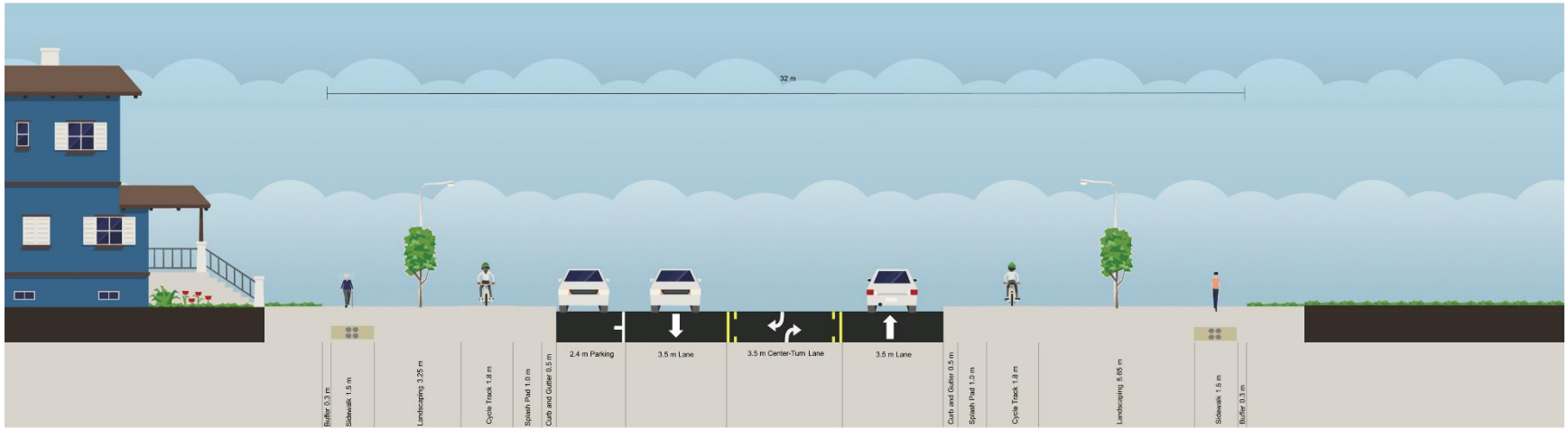


Exhibit 6-11: Alternative CP2 Cross-Section

6.2.6 Area 6: South Gateway

Area 6 consists of the major gateway to the Victoria Square community from the south. There are various single detached residential properties (including a heritage property) on the east side of the road. There is also a school on the east side of the road. Frisby Park is situated on the west side of the road. The ROW width within Area 6 is typically 26 m. Design Cross-Section alternatives for this area are illustrated in **Exhibit 6-12**, **Exhibit 6-13**, and **Exhibit 6-14**.

Alternative S1: Assuming a 26 m ROW width; curb and gutter, sidewalks, utilities, landscaping, and cycle tracks can be provided on both the west and east sides of the road. Between the two travel lanes, a southbound left-turn lane would be retained. This alternative does not provide opportunities for on-street parking.

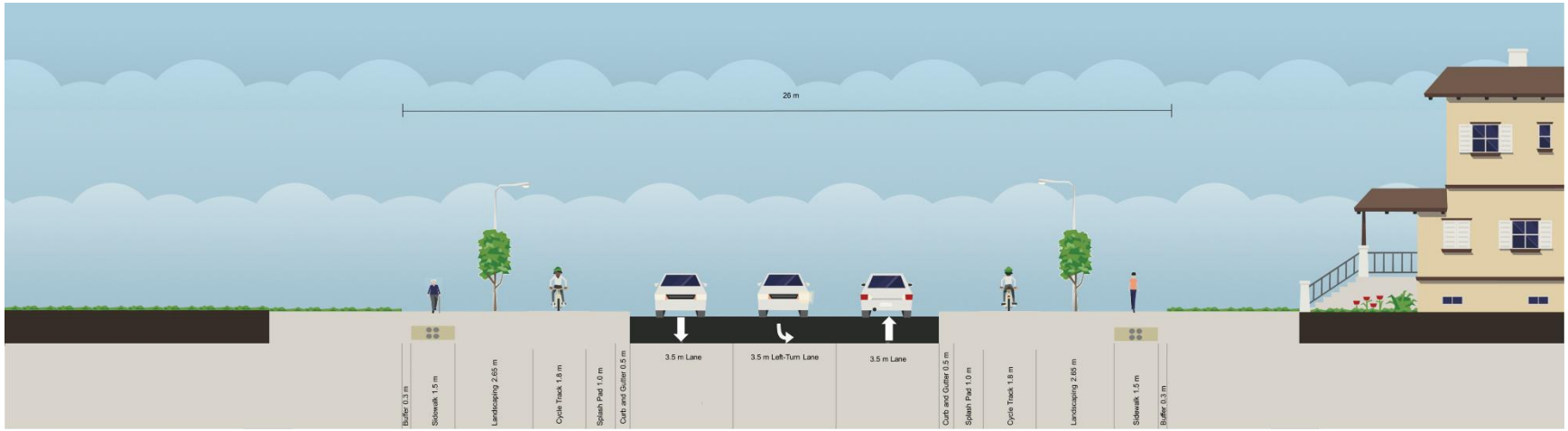


Exhibit 6-12: Alternative S1 Cross-Section

Alternative S2: Assuming a 26 m ROW width; curb and gutter, sidewalks, minimal landscaping, utilities, and cycle tracks would be provided on both the west and east sides of the road. On-street parking would be provided on the west side of the road. Between the two travel lanes, a southbound left-turn lane would be retained.

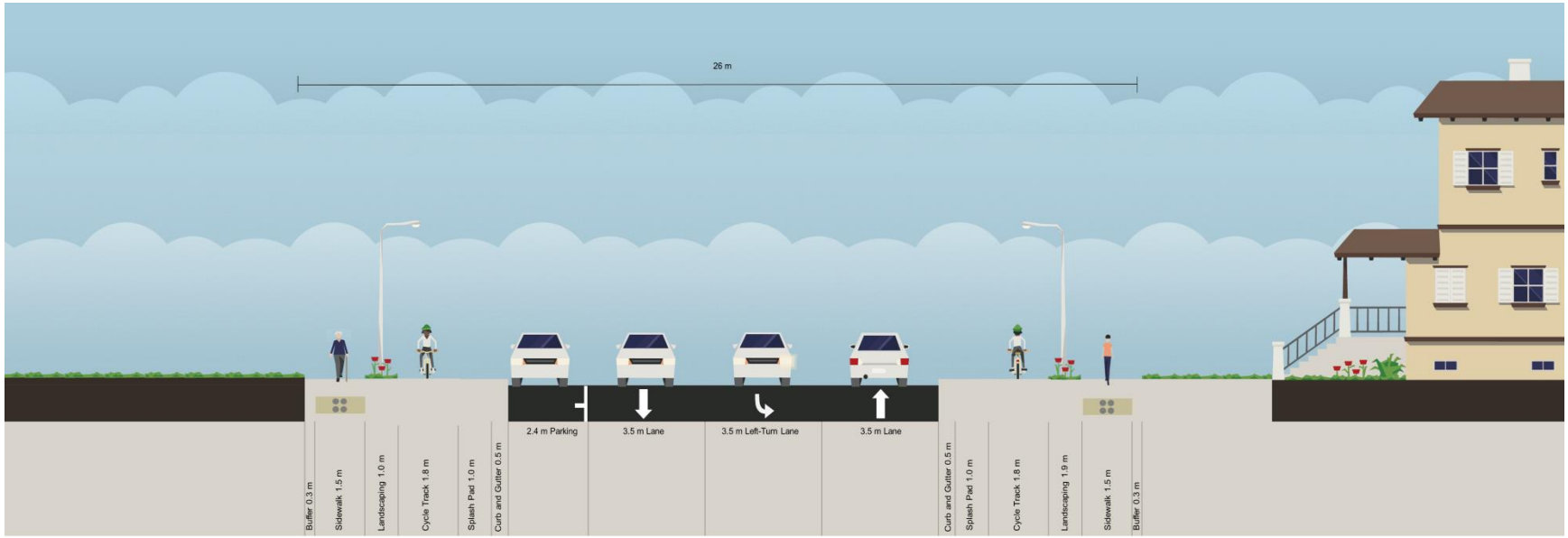


Exhibit 6-13: Alternative S2 Cross-Section

Alternative S3: Assuming a 26 m ROW width; curb and gutter, sidewalks, minimal landscaping, utilities, and cycle tracks would be provided on both the west and east sides of the road. Between the two travel lanes, dual left-turn lanes would be provided. This alternative does not provide opportunities for on-street parking.

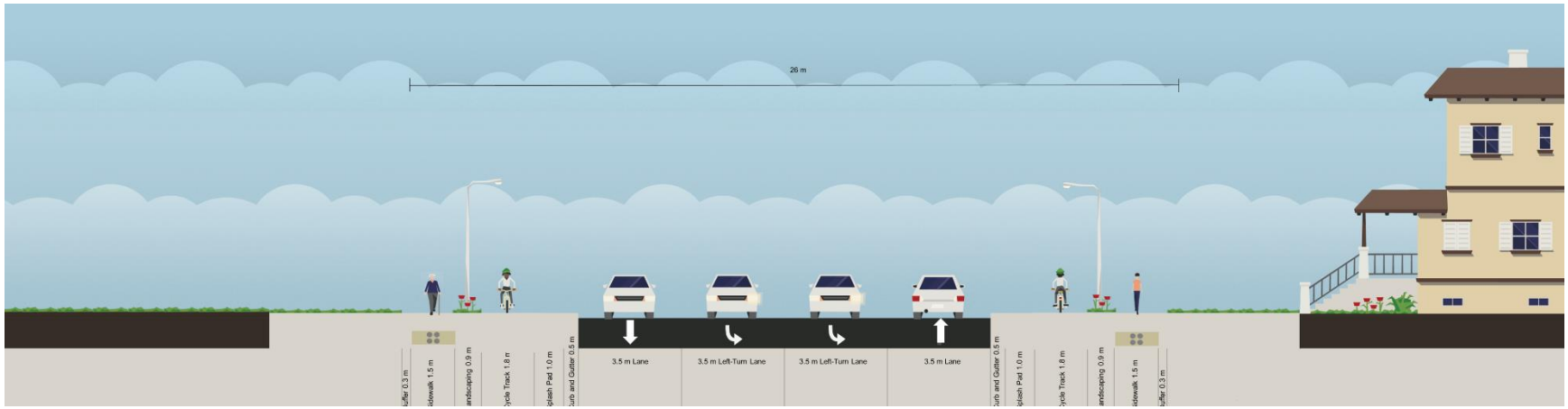


Exhibit 6-14: Alternative S3 Cross-Section

The following notes should be considered when assessing each alternative:

i. The minimum multi-use path width presented (3.0 m) may be increased to 4.0 m where space permits; otherwise, 2.4 - 3.0 m shall be used in constrained locations as per OTM Book 18.

ii. A dedicated continuous centre left-turn lane has been noted as a priority element, where feasible, in order to improve traffic flow along Victoria Square Boulevard and allow for safer left turns into and out of side roads and private entrances.

iii. Making use of existing infrastructure has been noted as a priority and retaining existing infrastructure has been considered where possible.

iv. Future underground utility corridors will be accommodated under the sidewalks (or multi-use trail where sidewalks do not exist). The exact placement of utilities will be determined at the detailed design stage.

6.3 Evaluation of Alternative Design Concepts

6.3.1 Evaluation Criteria

The evaluation of alternative cross-sections included the formulation of evaluation criteria and a method to evaluate these criteria. The evaluation criteria were developed based on transportation considerations as well as impacts to the natural, cultural, and socio-economic environments. The alternative cross-section alternatives identified were evaluated based on the following criteria:

Category	Criteria
Natural Environment	• Minimize impacts to vegetation, wildlife, aquatic habitat, surface/ground water, and air quality.
Social Environment	• Compatible with adjacent land use • Improve access to adjacent areas • Improve visual aesthetics and community character and accommodate green space for tree planting and landscaping • Improve access to businesses and opportunities for commerce • Minimize effects on climate change
Cultural Environment	• Preserve and enhance archaeological and cultural heritage features
Transportation Service	• Ability to provide level of separation/protection for cyclists from other modes • Ability to provide level of separation/protection for pedestrians from other modes • Minimize potential conflicts between modes • Support planned transit improvements and operations • Provide direct, continuous and convenient connections • Accommodate all ages, abilities, and types of users (recreational/commuter) • Accommodates on-street parking based on surrounding land-use
Infrastructure Design	• Minimize above ground utility relocation • Minimize impacts to driveways • Feasibility – Ability to implement within proposed right-of-way at constrained locations and intersections • Stormwater management impacts due to amount of hard surface
Economic Consideration	• Minimize capital costs • Minimize operating and maintenance costs • Minimize rehabilitation and replacement costs

It should be noted that the climate change criteria was added following the Open House, based on comments provided by MOECC; however, it does not change the overall outcome of the evaluation.

6.3.2 Evaluation of Alternatives

The alternative design cross-sections were evaluated using the established criteria. Both qualitative and quantitative evaluations were completed.

The grading footprints of the alternative design cross-sections are similar within each segment, as the existing right-of-way width for each segment will determine the allowable cross-section footprint. Therefore, property impacts and impacts to the natural and cultural features are anticipated to be the same for all the options considered for each segment. As such, the evaluation focused on the criteria where differences occur between options, and excludes the natural and cultural environment categories.

Although each criterion presents important considerations with respect to potential impacts, the relative weighting of each criterion to one another is not equal. For example, impacts to transportation services and the social environment are of greater relevance to choosing a preferred cross-section than infrastructure design and economic considerations. To reflect this reality, the evaluation of the urban cross-sections was weighted as high to low as follows:

- Social Environment: High (40%)
- Transportation Service: High (40%)
- Infrastructure Design: Low (10%)
- Economic Consideration: Low (10%)

The qualitative evaluations of the alternative cross-sections for Areas 1 – 3 are presented in **Table 6-1** and Areas 4 – 6 in **Table 6-2.** The quantitative summary of the evaluation of alternative cross-sections for Areas 1 – 6 is presented in **Table 6-3**. For the quantitative evaluation, a score from 1 to 5 is provided, where 1 is least desirable and 5 is most desirable.

