City of Barrie

Environmental Study Report

Harvie Road, Essa Road and Bryne Drive Class EA Study

Phases 3 and 4

HATCH

October 2017

Environmental Study Report

H353437-83-240-0001

							
2017-10-12	**A**	**Client Review**	**Melissa Alexander**	**John Hemingway**	**Terry Kelly**	**As Required**
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				Discipline Lead	**Functional Manager**	**Choose Approver**

Executive Summary

Study Background

The City of Barrie has initiated a Class Environmental Assessment (Class EA) Study to identify improvements to Harvie Road and Essa Road and the extension of Bryne Drive. In 2014, the City approved the Multi-Modal Active Transportation Master Plan (MMATMP) covering Phases 1 and 2 of the Municipal Class EA process. In addition, the City undertook and approved the Master Plan Addendum for the extension of Bryne Drive in 2016. The MMATMP identified the need for improvements to the transportation system to accommodate growth to the year 2031 and beyond. It was identified that there is an opportunity to provide safe, efficient and accessible options, to encourage a sustainable transportation network, the provision of public transit and opportunity to consider on and off-road pedestrian and cycling facilities to encourage active transportation. The purpose of the Study is to recommend a preferred design concept to address the identified capacity deficiencies along the Study Area corridors.

Need and Justification

Under existing conditions, all intersections in the Study Area on Harvie Road, Essa Road, and Bryne Drive are operating at acceptable levels. There is sufficient capacity along Harvie Road and along Essa Road to accommodate existing traffic demand. However, by 2031, projected higher traffic volumes in the Study Area will exceed the current infrastructure. Harvie Road from Essa Road to Bryne Drive must be widened to support traffic, intersections must be reconfigured, and signal timing must be installed to support an efficient traffic flow. Further, there is a noticeable lack of active transportation facilities along the three Study Area corridors. The MMATMP does not identify or recommend any future transit routes within the Study Area up to the 2031 planning horizon.

Existing Conditions

A few locations located along the Study Area corridors are regulated by the LSRCA. The Essa Road Study Area corridor is located within the NVCA. The Bear Creek watercourse within the Study Area corridor is regulated by NVCA. The MNRF provided a list of SAR that are known to the Study Area corridors. Through consultation with the MNRF, a series of targeted surveys was identified to be required for all three Study Area corridors. If DFO identifies that approval for the project is needed, offsetting measures may be required. The topography associated with the Study Area is mainly flat with rolling hills. According to the Soil Map of Simcoe County, the Study Area is dominantly sandy and gravelly sandy loam with good soil drainage. Watercourses that may be defined as fish habitats are present within the Study Area corridor. These include Whiskey Creek, Bear Creek Subwatershed, the Barrie Creeks, Lovers Creek and Hewitt's Creek Subwatershed (LSRCA, 2012). No fish species were observed within watercourses within the Study Area corridor. The vegetation community classes identified within the Study Area corridor were Cultural, Forest, Swamp, and Marsh. Residential landscapes, commercial and institutional landscapes were observed. Cultural and forest landscapes were also observed. Based on the review of applicable background materials, no wetlands or unevaluated wetlands have been mapped for the Study Area corridor by the LSRCA, the MNRF, Simcoe County or the City of Barrie, although some were identified during the 2017 field investigations. Woodlands have been mapped by both the LSRCA and MNRF, as well as by Simcoe County and the City of Barrie within the Study Area corridor. There are

no valleylands mapped within the Study Area for any of the three corridors. There are no ANSIs located within the Study Area.

The Study Area includes Residential, Agricultural, General Commercial, General Industrial, and Environmental Protection Area land uses. Some of the land is presently undeveloped.

Archeological Assessment

A Stage 1 Archaeological Assessment was undertaken for Harvie Road and Essa Road to determine where additional archaeological investigations are required. A previous Stage 1 Archaeological Assessment determined that a significant portion of the Bryne Drive Study Area corridor contains archaeological potential (AMICK 2005). Given the location of three ancestral Huron-Wendat villages within one kilometer, there is an increased risk of impacting an ossuary within the Harvie Road and Bryne Drive Study Area corridors. Portions of each of the Study Area corridors require Stage 2 Archaeological Assessment to confirm the presence or absence of any archaeological resources.

Cultural Heritage

A Cultural Heritage Resource Assessment identified Kempenfelt as an important site during the War of 1812 and as the starting point for a portage route established by First Nations connecting between Lake Simcoe and Lake Huron, Essa Road and Harvie Road as historical roadways, and the Barrie Creeks Subwatershed as natural heritage features. No cultural heritage resources were identified within or adjacent to the Harvie Road or Bryne Drive Study Area corridors. A review of background documents and a site visit confirmed that there are two cultural heritage resources within the Essa Road Study Area corridor.

Noise Impact Assessment

Given the proximity of the Highway 400, Bryne Drive and Harvie Road to Essa Road, there will be no significant change to noise. Harvie Road may require noise mitigation measures given the anticipated increase in volume of traffic along the roadway, however given that the front facing houses and driveways providing access to Harvie Road, it will be difficult to implement noise mitigation measures.

Utilities

Utilities within the Study Area include multiple Sanitary Systems and Watermains, drainage and stormwater management, as well as street lighting and driveway access along Harvie Road, Essa Road, and Bryne Drive.

Drainage and Stormwater Management

The Study Area was divided into six distinct drainage areas based on the subwatershed boundaries for Lovers Creek, Whiskey Creek, Hotchkiss Creek, and Bear Creek. Water drains mostly via surface runoff through undeveloped field area or through wooded areas, flowing to the Constructed Pond A or to various creek culverts. It was assessed that culvert crossings in the Study Area should be replaced and/or extended.

Alternative Design Concepts for the Preferred Solution

Three alternative design concepts for the preferred solution have been prepared for each of the three Study Area corridors. They are as follows: Harvie Road: Do Nothing; Widen to the South; Widen About

the Centre-Line; and Widen to the North. For Essa Road: Do Nothing; Widen to the West; Widen About the Centre-Line; and Widen to the East. For Bryne Drive: Do Nothing; Extend to the West; Extend About the Centre-Line; and Extend to the East.

Description of Preferred Design Concept – Harvie Road

The Preferred Design Concept for Harvie Road is to widen about the centre-line, as it has less impact on the regulated woodlots north and south of Harvie Road. In addition, it equally shares the property impacts on either side of the roadway. The typical cross-section for the preferred design for Harvie Road includes a three-lane cross-section between Essa Road and Veterans Drive, transitioning to a five-lane cross-section with a two-way left-turn lane, between Veterans Drive and Bryne Drive, including buffered bike lanes and sidewalks. Changes to intersections, drainage and stormwater, culvert design, utilities streetlighting and traffic signals, landscaping and streetscaping, and property requirements will also be made. The preliminary construction cost estimate is $11,723,450.

Description of Preferred Design Concept – Essa Road

The preferred design concept is to widen about the centre-line, as this alternative has little potential impact to natural heritage, and there is minimal potential for Stage 2 Archaeological work. In addition, there is no property impact. The typical cross-section for the preferred design for Essa Road includes a 5-lane crosssection with a two-way left-turn lane. The cross-section has a 30m right-of-way, with a 3.0m multi-use trail on the west side and a 2.0m sidewalk on the east-side. With five-lane widening, the existing lane configurations and the traffic operations at the intersections of Essa Road with Mapleview Drive and with Coughlin Road will be improved. Lane configuration improvements will be made to intersections, and changes will be made to streetlighting and traffic signals, drainage and stormwater, culvert design, utilities, landscaping and streetscaping, and property requirements. The estimated construction cost for the road widening is $7,797,000.

Description of Preferred Design Concept – Bryne Drive

The preferred design concept is to widen about the centre-line, as this opportunity has less potential to impact archaeological sites to the northwest and east (north of Harvie Road). In addition, this alternative provides the most acceptable alignment connectivity to the segment south of Harvie Road, as it includes gradual curves. The typical cross-section for the preferred design for Bryne Drive includes a 5-lane crosssection with a two-way left-turn lane. The cross-section is a 34m right-of-way, with a 2.0m sidewalk and 1.5m bike lane on both sides of the road. In 2021, the Bryne Drive extension is recommended to be constructed with two through lanes in each direction and a center two-way left turn lane (TWLTL). Lane configuration improvements will be made to intersections, and changes will be made to streetlighting and traffic signals, drainage and stormwater, culvert design, utilities, landscaping and streetscaping, and property requirements. The estimated construction cost for the road widening is $35,859,750.

Public Consultation

The Study was undertaken as a Schedule C Municipal Class EA according to the Municipal Engineers' Association Municipal Class EA process. Review agencies, members of the public and First Nation communities were consulted throughout the Study to solicit input at key milestones. The Project Team reached out to the Lake Simcoe and Region Conservation Authority and the Nottawasage Valley

Conservation Authority in March 2017 to receive Natural Heritage Information related to the Study Area to identify potential gaps in the data. The Project Team met with the LSRCA prior to the issuance of the Environmental Study Report to present the recommendations and receive input in August 2017. One Public Information Centre (PIC) was held during the study to present the alternative design concepts and the evaluation, as well as the preliminary preferred design concept. Six Comment Sheets were received at the PIC, one requiring a written response. The majority of the comments related to timing to have the project implemented, property impacts and recommendation for improved active transportation facilities.

Impacts of Recommended Alternative Design

Natural Environment

The Study identified potential impact to mature trees along Harvie Road and Bryne Drive, to Brook Trout spawning activities, to species at risk, to migratory birds, and to wildlife. There may be an increase in suspended solid loading, as well as a potential impact to watercourses as a result of soil disturbance from excavating and cut/fill activities. To minimize impacts construction timing will consider local breeding season and the presence of Brook Trout within Whiskey Creek. An erosion and sediment control plan will be developed prior to construction and will be monitored and inspected during construction. Trees shall be protected and disturbed areas should be restored with native, non-invasive seed mix.

Cultural Environment

The Study identified potential impact to archaeological resources within the Study Area. A Stage 2 Archaeological Assessment will be required prior to Detailed Design, given that a significant portion of the Study Area has archaeological potential. There were no identified cultural heritage resources identified within the Harvie Road or Bryne Drive Study Area corridors.

Socio-Economic Environment

Slight increase in noise levels are expected during construction, however the impact is not expected to be significant enough to require mitigation. To minimize the potential for construction noise impacts, it is recommended that provisions be written into the contract documentation. The increase in traffic on the widened Harvie Road and Essa Road, as well as the extension of Bryne Drive could cause an increase in tailpipe emissions. Recommendations to offset the negative impacts on the air quality from the proposed road improvements include implementing active transportation options, and adjusting traffic signal timing plans to promote traffic flow. During construction, air quality will be degraded locally due to construction equipment and dust, and it is recommended that mitigation measures be implemented.

Commitments to Further Work

Below is a summary of the commitments for further work:

- A DFO self-assessment or Request for Review will be required once improvements to culverts are confirmed;
- Vegetation clearing and/or grubbing should be kept to a minimum and areas restored with non-invasive species;

- Tree areas that shall be preserved should be protected;
- Proper erosion and sediment control measures should be implemented at construction to prevent any impacts to nearby watercourses;
- Mitigation measures should be applied to present impacts associated with proposed transportation improvements;
- Should work be required outside of the study area, a qualified cultural heritage consultant should be contacted to confirm the impacts of the proposed work on potential heritage resources;
- Should construction of a new wall be required in southwest quadrant of Harvie Road and Thrushwood Drive, design discussions are required to incorporate into Detailed Design;
- A geotechnical investigation will be undertaken prior to Detailed Design to support; recommendations for reconstruction of roadways;
- Construction staging will be addressed during Detailed Design; and
- The following permits and approvals will be warranted for this project:
    - Harvie Road and Bryne Drive: Development, Interference with Wetlands and Alteration to Shorelines and Watercourses Regulation permit from the LSRCA under Regulation 179/06 for works within regulated areas of watercourses.
    - Essa Road: Development, Interference with Wetlands and Alteration to Shorelines and Watercourses Regulation permit from NVCA under Ontario Regulation 172/06 for works within regulated areas associated with Bear Creek.
    - MOECC Permit to Take Water/Registration
    - Tree Preservation By-law
    - DFO self-assessment or Request for review;
    - SAR permit and/or approval; and
    - Wildlife Scientific Collectors Permit for potential defishing during construction.

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1. Introduction

1.1 Introduction

The City of Barrie initiated a Schedule C Municipal Class Environmental Assessment (Class EA) Study to identify improvements to Harvie Road and Essa Road and the extension of Bryne Drive. The Study Area includes Harvie Road, Essa Road and Bryne Drive corridors as identified in Figure 1-1 below:

- Harvie Road: from Essa Road easterly to Bryne Drive;
- Essa Road: from Mapleview Drive West northerly to Coughlin Avenue; and
- Bryne Drive: from Caplan Avenue northerly to Essa Road.

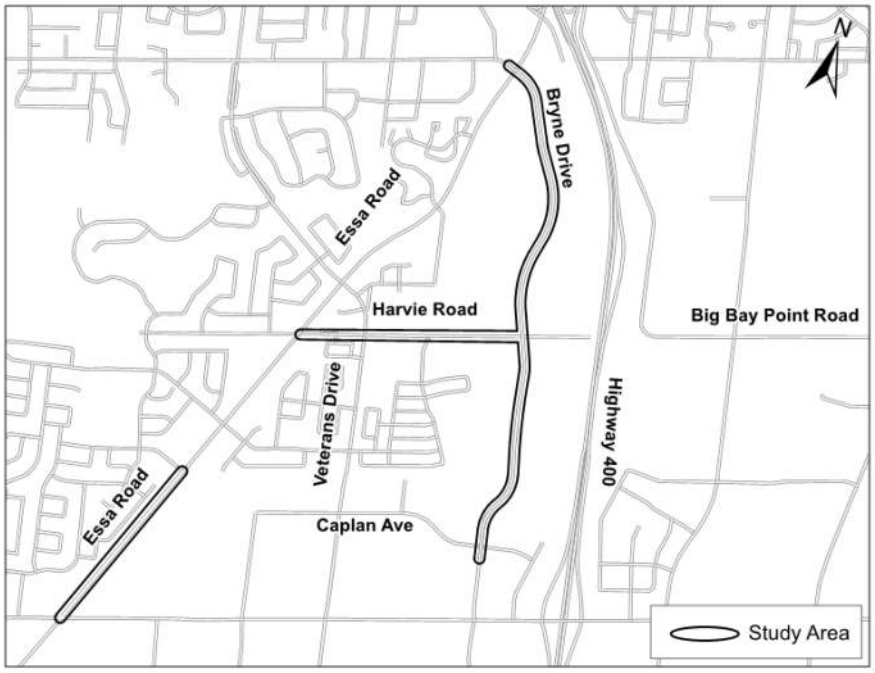


Figure 1-1: Study Area

All municipal road projects in Ontario require approval under the *Ontario Environmental Assessment Act* (EA Act). The Municipal Engineers Association (MEA)'s Municipal Class EA process streamlines the planning and construction of municipal infrastructure with an approved procedure designed to protect the environment. The Municipal Class EA process provides a decision-making framework that enables the requirements of the EA Act to be met in an effective manner. Further details regarding the Class EA process are described in Section 1.5.

Hatch was retained by the City of Barrie to undertake a Class EA Study for improvements to the roadway sections described above. The Study includes the review of the existing work already completed as part of the City's Multi-modal Active Transportation Master Plan (MMATMP) – which covered the requirements of Phases 1 and 2 of the Class EA process. This study will include the completion of Phases 3 and 4 of the Class EA process.

1.2 Background

In 2014, a series of six Master Plans were prepared for the City of Barrie in accordance with the Municipal Class EA process. Pertinent to this study a MMATMP was prepared.

The MMATMP identified various projects to address growth in the City of Barrie. The MMATMP outlines the required transportation improvements to address existing and future needs within the City. The City has experienced rapid growth and initiated the MMATMP to assist with determining how to address growth in a sustainable manner. The MMATMP was conducted in accordance with the Master Plan process as described in the MEA and addresses Phases 1 and 2 of the five-phase Municipal Class EA Process. These phases identify problems or opportunities and a preferred solution to address them. The Master Plan reviewed the natural, social and economic environment and took into consideration all modes of transportation. The City of Barrie identified the need for a transportation system to accommodate growth to the year 2031. The study identified that an opportunity exists to provide safe, efficient and accessible transportation options, the opportunity to encourage a sustainable transportation network, the provision of public transit as a true alternative to single occupant vehicles, and the opportunity to consider on and off road pedestrian and cycling facilities to encourage active transportation over the single occupant vehicle. The MMATMP reviewed other planned transportation projects that will influence the City of Barrie's transportation network including improvements to Highway 400; improvements to Simcoe County's road network and the provision of increased service for GO Train and Bus.

As it pertains to this Study Area, the MMATMP recommended the following:

- Harvie Road
    - Widen to two lanes and a Two-Way Left Turn Lane (TWLTL) or continuous median between Essa Road and Veterans Drive; and to four lanes + TWLTL or continuous median between Veterans Drive and Bryne Drive;
    - Provide buffered bike lanes; and
    - Provide a right-of-way (ROW) of 27m (up to Veterans Drive) and 34m (up to Bryne Drive).
- Essa Road
    - Widen to two lanes and a TWLTL or continuous median;
    - Provide sidewalks; and

- Provide a ROW of 27 m.

- Bryne Drive
  - Widen to four lanes and TWLTL or continuous median;
  - Provide bike lanes; and
  - Provide a ROW of 34m.

In addition, the MMATMP identified the need to provide a crossing of Highway 400 at Harvie Road. Having a continuous connection between Big Bay Point Road and Harvie Road across the highway, in conjunction with a partial interchange with the highway was shown to have potential to reduce the traffic volumes at the Essa Road and Mapleview Road interchanges with Highway 400. (Note: the extension of Harvie Road across Highway 400 is currently in Detailed Design and construction is planned for 2019-2020. A future interchange at Harvie Road and Highway 400 is planned as a longer-term improvement).

In 2002, the City undertook a Class EA for improvements to Harvie Road from Essa Road to Bryne Drive. The recommendation included the reconstruction of Harvie Road to four-lanes, including operational improvements at Essa Road, Veterans Drive and Bryne Drive.

In 2005, the City undertook a Class EA for improvements to Essa Road from Ferndale to the south City limits. The recommendation included a 5-lane cross-section. Following the EA, Essa Road was reconstructed and widened from Ardagh Road to Coughlin Road.

Given the length of time since these EAs were undertaken, the basis for the Harvie Road, Essa Road and Bryne Drive Class EA is the MMATMP that was completed by the City in 2014.

1.3 Phases 1 and 2 Summary

The Opportunity Statement from the MMATMP (covering the requirements of Phases 1 and 2 of the Municipal Class EA process) is as follows:

- The City of Barrie is in need of a transportation system to accommodate growth to 2031. An opportunity exists to plan a transportation system which:
  - Is safe, efficient and accessible with mobility choices;
  - Fosters the use and development of sustainable transportation network;
  - Provides a public transit system as a good alternative to private automobile use; and
  - Provides a network of on-road and off-road pedestrian and cycling facilities that provide active transportation modes as an alternative to the automobile

Alternative solutions to address the Opportunity Statement included:

- Do Nothing;
- Low/existing modal share – Auto-oriented 'status quo' approach; and
- Medium modal share – increased emphasis on non-auto modes.

Following the completion of Phases 1 and 2 of the Class EA, the following preferred solution was recommended:

- Median modal share – increased emphasis on non-auto modes.

The alternative selected would improve existing active transportation, while also serving new developments including those in the Annexed Lands and Intensification Areas. Currently there is a low modal share for transit and active transportation. The preferred alternative would increase the use of active transportation and transit significantly and provide residents of Barrie with greater choice in transportation mode.

1.4 Purpose of the Study

The purpose of the Study is to recommend a preferred design concept to address the identified capacity deficiencies along the Study Area corridors, based on the Preferred Solution identified in the MMATMP that addresses these deficiencies. This Study was completed in accordance with the Municipal Class EA process for Schedule C projects, covering Phases 3 and 4 of the Class EA process and included the following steps:

- Update technical studies pertinent to the Study Area;
- Identify and evaluate Alternative Design Concepts for the Preferred Solution within the Study Area corridors;
- Present project-specific information to and receive input from the public, property owners and review agencies throughout the Study;
- Select a Preferred Alternative Design Concept; and
- Prepare and file an Environmental Study Report for a minimum 30-day public review period. The ESR documents the Class EA process, including mitigation measures and commitments to implement the recommended improvements.

1.5 Municipal Class Environmental Assessment Process

Under the provisions of the *Ontario Environmental Assessment Act* and Regulation 334, certain types of provincial and municipal undertakings can meet the requirements of the Act through the use of an approved environmental planning process referred to as a Class Environmental Assessment (Class EA).

The Class EA process is a self-assessing procedure by which a group or 'class' of undertakings can be planned and implemented in a way that fulfills the requirements of the Act without proponents having to undertake an Individual Environmental Assessment. Upon

completion of the appropriate process, the undertaking is considered approved and does not require formal submission to the Ministry of Environment and Climate Changes (MOECC).

The Municipal Class EA prepared by the Municipal Engineers Association (Dated October 2000, as amended in 2007, 2011 and 2015), outlines the approved process for the planning and design of municipal infrastructure.

Figure 1-2 summarizes the five phases of this process. As the figure notes, review agencies and members of the public are consulted to solicit input and comments at key milestones throughout the process. This input is essential to ensure that issues are identified early in the process and can be addressed prior to moving forward and making final recommendations.

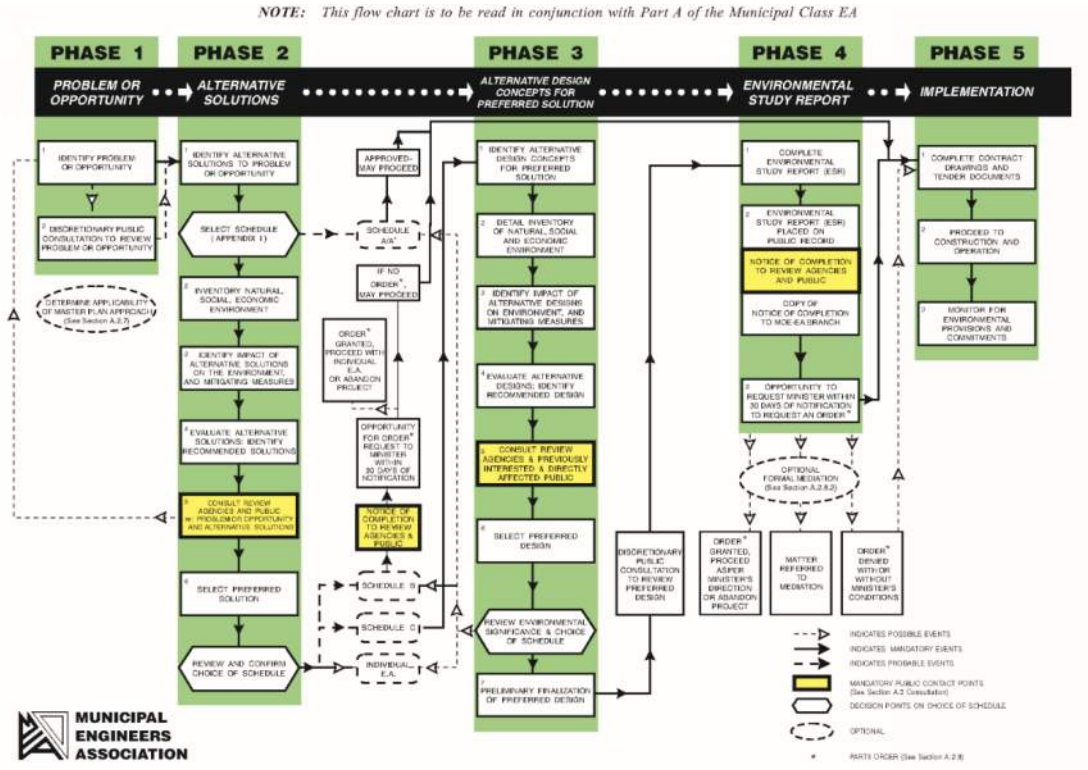


Figure 1-2: Municipal Class EA Planning and Design Process

Source: *Municipal Engineers Association, Exhibit A.2 Municipal Class Environmental Assessment Planning and Design Process, October 2000, as amended in 2007, 2011 and 2015*

The Municipal Class EA process recognizes that there are varying levels of impact requiring a greater or lesser amount of assessment, depending on the nature of the work, the estimated cost and the potential impacts on the environment (which includes natural, social, economic,

cultural and technical). There are four levels or 'schedules' of undertakings defined in the Municipal Class EA as follows:

Schedule A: These projects are limited in scale and include emergency operational and maintenance activities. Schedule A projects are deemed pre-approved without the need for further assessment.

Schedule A+: As introduced in the 2007 amendment to the Municipal Class EA, Schedule A+ projects are also pre-approved, but require the proponent to advise the public of the initiative prior to implementation.

Schedule B: These projects have the potential for some adverse environmental effects and include improvements and minor expansions of existing facilities. For Schedule B projects, the proponent must undertake a screening process, including consultation with those who may be affected by the undertaking. At the conclusion of the process, a Project File Report is prepared to document the findings.

Schedule C: These projects have the potential for significant environmental effects and include new facilities and major expansions to existing facilities. Schedule C projects must follow the full planning and decision-making process outlined in the Class EA, including the preparation of an Environmental Study Report.

1.6 Environmental Study Report

The Environmental Study Report (ESR) documents the planning and decision-making process followed for Schedule C projects. The report clearly documents the steps taken to select the technically preferred design concept. The ESR is finalized with the issuance of a Notice of Study Completion inviting the public to review and provide input on the document within the 30 calendar day review period. The Notice will identify the location(s) where the ESR can be reviewed.

1.7 Part II Order

It is recommended that all stakeholders work together to determine the preferred means of addressing the problem. If concerns regarding the project cannot be resolved through discussions with the proponent (for this Study, the proponent is the City of Barrie, the person or party raising the objection may request that the proponent voluntarily elevate the Schedule C project to an individual EA. If the proponent declines and the person or party with the concern wishes to pursue the matter further, they may write to the Minister of the Environment and Climate Change to request a Part II Order. The request should be copied to the proponent and the Director of the Environmental Approvals Branch, at the same time that the request is submitted to the Minister. The Minister will determine whether or not the request is necessary and the decision is considered final.

A written request must be submitted to the Minister within the 30 calendar day review period after the Notice of Completion has been issued. The Minister of the Environment and Climate Change can be contacted as follows:

The Ministry/Minister of Environment and Climate Change
77 Wellesley Street West
11th Floor, Ferguson Block
Toronto, ON M7A 2T5
Fax (416) 314-8452

The Director, Environmental Approvals Branch can be contacted as follows:

Director, Environmental Approvals Branch
Ministry of the Environment and Climate Change
135 St. Clair Avenue West, 1st Floor
Toronto, ON M4V 1P5

The proponent (City of Barrie) can be contacted as follows:

City of Barrie
Engineering Department
70 Collier Street, P.O. Box 400
Barrie, ON L4M 4T5

1.8 Study Approach

As discussed in Section 1.3, and presented in Figure 1-2, the Municipal Class EA process consists of five phases. Phase 1 includes the problem identification; Phase 2 includes the identification of the preferred solution; Phase 3 includes the identification of the Preferred Design Concept; Phase 4 includes the documentation of the EA process; and Phase 5 includes the detail design and construction (implementation) of the project. Public and regulatory consultation is integrated into the entire Study process.

Given that the MMATMP completed the requirements for Phases 1 and 2, this Study will only involve the completion of Phases 3 and 4 of the Class EA process, including the preparation of an Environmental Study Report.

1.9 Study Organization

The Consultant Team and their roles included the following:

Hatch Corporation	• Project Management • Consultation • Environmental Assessment Planning • Natural Heritage • Traffic and Safety Impact

	• Drainage and Stormwater Management
	• Noise Assessment
	• Road and Structure Design
Archaeological & Heritage Services Inc.	• Stage 1 and 2 Archaeological Assessment
	• Cultural Heritage Assessment Report
Water's Edge	• Geomorphology
DFP Surveyors	• Topographical and Legal Survey

2. Need and Justification

2.1 Existing Traffic and Transportation

A Traffic Analysis Memo was prepared that summarized the findings of a traffic assessment for each Study Area corridor including Harvie Road, Essa Road and Bryne Drive. Copies of these memos are included in Appendix A.

2.1.1 Related Ongoing Studies

The following section includes related ongoing or recently completed studies that may have an influence on the Harvie Road, Essa Road and Bryne Drive Class EA.

Harvie Road-Big Bay Point Crossing

This Study was initiated to address existing traffic congestion and support growth in Barrie's south end by connecting Harvie Road to Big Bay Point Road across Highway 400. The Study was initiated in 2015 and is currently in the Detailed Design phase. The preferred design alternative for the Harvie Road / Big Bay Point Road crossing includes:

- Harvie Road / Big Bay Point Road crossing over Highway 400
- Removal of the existing railway crossing on Big Bay Point Road between Bayview Drive and Fairview Drive
- Buffered bike lanes and sidewalks on both sides
- Five (5) lanes in the interim and ultimate seven (7) lanes between Bryne Drive and Bayview Drive
- Protection of land for a potential future Highway interchange.

Essa Road interchange

The City approved making Essa Road six lanes from Anne Street to Bryne Drive in 2011. It is now scheduled to be constructed in 2019-2021 by the Ministry of Transportation (MTO).

As part of the Highway 400 Class EA and Preliminary Design Study undertaken for improvements to Highway 400 (April 2017), the Essa Road bridge/interchange replacement is in the Ministry of Transportation's (MTO) five-year plan.

Mapleview Drive Interchange

The MTO is undertaking an Addendum to the Transportation Environmental Study Report (TESR) completed in 2004 for the Highway 400 Planning and Preliminary Design Study from 1km south of Highway 89 northerly 30km to the Junction of Highway 11. The recommendation for the Mapleview Drive interchange includes a Diverging Diamond Interchange (DDI), with no property requirements from the 2004 study recommendations. The City of Barrie fully supports MTO's recommendation for the DDI.

2.1.2 Existing Road Geometry

2.1.2.1 Harvie Road

Figure 2-1 illustrates the existing lane configuration and intersection traffic control of roads and intersections within the Harvie Road Study Area corridor. Harvie Road is a two-lane major arterial road running east-west, from Essa Road to a cul-de-sac termination east of Thrushwood Drive. The length of the Study Area corridor is approximately 1.5 km. There is no posted maximum speed limit along this section. East of Essa Road, the roadway has a rural cross-section with curbs and gutters provided only at intersections.

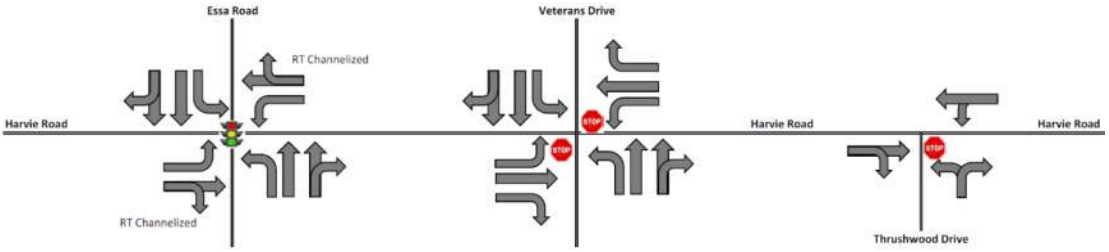


Figure 2-1: Harvie Road - Existing Lane Configuration

2.1.2.2 Essa Road

Figure 2-2 illustrates the existing lane configuration and intersection traffic control of roads and intersections within the Study Area. Essa Road is a two-lane major arterial road running generally in a north-south direction connecting between County Road 27 and Mapleview Drive in the south, to an interchange with Highway 400, and farther north, ending at an intersection with Tiffin Street, near the Barrie GO Station. The length of the Essa Road within the Study Area corridor between Mapleview Drive and Coughlin Road is approximately 1.0 km. In this section, the roadway has a rural cross section with a maximum speed limit of 60 km/h as per the City of Barrie By-Law 2002-191.

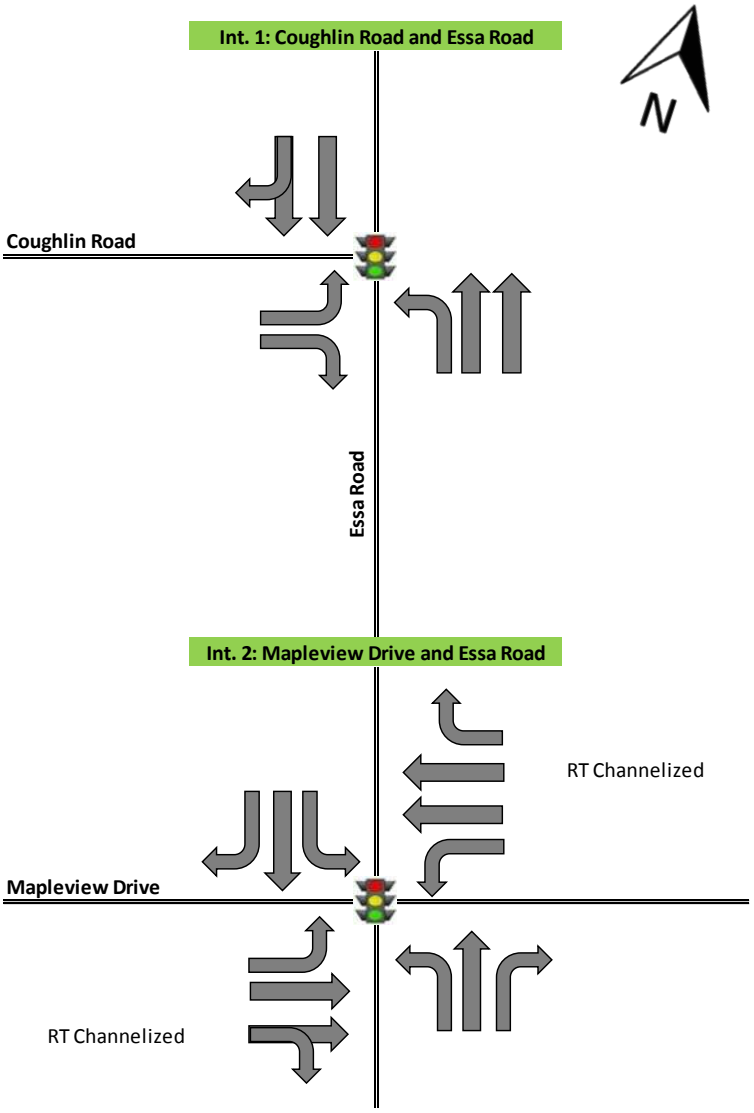


Figure 2-2: Essa Road – Existing Lane Configuration

2.1.2.3 Bryne Drive

Figure 2-3 illustrates the existing lane configuration and intersection traffic control of roads and intersections within the Study Area corridor. Bryne Drive is a Major Collector running southerly from Essa Road to a cul-de-sac, and northerly from Caplan Avenue to another cul-de-sac. The distance between the two termini is approximately 1.4km. The length of the full Study Area corridor is 2.5km. Both segments of the roadway have an urban cross section with a posted speed limit of 50 km/h.

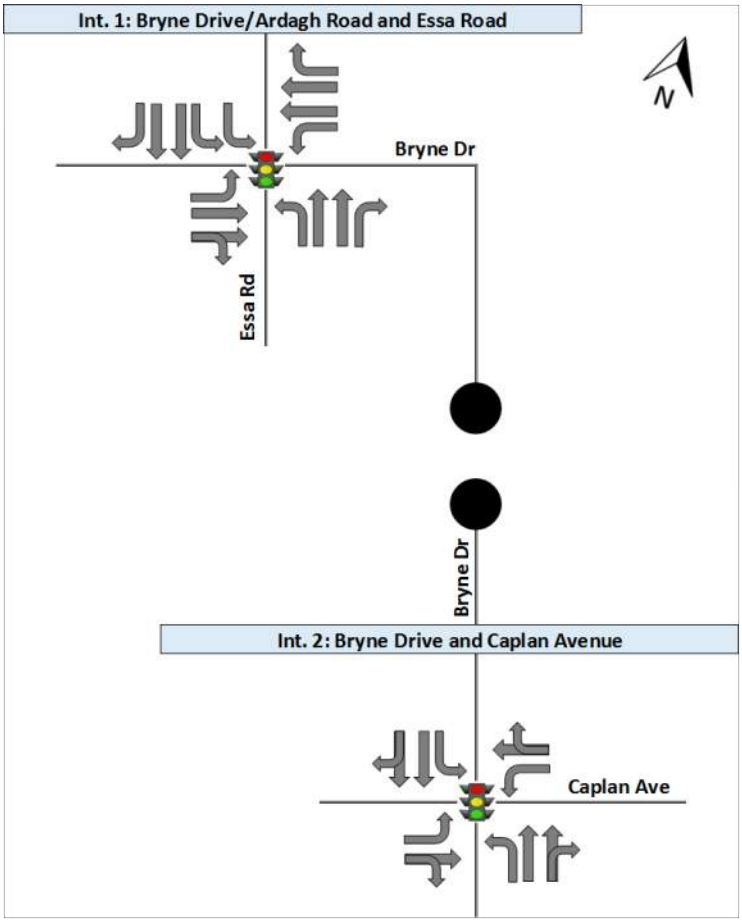


Figure 2-3: Bryne Drive – Existing Lane Configuration

2.1.3 Transit Services

Barrie Transit operates the following bus routes within the Study Area:

- Route 2 operates on a portion of Veterans Drive, connecting the Downtown Terminal with Park Place;
- Route 8 operates along a portion of Essa Road (north of the Study Area), connecting the Downtown Terminal with both Go Transit Stations, Georgian College and Park Place; and
- Routes 7A and 7B operate along Bryne Drive southerly from Caplan Avenue and along Essa Road, connecting Bell Farm Road to the north of the Study Area with Park Place to the east of the Study Area.

The MMATMP does not identify or recommend any future transit routes within the Study Area up to the 2031 planning horizon.

2.1.4 Active Transportation (Network Overview)

There is a noticeable lack of active transportation facilities along the three Study Area corridors. Sidewalks are the main component of the City of Barrie's Active Transportation system, along with on-street bicycle lanes, boulevard pathways and signed routes.

2.1.4.1 Harvie Road

A section of sidewalk is provided on the south side of Harvie Road, immediately west of Veterans Drive, to serve residents of Southwoods Crescent. There is also a small section of sidewalk on the north-east corner of the Veterans Drive intersection, serving the lone residential property at that corner.

Sidewalks are provided on both sides of the street along Thrushwood Drive and Veterans Drive. On-street bicycle lanes are provided along Veterans Drive, south of Harvie Road.

The MMATMP, identified several active transportation measures to be undertaken to provide an integrated pathway network. Within the study area, the following measures are proposed:

- Provision of sidewalks along Harvie Road; and
- Provision of buffered bicycle lanes along Harvie Road.

2.1.4.2 Essa Road

The following measures are proposed throughout the Study Area:

1. Provision of sidewalks along Essa Road; and
2. Provision of buffered bicycle lanes along Essa Road.

2.1.4.3 Bryne Drive

There are sidewalks on both sides of the existing segments of Bryne Drive, but no cycling facilities are provided. The following measures are proposed through the Study Area:

- Provision of sidewalks on both sides of the Bryne Drive extension as part of the road construction project from south of Essa Road to north of Caplan Avenue.
- Provision of buffered bicycle lanes along Bryne Drive just south of Essa Road, and between Caplan Avenue and Commerce Park Drive; provision of bicycle lanes along the remaining sections of Bryne Drive, including along the proposed extension between the existing segments.

2.1.5 Existing Traffic Volumes

Traffic volumes provided by the City of Barrie for the existing road network were used as the basis to complete the analysis of existing conditions. A 2017 base year was used for the traffic analysis using traffic counts provided by the City.

2.1.5.1 *Harvie Road*

The current signalized timing of the intersection of Harvie Road and Essa Road was provided by the City and used for the analysis.

2.1.5.2 *Essa Road*

Turning movement count information collected at the intersection of Mapleview Drive and Essa Road in 2015 was adjusted to 2017 using a 2% per annum growth assumption. An annual growth rate of 2% was selected based on discussions with the City of Barrie and a review of growth shown in the City's EMME model outputs. Traffic volumes in the Study Area road network were then balanced to remove any differences in link volumes. Figure 2-4 provides a summary of the balanced 2017 traffic volumes. Traffic signal timing information used for the analysis was also provided by the City.

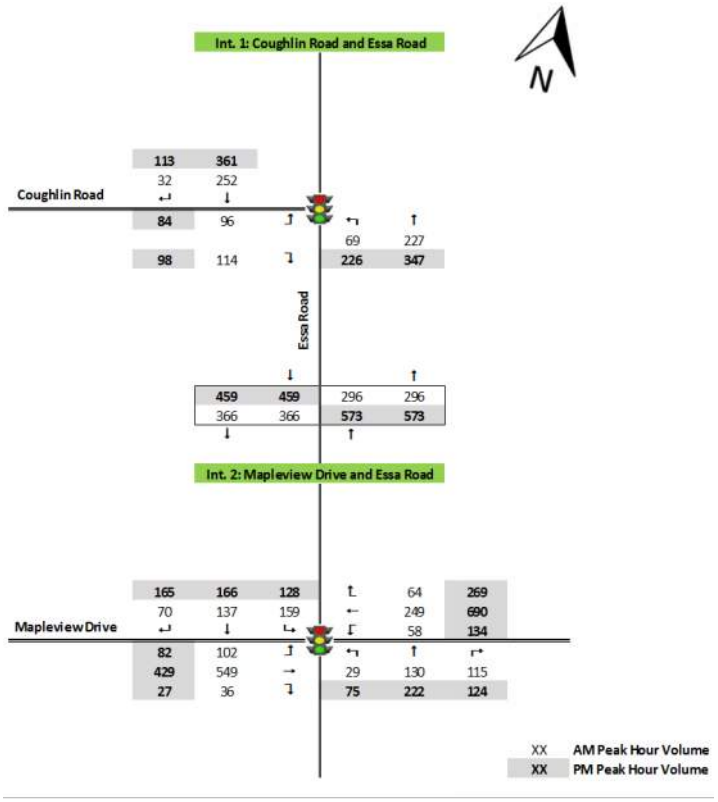


Figure 2-4: Essa Road - Existing Traffic Volumes

2.1.5.3 *Bryne Drive*

Turning movement count information collected at the intersection of Bryne Drive and Essa Road in 2011 and Bryne Drive and Caplan Avenue were adjusted to 2017 using a 2% per annum growth assumption. An annual growth rate of 2% for background traffic was selected

based on discussions with the City of Barrie. Traffic volumes in the Study Area road network were then balanced to remove any differences in link volumes. Figure 2-5 provides a summary of 2017 traffic volumes at the Study Area intersections. Traffic signal timing information used for the analysis was also provided by the City.