Table 6-1: Qualitative Evaluation of Alternative Cross-Sections (Areas 1-3)

Evaluation Criteria	Area 1: North Gateway	Area 2: Residential Main Street		Area 3: Hamlet of Victoria Square Area	
	Alternative N1 Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. Retain northbound left-turn lane.	**Alternative RM1** Sidewalks, landscaping, utilities, and cycle tracks on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative RM2** Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. On-street parking on east side of the road. Continuous centre left-turn lane.	**Alternative H1** Utilities, sidewalks, and cycle tracks on both west and east sides of the road.	**Alternative H2** Utilities and a multi-use trail on both west and east sides of the road. Continuous centre left-turn lane.
Social Environment					
Compatible with adjacent land use	• Compatible with lower intensity uses such as low density residential.	• Compatible with higher intensity uses such as mixed-use, commercial, institutional, and medium density residential.		• Compatible with lower intensity uses such as low density residential.	
Improve access to adjacent areas	• Improves access for all modes to both sides of the street.	• Improves access for all modes to both sides of the street.		• Improves access for all modes to both sides of the street.	
Improve visual aesthetics/community character and accommodates green space for tree planting and landscaping	• Potential to improve visual aesthetics and community character. • Accommodates 1.15 m landscape buffer on both sides of the road.	• High potential to improve visual aesthetics and community character. • Accommodates 3.15 m landscape buffer on both sides of the road.	• Moderate potential to improve visual aesthetics and community character. • Accommodates 2.9 m landscape buffer on west side of the road and 1 m landscape buffer on east side of the road.	• Low potential to improve visual aesthetics and community character. • Accommodates 1.4 m landscape buffer on both sides of the road.	• Low potential to improve visual aesthetics and community character. • Does not accommodate landscape buffer on either side of the road.
Improve access to businesses and opportunities for commerce	• Highest potential to improve access to businesses and opportunities for commerce through continuous centre left-turn lane.	• Moderate potential to improve access to businesses and opportunities for commerce.	• Highest potential to improve access to businesses and opportunities for commerce.	• Moderate potential to improve access to businesses and opportunities for commerce.	• Highest potential to improve access to businesses and opportunities for commerce.
Minimize effects on climate change	• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change	• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Provision of a continuous centre left-turn lane will improve traffic operations, reducing congestion and vehicular idling, thereby reducing vehicle emissions • Opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change		• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change	• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Provision of a continuous centre left-turn lane, where feasible, will improve traffic operations, reducing congestion and vehicular idling, thereby reducing vehicle emissions • Limited opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study

Evaluation Criteria	Area 1: North Gateway	Area 2: Residential Main Street		Area 3: Hamlet of Victoria Square Area	
	Alternative N1 Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. Retain northbound left-turn lane.	**Alternative RM1** Sidewalks, landscaping, utilities, and cycle tracks on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative RM2** Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. On-street parking on east side of the road. Continuous centre left-turn lane.	**Alternative H1** Utilities, sidewalks, and cycle tracks on both west and east sides of the road.	**Alternative H2** Utilities and a multi-use trail on both west and east sides of the road. Continuous centre left-turn lane.
					corridor resiliency to climate change
Summary	**Preferred**	**Preferred**	**Preferred**	**Preferred**	**Less Preferred**
Transportation Service					
Ability to provide level of separation/protection for cyclists from other modes.	• Accommodates cyclists on both the west and east side in a facility separate from pedestrians and vehicular traffic.	• Accommodates cyclists on both the west and east side in a facility separate from pedestrians and vehicular traffic.		• Accommodates cyclists on both the west and east side in a facility separate from pedestrians and vehicular traffic.	• Accommodates cyclists on both the west and east side in a combined facility with pedestrian traffic.
Ability to provide level of separation/protection for pedestrians from other modes.	• Accommodates pedestrians on both the west and east side in a dedicated facility separate from cyclist and vehicular traffic.	• Accommodates pedestrians on both the west and east side in a dedicated facility separate from cyclist and vehicular traffic.		• Accommodates pedestrians on both the west and east side in a dedicated facility separate from cyclist and vehicular traffic.	• Accommodates pedestrians on both the west and east side in a combined facility with cyclist traffic.
Minimize potential conflicts between modes	• Reduced potential for conflicts between modes as each mode has its own separate facilities	• Reduced potential for conflicts between modes as each mode has its own separate facilities		• Reduced potential for conflicts between modes as each mode has its own separate facilities	• Potential for cyclist / pedestrian conflicts within combined facilities on both west and east sides of the road. • Turning drivers may not expect contra-flow bicycle traffic on both west and east side.
Support planned transit improvements and operations	• Supports planned transit improvements and operations.	• Supports planned transit improvements and operations.		• Supports planned transit improvements and operations.	
Provide direct, continuous and convenient connections	• Full access to both sides of the road for pedestrians and cyclists.	• Full access to both sides of the road for pedestrians and cyclists.		• Full access to both sides of the road for pedestrians and cyclists.	
Accommodate all ages, abilities, and types of users (recreational/commuter)	• Separate cyclist/ pedestrian facilities encourage use by all ages and abilities. • Greater potential for use of cyclist facilities by commuter cyclists versus recreational cyclists.	• Separate cyclist/ pedestrian facilities encourage use by all ages and abilities. • Greater potential for use of cyclist facilities by commuter cyclists versus recreational cyclists.	• Separate cyclist/ pedestrian facilities encourage use by all ages and abilities. • Greater potential for use of cyclist facilities by commuter cyclists versus recreational cyclists.	• Separate cyclist/ pedestrian facilities encourage use by all ages and abilities. • Greater potential for use of cyclist facilities by commuter cyclists versus recreational cyclists.	• Accommodates a variety of users, in a shared space with pedestrians. • Greater potential for use of cyclist facilities by recreational cyclists versus commuter cyclists.
Accommodates on-street parking based on surrounding land-use	• No opportunity or perceived need for on-street parking due to ROW constraints and surrounding land-use	• Does not accommodate on-street parking	• Accommodates on-street parking on east side of the road	• No opportunity or for on-street parking due to ROW constraints and surrounding land-use	• No opportunity for on-street parking due to ROW constraints and surrounding land-use

Evaluation Criteria	Area 1: North Gateway	Area 2: Residential Main Street		Area 3: Hamlet of Victoria Square Area	
	Alternative N1 Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. Retain northbound left-turn lane.	**Alternative RM1** Sidewalks, landscaping, utilities, and cycle tracks on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative RM2** Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. On-street parking on east side of the road. Continuous centre left-turn lane.	**Alternative H1** Utilities, sidewalks, and cycle tracks on both west and east sides of the road.	**Alternative H2** Utilities and a multi-use trail on both west and east sides of the road. Continuous centre left-turn lane.
Summary	**Preferred**	**Less Preferred**	**Preferred**	**Preferred**	**Less Preferred**
Infrastructure Design					
Minimize above ground utility relocation	• Above ground utility pole relocation required to accommodate proposed road widening regardless of boulevard treatment.	• Above ground utility pole relocation required to accommodate proposed road widening regardless of boulevard treatment.		• Above ground utility pole relocation required to accommodate proposed road widening regardless of boulevard treatment.	
Minimize impacts to driveways.	• No potential for impacts to driveways.	• Moderate potential for impacts to driveways.		• Moderate potential for impacts to driveways.	
Feasibility – ability to implement within proposed ROW and at constrained locations and intersections	• Accommodated within proposed 23 m right-of-way. • High potential to implement within constrained locations without major trade-offs. • More complex intersection configuration.	• Accommodated within proposed 30 m right-of-way. • High potential to implement within constrained locations without major trade-offs. • Straight-forward intersection configuration.		• Accommodated within proposed 20 - 28 m right-of-way. • High potential to implement within constrained locations without major trade-offs. • Straight-forward intersection configuration	
Stormwater management impacts due to amount of hard surface	• Neutral stormwater management impacts from marginally increased hard surface	• Greatest amount of hard surface	• Least amount of hard surface	• Least amount of hard surface	• Greatest amount of hard surface
Summary	**Preferred**	**Less Preferred**	**Preferred**	**Preferred**	**Less Preferred**
Economic Consideration					
Minimize capital cost	• Least capital cost.	• Moderate capital cost. • Potential to make use of existing sidewalk infrastructure.	• Moderate capital cost, but higher than R1. • Potential to make use of existing sidewalk infrastructure.	• Moderate capital cost	• Moderate capital cost, but higher than H1
Minimize operating and maintenance costs	• Moderate operating and maintenance costs.	• Moderate operating and maintenance costs.	• Moderate operating and maintenance costs, but higher than R1.	• Moderate operating and maintenance costs.	• Moderate operating and maintenance costs, but higher than H1.
Minimize rehabilitation and replacement costs	• Moderate rehabilitation and replacement costs	• Moderate rehabilitation and replacement costs		• Moderate rehabilitation and replacement costs	
Summary	**Preferred**	**Preferred**	**Less Preferred**	**Preferred**	**Less Preferred**
Recommendation	**Recommended**	**Not recommended**	**Recommended**	**Recommended**	**Not recommended**

Table 6-2: Qualitative Evaluation of Alternative Cross-Sections (Areas 4-6)

Evaluation Criteria	Area 4: Cathedral Residential Area		Area 5: Cathedral Precinct Area		Area 6: South Gateway		
	Alternative CR1 Sidewalks, minimal landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on west side of road only. Continuous centre left-turn lane.	**Alternative CP1** Sidewalks, landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CP2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on the west side of the road only. Continuous centre left-turn lane.	**Alternative S1** Sidewalks, utilities, and cycle tracks on both west and east sides of the road. Retain southbound left-turn lane.	**Alternative S2** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of road. On-street parking on the west side of the road only. Retain southbound left-turn lane.	**Alternative S3** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of the road. Dual southbound left-turn lanes at Woodbine Avenue.
Social Environment							
Compatible with adjacent land use	• Compatible with higher intensity uses such as mixed use, commercial, institutional, and low/medium density residential.		• Compatible with higher intensity uses such as mixed use, commercial, institutional, and low/medium density residential.		• Compatible with lower intensity uses such as low density residential.	• Compatible with higher intensity uses such as mixed use, commercial, institutional, and low/medium density residential.	
Improve access to adjacent areas	• Improves access for all modes to both sides of the street.		• Improves access for all modes to both sides of the street.		• Improves access for all modes to both sides of the street.		
Improve visual aesthetics/ community character and accommodates green space for tree planting and landscaping	• Moderate potential to improve visual aesthetics and community character. • Accommodates 0.75 m landscape buffer on both sides of the road.	• High potential to improve visual aesthetics and community character. • Accommodates 1.0 m and 2.9 m landscape buffer to the west and east side of the road, respectively.	• High potential to improve visual aesthetics and community character. • Accommodates 3.25 m landscape buffer on both sides of the road.	• High potential to improve visual aesthetics and community character. • Accommodates 3.25 m and 5.65 m landscape buffer on the west and east sides of the road, respectively.	• Highest potential to improve visual aesthetics and community character. • Accommodates 2.65 m landscape buffer on both sides of the road.	• Moderate potential to improve visual aesthetics and community character. • Accommodates 1.0 m and 1.9 m landscape buffer to the west and east side of the road, respectively.	• Low potential to improve visual aesthetics and community character. • Accommodates 0.9 m landscape buffer on both sides of the road.
Improve access to businesses and opportunities for commerce	• Improves access for all modes to both sides of the street.		• Improves access for all modes to both sides of the street.		• Improves access for all modes to both sides of the street.		
Minimize effects on climate change	• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Provision of a continuous centre left-turn lane will improve traffic operations, reducing congestion and vehicular idling, thereby reducing vehicle emissions	• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Provision of a continuous centre left-turn lane will improve traffic operations, reducing congestion and vehicular idling,	• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Provision of a continuous centre left-turn lane will improve traffic operations, reducing congestion and vehicular idling, thereby reducing vehicle emissions • Opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change		• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Opportunities for implementation of tree plantings and Low Impact Development	• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Limited opportunities for implementation of tree plantings and Low Impact	• Active transportation improvements can marginally reduce dependence on automobile and provide minor improvements to effects on climate change • Provision of a dual left-turn lane will improve traffic operations, reducing congestion and vehicular idling,

Evaluation Criteria	Area 4: Cathedral Residential Area		Area 5: Cathedral Precinct Area		Area 6: South Gateway		
	Alternative CR1 Sidewalks, minimal landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on west side of road only. Continuous centre left-turn lane.	**Alternative CP1** Sidewalks, landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CP2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on the west side of the road only. Continuous centre left-turn lane.	**Alternative S1** Sidewalks, utilities, and cycle tracks on both west and east sides of the road. Retain southbound left-turn lane.	**Alternative S2** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of road. On-street parking on the west side of the road only. Retain southbound left-turn lane.	**Alternative S3** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of the road. Dual southbound left-turn lanes at Woodbine Avenue.
	• Limited opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change	thereby reducing vehicle emissions • Opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change			stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change	Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change	thereby reducing vehicle emissions • Limited opportunities for implementation of tree plantings and Low Impact Development stormwater management strategies as part of road improvements can improve the study corridor resiliency to climate change
Summary	**Less Preferred**	**Preferred**	**Preferred**	**Preferred**	**Preferred**	**Preferred**	**Less Preferred**
Transportation Service							
Ability to provide level of separation/ protection for cyclists from other modes.	• Accommodates cyclists on both the west and east side in facility separate from pedestrians and vehicular traffic.		• Accommodates cyclists on both the west and east side in facility separate from pedestrians and vehicular traffic.		• Accommodates cyclists on both the west and east side in facility separate from pedestrians and vehicular traffic.		
Ability to provide level of separation/ protection for pedestrians from other modes.	• Reduced potential for cyclist / pedestrian conflicts within separated facilities on both west and east sides of the road.		• Reduced potential for cyclist / pedestrian conflicts within separated facilities on both west and east sides of the road.		• Reduced potential for cyclist / pedestrian conflicts within separated facilities on both west and east sides of the road.		
Minimize potential conflicts between modes	• Reduced potential for conflicts between modes as each mode has its own separate facilities		• Reduced potential for conflicts between modes as each mode has its own separate facilities		• Reduced potential for conflicts between modes as each mode has its own separate facilities		
Support planned transit improvements and operations	• Supports planned transit improvements and operations.		• Supports planned transit improvements and operations		• Supports planned transit improvements and operations		
Provide direct, continuous and convenient connections	• Full access to both sides of the road for pedestrians and cyclists.		• Full access to both sides of the road for pedestrians and cyclists.		• Full access to both sides of the road for pedestrians and cyclists.		

Evaluation Criteria	Area 4: Cathedral Residential Area		Area 5: Cathedral Precinct Area		Area 6: South Gateway		
	Alternative CR1 Sidewalks, minimal landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on west side of road only. Continuous centre left-turn lane.	**Alternative CP1** Sidewalks, landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CP2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on the west side of the road only. Continuous centre left-turn lane.	**Alternative S1** Sidewalks, utilities, and cycle tracks on both west and east sides of the road. Retain southbound left-turn lane.	**Alternative S2** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of road. On-street parking on the west side of the road only. Retain southbound left-turn lane.	**Alternative S3** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of the road. Dual southbound left-turn lanes at Woodbine Avenue.
Accommodate all ages, abilities, and types of users (recreational / commuter)	• Separate cyclist/pedestrian facilities encourage use by all ages and abilities. • Greater potential for use of cyclist facilities by commuter cyclists versus recreational cyclists.		• Separate cyclist/pedestrian facilities encourage use by all ages and abilities. • Greater potential for use of cyclist facilities by commuter cyclists versus recreational cyclists.		• Separate cyclist/pedestrian facilities encourage use by all ages and abilities. • Greater potential for use of cyclist facilities by commuter cyclists versus recreational cyclists.		
Accommodates on-street parking based on surrounding land-use	• Accommodates on-street parking on both west and east side of the road.	• Accommodates on-street parking on west side of the road only.	• Accommodates on-street parking on both west and east side of the road.	• Accommodates on-street parking on west side of the road only.	• No opportunity for on-street parking due to ROW constraints.	• Accommodates on-street parking on west side of the road only.	• No opportunity for on-street parking due to ROW constraints.
Summary	**Preferred**	**Less Preferred**	**Preferred**	**Less Preferred**	**Less Preferred**	**Preferred**	**Less Preferred**
Infrastructure Design							
Minimize above ground utility relocation	• Above ground utility pole relocation required to accommodate proposed road widening regardless of boulevard treatment.		• Above ground utility pole relocation required to accommodate proposed road widening regardless of boulevard treatment.		• Above ground utility pole relocation required to accommodate proposed road widening regardless of boulevard treatment.		
Minimize impacts to driveways.	• Moderate potential for impacts to driveways.		• Low potential for impacts to driveways.		• Moderate potential for impacts to driveways.		
Feasibility – ability to implement within proposed ROW and at constrained locations and intersections	• Accommodated within proposed 30 m right-of-way. • High potential to implement roadway elements within constrained locations without major trade-offs. • Straight-forward intersection configuration.		• Accommodated within proposed 36 m right-of-way. • Straight-forward intersection configuration.		• Accommodated within proposed 26 m right-of-way. • Some trade-offs required at constrained locations. • More complex intersection configuration.		
Stormwater management impacts due to amount of hard surface	• Greatest amount of hard surface	• Least amount of hard surface	• Greatest amount of hard surface	• Least amount of hard surface	• Least amount of hard surface	• Greatest amount of hard surface	
Summary	**Less Preferred**	**Preferred**	**Less Preferred**	**Preferred**	**Preferred**	**Less Preferred**	**Less Preferred**
Economic Consideration							
Minimize capital cost	• Moderate capital cost, but higher than RM2. • Potential to make use of existing sidewalk infrastructure.	• Moderate capital cost. • Potential to make use of existing sidewalk infrastructure.	• Moderate capital cost, but higher than C2. • Potential to make use of existing sidewalk infrastructure.	• Moderate capital cost. Potential to make use of existing sidewalk infrastructure.	• Moderate capital cost.	• Moderate capital cost, but higher than S1.	