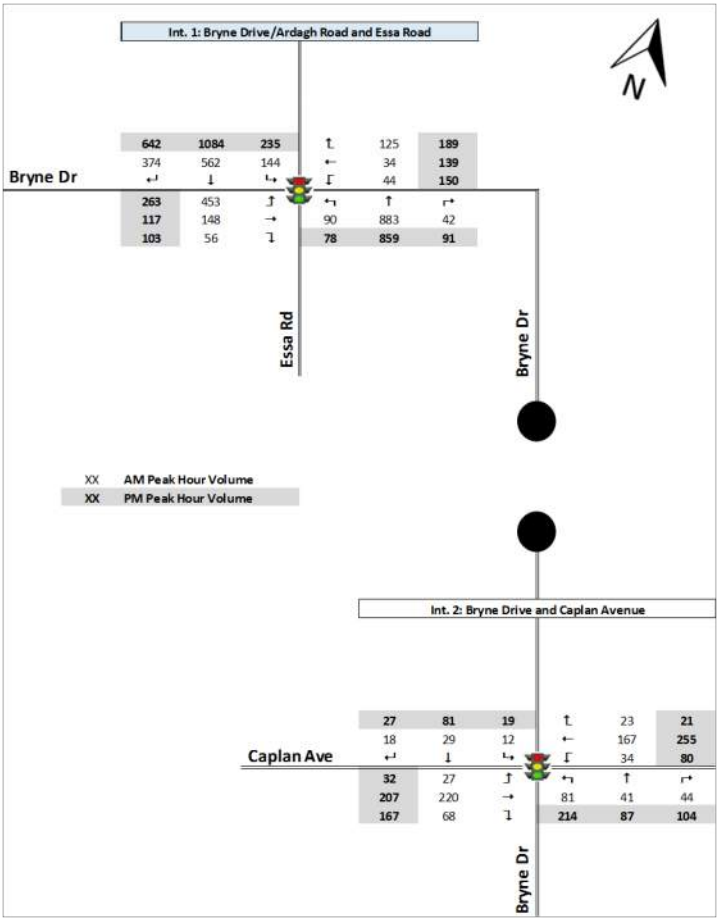


Figure 2-5: Bryne Drive – Existing Traffic Volumes

2.1.6 2017 Midblock Analysis

For midblock sections, the quality of service for vehicular traffic was characterized based on the volume-to-capacity (v/c) ratio for each road section. The v/c ratio provides a measure of traffic volume demand to available capacity, with an at-capacity condition represented by a v/c ratio of 1.00 (i.e., volume demand equals theoretical capacity). For this planning level analysis, a **v/c ratio of 0.85 or less was deemed an acceptable level of operation** for midblock locations. The City of Barrie's Urban Design Manual (Revised October 2014)

indicates that road segments with v/c ratios exceeding this threshold should be considered as candidates for remedial action.

The midblock v/c ratios were calculated by dividing the traffic link volume by the theoretical capacity for the subject link (i.e., the maximum hourly flow rate at which vehicles can be expected to traverse the section of roadway within a given time period under prevailing roadway, traffic and control conditions). A theoretical lane capacity based on the adjusted road classification in the MMATMP[1] was used in the analysis.

2.1.6.1 *Harvie Road*

Harvie Road, is designated as a two-lane Arterial Road[2], with an adjusted lane capacity of 750 vehicle-per-hour.

Table 2-1 below shows the AM and PM peak direction midblock volumes and volume-to-capacity (v/c) ratios for traffic, on key roads based on the available 2017 midblock and intersection traffic counts. The results indicate that there is sufficient capacity along Harvie Road to accommodate existing traffic demand.

Table 2-1: Existing Conditions Midblock Capacity Analysis – Harvie Road

Section	AM Peak Direction Volume (vph)	AM Volume-to-Capacity Ratio (v/c)	PM Peak Direction Volume (Vph)	PM Volume-to-Capacity Ratio (v/c)
Harvie Road (750 vph/l)				
Essa Road to Veterans Drive	45	0.06	54	0.07
Veterans Drive to Thrushwood Drive	113	0.15	84	0.11

2.1.6.2 *Essa Road*

Essa Road, is designated as a two-lane Arterial Road[3], with an adjusted lane capacity of 750 vehicles-per-hour.

Table 2-2 shows the AM and PM peak direction midblock volumes and volume-to-capacity (v/c) ratios for traffic on key roads based on the available 2017 midblock and intersection traffic counts. The results indicate that there is sufficient capacity along Essa Road to accommodate existing traffic demand with one basic travel lane in each direction.

[1] *City of Barrie Multi-modal Active Transportation Master Plan, Appendix H - Table 1-3.*
[2] *City of Barrie Multi-modal Active Transportation Master Plan, Figure 2-1 Roadways Classification Existing 2011.*
[3] *City of Barrie Multi-modal Active Transportation Master Plan, Figure 2-1 Roadways Classification Existing 2011.*

Table 2-2: Existing Conditions Midblock Capacity Analysis – Essa Road

Section	AM Peak Direction Volume (vph)	AM Volume-to-Capacity Ratio (v/c)	PM Peak Direction Volume (vph)	PM Volume-to-Capacity Ratio (v/c)
Essa Road (750 vph/l)				
Coughlin Road to Mapleview Drive	370	0.49	575	0.77

2.1.6.3 Bryne Drive

A midblock analysis was not considered under existing conditions because Bryne Drive is discontinuous from south of Essa Road to north of Caplan Avenue in 2017.

2.1.7 2017 Intersection Operational Analysis

A capacity and level of service analysis was completed for the signalized intersections within the Study Area using Synchro 9 traffic analysis software, which implements methodologies defined in the Highway Capacity Manual (HCM). The Synchro network was developed specifically for this study and further refined through the analysis. The City of Barrie Synchro Guidelines for using Synchro and SimTraffic software were followed in conducting the traffic analysis.

Capacity is assessed based on the volume-to-capacity (v/c) ratio, which is the ratio of demand flow rate to the available capacity at the intersection. The v/c ratio provides an estimate of capacity utilization based on the specific geometry and traffic control at an intersection. A v/c ratio equal to or greater than 1.0 indicates an approach that is operating above capacity and with long vehicle delays.

Operations are defined by the concept of level of service (LOS). LOS is a key measure of effectiveness for both signalized and unsignalized intersections and is based on the average stopped delay per vehicle. It is a qualitative measure of the ability of the intersection to accommodate traffic volumes and is measured as the average delay per vehicle, in seconds. It is a qualitative measure of the ability of the intersection to accommodate traffic volumes. For signalized intersections, the tabulated LOS is for the intersection as a whole. For unsignalized intersections, the tabulated LOS is for the most critical movement. The LOS criteria as defined in the HCM for each type of intersection control is summarized in Table 2-3.

A Level of Service lower than LOS of D and a Volume-to-Capacity (v/c) ratio higher than 0.85 were used to identify critical movements. Critical movements are those that are defined to be at or below the level for which operations are deemed to be satisfactory from a planning perspective and would normally be indicative of a traffic problem that needs attention.

Table 2-3: Intersection Level of Service Criteria for Automobile Mode

Level of Service	Average Control Delay per Vehicle (s/veh)	Average Control Delay per Vehicle (s/veh)
	Signalized Intersections	Unsignalized Intersections
A (Free Flow)	=< 10	=< 10
B	> 10 - 20	> 10 – 15
C	> 20 - 35	> 15 – 25
D	> 35 - 55	> 25 – 35
E (Capacity)	> 55 - 80	> 35 – 50
F (Forced Flow)	> 80	> 50

2.1.7.1 *Harvie Road*

Under existing conditions, all intersections are operating at acceptable levels of service on an overall basis, and only two problematic movements were identified at the intersection of Harvie Road and Veterans Drive, and during the afternoon peak hour:

- The eastbound left-turn movement, along Harvie Road, operates at LOS F with an average delay of approximately 54 second; and
- The westbound left-turn movement, along Harvie Road, operates at LOS F with an average delay of approximately 67 seconds.

These levels of operation are due to the high volumes of northbound and southbound traffic along Veterans Drive that limit available gaps for vehicles turning left from Harvie Road to Veterans Drive.

2.1.7.2 *Essa Road*

Under existing conditions, both intersections operate at acceptable levels on an overall basis during the peak hours. All turning movements at the two intersections operate at LOS D or better, with low delays and minimal queuing.

2.1.7.3 *Bryne Drive*

Under existing conditions, the intersections operate at acceptable levels on an overall basis, with low delays and LOS C in both peak hours. The intersections operate within effective capacity; only the intersection of Bryne Drive and Essa Road operate at a v/c ratio above 0.85 in the AM peak hour. The following intersection movements were also found to be close to effective capacity:

1. The eastbound left (EBL) turn movement at the intersection of Bryne Drive / Ardagh Roadtha and Essa Road operates with a v/c ratio of 0.93, with queues extending to 122m in the AM peak hour. The intersection of Ardagh Road/Essa Road with Morrow Road is located approximately 95m west of the intersection of Bryne Drive and Essa Road and may be blocked by the EBL queueing during the AM peak hour. The high volumes of EBL movements in the AM peak hour are likely due to traffic traveling to the Highway 400 interchange located just north of the Study Area.
2. The southbound through (SBT) movement at the intersection of Bryne Drive / Ardagh Road and Essa Road operates with a v/c ratio of 0.96 with queues extending to 149m in the PM peak hour. The high volumes of SBT movements in the PM peak hour are likely due to traffic accessing Essa Road from the Highway 400 interchange located just north of the Study Area.
3. The eastbound shared through-right (EBTR) movement at the intersection of Bryne Drive and Caplan Avenue operates with a v/c ratio of 0.90 with queues extending to 102m in the PM peak hour. This can be attributed to high right turn volumes in the PM peak hour using the shared lane to access Mapleview Drive, and subsequently the Highway 400 interchange located just south of the Study Area.

2.2 Future Transportation and Traffic Operations – Harvie Road

2.2.1 Traffic Forecast

The future transportation operations were assessed using forecast traffic volumes for the 2021 and 2031 planning horizons. The City provided forecast traffic volumes for the 2021 and 2031 horizon years. These forecasts included the following infrastructure improvements as recommended in the MMATMP:

- The Harvie Road crossing of Highway 400 to complete the connection between Harvie Road and Big Bay Point Road;
- The Harvie Road/ Big Bay Point Road partial interchange with Highway 400; and
- The extension of Bryne Drive from its current terminus south of Essa Road to Coughlin Avenue.

For the 2021 horizon year, it was assumed that the partial interchange at Highway 400 and Harvie Road will not yet have been constructed. For the new intersection of Harvie Road and Bryne Drive, the traffic volume forecasts prepared as part of the Harvie/Big Bay Point crossing project were used in the traffic analysis, rather than the EMME model forecasts.

As highlighted in the traffic study for the Harvie/Big Bay Point Crossing[4], adjustments were made to reflect anticipated travel patterns without the interchange in place.

[4] City of Barrie – Harvie/Big Bay Point Crossing – New crossing of Highway 400 – Study is currently in detailed design.

For the 2031 horizon year, the higher traffic volumes from the Harvie/Big Bay Point crossing project (which included the interchange in the 2031 forecasts) were compared to the City's EMME model and found to be higher. The higher volumes were used for consistency with the neighbouring project.

2.2.2 Future Midblock Analysis

2021 Midblock Analysis

For the analysis of midblock capacity for the 2021 horizon, it is assumed that Harvie Road will remain as a two-lane arterial road. In the 2021 horizon year, based on the forecasted traffic volumes without an interchange at Highway 400 and Harvie Road, it is expected that Harvie Road from Essa Road to Bryne Drive will operate within effective capacity, having reached the 0.85 volume-to-capacity threshold for acceptable operations during the PM peak hour.

A widening of Harvie Road between Essa Road and the future Bryne Drive to two through lanes with a centre turning lane will likely be needed to accommodate provision of separate left turn lanes and approach tapers at key intersections due to the closely spaced intersections. This widening also provides opportunities to improve access to the adjacent properties in these sections

2031 Midblock Analysis – Without Roadway Widening

For 2031, with the interchange in place, and with Harvie Road remaining as a two-lane arterial road, it is expected that Harvie Road, from Veterans Drive to Bryne Drive will exceed effective capacity.

2031 Midblock Analysis – With Roadway Widening

For the 2031, with the interchange in place, it is assumed that Harvie Road remains as an arterial road with the following widened cross sections:

- Three lanes from Essa Road to Veterans Drive; and
- Five lanes from Veterans Drive to Bryne Drive.

By the 2031 horizon year, based on the forecasted traffic volumes and road widening improvements, it is expected that Harvie Road, from Essa Road to Bryne Drive will be operating within effective capacity. The midblock section between Essa Road and Veterans Drive in the PM peak hour is expected to be operating at 0.90, which is over the City's acceptable threshold. However, no further widening of Harvie Road in this section has been identified in the MMATMP beyond 2031.

2.2.3 Future Intersection Operations

As part of the future operations analysis the road intersections were analyzed based on the forecasted traffic volumes for the horizon years 2021 and 2031. The analysis focused on a 'Base' scenario for each horizon year that evaluates the operations of the existing road network, with approved improvements in place. In 2021 it was assumed that there will be no

interchange with Highway 400. In 2031 it was assumed that the partial interchange with Highway 400 will be in place for the base scenario. A subsequent analysis was then completed that identified improvements to the approved road network required to accommodate the forecast volumes. This is referred to in the following discussion as the 'Improved' scenario for its respective horizon year.

The Synchro models were optimized and a peak hour factor of 1.00 applied to all movements and a 1,900 v/h/l saturation flow rate used according to the City of Barrie guidelines.

Lane configurations and the need for auxiliary lanes at signalized intersections were identified on the basis of the operational assessment of the 2021 and 2031 traffic and network conditions.

2021 Intersection Analysis – 'Base' Scenario without Interchange
For the 2021 'Base' scenario, the following lane configuration was considered:

- Harvie Road and Essa Road intersection – same as existing;
- Harvie Road and Veterans Drive intersection – same as existing;
- Harvie Road and Thrushwood Drive intersection – same as existing; and
- Harvie Road and Bryne Drive intersection – new signalized intersection.
    - North and south approaches – two through lanes, and dedicated turning lanes
    - East approach – one through lane and dedicated turning lanes
    - West approach – one dedicated left-turn lane, one through lane, one shared through and right-turn lane

With the additional traffic added to Harvie Road, the unsignalized intersection of Harvie Road and Veterans Drive is expected to experience severe operational problems in both the AM and PM peak hours. Stop-controlled eastbound and westbound movements along Harvie Road are expected to operate at LOS of F, with high delays and queuing that exceeds the calculation threshold of Synchro. This is due to high volumes travelling in the north-south direction leaving few gaps for turning movements from the side streets. To improve operations at this intersection, signalization was considered.

The remaining intersections are expected to operate at acceptable LOS and capacity.

2021 Intersection Analysis – With Improvements
The results of the 2021 Scenario include the following improvements to the intersection of Harvie Road and Veterans Drive:

- Installation of traffic signal;
- Dedicated eastbound right-turn lane.

The analysis indicates that with the installation of traffic signals and assumed cycle length of 110 seconds, and the other improvements listed above, the intersection is expected to operate at LOS A, well within capacity.

A signal warrant analysis was completed for the intersection of Harvie Road and Veterans Drive based on projected 2021 volumes and it was found to be justified based on minimum vehicle volume. When this justification is met, installation of a traffic signal is warranted to minimize total average vehicle delay at the intersection. A signal warrant analysis was also completed for the intersection of Harvie Road and Thrushwood Drive. It was determined that a traffic signal is not warranted at this intersection.

2031 Intersection Analysis - Scenario with Interchange
For the 2031 'Base' scenario, the following lane configuration was considered:

1. Three lanes on Harvie Road, from Essa Road to Veterans Drive:
    a. One through lane eastbound;
    b. One through lane westbound; and
    c. Centre TWLTL.
2. Five lanes on Harvie Road, from Veterans Drive to Bryne Drive:
    a. Two through lanes eastbound;
    b. Two through lanes westbound; and
    c. Centre TWLTL.
3. Harvie Road and Essa Road intersection – existing signals
4. Harvie Road and Veterans Drive intersection – signalized
    a. To transition Harvie Road eastbound from a single lane west of Veterans Drive to two lanes east of Veterans Drive, the minimum requirement is approximately 150m (approx. 75m storage length, and 70m taper length);
5. Harvie Road and Thrushwood Drive intersection – remains stop-controlled, with dedicated westbound left-turn lane.
6. Harvie Road and Bryne Drive intersection – New signalized intersection.
    a. Two through lanes, and dedicated turning lanes for all approaches.

With the additional traffic added to Harvie Road in 2031, all intersections except for the intersection of Harvie Road and Essa Road are expected to operate at acceptable LOS C or better. The Harvie Road and Essa Road intersection operates at LOS C during the AM peak

hour and LOS E during the PM peak hour. There is one problematic movement within the Study Area:

- The westbound left turn movement along Harvie Road operates at LOS E with a 69 second delay during the morning peak hour and a LOS F with a 191 second delay during the afternoon peak hour.

These levels of operation are due to the high volume for the westbound left turn movement, as well as the high volume for the eastbound through movement leaving few gaps for the left turn maneuver. Since the movement is at capacity, optimizing signal timing at the Harvie Road and Essa Road intersection was considered.

2.2.3.1 2031 Intersection Analysis – With Improvements

Based on the following improvements for the intersection of Harvie Road and Essa Road:

1. Increased cycle length to 110 seconds;
2. Added westbound advanced left-turn movement;
3. Optimized traffic signal phase timing.

With the proposed improvements, the intersection at Harvie Road and Essa Road is expected to operate at acceptable LOS C, well within capacity.

The intersection of Harvie Road and Bryne Drive is expected to operate at LOS E or better, with several movements operating near or at effective capacity. Under the improved scenario, the unreasonable delay experienced by a single southbound left turn lane is alleviated with dual left turn lanes accommodating over 700 vehicles per hour. Dual left turn lanes in the westbound direction is also included in the improvements for this new intersection.

2.2.4 Queuing Assessment, Storage Lane Requirements

An analysis of storage lane requirements for left and right turning lanes was completed for the intersections. Storage lengths were reviewed and recommended to ensure that they are sufficiently long to accommodate the maximum vehicle queue expected to accumulate during the peak periods of the 2031 design year conditions. It is noted that the design of left and right turn auxiliary lanes should also incorporate these storage lengths and sufficient parallel lane and taper lengths to satisfy deceleration length requirements that are in accordance with the design speed selected for the roadway.

2.2.5 Roundabout Feasibility Assessment

Roundabouts were considered as an alternative to all-way stops and traffic signals at the following intersections:

- Harvie Road and Essa Road
- Harvie Road and Veterans Drive

- Harvie Road and Bryne Drive

In determining where roundabouts should be implemented, consideration was given to locations with low volumes of pedestrians and cyclists, proximity of structures, traffic control, and adjacent land uses.

Geometric constraints were also considered to ensure that there are no steep grades, drainage issues and sight distance restrictions that could impede the installation of a roundabout. In order to determine the feasibility of the construction of roundabouts at these locations an assessment was completed for these two locations.

2.2.5.1 Harvie Road at Essa Road

This skewed intersection is currently under traffic signal control and converting the intersection into a roundabout is an option to improve the skewed alignment of the intersection.

The operations analysis for a roundabout show that the intersection is expected to perform at LOS A with short delays and queue lengths under both the 2021 and 2031 horizon years.

Historical collision data provided by the City identified that there were 15 collisions reported at the intersection of Harvie Road and Essa Road between 2012 and 2016. Of the 15 collisions, two were non-fatal injury, one was property damage only (PDO) and the remaining 12 were reported as unknown–assumed to be PDO.

All collisions occurred under daylight conditions, during or between the morning and afternoon peak periods.

Converting intersections from stop or signal control to roundabouts can result in a 38% reduction for all crashes; 76% reduction for injury crashes and 89% reduction in fatal and incapacitating injury crashes. In addition, there is a potential monetary benefit from reducing collisions at the intersection by installing a roundabout.

Based on a balanced evaluation of the criteria listed above, provision of a roundabout at the intersection of Harvie Road and Essa Road is considered to be feasible and more preferred to the existing traffic signal control intersection. However, with the recent reconstruction of the intersection, it would not be practical to convert it into a roundabout. The City should consider property requirements to accommodate future implementation of a roundabout at the intersection of Harvie Road and Essa Road. Further design studies should be undertaken to refine the impacts of the roundabout footprint and property requirements.

2.2.5.2 Harvie Road and Veterans Drive

The intersection is currently stop-controlled and is warranted for signalization by the 2021 horizon year.

Roundabout capacity and LOS analyses were completed for the projected 2021 and 2031 horizon year traffic demand. The analysis shows that the intersection is expected to perform at LOS A, with short delays and queue lengths under both the 2021 and 2031 horizon years.

Based on a review of historical collision data provided by the City, there were 4 collisions reported at the intersection of Harvie Road and Veterans Drive between 2012 and 2016. Of the four collisions, two were property damage only (PDO), one reported as 'Other' and one unknown (assumed to be PDO). Two of the collisions occurred during daylight conditions, and the other two during dusk.

Given the low frequency and severity of collisions reported at this intersection, the installation of a roundabout is expected to provide marginal benefits.

Based on the evaluation, the provision of a roundabout at the intersection of Harvie Road and Veterans Drive is not preferable to traffic signal control. There are no operational improvements, and major impacts to existing adjacent residential properties are expected.

2.2.5.3 Harvie Road and Bryne Drive

A new intersection of Harvie Road and Bryne Drive is expected to be built in 2021 as a result of the proposed 5-lane extension of Bryne Drive and the completion of a crossing over Highway 400 to connect Harvie Road and Big Bay Point Road. The Harvie/ Big Bay Point crossing project considered roundabouts as an alternative to conventional traffic signals at this new intersection.

In order to identify if the new intersection of Harvie Road and Bryne Drive will be a suitable location for installing a two-lane roundabout, a feasibility assessment was done for traffic volumes projected to 2021, and to 2031 based on previous studies. The 2031 horizon year was investigated under two conditions – with and without the implementation of a partial interchange between Highway 400 and Harvie Road. For the purposes of the current study, it was assumed that an interchange will be built in 2031.

The analysis shows that the intersection is expected to perform at an overall LOS C in 2021, with short delays and queues. However, in 2031, the intersection is expected to operate at unacceptable LOS F during the PM peak hour. There will be high delays and long queues at the roundabout when the interchange is in place, especially since the heavy through movements on the crossing and at the east-west approaches of the roundabout will contribute to the poor levels of service for the north-south approaches.

Based on a balanced evaluation of the criteria listed above, installation of a roundabout at the intersection of Harvie Road and Bryne Drive is **less preferable** to a conventional signalized intersection. A roundabout will not be operationally feasible in 2031 due to the high traffic volume expected on Harvie Road when the proposed partial interchange at Highway 400 is in place.

2.3 Future Transportation and Traffic Operations – Essa Road

2.3.1 Traffic Forecast

The future transportation operations were assessed using forecast traffic volumes for 2021 and 2031.

2.3.1.1 Background Traffic Growth

The City of Barrie provided EMME model outputs of forecast traffic volumes for 2016 and the 2021 and 2031 horizon years which include the Harvie Road and Bryne Drive infrastructure improvements. The volumes from the EMME model outputs along the section of Essa Road were found to be lower than the forecasts based on a 2% per annum growth rate applied to existing traffic data collected by the City in 2015 and 2017. Based on discussions with the City, the typical background growth rate in the vicinity was assumed to be 2%. The average growth rates between 2016 EMME forecasts to 2021 and 2031 were found to be 1.7% and 1.6%, respectively, which are close to the assumed 2% growth rate of background traffic. As such, traffic volumes at the existing intersections of Essa Road with Coughlin Road and Mapleview Drive were increased using the 2% growth rate to 2021 and 2031.

2.3.1.2 Messa Village Development

Messa Village is a proposed mixed-use development in the northeast quadrant of the intersection of Mapleview Drive and Essa Road, slated for full-build out in 2019. There will be four access points, including two full accesses along Mapleview Drive, east of Essa Road; one right-in; right-out access on Essa Road and one full access on Essa Road, approximately 365m north of the Mapleview Drive intersection. The proposed development will feature a number of residential and commercial land uses, including office and retail. The number of vehicle trips is expected to be generated by the development. For the purposes of completing the capacity and operations analysis along Essa Road for the weekday PM peak hour, the additional site-generated trips at the intersection of Mapleview Drive and Essa Road were extracted from the report and added to the background traffic in 2021 and 2031. For the weekday AM peak hour, trips were generated using trip rates from the ITE Trip Generation Manual, and assigned based on the proportions by which trips in the Saturday peak hour were assigned in the Messa Village report.

This application is active and still subject to final approvals by the City of Barrie.

2.3.2 Future Midblock Analysis

2.3.2.1 2021 Midblock Analysis

Without Roadway Widening

Assuming that Essa Road will remain as a two-lane arterial road in 2021, the results of the midblock capacity analysis under the 2021 forecast traffic condition show that it is expected that Essa Road between Coughlin Road and Mapleview Drive will operate at effective capacity in the PM peak hour.

Widening to 3-lanes

With a widening of Essa Road to three lanes (one through traffic lane and one two-way left turn lane) between Coughlin Road and Mapleview Drive, as identified in the MMATMP, it is expected that under the 2021 forecast traffic conditions, the road will operate within an effective capacity. However, in the PM Peak Hour, the section will operate at a v/c above 0.85 indicating that further improvement may be needed.

Widening to 5-lanes

The MMATMP identified a 3-lane cross-section for Essa Road, from Mapleton Avenue to Salem Road, as the preferred option for 2031 horizon. However, following the completion of the MMATMP, a number of development proposals have been received for lands along Essa Road. In addition, Essa Road was recently widened to 5 lanes in 2016 between Mapleton Drive and Coughlin Road.

Based on the City's request to re-evaluate the MMATMP's recommendations for Essa Road and to consider the merit of a 5-lane cross-section, a midblock capacity analysis was completed under 2021 forecast traffic conditions. With a 5-lane cross section, Essa Road between Mapleview Drive and Coughlin Road will operate within effective capacity.

2.3.2.2 2031 Midblock Analysis

Without Road Widening

Under 2031 forecast traffic conditions, if Essa Road remains as a two-lane arterial road between Mapleview Drive and Coughlin Road, the midblock section of the road will exceed effective capacity in the PM peak hour.

Widening to 3-lanes

With the preferred 3-lane widening improvements along Essa Road between Coughlin Road and Mapleview Drive as identified in the MMATMP, it is expected that under 2031 forecast traffic conditions, the road will operate at effective capacity in the PM peak hour.

Widening to 5-lanes

Based on the City's request to re-evaluate the MMATMP's recommendations and consider the merit of a 5-lane cross section, a midblock capacity analysis was completed under 2031 forecast traffic conditions. With a 5-lane cross section, Essa Road between Mapleview Drive and Coughlin Road will operate within effective capacity.

2.3.3 Future Intersection Operations

As part of the future operations analysis, intersections were analyzed using the forecasted traffic volumes for the 2021 and 2031 horizon years. The analysis for each horizon year evaluates the operations of the road network with the proposed widening improvements. In the Synchro models for both 2021 and 2031 peak conditions, a 1,900 vehicle per hour lane

saturation flow rate was used in accordance with the City of Barrie Synchro and SimTraffic guidelines, a peak hour factor of 1.00 was applied to all movements in the 2031 horizon year.

Lane configurations and the need for auxiliary lanes at signalized intersections were identified on the basis of the operational assessment of the 2021 and 2031 traffic and network conditions using SimTraffic outputs and based on Transportation Association Canada Geometric Design Guide for Canadian Roads.

2.3.3.1 2021 Intersection Analysis

Without Roadway Widening

For the 2021 scenario, the existing configurations of the signalized intersections of Essa Road at Mapleview Drive and Coughlin Road were analyzed using 2021 forecast traffic volumes. The Messa Village is expected to be complete by 2021 with a full access at Essa Road. This access was analyzed as an unsignalized intersection with stop control on the exit lane from the development. The northbound and southbound movements on Essa Road were assumed to move freely.

The impact of traffic growth to 2021 is expected to be minimal at the intersections of Essa Road with Mapleview Drive and Coughlin Road. Both intersections will continue to operate at acceptable levels on an overall basis during the peak periods. All turning movements at the two intersections will also continue to operate at LOS D or better, with low delays and short queues.

Traffic operation at the unsignalized intersection of Essa Road and Messa Village access is expected to be satisfactory, with low overall delay and v/c ratio, with no turning movement operating worse than at LOS D.

3-Lane Roadway Widening

When Essa Road is widened to 3 lanes, with one lane in each direction and a two-way left-turn lane (TWLTL), the approach lane configurations remain the same at the intersection of Essa Road and Mapleview Drive, and Essa Road and Coughlin Road. Traffic operations show that the addition of the two-way left turn lane is expected to improve the operation of turning movements at the unsignalized intersection of Essa Road with the Messa Village Access. The turning movements at this intersection will operate at LOS C or better.

5-Lane Roadway Widening

Widening of Essa Road to a 5-lane cross section will result in changes in the lane configuration at some approaches of the intersections.

- A southbound through lane will be added at the intersection of Essa Road and Mapleview Drive.

- A lane in each of the northbound and southbound directions will be added at the intersection of Essa Road and the Messa Village access; the center TWLTL will accommodate a southbound left-turn lane with the required storage length.

The addition of a through lane in each direction on Essa Road and a center TWLTL will result in slightly improved traffic operations for through movements at the two signalized intersections of Essa Road with Mapleview Drive and Coughlin Road.

Overall, the intersections will continue to operate at LOS C or better with low delays and v/c ratios. The operations at the unsignalized intersection of Essa Road with Messa Village access will be slightly better under the 5-lane cross section of Essa Road than under both the existing conditions and the 3-lane cross section.

2.3.3.2 2031 Intersection Analysis

Without Roadway Widening

For the 2031 scenario, the existing configurations of the signalized intersections of Essa Road at Mapleview Drive and Coughlin Road were analyzed using 2031 forecast traffic volumes. The unsignalized intersection of Essa Road and the Messa Village Access was also analyzed with stop control on the exit leg from the development.

With 2031 traffic forecasts, the signalized intersections along Essa Road continue to perform at overall LOS C or better with low delays.

The unsignalized intersection at the Messa Village Access will experience some congestion in the PM peak hour, as the westbound movements exiting Messa Village are required to stop, find an acceptable gap in the free-flowing northbound and southbound movements along Essa Road to complete the respective maneuvers. There are higher volumes of north-south traffic on Essa Road in 2031, providing fewer acceptable gaps and causing the WBLR to operate as a critical movement at a LOS E.

3-Lane Roadway Widening

When Essa Road is widened to 3 lanes, the approach lane configurations remain the same at the intersections of Essa Road and Mapleview Drive, and Essa Road and Coughlin Road. Under the 2031 traffic forecasts, the traffic conditions in the study network will continue to be acceptable with all intersections operating at LOS D or better. With the 3-lane cross section, the operations at the intersection of Essa Road and Messa Village Access will be better than under existing road configuration, with turning movements operating at LOS C or better in both peak hours.

5-Lane Roadway Widening

Widening to a 5-lane cross section will result in the changes to the intersection lane configurations as discussed previously. With 2031 traffic forecasts, the study network intersections are expected to operate at LOS C or better and with low overall delays.

2.3.4 Queuing Assessment, Storage Lane Requirements

An analysis of storage lane requirements for left and right turning lanes was completed for the intersections assuming a 5-lane cross section of Essa Road. Storage lengths were reviewed and recommended based on the average of five simulation runs. This is to ensure that the turning lanes are sufficiently long to accommodate vehicle queues expected to accommodate during the peak periods of the 2031 design year conditions. It is noted that the design of left and right turn auxiliary lanes should also incorporate these storage lengths and sufficient parallel lane lengths to satisfy deceleration length requirements that are in accordance with the design speed selected for the roadway.

2.4 Future Transportation Operations – Bryne Drive

2.4.1 Traffic Forecast

The future transportation operations were assessed using forecast traffic volumes for the 2021 and 2031 planning horizons. The City provided EMME model outputs of forecast traffic volumes for the 2021 and 2031 planning years.

2021 Horizon Year

For the 2021 horizon year, it was assumed that the Harvie Road / Big Bay Point Road partial interchange with Highway 400 will not have been constructed yet. For the new intersection of Harvie Road and Bryne Drive, the traffic volume forecasts prepared as part of the Harvie / Big Bay Point crossing project as well as those in Ainley's Bryne Drive EA Study were used in the traffic analysis.

As highlighted in Morrison Hershfield's traffic study for the Harvie / Big Bay Point Crossing, the following adjustments were made to reflect anticipated travel patterns without the interchange in place in 2021:

1. The southbound right turning movements from Highway 400 N-E/W Off-ramp were removed from entering Harvie Road / Big Bay Point Road. This resulted in reduced westbound through movements at the intersection of Harvie Road and Bryne Drive.
2. The northbound left turning movements from Highway 400 S-E/W Off-ramp were removed from entering Harvie Road / Big Bay Point Road. This resulted in reduced westbound through movements at the intersection of Harvie Road and Bryne Drive.
3. The eastbound right turns on the E/W-S On-Ramp were removed by a combined reduction of traffic from the westbound through, northbound right and southbound left turns at the intersection of Harvie Road and Bryne Drive.

Based on discussions with the City of Barrie, the typical background growth rate in the vicinity of the Study Area was assumed to be 2%. The traffic volumes at the existing intersections of Bryne Drive and Essa Road, and Bryne Drive and Caplan Avenue, were grown using the 2% per annum growth rate to 2021. The differences in link volumes on the two segments of Bryne

Drive were adjusted by assuming that some vehicles will access the existing and potential future commercial properties along Bryne Drive during both peak hours.

Ainley's forecasts generally assigned higher traffic volumes on Bryne Drive, as well as higher turning movements onto Harvie Road from Bryne Drive.

2031 Horizon Year

For the 2031 horizon year, the traffic volumes at the new intersection of Bryne Drive and Harvie Road were extracted from the previously completed Harvie / Big Bay Point crossing project (which included the interchange in the 2031 forecasts) and Ainley's Bryne Drive EA.

The traffic volumes at the existing intersections of Bryne Drive / Ardagh Road and Essa Road, and Bryne Drive and Caplan Avenue, were grown using the 2% per annum growth rate to 2031. The differences in link volumes on the two segments of Bryne Drive were adjusted by assuming that some vehicles will access the existing and potential future commercial properties along Bryne Drive during both peak hours.

2.4.2 Future Midblock Analysis

For years 2021 and 2031, with the proposed Bryne Drive extension in place and under projected traffic volumes, the quality of service along midblock sections of the road was characterized on the basis of volume-to-capacity (v/c) ratio for each road section. The v/c ratio provides a measure of traffic volume demand to available capacity, with an at-capacity condition represented by a v/c ratio of 1.00 (i.e., volume demand equals theoretical capacity). For this planning level analysis, a v/c ratio of 0.85 or less was deemed an acceptable level of operation for midblock locations. The City of Barrie's Urban Design Manual indicates that road segments with v/c ratios exceeding this threshold should be considered as candidates for remedial action.

The midblock v/c ratios were calculated by dividing the traffic link volume by the theoretical capacity for the subject link (i.e., the maximum hourly flow rate at which vehicles can be expected to traverse the section of roadway within a given time period under prevailing roadway, traffic and control conditions). A theoretical lane capacity based on adjusted road classification in the MMATMP[5] was used in the analysis.

In the MMATMP, existing Bryne Drive is designated as a Major Collector road[6] and the future extension is proposed to have a 5-lane cross section including a TWLTL with an adjusted lane capacity of 550 vehicles per hour. The analysis in this report also considered a 3-lane cross section of the proposed extension to confirm the required configuration for projected traffic volumes in the future planning horizons.

[5] *City of Barrie Multi-modal Active Transportation Mater Plan, Appendix H - Table 1-3.*
[6] *City of Barrie Multi-modal Active Transportation Mater Plan, Figure 2-1 Roadways Classification Existing 2011.*

2.4.2.1 2021 Midblock Analysis

3-Lane Extension

A 3-lane extension of Bryne Drive between the current termini will result in two road sections along Bryne Drive, including from Essa Road to Harvie Road, and from Harvie Road to Caplan Avenue. In the 2021 horizon year, based on the forecasted traffic volumes, it is expected that Bryne Drive between both Essa Road and Harvie Road, and between Harvie Road and Caplan Avenue will exceed effective capacity in the PM Peak hour with the 3-lane extension.

5-Lane Extension

The MMATMP identified a 5-lane cross section (two through traffic lanes and one TWLTL) for the Bryne Drive extension between the current termini, 680m south of Essa Road and 530m north of Caplan Avenue, as the preferred option for the 2031 horizon. It also recommended widening the existing 3-lane sections to 5 lanes between the intersections of Bryne Drive with Essa Road and Caplan Avenue, and the termini, to maintain consistency with the lane configurations of the existing intersections and the future extension. It should be noted that the MMATMP does not identify any further expansion of Bryne Drive in the Study Area beyond 2031.

In 2021, both sections of Bryne Drive, between Essa Road and Harvie Road, and between Harvie Road and Caplan Avenue, under the projected traffic volumes from Morrison Hershfield's study will operate within effective capacity with a 5-lane cross section. In the critical design hour based on weekday PM traffic forecasts based on Ainley's Bryne Drive EA Study, the stretch of Bryne Drive between Harvie Road and Caplan Avenue will approach effective capacity with a v/c ratio of 0.9.

2.4.2.2 2031 Midblock Analysis

3-Lane Extension

Under 2031 forecast traffic conditions, a 3-lane extension of Bryne Drive between the current termini will result in the midblock sections of the road exceeding effective capacity.

5-Lane Extension

Under the 2031 traffic forecast based on Morrison Hershfield's study, a 5-lane extension of Bryne Drive between the current termini will result in the midblock sections of the road operating within effective capacity. However, the v/c ratio at the midblock section between Harvie Road and Caplan Avenue in the PM peak hour is expected to be 0.92, which exceeds the City's acceptable threshold.

A 5-lane cross section is also found to be insufficient for the midblock traffic projections along Bryne Drive in the critical design hour. However, as noted earlier, the 2031 traffic volume projections by Ainley represent a "worst-case" scenario. Furthermore, no additional widening

of Bryne Drive has been identified in the MMATMP beyond 2031. Under the existing conditions Bryne Drive is designated as a Minor Collector Road. There are limited opportunities to add capacity to Bryne Drive in the Study Area to accommodate the critical design hour volumes, unless this designation is changed to a higher order road, or the road is widened.

2.4.2.3 Future Intersection Operations

As part of the future operations analysis, the intersections were analyzed based on the forecast traffic volumes for the horizon years 2021 and 2031 based on the study by Morrison Hershfield. The intersection operations analysis was also completed for the critical design hour based on the weekday PM Peak hour traffic volumes in Ainley's Bryne Drive EA. The analysis focused on a scenario for each horizon year that evaluated the operations of the existing road network, with the approved improvements in place. In 2021, it is assumed that there will be no interchange with Highway 400. In 2031, it is assumed that the partial interchange with Highway 400 will be in place for the scenario. A subsequent analysis was then completed (where required) that identified improvements to the approved road network to accommodate the forecast volumes. This is referred to in the following discussion as the 'Improved' scenario for its respective horizon year.

The Synchro models were optimized and a peak hour factor of 1.00 was applied to all movements and a 1900 v/h/l saturation flow rate was used in accordance with the City of Barrie Synchro and SimTraffic guidelines.

Lane configurations and the need for auxiliary lanes at signalized intersections were identified based on the operational assessment of the 2021 and 2031 traffic and network conditions using SimTraffic outputs (average of five simulation runs) and based on Transportation Association Canada (TAC) Geometric Design Guide for Canadian Roads (Chapter 2.3).

The extension and widening of Bryne Drive is not expected to impact the existing lane configurations of the intersections at Bryne Drive and Essa Road, and Bryne Drive and Caplan Avenue. However, in both horizon years, there will be a new intersection of Harvie Road and Bryne Drive. The lane configuration of the new intersection in 2021 is assumed to include two through lanes and dedicated left and right turning lanes at the north and south approaches. The east approach will have one through lane with a dedicated left turn and a shared through-right turn lane. The west approach will have one through lane and dedicated left and right turning lanes. For the 2031 scenario, the intersection is assumed to include two through lanes and dedicated left and right turning lanes at each approach.

The two through lanes at the north and south approaches of the intersection are based on the 5-lane cross-section of Bryne Drive as identified by the MMATMP. The continuous TWLTLs are expected to accommodate dedicated left turn lanes at the intersection approaches. The lane configurations at the east and west approaches of the intersection are consistent with the assumptions made for traffic analysis for Harvie Road.

2021 Intersection Analysis

For the 2021 scenario, the existing configurations of the signalized intersections of Bryne Drive at Essa Road and Caplan Avenue were analyzed using 2021 forecast traffic volumes. The new intersection of Bryne Drive and Harvie Road was also analyzed using the revised lane configuration.

Although traffic in the Study Area is assumed to grow at a rate of 2% per annum between 2017 and 2021, the overall traffic operations at the existing intersections of Bryne Drive with Essa Road and Caplan Avenue are expected to improve slightly or remain similar to existing conditions by Morrison Hershfield.

An “Improved” scenario was not considered for the 2021 horizon year as all intersections along Bryne Drive in the study area and the intersection turning movements perform at overall acceptable LOS.

2031 Intersection Analysis

For the 2031 horizon year, the same lane configurations as 2021 were considered at the intersections of Bryne Drive with Essa Road and Caplan Avenue. The Bryne Drive and Harvie Road intersection was updated to reflect the revised configuration. The analysis was completed with 2031 traffic forecasts based on Morrison Hershfield’s study as well as Ainley’s Bryne Drive EA.

Under the 2031 traffic forecasts, the overall operations at intersections in the Study Area are expected to deteriorate from 2021 levels. The critical movements identified in both existing conditions and in the 2021 horizon year will worsen. Overall, the intersections will perform at LOS D or better with acceptable delays in both peak hours; however, the intersection of Bryne Drive with Essa Road is expected to approach effective capacity and operate with a v/c ratio of 0.98 in the AM peak hour and a v/c ratio of 0.92 in the PM peak hour.

A couple of turning movements at the intersections of Bryne Drive with Essa Road and with Caplan Avenue are expected to operate close to or at effective capacity with moderate to high delays. In particular, the eastbound left (EBL) turn movement is expected to operate at effective capacity and at LOS E due to the high volume of left turning vehicles in the AM peak hour being accommodated by a single left turn lane. This also has an impact on the operations of the opposing northbound through (NBT) movement.

At the intersection of Bryne Drive and Caplan Avenue, the eastbound through right movement from the shared lane will operate at LOS E, and experience high delays and longer queues with the forecast traffic volumes in 2031.

2031 Intersection Analysis with Improvements

There is scope for improvements to the intersections along Bryne Drive based on the analysis with the two sets of traffic forecasts. Since the forecasts are inherently different in weighting

the traffic along arterial roads and Highway 400, two sets of adjustments were considered to improve the traffic operations at the Study Area intersections:

Traffic Forecasts based on Morrison Hershfield's Study:

Bryne Drive and Essa Road:

1. Addition of a second eastbound left turn lane
2. Optimization of signal timing splits

Bryne Drive and Caplan Avenue:

1. Increasing signal cycle length to 100 seconds
2. Optimization of signal timing splits

The analysis of traffic conditions in the 2031 horizon year with the improvements listed above indicates that the intersections along Bryne Drive in the Study Area can be expected to operate at acceptable LOS C or better and within capacity. Only one critical movement was identified with the improvements in place. The southbound through movement at the intersection of Bryne Drive and Essa Road is expected to approach its effective capacity (v/c 0.94) but remain operating at LOS D with moderate delay.

Traffic Forecasts based on Ainley's Bryne Drive EA:

Bryne Drive and Essa Road:

1. Increasing signal cycle length to 115 seconds
2. Optimization of signal timing splits

Bryne Drive and Harvie Road:

1. Increasing signal cycle length to 140 seconds
2. Addition of a second southbound left turn lane and westbound left turn lane
3. Optimization of signal timing splits

Bryne Drive and Caplan Avenue:

1. Increasing signal cycle length to 100 seconds
2. Optimization of signal timing splits

The analysis of traffic conditions in the 2031 horizon year with the improvements listed above indicates that the intersections along Bryne Drive in the Study Area will operate at LOS E or better, with several movements still close to or at effective capacity.

At Bryne Drive and Essa Road, the presence of high left turn volumes in several directions, and high through movements continues to cause high delays. While dual left turn lanes in the westbound direction may be provided, there are mostly residential areas to the west of the

intersection along Essa Road and may not be a cost effective solution for the 339 vehicles per hour. Property constraints limit any widening improvements at the intersection of Bryne Drive and Caplan Avenue. However, addition of turning lanes at the intersection of Bryne Drive and Harvie Road is possible. Under the improved scenario, the unreasonable delay experienced by a single southbound left turn lane is alleviated with dual left turn lanes accommodating over 700 vehicles per hour. Dual left turn lanes in the westbound direction is also included in the improvements for this new intersection.

2.4.3 Queuing Assessment, Storage Lane Requirements

An analysis of storage lane requirements for left and right turning lanes was completed for the intersections, assuming that the recommended improvements are made by 2031. Storage lengths were reviewed and recommended based on the average of 5 simulation runs, to ensure that they are sufficiently long to accommodate the maximum vehicle queue expected to accumulate during the peak hours of the 2031 design year conditions.

2.4.4 Roundabout Feasibility Assessment

Roundabouts were considered as alternative to the traffic signal controls at the following intersections:

1. Bryne Drive/ Ardagh Road and Essa Road
2. Bryne Drive and Harvie Road

In determining where roundabouts should be implemented, consideration was given to locations with low volumes of pedestrians and cyclists, proximity of structures and traffic control, and adjacent land uses.

Geometric constraints were considered, and an assessment to determine the feasibility of construction.

2.4.4.1 Bryne Drive/ Ardagh Road at Essa Road

The intersection of Bryne Drive and Essa Road is currently under signal control and may be considered for conversion to a two-lane roundabout, especially to assess any benefits afforded for the closely spaced intersections in maintaining short queue lengths and meeting driver expectations.

Capacity and LOS analysis was completed for the traffic demand projected to the 2021 and 2031 horizon years. The analysis shows that the intersection in 2021 is expected to operate at LOS D during the AM peak hour and LOS F during the PM peak hour. In 2031 the intersection is expected to operate at LOS F during both the AM and PM peak hours. Delays and queues at the roundabout during 2021 and 2031 are expected to be long, therefore a roundabout is not recommended.

2.4.4.2 Bryne Drive and Harvie Road

A new intersection of Bryne Drive and Harvie Road is expected to be built in 2021 as a result of the proposed 5-lane extension of Bryne Drive and the completion of a crossing over Highway 400 to connect Harvie Road and Big Bay Point Road. The Harvie/ Big Bay Point crossing project considered roundabouts as an alternative to conventional traffic signals at this new intersection. Modern roundabouts can offer benefits over conventional traffic signals when placed in the appropriate location with suitable traffic demand, such as improved vehicular safety and traffic flow.

In order to identify if the new intersection of Bryne Drive and Harvie Road will be a suitable location for installing a two-lane roundabout, a feasibility assessment was done for traffic volumes projected to 2021, and to 2031 based on the traffic study by Morrison Hershfield. The 2031 horizon year was investigated under two conditions – with and without the implementation of a partial interchange between Highway 400 and Harvie Road. For the purposes of the current study, it was assumed that an interchange will be built in 2031.

The operational analysis of a roundabout at this location was completed assuming two-lane entries, exits and circulation lanes, and a 50m inscribed circle diameter. The capacity and LOS analysis for the two-lane roundabouts at the study intersections was completed.

The analysis shows that the intersection is expected to perform at an overall LOS C in 2021, with short delays and queues. However, in 2031, the intersection is expected to operate at unacceptable LOS F during the PM peak hour. There will be high delays and long queues at the roundabout when the interchange is in place, especially since the heavy through movements on the crossing and at the east-west approaches of the roundabout will contribute to the poor levels of service for the north-south approaches.

Based on a balanced evaluation of the criteria listed above, installation of a roundabout at the intersection of Bryne Drive and Harvie Road is less preferable to a conventional signalized intersection. A roundabout will not be operationally feasible in 2031 due to the high traffic volume expected on Harvie Road when the proposed partial interchange at Highway 400 is in place.

2.5 Summary

2.5.1 Harvie Road

The traffic analysis indicates that no improvements along Harvie Road are required under existing conditions. Under existing conditions, all intersections are operating at acceptable levels on an overall basis.

In the 2021 planning horizon:

- Harvie Road will have a new intersection at the Bryne Drive extension location, with the following configuration:

- North & South approaches – Two through lanes, and dedicated turning lanes.
- East approach – One through lane, and dedicated turning lanes.
- West approach – One dedicated left-turn lane, one through lane, one shared through and right-turn lane.

- The intersection at Harvie Road and Veteran's Drive should be signalized.
- With the new intersection at Byrne Drive and the signalization of the Veteran's Drive intersection all traffic operations along Harvie Road are expected to be acceptable.

In the 2031 planning horizon:

- To accommodate projected demand, Harvie Road will need to be widened to 3 lanes from Essa Road to Veteran's Drive with one westbound through lane, one eastbound through lanes and one centre two-way left-turn lane. Furthermore, Harvie Road will need to be widened to 5 lanes from Veteran's Drive to Bryne Drive with two eastbound through lanes, two westbound through lanes and a centre two-way left-turn lane.
- A number of intersection improvements are recommended to accommodate the traffic volumes based on the study by Morrison Hershfield as well as the critical design hour represented by the weekday PM traffic forecasts in Ainley's Bryne Drive EA. These include:
  - Harvie Road and Essa Road - increase the signal cycle length to 110 seconds, and include a protected westbound left-turn phase.
  - Harvie Road and Bryne Drive - addition of a second southbound left turn lane and a second westbound left turn lane. Increase the signal cycle length to 140 seconds.
  - Optimization of signal timing splits at all intersections.

The need and timing for the identified improvements should be monitored as traffic volumes increase. Improvements should be implemented on an as-needed basis, particularly when the crossing and partial interchange at Harvie Road / Big Bay Point Road is constructed, due to its impact on induced traffic demand in the Study Area.

2.5.2 Essa Road

The traffic analysis indicates that no improvements along Essa Road within the Study Area corridor are required under existing conditions. In the 2021 planning horizon:

- Widening Essa Road to 5 lanes, with two lanes in each direction and a center TWLTL, is required to support projected traffic volumes, including traffic generated from the development of Messa Village.

- With 5-lane widening, the existing lane configurations and the traffic operations at the intersections of Essa Road with Mapleview Drive and with Coughlin Road will be improved. The new unsignalized intersection of Essa Road with the full access to Messa Village is also expected to operate well with the widened cross section of Essa Road.

In the 2031 planning horizon:

- The 5-lane cross section of Essa Road is sufficient to support projected traffic volumes within the Study Area corridor.
- All Study Area intersections are expected to operate at acceptable levels and no further improvements are needed to accommodate projected demand.

2.5.3 Bryne Drive

The traffic analysis in this report indicates that the extension of Bryne Drive between the current termini south of Essa Road and north of Caplan Avenue requires at least a 5-lane cross section to support projected traffic volumes in both 2021 and 2031. In the critical design hour, the projected volumes in 2031 will be higher than the effective capacity of a 5-lane Major Collector road, but this represents the “worst case” scenario. The traffic volumes in 2021 consider the impacts of the Harvie Road crossing over Highway 400 connecting to Big Bay Point Road. The traffic volumes in 2031 consider the impacts of the potential partial interchange at Harvie Road / Big Bay Point Road with Highway 400.

In 2021, the Bryne Drive extension is recommended to be constructed with two through lanes in each direction and a center two-way left turn lane (TWLTL). A new intersection at Harvie Road and Bryne Drive will be built in 2021 and it is recommended that the intersection be signalized. Although a new two-lane roundabout is feasible in 2021, it will not provide operational benefits in the long term when the construction of the interchange is expected to bring more traffic to the area. The new intersection is recommended to have two through lanes and one left and one right auxiliary turn lane at the north and south approaches. The east approach will include one through lane with a dedicated left turn lane and a shared through right lane. The west approach will include one through lane and one left and one right auxiliary turn lane. No improvements are required at the existing intersections of Bryne Drive with Essa Road and Caplan Avenue in the in 2021 horizon year.

In 2031, the intersection at Harvie Road and Bryne drive will be widened to include two through lanes and one left and one right auxiliary turn lane at each approach. A number of intersection improvements at Bryne Drive and Essa Road, and at Bryne Drive and Caplan Avenue are recommended to accommodate the traffic volumes based on the study by Morrison Hershfield as well as the critical design hour represented by the weekday PM traffic forecasts in Ainley’s Bryne Drive EA. These include:

- Addition of a second southbound left turn lane and a second westbound left turn lane at the intersection of Bryne Drive and Harvie Road.

- Increase in signal cycle length to 115 seconds at the intersection of Bryne Drive and Essa Road, to 100 seconds at the intersection of Bryne Drive and Caplan Avenue, and to 140 seconds at the intersection of Bryne Drive and Harvie Road.
- Optimization of signal timing splits at all intersections.

The need and timing for the identified improvements should be monitored as traffic volumes increase. Improvements should be implemented on an as-needed basis, particularly when the partial interchange at Harvie Road / Big Bay Point Road is constructed, due to its impact on induced traffic demand in the Study Area.

3. Alternative Design Concepts for Preferred Solution

Three alternative design concepts for the preferred solution have been prepared for each of the three roadways within the Study Area, based on recommendations in the MMATMP, background studies, as well as the findings of the existing and future traffic assessment conducted as part of the Phases 3 and 4 of the Class EA Study (See Section 2.0).

3.1 Harvie Road

Harvie Road has been identified as an arterial roadway. Between Essa Road and Veterans Drive, the recommendation in the MMATMP is that the road be widened to three lanes (including two travel lanes and TWLTL or a median). Between Veterans Drive and Bryne Drive, the MMATMP recommends a widening to five lanes to accommodate future development. All three alternatives (in each segment) include the same cross-section and similar treatment, consisting of the following:

Three-Lane cross-section	Five-lane cross-section
• 1 lane in each direction • Two-way left-turn lane (TWLTL) • Buffered bike lanes • Sidewalks	• 2 lanes in each direction • Two-way left-turn lane (TWLTL) • Buffered bike lanes • Sidewalks

Within the three-lane cross-section, the right-of-way was identified to be a 27m ROW, and within the five-lane cross-section the right-of-way was identified to be a 34m ROW. The alternative design concepts included:

- A widening to the north;
- A widening along the centre-line; and
- A widening to the south.

To the east of Bryne Drive, as part of the Harvie Road/Big Bay/Highway 400 project, the cross-section includes a four-lane cross-section, with buffered bike lanes (1.8m) and sidewalks (2m). On the Highway 400 structure, the cross-section includes four lanes plus a median, as well as buffered bike lanes and sidewalks. Further east, after the structure, the cross-section includes four-lanes plus a TWLTL, buffered bike lanes and sidewalks.

3.2 Essa Road

The Essa Road alternatives include four lanes plus a TWLTL or continuous median, as well as 1.5m sidewalk on east side and 3m multi-use trail on west side, within a 30m ROW. The three alternative design concepts included:

- A widening to the west;

- A widening along the centre-line; and
- A widening to the east.

3.3 Bryne Drive

The Bryne Drive alternatives include four lanes plus median or a TWLTL, as well as sidewalks and bike lanes. The three alternative design concepts evaluated included a 34m right-of-way. The intersection of Harvie Road with Bryne Drive had previously been determined through the Bryne Drive Master Plan Update completed in 2016, as well as part of the Harvie Road/Big Bay Point Drive/Hwy 400 EA and Detailed Design. From Caplan Avenue north to Harvie Road, the alignment alternatives cannot be shifted to the west, given the location of the future Stormwater Pond A, nor can the alignments be shifted to the east, given the location of the future Bryne Drive/Harvie Road intersection. However alternative alignments were considered north of Harvie Road, however the basis of the recommendation from the Bryne Drive Master Plan Update study was used as a starting point. Alternative alignments were based on the recommended 3R alignment from the Master Plan Update study, and considered shifts to the west and east as follows:

- A 100m shift to the west;
- Along the proposed centre-line; and
- A 100m shift to the east.

4. Existing Environment

A detailed description of the Study Area corridors has been prepared in order to evaluate the alternative design concepts.

4.1 Natural Environment

A Natural Heritage Report was prepared for each Study Area corridor and they are included in Appendix B. A summary of the findings are included in the section below.

4.1.1 Natural Heritage Policies

4.1.1.1 Provincial Policy Statement

Natural Heritage Policy 2.1 of the Provincial Policy Statement (PPS) (Ministry of Municipal Affairs and Housing (MMAH) 2014) provides direction to regional and local municipalities regarding planning policies for the protection and management of natural heritage features and resources for applications pursuant to the *Planning Act*. The PPS defines seven natural heritage features and provides planning policies for each. The Natural Heritage Reference Manual (MNRF, 2005), is a technical document used to help assess the natural heritage features listed below, in addition to the province's Significant Wildlife Habitat Criteria Schedules for respective Ecoregions (2015):

- significant wetlands;
- significant habitat of endangered and threatened species;
- fish habitat;
- significant woodlands;
- significant valleylands;
- significant ANSIs; and
- significant wildlife habitat.

Each of these features is afforded varying levels of protection subject to guidelines, and in some cases, regulations. Significant Woodlands and valleylands and even wetlands can be designated by municipalities and/or the MNRF (e.g., Ontario Wetland Evaluation System). Fish habitat information can be identified by Conservation Authorities, the MNRF and the Fisheries and Oceans Canada (DFO); however, the management of fish habitat is governed by DFO. Significant wildlife habitat, habitat of endangered and threatened species and ANSIs is designated by MNRF.

Based on a review of available mapping from the MNRF Make a Natural Heritage Mapping Tool (2015a), there are no (PSWs), unevaluated wetlands, within the Study Area for Bryne Drive, Harvie Road, and Essa Road. There are woodlands mapped for Bryne Drive and

Harvie Road – similar to the City of Barrie mapping systems. See Figure 4-1 showing the location of the woodlands near the Bryne Drive and Harvie Road Study Area corridors. There are no ANSIs within the Study Area as mapped by MNRF.

4.1.1.2 Conservation Authority

4.1.1.2.1 Lake Simcoe Region Conservation Authority

Harvie Road and Bryne Drive Study Area corridors are located within the LSRCA. The LSRCA regulates watercourses, wetlands, and hazard lands (valleylands, shorelines, floodplains) through application of Ontario Regulation 179/06, as made under Section 28 of the Conservation Authorities Act. The main purpose of this regulation is to ensure public health and safety and protection of life and property in relation to natural hazards. This regulation establishes guidelines for development, interference with wetlands and alterations to shorelines and watercourses.

A few locations located along the Study Area corridors are regulated by the LSRCA. See Figure 4-2.

4.1.1.2.2 Nottawasaga Valley Conservation Authority

The Essa Road Study Area corridor is located within the NVCA. The NVCA regulates watercourses, wetlands, and hazard lands (valleylands, shorelines, floodplains) through application of Ontario Regulation 172/06, as made under Section 28 of the *Conservation Authorities Act*. The main purpose of this regulation is to ensure public health and safety and protection of life and property in relation to natural hazards. This regulation establishes guidelines for development, interference with wetlands and alterations to shorelines and watercourses.

The Bear Creek watercourse within the Study Area corridor is regulated by NVCA. See Figure 4-2.

4.1.1.3 Provincial Endangered Species Act

Ontario's *Endangered Species Act*, 2007 (ESA) was passed into law in 2007 and came into effect on June 30, 2008. Under the ESA there are more than 200 species in Ontario that are identified as extirpated, endangered, threatened, or of special concern. Section 9 of the ESA generally prohibits the killing or harming of a threatened or endangered species, as well as the destruction of its habitat. Section 10 of the ESA prohibits the damage or destruction of the habitat of all endangered and threatened species.

The MNRF provided a list of SAR that are known to the Study Area corridors. Through consultation with the MNRF, a series of targeted surveys was identified to be required for all three Study Area corridors.

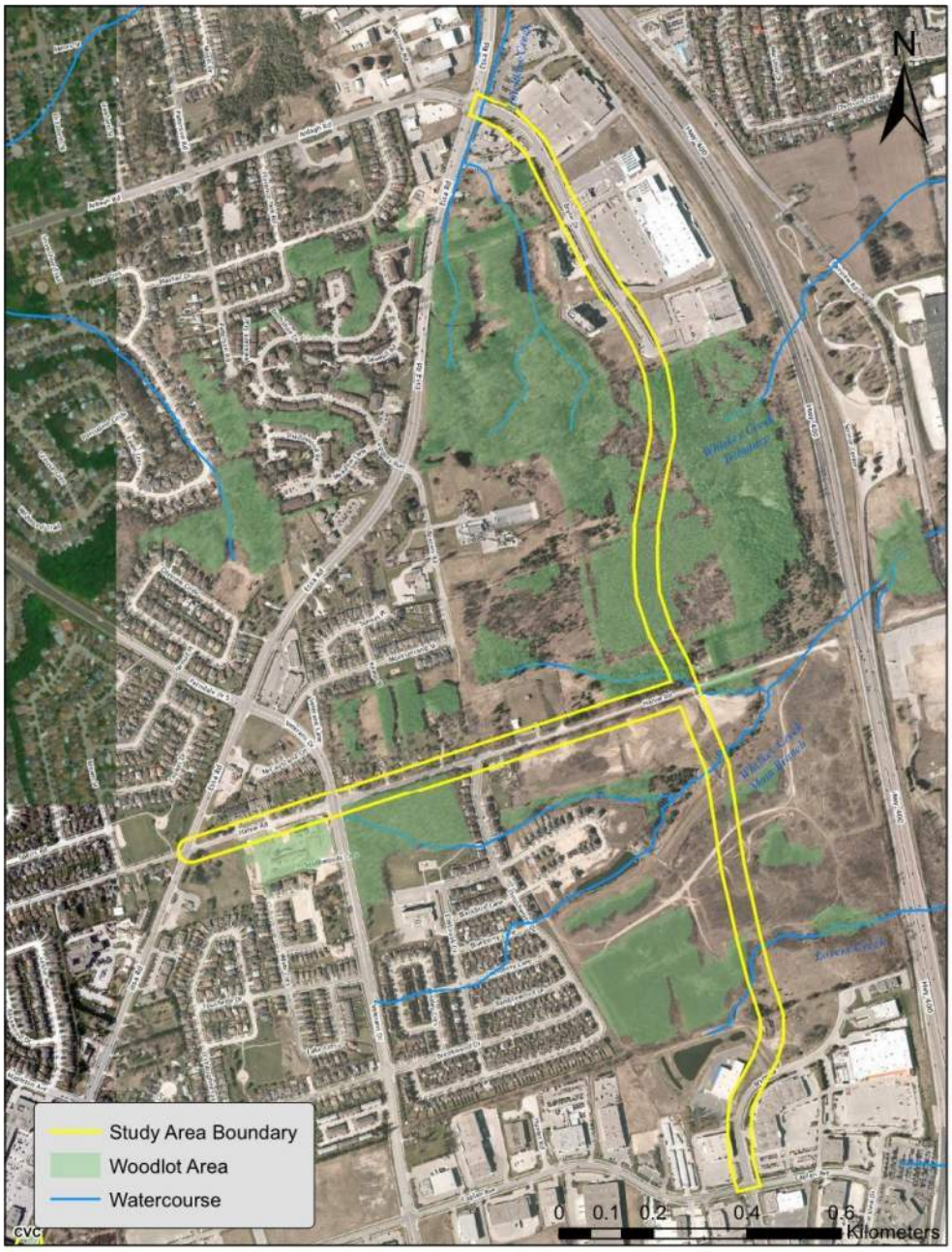


Figure 4-1: Woodlands near Bryne Drive and Harvie Road Study Area

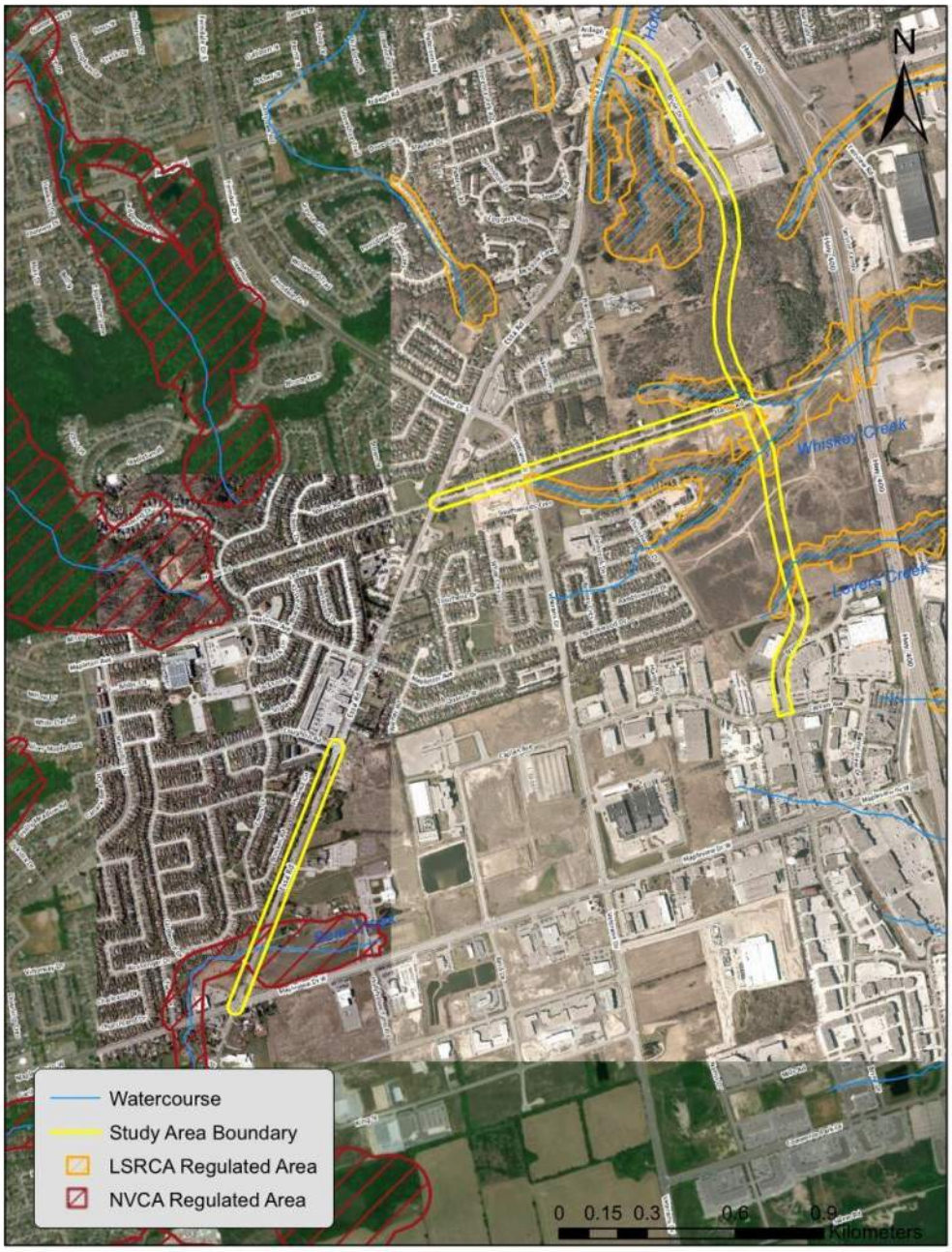


Figure 4-2: Areas regulated by LSRCA and NVCA

4.1.1.4 Federal Fisheries Act

The *Federal Fisheries Act* was established in 1985 with amendments made came into effect on November 25, 2013. This Act provides protection to fish and fish habitat such that:

> "*No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or to fish that support such a fishery*" (Section 35 (1)).

Fish habitat is defined by the Act as "spawning grounds, and any other areas, including nursery, rearing food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes".

If mitigation measures cannot be applied, and residual effects will cause serious harm to fish then a request for review by DFO must be submitted. If DFO identifies that approval for the project is needed, offsetting measures may be required.

4.1.1.5 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) was passed in 1917 and updated in 1994 and 2005. The MBCA protects migratory bird populations by regulating potentially harmful anthropogenic activities. Bird species that are protected are listed under Article I of the MBCA, are native or naturally occurring in Canada, and are species that are known to occur regularly in Canada. The MBCA prohibits harming and/or killing of listed bird species under the MBCA and/or destroying of collecting their eggs, nests or nest shelters.

4.1.2 Topography and Soils

The topography associated with the Study Area is mainly flat with rolling hills. According to the Canadian Land Inventory Soil Class available on the Simcoe County interactive mapping tool (2017), there are three soil classes within the Study Area including Class 1, 2 and 3 Class 1 lands have the highest potential to support agricultural land use, with Class 7 soils being the lowest. According to the Soil Map of Simcoe County, the Study Area is dominantly sandy and gravelly sandy loam with good soil drainage.

Harvie Road

Soils dominantly consists of sandy loam, having stone-free to moderately stoney soil, a grey, calcareous outwash sand and outwash sand underlain by grey calcareous loam or sandy loam till depths. They are of the Podzol and Grey-Brown Podzolic Great Soil Group. Acidity in these areas can range from little to medium acidity.

Essa Road

Soils are described as being stone-free, a pale brown calcareous outwash gravel and outwash sand underlain by grey calcareous loam or sandy loam till depths. These soils are of the Brown Forest Group or Grey-Brown Podzolic Great Soil Group and acidity can be neutral, alkaline and slightly acidic.

Bryne Drive

Soils are predominantly of sandy loam. They are described as having good soil drainage and stone-free to moderately stony soil, a grey, calcareous outwash sand and outwash sand underlain by grey calcareous loam or sandy loam with till depths of 3 feet or less (Hoffman et. Al, 1962). Acidity in these areas can range from little to medium acidity (Hoffman et al., 1962).

4.1.3 Bedrock, Physiography and Geology

Bedrock geology can be classified as a mixture of limestone, dolostone, shale, arkose and sandstone as part of the Lower Ordovician period. This formation is also classified as part of the Peterborough Drumlin Field Physiographic Region and the Till Plains Physiographic Landform. The surficial Geology consists of Ice-contact stratified deposits with sand and gravel, minor silt, clay and till. Till with stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain is also documented.

4.1.4 Fisheries and Fish Habitat

4.1.4.1 Harvie Road

The proposed transportation improvements cross the main and northern branch of Whiskey Creek. Whiskey Creek is approximately 12km in length. Whiskey Creek is classified as coolwater according to the LSRCA. The fish community ranges from coldwater species such as Brook Trout and Mottled Sculpin within its lower reaches to diverse coolwater species including Smallmouth Bass and Rockbass. Although Whiskey Creek supports Brook Trout in areas upstream of Lake Simcoe, indicating coldwater conditions, the majority of the watercourse supports coolwater thermal conditions (LSRCA 2012).

The north branch of Whiskey Creek can be described as a natural channel, originating approximately 450m northwest of the existing Harvie Road culvert. Immediately upstream of Harvie Road, the creek is contained within a well-defined and shaded channel.

The bankfull width ranged from 0.5 to 1.5m with minimal water depths of approximately ten (10) cm. A few small pools had water depths greater than 20cm. Nearing the existing corrugated steel pipe (CSP) culvert, the channel gradient increases, vegetation becomes more prevalent due to the increased sunlight penetration associated with the road clearing, and the substrate becomes coarser as a result of material used during the initial culvert installation. Similar to the upstream end, the downstream end of the culvert contains coarse material creating a series of vertical drops expected to be a barrier to upstream fish movement. The north branch continues approximately 150m before discharging into the main branch south of Harvie Road.

Immediately downstream of the confluence, the main stem of Whiskey Creek has relatively steep banks with varying degrees of shrub species. Where shrubs are void, some areas of erosion currently exist. The majority of the creek is approximately 1.5m wide. Immediately

upstream of the main branch CSP, the creek narrows with coarser substrates. Downstream of the CSP, waters discharge into a small scour pool before continuing through a straight channel with herbaceous banks on both sides leading to Highway 400 to the east.

Immediately east of the Veterans Drive, adjacent to the southern shoulder of Harvie Road, an unknown watercourse exists. The watercourse originates at the intersection via a 30 cm storm-water pipe and traverses parallel to Harvie Road for approximately 100 m before discharging and dissipating into the woodland to the south. Upon entering the southern woodland, the watercourse does not possess any defined channel nor does it convey sufficient water to create wetland conditions, concluding that the watercourse is an ephemeral drainage feature. Given its seasonal character, the fact it originates from a storm-water pipe and does not discharge into any other watercourse, Hatch is of the opinion that it does not meet the definition of fish habitat.

Upstream of the confluence, the northern branch is expected to be an intermittent watercourse with limited fish usage. Downstream of the culvert the northern branch and the main branch of Whiskey Creek are expected to be permanent watercourses potentially supporting limited coldwater fisheries. The high gradient portions are expected to contain a relatively abundant benthic invertebrate community likely contributing to the success of any fish present as well as fish communities further downstream.

As noted above, there is evidence that that Brook Trout are successfully spawning and surviving in sections of Whiskey Creek downstream of the Study Area, which is due to contributions of groundwater that moderate water temperatures (LSRCA, 2012). Flow conditions are permanent from Lackie's Bush downstream to Lake Simcoe, with intermittent and ephemeral conditions occurring upstream of Lackie's Bush as a result of urban influences, stormwater management systems and reduced groundwater contributions.

4.1.4.2 Essa Road

The Essa Road Study Area corridor is located within the Bear Creek Subwatershed of the Nottawasage River. Essa Road transects Bear Creek approximately 200m north of Mapleview Drive. The existing crossing is a box culvert with water extending the entire width. Upstream of Essa Road, Bear Creek is a naturalized drainage channel which was constructed straight. The entire channel possesses emergent vegetation dominated by Broad-leaved Cattails with waters slowly flowing through. The branch of Bear Creek originates approximately 630m upstream of a stormwater management pond with an overflow structure creating a warmwater community. Since the realignment of Bear Creek in 2007 to accommodate the Shoppers Drug Mart, the entire channel has colonized with emergent species similar to upstream conditions. This portion of stream is considered warmwater, while also contributing to a coldwater fishery downstream.

A single forage fish of unknown species was observed within the culvert. Although no fisheries records were available from the NVCA, the watercourse is known to contribute to

downstream coldwater habitat including Brook Trout. Given the lack of pools within Bear Creek, over wintering is thought to be a limiting factor to fish survival. With fish expected to inhabit upstream and documented downstream, the connecting waters of Bear Creek within the Study Area corridor are expected to be considered fish habitat with coldwater timing restrictions as per NVCA's coldwater management strategy.

4.1.4.3 Bryne Drive

The proposed improvements will cross the Main and North Branches of Whiskey Creek, the tributary of Lovers Creek and will be within the Hotchkiss Creek regulated area. Improvements aside from widening will also include upsizing and replacing culverts associated with the Whiskey Creek crossings along Harvie Road and the Lovers Creek crossing. Improvements will also include measures to maintain function of existing culverts associated with Whiskey Creek and Lovers Creek at Highway 400 outside of the proposed alignment.

No fish collection was completed as part of the 2017 field investigations, as data provided and correspondence with the LSRCA identified the thermal regime for Whiskey Creek, Lovers Creek and Hotchkiss Creek as it relates to construction timing windows.

Lovers Creek

Lovers Creek is considered a cool water fishery according to the LSRCA and is known to support Brook Trout in some areas. Lovers Creek is approximately 93km in length draining an area of approximately 60km^2. The unnamed tributary of Lovers Creek that crosses the Study Area corridor is approximately 3.5km in length, originating 200m west of the Bryne Drive extension. Habitat conditions described by LGL Limited (2005) and confirmed by Hatch in 2017, indicate that the section of Lovers Creek within the Study Area corridor does not sustain enough flow to support fish in general. However, it is anticipated that this section does not support downstream fish communities through water contribution and may possess limited seasonal utilization dependent on upstream movement barriers.

Based on field investigations in 2017, as well as previous habitat documents, the section of Lovers Creek within the Study Area corridor is described as a vegetated, define channel approximately 0.5m in width with a bankful width of approximately 2.5m. The channel possesses very little flow. Grasses, sedges and ferns line the banks. Substrates were described as primarily silts and sands consistent with the flow velocities and surrounding land use.

Whiskey Creek

The proposed extension of Bryne Drive crosses the main and northern branch of Whiskey Creek. Whiskey Creek is considered a coolwater fishery according to the LSRCA and is known to support Brook Trout in some areas. Whiskey Creek is approximately 12km in length draining an area of approximately 6km^2.

The Main Branch of Whiskey Creek within the Study Area corridor consists primarily of an existing concrete water control structure with the intake upstream. Whiskey Creek exits the structure approximately halfway through the proposed roadway. The downstream end is grated with concrete baffles installed to dissipate flows. Immediately downstream of the structure, Whiskey Creek is stable with heavily vegetated banks of grasses, sedges and willow species and emergency vegetation within the channel. Installed baffles and instream vegetation effectively dissipate flows, creating a disposition area of sands after which the creek transitions to a relatively long, stable, shaded riffle segment with course rip rap substrates as it exits the Study Area corridor.

Whiskey Creek is a permanent watercourse potentially supporting limited coolwater fisheries. The high gradient portions contain a relatively abundant benthic invertebrate community likely contributing to the success of any present fish, as well as any fish communities further downstream. Fish sampling completed in 2003 and 2005 close to the Study Area corridor did not capture any fish.

The northern branch of Whiskey Creek can be described as a natural channel, originating approximately 450m northwest of the existing Harvie Road culvert. Immediately upstream of Harvie Road, the creek is contained within a well-defined and shaded channel, which is relatively stable, with abundant woody debris and void of shoreline vegetation due to shading from the White Cedar canopy.

The bankfull width ranged from 0.5 to 1.5m with minimal water depths of approximately ten (10) cm. Nearing the existing culvert, the channel gradient increases, the vegetation becomes more prevalent due to the increased sunlight penetration associated with the road clearing, and the substrate becomes coarser as a result of material used during the initial culvert installation. Similar to the upstream end, the downstream end of the culvert contains coarse material creating a series of vertical drops expected to be a barrier to upstream fish movement. The north branch continues approximately 150m before discharging into Whiskey Creek's main branch south of Harvie Road.

The North Branch is expected to be intermittent with limited fish usage. The lack of deep pools to sustain fish life during dry and winter periods combined with the barriers to upstream movement located downstream of the Harvie Road culvert are expected to be the limiting factor. The North Branch is however expected to contribute to downstream fisheries through hydraulic, nutrient and benthic invertebrate production.

There is evidence that that Brook Trout are successfully spawning and surviving in sections of Whiskey Creek downstream of the Study Area corridor, due to contributions of groundwater that moderate water temperatures (LSRCA, 2012).

Hotchkiss Creek

Hotchkiss Creek is enclosed underground within the Study Area corridor, therefore there are no anticipated impacts to the watercourse or fish community. The upstream limits need to be confirmed.

The LSRCA did document fish within Hotchkiss Creek, however, as noted, the section of Hotchkiss Creek within the Study Area corridor was not observed, as it is enclosed underground.

4.1.5 Vegetation and Flora

The Study Areas were documented for existing vegetation communities based on the Ecological Land Classification (ELC) protocol.

Harvie Road

There were three different vegetation community classes identified within the Study Area corridor, including Cultural, Forest and Swamp. Residential landscapes and commercial and institutional landscapes were also observed. The dominant communities were split between cultural and forest. See Figure 4-3 to Figure 4-5. The Communities present include:

- CUM1-1 – Dry-Moist Old Field Meadow Type;
- FOD3-1 – Dry-Fresh Poplar Deciduous Forest Type;
- FODM11 – Naturalized Deciduous Hedge-row Ecosite;
- FOMM4-2 – Dry-Fresh White Cedar – Poplar Mixed Forest Type;
- SWCM1-1 – White Cedar Mineral Coniferous Swamp Type;
- WODM4 – Dry-Fresh Deciduous Woodland Ecosite;
- FOD5 – Dry-Fresh Sugar Maple Deciduous Forest Type;
- CGL-2 – Parkland;
- CVC – Commercial and Institutional;
- CVR-1 – Low Density Residential; and
- CVR-2 – High Density Residential.

Essa Road

There were three different vegetation community classes identified including Cultural, Forest and Marsh. Residential landscapes, commercial and institution landscapes were also observed. The dominant communities were cultural, as to be expected along the road corridor due to the high level of disturbance in this area. See Figure 4-6 and Figure 4-7. The Communities present include:

- CUM1-1 – Dry-Moist Old Field Meadow
- MAMM2-1 – Cattail Graminoid Mineral Meadow Marsh Type;
- FODM4-12 – Dry-Fresh Black Locust Deciduous Forest Type;
- CUW – Cultural Woodland;
- CVC – Commercial and Institutional;
- CVR-2 – High Density Residential; and
- CVR-4 – Rural Property.

Bryne Drive

There were four different vegetation community classes identified within the Study Area corridor including Cultural, Forest, Swamp and Marsh. See Figure 4-8 to Figure 4-11. The dominant communities present include:

- CUM1-1 – Dry-Moist Old Field Meadow Type;
- FOD3-1 – Dry-Fresh Poplar Deciduous Forest Type;
- FODM11 – Naturalized Deciduous Hedge-row Ecosite;
- FOMM4-2 – Dry-Fresh White Cedar – Poplar Mixed Forest Type;
- FODM8-1 – Fresh-Moist Deciduous Forest Type;
- FOMM2-3 – Dry-Fresh White Pine – Harwood Mixed Forest Type;
- SWCM1-1 – White Cedar Mineral Coniferous Swamp Type;
- THDM2 – Dry-Fresh Deciduous Shrub Thicket Ecosite;
- WODM5 – Fresh-Moist Deciduous Woodland Ecosite;
- WODM4 – Dry-Fresh Deciduous Woodland Ecosite;
- FOD5 – Dry-Fresh Sugar Maple Deciduous Forest Type;
- MAMM1-2 – Cattail Graminoid Mineral Meadow Marsh Type;
- OAGM1 – Annual Row Crop; and
- CVC – Commercial and Institutional.