Evaluation Criteria	Area 4: Cathedral Residential Area		Area 5: Cathedral Precinct Area		Area 6: South Gateway		
	Alternative CR1 Sidewalks, minimal landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on west side of road only. Continuous centre left-turn lane.	**Alternative CP1** Sidewalks, landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CP2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on the west side of the road only. Continuous centre left-turn lane.	**Alternative S1** Sidewalks, utilities, and cycle tracks on both west and east sides of the road. Retain southbound left-turn lane.	**Alternative S2** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of road. On-street parking on the west side of the road only. Retain southbound left-turn lane.	**Alternative S3** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of the road. Dual southbound left-turn lanes at Woodbine Avenue.
Minimize operating and maintenance costs	• Moderate operating and maintenance costs, but higher than RM2.	• Moderate operating and maintenance costs.	• Moderate operating and maintenance costs, but higher than C2.	• Moderate operating and maintenance costs.	• Moderate operating and maintenance costs.	• Moderate operating and maintenance costs, but higher than S1.	
Minimize rehabilitation and replacement costs	• Moderate rehabilitation and replacement costs		• Moderate rehabilitation and replacement costs		• Moderate rehabilitation and replacement costs		
Summary	**Less Preferred**	**Preferred**	**Less Preferred**	**Preferred**	**Preferred**	**Less Preferred**	**Less Preferred**
Recommendation	**Not recommended**	**Recommended**	**Not recommended**	**Recommended**	**Not recommended**	**Recommended**	**Not recommended**

Table 6-3: Quantitative Evaluation of Alternative Cross-Sections (Areas 1-6)

Evaluation Criteria	Area 1: North Gateway	Area 2: Residential Main Street		Area 3: Hamlet of Victoria Square Area		Area 4: Cathedral Residential Area		Area 5: Cathedral Precinct Area		Area 6: South Gateway		
	Alternative N1 Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. Retain northbound left-turn lane.	**Alternative RM1** Sidewalks, landscaping, utilities, and cycle tracks on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative RM2** Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. On-street parking on east side of the road. Continuous centre left-turn lane.	**Alternative H1** Utilities, sidewalks, and cycle tracks on both west and east sides of the road.	**Alternative H2** Utilities and a multi-use trail on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR1** Sidewalks, minimal landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on west side of road only. Continuous centre left-turn lane.	**Alternative CP1** Sidewalks, landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CP2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on the west side of the road only. Continuous centre left-turn lane.	**Alternative S1** Sidewalks, utilities, and cycle tracks on both west and east sides of the road. Retain southbound left-turn lane.	**Alternative S2** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of road. On-street parking on west side of road only. Retain southbound left-turn lane.	**Alternative S3** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of the road. Dual southbound left-turn lanes at Woodbine Avenue.
Social Environment												
Compatible with adjacent land use	5	5	5	5	5	5	5	5	5	5	5	5
Improve access to adjacent areas	4	4	5	4	4	5	5	5	5	4	5	4
Improve visual aesthetics/community character and accommodates green space for tree planting and landscaping	2	5	3	3	1	1	3	5	5	5	4	1
Improve access to businesses and opportunities for commerce	5	4	5	4	5	5	5	5	5	5	5	5
Minimize effects on climate change	5	5	5	4	4	4	5	5	5	4	3	4
Summary (Average)	**Preferred (4.20)**	**Preferred (4.60)**	**Preferred (4.60)**	**Preferred (4.00)**	**Less Preferred (3.80)**	**Less Preferred (4.00)**	**Preferred (4.60)**	**Preferred (5.00)**	**Preferred (5.00)**	**Preferred (4.60)**	**Preferred (4.40)**	**Less Preferred (3.80)**
Transportation Service												
Ability to provide level of separation / protection for cyclists from other modes.	5	5	5	5	4	5	5	5	5	5	5	5

Evaluation Criteria	Area 1: North Gateway	Area 2: Residential Main Street		Area 3: Hamlet of Victoria Square Area		Area 4: Cathedral Residential Area		Area 5: Cathedral Precinct Area		Area 6: South Gateway		
	Alternative N1 Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. Retain northbound left-turn lane.	**Alternative RM1** Sidewalks, landscaping, utilities, and cycle tracks on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative RM2** Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. On-street parking on east side of the road. Continuous centre left-turn lane.	**Alternative H1** Utilities, sidewalks, and cycle tracks on both west and east sides of the road.	**Alternative H2** Utilities and a multi-use trail on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR1** Sidewalks, minimal landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on west side of road only. Continuous centre left-turn lane.	**Alternative CP1** Sidewalks, landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CP2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on the west side of the road only. Continuous centre left-turn lane.	**Alternative S1** Sidewalks, utilities, and cycle tracks on both west and east sides of the road. Retain southbound left-turn lane.	**Alternative S2** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of road. On-street parking on west side of road only. Retain southbound left-turn lane.	**Alternative S3** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of the road. Dual southbound left-turn lanes at Woodbine Avenue.
Ability to provide level of separation/protection for pedestrians from other modes.	5	5	5	5	4	5	5	5	5	5	5	5
Minimize potential conflicts between modes	5	5	5	5	3	5	5	5	5	5	5	5
Support planned transit improvements and operations	5	5	5	5	5	5	5	5	5	5	5	5
Provide direct, continuous and convenient connections	5	5	5	5	5	5	5	5	5	5	5	5
Accommodate all ages, abilities, and types of users recreational / commuter)	5	5	5	5	4	5	5	5	5	5	5	5
Accommodates on-street parking based on surrounding land-use	1	1	5	1	1	5	4	5	4	1	5	1
Summary (Average)	**Preferred (4.43)**	**Less Preferred (4.43)**	**Preferred (5.00)**	**Preferred (4.43)**	**Less Preferred (3.71)**	**Preferred (5.00)**	**Less Preferred (4.86)**	**Preferred (5.00)**	**Less Preferred (4.86)**	**Less Preferred (4.43)**	**Preferred (5.00)**	**Less Preferred (4.43)**
Infrastructure Design												
Minimize above ground utility relocation	3	3	3	3	3	3	3	3	3	3	3	3

Evaluation Criteria	Area 1: North Gateway	Area 2: Residential Main Street		Area 3: Hamlet of Victoria Square Area		Area 4: Cathedral Residential Area		Area 5: Cathedral Precinct Area		Area 6: South Gateway		
	Alternative N1 Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. Retain northbound left-turn lane.	**Alternative RM1** Sidewalks, landscaping, utilities, and cycle tracks on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative RM2** Sidewalks, landscaping, utilities, and cycle tracks on both west and east side of the road. On-street parking on east side of the road. Continuous centre left-turn lane.	**Alternative H1** Utilities, sidewalks, and cycle tracks on both west and east sides of the road.	**Alternative H2** Utilities and a multi-use trail on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR1** Sidewalks, minimal landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CR2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on west side of road only. Continuous centre left-turn lane.	**Alternative CP1** Sidewalks, landscaping, utilities, cycle tracks and on-street parking on both west and east sides of the road. Continuous centre left-turn lane.	**Alternative CP2** Sidewalks, landscaping, utilities and cycle tracks on both west and east sides of the road. On-street parking on the west side of the road only. Continuous centre left-turn lane.	**Alternative S1** Sidewalks, utilities, and cycle tracks on both west and east sides of the road. Retain southbound left-turn lane.	**Alternative S2** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of road. On-street parking on west side of road only. Retain southbound left-turn lane.	**Alternative S3** Sidewalks, minimal landscaping, utilities, and cycle tracks on both west and east side of the road. Dual southbound left-turn lanes at Woodbine Avenue.
Minimize impacts to driveways.	5	4	4	4	4	3	3	5	5	3	3	3
Feasibility – ability to implement within proposed ROW and at constrained locations and intersections	3	4	4	4	4	5	5	5	5	4	4	4
Provides stormwater management improvements	4	2	4	4	2	2	4	2	4	4	3	3
Summary (Average)	**Preferred (3.75)**	**Less Preferred (3.25)**	**Preferred (3.75)**	**Preferred (3.75)**	**Less Preferred (3.25)**	**Less Preferred (3.25)**	**Preferred (3.75)**	**Less Preferred (3.75)**	**Preferred (4.25)**	**Preferred (3.50)**	**Less Preferred (3.25)**	**Less Preferred (3.25)**
Economic Consideration												
Minimize capital cost	4	4	3	4	3	3	4	3	4	4	3	3
Minimize operating and maintenance costs	4	4	3	4	3	3	4	3	4	4	3	3
Minimize rehabilitation and replacement costs	4	4	4	4	4	4	4	4	4	4	4	4
Summary (Average)	**Preferred (4.00)**	**Preferred (4.00)**	**Less Preferred (3.33)**	**Preferred (4.00)**	**Less Preferred (3.33)**	**Less Preferred (3.33)**	**Preferred (4.00)**	**Less Preferred (3.33)**	**Preferred (4.00)**	**Preferred (4.00)**	**Less Preferred (3.33)**	**Less Preferred (3.33)**
Recommendation (Weighted Average)	**Recommended (4.23)**	**Not Recommended (4.34)**	**Recommended (4.55)**	**Recommended (4.15)**	**Not Recommended (3.66)**	**Not Recommended (4.26)**	**Recommended (4.56)**	**Not Recommended (4.71)**	**Recommended (4.77)**	**Not Recommended (4.36)**	**Recommended (4.42)**	**Not Recommended (3.95)**

6.4 Preferred Typical Cross-Section

The following summarizes the typical cross-sections that were selected for each area. Each of the preferred cross-sections most appropriately addresses the problem/opportunity statement and the following recurring themes noted by stakeholders and the public:

- Maximizes safety by providing physical separation between cyclists, pedestrians and motor vehicles each in a dedicated facility within the ROW.
- Accommodates all ages, abilities, and types of users (recreational and commuter) by providing continuous active transportation facilities in the form of cycle track and sidewalk infrastructure, or multi-use trails.

Looking ahead we will develop a preliminary design plan applying the various elements of the preferred typical sections and identify where there are constraints that require modification from the preferred typical sections.

6.4.1 Area 1: North Gateway

The preferred typical cross-section for Victoria Square Boulevard from the intersection with Woodbine Avenue (north intersection) to approximately 40 m north of Vetmar Road is Alternative N1 which is comprised of sidewalks, nominal landscaping, utilities and cycle tracks on both the west and east sides of the road. Between the two travel lanes, the left-turn lane will be retained.

Due to the relatively short length of the segment and ROW constraints, Area 1 has only one alternative design concept. This segment is mirrored to the preferred typical cross-section of Area 2 as a result of spatial constraints, restricting the feasibility of a transition. Alternative N1 scores high on the social environment and transportation service categories which are weighted the highest among the evaluation criteria.

Alternative N1, illustrated in **Exhibit 6-15**, is the preferred cross-section for Area 1. In addition to the common themes mentioned above, this alternative provides only nominal landscaping opportunities on either side of the road.

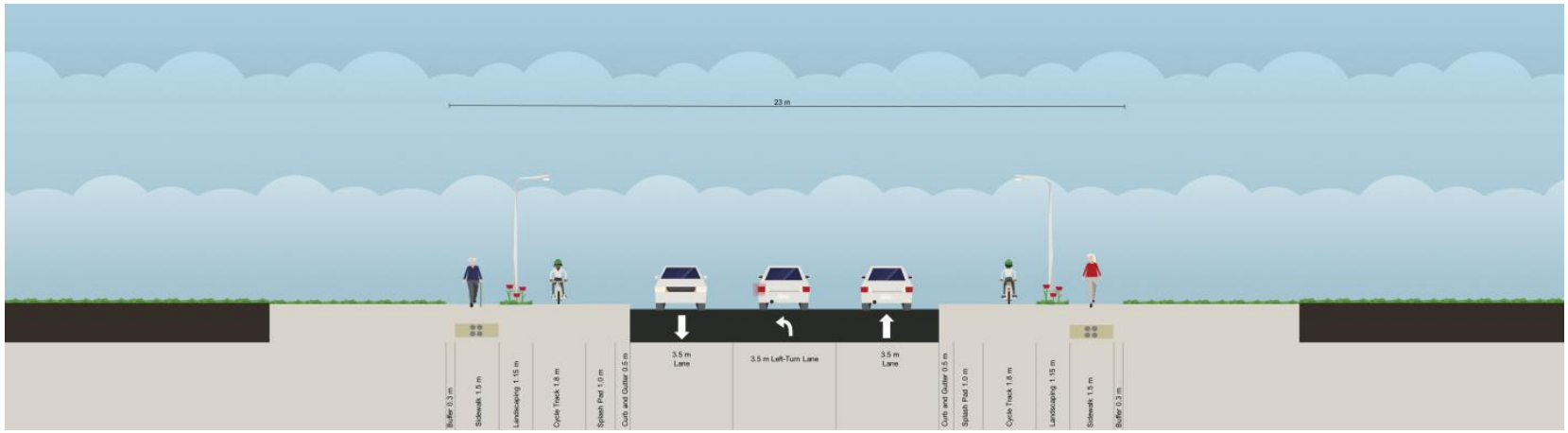


Exhibit 6-15: Area 1 Preferred Typical Cross-Section

6.4.2 Area 2: Residential Main Street

The preferred typical cross-section for Victoria Square Boulevard from approximately 40 m north of Vetmar Road to Prince of Wales Drive is Alternative RM2 which is comprised of sidewalks, utilities and cycle tracks on both the west and east sides of the road. Between the two travel lanes, a continuous centre-left-turn lane will be provided.

Alternative RM2, illustrated in **Exhibit 6-16**, is the preferred cross-section for Area 2. In addition to the common themes mentioned above, this alternative accommodates on-street-parking on the east side of the road to accommodate the future street-fronting townhomes proposed at this location. In addition this alternative accommodates full landscaping opportunities on the west boulevard.

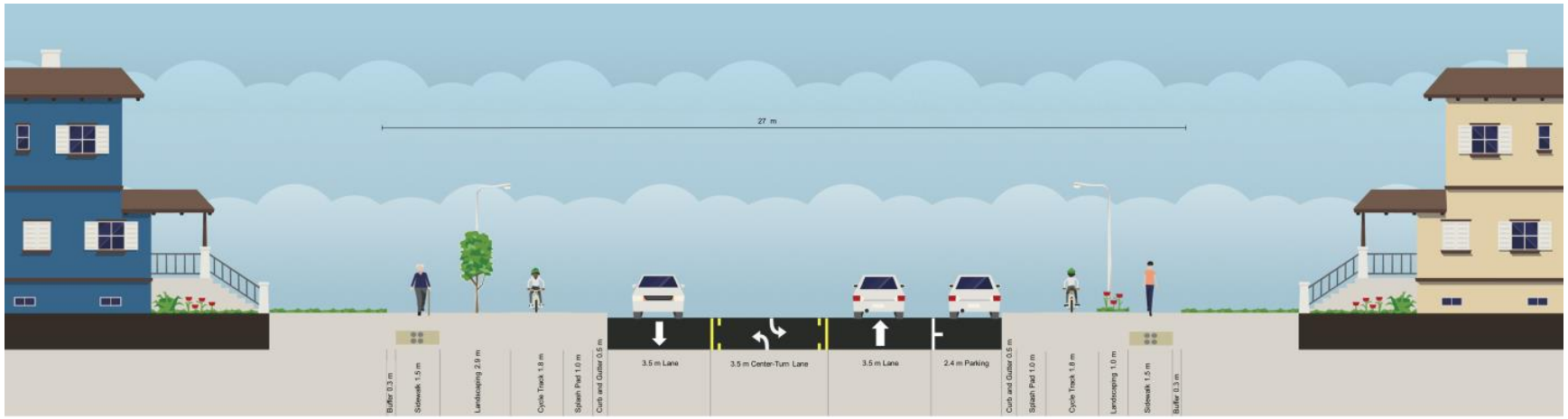


Exhibit 6-16: Area 2 Preferred Typical Cross-Section

6.4.3 Area 3: Hamlet and Cultural Heritage

The preferred typical cross-section for Victoria Square Boulevard from Prince of Wales Drive to approximately 90 m north of Reflection Road/Rinas Avenue is Alternative H1 which is comprised of sidewalks, nominal landscaping opportunities, utilities, and cycle tracks on both the west and east sides of the road. ROW constraints in this section do not permit for a continuous centre left-turn lane with the existing configuration. The roadway operations of Alternative H2 are preferred however, the demonstrated need for separated active transportation improvements and the undesirable location of illumination (set further back from the roadway) hinder Alternative H2 from being the preferred design alternative.