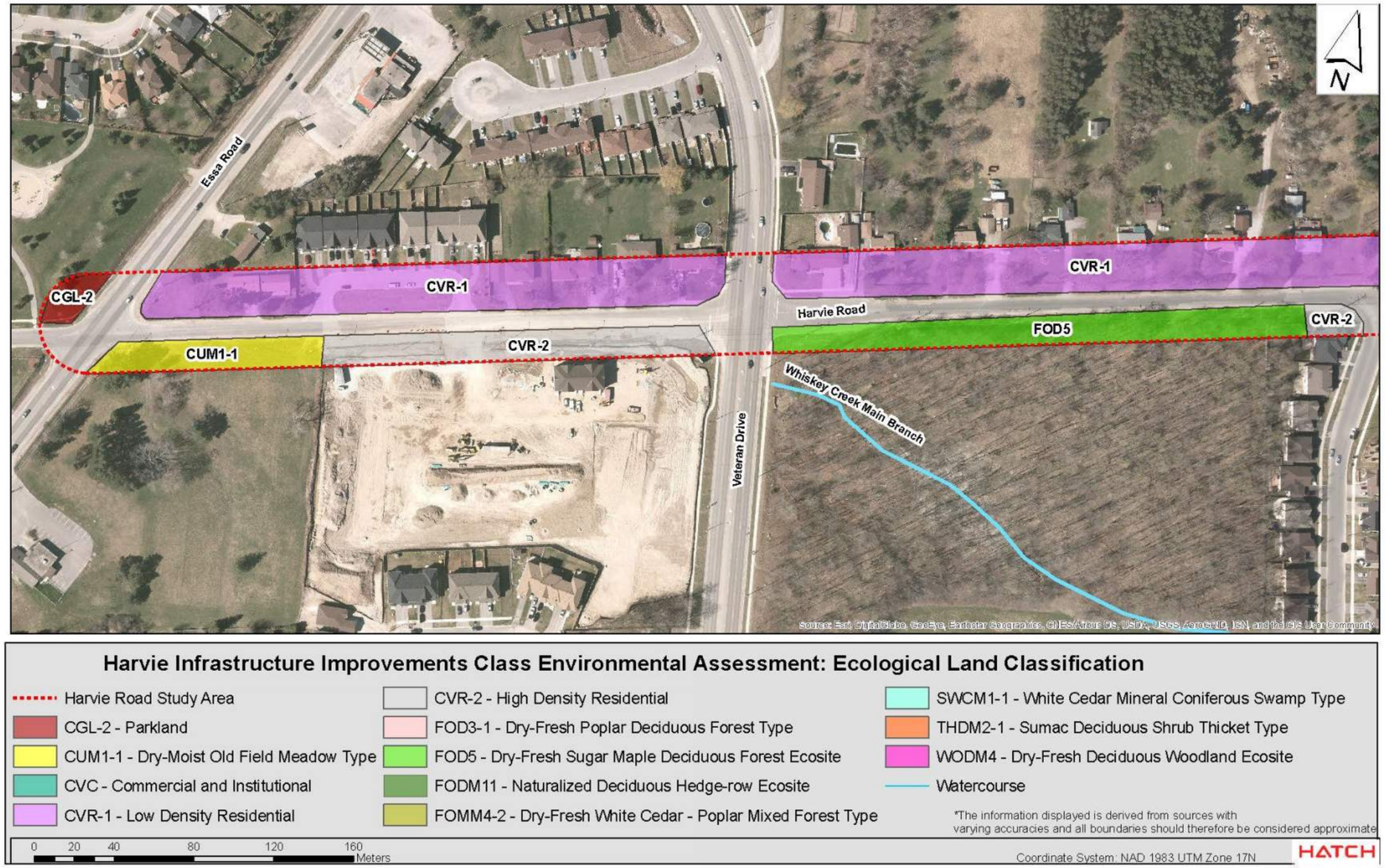


Figure 4-3: Ecological Land Classifications – Harvie Road (Part 1)

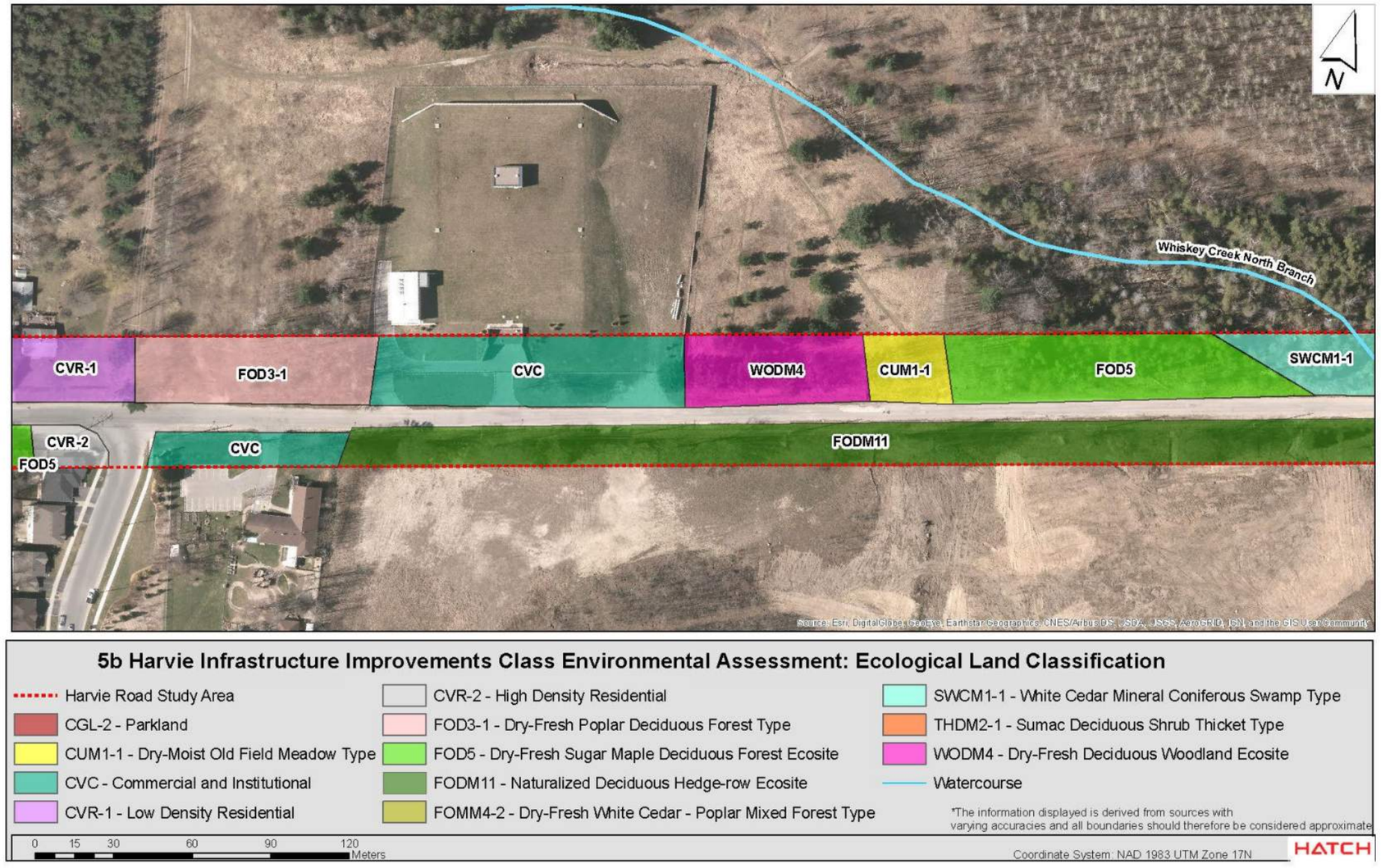


Figure 4-4: Ecological Land Classifications – Harvie Road (Part 2)

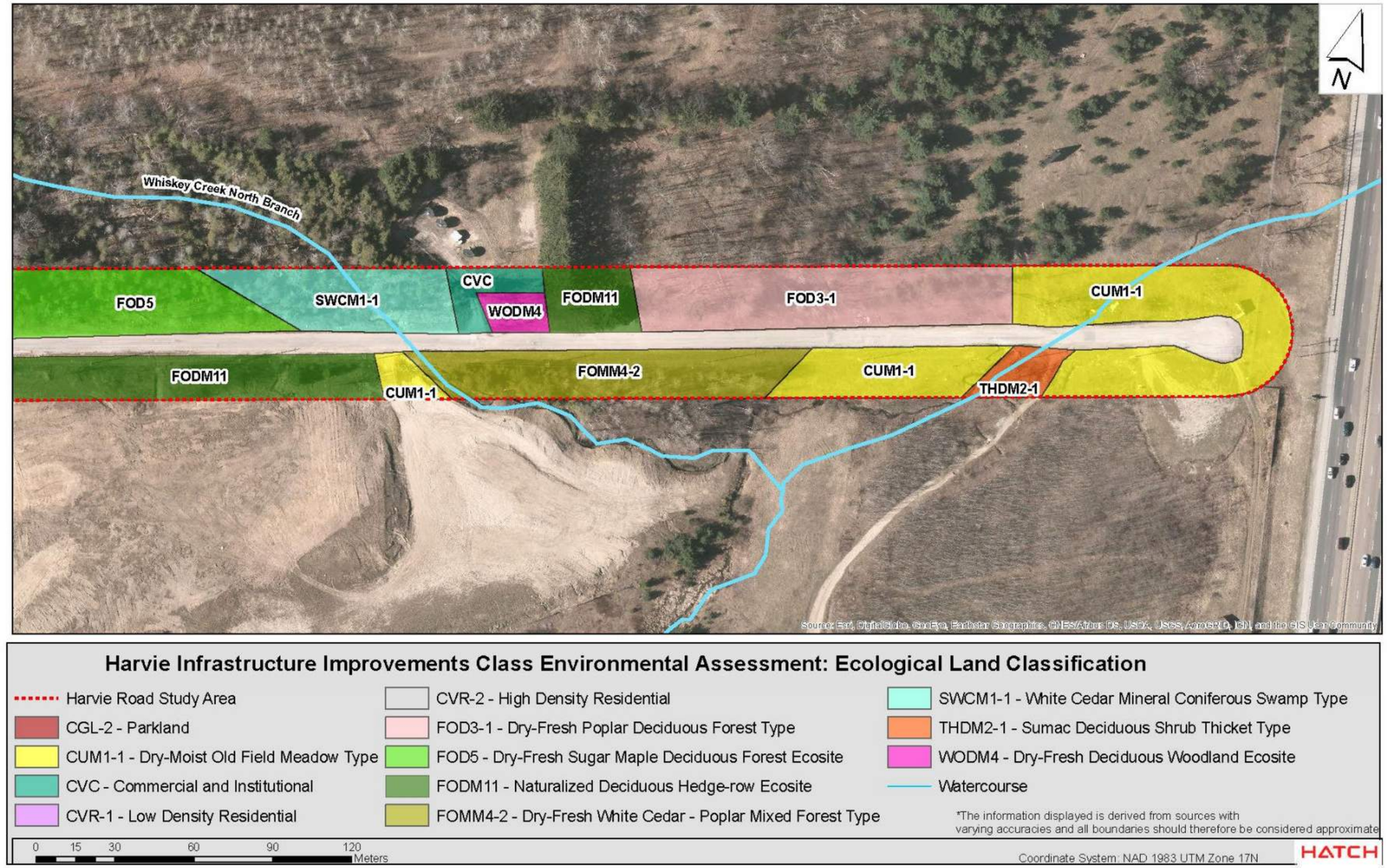


Figure 4-5: Ecological Land Classifications – Harvie Road (Part 3)

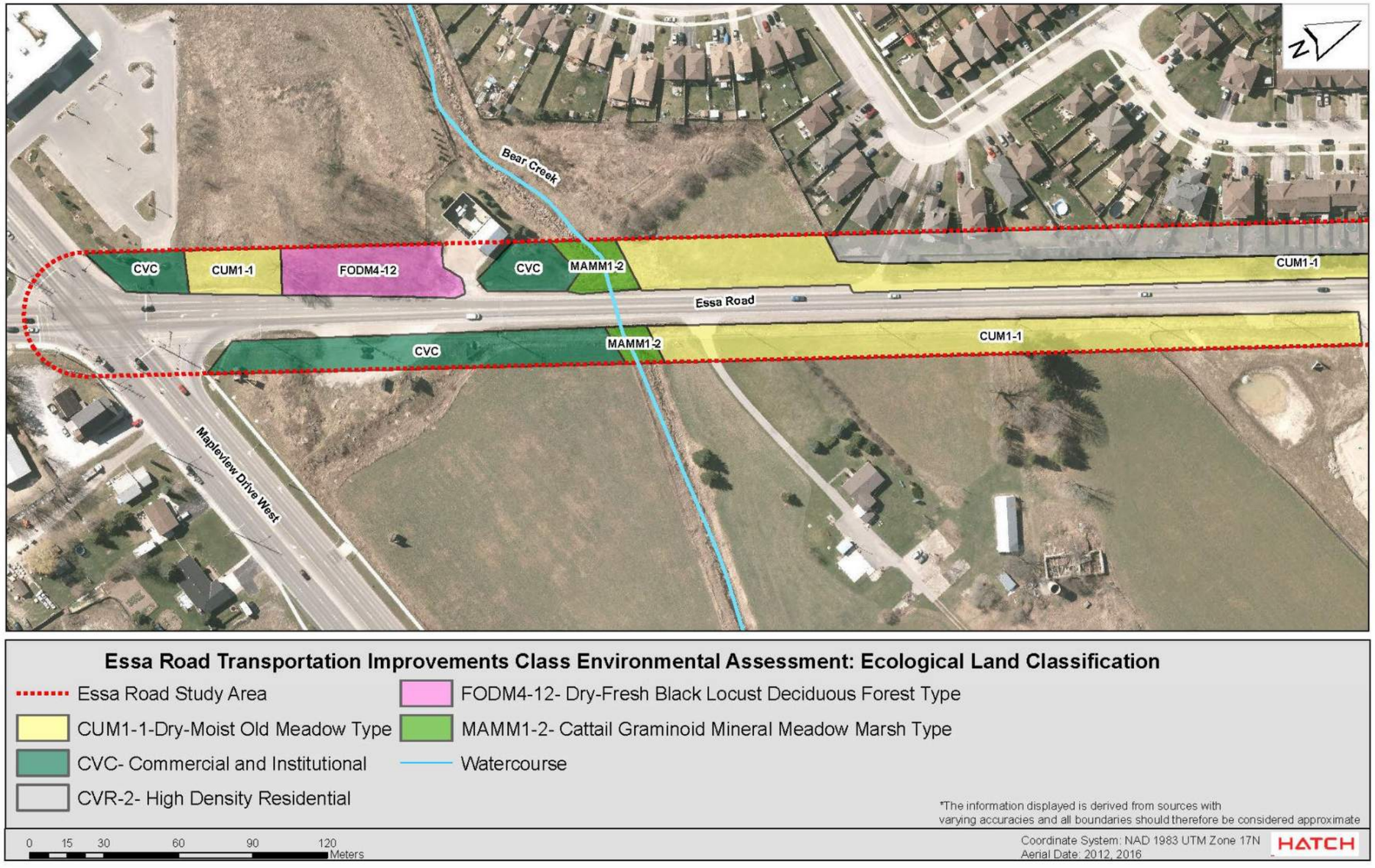


Figure 4-6: Ecological Land Classifications – Essa Road (Part 1)

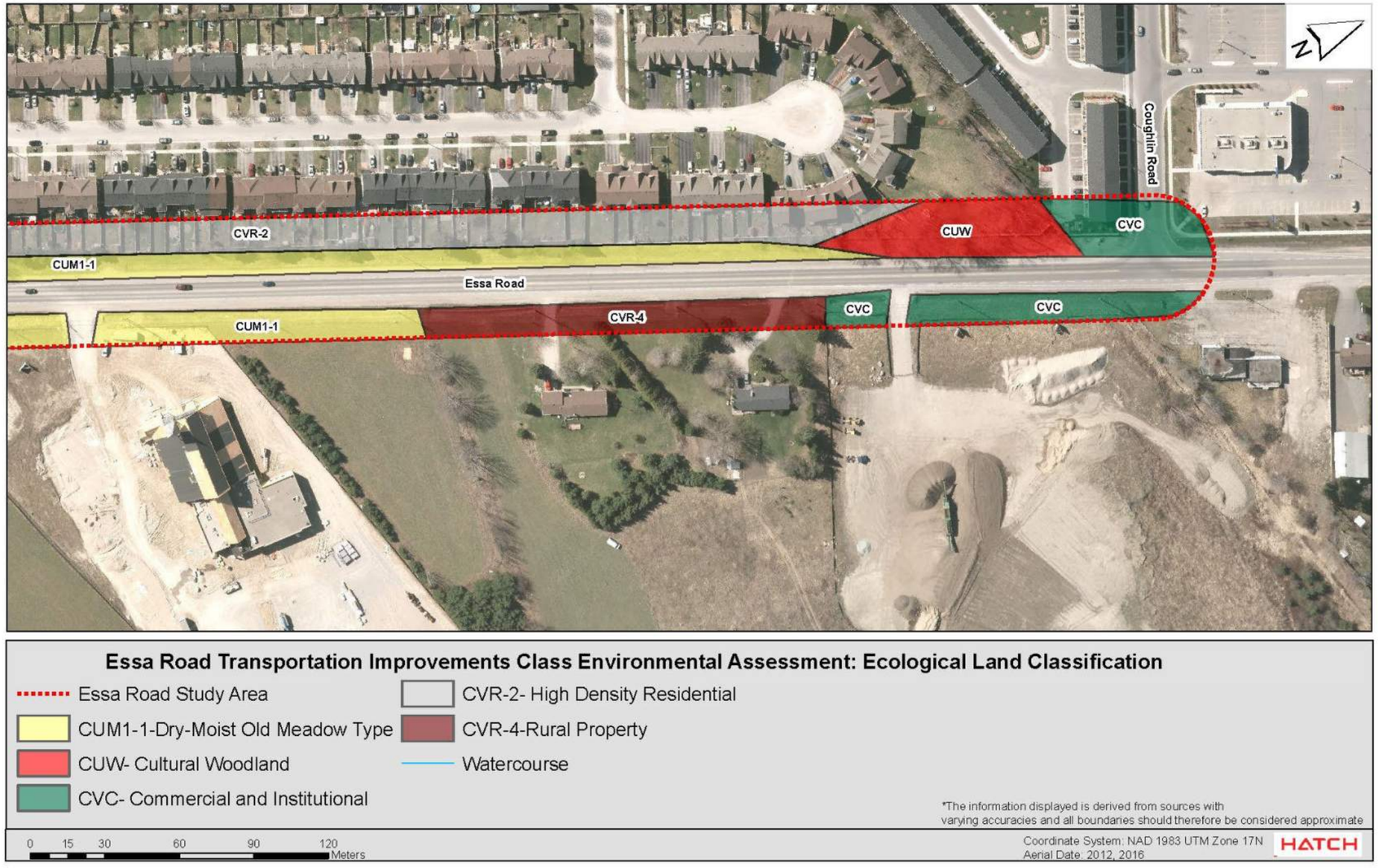


Figure 4-7: Ecological Land Classifications – Essa Road (Part 2)

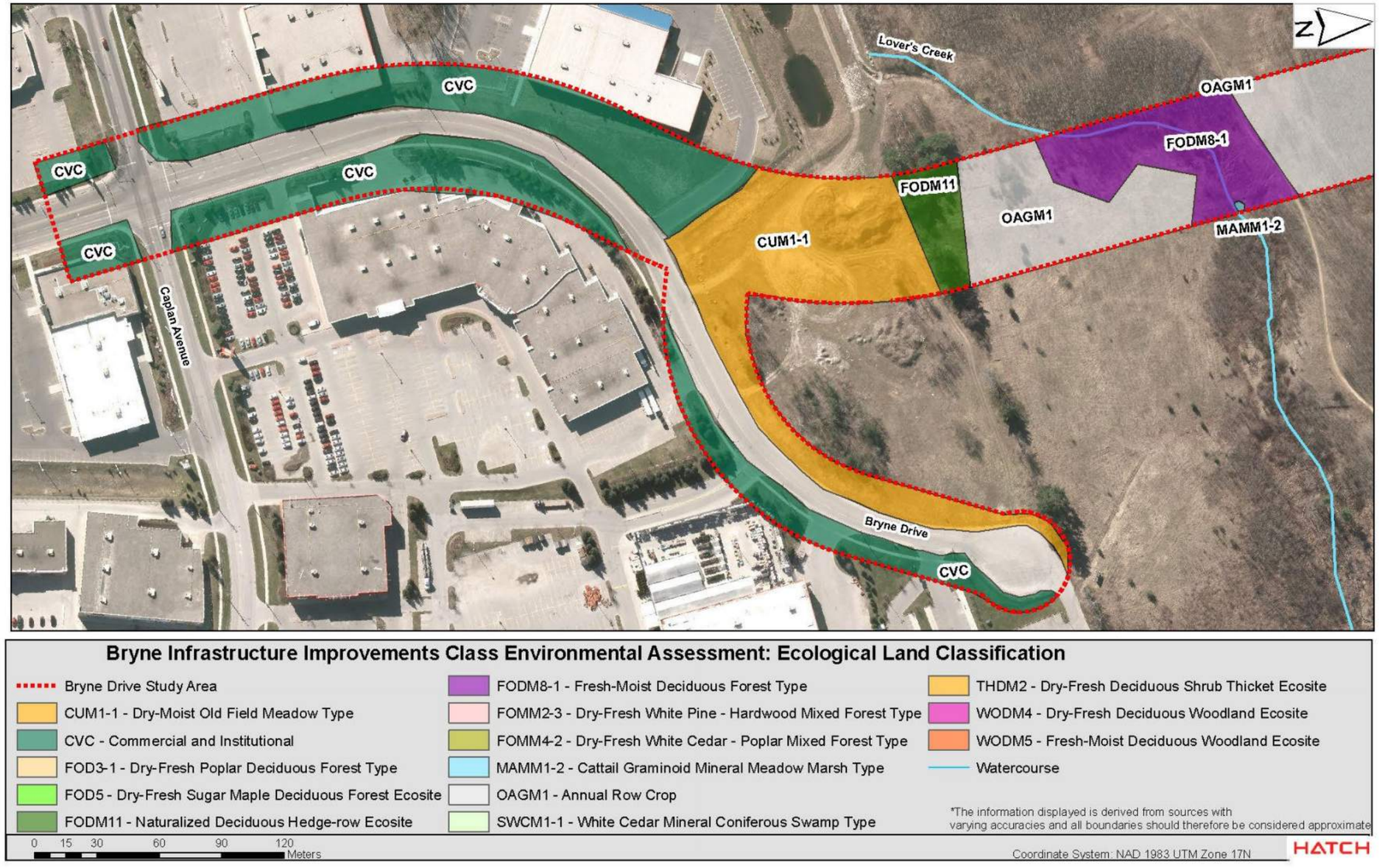


Figure 4-8: Ecological Land Classifications – Bryne Drive (Part 1)

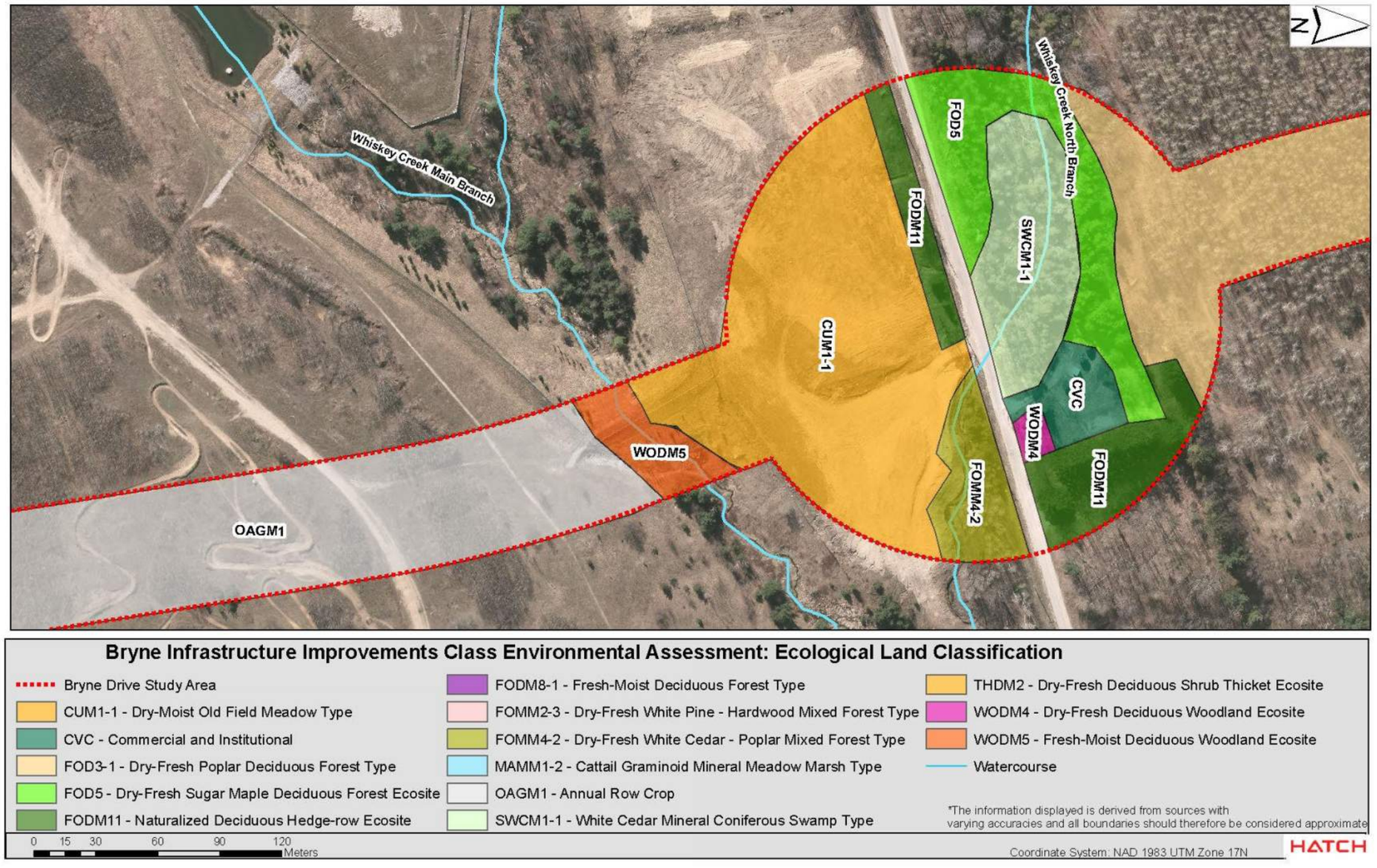


Figure 4-9: Ecological Land Classifications – Bryne Drive (Part 2)

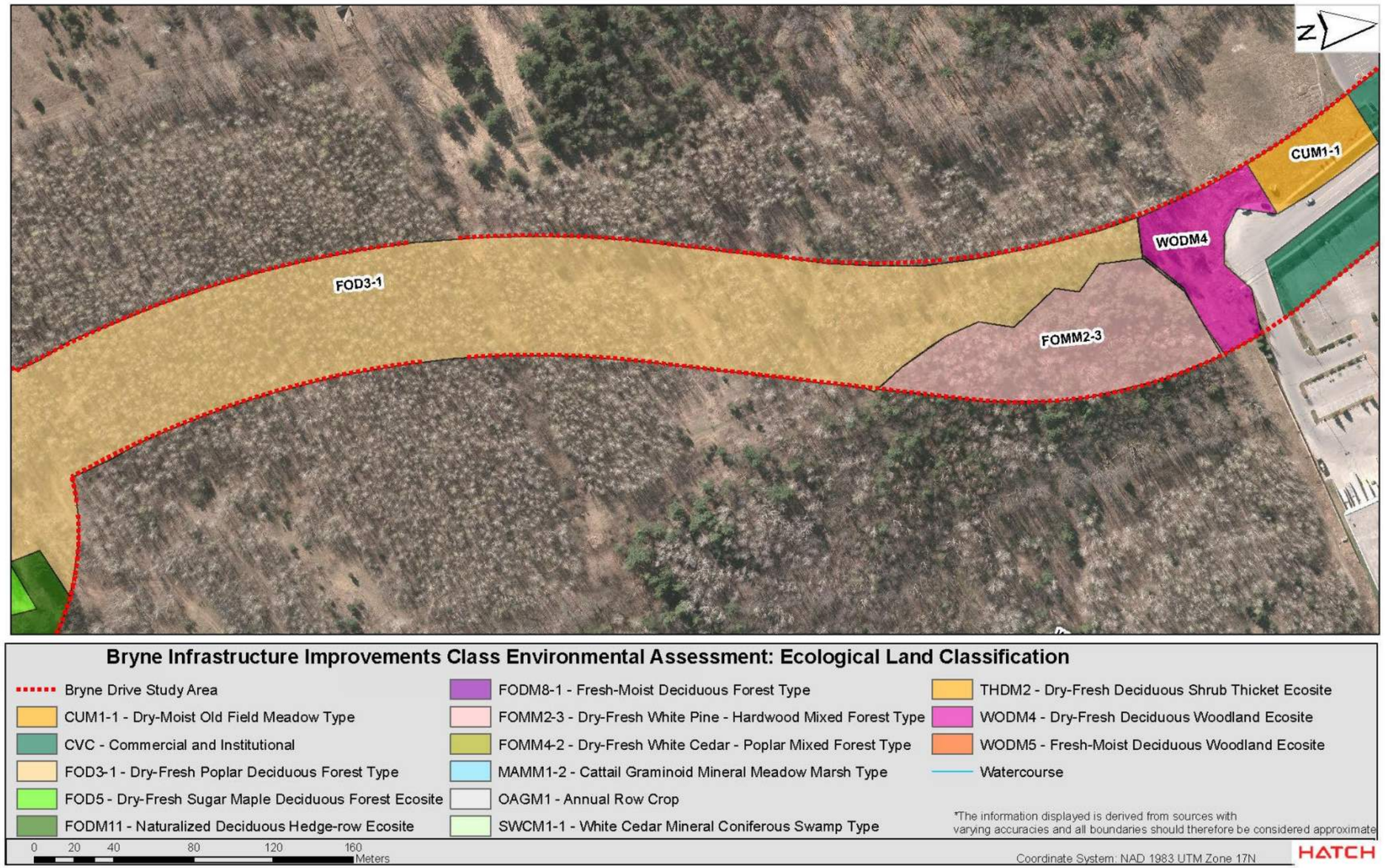


Figure 4-10: Ecological Land Classifications – Bryne Drive (Part 3)

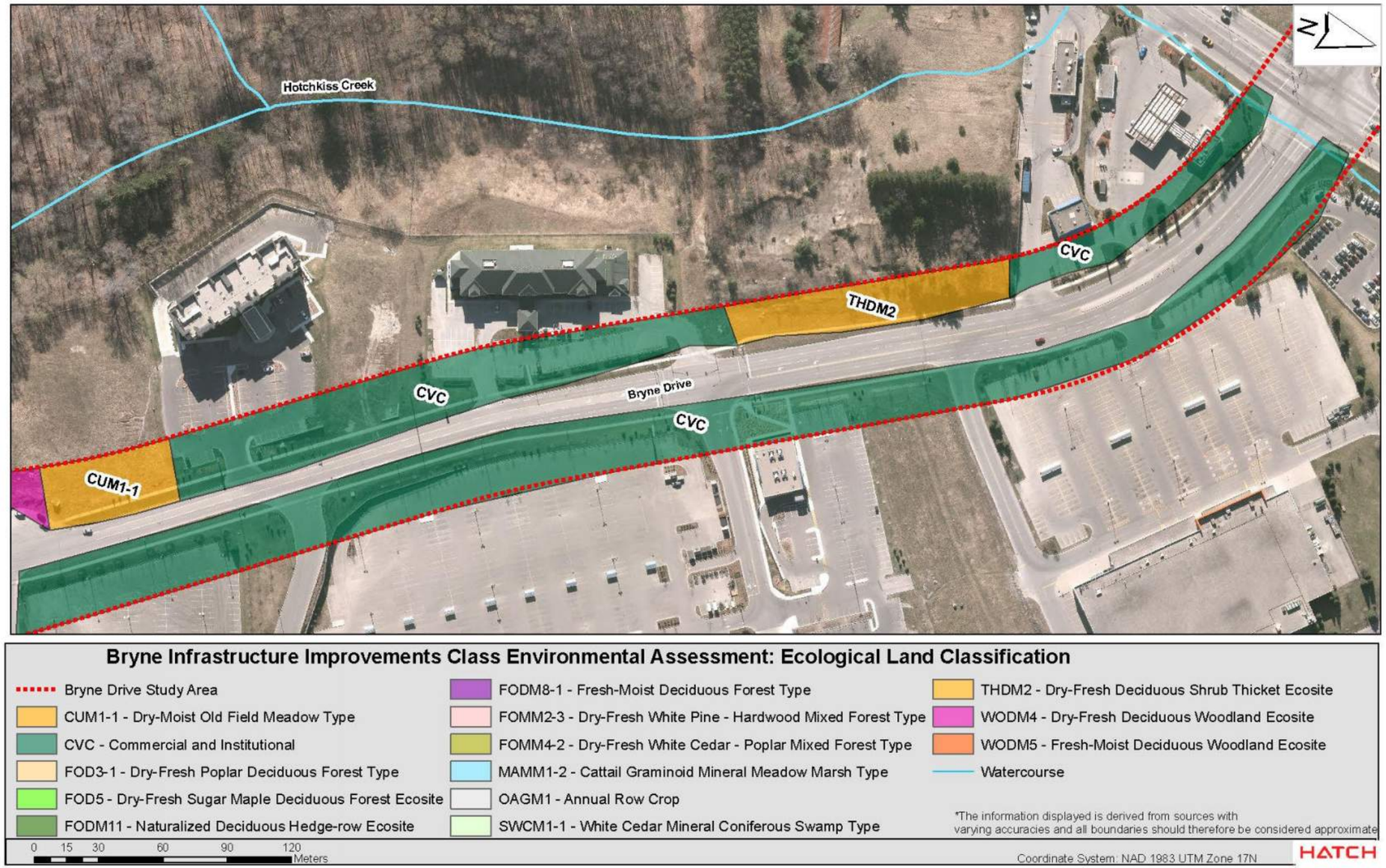


Figure 4-11: Ecological Land Classifications – Bryne Drive (Part 4)

4.1.6 Wetlands

Harvie Road

Based on the review of applicable background materials, no PSWs or unevaluated wetlands have been mapped for the Study Area corridor by the LSRCA, the MNRF, Simcoe County or the City of Barrie. During the 2017 field investigations, one wetland community SWCM1-1 – White Cedar Mineral Coniferous Swamp was identified north of Harvie Road.

Essa Road

NVCA and MNRF did not note any mapped wetlands within the Study Area. During the 2017 field investigations, a wetland community MAMM2-1 Cattail Graminoid Mineral Meadow Marsh Type was noted along the section of Bear Creek that crosses the Study Area corridor.

Bryne Drive

Based on the review of applicable background materials, no wetlands or unevaluated wetlands have been mapped for the Study Area corridor by the LSRCA, the MNRF, Simcoe County or the City of Barrie. During the 2017 field investigations, two (2) wetland communities SWCM1-1 – White Cedar Mineral Coniferous Swamp and MAMM1-2 – Cattail Graminoid Mineral Meadow Marsh Type were identified.

4.1.7 Woodlands

Harvie Road and Bryne Drive

Woodlands have been mapped by both the LSRCA and MNRF, and the City of Barrie within the Study Area corridor. According to the City of Barrie's Urban Forestry Department, the woodland south of Harvie Road (between Veterans Drive and Thrushwood Drive) is regulated – in addition to the woodlands at the east end of the Study Area corridor located both north and south of Harvie Road.

Woodland communities identified based on the 2017 field observations include: FOD3-1 – Dry-Fresh Poplar Deciduous Forest, FOD5 – Dry-Fresh Sugar Maple Forest, FOMM4-2 - Dry-Fresh White Cedar – Poplar Mixed Forest, SWCM1-1 – White Cedar Mineral Coniferous Swamp and WODM4 - Dry-Fresh Deciduous Woodland. Each of these woodlands contained native and non-native species, with the majority of the trees comprised of native species.

Given the size of the woodlands on the north side of Harvie Road – the amount of interior woodland habitat provided was greater than 10 ha, coupled with its species composition, this woodland could be considered significant based on the MNRF Natural Heritage Reference Manual (2010). Additional confirmation of significance should be sought out with the City's Urban Forestry department. Conversely, the woodlands to the south of Harvie Road are too small, and although regulated would not be considered significant due to their size, age class and species composition.

Essa Road

There are no woodlands mapped by MNRF, NVCA or the City of Barrie. During the 2017 field investigations, two (2) woodland communities were observed FODM4-12 and CUW. Each of these communities was comprised of common and non-native invasive species. Tree species found within each of the woodlands varied in size and health. However, due to the size and species composition, neither of these two (2) woodlands would be identified as significant.

4.1.8 Valleylands

There are no valleylands mapped within the Study Area for any of the three corridors.

4.1.9 Areas of Natural and Scientific Interest

There are no ANSIs located within the Study Area for any of the three corridors.

4.1.10 Wildlife Observations

A review of the Atlas of Mammals of Ontario (1994) identified 18 species that are known to occur in proximity to the Study Area corridors. This list included two (2) endangered species: Little Brown Bat (Myotis lucifugus) and Northern Long-eared Bat (Myotis septentrionalis). These species and their habitat are protected under the ESA (2007). Based on the field investigations completed in 2017, habitat for these two (2) species was were deemed to be present within the Study Area corridors.

Harvie Road

Incidental wildlife sightings made outside of the formal field surveys included: Grey Squirrel (4 observations), Black Squirrel (2 observations), Eastern Cottontail, Eastern Chipmunk, Raccoon, Red Squirrel, and White-tailed Deer.

Essa Road

Incidental wildlife sightings made outside of the formal field surveys included: Grey squirrel (2 observations) and Black squirrel (3 observations).

Bryne Drive

Incidental wildlife sightings included: Grey squirrel, black squirrel, eastern cottontail, eastern chipmunk, red squirrel and white-tailed deer.

4.1.11 Wildlife Habitat

Harvie Road

The MNRF provided an ESA screening and identified four (4) species of special concern that have the potential to occur: Eastern Wood-Pewee, Golden-winged Warbler, Monarch, and the Short-eared Owl. Breeding Bird surveys and incidental wildlife sightings completed during the 2017 field investigations did not reveal presence of any of the above noted species of special concern within the Study Area corridor.

Essa Road

The MNRF provided an ESA screening for this project and identified two (2) species that have the potential to occur that are special concern: Monarch and the Short-eared Owl. Breeding Bird surveys and incidental wildlife sightings completed during the 2017 field investigations did not reveal presence of either species of special concern.

Bryne Drive

The MNRF provided an ESA screening and identified six (6) species of special concern that have the potential to occur: Eastern Wood-Pewee, Common Nighthawk, Golden-winged Warbler, Monarch, Red-headed Woodpecker and the Short-eared Owl. Breeding Bird surveys and incidental wildlife sightings completed during the 2017 field investigations revealed the presence of Eastern Wood-Pewee and Wood Thrush (a species not previously identified by MNRF). Both species were identified within the large woodland north of Harvie Road.

4.1.12 Wildlife Movement Corridors

Harvie Road

Based on the Criteria Schedule, amphibian movement corridors are determined based on identifying significant breeding habitat. The observations documented during the two (2) surveys for amphibians completed in 2017 were not enough to classify any of the Study Area corridor as significant breeding habitat, as only limited observations of amphibians were made. Therefore, amphibian movement corridors are deemed absent for the Project Study Area.

According to MNRF there are no deer wintering habitats mapped for the Study Area corridor.

Essa Road

Based on the Criteria Schedule, amphibian movement corridors are determined based on identifying significant breeding habitat. Based on the two (2) surveys for amphibians completed in 2017, there were not enough observations to classify any of the Study Area corridor as significant breeding habitat, as no observations of amphibians were made.

According to MNRF there are no deer wintering habitats mapped for the Project Study Area.

Bryne Drive

Based on the Criteria Schedule, amphibian movement corridors are determined based on identifying significant breeding habitat. After completion of the two surveys for amphibians in 2017, there were not enough observations to classify any of the Study Area corridor as significant breeding habitat, as only limited observations of amphibians were made. Therefore, amphibian movement corridors are deemed absent.

According to feedback received from the MNRF, there are no deer wintering habitats mapped and therefore no deer movement corridors deemed present within the Project Study Area.

4.1.13 Breeding Birds

Harvie Road

According to the OBBA for the 10 km X 10 km square that covers the Project Study Area there are approximately 110 records of bird species known to inhabit the area. A number of these species are considered waterfowl and/or area sensitive species that require large transects of woodland within a minimum of 100 m interior woodland habitat. Of the 100 species, nine (9) are listed under the ESA: six (6) are considered threatened: Bank Swallow, Barn Swallow, Bobolink, Eastern Meadowlark, Chimney Swift, and Eastern Whip-poor Will. Four (4) are considered special concern: Red-headed Woodpecker, Common Nighthawk, Wood Thrush and Eastern Wood-Pewee. None of these species were observed within the Study Area corridor during the 2017 field investigations.

A total of five (5) point count locations were surveyed during the field investigations in 2017, with a total of 32 different species visually and/or vocally observed to be within the Study Area corridor.

Essa Road

According to the Ontario Breeding Bird Atlas (OBBA) (2001-2005), for the 10km x 10km squares that cover the Study Area corridor, there are approximately 125 bird species known to the area. A number of these species are considered waterfowl and/or area sensitive species that require large transects of woodland within a minimum of 100m interior woodland habitat. Of the 125 species, nine are listed under the ESA including: Bank Swallow, Barn Swallow, Bobolink, Eastern Meadowlark, Chimney Swift, and Eastern Whip-poor Will. Six are considered special concern: Grasshopper Sparrow, Olive-sided Flycatcher, Red-headed Woodpecker, Common Nighthawk, Wood Thrush and Eastern Wood Pewee. None of these species were observed within the Study Area during the 2017 field investigations.

Over the course of five field investigations, which included targeted SAR bird surveys, bird observations were recorded. A total of 14 different species visually and/or vocally were observed. A 150m survey radius to each survey stop location was applied.

Most of the birds observed were considered possible breeders. The number of birds is consistent with surveys conducted along road corridors due to habitat normally associated with edges, disturbed areas and road traffic which often may deter birds from breeding near the road ROW due to sounds and the ability of males and females to communicate. All birds documented are common to southern Ontario and are not considered rare. No SAR were observed both audibly or visually during the 2017 field investigations.

Bryne Drive

Over the course of seven (7) field investigations, which included targeted SAR bird surveys, bird observations were recorded within the Study Area corridor. A total of 12 survey locations were assessed during the field investigations in 2017, with a total of 43 different species visually and/or vocally observed to be within the Study Area corridor. A 150m survey radius to each survey stop location was generally applied, and may vary at different point count locations depending on the terrain, noise, type of vegetative cover, and weather conditions.

The majority of the birds observed were considered possible breeders within the Study Area corridor. The number of birds is consistent with surveys completed in open field areas. A number of the area sensitive species were noted within the woodlands north of Harvie Road. All of the birds documented are common in southern Ontario. Eight species had regional conservation status including Baltimore Oriole, Brown Thrasher, Black-billed Cuckoo, Eastern Kingbird, Eastern Wood-Pewee, Field Sparrow, Northern Flicker and Wood Thrush (Ontario Partners in Flight (OPIF), 2008).

Two of the birds are listed as special concern in Ontario, Eastern Wood-Pewee and Wood Thrush. The Eastern Wood-Pewee was vocally heard during all three (3) breeding bird surveys within FOD3-1, and the Wood Thrush was heard during the June 28 breeding bird survey also within FOD3-1. Species listed as special concern are not considered endangered or threatened but may become threatened or endangered due to a combination of biological characteristics and identified threats (e.g., habitat loss). As both species are listed as special concern, they do not receive species or habitat protection under the ESA (2007). No additional wildlife SAR were observed both audibly or visually during the 2017 field investigations.

4.1.14 Amphibians and Reptiles

Targeted amphibian surveys were completed in the spring of 2017. A review of the Ontario Reptile and Amphibian Atlas identified 22 species that are known to occur within the 10km x 10km squares containing the Essa Road corridor. The list includes five (5) species that are listed under the ESA: four (4) are listed as special concern: Snapping Turtle, Northern Map Turtle, Milksnake and Common Five-lined skink. One species was identified as threatened: Blanding's Turtle. Habitat for the above species, with the exception of Milksnake was not identified within the three Study Area corridors.

There is no habitat within the Study Area corridors that would support turtles. Snakes tend to forage in all areas including road corridor in search of food and cover, however no snakes were observed during the field investigations. The observations made during the field investigation do not indicate the absence or habitat and species occurrence outside of the proposed road corridor.

4.1.15 Species at Risk

An endangered species screening information request was submitted to the MNRF Midhurst District Office on March 3, 2017. A total of 16 Species at Risk (SAR) were identified by the

MNRF to potentially be within the Study Area for the three corridors. The Table 4-1 summarizes the species, their preferred habitat, whether that habitat is present within each of the Study Area corridors and observations made during 2017 field investigations.

Butternut Survey

A total of six butternut trees were documented with six (6) of the trees were documented by Hatch with an additional two documented by LGL Ltd. Due to the status and sensitivity of this species, the exact locations are not provided within this Report, but details of exact locations are on file for further consultation with the MNRF. The specimens observed were quite small in DBH (i.e., <10 cm). To facilitate further discussions with the MNRF and possible permitting requirements under the ESA (2007), a Butternut Health Assessment is required for any Butternut located within or to be impacted by the Project.

Additional information was provided by Skelton Brumwell and Associates in September 2017, as part of the Environmental Impact Statement (EIS) for the Bell Media Lands located north of Harvie Road. The information revealed that there are three (3) additional Butternut Trees within the woodlands north of Harvie Road.

Butternuts are provided a 50 metre protective buffer in order to protect the individual tree, as well as the surrounding ecosystem that provides habitat.

Due to the buffer requirements for Butternut as part of the ESA and associated Regulations, follow-up coordination with Skelton Brumwell and Associates is needed, as well as additional consultation with the MNRF during detailed design as part of the permitting and approval process.

Eastern Whip-poor Will

A total of three surveys were completed for Eastern Whip-poor Will during good weather conditions. No Eastern Whip-poor Wills were documented during the three evening surveys.

Bat Survey

Surveys for SAR bats were completed by LGL Limited in the Spring and Summer 2017 for the Bryne Drive Study Area corridor. Two nights of evening pedestrian surveys were conducted on June 8 and July 4 using hand-held detectors (Echo Meter Touch, Wildlife Acoustics), attached to a SmartPhone (with built-in Kaleidoscope software developed by Wildlife Acoustics). Echolocation recordings were compared to the North American library to assign bat calls to species identification. Based on the recordings, no SAR bats were detected by LGL Limited.

Skelton Brumwell and Associates completed SAR bat surveys as part of their EIS for the Bell Media lands. They installed passive acoustic bat detector units within the woodlands that cover the Bryne Drive Study Area corridor. Their preliminary data analysis in September 2017, identified occurrences on the detector of the presence of Little Brown Myotis within the

woodlands just east of the Study Area corridor north of Harvie Road (outside the proposed alignment). Little Brown Myotis are considered endangered in Ontario, whereby the species and their habitat are provided protection. Due to these findings and preliminary analysis, further coordination with Skelton Brumwell and the MNRF will be needed during Detailed Design, as the woodlands are continuous with the Bryne Drive Study area. Similar to butternut, due to the sensitivity of SAR, no maps with the location of Myotis habitat are included in this report.

Table 4-1: Species at Risk records provided by the MNRF ESA screening

Scientific Name	Common Name	SARO	Preferred Habitat	Habitat Present within the Study Area	Conclusions of Field Investigations 2017
Juglans cinerea	Butternut	END	Commonly associated with riparian habitat with rich moist, well-drained soils. They are intolerant to shade.	Yes – based on aerial imagery habitat for this species is present within Study Area corridors.	Harvie Road: No Butternuts were observed. An additional consultant Skelton Brumwell completed a search of the woodlands north of Harvie Road as part of an EIS. Skelton Brumwell documented Butternut within the woodlands north of Harvie Road just outside the Study Area corridor. A Butternut Health Assessment and further consultation with MNRF will be completed during Detailed Design. Essa Road: No Butternut were observed. Bryne Drive: A total of six (6) Butternut's or Butternut hybrids were observed, with five (5) located within the Project Study Area. A Butternut Health Assessment will be completed during Detailed Design and provided under a separate cover.
Hirundo rustica	Barn Swallow	THR	Commonly associated with human structures including buildings, open barns, bridges and culverts where their mud nest-cups can be built	Yes – based on aerial imagery, habitat for this species is present within the Harvie Road Study Area corridor.	Harvie Road: No Barn Swallows were observed during the breeding bird and targeted SAR surveys for the species.
Contopus virens	Eastern Wood-Pewee	SC	Commonly found in the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. Mostly found within	Yes – based on aerial imagery, habitat for this species is present within	Harvie Road: No Eastern Wood-Pewee's were observed within the Study Area corridor during the breeding bird and targeted SAR surveys for the species.

Scientific Name	Common Name	SARO	Preferred Habitat	Habitat Present within the Study Area	Conclusions of Field Investigations 2017
			intermediate-age mature forest stands with very little understory.	Study Area corridors.	Bryne Drive: Eastern Wood-Pewee's were observed during the breeding bird and targeted SAR surveys for the species.
Caprimulgus vociferous	Eastern Whip-poor-Will	THR	Usually found in areas with a mix of open and forested areas, such as savannahs, open woodlands or where there are openings in mature deciduous, coniferous and mixed forests.	Yes – based on aerial imagery, habitat for this species is present within Bryne Drive Study Area corridor.	Bryne Drive: No Eastern Whip-poor Wills were documented during the targeted SAR surveys for the species.
Melanerpes erythrocephalus	Red-headed Woodpecker	SC	Commonly found in open woodland and woodland edges and is often found in parks, golf courses and cemeteries.	Yes – based on aerial imagery, habitat for this species is present within the Bryne Drive Study Area corridor.	Bryne Drive: No Red-headed Woodpecker's were observed during the breeding bird and targeted SAR surveys for the species.
Myotis lucifugus *Myotis leibii* *Myotis septentrionalis* *Perimyotis subflavus*	SAR bats: Little Brown Myotis Eastern small-footed myotis Northern myotis	END	Roosting sites are within trees and buildings. Rock outcrops, buildings, under bridges, caves, mines and hollow trees. Roosts under loose bark and in cavities of trees.	Yes – based on aerial imagery, habitat for these species are present within the Harvie Road and Bryne Drive Study Area corridors.	Harvie Road: No SAR bats were documented by LL Limited during their acoustic monitoring. Skelton Brumwell documented occurrence of Little Brown Myotis within the Study Area corridor as part of their EIS. Due to the preliminary nature of the data, and protection of this species and habitat, further coordination with Skelton Brumwell and consultation with MNRF will be undertaken during detailed design.

Scientific Name	Common Name	SARO	Preferred Habitat	Habitat Present within the Study Area	Conclusions of Field Investigations 2017
	Tri-colored bat		Roosts in a variety of forested habitats – but mainly in older forests and occasionally in barns and other structures.		
Hirundo rustica	Barn Swallow	THR	Commonly associated with human structures such as buildings, open barns, bridges and culverts where their mud nest-cups can be built.	Yes – based on aerial imagery, habitat for this species is present within the Bryne Drive Study Area corridor.	Bryne Drive: No Barn Swallows were observed during the breeding bird and targeted SAR surveys for the species
Chordeiles minor	Common Nighthawk	SC	Traditionally associated with open areas with little to no ground vegetation, but have been known to be along gravel roads and railways, in urban parks, nesting in cultivated fields, orchards and mine tailings	Yes – based on aerial imagery, habitat for this species is present within the Bryne Drive Study Area corridor.	Bryne Drive: No Common Nighthawks's were observed during the breeding bird and targeted SAR surveys for the species
Dolichonyx oryzivorus	Bobolink	THR	Commonly found in areas with medium to tall grass – meadows or tall grass prairies.	Yes – based on aerial imagery habitat for this species is present in all Study Area corridors.	Harvie Road: No Bobolinks were observed. Essa Road: No Bobolinks were observed. Bryne Drive: No Bobolink's were observed during the breeding bird and targeted SAR surveys for the species.
Sturnella magna	Eastern Meadowlark	THR	Primarily in moderately tall grasslands, such as	Yes – based on aerial imagery	Harvie Road: No Eastern Meadowlark's were observed.

Scientific Name	Common Name	SARO	Preferred Habitat	Habitat Present within the Study Area	Conclusions of Field Investigations 2017
			pastures and hayfields – can also be found in alfalfa fields, weedy borders of croplands, roadsides, orchards, overgrown fields and other open areas.	habitat for this species is present in all Study Area corridors.	Essa Road: No Eastern Meadowlark's were observed. Bryne Drive: No Eastern Meadowlark's were observed during the breeding bird and targeted SAR surveys for the species.
Ammodramus henslowii	Henslow's Sparrow	END	Associated with abandoned farm fields, pastures and wet meadows.	Yes – based on aerial imagery habitat for this species is present in all Study Area corridors.	Harvie Road: No Hewnslow's Sparrows were observed. Essa Road: No Henslow's Sparrows were observed. Bryne Drive: No Henslow's Sparrows were observed during the breeding bird and targeted SAR surveys for the species.
Vermivora chrysoptera	Golden winged-Warbler	SC	Tends to nest in shrubby areas that are surrounded by mature forests – locations of recent disturbance which include, fields, hydro and utility corridors and logged areas.	Yes – based on aerial imagery, habitat for this species is present within the Harvie Road and Bryne Drive Study Area corridors.	Harvie Road: No Golden winged-Warblers were observed during the breeding bird and targeted SAR surveys for the species. Bryne Drive: No Golden winged-Warblers were observed during the breeding bird and targeted SAR surveys for the species.
Danaus plexippus	Monarch	SC	Caterpillars utilize milkweed plants found in meadows and open areas. Adult butterflies found in diverse areas where nectar from wildflowers is present.	Yes – based on aerial imagery habitat for this species is present for the Study Area corridors.	Harvie Road: No Monarch's were observed during the incidental wildlife observations along the road corridor. Essa Road: No Monarch's were observed during the incidental wildlife observations along the road corridor.

Scientific Name	Common Name	SARO	Preferred Habitat	Habitat Present within the Study Area	Conclusions of Field Investigations 2017
					Bryne Drive: No Monarch's were observed during the incidental wildlife observations along the road corridor.
Asio flammeus	Short-eared Owl	SC	Tends to be found in large grasslands and marshes and tundra habitats.	Yes – based on aerial imagery habitat for this species is not present for the Study Area corridors.	Harvie Road: No Short-eared Owls were observed. Essa Road: No Short-eared Owls were observed. Bryne Drive: No Short-eared Owls were observed during the breeding bird and targeted SAR surveys for the species.

4.1.16 Surface and Groundwater

The City of Barrie has prepared a South Protection Plan for the South Georgian Bay Lake Simcoe Source Protection Region to meet the requirements of the *Clean Water Act*. The Plan introduces a variety of policies to keep contaminants out of the drinking water courses, as part of Ontario's strategy to provide safe drinking water from source to tap. The Plan includes policies which apply to activities located within the surface water Intake Protection Zones or Wellhead Protection Areas.

According to Schedule G of the Official Plan (March 2017), a small section of the west limits of the Harvie Road Study Area corridor and Bryne Drive falls within the Wellhead Protection Area – D (between Essa Road and Veterans Drive). See Figure 4-12. In addition, this same section has been identified as a Contributing Area for Well 11, 12, and 14 for Chloride and Sodium. Bryne Drive is located within the Contributing Area for Well 11, 12 and 14 for Chloride and Sodium.

4.2 Socio-Economic Environment

4.2.1 Land Uses (Residential, Commercial, Agricultural, Recreational)

4.2.1.1 Harvie Road

Between Essa Road and Thrushwood Drive, there are generally residential properties with mid-twentieth century single family homes on both sides of the road, with the exception of a wooded area on the south side of Harvie Road between Veterans Drive and Thrushwood Drive. East of Thrushood Drive is a woodlot on the north side and grass lands on the south side. Mature trees are located on the north side, while also lining the south side dividing the roadway from the agricultural fields. Within this section, there are residences at Harvie Road and Thrushwood Drive, and a child care centre at the southeast corner of Harvie Road and Thrushwood Drive. There is a hydro corridor that extends north of Harvie Road, as well as a reservoir on the north side, east of Thrushwood Drive. There are a group of TV satellites north of Harvie Road within the trees, east of the future Bryne Drive intersection.

The section of Harvie Road east of the reservoir has been closed to vehicles by a gate since approximately June 2015, however there are desire paths on both sides of the gate leading to private property.

The future land uses along this stretch of roadway includes Residential from Essa Road to Thrushwood Drive; and General Industrial between Thrushwood Drive and future Bryne Drive (See Figure 4-13).

4.2.1.2 Essa Road

The Essa Road Study Area corridor is located between Mapleview Drive West and Coughlin Road, a stretch of 950m. The majority of the east side of the Study Area is agricultural with the exception of a Church midway along the roadway. On the west side, the majority of the land use is residential. The roadway within the existing corridor has a two-lane cross section

with gravel shoulders. Messa Village is planned to be developed at the northeast quadrant of Essa Road and Mapleview Drive West.

4.2.1.3 Bryne Drive

The existing sections of Bryne Drive (north near Essa Road and south near Caplan Road) are already built up and include light-industrial and commercial land-uses. The existing missing link between the north and south is agricultural land south of Harvie Road and primarily woodlot north of Harvie Road.

The future land uses along this section of roadway from south to Harvie Road include General Commercial on the east side and General Industrial on the west side, with a small Environmental Protection Area associated with Whiskey Creek. North of Harvie Road to the existing Essa Road includes General Industrial, and General Commercial (See Figure 4-13).

4.2.2 Noise

A noise impact assessment was undertaken to document existing Noise Sensitive Receptors along each of the corridors. Traffic growth rates were applied to determine the noise projections following the build and no-build scenarios. The Noise Report is included in Appendix D.

The Ministry of Environmental and Climate Change (MOECC) uses the Joint Protocol for municipal projects. The Joint Protocol sets out an Outdoor Objective sound level of 55 dBA Leq (or existing ambient). For sound levels less than 65 dBA, noise impacts are assessed. The evaluation of noise impacts is determined by the change in cumulative sound levels from the 2031 “no-build” scenario to the future “build” scenario. Assessments are based on a minimum 10-year future horizon year (i.e., traffic volumes 10 years after the construction of the project).

Noise mitigation is warranted when increases in sound level over the “no build” ambient are greater than 5 dBA. Mitigation measures can include changes in vertical profiles and horizontal alignments, noise barriers, and noise reducing asphalts. Noise mitigation must be administratively, economically and technically feasible and must provide at least 5 dBA of reduction averaged over the first row of noise-sensitive receivers. In addition, mitigation measures are restricted to within the road right-of-way.

Noise impacts from transportation projects are evaluated at noise sensitive receptors – Noise Sensitive Areas (NSAs), which are selected based on the land use and provided that they have an Outdoor Living Area (OLA) associated with them.

Numerous NSAs were used in the analysis to represent worst-case potential noise impacts at all nearby noise sensitive land uses. NSAs were picked to assess areas with similar overall noise levels and similar changes in noise (“build” versus “no build”). The representative locations are listed in Table 2 of Appendix D. A total of nine locations were selected along Harvie Road; 12 locations along Essa Road and four locations along Bryne Drive.

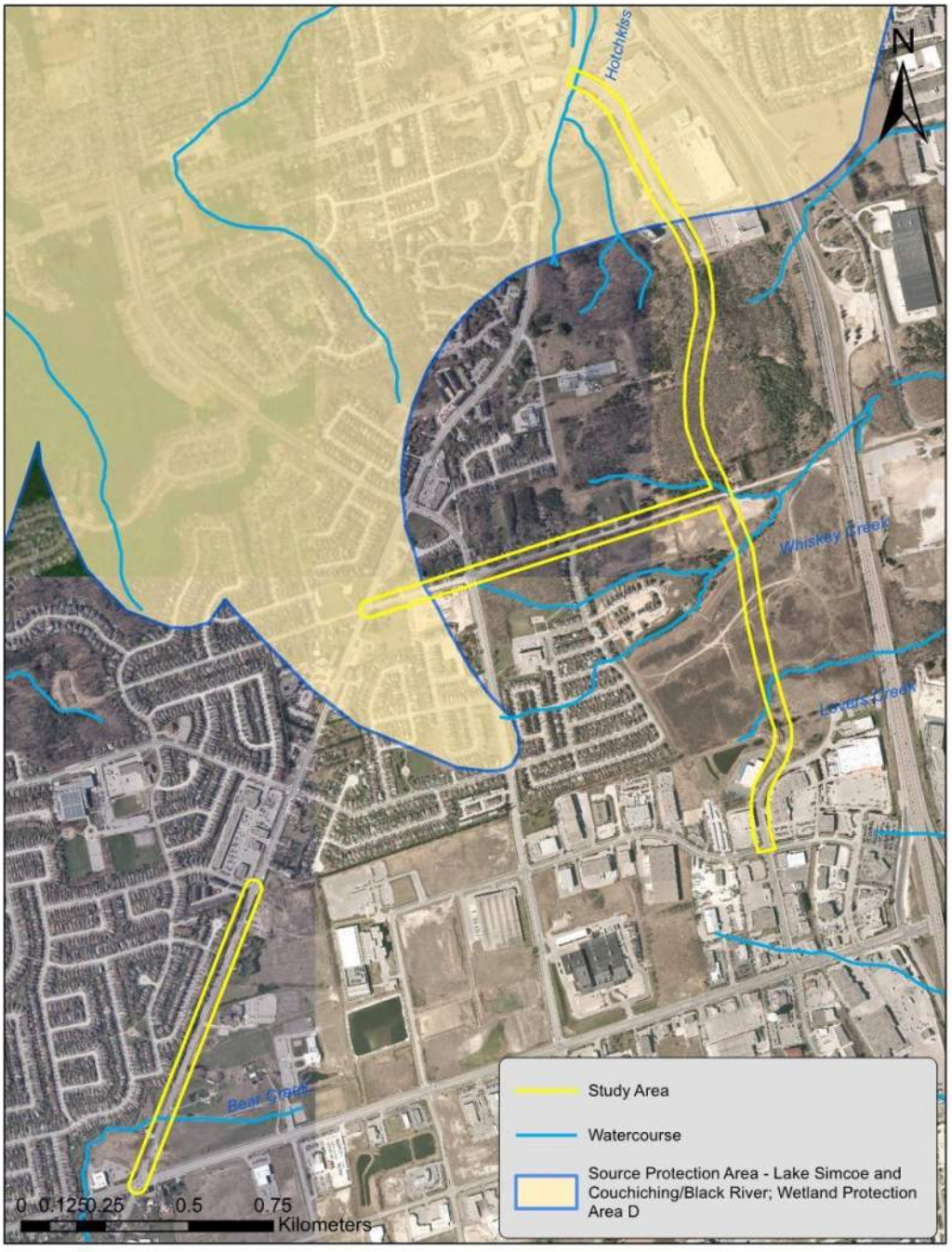


Figure 4-12: Wellhead Protection Area for Study Area corridors

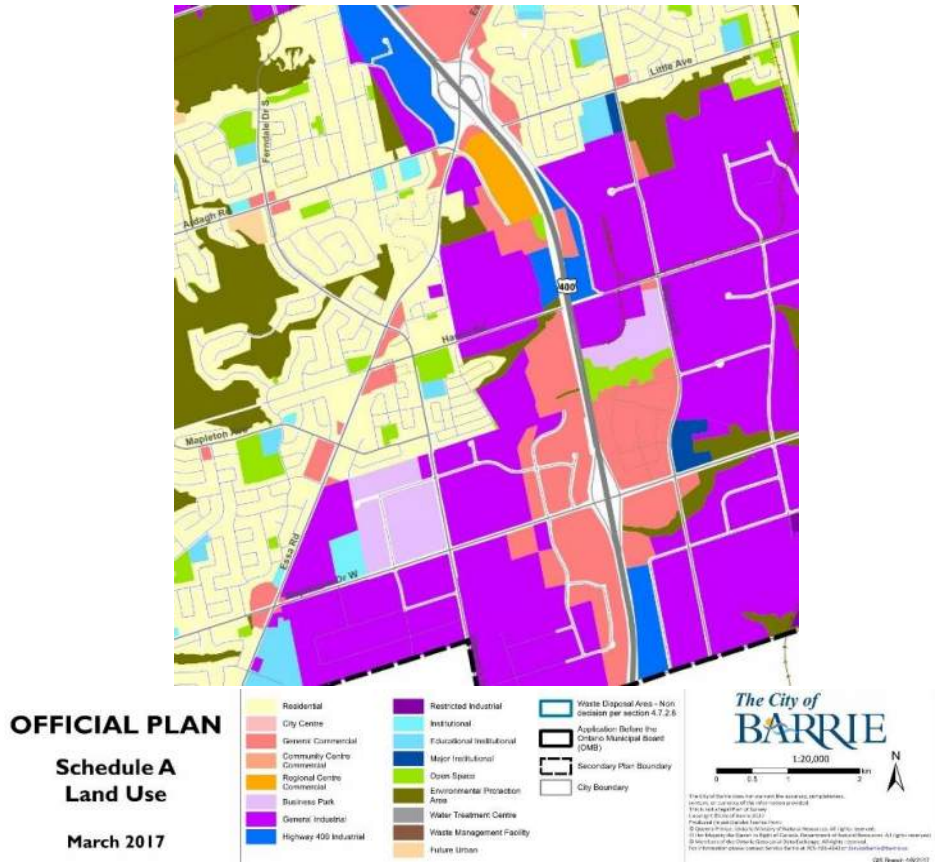


Figure 4-13: Schedule A – Land Use (Official Plan March 2017)

4.3 Cultural Heritage Environment

4.3.1 Archaeology

A Stage 1 Archaeological Assessment was undertaken for Harvie Road and Essa Road to determine where additional archaeological investigations are required. The Stage 1 Archaeological Assessment Reports are included in Appendix E. A Stage 1 Archaeological Assessment was completed for Bryne Drive by AMICK (2005) which determined that a significant portion of the Study Area corridor contains archaeological potential (this report is included under a separate cover in the Bryne Drive Master Plan Update Study (2016)).

4.3.1.1 Harvie Road

In reviewing the maps of the Study Area corridor from 1871, there are no structures identified, however in the 1878 map, there are two houses set back from the road, as well as the Holly-Allendale school located on the east side of Essa Road. Highway 400 was constructed in 1952 causing the terminus of Harvie Road, just west of the Provincial highway. By this date, there are 18 structures, including mid-twentieth century homes along the north side of Harvie Road.

There are 11 previously registered archaeological sites located within one kilometer of the Study Area corridor. The Study Area corridor is also located in close proximity to six ancestral Huron-Wendat sites. Ossuaries have not been identified for any of the villages except one.

One site is located within 50 m of the Study Area corridor (north of Harvie Road, and west of Highway 400). It has two locations including north locus and south locus. The north location was subject to a Stage 3 investigation where no further assessment is recommended. A Stage 4 was completed in 2017.

The majority of the area between Essa Road and Veterans Drive has been deemed to have no Archaeological potential based on previous disturbance. Between Veterans Drive and the future Bryne Drive crossing has archaeological potential with the requirement of a Stage 2 Survey be completed. There is a small section on the north side of Harvie Road at the eastern terminus that has no potential, given the previous Archaeological investigations which were completed as part of the work associated with the new overpass of Highway 400. The areas requiring future investigations are identified below.

Figure 4-14: Harvie Road Corridor Archaeological Potential

The entire Study Area corridor, with the exception of the water reservoir on the north side of Harvie Road requires ossuary potential monitoring during construction.

4.3.1.2 Essa Road

The former Holly Post office was previously located at the northeast corner of Essa Road and Mapleview Drive West.

According to the map from 1871, the church at Essa Road and Mapleview Drive West is the only structure illustrated along the Study Area corridor. The 1878 map shows the church, as well as the Holly Village post office on the east side of the road.

The maps from 1928 and 1986 National Topographic Series Barrie sheets show the Study Area corridor was located within a rural landscape along the present alignment of Essa Road. In 1928 there were six structures; however, in 1986 there were 12 structures and a campground on the west side of the roadway.

The Holy Spirit Parish church was constructed to the east of Essa Road in 2011 and the Shoppers Drug Mart at the intersection to the south at Mapleview Drive West was built between 2009 and 2011.

According to the Ontario Archaeological Sites Database maintained by the MTCS, there are 14 previously registered archaeological sites within 1 km, with one being within 50m of the Study Area corridor (Tall Trees site (BbGw-23)). Material associated with the nineteenth-century Euro-Canadian homestead were found within the proposed subdivision lands west of Essa Road and north of Mapleview Drive West.

The property in the northeast corner of the intersection of Mapleview Drive and Essa Road was noted to be significantly higher in elevation than the surrounding field areas and was composed entirely of fill material to raise the grade at the intersection. It has been noted that the Holly Village Post Office was located in this quadrant, therefore there is potential for archaeological deposits associated with this historic post office to be identified below the fill layer. A previous report completed in 2015 recommended that heavy equipment monitoring be conducted by a licensed archaeologist during any excavation or grading work conducted in this area.

This area will require Stage 2 mechanical trenching at a maximum of 10m intervals prior to construction to remove artificial fill and identify any archaeological resources. Testing should be carried out using a backhoe with a smooth bucket to sample any deeply buried soil horizons and sample subsurface features that may be present. Additional hand exposure/excavation of significant archaeological features or deposits may be required. Figure 4-15 shows areas requiring further study.

4.3.1.3 Bryne Drive

A Stage 1 Archaeological Assessment was undertaken by AMICK (2005) and determined that a significant portion of the Study Area corridor contains archaeological potential.

4.3.2 Cultural Heritage Resource Assessment

A Cultural Heritage Resource Assessment was undertaken for each of the three Study Area corridors to present a built heritage and cultural landscape inventory of cultural heritage resources, identify existing conditions, impacts to cultural heritage resources and proposed mitigation measures. The CHRAs are included in Appendix F.

A cultural heritage assessment considers cultural heritage resources including above ground cultural heritage resources over 40 years old. This is a guiding principle when conducting the preliminary identification of resources.

A built structure or landscape is identified as a cultural heritage resource if it is considered to be 40 years or older and if the resource satisfies at least one criteria related to Design/Physical Value; Historical/Associated Value; or Contextual Value.

Historically, the Study Area corridors are located in the former Township of Innisfil, County of Simcoe. The boundaries were refined over the years and as of the late twentieth century, Simcoe County had two cities, seven towns and eight villages.

Growth in the Township of Innisfil was slow with the first sawmill not erected until the 1830s. Following the connection of the Northern Railway in 1853, the township became an important shipping hub for the lumber industry of central Ontario.

The City of Barrie is located at the junction of major transportation routes, and Kempenfelt was an important site during the War of 1812, as well as the starting point for a portage route established by First Nations connecting between Lake Simcoe and Lake Huron.

A review of the nineteenth-century mapping reveals that Essa Road and Harvie Road are historical roadways, as they appear on mapping from 1871.

Lake Simcoe is known to the Huron-Wendat as Ouentironk, or ‘beautiful water’ (LSRCA 2016). Lake Simcoe was an important terminal as part of the fur trade connecting Lake Ontario.

The Study Area corridors are located within the Barrie Creeks subwatershed, 75% of which is developed with small areas of natural heritage features and agriculture.

4.3.2.1 Harvie Road

Mapping from 1928 shows four structures fronting along Harvie Road, as well as a bridge carrying Harvie Road over the unnamed creeks at the east end of the Study Area corridor. The mapping also shows Hydro lines along the north side of Harvie Road, as well as tree lines following the boundaries of individual lots to the north and south of the Study Area corridor.

Throughout the next 40 years, the area remained primarily agricultural, however in 1968 the mapping shows a trail extending north-south crossing Harvie Road. The mapping from 1989 shows an increase in development, as well as a number of new structures on the north side, in the western half of the Study Area corridor.

Based on a background review, no cultural heritage resources were identified within or adjacent to the Harvie Road Study Area corridor. Proposed improvements along the roadway will not impact any cultural heritage resources.

4.3.2.2 Essa Road

A church is illustrated on the northwest corner of Essa Road and Mapleview Drive (1871 map), and from the 1881 mapping, there is the Holly Post Office at the northeast corner of Essa Road and Mapleview Drive.

Mapping from 1928 shows five structures along Essa Road. In addition, there is a church in the southeast corner of the Essa and Mapleview Drive intersection. Development continues along Essa Road according to mapping in 1968, 1989 etc, including farms and silos.

A review of background documents identified that there is one cultural heritage resource identified by the Ontario Heritage Trust within and/or adjacent to the Study Area corridor including a former early twentieth-century church, which has been altered to accommodate commercial space located at 371 Mapleview Drive. The red brick Gothic Revival style church has been repurposed as a commercial space and is listed in the Ontario Heritage Trust in their Places of Worship Inventory. An additional cultural heritage resource was identified during a site visits, located at 664 Essa Road, which is a Nineteenth-century farmscape.

4.3.2.3 Bryne Drive

A review of available heritage inventories confirmed that no properties located in or adjacent to the Study Area corridor have been previously identified to be of potential cultural heritage interest. The proposed improvements will not impact any built heritage resources or cultural heritage landscapes within the Study Area corridor.

Figure 4-15: Essa Road Corridor Archaeological Potential

4.4 Engineering Environment

4.4.1 Sanitary System and Watermains

4.4.1.1 Harvie Road

Watermains, sanitary sewers and storm sewers serviced by the City of Barrie are identified between Brown Street and just west of Highway 400, with pipe sizes ranging from 300mm to 750mm.

4.4.1.2 Essa Road

Multiple watermains, sanitary sewers and storm sewers serviced by the City of Barrie are identified at the Harvie Road intersection, with pipe sizes from 300mm to 600mm.

4.4.1.3 Bryne Drive

Multiple sanitary sewers and watermains serviced by the City of Barrie with pipe sizes ranging from 375mm to 600mm are located near the Harvie Road/Bryne Drive intersection.

4.4.2 Utilities and Other Services

4.4.2.1 Harvie Road

Telecom

Along Harvie Road, Bell and Rogers provide telecommunication services There are Bell underground assets mainly on the north side of the Roadway from Emms Drive to east of the Thrushwood Drive intersection, while Rogers runs overhead and underground assets south of the roadway, extending up to Highway 400.

Power/Illumination

Both Alectra Utilities (previously PowerStream) and Hydro One provide hydro services: Alectra owns multiple hydro facilities such as hydro lines, hydro poles and transformers along both sides of the roadway, while there is one Hydro One Network hydro tower identified at the Thrushwood Drive intersection.

Street lighting is provided along the south side of Harvie Road the full length of the Study Area corridor.

Gas

Gas services are provided by Enbridge Gas Distribution, with gas mains located along the north side of Harvie Road, except a small section between Veterans Drive and Thrushwood Drive and eventually extend to the east side of Highway 400.

4.4.2.2 Essa Road

Telecom

Bell, Rogers and Cogego provide telecommunication services along Essa Road.

Bell has conduits and buried cables running along both east and west sides of Essa Road, except along a small section from approximately 200m north of Mapleview Drive West to the Holy Spirit Parish. with various crossings at the intersection of Essa Road and Harvie Road. Several crossings also exist south of Harvie Road, south of Coughlin Road and north of Mapleview Drive.

Rogers has underground plant along the east side Essa Road from north of Bryne Drive up to Loggers Run. There is also Rogers overhead plant along the east side of Essa Road from north of Bryne Drive up to south of Mapleview Drive W. Underground Rogers plant also crosses Essa Road at Mapleton Avenue, and Mapleview Drive West. An underground feed also runs west from Essa Road south of Bear Creek.

Cogeco's telecommunication assets are located at the intersection of Essa Road and Mapleview Drive. The assets run along the north side of Mapleview Drive, crossing Essa Road just north of Mapleview Drive.

Power/Illumination

Hydro services are provided by Alectra Utilities. Alectra has underground assets on Essa Road beginning just north of Harvie Road and continues along the west side of Essa Road onto the north side of Harvie Road. There are also underground assets on the east side of Essa Road within the intersection of Harvie Road. There are underground assets along the east side of Essa Road just south of Harvie Road and crosses to the west side of Essa Road. At the intersection of Essa Road and Mapleton Avenue, underground assets on the east side of Essa Road cross to the west side of Essa Road at Mapleton Avenue to continue along Mapleton Avenue. Additional Alectra underground assets begin on the east side of Essa Road just south of Coughlin Road and crosses to the west side of Essa Road to continue services along Coughlin Road. There are two sets of underground assets on the east side of Essa Road south of Huitema Court crossing to the west side of Essa Road. These assets continue along the west side of Essa Road and moves west into the residential areas of Huitema Court. There are also three additional sets of underground services crossing Essa Road north of Mapleview Drive.

Alectra has overhead assets along the east side of Essa Road from Harvie Road to Mapleview Drive.

Street lighting is provided at the intersection of Essa Road and Mapleview Drive and extends northerly along the east side of Essa Road. Facilities are provided on every other pole in the south end and then on every pole from the Holy Spirit Parish Church up to Coughlin Drive.

Gas

Gas services are provided by Enbridge Gas Distribution. Enbridge Gas Distribution's 6" gasmain is located on Essa Road along the east side of the road from Harvie Road to Mapleview Drive with service connections to nearby residential areas. North of Harvie Road,

there is an 8” gasmain along Essa Road on the west side of the road. There is also an 8” gasmain along Harvie Road on the north side. The gasmain crosses Harvie Road on the east side of Harvie Road and continues along Essa Road on the east side of the road, crossing Mapleview Drive. There is a 12” gasmain located on Mapleview Drive on the south side of the road. South of Mapleview Drive, the 6” gasmain continues on the west side of Essa Road.

4.4.2.3 Bryne Drive

There are a limited number of utilities on Bryne Drive. Most utilities are in the section closer to Essa Road, another section closer to Caplan Avenue, and at the Harvie Road/Bryne Drive intersection.

Telecom

Both Bell and Rogers service the section closest to Essa Road while providing underground services on both sides of the roadway.

Bell has conduits and buried cables running along both east and west sides of Bryne Drive, with various crossings at the intersection of Bryne Drive and Essa Road. There are also service connections to the commercial areas along Bryne Drive, between the intersection of Bryne Drive and Essa Road and the southern end of Bryne Drive.

Rogers has underground plant located on Bryne Drive along the east side from west of Essa Road to north of the Hampton Inn driveway. The underground plant then crosses at the location of the Hampton Inn driveway to the west side of Bryne Drive and continues north along Bryne Drive up to the Four Points by Sheraton driveway. Rogers’ overhead plant crosses Bryne Drive on the south side of Caplan Avenue and continues south on the east side of Bryne Drive starting at Caplan Avenue.

Power/Illumination

Hydro services are provided by Alectra utilities and Hydro One Networks. Alectra owns multiple hydro facilities such as hydro lines, hydro poles and transformers in both sections of Bryne Drive, while three hydro poles located at the Caplan Avenue intersection are owned by Hydro One Network.

Along the existing Bryne Drive (north) – street lighting is provided primarily along the east side of the roadway, however there are facilities at intersections on both the east and west sides. Along the existing Bryne Drive (south) – street lighting is also provided primarily along the east side of the roadway, and at intersections, facilities also exist on the other side of the roadway.

Hydro One’s hydro transmission towers and overhead lines are running parallel to Highway 400, located west of Highway 400, and crosses Bryne Drive just south of Caplan Avenue.

Gas

Enbridge Gas Distribution's gas mains are located along the east side in both sections of Bryne Drive. Enbridge Gas Distribution has a 4" gasmain on Ardagh Road at Essa Road along the south side of the road. At the intersection of Essa Road and Ardagh Road, the 4" gasmain continues along Essa Road on the east side of Essa Road south of Bryne Drive. On Bryne Drive, there is a 4" gasmain along the east side of the road from Essa Road and ends south of Southridge Court.

4.4.3 Fluvial Geomorphology

A Fluvial Geomorphology and meanderbelt assessment was undertaken by Water's Edge during the spring of 2017 for Whiskey Creek, Lovers Creek and Bear Creek. The report is contained in Appendix C. Two of the watercourses (Whiskey Creek and Lovers Creek) are well-defined channels with definable bankful parameters. Bear Creek is a constructed drainage channel that is stabilized and has not had any change in its alignment since construction.

Whiskey Creek is a 3rd order stream that has a total drainage area of 6.15km², but only 1.6km² of it is included in this assessment's Study Area. It originates west of Highway 400 in predominantly community/infrastructure land uses. The southwest branch of Whiskey Creek originates from a SWM pond while the northwest originates in forested areas north of Harvie Road. The remaining land use of the area is 13% agricultural lands, 14% forested areas and 4% swamp. After the Creek flows through the Study Area corridor, it flows east under Highway 400 and then through industrial, forested and residential areas before outletting into Kempenfelt Bay.

Lovers Creek is a 4th order stream which originates south of the City of Barrie and flows through the city before draining into the Kempenfelt Bay of Lake Simcoe. The Lovers Creek watershed is 59km² in size while the area for this study is only small portion of that at 0.6km². The general slope of Lovers Creek is 3.81% while in the Study Area it is only 1.5%. The Study Area subwatershed is primarily community/infrastructure with the remaining areas being agricultural, forested and marsh.

Bear Creek falls within the Nottawasaga Valley Conservation Authority (NVCA) given than it flows west towards the Nottawasaga River. Bear Creek is likely a 5th order stream which originates on the southwest side of the City of Barrie and flows west through primarily forested and agricultural lands before outletting to the Nottawasaga River in the Town of Angus. The Bear Creek watershed is approximately 89km² in size but only 2.5km² of that is within the Study Area. The headwaters for this portion of Bear Creek come from SWM ponds east of the site that drain industrial areas. The landuse for this area is primarily community/infrastructure (82%) and agricultural. The general slope for Bear Creek is 3% while through the Study Area it is 1.5%.

All of the study reaches were assessed using field forms and all reaches received a rating of 'Transitional/Stressed' or 'In Regime' for stability of the stream, as well as Good, Fair or Poor

condition for soil conditions. Table 4-2 provides a summary of the typical stream characteristics. Figure 4-16 identifies the locations of the stream crossings.

Table 4-2: Initial Findings for Crossings

Crossing	Road	Watercourse	Substrate	Stability of System	Soil Conditions
1	Harvie Road	Whiskey Creek (main branch)	Sand/gravel	Transitional/stressed	Good
2	Bryne Drive	Whiskey Creek tributary	Sand	In Regime	Good
3	Bryne Drive	Lovers Creek	Sand/gravel	Transitional/ Stressed	Fair
4	Essa Road	Bear Creek	Muck/Sand	In Regime	Poor

Meanderbelt widths were calculated for Whiskey Creek and Lovers Creek. The current top of bank width for Bear Creek is the belt width.

The beltwidths were calculated to be a sum of the preliminary beltwidth and a 10% or 15% factor of safety as no 100-year migration rates were calculated (lack of air photos). The factor of safety is based on soil conditions as presented in Table 4-2 above. The LSRCA established setback requirements including 15m on both sides of the channel (i.e., erosion access allowance), which has been added to the final beltwidth. Table 4-3 below provides a summary of the final beltwidths and the final corridor widths.

Table 4-3: Summary of Beltwidths at Proposed Culvert Locations

Crossing	Meander Axis	Preliminary Meander Beltwidths (m)	Erosion Setback (m)	Final Meander Beltwidth (m)	Erosion Access Allowance	Final Corridor Width (m)
1	1	11.1	1.11	13.3	30	43.3
1	2	8.3	0.8	9.9	30	39.9
1	3	7.6	0.8	9.2	30	39.2
1	1	17.5	1.8	21.1	30	51.1
3	1	10.4	1.6	13.6	30	43.6
3	2	12.0	1.8	15.6	30	45.6
3	3	10.5	1.6	13.7	30	43.7
4	1	11	0	11	0	11

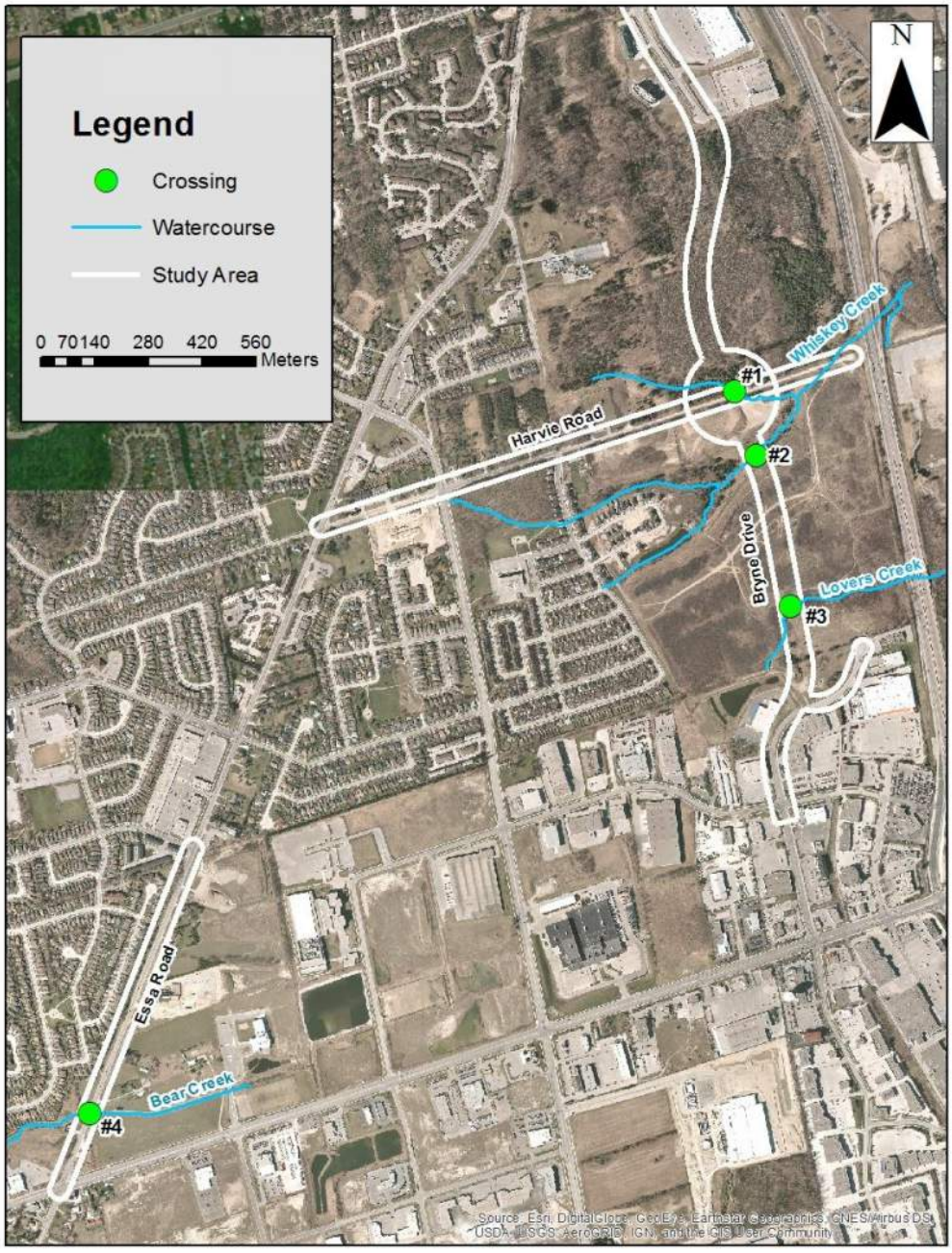


Figure 4-16: Crossing Locations

4.4.5 Drainage and Stormwater Management

For drainage study, the existing Study Area was divided into six (6) distinct drainage locations based on the subwatershed boundaries for Whiskey Creek, Hotchkiss Creek, Lover's Creek and Bear Creek. The following sections summarize the existing drainage conditions within these six (6) study areas:

- Harvie Road at Whiskey Creek
- Essa Road at Bear Creek
- Bryne Drive, South of Harvie Road and north of Caplan Avenue at Lovers Creek
- Bryne Drive, South of Harvie Road at Whiskey Creek
- Bryne Drive, North of Harvie Road at Whiskey Creek
- Bryne Drive, North of Harvie Road and South of Essa Road at Hotchkiss Creek

4.4.5.1 Harvie Road at Whiskey Creek Subwatershed

This area is contained within the Whiskey Creek subwatershed, draining subdivisions to the west primarily into the constructed Pond "A" located to the south of Harvie Road and west of the future Bryne Drive. The outflow from the pond drains easterly toward the Whiskey Creek culvert crossing at Highway 400.

Pond B, which has not been constructed, was proposed in the City of Barrie Whiskey Creek Master Plan for the upstream development in the Whiskey Creek Subwatershed. It was proposed to the north of Harvie Road, and immediately adjacent to the east side of future Beacon Road.

4.4.5.2 Essa Road at Bear Creek Subwatershed

The Essa Road area is currently a rural cross-section draining primarily impervious area via ROW ditches to Bear Creek. There is an existing culvert crossing to the south draining towards Mapleview Drive West.

4.4.5.3 Bryne Drive, South of Harvie Road and north of Caplan Avenue at Lovers Creek Subwatershed

The existing study area are mainly comprised of commercial and residential areas and a small portion of undeveloped rural/woodlot area to the west of Highway 400. The SWM Pond LV14 features the water quality and quantity control within this study area. Runoff from the external catchment areas is conveyed by existing storm sewer along Bryne Drive which ultimately routed through Pond LV14. The outflow from Pond LV14 makes a channel of Lovers Creek and eventually drains easterly through an open undeveloped field flowing to Lovers Creek culvert crossing at Highway 400 to the south of Harvie Road.

4.4.5.4 Bryne Drive, South of Harvie Road at Whiskey Creek Subwatershed

This area drains via surface runoff through an open undeveloped field flowing to the constructed Pond A and the Whiskey Creek culvert crossing at Highway 400.

4.4.5.5 *Bryne Drive, North of Harvie Road at Whiskey Creek Subwatershed*

This distinct drainage location is contained within Whiskey Creek draining the areas to the west of Highway 400 and north of Harvie Road. This location drains via surface runoff and is currently wooded/vegetated area. No SWM facilities currently exists within these catchment locations; however, SWM Pond B, was proposed in the Master Drainage Plan of Whiskey Creek Subwatershed, will be located on the west side of Future Bryne Drive. The area ultimately outlets to the west side of Highway 400 culvert crossing as part of the north Whiskey Creek tributary.

4.4.5.6 *Bryne Drive, North of Harvie Road and South of Essa Road at Hotchkiss Creek Subwatershed*

This area is contained within Hotchkiss Creek draining the existing Bryne Drive to Essa Road. The existing Bryne Drive is an urban section with minor system runoff conveyed by storm sewers. On the west side of Bryne Drive, the existing commercial center drains via existing storm sewers, which ties into the Bryne Drive sewer system to Pond HT-06, while major system runoff drains overland and will eventually capture by the catch basins of Bryne Drive sewer system. This storm sewer system connects to Essa Road storm sewer which ultimately outlets to the west side of Highway 400.