Alternative H1, illustrated in **Exhibit 6-17**, is the preferred cross-section for Area 3. In addition to the common themes mentioned above, this alternative:

- Maintains separated pedestrian and cycling facilities that provide a safer pedestrian and cyclist environment.
- Maintains the objectives of the study despite the fact that the ROW width is constrained in this segment.

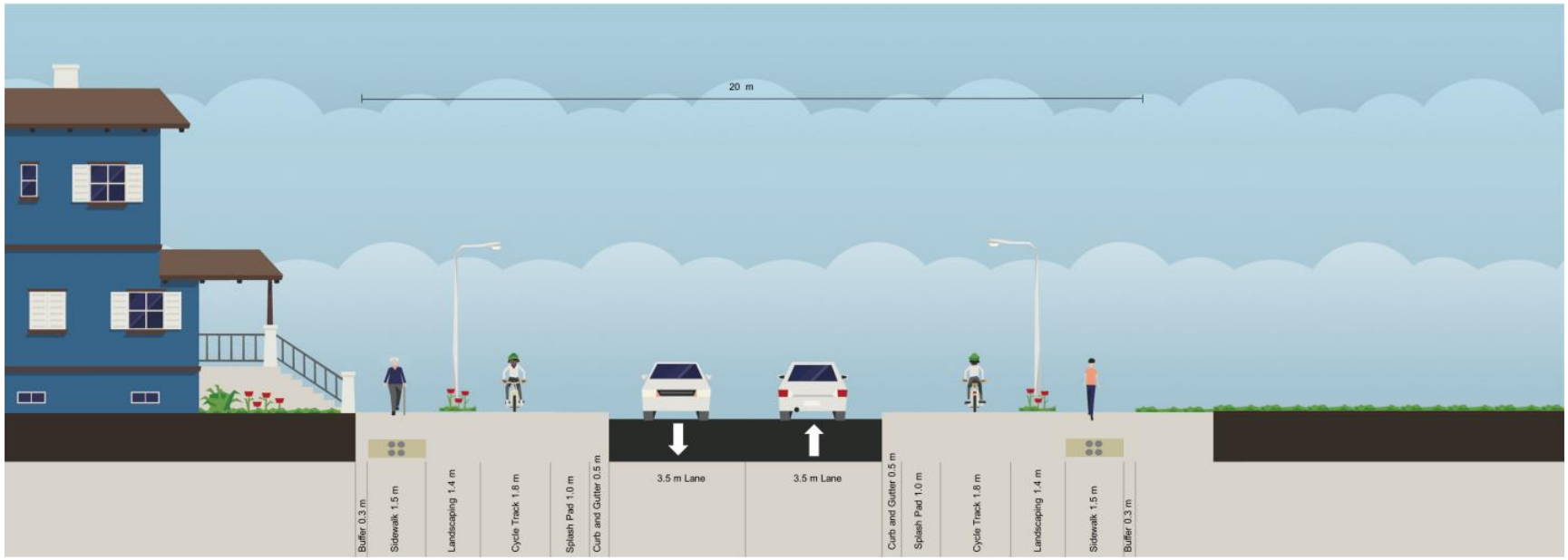


Exhibit 6-17: Area 3 Preferred Typical Cross-Section

6.4.4 Area 4: Cathedral Residential Area

The preferred typical cross-section for Victoria Square Boulevard from approximately 90 m north of Reflection Road/Rinas Avenue to Church View Avenue is Alternative RM2 which is comprised of sidewalks, utilities, and cycle tracks on both the west and east sides of the road. On-street parking will be accommodated on the west side of the road. Between the two travel lanes, a continuous centre left-turn lane will be provided.

Alternative CR2, illustrated in **Exhibit 6-18**, is the preferred cross-section for Area 4. In addition to the common themes mentioned above, this alternative:

- Provides adequate space for a landscaping buffer on the east boulevard only.
- Its configuration of on-street parking facilities provides less potential for vehicular / pedestrian conflicts.
    - Allows for existing pedestrian infrastructure to potentially be preserved and integrated into the design to minimize capital costs.

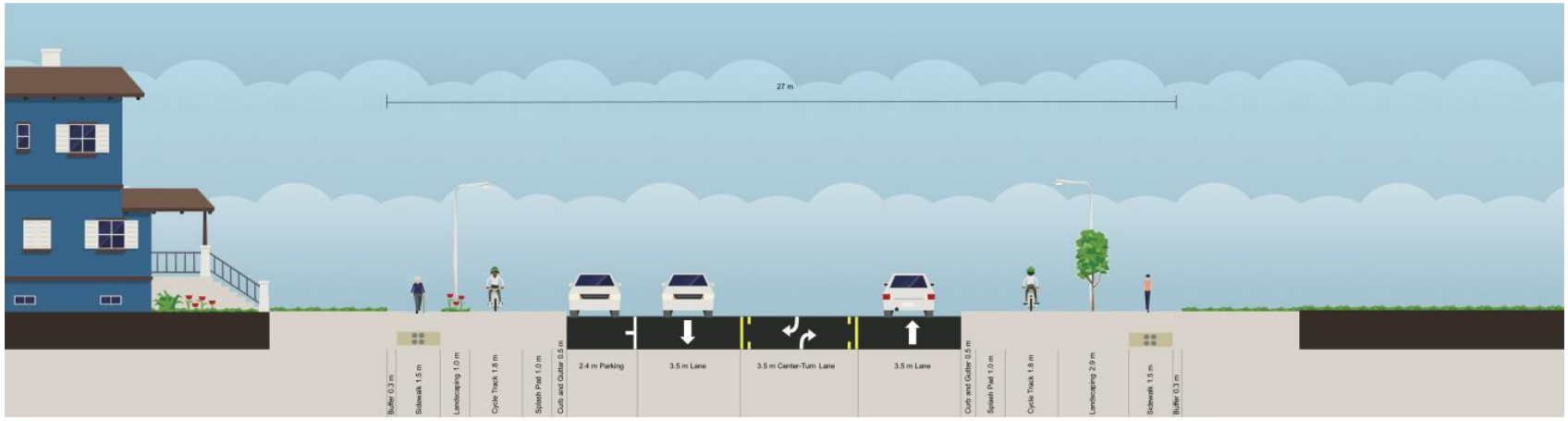


Exhibit 6-18**: Area 4 Preferred Typical Cross-Section**

6.4.5 Area 5: Cathedral Precinct Area

The preferred typical cross-section for Victoria Square Boulevard from Church View Avenue to approximately 30 m south of Murison Drive is Alternative CP2 which is comprised of sidewalks, landscaping, utilities, and cycle tracks on both the west and east sides of the road. On-street parking will be accommodated on the west side of the road. Between the two travel lanes, a continuous centre left-turn lane will be maintained.

Alternative CP2, illustrated in **Exhibit 6-19**, is the preferred cross-section for Area 5. In addition to the common themes mentioned above, this alternative:

- Provides adequate space for landscaping buffers on either side of the road.
- Its configuration of on-street parking facilities provides less potential for vehicular / pedestrian conflicts.
- Allows for existing pedestrian infrastructure to potentially be preserved and reused to minimize capital costs.

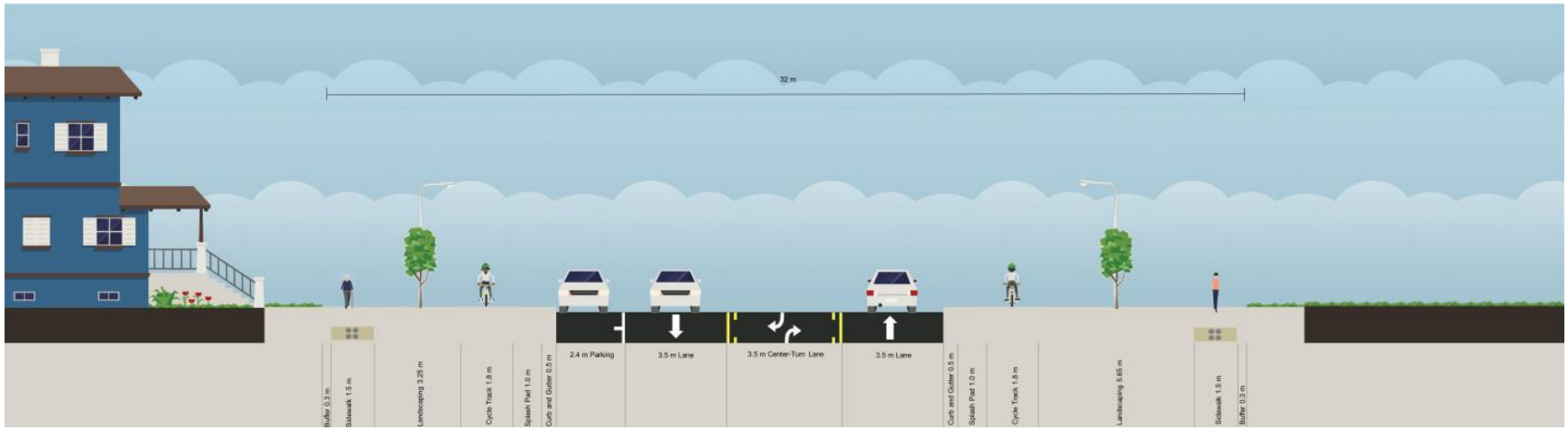


Exhibit 6-19: Area 5 Preferred Typical Cross-Section

6.4.6 Area 6: South Gateway

The preferred typical cross-section for Victoria Square Boulevard from approximately 30 m south of Murison Drive to Woodbine Avenue is Alternative S2 which is comprised of sidewalks, utilities, and cycle tracks on both the west and east sides of the road. There will be on-street parking facilities on the west side. Between the two travel lanes, a centre-left-turn lane will be maintained.

Alternative S2, illustrated in **Exhibit 6-20**, is the preferred cross-section for Area 6. In addition to the common themes mentioned above, this alternative:

- Provides only nominal landscaping opportunities on either side of the road.
- Its configuration of on-street parking facilities provides less potential for vehicular / pedestrian conflicts.

In areas where there are spatial constraints (≤21 m ROW), modifications to the preferred typical cross-sections will be made accordingly.

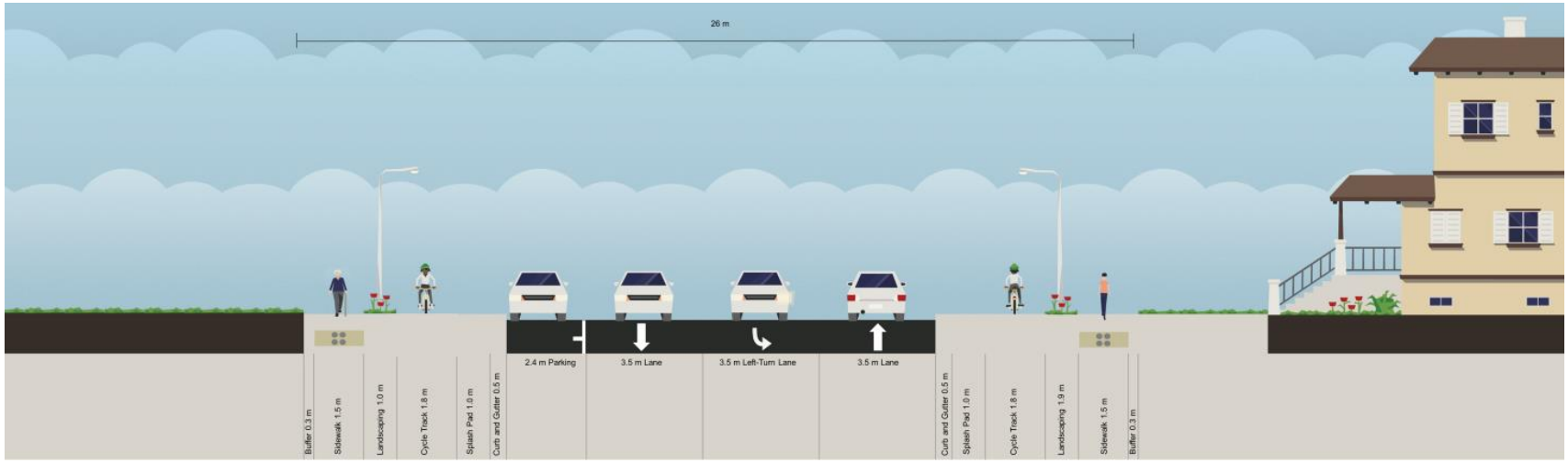


Exhibit 6-20**: Area 6 Preferred Typical Cross-Section**

6.5 Modifications to the Preferred Alternative Based on Public and Stakeholder Feedback

Upon review of the preferred typical cross-sections, the City of Markham's operations group raised concerns regarding the active transportation recommendations for the corridor. Some of the concerns included:

- Separate cycle track and sidewalk create additional conflict points at driveway locations
- Location of active transportation facilities (e.g. pedestrian sidewalks and cycle tracks) within the boulevard requires further review to address elevation changes due to the need for depressed curbs adjacent to driveways, which would result in a negative user experience ("rollercoaster" effect)
- City's current maintenance standards consist of snow plowing of sidewalk and multi-use paths (MUPs), not cycle tracks; therefore, cycle tracks are not recommended by the City's operations group

As a result of these discussions, it was recommended to modify the preferred design for Areas 1 through 3, where there are multiple existing driveways/entrances, to show a combined MUP on each side of Victoria Square Boulevard, and continue to show the separate cycle track and sidewalk on each side of Victoria Square Boulevard for Areas 4 through 6, where very few driveways/entrances currently exist. This is consistent with the material presented at Public Open House #2 in June 2017.

Feedback from the public following Public Open House #2 included the following:

- General support for the implementation of active transportation facilities, regardless of the type of facility (cycle track and sidewalk or MUP)
- Requests for consistency in the active transportation facility approach proposed for the corridor

Following Public Open House #2, additional discussions were held with City of Markham staff in an effort to confirm the active transportation recommendations. It was agreed that two types of facilities (MUP for segments 1-3 and separate cycle track and sidewalk for segments 4-6) could be confusing to cyclists, and consistency in the active transportation approach for the study area was recommended. City staff agreed that based on the land uses and active transportation demand in the area, a consistent MUP on both sides of Victoria Square Boulevard, along the entire study corridor (Areas 1

through 6), is the appropriate recommendation. Additional benefits of a continuous MUP were identified as follows:

- MUP would simplify winter maintenance for all modes (MUPs and sidewalks are currently maintained in the winter, while cycle tracks are not)
- A consistent MUP allows for a wider boulevard for streetlights and streetscaping (there would be an additional 0.3m available where MUP is provided compared to where separate cycle track and sidewalk are provided)

City staff recommended that the MUP should generally be placed 0.3m from the property line to minimize conflicts at driveway locations and address the elevation change concern. However, due to the existing utilities in the area, MUP placement should be reviewed to minimize conflicts with existing above-ground utilities.

Following these discussions, the preliminary designs were modified to reflect the input received from the public and other stakeholders, including City of Markham staff. The final recommended preliminary designs are presented in **Section 7**.

6.6 Summary of Preferred Alternative Design

Following the various iterations of assessment and stakeholder and public consultation, the preferred alternative design contains the following key elements:

- Provide a continuous urban cross-section, replacing roadside drainage ditches with curb and gutter subsurface drainage system.
- Maintain existing number of through lanes (one in each direction, as there is no proposed widening for additional through lanes).
- Provide a continuous two way centre left turn lane through areas 2, 4, and 5 to facilitate more efficient turning movements. A two way centre left turn lane is not proposed within segment 3 due to the constrained right-of-way availability through the village.
- Continuous multi-use paths on both sides of Victoria Square Boulevard, through the entire study corridor, to accommodate pedestrians and cyclists in a dedicated, shared active transportation facility.
- On-street parking on one side of the street for portions of areas 2, 4, 5, and 6, to facilitate access to the adjacent townhomes and municipal parks.
- Provide gateway features at the north and south connections with Woodbine Avenue.
- Provide boulevard landscaping where sufficient space is available.