A structural assessment was completed on the existing culverts and is detailed in Table 4-4.

Table 4-4: Culvert Structural Assessment

#	Crossing ID	Creek	Roadway	Size	Notes	Comments
1	E.C.W-1	Whiskey Creek	Harvie Road	1.05 m circular CSP	Replace	Overtops the 2-year and above storm flows
2	E.C. B-1	Bear Creek	Essa Road	1.8m x 0.6m concrete box	Extend	Conveys the 100-year and Regional Storm flows.
2	E.C.W-4	Whiskey Creek Tributary	Bryne Drive	2.0m x 2.0m concrete box	Extend	Conveys the 100-year and Regional Storm flows.
3	E.C.L-2	Lovers Creek	Bryne Drive	Twin 1.2 m Circular CSP	Replace	Culvert was very corroded and needs replacement.

4.4.6 ***Pavement***

Harvie Road is a flexible pavement with an asphalt surface underlain by a granular base/subbase with no shoulders. Native soils within the project limits typically vary from sand and gravel trace silt to sandy silt trace gravel.

Pavement structural designs were completed for all roadways using traffic data, existing pavement conditions and subsoil information. In compliance with the City of Barrie's MMATMP, a 45-year life expectancy was used for all pavement designs for Harvie Road.

Pavement types considered for the new pavement platform on Harvie Road included: flexible (asphalt) pavement; rigid (concrete) pavement, and composite (asphalt over concrete) pavement. The cost to construct and maintain each pavement design option was analyzed in a Life Cycle Cost Analysis (LCCA).

The results of the LCCA indicate that the flexible pavement option will have a lower life cycle cost of 20% compared to the rigid pavement option. The composite pavement option is expected to be 33% more expensive over a 45-year analysis period.

4.4.7 Driveway Access

Driveway access and transitions identified herein as well as any updates/requests from empty of undeveloped lots, will be developed further in detailed design.

4.4.7.1 Harvie Road

There are five driveways located along the north side of Harvie Road between Essa Road and Veterans Drive, in addition to Claudio Crescent providing access to a row of townhomes along the north side. Along the south side of this same stretch of Harvie Road, there is one driveway providing access to a neighbourhood of townhomes.

There are eight driveways along the north side of Harvie Road between Veterans Drive and Thrushwood Drive. There are no driveways along the south side of Harvie Road within this same stretch of road.

There are three driveways along the north side of Harvie Road between Thrushwood Drive and the future Bryne Drive extension. The driveways provide access to the Harvie Reservoir. There is one driveway along the south side of Harvie Road providing access to the Discovery Child Care Centre.

4.4.7.2 Essa Road

On the west side of Essa Road between Mapleview Drive and Coughlin Avenue, there is only one driveway providing access to a municipal services building. On the east side of Essa Road, there are five driveways, including three providing access to private rural properties, one to the Holy Spirit Parish and one to a future development property.

4.4.7.3 Bryne Drive

Along Bryne Drive from Caplan Avenue northward, there are two driveways along the west side providing access to commercial land uses, as well as seven driveways providing access to industrial land uses on the east side. Near the north end of the Bryne Drive Study Area corridor, there are five driveways along the west side and five driveways along the east side providing access to commercial/hotel land uses.

5. Alternative Design Concepts

5.1 Evaluation Criteria

The design concepts developed to address the growth and development problems identified within the Study Area were evaluated with respect to their impact on the natural, social/cultural, physical, technical and economic environments. The evaluation process compares the alternatives to ensure that the recommendations followed a clear and logical evaluation, and that all environmental issues within the Study Area are provided with thorough consideration. The evaluation of design alternatives described in Section 2, was based on the following evaluation criteria.

Engineering/Operational Environment

- Traffic Operations
- Cycling Operations
- Pedestrian Operations
- Driveway Impacts
- Municipal services
- Stormwater Management
- Potential impact to surface water
- Utilities
- Impacts to Structures
- Emergency Services

Natural

- Watercourses/fisheries/ aquatic impacts
- Species at Risk
- Vegetation Impacts
- Impacts to Wetlands and PSW
- Land Use

Social

- Property Acquisition
- Aesthetics
- Noise Impacts
- Accessibility and Public Safety
- Construction Impacts

Cultural Heritage

- Archaeological Impacts/First Nations
- Cultural Heritage Impacts

Economic

- Construction Costs
- Maintenance Costs
- Land Acquisition Costs

The design concepts were each assessed and evaluated based on these criteria.

5.2 Evaluation of Alternative Design Concepts – Harvie Road

The evaluation table completed for the Harvie Road design concepts is included in Appendix H (Consultation).

5.2.1 Do Nothing

Advantages

The Do Nothing alternative has the least impact on the Natural Heritage, Cultural Heritage and Social Environment, however it does not address the need for improvements along the corridor to address anticipated growth and development.

Disadvantages

With the extension of the new crossing over the Highway 400, there will be additional traffic which cannot be accommodated along the existing two-lane Harvie Road. The road will continue to deteriorate and requires rehabilitation. The existing Harvie Road is also not structurally adequate to accommodate existing or future traffic. This Alternative does not provide improved connectivity for pedestrians or cyclists along the corridor.

5.2.2 Widen to South

Advantages

This Alternative addresses the need for improvements along the existing Harvie Road and provides for improved active transportation connectivity. The improvements will provide opportunity to improve stormwater management and turning movements along the corridor.

Disadvantages

The widening to the south will result in moderate impacts to the natural heritage features along the corridor, including impact to the woodlot to the south of Harvie Road between Veterans Drive and Thrushwood Road. In addition, there will be an impact to the lengths of existing driveways and significant impact to the property on the south side of the road, west of Thrushwood Road (buy-out). The culvert for Whiskey Creek main branch will need to be lengthened. There is also a significant portion of the south side of the corridor that will require Stage 2 archaeological assessment and the entire area has the potential for locating an ossuary given the proximity to watercourses and other archaeological features.

5.2.3 Widen About the Centre-Line

Advantages

This Alternative addresses the need for improvements along the existing Harvie Road, and provides for improved active transportation connectivity. The improvements will provide opportunity to improve stormwater management and turning movements along the corridor. This alternative equally shares the property impact on both sides of the road. In addition, it has less impact on the woodlots north and south of Harvie Road, compared to the other alternatives.

Disadvantages

The widening along the centre results in moderate impacts to natural heritage features along the corridor, including the woodlot to the north and the woodlot to the south. In addition, the Whiskey Creek main branch culvert will need to be extended to accommodate the wider road profile. There is a greater potential to impact the wetland north of Harvie Road at future Bryne Drive. There is also a moderate impact to residents along the north side of Harvie Road. A significant portion of the Study Area corridor requires Stage 2 archaeological assessment, and the entire Study Area has the potential for locating an ossuary given the proximity to watercourses and other archaeological features.

5.2.4 Widen to North

Advantages

This Alternative addresses the need for improvements along the existing Harvie Road, and provides for improved active transportation connectivity. The improvements will provide opportunity to improve stormwater management and turning movements along the corridor. This Alternative also aligns better with the future Harvie Road overpass, given the job at Highway 400.

Disadvantages

The widening to the north results in potentially significant impact to the woodlot north of Harvie Road, as well as the residents along the north side of the roadway. There is also archaeological potential along a significant portion of the roadway and there is a potential that an ossuary may be uncovered given the location of four villages and the proximity of the Whiskey Creek watercourse. This alternative requires the extension of the Whiskey Creek main branch culvert. In addition, this alternative will impact the existing driveways along the roadway and may include the relocation of a driveway along the north side of the corridor. This alternative will result in significant property impacts along the north side, including the potential for multiple buy-outs. The multiple buy-outs will also result in a significant cost compared to the other alternative design concepts.

5.2.5 Preferred Design Concept

The Preferred Design Concept for Harvie Road is to widen about the centre-line, as it has less impact on the regulated woodlots north and south of Harvie Road. In addition, it equally shares the property impacts on either side of the roadway.

5.3 Evaluation of Alternative Design Concepts – Essa Road

5.3.1 Do Nothing

Advantages

The Do Nothing alternative has the least impact on the Natural Heritage, Cultural Heritage and Social Environment, however it does not address the need for improvements along the

corridor to address anticipated growth and development. This alternative has no impact on existing utility facilities along the Study Area corridor.

Disadvantages

This alternative does not provide for improved active transportation operations for pedestrians and cyclists, nor does it provide additional lanes to accommodate the future growth within the Study Area to 2031. There will continue to be congestion once the area is built-out. The alternative also does not improve safety or accessibility and results in continued deterioration of the roadway.

5.3.2 Widen to the West

Advantages

This Alternative addresses the need for improvements along Essa Road and provides improved active transportation connectivity along the corridor, and improved vehicular connectivity and turning movements at intersections. This alternative also has very little potential to impact the natural heritage and has minimal impact on archaeological potential.

Disadvantages

This Alternative has the potential to impact indirect fish habitat associated with Bear Creek, and requires a significant amount of existing residential property on the west side of Essa Road. There is a potential increase in noise, as a result of the road being closer to the houses, however the houses already currently have a fence, which may provide sufficient noise mitigation. This alternative has a moderate amount of property impact on the west side, bringing the road closer to the backs of houses.

5.3.3 Widen About the Centre-Line

Advantages

This Alternative addresses the need for improvements along Essa Road and provides for improved active transportation connectivity along the corridor. This option provides for improved connectivity and turning movements at intersections. This alternative also little potential for impact to natural heritage. There is minimal potential for Stage 2 Archaeological investigations. This alternative also has no property impacts.

Disadvantages

This Alternative has the potential to increase noise to the residents along the west side of the Study Area, bringing the roadway closer to the residential houses. This alternative has moderate potential to impact the existing hydro towers on the east side of Essa Road, and may require relocation.

5.3.4 Widen to the East

Advantages

This Alternative addresses the need for improvements along Essa Road and provides for improved active transportation connectivity along the corridor. This alternative has little potential to impact the natural heritage.

Disadvantages

This Alternative has potential to impact an area requiring Stage 2 Archaeological potential, given the location of the former Holly Post Office located on the east side of the Study Area. This alternative also has potential to impact a small section of a Cultural Heritage Landscape located along the east side of Essa Road. This alternative will result in a significant impact to the hydro poles located on the east side of Essa Road, requiring relocation. This alternative has a moderate impact to property, encroaching properties on the east side of the roadway.

5.3.5 Preferred Design Concept

The preferred design concept is to widen about the centre-line, as this alternative has little potential impact to natural heritage, and there is minimal potential for Stage 2 Archaeological work. In addition, there is no property impact.

5.4 Evaluation of Alternative Design Concepts – Bryne Drive

Given the location of the proposed intersection of Harvie Road and future Bryne Drive, which was determined as part of the Harvie Road/Big Bay Point Drive/Highway 400 EA and Detailed Design, all of the alternatives have the same impact south of Harvie Road. In addition, to the north of the intersection, there is a potential to impact two butternut trees. Given that all three alternatives cut through the same intersection location at Harvie Road, all of the alternatives will result in the same impact and therefore the same recommended mitigation and compensation to minimize or reduce the impact to the Butternut species. Further details regarding this impact is discussed in Section 10.

5.4.1 Do Nothing

Advantages

The Do Nothing alternative has the least impact on the Natural Heritage, Cultural Heritage and Social Environment.

Disadvantages

This Alternative does not address the need for improvements along the corridor to address anticipated growth and development. In addition, it does not provide for improved active transportation operations for pedestrians and cyclists. The alternative also does not improve safety or accessibility. It also does not increase the development potential along the corridor.

5.4.2 Extend to the West (north of Harvie Road)

Advantages

This Alternative addresses the need for improvements along Bryne Drive and provides for improved active transportation connectivity along the corridor. This alternative provides for improved traffic operations, capacity and connectivity for vehicular traffic and provides for improved opportunity for municipal service upgrades. There are opportunities to improve stormwater management and improve connectivity for emergency vehicle access. In addition, this option provides for development potential to the east of the roadway and there are opportunities to incorporate AODA features. This alternative will require the construction of a culvert for the Whiskey Creek North Branch providing a perpendicular crossing which is preferred.

Disadvantages

This alternative has the potential to impact additional land outside of the Bell Media lands, including the CTV land to the northwest of the intersection of Harvie Road/Bryne Drive. In addition, this alignment, has the potential to cut through a significant Archaeological site, which will require further Stage 2 Archaeological investigations. This alignment has more potential to impact the wetland located at the northwest corner of the future Harvie Road/Bryne Drive intersection, and will have a significant impact on the regulated woodlot north of Harvie Road, resulting in a potential to impact bat species and bat habitat (SAR).

5.4.3 Extend About the Centre-Line (north of Harvie Road)

Advantages

This Alternative addresses the need for improvements along Bryne Drive and provides for improved active transportation connectivity along the corridor. This alternative provides for improved traffic operations, capacity and connectivity for vehicular traffic and provides for improved opportunity for municipal service upgrades. There are opportunities to improve stormwater management and improved connectivity for emergency vehicle access. In addition, this option provides for development potential to both the east and west of the roadway and there are opportunities to incorporate AODA features. This alternative provides the most acceptable alignment connectivity to the segment south of Harvie Road, as it includes gradual curves.

Disadvantages

This alternative will require property from Bell Media, and will have a minor impact on the wetland in the northwest quadrant of the intersection with Harvie Road. This alternative will have a significant impact on the regulated woodlot north of Harvie Road, resulting in a potential to impact bat species and bat habitat (SAR).

5.4.4 Extend to the East (north of Harvie Road)

Advantages

This Alternative addresses the need for improvements along Bryne Drive and provides for improved active transportation connectivity along the corridor. This alternative provides for improved traffic operations, capacity and connectivity for vehicular traffic and provides for improved opportunity for municipal service upgrades. There are opportunities to improve stormwater management and improved connectivity for emergency vehicle access. In addition, this option provides for development potential to the west of the roadway and there are opportunities to incorporate AODA features.

Disadvantages

This alternative will impact Bell Media land and has the potential to cut through a significant Archaeological site, which will require further Stage 2 Archaeological investigations. This alignment has more potential to impact the wetland located to the northeast of the Bryne Drive/Harvie Road intersection, and will have a significant impact on the regulated woodlot north of Harvie Road, resulting in a potential to impact bat species and bat habitat (SAR).

5.4.5 Preferred Design Concept

The preferred design concept is to widen about the centre-line, as this opportunity has less potential to impact archaeological sites to the northwest and east (north of Harvie Road). In addition, this alternative provides the most acceptable alignment connectivity to the segment south of Harvie Road, as it includes gradual curves.

6. Description of Preferred Design Concept – Harvie Road

6.1 Design Criteria

The Design Criteria for Harvie Road are described in detail in Table 6-1. The Preferred Design Concept (Plan and Profile) is included in Appendix G.

Table 6-1: Design Criteria for Harvie Road

Harvie Road		
Parameter	**Design Standards**	**Achieved Value**
Design Classification	UAD 80	UAD80
Posted Speed	70 km/h	70 km/h
Design Speed	80 km/h	80 km/h
Basic Lanes	4	4
Design Vehicle	WB-20	WB-20
Minimum Stopping Sight Distance	115m – 140m	120 m
Min. K Factor – Crest	24-36	30
Min. K Factor – Sag	25-32	30
Grades maximum	0.5% - 5%	0.5% - 5%
	290m – 530m (CoB)	
Minimum Radius	280m (0.04 m/m)	290m (0.04 m/m)
	250m (0.06 m/m)	
Lane Width		
Inside	2 @ 3.50m	2 @ 3.50m
Outside	2 @ 3.50m	2 @ 3.50m
Left Turn Lane Width	3.00m	3.00m
Right Turn Lane Width	3.50m	3.50m
Two-Way Left Turn lane	3.25m – 4.20m	3.25m – 4.20m
Raised island width (at intersections)	1.20m	1.20m
Road Allowance	34m	34m
Miscellaneous		
Bike Lanes	2 @ 1.50m	2 @ 1.50m
Bike Lane Buffers	0.50m	0.50m
Curb and Gutter	OPSD 600 series	OPSD 600.040
Boulevard Width	2.90m	2.90m
Sidewalk	2 @ 2.00m	2 @ 2.00m
Rounding	0.50m	0.50m

6.2 Typical Cross-Sections

The typical cross-section for the preferred design for Harvie Road includes a 5-lane cross-section with a two-way left-turn lane (See Figure 6-1). The typical cross-section for the preferred design is based on the MMATMP and the input received at the Public Information Centre (PIC) and includes the following:

- Two 3.5m lanes (between Essa Road and Veterans Drive); and four 3.5m lanes (between Veterans Drive and Bryne Drive);
- One 4.2m median;
- 1.5m buffered bicycle lanes on each side of the road;
- 2.0m sidewalk on both sides of the road – completes missing sections of sidewalk along the corridor; and
- 2.90m boulevard on either side of the road.

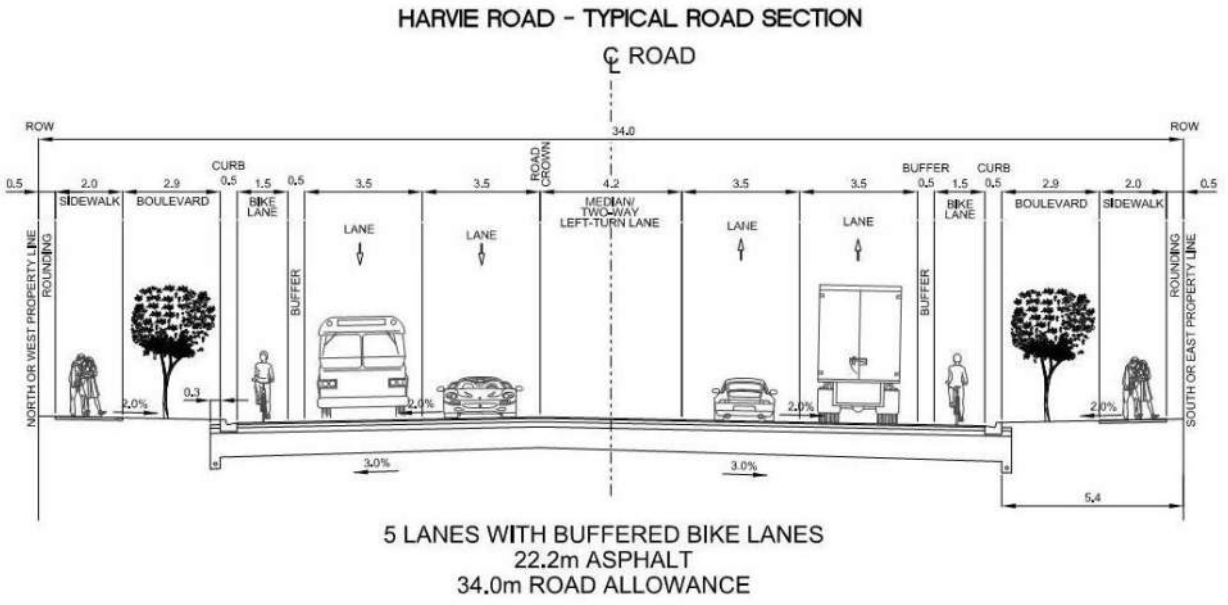


Figure 6-1: Harvie Road Cross-Section

6.3 Pavement Structural Design

The horizontal alignment mostly follows the existing centerline on Harvie Road based on property constraints to the north and south of the corridor.

The pavement structure recommended for Harvie Road is:

50mm	HL1 Surface Asphalt
50mm	HL8 Binder Asphalt
60mm	HL8 Binder Asphalt
75mm	HL8 Binder Asphalt
150mm	Granular A Base material
600mm	Granular B Type I Subbase material

6.4 Horizontal and Vertical Alignment

The horizontal alignment mostly follows the existing centerline on Harvie Road, with the exception of near the intersection with Bryne Drive on the east end of the Study Area, where the horizontal alignment begins to shift to the north to tie into the future Highway 400 crossing.

The vertical alignment for the roadway was designed to:

- Minimize raising the grade of the road to reduce impacts on adjacent properties;
- Minimize impact to existing stream crossings and culverts;
- Minimize surcharge loading of fill overtop of existing utilities;
- Follow existing alignment as closely as possible; and
- Satisfy the design criteria and design standards as closely as possible.

6.5 Traffic and Transportation

There are a number of improvements which will be implemented within the Study Area prior to 2021, including the construction of the overpass of Harvie Road over Highway 400, connecting to Big Bay Point Road. Based on the forecasted volumes without an interchange and no road widening, it is expected that Harvie Road will be operating within effective capacity.

A widening of Harvie Road between Essa Road and the future Bryne Drive to two through lanes with a centre turning lane will likely be needed to accommodate provision of separate left turn lanes and approach tapers at key intersections due to the closely spaced intersections. This widening also provides opportunities to improve access to the adjacent properties in these sections.

Following the construction of the interchange post 2031 and the widening of Harvie Road by 2031, Harvie Road is expected to operate at acceptable levels.

To accommodate projected demand for the 2031 planning horizon, Harvie Road will need to be widened to three lanes from Essa Road to Veteran's Drive with one westbound through lane, one eastbound through lane and one centre TWLTL. Furthermore, Harvie Road will need to be widened to 5 lanes from Veteran's Drive to Bryne Drive with two eastbound through lanes, two westbound through lanes and a TWLTL.

6.6 Intersections and Entrances

In the 2021 planning horizon, Harvie Road will have a new intersection at Bryne Drive with the following configuration:

- North and south approaches: two through lanes and dedicated turning lanes
- East approach: one through lane and dedicated turning lanes
- West approach: one dedicated left-turn lane, one through lane, one shared through and one right-turn lane.

The intersection of Harvie Road and Veteran's Drive is recommended to be signalized. With the new intersection at Bryne Drive and the signalization of the Veteran's Drive intersection, all traffic operations along Harvie Road are expected to be acceptable.

The remaining intersections are expected to operate at acceptable LOS and capacity. The intersection of Harvie Road and Essa Road can be controlled with either the existing traffic signal. Given the recent construction of the intersection, it would not be prudent to change the intersection type. The City should consider a roundabout in the longer term as opportunities arise.

With the proposed improvements, unrestricted access is maintained for all driveways along the Harvie Road Study Area corridor. Widening of the roadway provides gaps in through traffic for vehicles to access driveways.

The signal timing at the Harvie Road and Essa Road intersection should be modified to include a cycle length of 110 seconds and a protected westbound left-turn phasing to accommodate the projected westbound left-turn movement volumes.

With the road widening along Harvie Road and the optimized signal timing at the Essa Road intersection, all Study Area intersections are expected to operate at acceptable levels without further improvements.

6.7 Provision of Cyclists and Pedestrians

Pedestrians and cyclists will be accommodated by way of a 1.5m buffered bicycle lane on either side of the roadway, as well as 2.0m sidewalk on either side of the roadway. The design of bike lanes will be completed in accordance with the requirements of the Ontario Traffic Manual (OTM) Book 18. The provision of bike lane crossings at intersections will be reviewed by the City of Barrie during the detailed design phase.

Proposed crossings, connections with existing trail and sidewalk systems, as well as facilities meeting AODA requirements.

6.8 Drainage and Stormwater Management

The Harvie Road area will drain primarily into the constructed Pond "A" located to the south of Harvie Road and west of the Bryne Drive. The minor storm condition area will be conveyed via urban cross-section storm sewer drainage infrastructure. The proposed Harvie Road new crossing structure over Highway 400 has been drafted to consider the future Harvie Road expansion.

It is noted that in HBBP Project, Pond A expansion was proposed to treat the increase flow from the Harvie/Big Bay Point/Highway 400 Overpass, Harvie Road to the west and the southern stretch of Bryne Drive within the Whiskey Creek subwatershed. Major and minor flows will be routed into Pond A for water quality and quantity treatment.

Through the HBBP project, in order to meet the LSRCA LID infiltration requirements, the proposed Pond A expansion is approximately 1,155 m^3. The expansion is positioned along the north side of the existing Pond A main cell and will be installed beneath the surface in the form of a soakaway pit facility.

6.9 Culvert Design

Based on the hydraulic analysis of design alternatives, the following includes the recommendations for the two Whiskey Creek crossings (See Figure 6-2):

- E.C.W -1 is an 1050mm existing CSP culvert that conveys the northern tributary of Whiskey Creek southerly to the main Whiskey Creek at the Bryne Drive and Harvie Road intersection. As proposed in the Harvie Road/Big Bay Point Road/Highway 400 overpass project, it is recommended to be replaced with a 1650mm diameter circular concrete pipe to convey the flows. An outlet pool with rock protection at the downstream end and rock protection at upstream end are proposed to mitigate the erosion impact.
- E.C. W-3 is a 1200mm existing CSP culvert that conveys the Whiskey Creek main branch upstream of the Hwy 400 concrete culvert crossing. As proposed in the Harvie Road/Big Bay Point Road/Highway 400 Project, the culvert proposed under Harvie Road is recommended to convey surface runoff from the north-west quadrant of the Highway 400 and Harvie Road southerly to the relocated main branch of Whiskey Creek.

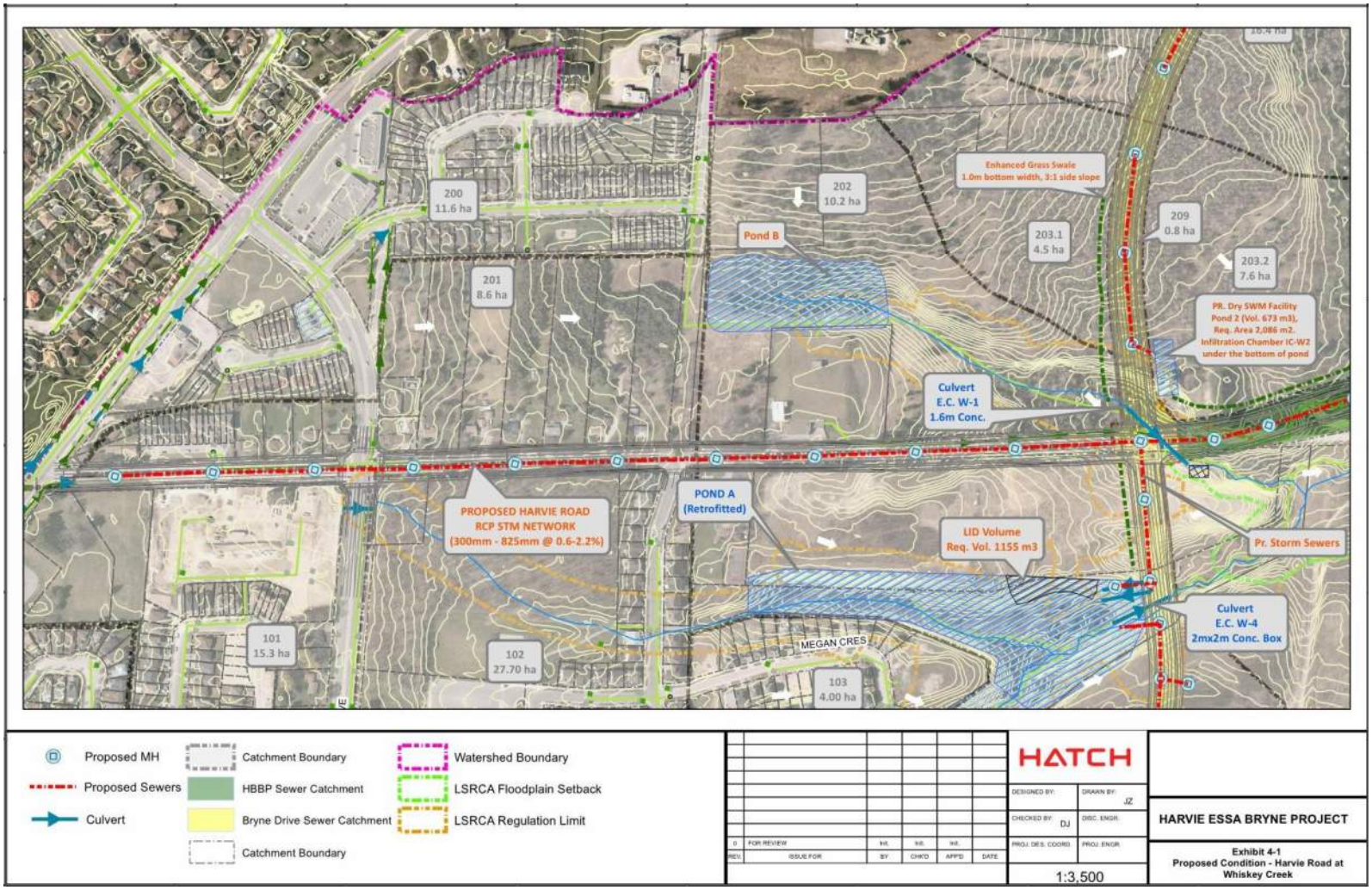


Figure 6-2: Harvie Road Drainage Concept

6.10 Utilities and Other Services

A utility corridor along the south side of Harvie Road is recommended to tie into the work associated with the Harvie Road/Big Bay Point Road/Highway 400 overpass.

Watermain

Harvie Road contains a network of transmission and distribution watermains as well as a water reservoir located between Bryne Drive and Thrushwood Road. The proposed alternative is expected to require the relocation of the 400mm and 500mm distribution watermain as well as the 750mm transmission watermain from just west of proposed intersection of Bryne Drive and Harvie Road, easterly towards the Harvie Road Overpass, as is required as part of the Overpass construction. The watermains west of the water reservoir, consisting of four (4) distribution watermains (sized 300mm, 400mm, 500mm, and 600mm) and a 750mm transmission watermain are intended to remain based on the proposed road alignment, however the locations of these watermains will be investigated further in detailed design to confirm location and assessed to ensure proper cover and clearance is maintained to the proposed construction, including storm sewer network and catchbasin locations.

Any existing watermains will be assessed for clearance, coverage, and protection, including assessment for surcharge loading in situations where road profile is raised.

Sanitary

There is an existing 375mm sanitary sewer that will also be relocated within similar limits to the watermain as noted above (i.e. west of Bryne Drive as part of the Harvie Overpass utility relocation program). On Harvie Road west of Bryne Drive, a new gravity sanitary sewer will potentially be installed to service the residential area. This will also be confirmed in detail design.

Private/3rd Party Utilities

Based on preliminary assessment of the preferred design, there are known utility conflicts that must be addressed in detailed design, such as hydro poles that will need to be relocated as their current location encroach on the proposed right-of-way. Remaining hydro poles will also have to be assessed for adequate support depth in instances where proposed profiles are lowered, or wire clearances confirmed where proposed profiles are raised which may also require additional guy wires and potentially additional easements for these guy wires.

The location and alignment of existing private utilities 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. Meetings will be held during detailed design to investigate and discover locations of utilities and to evaluate the extent and degree of impact as measured against the detailed design, with consequential coordination, planning and relocation design by affected utilities for relocation and/or protection of respective utility infrastructure.

Storm Sewer

Proposed storm sewer system along Harvie Road between Veterans Drive and Highway 400 will collect and convey runoff for the minor 5-year storm event towards the future Bryne Drive and ultimately to SWM Pond A for quality and quantity control. The sizes of proposed storm sewers ranged from 300mm to 825mm.

6.11 Streetlighting and Traffic Signals

The existing unsignalized intersection at Harvie Road and Veterans Drive is expected to experience severe operational problems in both the AM and PM peak hours following the extension of Harvie Road over Highway 400 connecting with Big Bay Point Road in the 2021 Future Condition. Signalization would be required to improve operations at this intersection.

By 2031, the intersection of Harvie Road and Essa Road will be operating at a LOS E during the PM peak hour. An increase in the traffic signal cycle length to 110 seconds and addition of a protected westbound left-turn movement is required to improve operations at this intersection.

6.12 Landscaping and Streetscaping

The widening of Harvie Road may affect existing trees on private property. The requirement for tree removal and replacement will be confirmed during Detailed Design and through consultations with individual property owners during negotiations for property acquisition.

The proposed streetscaping improvements on Harvie Road will include a 2.9m boulevard on either side of the road between the curb and the sidewalk. This boulevard will provide a buffer for pedestrians and improve street vegetation and corridor aesthetics.

6.13 Property Requirements

The MMATMP identifies a road allowance width of up to 34m for Harvie Road. The recommended Design Concept to widen the roadway attempts to minimize full property buy-outs. The property requirements are presented in the Preliminary Design in Appendix G.

The preliminary property requirements for the improvements to Harvie Road are detailed in Table 6-2. Property impacts will be further refined and finalized during Detailed Design.

Table 6-2: Property Required along Harvie Road

Location	34m ROW (m²)
North Side	5,083
South Side	9,078
TOTAL	14,161

Temporary easements may be required in some sections of the corridor to provide for grading and blending in for graded slopes. The temporary easements will be reviewed during Detailed Design

6.14 Noise Assessment

The results of the noise assessment show that there are some sound levels resulting from the proposed project which show the change to be in the worst cases between 6.2 to 8.2 dBA, which is in excess of the 5 dBA limit. There are three homes which will experience an increase over 5.0 dBA. All of the impacted homes are near the existing Harvie Road. The primarily cause is the large increase in road traffic volumes and to a lesser degree the road widening. The road traffic volumes will increase from approximately 2,000 to 30,000 vehicles per day. All of the homes on Harvie Road that experience noise impacts have private driveways that are accessed by Harvie Road. The exception to this are the homes in the southwest quadrant of Harvie Road and Thrushwood Drive.

6.15 Preliminary Cost Estimate

A preliminary construction cost estimate was completed for the road widening, storm sewer improvements and provision of full illumination. Note that the cost for the culvert replacements associated with Whiskey Creek, for both the north and main branches are covered under the costs for the Harvie Road/Big Bay Point Road/Highway 400 project. The estimated construction cost for the road widening is $11,723,450. Further detail of the cost estimate is included in Appendix I.

7. Description of Preferred Design Concept – Essa Road

7.1 Design Criteria

The Design Criteria for Essa Road is described in Table 7-1 below. The Preferred Design Concept (Plan and Profile) is included in Appendix G.

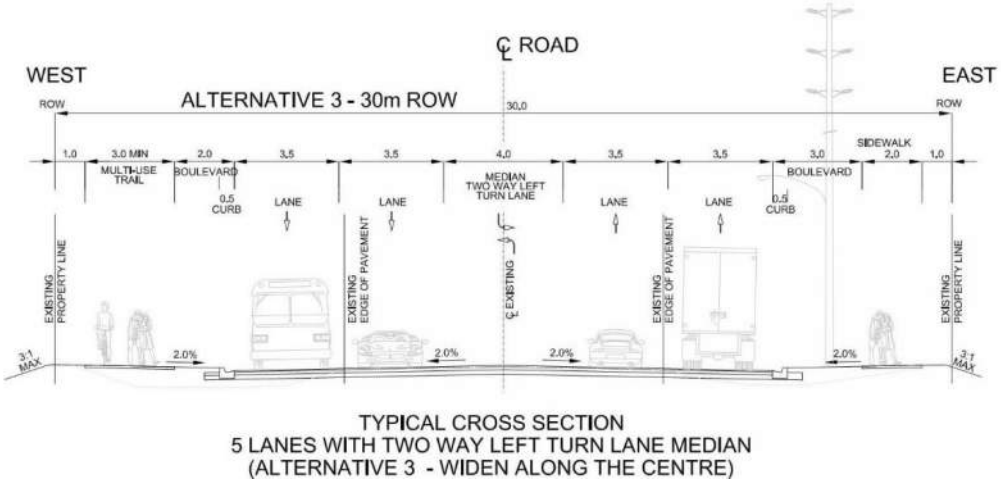
Table 7-1: Design Criteria for Essa Road

Essa Road		
Parameter	**Design Standards**	**Achieved Value**
Design Classification	UAU70	UAU70
Basic Lanes	4	4
Minimum Stopping Sight Distance	100 m	100
Min. K Factor - Crest	20	Unknown at this time
Min. K Factor – Sag	20	Unknown at this time
Grades Maximum	5 %	Unknown at this time
Minimum Radius	200 m	Unknown at this time
Lane Width	3.7 m	3.5 m
TWLTL/Median Width	N/A	4.0 m
Posted Speed	70 km/hr	70 km/hr
R.O.W. Width	Varies	Varies

7.2 Typical Cross-Sections

The typical cross-section for the preferred design for Essa Road includes a 5-lane cross-section with a two-way left-turn lane (See Figure 7-1). The cross-section has a 30m right-of-way, with a 3.0m multi-use trail on the west side and a 2.0m sidewalk on the east-side. The following is a summary of the preferred design concept for Essa Road:

- Four 3.5m lanes
- One 4.0m two-way left-turn lane – maintains access to properties and future developments on the east side
- Sidewalk on the east side – provides for improved pedestrian connectivity
- Multi-Use Trail on the west side – provides for improved cycling and alternative mode of travel connectivity
- Boulevard – 2m west side and 3m east side



TYPICAL CROSS SECTION
5 LANES WITH TWO WAY LEFT TURN LANE MEDIAN
(ALTERNATIVE 3 - WIDEN ALONG THE CENTRE)

Figure 7-1: Essa Road Cross-Section

Note that Figure 7-1 shows the existing hydro corridor to be located within the proposed boulevard. The detail design of this treatment and/or relocation is currently in progress.

7.3 Horizontal and Vertical Alignment

The horizontal alignment mostly follows the existing centre line on Essa Road. The vertical alignment for the roadway was designed to:

- Minimize the impact to Bear Creek crossing and the culvert;
- Follow existing alignment as closely as possible; and
- Satisfy the design criteria and design standards as closely as possible.

7.4 Traffic and Transportation

In the 2021 planning horizon:

- Widening Essa Road to 5 lanes, with two lanes in each direction and a center TWLTL, is required to support projected traffic volumes, including traffic generated from the development of Messa Village.
- With 5-lane widening, the existing lane configurations and the traffic operations at the intersections of Essa Road with Mapleview Drive and with Coughlin Road will be improved. The new unsignalized intersection of Essa Road with the full access to Messa Village is also expected to operate well with the widened cross section of Essa Road.

In the 2031 planning horizon:

- The 5-lane cross section of Essa Road is sufficient to support projected traffic volumes in the study area.

- All study area intersections are expected to operate at acceptable levels and this no further improvements are needed to accommodate projected demand.

7.5 Intersections and Entrances

There are no driveways on the west side of Essa Road, and the existing driveways on the east side of Essa Road will be maintained. Following the widening to 5-lanes by 2021, the following lane configuration improvements will be made to intersections including:

- Addition of southbound through lane at the intersection of Essa Road and Mapleview Drive;
- Addition of a lane in each of the northbound and southbound directions at the intersection of Essa Road and the Messa Village access; and
- Addition of a southbound left-turn only lane with adequate storage length accommodated by the TWLTL at the intersection of Essa Road and the Messa Village Access.

7.6 Provision of Cyclists and Pedestrians

Pedestrians and cyclists will be accommodated by way of a 3.0m multi-use trail on the west side and a 2.0m sidewalk on the east side so that a continuous bicycle network and sidewalk network are provided throughout the Study Area corridor, connecting with the improvements made by the City of Barrie north of Coughlin Avenue. The design of the multi-use trail will be completed in accordance with the requirements of the Ontario Traffic Manual (OTM) Book 18.

7.7 Drainage and Stormwater Management

Proposed storm sewer system beneath Essa Road will collect and convey runoff from roadway Catchments C501 and C502 for the minor 5-year event. The storm sewer system will be pre-treated via an oil grit separator (OGS) unit and discharged to the proposed dry SWM facility Pond BR-P2. The pond will be overcontrolled to balance the flow conveyed from Catchment C502. The provided volume within BR-P2 will be 732 m^3, which meets both the LSRCA and MOECC requirements. Approximately 1300 m^2 area is required for the proposed pond.

An infiltration chamber IC-B1 will be installed adjacent to and beneath BR-P2 as an LID measure to meet the infiltration requirements for the Essa Road ROW catchments. The outflow from the proposed BR-P2 will be directed to the Bear Creek channel downstream of Culvert E.C. B-1 via a proposed water quality swale.

The controlled outflow from existing Dry Pond BR-27 will be directed to the upstream end of existing Culvert E.C. B-1 through a proposed separated clean water storm sewer system.

Figure 7-2 illustrates the drainage concept of Essa Road.

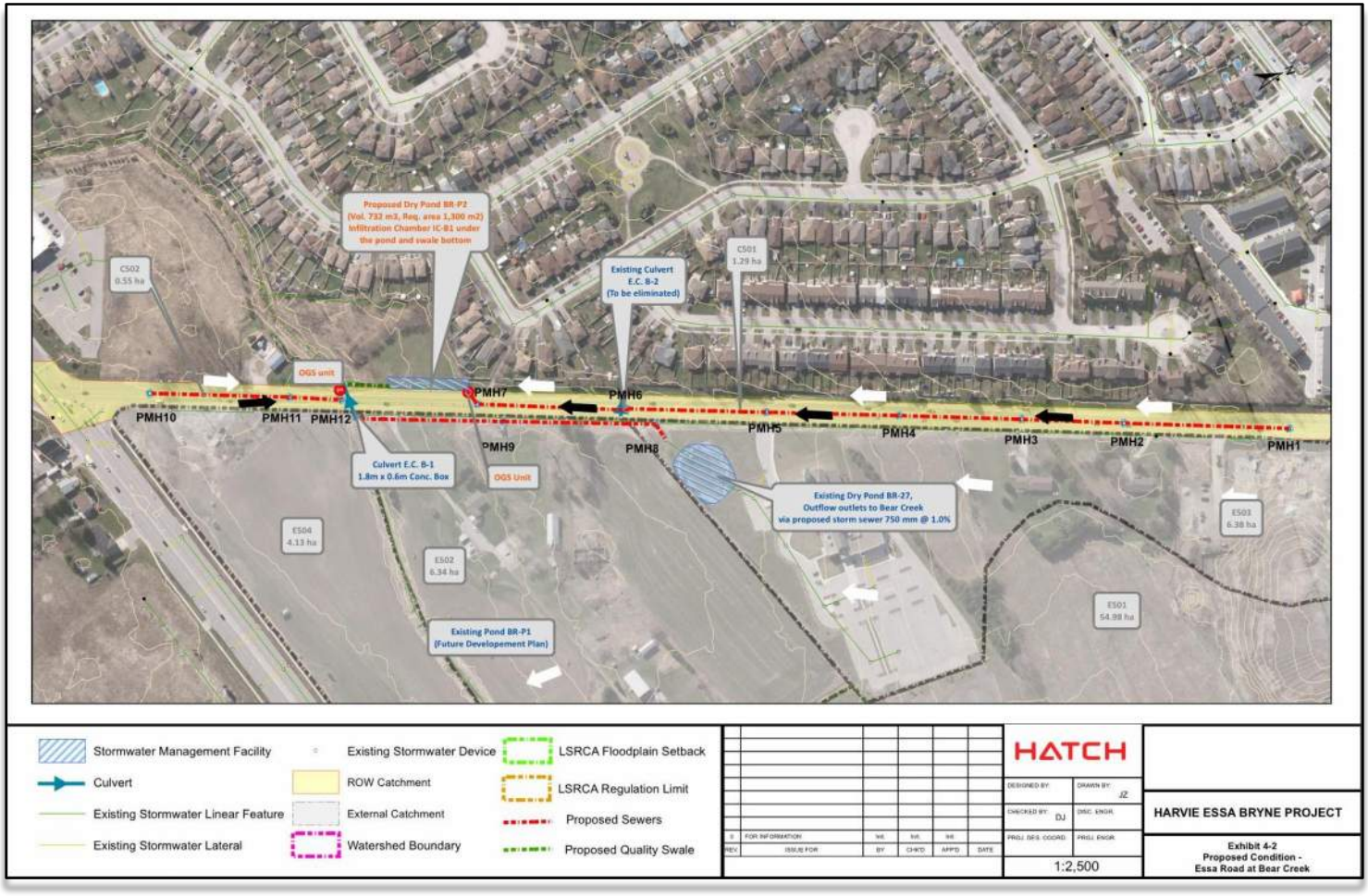


Figure 7-2: Proposed Drainage Concept – Essa Road at Bear Creek

7.8 Culvert Design

The existing culvert E.C. B-1 on Essa Road at Bear Creek was assessed against the current City of Barrie criteria. The existing culvert structure is recommended to be maintained on site; however, some extension may be required to accommodate the widening of Essa Road.