7 Project Description

7.1 Description of the Recommended Design Concept

The preferred design for Victoria Square Boulevard was chosen after consideration of transportation service for all road users (pedestrians, cyclists, transit users, motorists) and potential impacts to the natural environment, community, cultural heritage, safety, aesthetics, drainage, driveway access, property requirements, and capital construction and maintenance costs. This section presents the preferred design that best met the goals of the study and balanced the transportation service benefits with the overall potential impacts of the recommendations, including consideration of mitigation measures. The preferred design, illustrated in the preliminary design plates in **Appendix A**, was selected, developed, and refined, through extensive consultation with agencies, stakeholders and the public, as documented in **Appendix B** and **Appendix C.**

7.1.1 Design Criteria

The design criteria for Victoria Square Boulevard is summarized in **Table 7-1**.

Table 7-1 Design Criteria

DESIGN PARAMETERS	PRESENT CONDITIONS	DESIRED DESIGN STANDARDS (2-LANE)	PROPOSED DESIGN (2-LANE)	DESIGN STANDARD REFERENCE
ROAD CLASSIFICATION	2 Lane RCU	2 Lane UCU	2 Lane UCU	TAC (Pg. 1.3.2.1)
DESIGN SPEED	N/A	60Km/H	60Km/H	CM-RDC Sec B-2
POSTED SPEED	50Km/H	50Km/H	50Km/H	CM-RDC Sec B-2
MINIMUM STOPPING SIGHT DISTANCE	312m	85m	85m	CM-RDC Sec B-2

DESIGN PARAMETERS	PRESENT CONDITIONS	DESIRED DESIGN STANDARDS (2-LANE)	PROPOSED DESIGN (2-LANE)	DESIGN STANDARD REFERENCE
EQUIVALENT MINIMUM 'K' FACTOR	20 (Sag) 20 (Crest)	20 (Sag) 15 (Crest)	20 (Sag) 15 (Crest)	CM-RDC Sec B-2
GRADES MAXIMUM	2.75%	6.0%	6.0%	CM-RDC Sec B-2
MINIMUM HORIZONTAL RADIUS	151m	130m - 4% Super Elevation 200m - Reverse Crown 1500m - Normal Crown	151m with 2.7% Super Elevation	TAC (Pg. 2.1.2.8 Table 2.1.2.4)
LANE WIDTH	Estimated at: 4.5m Thru Lane	3.5m Thru Lane 3.3m Turn Lane 2.4m On Street Parking	3.5m Thru Lane 3.0m Right Turn Lane 3.5m Continuous Centre Left Turn Lane 2.4m On Street Parking	CM-RDC Sec B-2
SHOULDER WIDTH	Estimated at 1.5m	N/A	N/A	N/A
SHOULDER ROUNDING	Estimated to be: 0.5m (1.0m with guiderail)	N/A	N/A	N/A
MEDIAN WIDTH	N/A	N/A	N/A	N/A
SIDEWALK [1]	1.5m (Discontinuous)	1.5m min	1.5m	CM-RDC Sec B-7

DESIGN PARAMETERS	PRESENT CONDITIONS	DESIRED DESIGN STANDARDS (2-LANE)	PROPOSED DESIGN (2-LANE)	DESIGN STANDARD REFERENCE
RAISED CYCLE TRACK [1]	N/A	1.5m (min) 2m (desired)	1.8m	OTM Book 18, Table 4.7
MULTI-USE PATH	N/A	4.0m (desired) 3.0m (min) 2.4m (min where constrained)	2.4-3.0m	OTM Book 18, Table 4.7
ROW WIDTH	Varies 20m-36m	Varies 26.0 – 27.5m	Varies 20.0 – 36.0m	CM-RDC Sec B-1
SIGNALS & ILLUMINATION	Signalized Intersection(s) along Victoria Square at: Woodbine Ave (South Connection) Elgin Mills	N/A	Signalized Intersection(s) along Victoria Square at: Woodbine Ave (South Connection) Elgin Mills	
GRADES MINIMUM	0.4%	0.7%	0.7%	CM-RDC Sec B-2
SUPERELEVATION	Reverse Crown	130m - 4% Super Elevation 200m - Reverse Crown 1500m - Normal Crown	151m with 2.7% Super Elevation	CM-RDC Sec B-2 TAC (Pg. 2.1.2.8 Table 2.1.2.4)
MINIMUM TANGENT BETWEEN CURVES	N/A	0m	0m	TAC (Pg. 2.1.2.28 Fig 2.1.2.8)
APPROACH GRADES AT INTERSECTIONS	N/A	0.15 – 3.0%	0.15 – 3.0%	MTO – GDSM (Pg. E4-6 Fig. E4-5)

DESIGN PARAMETERS	PRESENT CONDITIONS	DESIRED DESIGN STANDARDS (2-LANE)	PROPOSED DESIGN (2-LANE)	DESIGN STANDARD REFERENCE
AUXILIARY LEFT TURN LANES	Aux. left turn lane on Victoria Square at: Murison Dr Vine Cliff Blvd / Pope John Paul II Square Betty Roman Blvd / Stony Hill Blvd Woodbine Ave	3.0m 15m Storage 45m Taper	3.5m Continuous Centre Left Turn Lane	TAC (Pg. 2.3.8.2)
AUXILARY RIGHT TURN LANES	Aux. right turn lane on Victoria Square at: Murison Dr Elgin Mills Road	3.0m 42m Taper 40m Parallel	3.0m Right Turn Lane 42m Taper 25m Parallel	TAC (Pg. 2.3.5.5) (Table2.3.5.2)
MAXIMUM GRADE THROUGH INTERSECTION	N/A	0.15% to 3% Intersection- Main Road 0.5% to 2% Intersection-Side Road	0.15% to 3% Intersection- Main Road 0.5% to 2% Intersection-Side Road	TAC (Pg. 2.3.2.8)
INTERSECTION ANGLE	70 to 110 degrees	90 degrees (desirable) 70 (min) to 110 (max) degrees	70 to 110 degrees	MTO – GDSM (Pg. E2-8)
INTERSECTION CURB RADIUS	Varies 7.5m to 15m	7.5m	Varies 7.5m to 15m	CM-RDC Sec B-4 Table 3
INTERSECTION SIGHT TRIANGLES	Varies 10mx10m to 15mx15m	15mx15m	15mx15m	CM-RDC Sec B-4 Table 4

[1] These cross-section elements were not included in the final design

Design Standard References:

City of Markham – Engineering Design Criteria – Roads (CM-RDC) – Rev 6 dated July 2016
Ministry of Transportation – Geometric Design Standards for Ontario Highways Manual (MTO – GDSM) – 1994, updated 2002
Transportation Association of Canada Geometric Design Guide (TAC) – September 1999, updated December 2007

7.2 Road Geometry

7.2.1 Horizontal Alignment

The horizontal alignment for the preferred design (with a 60 km/h design speed) generally follows the existing centreline of Victoria Square Boulevard. Minor centreline adjustments are proposed in order to avoid property impacts north of Elgin Mils Road and to better match into the existing elevations at the property line at some locations. The proposed horizontal alignment is illustrated on the preliminary design drawings in **Appendix A**.

7.2.2 Vertical Alignment

The vertical alignment for the preferred design (with a 60 km/h design speed) aims to follow the existing vertical profile. Minor profile adjustment is proposed to minimize impacts to existing entrances and driveways, and reduce grading impacts to adjacent properties and features. The proposed vertical alignment is illustrated on the preliminary design drawings in **Appendix A.**

7.3 Typical Cross-Sections

The typical cross-sections for the six areas are illustrated in **Exhibit 7-1, Exhibit 7-2, Exhibit 7-3, Exhibit 7-4, Exhibit 7-5**, and **Exhibit 7-6**.

7.3.1 Area 1: North Gateway

The typical cross-section for Area 1 of the corridor (**Exhibit 7-1**) consists of:

- Two 3.5 m vehicular lanes (one in each direction)
- A 3.5 m one way centre left turn lane
- 1.75 m landscaping zones (on each side of the ROW)
- Two off-road 3.0 m multi-use-pathways (one on each side of the ROW)

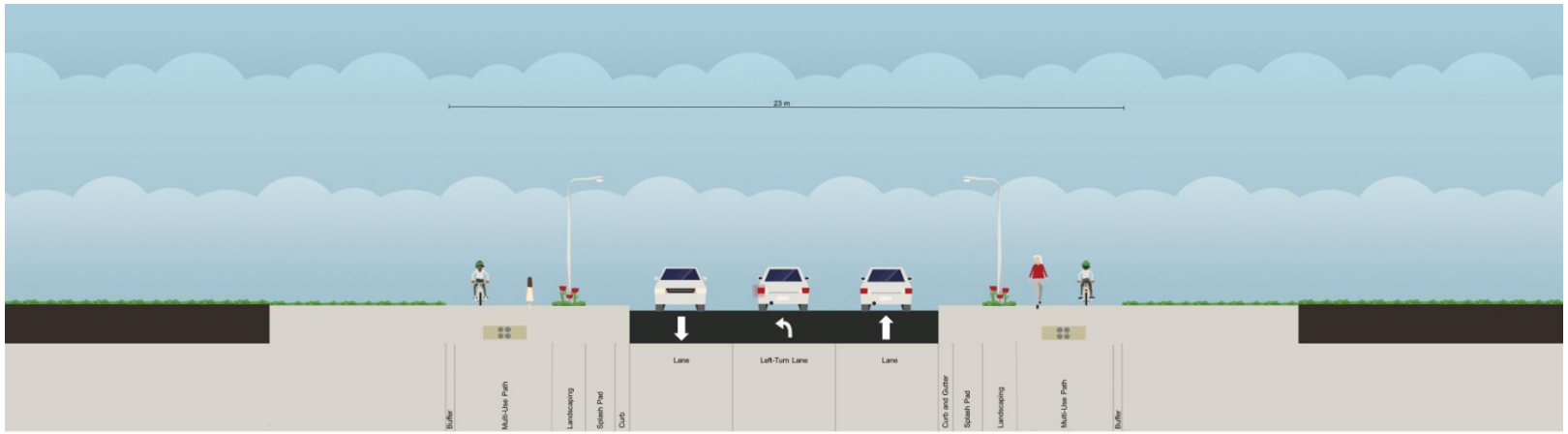


Exhibit 7-1 Typical Cross Section for Area 1

7.3.2 Area 2: Residential Main Street

The typical cross-section for Area 2 of the corridor (**Exhibit 7-2**) consists of:

- Two 3.5 m vehicular lanes (one in each direction)
- A 3.5 m two way centre left turn lane
- Landscaping zones ranging from 1.75 m to 5.3 m (on each side of the ROW)
- Two off-road 3.0 m multi-use-pathways (one on each side of the ROW)
- A 2.5 m on-street parking bay on the east side of the ROW

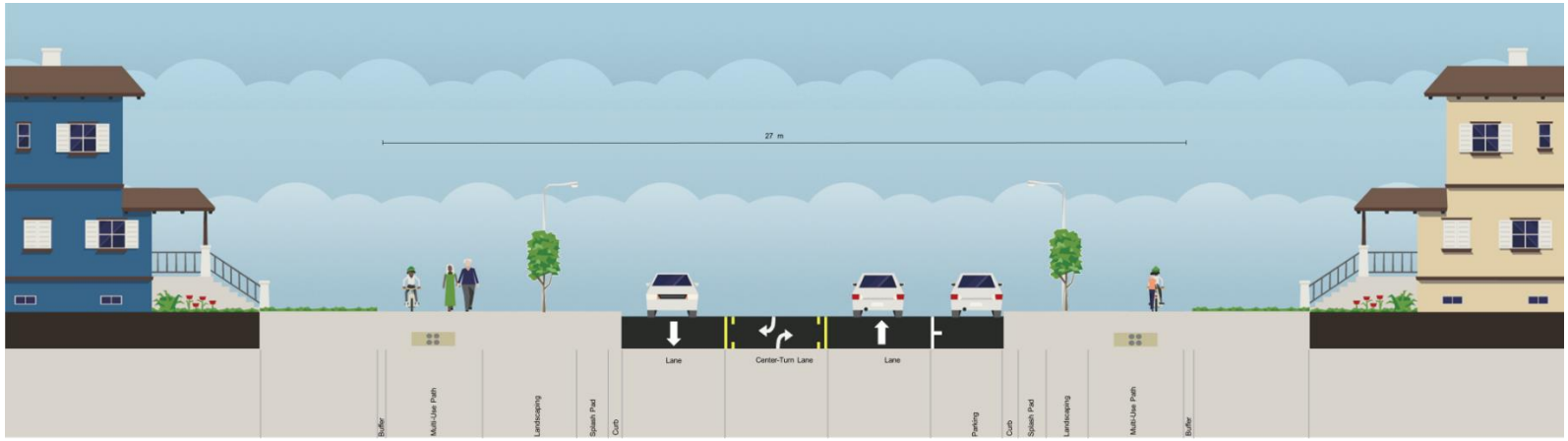


Exhibit 7-2 Typical Cross-Section for Area 2

7.3.3 Area 3: Hamlet and Cultural Heritage

The typical cross-section for Area 3 of the corridor (**Exhibit 7-3**) consists of:

- Two 3.5 m vehicular lanes (one in each direction)
- Landscaping zones ranging from 1.0 m to 7.3 m (but typically 2.0 m) (on each side of the ROW)
- Two multi-use-pathways ranging from 2.4 m to 3.0 m (one on each side of the ROW)

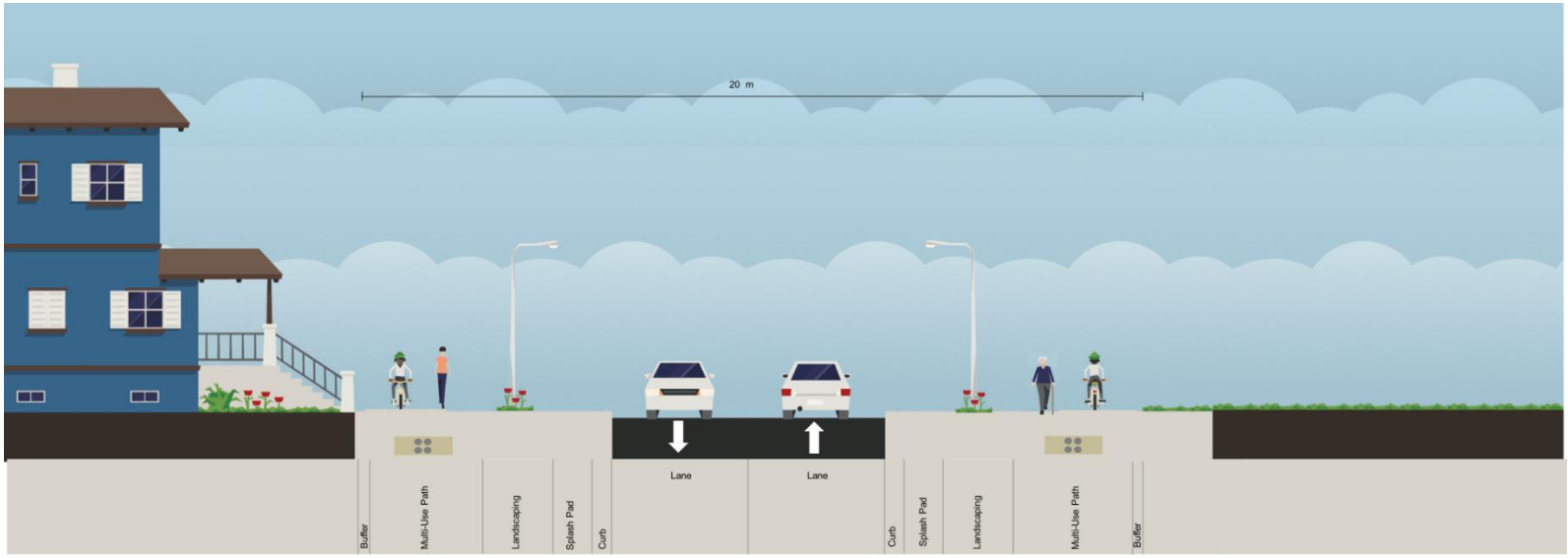


Exhibit 7-3 Typical Cross-Section for Area 3

7.3.4 Area 4: Cathedral and Residential Area

The typical cross-section for Area 4 of the corridor (**Exhibit 7-4**) consists of:

- Two 3.5 m vehicular lanes (one in each direction)
- A 3.5 m two way centre left turn lane
- A 2.5 m on-street parking bay on the west side of the ROW
- Landscaping zones ranging from 2.0 m to 5.5 m (on each side of the ROW)
- Two 3.0 m multi-use paths (one on each side of the ROW)

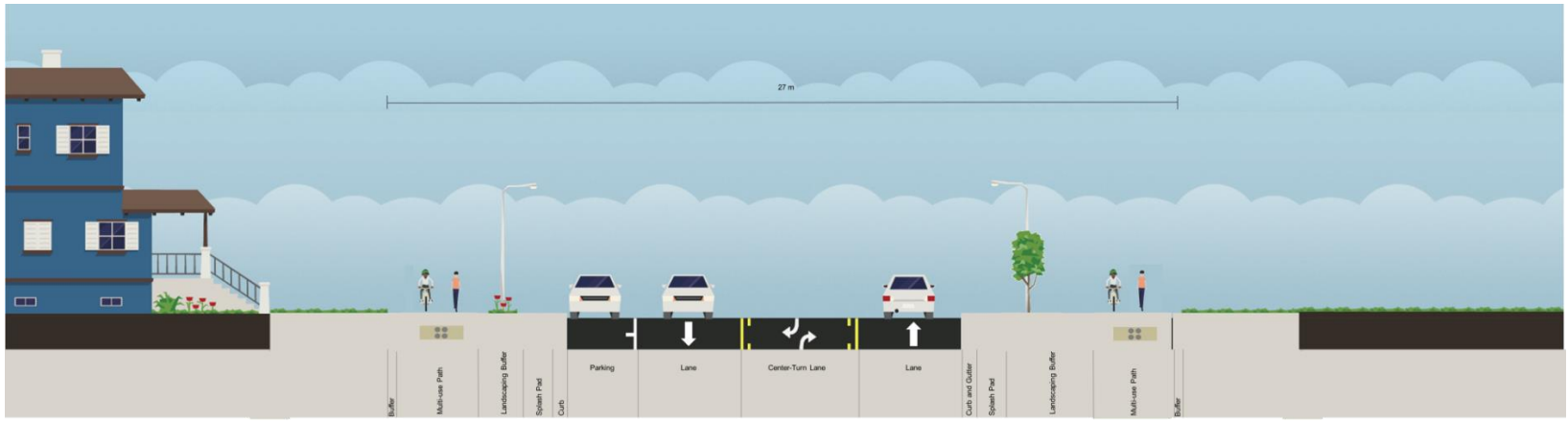


Exhibit 7-4 Typical Cross-Section for Area 4

7.3.5 Area 5: Cathedral Precinct Area

The typical cross-section for Area 5 of the corridor (**Exhibit 7-5**) consists of:

- Two 3.5 m vehicular lanes (one in each direction)
- A 3.5 m two way centre left turn lane
- A 2.5 m on-street parking bay on the west side of the ROW
- Landscaping zones ranging from 1.0 m to 6.0 m (on each side of the ROW)
- Two 3.0 m multi-use paths (one on each side of the ROW)

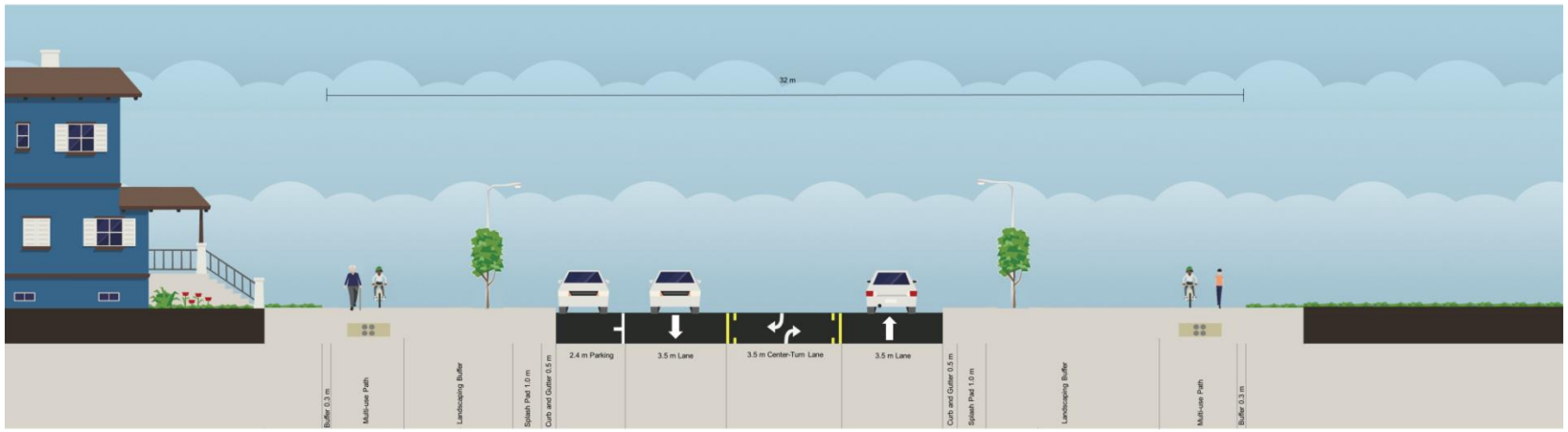


Exhibit 7-5 Typical Cross-Section for Area 5

7.3.6 Area 6: South Gateway

The typical cross-section for Area 6 of the corridor (**Exhibit 7-6**) consists of:

- Two 3.5 m vehicular lanes (one in each direction)
- A 3.5 m left turn lane
- A 3.25 m right turn lane (not shown on **Exhibit 7-6** as it is only required at the Woodbine Avenue south gateway intersection)
- A 2.5 m on-street parking bay on the west side of the ROW
- Landscaping zones ranging from 1.0 m to 3.0 m (on both sides of the ROW)
- Two 3.0 m multi-use paths (one on each side of the ROW)

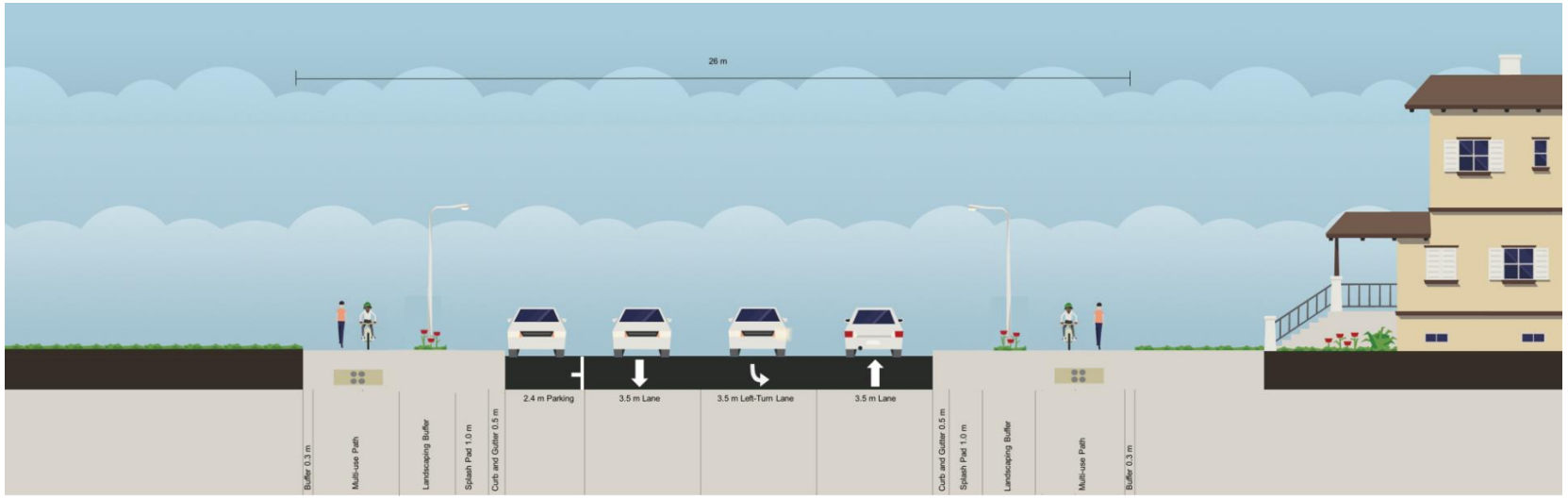


Exhibit 7-6 Typical Cross-Section for Area 6

7.1 Transit

The study area is currently serviced by regular and seasonal bus routes operated by both the Toronto Transit Commission (TTC) and York Region Transit (YRT). No dedicated transit facilities are included in the proposed Victoria Square Boulevard design.

7.1 Cycling and Pedestrian Facilities

York Region's ***Pedestrian and Cycling Master Plan*** (PCMP) indicated that the lands in the Study Corridor are part of the City of Markham Pedestrian Zone and should have "enhanced pedestrian infrastructure". Based on the feedback received throughout the EA, the public and stakeholders showed support for shared pedestrian and cycling facilities and improved connectivity throughout the corridor. Therefore, the preferred design incorporates multi-use path (MUP) on both sides of Victoria Square Boulevard along the entire study corridor.

Shared facilities with a typical 3.0m width (minimum 2.4 m at constrained locations) are proposed on both the east and west sides of the ROW. The MUP is separated from the curb lane by a splash pad, and in some locations a landscaping zone of varying widths. Where the ROW is constrained, there may not be sufficient space for tree plantings. At some locations, to minimize conflicts with utilities, localized shifts to the MUP alignment were incorporated. Opportunities to optimize the location of the MUP within the available boulevard can be reviewed during detailed design to further minimize utility relocations and maximize tree planting opportunities based on the most current information at that time.

7.2 Intersections

Intersections have been designed in accordance with AODA standards and to facilitate the movement of all road users, including pedestrians and cyclists. The design and location of crosswalks and cross-rides to facilitate movement of pedestrians and cyclists across the intersections will be confirmed during detailed design.

North and south of the study corridor, the proposed road design will match into the existing Woodbine Avenue intersections. In general, existing intersection configurations, including the number of signalized intersections, will be maintained with the exception of one proposed all-way stop with crosswalk at the Betty Roman Boulevard/ Stony Hill Boulevard intersection. Refer to **Section 7.4.**

7.3 Access Locations

Existing access locations within the study area will be maintained. Proposed entrance locations for future developments, such as the Cathedraltown Piazza (located on the west side of Victoria Square Boulevard north of Pope John Paul II Boulevard) and the Eaton Square development (located on the east side of Victoria Square Boulevard north of Bruce Thomson Boulevard), have been accommodated. Driveway access locations for existing properties have not been impacted as a result of the road improvements; however, some driveways may need profile adjustments.

7.4 Intersection Traffic Controls

There are no new signalized intersections proposed along the study corridor. Signalized intersections will be maintained where they already exist – one at the South Gateway at Woodbine Avenue, and a second where Victoria Square Boulevard meets Elgin Mills Road, both falling under Regional jurisdiction. As a result of the proposed Victoria Square Boulevard improvements, the existing signals will need to be relocated within their intersection to accommodate the proposed roadway lane configuration.

An all-way stop is proposed at the Victoria Square Boulevard and Betty Roman Boulevard/Stony Hill Boulevard intersection. At this location, the public raised safety

concerns related to speeding along Victoria Square Boulevard. In addition, the proximity of Sir Wilfred Laurier Public School and residential areas generate pedestrian and cycling traffic with no controlled crossing of Victoria Square Boulevard, resulting in additional safety concerns. The proposed all-way stop at this intersection will facilitate pedestrian and cycling crossings. Although an all-way stop is recommended at this time, it is recommended that the City continue to review this location and other intersections along the corridor (such as Victoria Square Boulevard and Donald Buttress Boulevard/Vine Cliff Boulevard) for the need to provide additional traffic controls as a result of future growth in the area.

Future intersections will be coordinated with developers to determine requirements for traffic signals or stop controls.

7.5 Illumination

Full illumination is proposed along Victoria Square Boulevard. Details will be based on City of Markham standards and will be confirmed during detailed design. Illumination will consider the roadway profile, the urban cross-section, and active transportation requirements along the study corridor. During detailed design, illumination design will consider the type and location of poles and luminaires.

7.6 Streetscaping and Landscaping

The preferred design considered maximizing the available boulevard space for tree plantings and other landscaping within the corridor. Landscaping zones are generally provided between the MUP and curb, or within the MUP and property line, with the exception of constrained areas, and vary in width between 1.0 m to 7.3 m. Wherever there is sufficient space, opportunities for tree planting are considered. At locations with more constrained space, other streetscaping features can be incorporated. Streetscaping details along each segment of the corridor will be confirmed during detailed design.

Where the Victoria Square Boulevard corridor runs adjacent to the Cathedraltown Piazza development, where it is subject to the East Cathedral Community Design Plan (2002) and the Cathedral Community Design Plan (2009), streetscaping details will be coordinated with the developers and City staff. The East Cathedral Community Design Plan provides direction with respect to landscaping along the road. The Cathedral Community Design Plan provides specific directions with respect to streetscape design including landmark locations and parking.

7.7 Property Requirements

The proposed improvements along Victoria Square Boulevard can be accommodated within the existing ROW and do not require property acquisition. In order to minimize

property requirements, grading is proposed to stay within the existing ROW; however, along properties known to be undergoing development, the development is expected to match the recommended grading for Victoria Square Boulevard.

At the northwest quadrant of the Victoria Square Boulevard and Elgin Mills Road intersection, there is an area of undeveloped property. If this property develops in the future, the City will acquire the necessary property for a daylighting triangle in order to improve sightlines at this intersection.

7.8 Culverts and Structures

Within the EA Study limits, there exists one watercourse crossing which traverses the Victoria Square Boulevard corridor. The crossing, known as Carlton Creek, is located approximately 200 m south of Betty Roman Boulevard and currently is conveyed across the roadway via a 1.25m x 1.25m open footing box culvert.

Geomorphic assessments were conducted along this reach of Carlton Creek in support of the residential developments east and west of Victoria Square Boulevard. New culvert crossings were constructed immediately upstream (Prince Regent Street) and downstream (Vine Cliff Boulevard) of Victoria Square Boulevard and were sized as 8.5m x 1.5m pre-cast concrete open-footing structures to meet the geomorphic and hydraulic criteria. Based on these precedents, it is recommended that any replacement structure at the Victoria Square Boulevard crossing should be consistent with the crossing sizes established upstream/downstream of Victoria Square Boulevard. As such, a replacement pre-cast concrete open footing culvert is proposed with dimensions of 8.5m wide by 1.5m high. In addition to improving the geomorphic conditions within this reach of Carlton Creek, the culvert replacement will provide a larger hydraulic opening, thereby increasing the flow width, lowering flood elevations and decreasing the flow velocity at the crossing C-2 location. As part of the culvert replacement, a realignment of the creek is proposed. Based on the existing instream and riparian conditions and fish habitat function of Carlton Creek, this creek is believed to be tolerant to a realignment (with consideration for the channel design to avoid serious harm to fish and fish habitat). The creek realignment provides opportunities to improve the existing fish habitat as it can be designed to reduce road runoff (winter salt/sand) into the creek, and can incorporate natural channel elements to allow the creek to ‘naturally evolve’. More details are provided in the Drainage and Stormwater Management Report provided in **Appendix F** and the Natural Environment Report in **Appendix H**.

7.9 Drainage/ Stormwater Management Plan

7.9.1 Roadway Drainage

The preferred alternative design for Victoria Square Boulevard involves widening the road to add a continuous centre left-turn lane for most of the study corridor as well as

dedicated combined cycling and pedestrian facilities in the form of MUPs. This section documents the preliminary design concepts for upgrades and improvements to the drainage and stormwater management strategy.

Victoria Square Boulevard will be modified to an urban roadway cross-section which includes concrete curb and gutter and storm sewers. Overall, the existing drainage patterns and locations will not be altered with the proposed roadway improvements.