Culvert E.C.B-1 meets freeboard requirement for the 50-year design storm and meets H/D ratio requirement. The culvert safely conveys the100-yr and Regional Storm flows without overtopping the roadway. Rock protection is recommended at both inlet and outlet of the culvert to mitigate the erosion impact.

7.9 Utilities and Other Services

Watermain

The watermains may need to be relocated to accommodate for the new widened road and away from the centreline of the new road, typically 2-3m from the new property line. Any existing watermains will be assessed for clearance, coverage, and protection, including assessment for surcharge loading in situations where road profile is raised.

Sanitary

There is no existing sanitary, however a new sanitary sewer will be developed in detailed design to service proposed developments.

Private/3rd Party Utilities

Based on preliminary assessment of the preferred design, there are known utility conflicts that must be addressed in detailed design, such as hydro poles that will need to be relocated as their current location encroach on the proposed right-of-way.

Remaining hydro poles will also have to be assessed for adequate support depth in instances where proposed profiles are lowered, or wire clearances confirmed where proposed profiles are raised which may also require additional guy wires and potentially additional easements for these guy wires.

The widening of Essa Road will impact Bell underground assets, as the assets on the east and west sides of Essa Road will end up in the middle of the road. Bell relocations will be required to accommodate the new widened road and grading. Note that the detailed treatment and/or relocation plans are in progress and the final plan will be based on Bell's final design.

Cogeco's asset may only require protection during construction as Essa Road will be tying into existing conditions at this intersection of Essa Road and Mapleview Drive.

Since Enbridge does not prefer their gasmains to be located within the road way, relocation may be necessary in order to maintain their gasmains approximately 1m from the new property line.

The location and alignment of existing private utilities 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. Meetings will be held during detailed design to investigate and discover locations of utilities and to evaluate the extent and degree of impact as measured against the detailed design, with consequential coordination, planning and relocation design by affected utilities for relocation and/or protection of respective utility infrastructure.

Storm Sewer

Storm sewers with diameters ranges from 375 to 675 mm @ 0.50 – 2.50 % are proposed on the north side of the existing culvert on Essa Road. Another set of storm sewers with diameter of 450mm @ 0.5% are proposed on the south side of the existing culvert on Essa Road. In addition, storm sewer (750 mm @ 1.00%) has been proposed at the east side of Essa Road to convey the outflow from Pond BR-27 to discharge to Bear Creek.

7.10 Streetlighting and Traffic Signals

The existing traffic signals at Coughlin Avenue is to be relocated/replaced to accommodate the widened roadway. The condition of the existing equipment is to be reviewed during the design stage and the signals upgraded or replaced if necessary. The design of all signals and related intersection improvements will be in compliance with the *Accessibility of Ontarians with Disabilities Act* (OADA).

7.11 Landscaping and Streetscaping

The widening of Essa Road may affect existing trees along private property on the east side of the right-of-way. The requirement for tree removal and replacement will be confirmed during Detailed Design and through consultations with individual property owners during negotiations for property acquisition.

The proposed improvements on Essa Road will include a 2.0m wide boulevard on the west side and a 3.0m wide boulevard on the east side between the curb and the sidewalk. The boulevard will provide a buffer for pedestrians, and the consideration of street vegetation, however it will also provide for utilities.

7.12 Property Requirements

The recommended Design Concept to widen the roadway attempts to minimize property requirements. There are potential property impacts along the west side, measuring approximately 256m², however these impacts can be mitigated by reducing the boulevard width on the west side. There are potential property impacts on the east side, measuring 1,207m². These details will be confirmed during Detailed Design.

Temporary easements may be required in some sections of the corridor to provide for grading and blending for graded slopes. The temporary easements will be reviewed during Detailed Design.

7.13 Noise Assessment

A noise assessment was completed to review the need to mitigate traffic noise impacts upon project build out. Homes within the Essa Road Study Area corridor will experience slight noise level increases because of the increase in road traffic volumes in the area, as a result of the construction of both Harvie Road and Bryne Drive.

7.14 Preliminary Cost Estimate

A preliminary construction cost estimate was completed for the road widening, storm sewer improvements, culvert extension and provision of full illumination. The estimated construction cost for the road widening is $7,797,000. Further detail of the cost estimate is included in Appendix I.

8. Description of Preferred Design Concept – Bryne Drive

8.1 Design Criteria

The Design Criteria for Bryne Drive is described in Table 8-1. The Preferred Design Concept (Plan and Profile) is included in Appendix G.

Table 8-1: Bryne Drive Design Criteria

Bryne Drive		
Parameter	**Design Standards**	**Achieved Value**
Design Classification	UCD 60	UCD 60
Posted Speed	50km/h	50km/h
Design Speed	60km/h	60km/h
Basic Lanes	4	4
Design Vehicle	WB-20	WB-20
Minimum Stopping Sight Distance	95m-110m	100m
Min. K Factor – Crest	16-23	30
Min. K Factor – Sag	20-25	30
Grades maximum	0.5% - 6%	0.5% - 6%
	185m (CoB)	
Minimum Radius	150m (0.04m/m)	190m (0.06 m/m)
	190m (0.06m/m)	
Lane Width		
Inside	2 @ 3.50m	2 @ 3.50m
Outside	2 @ 3.50m	2 @ 3.50m
Left Turn Lane Width	3.00m	3.00m
Right Turn Lane Width	3.50m	3.50m
Two-Way Left Turn lane	3.25m – 4.20m	3.25m – 4.20m
Raised island width (at intersections)	1.20m	1.20m
Road Allowance	34m	34m
Miscellaneous		
Bike Lanes	2 @ 1.50m	2 @ 1.50m
Bike Lane Buffers	0.50m	0.50m
Curb and Gutter	OPSD 600 series	OPSD 600.040
Boulevard Width	2.90m	2.90m
Sidewalk	2 @ 2.00m	2 @ 2.00m
Rounding	0.50m	0.50m

8.2 Typical Cross-Sections

The typical cross-section for the preferred design for Bryne Drive includes a 5-lane cross-section with a two-way left-turn lane (See Figure 8-1). The cross-section is a 34m right-of-way, with a 2.0m sidewalk and 1.5m bike lane on both sides of the road. The following is a summary of the preferred design concept for Bryne Drive:

- Four 3.5m lanes
- One 4.2m two-way left-turn lane – maintains access to properties and future developments on the east side
- One 2.0m sidewalk on the east and west side – provides for improved pedestrian connectivity
- One 1.5m buffered bike lane on the east and west side – provides for improved cycling and alternative mode of travel connectivity

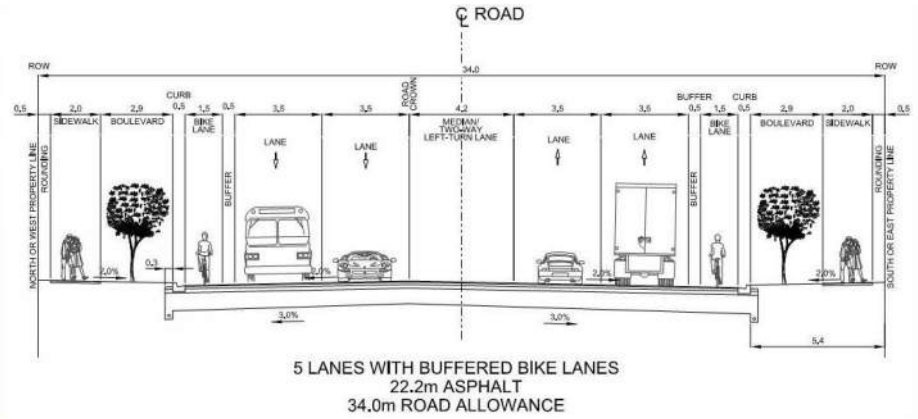


Figure 8-1: Bryne Drive Cross-Section

8.3 Horizontal and Vertical Alignment

The horizontal alignment follows the existing 3R alternative as presented in the 2016 Class EA Master Plan. The vertical alignment for the roadway was designed to:

- Minimize raising the grade of the road to reduce impacts on adjacent properties;
- Minimize impact to existing stream crossings and culverts, as well as Pond A;
- Follow existing alignment as closely as possible; and
- Satisfy the design criteria and design standards as closely as possible.

8.4 Traffic and Transportation

The traffic analysis in this report indicates that the extension of Bryne Drive between the current termini south of Essa Road and north of Caplan Avenue requires a 5-lane cross section to support projected traffic volumes in both 2021 and 2031. The traffic volumes in

2021 consider the impacts of the Harvie Road crossing over Highway 400 connecting to Big Bay Point Road. The traffic volumes in 2031 consider the impacts of the potential partial interchange at Harvie Road / Big Bay Point Road with Highway 400.

In 2021, the Bryne Drive extension is recommended to be constructed with two through lanes in each direction and a center two-way left turn lane (TWLTL).

8.5 Intersections and Entrances

In 2021, a new intersection at Harvie Road and Bryne Drive will be built, with two through lanes and one left and one right auxiliary turn lane at the north and south approaches. The east approach will include one through lane with a dedicated left turn lane and a shared through right lane. The west approach will include one through lane and one left and one right auxiliary turn lane. No improvements are required at the existing intersections of Bryne Drive with Essa Road and Caplan Avenue in the in 2021 horizon year.

In 2031, the intersection at Harvie Road and Bryne drive will be widened to include two through lanes and one left and one right auxiliary turn lane at each approach. A number of intersection improvements at Bryne Drive and Essa Road, and at Bryne Drive and Caplan Road are recommended. These include:

- Addition of a second eastbound left turn lane at the intersection of Bryne Drive and Essa Road
- Increase in signal cycle length to 100 seconds at the intersection of Bryne Drive and Caplan Avenue
- Optimization of signal timing splits at both intersections of Bryne Drive with Essa Road and with Caplan Avenue

8.6 Provision of Cyclists and Pedestrians

Pedestrians will be accommodated by way of a 1.5m sidewalk and 2.0m bike lane on both sides of the road. Both of these provisions will provide a continuous bicycle and sidewalk network throughout the Study Area. The design of bike lanes will be completed in accordance with the requirements of the Ontario Traffic Manual (OTM) Book 18.

8.7 Drainage and Stormwater Management

For the purpose of drainage study, the potential drainage concept within Bryne Drive has been divided into four (4) distinct study areas as follows:

8.7.1.1 Bryne Drive, South of Harvie Road and North of Caplan Avenue at Lover's Creek (Figure-8-2):

As part of this project, the existing Bryne Drive will be improved and realigned for the proposed extension of Bryne Drive within the Lovers Creek subwatershed. This improvement and extension of this roadway will affect the current drainage patterns, resulting in an increase to the impervious level within the ROW.

The southern stretch, which connects with the existing Bryne Drive, features existing storm sewer network flowing into the existing Pond LV14. The existing Storm Sewer System will be upsized to collect and convey runoff for the minor 5-year storm event from the proposed roadway area. Pond LV14 will be retrofitted to meet the additional volume requirement for quantity and quality control and it will provide Enhanced level of quality treatment. To meet the infiltration requirements, an underground infiltration chamber is proposed at the southwest corner of the existing Pond LV14, to provide LID infiltration control volume for the net impervious increase on Bryne Drive. The 25mm storm flow will be diverted to the infiltration chamber for LID infiltration control through a proposed inlet pipe designed to convey the 25mm event from the LV14. The inlet pipe from the LV14 will be positioned above the 2-year elevation within the pond and below the 5-year storm elevation in order to provide infiltration capacity above the permeant pool level of the pond facility.

Approximately 810 m^3 of additional storage volume is required to retrofit Pond LV14 to maintain the water quantity control requirement. It is recommended to provide approximately 2m widening to the existing boundary of Pond LV14 to achieve the additional quantity requirement.

Runoff from rural Catchment L-5A and the Pond LV14 outflow will be conveyed easterly via a re-aligned Lovers Creek channel through a proposed Culvert P.C.L-2 under the new roadway alignment of Bryne Drive.

Linear bio swales are proposed on both the north and south side of the culvert. Roadway runoff of Catchment L-5B will be conveyed to these swales through laterals for water quality treatment. CB-shields are recommended in catch basins for additional treatment. Granular infiltration galleries are proposed under these linear bio swales as a LID measure.

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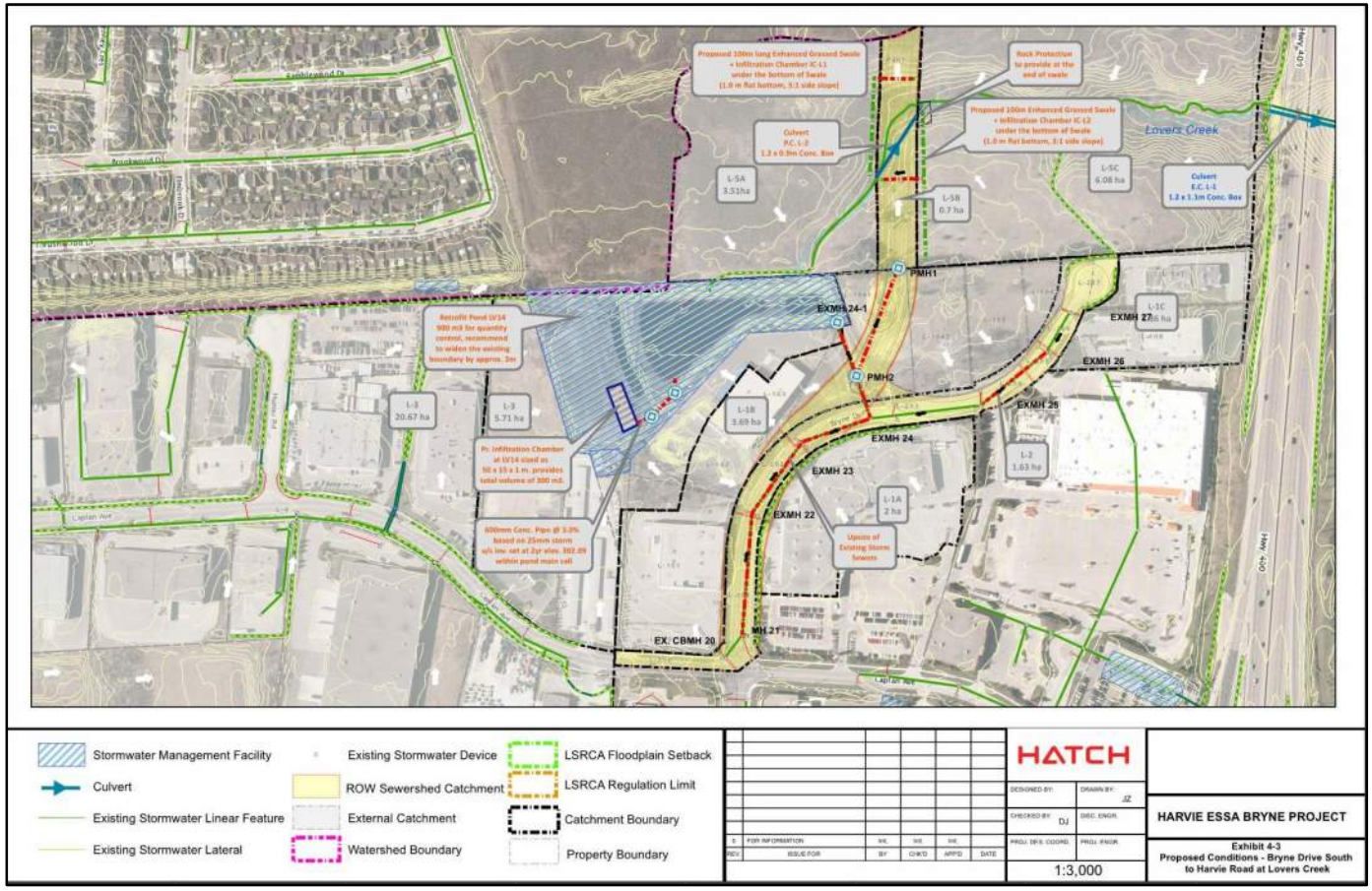

Figure 8-2: Proposed Drainage Concept - Bryne Drive, South of Harvie Road and North of Caplan Avenue at Lovers Creek

8.7.1.2 Bryne Drive, South of Harvie Road at Whiskey Creek (Figure 8-3):

The future Bryne Drive alignment runs along Catchments 104 to the south of Harvie Road. Catchment 104 was updated to include a small portion of drainage area located at the south-west corner of Harvie Road and Bryne Drive intersection. Due to proposed roadway cross-section and new roadway construction within the currently undeveloped lands, imperviousness at Catchments 104 will increase.

A proposed storm sewer system will collect and convey runoff for the minor 5-year storm event from the proposed Bryne Drive between Harvie Road, and Whiskey Creek and Lovers Creek subwatershed boundary. Runoff from the storm sewer will be directed to SWM Pond A for quantity and quality control.

The storm sewer outfall will be designed to accommodate the 100-year flow. Additional catch basins will be placed at the lowest point to capture and convey major storm runoff along the proposed roadway.

The section of Catchment 104 located east of Bryne Drive will be captured by a ditch inlet connected to the main storm sewer flowing to SWM Pond A.

As identified in HBBP project, an infiltration chamber will be provided on the north side of Pond A with a volume of 1,155 m^3, which meets the requirements as per LSRCA SWM guidelines.

Outflow from Pond A will be conveyed to the east side of proposed Bryne Drive via an existing 2.0 m x 2.0 m concrete box culvert that will need to be extended. The outfall extension will convey runoff from Pond A to the Whiskey Creek main branch flowing to the Highway 400 culvert crossing.

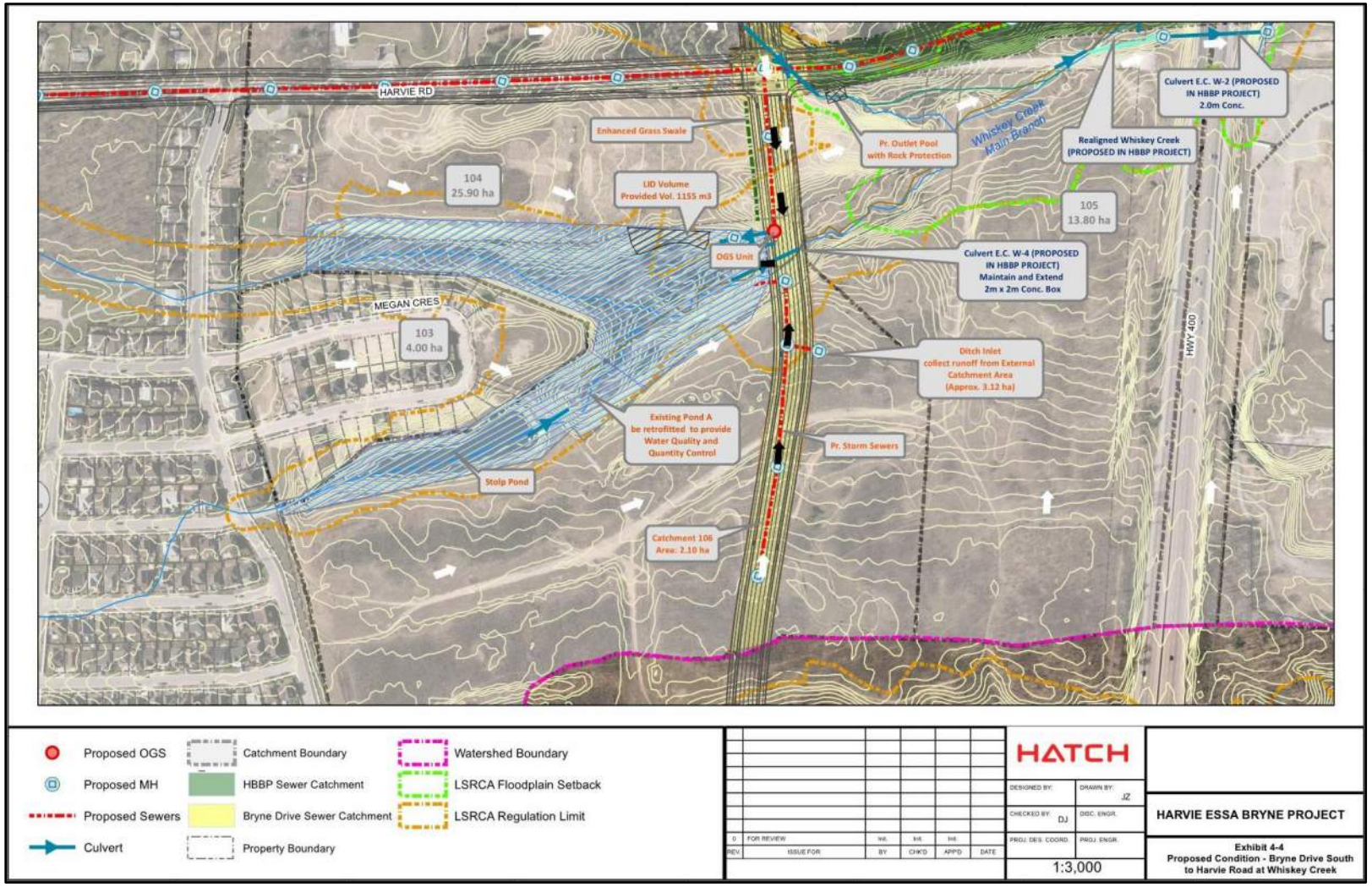

Figure 8-3: Proposed Drainage Concept - Bryne Drive, South of Harvie Road at Whiskey Creek

8.7.1.3 Bryne Drive, North of Harvie Road at Whiskey Creek (Figure 8-4):

The Bryne Drive alignment to the north of Harvie Road runs through the undeveloped areas through existing Catchments 203 and 205, which results in an increase to the imperviousness within these catchments.

Storm Sewer System will collect and convey runoff for the minor 5-year storm event from the roadway Catchments 208 and 209. The storm sewer in Catchment 208 will be discharged to the proposed Linear Dry SWM Pond 1. This SWM facility will include an infiltration chamber (IC-W1) at the bottom of the pond as a LID measure. The outflow from Pond 1 will discharge to the proposed water quality swale (D-W1), which eventually discharge to the Culvert E.C. W-5 at Highway 400. Pond 1 will provide a storage volume of approximately 673 m^3 and approximately 2,000 m^2 area is required for the pond.

The storm sewer in Catchment 209 will be discharged into the proposed Linear Dry SWM Pond 2. This facility will include an infiltration chamber (IC-W2 (at the bottom of the pond. The outflow from Pond 2 will discharge to the proposed water quality swale (D-W2), which eventually discharges to Culvert E.C. W-3 at Harvie road west Highway 400. Pond 2 will provide a storage volume of approximately 673 m^3 and approximately 2,000 m^2 area is required for the pond.

Pre-treatment in the form of a pair of appropriately sized OGS units are recommended prior to discharging to the two (2) road ROW outfall locations.

A culvert (P.C.W-1) is proposed at Bryne Drive within Catchment 208 to convey the runoff from the west side to the east of the proposed road in order to maintain the drainage pattern within the subwatershed. The proposed culvert conveys runoff to the proposed swale D-W1.

Runoff from a small undeveloped area located to the west of proposed Bryne Drive (Catchment 203.1) will be directed to Harvie Road Culvert E.C.W-1 through the proposed grassed swale.

As a potential option recommended from and consistent with the Whiskey Creek Master Drainage Plan, the consideration for Pond B has been reviewed. The design and construction of this facility could potentially provide compensation in terms of water quantity, quality and infiltration benefits within the Whiskey Creek subwatershed for the current project. However, it should be noted that a direct connection from the Bryne Drive ROW is not possible, the facility would need to be discussed with the LSRCA on a subwatershed basis to document benefits and meeting target criteria. If this will be an agreeable alternative, the proposed Pond 2 located near the Bryne Drive and Harvie Road intersection can be removed.

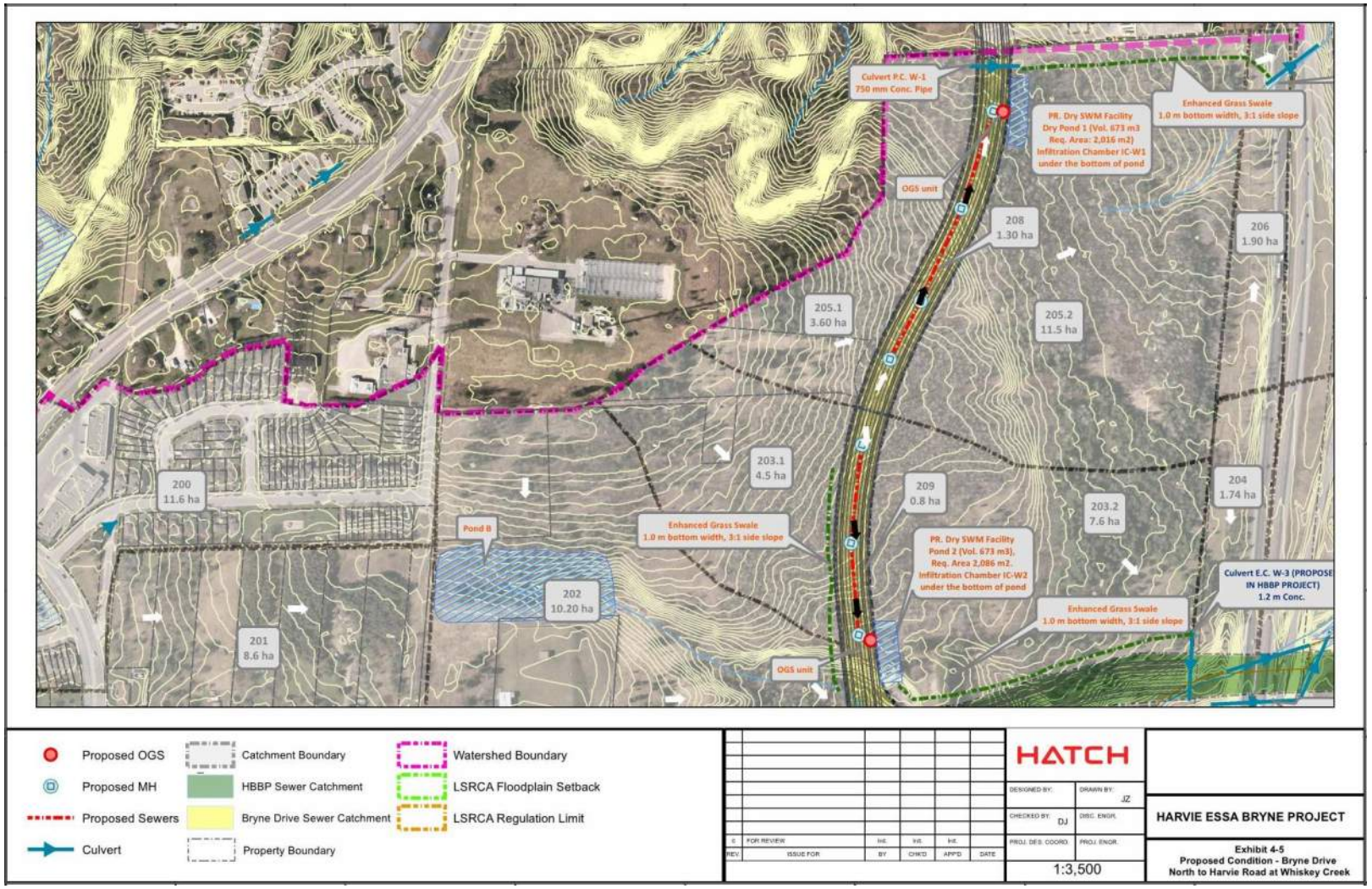

Figure 8-4: Proposed Drainage Concept - Bryne Drive North of Harvie Road at Whiskey Creek

8.7.1.4 *Bryne Drive, North of Harvie Road and South of Essa Road at Hotchkiss Creek (Figure 8-5):* Bryne Drive is proposed to be constructed with a widened urbanized cross-section featuring bike lanes and improved sidewalks. The proposed improvements will alter the catchment drainage conditions, increasing the imperviousness, which requires water quantity and quality treatment. The following is the drainage plan within the Bryne Drive section, which features the utilization of existing drainage and SWM infrastructure with additional quality and retrofit recommendations:

The existing storm sewer system will collect runoff for the minor 5-year event from the roadway. Three (3) sections of the existing Bryne Drive storm sewer within this area require upsizing as a result of the roadway design and conveyance criteria requirements.

The Bryne Drive storm sewer from MH 1 to MH 5 has sufficient capacity to convey the proposed condition runoff. Runoff from this system ultimately discharges to SWM Pond HT06. Due to the documented high infiltration capacity of the soil at Pond HT06, this facility was considered to be a dry pond.

Due to hydraulic conveyance capacity concerns, an upsized storm sewer has been identified as a requirement for the section from MH 5 to SWM Pond HT06. Storm sewers from MH 6 to MH 7 and from MH 8 to MH 9 have been identified as deficient in terms of meeting the conveyance criteria under the proposed condition. These sections will require replacement to meet the conveyance criteria.

Two (2) oil grit separator (OGS) units will be installed within this area. The first one will be installed prior to the outlet to HT06 at MH 5 in order to provide pre-treatment to contribute to meeting water quality requirements. The second unit will be located towards the Essa Road and Bryne Drive intersection at the downstream end of the system at MH 9 prior to discharging from the Bryne Drive ROW.

The existing Dry Pond HT06 will be retrofitted to provide additional water quantity, quality, and LID infiltration volume in order to meet the proposed Bryne Drive ROW runoff impacts associated within the increase in impervious area. HT06 is currently slated to be retrofitted, however this facility will require an additional 682m^3. One key benefit identified for this facility is the high infiltration rate at this location, which has resulted in this facility being able to infiltrate all runoff events within 24 hours and form a dry pond facility.

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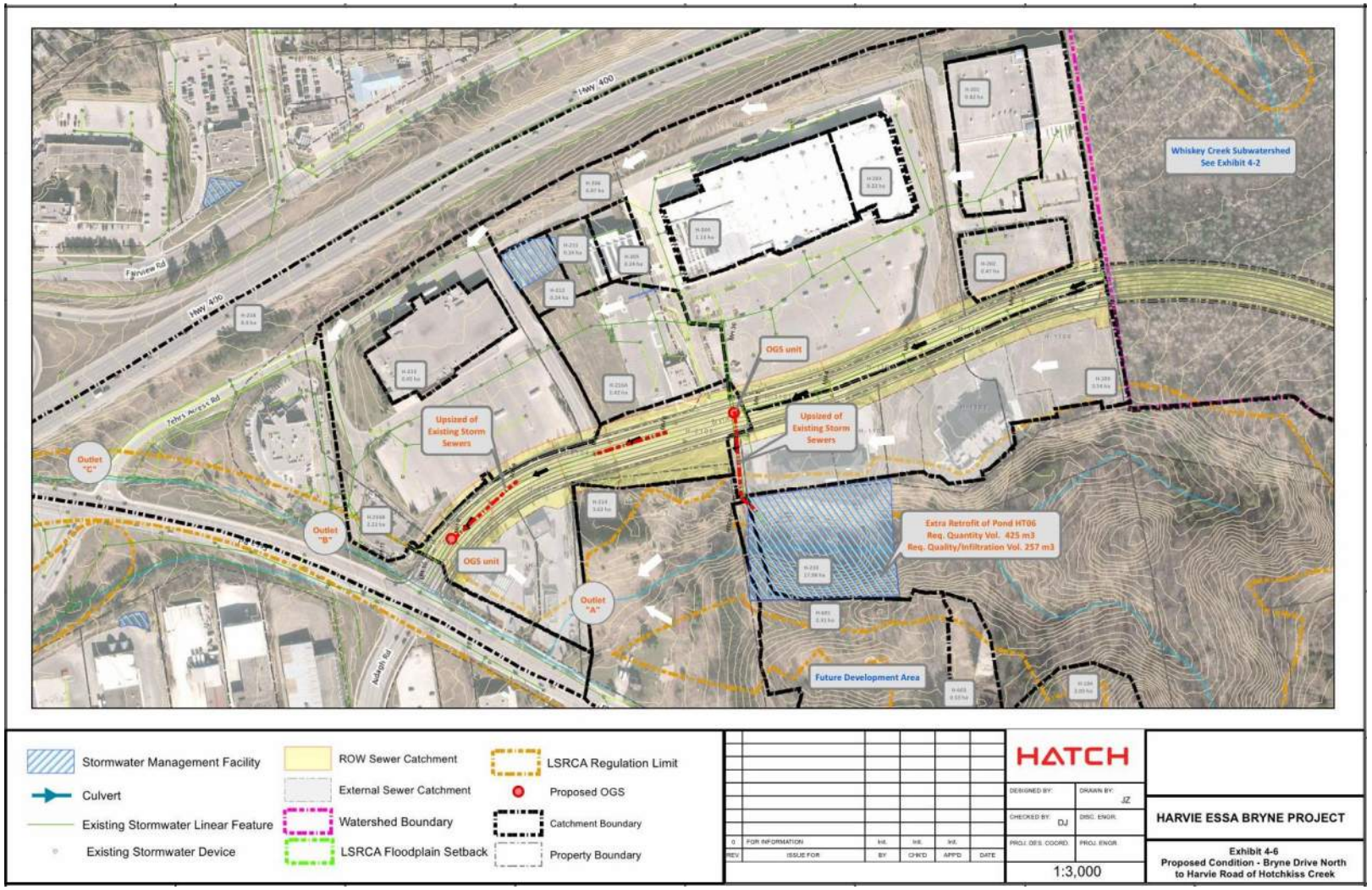

Figure 8-5: Proposed Drainage Concept - Bryne Drive, South of Harvie Road at Hotchkiss Creek

8.8 Culvert Design

Two (2) new culvert crossings are proposed on Bryne Drive, the preliminary sizing of these two culverts are presented in Table 8-2.

Culvert P.C. W-1 is proposed on Bryne Drive, north of Harvie Road at Whiskey Creek Tributary. Culvert P.C. L-2 is proposed on Bryne Drive, south of Harvie Road at the Lover Creek watercourse.

Table 8-2: Preliminary Sizing for Culverts

Location/Creek	Culvert ID	Material /Type	Barrel	Proposed Dimension	
				Span [m]	Rise [m]
Future Bryne Drive @ Whiskey Creek Main Branch	P.C. W-1	Concrete, Circular	1	0.75	0.75
Future Bryne Drive @ Lovers Creek	P.C. L-2	Concrete, Box	1	1.2	0.90

Both proposed Culverts P.C.W-1 and P.C.L-2 meet the freeboard requirement for the 50-year design storm. Both culverts safely convey the100-yr and Regional Storm flows without overtopping the roadway. For Culvert P.C.L-2, rock protection will be provided on both upstream and downstream end for erosion control.

Culvert E.C.W-1, as proposed in Harvie/Big Bay Point Road/Hwy 400 Overpass Project, of size 1650 mm diameter circular concrete located on Harvie Road and the existing culvert E.C.B-1 of size 1.8 m x 0.60 m concrete box located on Essa Road, will be extended, as required, to accommodate the proposed road widening.

Culvert E.C.W-1 meets freeboard requirement for the 50-year design storm and safely conveys the100-yr and Regional Storm flows without overtopping the roadway. Due to high velocity within the culvert barrel, an outlet pool with rock protection is required at the downstream end of the culvert. Rock protection will also be provided at the inlet of culvert.

Culvert E.C.B-1 meets freeboard requirement for the 50-year design storm and safely conveys the100-yr and Regional Storm flows without overtopping the roadway. Rock protection is recommended at both inlet and outlet ends of the culvert to mitigate the erosion impact.

8.9 Utilities and Other Services

Watermain

A new 300mm PVC watermain is proposed along the length of Bryne Drive. Watermain service shall tie into existing services at terminus points of existing north and south Bryne

Drive. Further system details will be established in detailed design including location of mainline valves/valve chambers, domestic service lines and fire service lines/fire hydrants.

Any existing watermains will be assessed for clearance, coverage, and protection, including assessment for surcharge loading in situations where road profile is raised.

Sanitary

A new local sanitary sewer will be developed in detailed design intended to service the proposed retail/mixed use development. This will include assessment of existing sanitary sewers along Bryne Drive south terminus from Caplan and Bryne Drive north terminus from Essa. Note that there is no sanitary sewer running along Bryne Drive north terminus, apart from a lateral sanitary sewer servicing the hotel and commercial properties, and as such any connection made to the north would occur at Essa/Bryne intersection.

Private/3rd Party Utilities

Based on preliminary assessment of the preferred design, there are potential utility conflicts that must be addressed in detailed design, notably at the north and south terminations of Bryne Drive. In those locations, infrastructure such as hydro poles that will need to be relocated as their current location encroach on the proposed right-of-way. Remaining hydro poles will also have to be assessed for adequate support depth in instances where proposed profiles are lowered, or wire clearances confirmed where proposed profiles are raised which may also require additional guy wires and potentially additional easements for these guy wires.

The location and alignment of existing private utilities 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. Meetings will be held during detailed design to investigate and discover locations of utilities and to evaluate the extent and degree of impact as measured against the detailed design, with consequential coordination, planning and relocation design by affected utilities for relocation and/or protection of respective utility infrastructure.

Storm Sewer

- Bryne Drive, South of Harvie Road and North of Caplan Avenue at Lovers Creek

  Based on the sewer capacity assessment, there are several existing storm sewers along Bryne Drive needed to be upsized and replaced to accommodate the increased runoff from impervious area. The preliminary assessment results and proposed size of storm sewers are summarized in the Drainage and Stormwater Management Report.

- Bryne Drive, South of Harvie Road at Whiskey Creek

  Storm sewers with diameter 1050 mm @ 0.5% are proposed on the north side of Pond A along Bryne Drive. The storm sewers network on Harvie Road and Hwy 400 Overpass ties into this section of storm sewer network. Storm sewers with diameters ranges from 450 to 800 mm @ 0.5 – 3.0 % are proposed on the south side of Pond A along Bryne Drive

- Bryne Drive, North of Harvie Road at Whiskey Creek

  Storm sewer with diameters ranges from 450 to 600 mm diameter @ 1.50% and 375 to 600 mm diameter @ 0.50 - 1.50 % are proposed north side of Harvie Road within Whiskey Creek subwatershed.

- Bryne Drive, North of Harvie Road and South of Essa Road at Hotchkiss Creek

  Based on the sewer capacity assessment, there are several existing storm sewers along Bryne Drive needed to be upsized and replaced to accommodate the increased runoff from impervious area. The preliminary assessment results and proposed size of storm sewers are summarized in the Drainage and Stormwater Management Report.

8.10 Streetlighting and Traffic Signals

Full illumination is to be provided along the Study Area corridor. Existing traffic signals at Essa Road and Caplan Avenue will be maintained, and an additional traffic signal will be implemented at the intersection of Harvie Road and Bryne Drive. The condition of the existing traffic signals will be reviewed during the design stage and signals upgraded or replaced if necessary. The design of all signals and related intersection improvements will be in compliance with the *Accessibility for Ontarians with Disabilities Act* (AODA).

8.11 Landscaping and Streetscaping

The widening of Bryne Drive along the existing sections may affect existing trees on private property. The requirement for tree removal and replacement will be confirmed during Detailed Design and through consultations with individual property owners during negotiations for property acquisition.

The proposed streetscaping improvements on the existing Bryne Drive, as well as on the new section of Bryne Drive will include a 2.9m boulevard on either side of the road between the curb and the sidewalk. The boulevard will provide a buffer for pedestrians, and improve street vegetation and corridor aesthetics.

Further compensation for the impact to the woodlot located north of Harvie Road will be discussed with the LSRCA during Detailed Design.

8.12 Property Requirements

The MMATMP identifies a road allowance width of up to 34m for Bryne Drive. The recommended Design Concept to widen the roadway attempts to minimize property requirements. The property requirements are presented in the Preliminary Design in Appendix G. The preliminary property requirements for the improvements to Bryne Drive are detailed in Table 8-3. Property impacts will be further refined and finalized during Detailed Design.

Table 8-3: Property Required along Bryne Drive

Location	34m ROW (m²)
West Side	48,810
East Side	47,633
TOTAL	96,443

Temporary easements may be required in some sections of the corridor to provide for grading and blending for graded slopes. The temporary easements will be reviewed during Detailed Design.

8.13 Noise Assessment

The City completed a noise assessment to review the need to mitigate traffic noise impacts upon project build out. A noise sensitive area, was identified to the west of the proposed Bryne Drive extension. The predicted noise levels at these receptors are dominated by transportation noise from Highway 400. Therefore, construction of the proposed Bryne Drive extension does not have a significant impact on homes in the vicinity.

8.14 Preliminary Cost Estimate

A preliminary construction cost estimate was completed for the road widening, storm sewer improvements, culvert construction and provision of full illumination. The estimated construction cost for the road widening is $35,859,750. Further detail of the cost estimate is included in Appendix I.

9. Consultation

9.1 Regulatory Agency Involvement

Review agencies were contacted at key points during the Study, including at the following project milestones:

- Study Commencement and Public Information Centre #1; and
- Notice of Study Completion and public review period of the Environmental Study Report.

No comments were received as part of Study Commencement and the announcement of the PIC. Hatch reached out to the Lake Simcoe and Region Conservation Authority and Nottawasaga Valley Conservation Authority in early 2017 to receive background data, reports and other pertinent information available regarding the Bryne Drive and Harvie Road Study Area, and Essa Road Study Areas respectively. Following the PIC, Hatch reached out again to determine the interest to meet and discuss the proposed improvements, and to receive additional comments and feedback before finalizing the Environmental Study Report.

9.1.1 Lake Simcoe Region Conservation Authority

The Lake Simcoe and Region Conservation Authority was contacted in early March 2017 to receive Natural Heritage information related to the Study Area corridors to assist the Project Team with identifying potential data gaps. In addition, the Project Team met with the LSRCA on August 8, 2017 and received the following input related to this Study:

- Should the project impact a watercourse on lands outside of the City of Barrie-owned property, then more than one permit will be required from the LSRCA for O. Reg. 179/06.
- A permit for potential impacts to Hotchkiss Creek will be required under O. Reg. 179/06 given that it is not always visible; and appears to be underground in some sections.
- Hatch to be aware of floodplain which is located between future Bryne Drive easterly past Highway 400.
- LSRCA requires that loss of natural heritage features be offset with replacement of similar features (woodland 2:1 and wetland 3:1). In addition, LSRCA requires compensation for loss of Ecosystem Service Value, which is calculated based on hectare.
    - Preference for the new feature to be within the same subwatershed. Preference for woodland for woodland and/or wetland for wetland.
- LSRCA prefers open-bottom culverts for habitat continuity

9.1.2 Nottawasaga Valley Conservation Authority

The Nottawasaga Valley Conservation Authority (NVCA) was contacted in early March 2017 to receive Natural Heritage information for the Essa Road Study Area corridor and to identify gaps. The following information was requested:

- Natural Heritage features (including wetlands, woodlands, ANSIs, Valleylands, wildlife habitat, fish habitat – cool and warmwater thermal regime data);
- Ecological Land Classification data;
- Fisheries Data – species type, habitat, sampling station;
- Floodplain/regulation mapping;
- NVCA property lines; and
- Additional reports or studies that may contain bird survey data, turtles, amphibians, vegetation – woodland/wetlands.