7.9.2 Stormwater Management Strategy

The stormwater management plan will be designed to comply with the MOECC Stormwater Management Practices Planning and Design Manual, the Toronto Region Conservation Authority Stormwater Management Guidelines and the City of Markham Design Guidelines. Stormwater management (water quality) measures within the study limits will be designed to provide “Enhanced” protection (Level 1), to augment, as a minimum, the increased pavement area project-wide. The storm sewer system for the ultimate roadway configuration is to be designed to the 5-year design storm event based on City of Markham standards.

Water Quality Control

Water quality control for the Victoria Square Boulevard EA should meet the following stormwater management criteria:

- Provide water quality treatment to offset, as a minimum, the increase in roadway pavement area as a result of roadway widening (consistent with direction provided by MOECC in their response to the Notice of Study Commencement);
- Any proposed measures should be sized to provide Level 1 treatment and meet the design requirements of the Ministry of the Environment and Climate Change Stormwater Management Planning and Design (MOECC Manual);

The proposed road widening will result in an additional pavement area of 1.55 hectares. Stormwater management ponds (Pond W-1, E-3, E-4, B-4 and B-3) located in the vicinity of the roadway corridor within existing subdivisions currently provide quality treatment and peak flow control to the Victoria Square Boulevard pavement area totalling 2.50 hectares. Consequently, with the proposed roadway improvements, stormwater quality treatment will be required for a minimum of 4.05 ha pavement area. The proposed stormwater management strategy will maintain the existing drainage pattern and provide quality and quantity control as well as erosion protection for the 4.64 hectares pavement area via the existing five stormwater management ponds. In addition, a proposed storm sewer system integrated with an oil grit separator and infiltration gallery will provide supplemental stormwater treatment to a 0.45 hectare ROW area.

To assess the applicability of the proposed SWM strategy, the existing stormwater management ponds should be further investigated during detail design to ensure that

the stormwater objectives are effectively addressed. Low impact development stormwater best management practices are to be explored during detail design. More details are provided in the Drainage and Stormwater Management Report provided in **Appendix F.**

7.10 Geotechnical and Foundations

The following sections summarize the geotechnical and foundations engineering recommendations. Additional details are provided in **Appendix G**.

7.10.1 Foundations and Groundwater

The Geotechnical Investigation assessed the subsoil condition along Victoria Square Boulevard in order to provide initial subsurface conditions, geotechnical design parameters, and recommendations pertaining to road and culvert foundation design including lateral earth pressures, embankment design, and excavation and dewatering. The findings and recommendations of the geotechnical investigation are summarized as follows:

- Based on the borehole advanced in the vicinity of the proposed culvert replacement, strip footings for the open footing culvert replacement should be founded at a minimum depth of 1.2 m below the lowest surrounding grade to provide adequate protection against frost penetration, as per Ontario Provincial Standard Drawing (OPSD) 3090.101 *(Foundation Frost Depths for Southern Ontario)*.
- The footings should extend below any existing fill, surficial organic materials, or loose/firm soils, where present. Based on the subsurface conditions encountered in Borehole 17-06, the footings should be founded on the stiff to very stiff silty clay deposit at or below Elevation 212.4 m.
- The silty clay subgrade will be susceptible to disturbance and degradation on exposure to water and construction traffic. It is recommended that a 100 mm thick, 20 MPa concrete working slab be placed within four hours following inspection and approval of the subgrade, to protect the subgrade from softening.
- Groundwater and/or surface water control will be required for excavation and construction of an open footing culvert. It is assumed that the existing culvert will remain in place until the new culvert footings have been constructed outside of the existing, or that surface water conveyed by the existing culvert will bypass the new construction by means of pumping.
- Excavation at the site will be advanced through existing non-cohesive fill and terminate in cohesive native soils. The non-cohesive soils were noted to be moist and the boreholes were generally dry through these deposits. Some groundwater pumping, from properly filtered sumps, may be required to address

shallow groundwater perched within the near-surface sand and gravel above the cohesive soil deposits. However, dewatering of the sand deposit (encountered at about Elevation 211.0 m) is not anticipated to be required based on the depth of excavation for the culvert replacement.

- Control of the surface water will be necessary for the construction of the culvert replacement, to allow excavation and foundation construction to be carried out in dry conditions. Depending on the creek flow at the time of construction, the surface water being conveyed by the existing culvert could bypass culvert construction area by means of a temporary pipe, or be diverted by pumping from behind a temporary barrier (cofferdam) placed/constructed inside the existing culvert. Precipitation runoff in the construction area should be directed away from the excavation areas, to prevent ponding of water that could result in disturbance and weakening of the shale bedrock subgrade or granular backfill/bedding material.

7.10.2 Pavement Design

The findings of the field investigations, laboratory testing and provided traffic data were used to carry out a design analysis for the initially proposed rehabilitation and widening of the existing pavement on Victoria Square Boulevard, within the project limits. The structural design analysis for the pavement rehabilitation and widening was carried out in accordance with the American Association of State Highway and Transportation Officials (AASHTO) 1993 “Guide for Design of Pavement Structures”.

Existing Pavement Structure

The geotechnical team considered various rehabilitation treatments for the project. Based on the investigation findings, including laboratory testing results that indicated that soils are frost susceptible and the existing granular materials are of relatively poor quality, and design analysis, the recommended design for Victoria Square Boulevard between Woodbine Avenue (south connection) and Elgin Mills Road is as follows:

- Pulverize the existing asphalt and blend with an equal thickness the underlying granular materials;
- Remove 150 mm of the combined material;
- Grade and compact the combined granular materials and pulverized asphalt layer;
- Place 100 mm of binder course asphalt, in two lifts; and
- Place 50 mm of surface course asphalt.

The recommended design for Victoria Square Boulevard between Elgin Mills Road and Woodbine Avenue (north connection) is as follows:

- Pulverize the existing asphalt and blend with an equal thickness the underlying granular materials;
- Remove 120 mm of the combined material;
- Grade and compact the combined granular materials and pulverized asphalt layer;
- Place 70 mm of binder course asphalt; and
- Place 50 mm of surface course asphalt.

Pavement Widening Design

It is understood that variable widening will be carried out throughout the project length. In order to match the grade of the rehabilitated pavement and to provide adequate frost protection taking into account that the soils are frost susceptible, the widening pavement structure design for Victoria Square Boulevard between Woodbine Avenue (south connection) and Elgin Mills Road should be as follows:

- Excavate the existing granular materials and subgrade soils to the top of the subgrade (bottom of granular material) in the adjacent pavement, or 850 mm below the top of the final pavement surface grade, whichever is deeper;
- Place and compact Granular B to a depth of 300 mm below the final pavement surface grade, or a minimum thickness of 550 mm;
- Place and compact 150 mm of Granular A;
- Place 100 mm of binder course asphalt, in two lifts; and
- Place 50 mm of surface course asphalt.

In order to match the grade of the rehabilitated pavement and to provide adequate frost protection taking into account that the soils are frost susceptible, the widening pavement structure for Victoria Square Boulevard between Elgin Mills Road and Woodbine Avenue (north connection) should be as follows:

- Excavate the existing granular materials and subgrade soils to the top of the subgrade (bottom of granular material) in the adjacent pavement, or 800 mm below the top of the final pavement surface grade, whichever is deeper;
- Place and compact Granular B to a depth of 270 mm below the final pavement surface grade, or a minimum thickness of 580 mm;
- Place and compact 150 mm of Granular A;
- Place 70 mm of binder course asphalt; and
- Place 50 mm of surface course asphalt.

7.11 Preliminary Cost Estimate

Based on preliminary cost estimates, the cost of the recommended improvements is estimated at **$11.7 million**. This preliminary cost estimate includes costs for road work, drainage, utility relocation, streetlights and traffic control, culvert replacement, channel works, landscaping, and engineering services. Potential property acquisition costs are not included in the estimate. The extent of cost sharing with developers and the City of Markham will be confirmed during detailed design. More details on the preliminary cost estimate are provided in **Appendix N**. These preliminary cost estimates are to be reviewed and confirmed during detailed design.

7.12 Constructability, Staging and Detouring Considerations

Victoria Square Boulevard is a primary north-south route through the City of Markham. As such, the construction staging will focus on being able to maintain pedestrian and vehicular traffic movements equal to preconstruction levels whenever possible during construction. However, the nature of the required work is such that traffic disruption and delays cannot entirely be avoided.

Impacts will be temporary in nature and the City will attempt to mitigate impacts as much as possible. During detailed design, a traffic management plan should be developed to determine how traffic and pedestrian access will be accommodated during construction and how access to properties adjacent to Victoria Square Boulevard will be maintained.

Opportunities to minimize potential impacts from the roadway improvements and other potential construction impacts will be reviewed further during detailed design in consultation with the various stakeholders.

7.13 Construction Monitoring and Maintenance Considerations

The improvements to Victoria Square Boulevard should be staged to maintain both local and through traffic within the study area to the extent possible, and minimize disruptions. Any interruptions to traffic should be minimized as feasible.

Where property owners may experience temporary interruptions to their property access or driveway during construction, property owners should be notified prior to construction and in advance of work related to their access. Detailed design plans should include details to describe how temporary accesses will be maintained, and contract specifications should specify the allowable lengths of closures and the notification requirements to property owners.

Construction of the improvements has the potential to create noise and dust for the adjacent property owners. Construction noise is temporary noise and will vary periodically during the construction depending on the specific activities being performed. Contract specifications should include provisions to define the allowable work hours, in accordance with local ordinances, to minimize impacts to the adjacent landowners in the evenings. However, some consideration should be given to the ability of completing the work in a lesser duration by allowing longer work hours. The impact of construction noise will vary based on the type of equipment used, number of pieces of equipment, time and duration of operation, and the proximity to noise sensitive receivers in question. Construction noise can be kept to a minimum through the use of well maintained equipment with appropriate noise controls by the contractors.

It is recommended that during the construction period, the following be considered:

- All pertinent noise by-laws to be adhered to.
- General noise control measures to be included in contract documents where applicable.
- Any noise complaints or concerns to be investigated to ensure compliance with the noise control measures as recommended in the contract documents. The contractor shall be warned for non-compliance and the contract shall be enforced.
- Additional noise control measures are to be investigated in accordance with the MOECC sound level criteria for construction equipment if a persistent complaint has been made.

Removal of the existing paved surface and existing landscaping will expose native soils to wind and rain erosion, and result in a temporary increase in dust in the study area. This dust can become airborne as construction traffic runs on the exposed ground, and may be noticeable by the adjacent property owners. This increase in dust levels will be temporary, and the application of best management practices, including the application of non-chloride dust suppressants, by the contractor during his normal operations can help to minimize the exposure of native soils to wind and rain erosion, and mitigate any air quality impacts caused by construction dust.

All waste generated during construction must be disposed of in accordance with ministry requirements and best management practices. Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met.

Construction and post-construction monitoring plans should be developed during detailed design in consultation with MOECC and other regulatory agencies.

8 Potential Environmental Effects and Mitigation

The proposed cross-section, horizontal and vertical alignment designs aim to minimize impacts to adjacent lands and features, including naturally sensitive areas, vegetation, culturally significant features, buildings, and properties outside the road right-of-way. However, there will be some impacts that will need to be mitigated, as described in the following sections.

8.1 Socio-Economic Environment

8.1.1 Archaeology

As discussed in **Section 3.2.2**, a Stage 3 Archaeological Assessment will be required along some segments of the study corridor. Per direction from the MTCS, the Stage 3 Assessment is to be completed during detailed design or at the time of construction.

Details on the findings of the Stage 1 and 2 Archaeological Assessment, and recommendations for the Stage 3 Archaeological Assessment are provided in **Appendix J.**

8.1.2 Built Heritage Resources and Cultural Heritage Landscapes

The Built Heritage Resources and Cultural Heritage Landscapes assessment identified two protected heritage properties and 24 properties of potential cultural heritage value or interest within the study area. The proposed design is contained within the already disturbed road right-of-way and avoids encroachment on the identified properties of cultural heritage value or interest, thus minimizing direct impacts. However, 17 properties were predicted to be at risk of impact during construction and operation due to their proximity to the proposed improvement limits (i.e. properties are within 10m of the road right-of-way). Recommendations for these 17 properties include site plan control and communication, creating a physical buffer, and vibration monitoring to ensure that the heritage attributes of the properties will not be adversely impacted by the construction of the proposed improvements along Victoria Square Boulevard, and during subsequent operation.

Despite the potential for negative impacts resulting from the improvements, there are several beneficial attributes to be considered. The new curbs, treed boulevards, new roadway illumination, street furniture, and on-street parking will serve as barriers protecting the study area's heritage attributes from motor vehicle collisions, especially the 19th century structures that were built close to the road right-of-way. The new multi-use paths and street furniture will encourage use and pedestrian traffic in the study area

and possibly result in increased interest in, and appreciation for the study area's heritage attributes. Lastly, the proposed multi-use paths for Victoria Square Boulevard are a modern reinstatement of historic paths that once paralleled the road.

More details on the Heritage Impact Assessment are included in **Appendix K.**

8.1.3 Noise

The proposed undertaking involves road improvements including minor road widening to accommodate a continuous left-turn lane and curb construction. As a result, no substantial change in road traffic is expected. Accordingly, future road traffic noise emissions with the recommended improvements are expected to be similar to those expected without the recommended improvements. Therefore, it is not expected the recommended improvements will substantially alter the background noise levels.

More details on the Noise Assessment are included in **Appendix M.**

8.1.4 Air Quality

The proposed undertaking involves road improvements including minor road widening to accommodate a continuous left-turn lane and curb construction. As a result, no substantial change in road traffic and accordingly to road traffic emissions are anticipated. Road traffic emissions from the recommended improvements are expected to be similar to those expected without the recommended improvements. Therefore, it is not expected the recommended improvements will substantially alter the existing conditions.

More details on the Air Quality Assessment are included in **Appendix M.**

8.1.5 Property Impacts and Access

As discussed in **Section 7.7** and **Section 7.3**, property acquisition is not anticipated and existing access locations within the study area are proposed to be maintained. Driveway access locations for existing properties have not been impacted as a result of the road improvements; however, some driveways may need profile adjustments.

Along properties known to be undergoing development, the development is expected to match the recommended grading for Victoria Square Boulevard, and proposed entrance locations for future developments have been accommodated.

8.2 Natural Environment

8.2.1 Fisheries and Aquatic Habitat

Although no fish were observed in the study area during the field survey, Carlton Creek was assessed as suitable to provide fish habitat. Carlton Creek is considered a warmwater fishery (TRCA 2007). Development and site alteration is prohibited within

fish habitat except in accordance with provincial or federal requirements (Markham 2014; MMAH 2014; York 2013). In addition, a minimum vegetation protection zone of 30m is applied adjacent to fish habitat under the City of Markham's OP policies (2014). A culvert replacement is proposed for the crossing at Carlton Creek approximately 185m south of Stony Hill Ave. As such, a DFO self-assessment for impacts must be conducted as part of project permitting. If impacts are unavoidable, a DFO Project Review will be required.

In order to minimize harm to fish and fish habitat, several mitigation measures may be implemented during construction. Mitigation measures include the following:

- Implementing standard and accepted mitigation measures outlined in the Land Development Guidelines for the Protection of Aquatic Habitat (DFO 1993), Fisheries Protection Policy Statement (DFO 2013a) and Measures to Avoid Causing harm to Fish and Fish Habitat (DFO 2013c) during construction;
- Retaining a qualified environmental professional to ensure applicable permits for relocating fish are obtained and to capture any fish trapped within an isolated/ enclosed area at the work site and safely relocate them to an appropriate location in the same waters;
- Since the fish community on site is classified as warmwater, no in-water work will occur between restriction periods for Southern Ontario (March 15 to July 15; DFO 2013d), subject to confirmation with DFO;
- An erosion and sediment control plan will be developed to minimize the risk of sedimentation of Carlton Creek during all phases of the project;
- A response plan will be developed that will be implemented immediately in the event of a sediment release or spill of a deleterious substance and an emergency spill kit will be kept on site; and
- Operation of machinery will occur on land above water mark where possible. All refuelling, washing, and servicing of machinery will be completed beyond 30m of the water courses where fish are present.

Further details with regards to fisheries and aquatic habitat are provided in **Appendix H.**

8.2.2 Vegetation and Wildlife

The majority of plant species identified through the vegetation surveys are secure and common in Ontario and globally. None of the plant species identified in the desktop Species at Risk (SAR) screening as having ranges which overlap the study area were found during the botanical, or other, field surveys. Kentucky coffee tree, designated threatened under the Endangered Species Act (ESA), was observed in the study area during field surveys. However, the individual observed was planted by the City as a boulevard tree and was not a naturally-occurring tree. Planted individuals are often

cultivars of non-native specimens and are not treated as protected SAR individuals. Since the boulevard tree is considered non-native, it was not carried forward to the impact assessment.

All of the species identified in the study area are provincially ranked S4 (apparently secure – uncommon, but not rare), or S5 (secure – common, widespread and abundant in the province).

In order to minimize any potential effects of the recommended improvements on vegetation and wildlife, the following mitigation measures should be implemented:

- Tree and vegetation protection should be implemented in accordance with the City of Markham's Tree Preservation Requirements (Streetscape Manual, June 2009);
- Post-construction planting should be undertaken to restore vegetation cover in all areas disturbed by construction activities where reasonable;
- All vegetation clearing should occur outside of the breeding bird season (April 15-August 15). If this is not possible, a nest search should be completed by a qualified biologist in all areas to be cleared prior to clearing activities;
- Rehabilitation, re-stabilization, and re-vegetation of all disturbed areas should occur upon completion of the construction works to restore the study corridor site to its pre-construction condition where possible.

There is habitat for snapping turtle in the study area and may specifically occur within or adjacent to existing stormwater management ponds. There is no species-specific habitat protection for snapping turtle under the ESA. Based on the proposed roadway improvements, habitat for snapping turtle is not expected to be directly impacted. However, to avoid any potential impact to snapping turtles that may be encountered in the study area, specifically during the nesting period (between May 15 and July 15), mitigation measures consisting of exclusion fencing are recommended to prevent the migration of snapping turtle from surrounding areas onto the site.

Further details with regards to Vegetation and Wildlife are provided in **Appendix H**.

8.3 Contamination

If subsurface construction work as part of the roadway improvements is to be conducted, any of the twelve identified properties described in **Section 3.4** may require further intrusive investigations. Based on the preliminary design, eight of the twelve identified properties (sites 1, 2, 7, 8, 9, 10, 11, and 12) are anticipated to require further investigation during detailed design. If contaminated material is encountered, it should be managed in consultation with a qualified professional.

8.4 Utilities and Other Services

Existing utilities along the corridor based on available information are described in **Section 3.9**. The proposed improvements aim to minimize impacts with utilities where possible; however, relocation will be required along the corridor due to several existing conflicts including the utility poles affected by the alignment of the proposed MUP. Where utilities are located within the proposed landscaping zones, suitable placement and plant sizing can be confirmed during detailed design to avoid conflict with overhead utilities. For instance, where utility lines do not provide adequate vertical clearance, hydro form tree species may be planted to avoid conflicts.

Opportunities to optimize the location of the MUP within the available boulevard space will be reviewed during detailed design to further minimize utility relocations. The location and alignment of existing municipal services is to be confirmed during detailed design, which may result in changes to the identified utility impacts. Formal definition of impacts on utilities will be determined during detailed design, in consultation with individual utility companies. All utility information should be updated prior to construction to ensure that the data is accurate and to finalize relocation requirements as necessary. During detailed design, meetings will be held with utility companies as required where potential impacts to existing or future services are identified.

8.5 Water Wells

There are a number of wells within 50 metres of the Victoria Square Boulevard ROW, some of which are being used for water supply. The proposed roadway improvements will result in only minor excavation depths, and dewatering is not anticipated to be required. As such, it is not anticipated that these wells will be impacted by construction activity. During detailed design, all active wells will need to be assessed for water quality and quantity, and monitored prior to, during, and after construction to ensure no adverse impacts.

8.6 Climate Change

8.6.1 Approach to Climate Change Consideration

The Ministry of the Environment and Climate Change (MOECC) guide *Consideration of Climate Change in Environmental Assessment in Ontario* sets out ministry expectations and supports the province's *Climate Change Action Plan* by outlining climate change considerations for Environmental Assessment studies.

The guide notes 'climate consideration' within a project means that consideration has been given to methods to reduce greenhouse gas emissions and developing a design that is more resilient to future changes in climate and helps maintain the ecological integrity of the local environment in the face of a changing climate. Specifically,

consideration should be given to mitigation (how the project might mitigate climate change such as reducing greenhouse gas emissions and/or improving carbon storage of the landscape or removal of carbon dioxide from the atmosphere) and adaptation (measures to adapt to climate change or make the project more resilient to the effects of climate change). Considering how a project may contribute to climate change, through its greenhouse gas emissions or its effects on the natural landscape, is important to the planning process as it allows proponents to consider climate mitigation measures to avoid, minimize, or offset such effects.

Planning and design of road infrastructure should take into consideration key factors and climate change trends, such as building to withstand extreme precipitation and extreme heat. These climate events will impact the physical infrastructures as well as those using the improved Victoria Square Boulevard corridor in the future. It is understood that that impacts of climate change on transportation systems are already visible and include:

- More travel disruptions due to flooding, winter storms, and road washouts
- Increased pavement damage from higher temperatures and freeze-thaw cycles
- Increased maintenance requirements for roads, medians and boulevards including hardscape and vegetative materials

8.6.2 Potential Climate Change Effects

During construction, road infrastructure being built should be as climate ready as possible. Potential effects to consider include the greenhouse gas (GHG) emissions associated with the construction period including the physical machinery and equipment, travel distance and time for construction workers to get to and from the site, and the sourcing of building materials.

Climate change impacts related to this study are also related to operations and maintenance as the transportation sector is one of the biggest contributors to CO_2, a key greenhouse gas. Once Victoria Square Boulevard has been improved, there is the potential for stormwater capacity and drainage system issues as the amount of impervious surface areas will increase. Climate change will also impact the study area in the future as extreme weather conditions will affect the conditions of the roadways and will require more frequent repairs and updates as time passes.

8.6.3 Climate Change Mitigation

Consistent with the City of Markham's sustainability policies and practices, the project-specific recommendations outlined in **Section 7** directly support many of the climate change policies. For example:

- A key objective the Victoria Square Boulevard EA study is to accommodate cyclists and pedestrians, therefore encouraging alternative modes of travel and reducing single occupancy automobile use
- No additional vehicular lanes which would add capacity and increase greenhouse gas emissions are proposed, Instead, a continuous two-way centre left-turn lane will be provided in areas 2, 4, and 5 to provide operational improvements and address congestion, thereby reducing vehicular idling and greenhouse gas emissions
- Tree plantings are proposed to be accommodated in the boulevards, as space permits
- Low impact development strategies are proposed to be explored as feasible.
- The proposed design makes use of an existing transportation route and proposes to accommodate all road users in such a way that minimizes impacts to surrounding areas including residences, business and valleylands.

To mitigate potential effects during the construction phase of the project, the following best practices are recommended:

- Development and implementation of detailed erosion and sediment control measures to be carried out during all construction phases in order to limit the amount of sediment/laden material entering receiving drainage systems
- Dust suppression techniques to be employed for the duration of construction activities
- A traffic staging plan to be developed during detailed design to accommodate local access and through traffic during construction to minimize excessive detouring and congestion in alternate routes. Further opportunities to reduce idling to be considered during detailed design.
- Movement and access to the site for construction vehicles is to be described in the contract documents to be prepared at the time of detailed design

To mitigate potential effects during the operational phase of the project, aligning with best practices for infrastructure design, practices such as the improvement of hydrological data collection, use of models and monitoring localized effects, more frequent monitoring and maintenance and improvement of road design to be more climate change resistant are recommended.

In addition, measures to adapt to climate change impacts and minimize impacts to individuals using Victoria Square Boulevard in the future may include (but are not limited to):

- Upsizing the culvert crossing of Carlton Creek from a 1.25m opening to an 8.5m opening will significantly reduce the risk of roadway overtopping and roadway wash-out during extreme storm events. This could reduce the potential loss of life and allow continued access for emergency vehicles.
- Erosion protection techniques will be developed during detailed design to limit the extent of channel and bank erosion in the vicinity of the Victoria Square Boulevard crossing of Carlton Creek
- Updating plans for weather emergencies, closures and rerouting during severe weather conditions/events, and traveler information systems to include future climate change projections
- As the amount of impervious surface areas will increase, appropriate stormwater capacity should be considered to mitigate additional runoff, climate change and the likelihood of extreme precipitation, as described in **Section 7.9**.

8.7 Source Water Protection

Potential impacts related to the threats described in **Section 3.4**, along with associated mitigation measures, are described below.

8.7.1 Stormwater Runoff

The additional impervious surface associated with the roadway improvements (such as the implementation of a continuous centre left-turn lane and the implementation of multi-use paths) would reduce the amount of groundwater infiltration from the surface. To offset these impacts and balance water quantity, the stormwater management strategy described in **Section 7.9** recommends the implementation of Low Impact Development (LID) measures that would encourage infiltration of stormwater runoff from the road right-of-way.

8.7.2 The Application of Road Salt

Additional road salt associated with winter maintenance for the proposed roadway improvements (such as the implementation of a continuous centre left-turn lane) may increase impacts to source water protection areas. Consistent with best management practices and as suggested in the Clean Water Act policies, the City of Markham has developed a Salt Management Plan that ensures effective winter maintenance for the safety of all roadway users in the City of Markham while striving to minimize the amount of salt entering the environment and at the same time meeting Provincial legislation related to road maintenance standards for winter services.

8.7.3 The Storage of Snow Related to Roadway Clearing Operations

Although the proposed roadway improvements will result in additional areas to be maintained in the winter (such as the implementation of a continuous centre left-turn lane and the implementation of multi-use paths), the study area is not in close proximity to municipal wellheads or surface water intakes. As such, snow storage in the boulevards is not anticipated to result in a serious threat to source water protection areas. In addition, the City of Markham has developed a Salt Management Plan that reduces the amount of salt that is applied during winter maintenance activities, and therefore reduces the amount of salt present in roadside snow banks. The stormwater management strategy (described in **Section 7.9**) addresses other contaminants that may be present in roadside snow banks. These would be treated by existing stormwater management facilities alongside the corridor prior to discharge into receiving watercourses.

9 Timing and Implementation of Future Commitments

9.1 Project Schedule

As part of the Environmental Assessment process, this Environmental Study Report is to be filed and placed on public record for at least 30 calendar days for review by the public and review agencies.

After the review period, provided that no Part II Orders are received, the Region may proceed to Phase 5 of the Class EA process – design and construction. If applicable, property acquisition and utility relocation will then be scheduled, followed by construction.

9.1.1 Lapse of Time

According to the Municipal Class EA, “If the period of time from the filing of the Notice of Completion of ESR in the public record or the MOECC’s denial of a Part II Order request(s), to the proposed commencement of construction for the project exceeds ten (10) years, the proponent shall review the planning and design process and the current environmental setting to ensure that the project and the mitigation measures are still valid given the current planning period. The review shall be recorded in an addendum to the ESR which shall be placed on the public record.”

Notice of Filing of Addendum shall be placed on the public record with the ESR, and shall be given to the public and review agencies, for a minimum 30-day public review period. The notice shall include the public’s right to request a Part II Order during the 30-day review period. If no Part II Order request is received the proponent is free to proceed with implementation and construction.

9.2 Commitments for Future Work

The ESR identifies specific items to be reviewed and confirmed during detailed design. Some of these commitments will address specific concerns raised by property owners and review agencies during the EA process. Items of particular interest to be addressed include:

Property Requirements

- Identify development application properties to determine property dedication requirements.
- If the property at the northwest quadrant of the Victoria Square Boulevard and Elgin Mills Road intersection develops in the future, the City will acquire the

necessary property for a daylighting triangle in order to improve sightlines at this intersection.

Archaeology

- Complete Stage 3 Archaeological Assessment. Findings from subsequent archaeological assessments are to be filed with the Ministry of Tourism, Culture and Sport (MTCS) to obtain clearance for archaeology.

Cultural Heritage

- Confirm the need for site plan control and communication, creating a physical buffer, and vibration monitoring to ensure that the heritage attributes of the identified properties will not be adversely impacted by the construction of the proposed improvements along Victoria Square Boulevard, and during subsequent operation.

Natural Environment

- A DFO self-assessment to be completed during detailed design as part of project permitting to determine if serious harm to fish or fish habitat is expected as a result of activities from the project.
- Channel realignments to match the upstream and downstream channel with the new culvert will be completed by a fluvial geomorphologist using natural channel design principles with the creation of habitat features/structures and the restoration of the banks and riparian vegetation. This work should be done in consultation with aquatic and terrestrial biologists to ensure that an overall habitat improvement will be realized. Efforts will be made to minimize effects to surrounding vegetated areas and vegetation removals will be compensated for via plantings of the same or similar species. The TRCA stream crossing guidelines shall be adhered to.
- A TRCA permit under *Ontario Regulation 166/06 - Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* will be required for all works within regulated areas. This will include channel realignments, where a coordinated design and review process to address both TRCA and DFO requirements will be necessary.
- Environmental Management Plans per TRCA's draft guidelines, or their equivalent if submitted within other technical reports, are to be provided for any active groundwater controls/dewatering required for construction, as both taking and disposal of groundwater may have negative impacts on natural features.
- Construction and post-construction monitoring plans, such as for groundwater monitoring and channel realignment works monitoring, are to be developed in consultation with MOECC and TRCA.

Active Transportation Facilities

- Material type and treatment for MUPs to be reviewed. City standards and specifications to be confirmed at the detailed design stage.
- MUP treatment at intersections and across driveways to be confirmed, and at a minimum, be compliant with AODA guidelines.

Streetscaping and Landscaping

- Streetscaping opportunities as identified in the preliminary designs are to be confirmed. A streetscaping plan, including individual tree planting locations, is to be developed during detailed design and reviewed by the City's Urban Design group.

Groundwater, Hydrogeology, Drainage and Stormwater Management

- Although dewatering is not anticipated as part of construction activity, a Permit to Take Water (PTTW) under the Ontario Water Resources Act will be required if any water takings exceed 50,000 litres per day. Dewatering requirements will be addressed through preparation of the PTTW application package as required. The City will address design requirements through the preparation of contract drawings and specifications.
- Additional water quality control measures including Low Impact Development (LID) strategies are to be reviewed during detailed design.
- TRCA review and approval is required for all works related to groundwater management, drainage alterations and stormwater management.
- Environmental Compliance Approval (ECA) will be required from MOECC for stormwater management facilities and storm sewers.
- All active wells will need to be assessed for water quality and quantity, and monitored prior to, during, and after construction to ensure no adverse impacts.

Contamination

- Further investigation is anticipated for eight of the twelve identified properties (sites 1, 2, 7, 8, 9, 10, 11, and 12) during detailed design. If contaminated material is encountered, it should be managed in consultation with a qualified professional.

Utilities

- Location of existing utilities and resulting impacts and required relocations are to be confirmed.

- Coordination of utilities, including hydro and Bell pole relocation and overhead wiring, is to be reviewed during detailed design.

Constructability, Staging and Detours

- Develop a traffic management plan to determine how traffic will be accommodated during construction and how access to properties adjacent to Victoria Square Boulevard will be maintained.

Additional Consultation and Coordination

- Consult with affected property owners including those where access to their property will be temporarily impacted.
- Consult with regulatory agencies as required.
- Coordinate with developers as required.

Summary of Anticipated Permits and Approvals

- DFO self-assessment
- TRCA permit under *Ontario Regulation 166/06 - Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*
- Permit to Take Water (PTTW) under the *Ontario Water Resources Act* for any water takings that exceed 50,000 litres per day
- Environmental Compliance Approval (ECA) will be required from MOECC for stormwater management facilities and storm sewers
- Obtain clearance for archaeology from MTCS based on findings from subsequent archaeological assessments
- Permission to Enter Agreements, if required

9.3 Timing of Improvements

Timing of improvements is to be confirmed during detailed design. At this time, it is anticipated that detailed design will commence in Summer 2018. Construction is anticipated to start after detailed design is completed pending funding and approval by City Council.