The NVCA advised that they do not have mapping for wetlands, woodlands or valleylands for our Study Area, nor do they have ELC data or studies. The NVCA advised that the watercourse (Bear Creek) was realigned when the Shopper's Drug Mart was constructed, however an EIS was not completed given that it was an existing commercial property. The watercourse has been identified as having a 'warmwater fishery but contributing to a coldwater fishery downstream', resulting in an enhanced buffer being put around the creek.

The NVCA advised that they do not have any fisheries records or fish habitat information at that point on Bear Creek, however the watercourse does contribute to downstream habitat and brook trout records from 2002.

9.2 First Nations Consultation

The following First Nation communities were contacted to announce the PIC:

- Alderville First Nation
- Algonquins of Ontario – Consultation Office
- Barrie Friendly Centre
- Beausoleil First Nation
- Chippewas of Georgina Island
- Chippewas of Mnijikaning
- Curve Lake First Nation
- Georgian Bay Metis Council
- Hiawatha First Nation
- Metis Nation of Ontario
- Mississaugas of Scugog Island First Nation
- Moose Deer Point First Nation
- Wahta Mohawk First Nation
- William Treaties First Nation

Chippewas of Rama First Nation advised that they received our letter and that it was shared with Council, as well as forwarded to Williams Treaties First Nation Process coordinator/ Negotiator, who will review the letter and take the necessary action if required.

9.3 Public Information Centre No. 1

9.3.1 Purpose

- The purpose of the PIC was to provide an update on the study to interested members of the public
- Provide an opportunity for the public to meet members of the Project Team and ask questions
- Review the recommendations and detailed design for the Highway 400/Harvie Road structure/overpass
- Provide an update on the work and studies completed to date
- Receive community input on the material presented, and incorporate comments into the finalizing of the preferred design alternative
- Answer questions that attendees may have about the project and other projects within the Study Area

9.3.2 Notification

Notices were sent to all property owners within the Study Area (on June 8th), two weeks prior to the first Public Information Centre. In addition, the Notice was placed in the Barrie Examiner newspaper on two separate occasions on June 8 and June 10. The Notice was also provided to review agencies, stakeholders and the study Mailing List and was posted on the City of Barrie website on June 8th. A copy of the Notice is included in Appendix H.

9.3.3 Public Information Centre No. 1

The PIC was held on June 22, 2017 at the Holly Community Centre from 4:00pm to 7:00pm.

Members of the Project Team were available to answer questions from the public. The Project Team included representatives from the City of Barrie's Harvie Road, Essa Road and Bryne Drive Study Team, as well as a representative from the Harvie Road-Big Bay Point Road Highway 400 crossing team. The City's project team was also supported by the General Manager from the City of Barrie. Representatives from Hatch were also in attendance to answer questions related to the alternative design concepts and the Class EA process.

9.3.4 Attendance and Presentation

There were 20 people in attendance at the PIC including one member of Council (Arif Khan).

The PIC was an open-house format, with 29 presentation boards spread around the room to provide background information on the Study, existing conditions, and identification and

evaluation of alternative design concepts. A copy of the boards is included in Appendix H. Key boards included:

- Study Background
- Summary of MMATMP
- Update and Summary of Technical Studies
- Study Area constraints
- Drainage and Stormwater Management Recommendations
- Evaluation of Alternative Design Concepts
- Selection of Preliminary Preferred Design Concept (s)

In addition, plots were attached to the walls of the Community Room showing the alternative design concepts for each of the Study Area corridors.

TV media was in attendance at the PIC and interviewed the City Project Manager, which was aired during the 11 o'clock local news.

9.3.5 Summary of Input

The majority of comments supported the proposed improvements along the three Study Area corridors. Attendees were most interested in the following:

- Timing of construction; and
- Timing of property acquisition.

Six Comment Sheets were received at the PIC. Only one response was requested to comments provided, which is summarized in Appendix H. The following is a summary of the comments:

- Overall impressed with efforts to advance schedule – property acquisition in 2017 will help advance clear cutting and utility locates.
- Concerned about truck traffic and safety of families dropping off and picking up children from daycare. Harvie Road is in terrible condition – many potholes; concerned about heavy truck traffic during construction.
- For Essa Road – a multi-use path does not seem to be best approach for commuting – it works fine for recreation, however commuting requires predictable travel times and multi-use paths result in delays, including when connecting to downtown which is frustrating. Buffered bike lanes are much preferable – there is a good bike lane on Veterans Drive, but cyclists are left hanging at Essa Road.
- Why has the Harvie Road overpass taken so long? Hope access ramps to Hwy 400 will be sooner, not later. Prefer middle alignment for Bryne Drive. Access road on west side of Hwy 400 going south from Essa could travel behind commercial buildings and become a service road parallel to Hwy 400 and/or a southbound ramp to Hwy 400 from Essa Rd.

- Essa Road should be at least 5 lanes to Mapleview Drive West (Coughlin southerly).

All consultation received throughout the EA is documented in the Consultation Tracking Table, and included in Appendix H.

10. Potential Environmental Impacts and Mitigation

10.1 Natural Environment

10.1.1 Construction Timing

Construction timing should take into consideration natural heritage features, more specifically the wildlife that inhabit the features within the Project Study Area. Vegetation removal should not take place during the local breeding bird season which is established from April 1 to August 31, to comply with the MBCA. Due to the uncertainty that lies with nest sweeps during construction, especially during leaf-on conditions, it is recommended that all tree clearing occur outside the above-noted breeding bird window.

Due to the potential presence of Brook Trout within Whiskey Creek, the MNRF Midhurst District office has recommended that no in-water works occur between October 1st and July 15th in any given year. As such, in-water works can only occur from June 1st to Sept 30th unless otherwise noted by MNRF and/or DFO. Discussions with respect to the in-water timing window should be scheduled with DFO during the detailed design phase once the design components are better understood. This will also enable the City to confirm whether the proposed works will require a *Fisheries Act* Authorization from the DFO.

10.1.2 Erosion and Sediment Control Measures

No development, construction or grading should occur outside of the construction envelope once it has been confirmed during the detailed design phase. An ESC Plan should be developed prior to construction, and applicable ESC measures implemented to avoid impacts to terrestrial and aquatic features.

Efforts should be made to reduce areas of exposed soils, and all types of erosion and sediment transport during staging and construction. Erosion and sediment controls should be installed prior to construction activities, remain through the entire duration, and monitored in order to ensure sufficient controls are in place. In addition, all ESC measures should be monitored/inspected during construction to confirm they are functioning properly and are maintained and/or upgraded as required. If not functioning properly, no further work should occur until the erosion and/or sediment problem is addressed. All ESC measures (e.g., coir logs) should be reflected on all construction drawings with notes on requirements.

10.1.3 Tree Clearing Protection and Replacement

No development, construction or grading should occur outside of the construction envelope once it has been identified.

Trees shall be protected in accordance with the City of Barrie Tree Protection Manual (2010). Trees within or adjacent to Municipal Road ROWs are provided protection either through the Public Tree By-law (2014-116) or the ROW Activity By-law (2005-256). The Manual prescribes minimum Tree Protection Zones that should be followed based on the trees

measured diameter at breast height (DBH). Tree protection barriers shall follow the City of Barrie specifications and consist of 1.2m high orange plastic web snow fencing on a 2' X 4" frame or attached to 2" X 2" wooden stakes.

It is noted that trees situated on public property are protected under the City of Barrie's Public Tree By-law 2014-116. Public trees are those which have 50 percent or more of its main stem situated on a public park, highway or lands owned by the City of Barrie. According to the By-law, trees requiring removal on public property as identified by the City of Barrie, are exempt from the permitting process.

The City of Barrie regulates private property tree removals when those trees are part of a woodlot as defined by the Tree Preservation By-law 2014-115. This applies to those forested areas that are 0.20 ha (or 0.5 acres) in size or larger. Both woodlands within the Project Study Area do not meet this minimum size and have not been mapped by the City of Barrie Urban Forestry Department.

All disturbed areas should be restored with native, non-invasive seed mix. A mixture of native trees and shrubs should also be incorporated along the ROW and along the Bear Creek crossing as permitted.

10.2 Cultural Environment

10.2.1 Archaeology

10.2.1.1 Harvie Road

A significant portion of the Study Area has archaeological potential, requiring that a Stage 2 Archaeological Assessment through test pit survey be completed prior to Detailed Design. The majority of the Study Area corridor requiring Stage 2 Archaeological Assessment includes both sides of Harvie Road between Veterans Drive and future Bryne Drive, as well as a small segment at the southeast corner of Essa Road and Harvie Road.

10.2.1.2 Essa Road

There are small sections along the Essa Road corridor that have been identified to have archaeological potential. A Stage 2 Archaeological Assessment will be completed prior to Detailed Design. The majority of the east side of Essa Road was identified as previously assessed by AMICK in 2016, with the exception of the northeast corner of Essa Road and Mapleview Drive which has the potential for deeply buried resources. This area is subject to Stage 2 Trenching, given the former location of the Holly Post Office. The majority of the west side has been identified as disturbed, given the residential development. However, the areas north and south of the Bear Creek watercourse have archaeological potential, requiring Stage 2 Archaeological Assessment.

10.2.1.3 Bryne Drive

A significant portion of the Study Area has archaeological potential, requiring that a Stage 2 Archaeological Assessment through test pit survey be completed prior to Detailed Design.

The details of the locations requiring Stage 2 Archaeological Assessment are included under a separate cover (i.e., AMICK, 2005).

10.2.2 Cultural Heritage

There were no identified cultural heritage resources identified within the Harvie Road or Bryne Drive Study Area corridors. Tree protection zones will be established along the western property line of the farmscape located at 664 Essa Road. This 19th century farmscape on the east side of Essa Road will experience minor impacts, including the potential removal of trees and vegetation.

10.3 Socio-Economic Environment

10.3.1 Noise

Harvie Road: The homes in the southwest quadrant of Harvie Road and Thrushwood Drive are currently protected by a 2m high wooden noise barrier wall. It is recommended that this wall be removed and a higher and longer wall constructed in its place, to reduce the noise impacting the homes south of the intersection. Further details regarding the design of this wall will be undertaken during Detailed Design.

Essa Road: Slight increase in noise levels, however no impact requiring mitigation.

Bryne Drive: No impact above existing noise levels given the proximity of Highway 400. No mitigation required.

Although the City of Barrie has a permanent exemption under the Noise By-law related to the operation of equipment in conjunction with City projects or reconstruction projects, to minimize the potential for construction noise impacts, it is recommended that provisions be written into the contract documentation, as follows:

- Where possible, construction should be carried out during the day time. If construction activities are required outside of these hours, the Contractor should try to minimize the amount of noise being generated.
- There should be explicit indication that contractors are expected to comply with all applicable requirements of the contract.
- All equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order.
- The contract documents should contain a provision that any initial noise complaint will trigger verification that the general noise control measures agreed to be in effect.
- In the presence of persistent noise complaints, all construction equipment should be verified to comply with MOECC NPC-115 guidelines.

- In the presence of persistent noise complaints and subject to the results of a field investigation, alternative noise control measured may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration should be given to the technical, administrative and economic feasibility of the various alternatives.

10.3.2 Air Quality

The increase in traffic on the widened Harvie Road and Essa Road, as well as the extension of Bryne Drive could cause an increase in tailpipe emissions. However, the recommendations from this project support various City of Barrie initiatives to offset the negative impacts on the air quality from the proposed road improvements and help improve the overall air quality. The recommendations include:

- Implementing active transportation options (i.e., bike lanes and sidewalks on both sides) that encourage alternative modes of travel over the single occupant vehicle, and reduce automobile tailpipe emissions;
- Adjusting traffic signal timing plans to promote traffic flow, reduce future congestion and idling; and
- Incorporating boulevards between the bike lane and the sidewalk on all cross-sections to enhance vegetation and landscaping in the right-of-way throughout the entire length of the corridor.

During construction, air quality will be degraded locally due to construction equipment and dust. The following measures are recommended to mitigate the effects of air quality:

- Harvie Road, Essa Road and Bryne Drive, as well as adjacent streets will be swept and/or washed at the end of each day as required;
- Non-chloride dust suppressants to be applied during construction to reduce dust emissions;
- All equipment will have properly installed and functioning exhaust systems; and
- Stockpiles of fine grained materials shall be covered with tarps during dry and/or windy periods.

10.4 Engineering Environment

10.4.1 Hydraulics

Two (2) new culvert crossings, Culvert P.C. W-1 on Bryne Drive, north of Harvie Road at the Whiskey creek and Culvert P.C. L-2 on Bryne Drive, south of Harvie Road at the Lovers Creek watercourse are proposed. Both proposed culverts safely convey the 50-year design flow, the100-yr and Regional Storm flows without overtopping the roadway. Both culverts do not pose any impact on the upstream. For Culvert P.C.L-2, rock protection will be provided on both upstream and downstream end for erosion control.

Culvert E.C. W-1, as proposed in Harvie/Big Bay Point Road/Hwy 400 Overpass Project, is located at the Harvie Road and Bryne Drive Intersection. The culvert safely conveys the 50-year design storm, the100-yr and Regional Storm flows without overtopping the roadway. However, due to larger difference of inlet and outlet elevation of the culvert, flow velocity is high. To mitigate the erosion impact due to high velocity, an outlet pool with rock protection is required at the downstream end of the culvert. Rock protection will also be provided at the inlet of culvert.

Culvert E.C.B-1 is located at Essa Road. Rock protection will also be provided to mitigate the erosion impact at both upstream and downstream ends of this culvert.

10.5 Environmental Effects and Mitigation Measures

It is recognized that the proposed improvements to the three Study Area corridors will result in some impact on the existing environment. Table 10-1 below provides an assessment of the potential environmental impacts associated with the project and the recommended mitigation measures required to reduce these effects.

Table 10-1: Environmental Effects and Mitigation Measures – Harvie Road

Factor	Anticipated Impact	Proposed Mitigation
Natural Environment		
Vegetation/ Trees	Potential impact to mature trees along Harvie Road	• Trees shall be protected in accordance with the City of Barrie Tree Protection manual. • Tree protection measures to follow City of Barrie specifications. • Advise contractor in advance of key invasive areas (e.g., MAM2-a) and promote awareness • All disturbed areas should be restored with native, non-invasive seed mix. A mix of native trees and shrubs should also be incorporated along the ROW and along the creek crossing as permitted. • A tree inventory and preservation plan is recommended to be completed by a Certified Arborist during Detailed Design. • Compensation for loss of woodland and wetland should follow LSRCA's Ecological Offsetting Plan (2017). Details of compensation to be identified during Detailed Design through consultation with LSRCA.
Fisheries and Aquatic	Potential impact to Brook Trout spawning activities	• No in-water works to occur between October 1st and July 15th in any given year, unless otherwise noted by MNRF and DFO. Discussions to occur with DFO during detailed design phase. • Installation of new culverts and/or replacement or extension of culverts will follow guidelines prescribed by relevant agencies and constructed in manner not to impede fish passage. • New culverts within Whiskey Creek should follow guidelines from DFO, MNRF and LSRCA and constructed in manner that does not impede fish passage. Culverts where feasible should be open-bottom such that substrates can be implemented.

Factor	Anticipated Impact	Proposed Mitigation
		• If dewatering required during in-water works, fish rescue plan should be prepared. All in-take pumps should be fitted with screens to prevent fish entrainment and impingement.
Species at Risk	Potential impact to SAR bat and Butternut	• Construction timing related to tree removals related to bat maternity roosting and additional parts of life cycle will be identified during detailed design through consultation with MNRF. • Minimize impacts to woodland north of Harvie and tree line south of Harvie. • Avoid impacts within 50 metres of identified Butternut observed just north of Study Area corridor. If additional SAR encountered during construction, works within immediate area must cease and MNRF Midhurst District office contacted. • MNRF to prescribe additional information relating to Little Brown Myotis in relation to Harvie Road project.
Migratory Birds	Potential impact to migratory birds	• Vegetation removal should not take place within the core local breeding bird season, from April 1st to August 31st, as protected by the MBCA. It is recommended that all tree clearing occur outside of the breeding bird window. • If migratory birds happen to nest within work area, measures to be taken to ensure protection of nest such that fleglings can successfully hatch and requirements under MBCA are met. Guidance can be sought from Canadian Wildlife Service.
Wildlife	Potential impact to wildlife	• Construction of new culverts and/or replacement culverts should follow guidelines as prescribed by relevant agencies and constructed in manner that does not impede fish passage. All culverts where feasible should be constructed using open-bottom such that proper substrate can be implemented to sustain and if not improve existing conditions.

Factor	Anticipated Impact	Proposed Mitigation
		• If dewatering required during in-water works, fish rescue plan should be prepared. All in-take pumps should be fitted with screens to present fish entrainment. • Efforts should be made to protect wildlife during construction, using erosion fencing. • Reference to MNRF Best Practices Technical Note on Reptile and Amphibian Exclusion Fencing (2013) and the MNRF SAR Handling Manual • All fencing to be periodically monitored by an environmental monitor who is trained in proper handling of these species should they be encountered during the work area. • Maintain woodland size north of Harvie Road to minimize impacts to seasonal concentration areas for bat materinity roosting.
Water Quality	Increase in suspended solid loading	• Oil-Grit Separator proposed at sewer outlets to achieve 80% total suspended solid removal • Enhanced grass swales recommended to provide additional quality control prior to discharging into local watercourses
Water Quantity		• Post- to pre-development flows are maintained at each subwatershed through retrofitting of existing ponds and by implementing new ponds as required.
Sediment and Erosion Control	Potential impact to watercourses as a result of soil disturbance from excavating and cut/fill activities	• No development, construction or grading should occur outside of development envelope once confirmed during detailed design. • Erosion and sediment control measures should be implemented to avoid impacts to terrestrial and aquatic features. • Develop and implement an ESC Plan. Designate areas for equipment storage a minimum of 30 metres away from both the Main and North Branch of Whiskey Creek or roadside ditches that outlet either section. • Establish a spill prevention plan.

Factor	Anticipated Impact	Proposed Mitigation
		• Efforts should be made to reduce areas of exposed soils, and all types of erosion and sediment transport during staging and construction. Erosion and sediment controls should be installed prior to construction activities, remain through the entire duration and monitored in order to ensure efficient controls in place. • All ESC measures to be reflected on all construction drawings. • ESC measures to be inspected after installation and before construction to ensure installed in accordance with specifications. • Construction areas to be monitored daily and prior to and immediately after precipitation events to ensure functioning according to design.
Cultural Environment		
Archaeology	Potential impact to archaeological resources	• Stage 2 Archaeological Assessment will be undertaken prior to Detailed Design within undisturbed areas identified in Stage 1 Report. Locations requiring Stage 2 AA will be subject to test pit survey at 5 metre intervals prior to proposed impacts. • Should proposed work extend beyond current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands. • Once Archaeological clearance has been received from MTCS, construction can commence. • In the event that human remains are found, the police or coroner must be contacted. • Should previously undocumented archaeological resources be discovered, they are subject to Section 48(1) of the *Ontario Heritage Act* and the person discovering the archaeological resources must cease alteration of the site and engage a licensed consultant archaeologist to carry out the archaeological field work.

Factor	Anticipated Impact	Proposed Mitigation
	Potential to impact ossuary within the Study Area	• To minimize the potential to impact an ossuary during construction, a liscensed archaeologist must be present to monitor the removal of topsoil for all areas within the proposed construction impacts that are within 1,000 metres from these sites and 300 metres from water.
Social Environment		
Noise	Increase in existing noise levels from traffic	• No mitigation measures can be provided to homes along Harvie Road to address the anticipated increase in noise levels as a result of the increase in traffic volumes along the corridor, given that the homes have private driveways that enter onto Harvie Road. • A higher noise wall is recommended to reduce the noise impacting the homes in the southwest quadrant of Harvie Road and Thrushwood Drive. Details of the dimension of the wall to be confirmed during Detailed Design.
	Potential nuisance impacts to residents during construction	• The City of Barrie has a bylaw restricting noise from construction activity within the City, however there is a permanent exemption under this by-law related to the operation of equipment in conjunction with City projects or reconstruction projects. • The MOECC stipulates limits on noise emissions from individual equipment, rather than overall construction noise. • Sound emission standards for the various types of construction equipment used on the project should be checked to ensure that they meet the specified limits contained in the MOECC Publication NPC-115-Construction Equipment.
Air Quality	Increase in particulates during construction	• Non-chloride dust suppressants to be applied during construction to reduce dust emissions. • Contractor to sweep adjacent roads clean at end of each day if mud has been tracked onto roadway. • Contractor to comply with all applicable by-laws for dust control and emissions.

Factor	Anticipated Impact	Proposed Mitigation
	Potential impact to air quality with increased traffic and tailpipe emissions	• The recommendations for the roadways including active transportation (bike lanes and sidewalks on both sides) to improve overall air quality and reduce emissions
Residential/Business	Impacts on residents/ businesses	• Prior to construction, specific notices and contact information must be delivered to area residents and property owners informing them of construction details • Maintain access to individual driveways during construction
Property Acquisition	Property anticipated. Discussions to be had with residents during detailed design to confirm requirements	• Preliminary property requirements are available for review as part of preliminary preferred design plans (included as Appendix in ESR) • The formal property acquisition process will be initiated following completion of the Class EA Study • Requirements for temporary working easements to complete grading to be confirmed during detailed design with reduced standards for slope grading
Construction Safety	Safety for corridor users	• During construction, open excavations will be fenced when no construction activity is taking place
Aesthetics/Streetscape	Potential for reduced aesthetics	• Streetscaping improvements proposed
Disruption to motorists during construction	Inconvenience during construction to motorists on Essa Road and Harvie Road	• Prior to commencing construction activities, design phase of the project, regulatory agencies and adjacent property/ business owners will be notified regarding the scheduling of construction activities • Impacts will be temporary in nature. The City will attempt to mitigate impacts as much as possible during detailed design and construction, through construction staging plans and traffic management plans.

Table 10-2: Environmental Effects and Mitigation Measures – Essa Road

Factor	Anticipated Impact	Proposed Mitigation
Natural Environment		
Vegetation/ Trees	Potential impact to tree cover and vegetation composition	• Trees shall be protected in accordance with the City of Barrie Tree Protection manual. • Tree protection measures to follow City of Barrie specifications. • All disturbed areas should be restored with native, non-invasive seed mix. A mix of native trees and shrubs should also be incorporated along the ROW and along the creek crossing as permitted. • A tree inventory and preservation plan is recommended to be completed by a Certified Arborist during Detailed Design. • Advise contractor in advance of key invasive areas (e.g., MAM2-a) and promote awareness. • Minimize soil exposure – restore or stabilize areas using erosion matting as work progresses. • Provide detailed clearing, ESC and restoration plans. • Clearly identify stockpile and laydown/staging areas on detailed drawings. • Tree protection to be installed prior to construction works. • Those areas designated as tree protection zones to be considered “no-go” zones whereby no stockpiles, storage materials or grade changes shall occur within its’ boundary.
Fisheries and Aquatic	Impacts to fish and fish habitat within Bear Creek	• No in-water works to occur between October 1st and July 15th in any given year, unless otherwise noted by MNRF and DFO. Discussions to occur with DFO during detailed design phase. • Installation of new culverts and/or replacement or extension of culverts will follow guidelines prescribed by relevant agencies and constructed in manner not to impede fish passage.

Factor	Anticipated Impact	Proposed Mitigation
		• Develop and implement an ESCA Plan. Designate areas for equipment storage a minimum of 30 metres away from Bear Creek or roadside ditches that outlet to Bear Creek. • Establish a spill prevention plan. • Prepare a fish rescue plan. • Ensure pumps have proper intake screens to prevent fish from entrainment or impingement.
Species at Risk	Potential impact to SAR bat and Butternut	• If SAR are encountered, works within the immediate area must cease and MNRF Midhurst District office be notified immediately.
Migratory Birds	Potential impact to migratory birds	• Vegetation removal should not take place within the core local breeding bird season, from April 1st to August 31st, as protected by the MBCA. It is recommended that all tree clearing occur outside of the breeding bird window. • If not possible, a bird nest survey by a qualified avian biologist should be conducted to determine presence and locations of active nests prior to construction. Bird nest surveys should be completed immediately prior to clearing events. If a nesting migratory bird is identified within or adjacent to construction site, the contractor must stop work within the immediate area and contact administrator.
Wildlife	Potential impact to wildlife	• Construction of new culverts and/or replacement culverts should follow guidelines as prescribed by relevant agencies and constructed in manner that does not impede fish passage. All culverts where feasible should be constructed using open-bottom such that proper substrate can be implemented to sustain and if not improve existing conditions. • If dewatering required during in-water works, fish rescue plan should be prepared. All in-take pumps should be fitted with screens to present fish entrainment. • Efforts should be made to protect wildlife during construction, using erosion fencing.

Factor	Anticipated Impact	Proposed Mitigation
		• Reference to MNRF Best Practices Technical Note on Reptile and Amphibian Exclusion Fencing (2013) and the MNRF SAR Handling Manual • All fencing to be periodically monitored by an environmental monitor who is trained in proper handling of these species should they be encountered during the work area.
Water Quality	Increase in suspended solid loading	• Oil-Grit Separator proposed at sewer outlets to achieve 80% total suspended solid removal • Enhanced grass swales recommended to provide additional quality control prior to discharging into local watercourses
Water Quantity		• Post- to pre-development flows are maintained at each subwatershed through retrofitting of existing ponds and by implementing new ponds as required.
Sediment and Erosion Control	Potential impact to watercourses as a result of soil disturbance from excavating and cut/fill activities	• No development, construction or grading should occur outside of development envelope once confirmed during detailed design. • Erosion and sediment control measures should be implemented to avoid impacts to terrestrial and aquatic features. • Efforts should be made to reduce areas of exposed soils, and all types of erosion and sediment transport during staging and construction. Erosion and sediment controls should be installed prior to construction activities, remain through the entire duration and monitored in order to ensure efficient controls in place. • All ESC measures to be reflected on all construction drawings. • Prepare an erosion and sediment control plan in accordance with Greater Golden Horseshoe Area Conservation Authorities Erosion and Sediment Control Guidelines for Urban Construction (2006). • All ESC measures to remain in place until all areas associated with construction activities have been stabilized.
Cultural Environment		

Factor	Anticipated Impact	Proposed Mitigation
Cultural Heritage	Minor impact to 19th century farmscape on east side of roadway including potential removal of trees and vegetation.	• Tree protection zones to be established along western property line of farmscape at 664 Essa Road to reduce impact of proposed roadway improvements on cultural heritage resource.
Archaeology	Potential impact to archaeological resources Potential to impact ossuary within the Study Area	• Stage 2 Archaeological Assessment will be undertaken prior to Detailed Design within undisturbed areas identified in Stage 1 Report. These lands will be subject to test pit survey at 5m intervals where identified in the Stage 1 report, as well as lands within 50m of the identified Tall Trees previously registered site) • Stage 2 assessment by mechanical trenching at a maximum of 10 metre intervals is required for the location of the former Holly Post Office known to have been located northeast of Essa Road and Mapleview Drive West (there is potential for deeply buried archaeological deposits below the fill layer). • Once Archaeological clearance has been received from MTCS, construction can commence. • In the event that human remains are found, the police or coroner must be contacted. • Should previously undocumented archaeological resources be discovered, they are subject to Section 48(1) of the *Ontario Heritage Act* and the person discovering the archaeological resources must cease alteration of the site and engage a licensed consultant archaeologist to carry out the archaeological field work.
Social Environment		

Factor	Anticipated Impact	Proposed Mitigation
Noise	Potential nuisance impacts to residents during construction	• The City of Barrie has a bylaw restricting noise from construction activity within the City, however there is a permanent exemption under this by-law related to the operation of equipment in conjunction with City projects or reconstruction projects. • The MOECC stipulates limits on noise emissions from individual equipment, rather than overall construction noise. • Sound emission standards for the various types of construction equipment used on the project should be checked to ensure that they meet the specified limits contained in the MOECC Publication NPC-115-Construction Equipment.
Air Quality	Increase in particulates during construction	• Non-chloride dust suppressants to be applied during construction to reduce dust emissions. • Contractor to sweep adjacent roads clean at end of each day if mud has been tracked onto roadway. • Contractor to comply with all applicable by-laws for dust control and emissions.
	Potential impact to air quality with increased traffic and tailpipe emissions	• The recommendations for the roadways including active transportation (bike lanes and sidewalks on both sides) to improve overall air quality and reduce emissions.
Residential/Business	Impacts on residents/ businesses	• Prior to construction, specific notices and contact information must be delivered to area residents and property owners informing them of construction details. • Maintain access to individual driveways during construction.
Property Acquisition	Property anticipated. Discussions to be had with residents during detailed design to confirm requirements	• Preliminary property requirements are available for review as part of preliminary preferred design plans (included as Appendix in ESR). • The formal property acquisition process will be initiated following completion of the Class EA Study. • Requirements for temporary working easements to complete grading to be confirmed during detailed design with reduced standards for slope grading.

Factor	Anticipated Impact	Proposed Mitigation
Construction Safety	Safety for corridor users	• During construction, open excavations will be fenced when no construction activity is taking place
Aesthetics/Streetscape	Potential for reduced aesthetics	• Streetscaping improvements proposed
Disruption to motorists during construction	Inconvenience during construction to motorists on Essa Road and Harvie Road	• Prior to commencing construction activities, design phase of the project, regulatory agencies and adjacent property/ business owners will be notified regarding the scheduling of construction activities • Impacts will be temporary in nature. The City will attempt to mitigate impacts as much as possible during detailed design and construction, through construction staging plans and traffic management plans.

Table 10-3: Environmental Effects and Mitigation Measures – Bryne Drive

Factor	Anticipated Impact	Proposed Mitigation
Natural Environment		
Vegetation/ Trees	Potential impact to mature trees along Bryne Drive	• Trees shall be protected in accordance with the City of Barrie Tree Protection manual. • Tree protection measures to follow City of Barrie specifications. • All disturbed areas should be restored with native, non-invasive seed mix. A mix of native trees and shrubs should also be incorporated along the ROW and along the creek crossing as permitted. • A tree inventory and preservation plan is recommended to be completed by a Certified Arborist during Detailed Design. • Advise contractor in advance of key invasive areas and promote awareness. • Avoid impacts within 50 metres of identified Butternut observed. Further consultation and assessment during detailed design will be required for species. • Provide restoration and/or compensation using native, non-invasive seed mix, trees and shrubs. All work zones to be clearly identified on design drawings. • Areas designated as tree protection zones to be considered “no-go” whereby no stockpiles, storage materials or grade changes shall occur within its boundary. • Compensation for loss of woodland and wetland should follow LSRCA’s Ecological Offsetting Plan (2017). Details of compensation to be identified during Detailed Design through consultation with LSRCA.
Fisheries and Aquatic	Potential impact to Brook Trout spawning activities	• No in-water works to occur between October 1st and July 15th in any given year, unless otherwise noted by MNRF and DFO. Discussions to occur with DFO during detailed design phase.

Factor	Anticipated Impact	Proposed Mitigation
		• Construction of new culverts and/or replacement culverts should follow guidelines as prescribed by relevant agencies and constructed in manner that does not impede fish passage. All culverts where feasible should be constructed using open-bottom such that proper substrate can be implemented to sustain and if not improve existing conditions. • If dewatering required during in-water works, fish rescue plan should be prepared. All in-take pumps should be fitted with screens to present fish entrainment. • Designate areas for equipment storage a minimum of 30 metres away from both the Main and North Branches of Whiskey Creek, Lovers Creek or roadside ditches that outlet either section. • Establish a spill prevention plan. • Prepare a fish rescue plan. • Ensure pumps have proper intake screens to prevent fish from entrainment.
Species at Risk	Potential impact to SAR bat and Butternut	• If clearing works will be within 50m of a butternut, the tree should be monitored throughout clearing activities to ensure no impacts to its survival occur as a result of the Project. Additional consultation with MNRF will determine any additional monitoring requirements during Detailed Design. • Maintain woodland as much as possible to minimize impacts to seasonal concentration areas for bat maternity roosting. Consult with MNRF to determine best strategy for clearing in relation to bat and life cycle requirements. • If additional SAR encountered during construction, works within the immediate area must cease and MNRF Midhurst District office notified immediately. • MNRF to prescribe additional information relating to Little Brown Myotis related to project.
Migratory Birds	Potential impact to migratory birds	• Vegetation removal should not take place within the core local breeding bird season, from April 1st to August 31st, as

Factor	Anticipated Impact	Proposed Mitigation
		protected by the MBCA. It is recommended that all tree clearing occur outside of the breeding bird window. • If not possible, a bird nest survey by a qualified avian biologist should be conducted to determine presence and locations of active nests prior to construction. Bird nest surveys should be completed immediately prior to clearing events. If a nesting migratory bird is identified within or adjacent to construction site, the contractor must stop work within the immediate area and contact administrator.
Wildlife	Potential impact to wildlife	• Maintain woodland size north of Harvie Road as much as possible to meet 100 metres of interior woodland habitat for area sensitive species. • Efforts should be made to protect wildlife during construction, using erosion fencing. • Reference to MNRF Best Practices Technical Note on Reptile and Amphibian Exclusion Fencing (2013) and the MNRF SAR Handling Manual • All fencing to be periodically monitored by an environmental monitor who is trained in proper handling of these species should they be encountered during the work area.
Water Quality	Increase in suspended solid loading	• Oil-Grit Separator proposed at sewer outlets to achieve 80% total suspended solid removal • Enhanced grass swales recommended to provide additional quality control prior to discharging into local watercourses
Water Quantity		• Post- to pre-development flows are maintained at each subwatershed through retrofitting of existing ponds and by implementing new ponds as required.
Sediment and Erosion Control	Potential impact to watercourses as a result of soil disturbance from excavating and cut/fill activities	• No development, construction or grading should occur outside of development envelope once confirmed during detailed design. • Prepare an erosion and sediment control plan in accordance with the Greater Golden Horseshoe Area Conservation Authorities Erosion and Sediment Control Guidelines for Urban Construction (2006).

Factor	Anticipated Impact	Proposed Mitigation
		• Minimize soil exposure – restore or stabilize areas using erosion matting as work progresses. • All ESC measures to remain in place until all areas associated with construction activities have been stabilized. • Erosion and sediment control measures should be implemented to avoid impacts to terrestrial and aquatic features. • Efforts should be made to reduce areas of exposed soils, and all types of erosion and sediment transport during staging and construction. Erosion and sediment controls should be installed prior to construction activities, remain through the entire duration and monitored in order to ensure efficient controls in place. • All ESC measures to be reflected on all construction drawings.
Cultural Environment		
Archaeology	Potential impact to archaeological resources	• Stage 2 Archaeological Assessment will be undertaken prior to Detailed Design within undisturbed areas identified in Stage 1 Report. Locations requiring Stage 2 AA will be subject to test pit survey at 5 metre intervals prior to proposed impacts. • Should proposed work extend beyond current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands. • Once Archaeological clearance has been received from MTCS, construction can commence. • In the event that human remains are found, the police or coroner must be contacted. • Should previously undocumented archaeological resources be discovered, they are subject to Section 48(1) of the *Ontario Heritage Act* and the person discovering the archaeological resources must cease alteration of the site

Factor	Anticipated Impact	Proposed Mitigation
		and engage a licensed consultant archaeologist to carry out the archaeological field work.
	Potential to impact ossuary within the Study Area	• To minimize the potential to impact an ossuary during construction, a liscensed archaeologist must be present to monitor the removal of topsoil for all areas within the proposed construction impacts that are within 1,000 metres from these sites and 300 metres from water.
Social Environment		
Noise	Potential nuisance impacts to residents during construction	• The City of Barrie has a bylaw restricting noise from construction activity within the City, however there is a permanent exemption under this by-law related to the operation of equipment in conjunction with City projects or reconstruction projects. • The MOECC stipulates limits on noise emissions from individual equipment, rather than overall construction noise. • Sound emission standards for the various types of construction equipment used on the project should be checked to ensure that they meet the specified limits contained in the MOECC Publication NPC-115-Construction Equipment.
Air Quality	Increase in particulates during construction	• Non-chloride dust suppressants to be applied during construction to reduce dust emissions. • Contractor to sweep adjacent roads clean at end of each day if mud has been tracked onto roadway. • Contractor to comply with all applicable by-laws for dust control and emissions.
	Potential impact to air quality with increased traffic and tailpipe emissions	• The recommendations for the roadways including active transportation (bike lanes and sidewalks on both sides) to improve overall air quality and reduce emissions
Residential/Business	Impacts on residents/ businesses	• Prior to construction, specific notices and contact information must be delivered to area residents and property owners informing them of construction details • Maintain access to individual driveways during construction

Factor	Anticipated Impact	Proposed Mitigation
Property Acquisition	Property anticipated. Discussions to be had with residents during detailed design to confirm requirements	• Preliminary property requirements are available for review as part of preliminary preferred design plans (included as Appendix in ESR) • The formal property acquisition process will be initiated following completion of the Class EA Study • Requirements for temporary working easements to complete grading to be confirmed during detailed design with reduced standards for slope grading
Construction Safety	Safety for corridor users	• During construction, open excavations will be fenced when no construction activity is taking place
Aesthetics/Streetscape	Potential for reduced aesthetics	• Streetscaping improvements proposed
Disruption to motorists during construction	Inconvenience during construction to motorists on Essa Road and Harvie Road	• Prior to commencing construction activities, design phase of the project, regulatory agencies and adjacent property/ business owners will be notified regarding the scheduling of construction activities • Impacts will be temporary in nature. The City will attempt to mitigate impacts as much as possible during detailed design and construction, through construction staging plans and traffic management plans.

11. Commitments to Further Work – Harvie Road

11.1 Natural Environment

11.1.1 Natural Heritage

- A DFO self-assessment or Request for Review will be required once plans for future culvert/replacement /repair are confirmed;
- Vegetation clearing and/or grubbing should be kept to a minimum and areas should be restored to equal or better condition with native non-invasive species that are reflective of regional vegetation;
- Trees areas that shall be preserved should be protected using protective hoarding according to the City of Barrie Tree Preservation By-law;
- Proper erosion and sediment control measures, and/or spill prevention should be implemented at construction to prevent any impacts to nearby watercourses and ditches; and
- Mitigation measures should be applied to present impacts associated with proposed transportation improvements.

11.2 Cultural Environment

11.2.1 Archaeology

A Stage 2 Archaeological Assessment will be completed following the EA, however prior to Detailed Design to confirm impacts and mitigation.

The work will entail the following:

- Lands requiring Stage 2 archaeological assessment will be completed by test pit survey at five metre intervals prior to proposed impacts to the property.
- Given the location of a previously registered site within 50 metres of the Study Area (i.e., late Woodland site), a Stage 3 assessment was undertaken to determine that there is further cultural heritage value or interest. A Stage 4 assessment is currently ongoing.
- Given the location of five ancestral Huron-Wendat villages for which five ossuaries have not been identified, are located within one kilometer of the Study Area. To minimize the risk of impacting an ossuary during the proposed construction, a licensed archaeologist must be present to monitor the removal of topsoil for all areas within the proposed construction impacts that are within both 1,000 metres from these sites and 300 metres from water; and

- Should the proposed work extend beyond the current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

11.3 Socio-Economic Environment

11.3.1 Noise

A noise wall is required along the south side of Harvie Road, just west of Thrushwood Drive to protect the house at the corner and the other houses to the south. This would involve the removal of the existing wall, with the replacement of a taller and longer wall. Details regarding the exact measurements of the wall will be reviewed during Detailed Design.

11.4 Engineering Environment

11.4.1 Stormwater Management

The following measures are recommended to support the Harvie Road detailed design:

- A 750 mm diameter Concrete Pipe Culvert be implemented for Culvert P.C.W-1 at Whiskey Creek Subwatershed area.
- A 1.2 m x 0.90 m Concrete Box Culvert be implemented for Culvert P.C.L-2 at Lovers Creek Subwatershed area.
- An outlet pool with rock protection will be provided as per HBBP Project at the outlet of Culvert E.C.W-1 for erosion control. Rock protection will be also provided on the upstream end of the culvert.
- Rock protection will be provided at the upstream and down stream ends of Culvert E.C.B-1 and Culvert P.C. L-2.
- Within Whiskey Creek Subwatershed:
    - Two (2) Linear Dry SWM facilities Pond 1 and Pond 2 be implemented for runoff quantity control.
    - Two (2) infiltration chambers (IC-W1 and IC-W2) be implemented at the bottom of the linear dry facilities.
    - Enhanced grassed swales are proposed to convey the outflow from SWM facilities.
    - Three (3) OGS units be implemented for runoff quality treatment.
    - Pond A be retrofitted to accommodate the infiltration requirements of Harvie Road and Bryne Drive south of Harvie Road. An infiltration chamber will be provided on the northside of Pond A to maintain the LID volume requirements.
    - Roadway runoff will be conveyed through the designed storm sewers.

- Within Hotchkiss Creek Subwatershed:
  - Pond HT06 be retrofitted to provide water quantity and LID infiltration control due to the roadway cross-section alterations of existing Bryne Drive
  - Two (2) OGS units be provided for runoff quality treatment.
  - Documented storm sewers with proposed condition capacity deficiencies be upgraded to accommodate the required design flow.
- Within Lovers Creek Subwatershed:
  - Pond LV14 be retrofitted to accommodate additional quantity control volume due to the improvement and extension of existing Bryne Drive.
  - Based on MOECC water quality volume criteria (Table 3.2), the existing pond LV14 provides sufficient water quality control for overall drainage area under the proposed condition.
  - An infiltration chamber will be implemented at LV14 to satisfy the LID infiltration volume requirement for the increased net impervious area on Bryne Drive within the Lovers Creek subwatershed.
  - Enhanced grassed swales to be provided at two locations within the watershed.
  - Infiltration chambers (IC-L1 and IC-L2) be implemented within the proposed grassed swales to meet the LID volume requirements.
  - Documented storm sewers with proposed condition capacity deficiencies be upgraded to accommodate the required design flow.
- Within Bear Creek Subwatershed:
  - A Linear Dry SWM facilities Pond BR-P2 be implemented for runoff quantity control.
  - Roadway runoff will be conveyed through the designed storm sewers.
  - Enhanced grassed swale is proposed on the downstream of the dry SWM facility to convey the outflow to downstream of Culvert E.C.B-1.
  - Two (2) OGS units be implemented for runoff quality treatment.
  - One infiltration chamber IC-B1 be implemented within the linear dry SWM facility and adjacent enhanced grassed swale.
  - Outflow from existing dry Pond BR-27 be directed to Bear Creek with new set of clean water storm sewers on the east of Essa Road.

11.4.2 Geotechnical

A geotechnical Investigation will be undertaken prior to Detailed Design to support the recommendations for the reconstruction of the roadways, including roadway pavement design, underground service installation, and re-use or disposal of excavated materials. A drilling investigation will also be completed with analytical laboratory testing, as well as a foundation investigation at the proposed culvert locations.

11.4.3 Construction Staging Considerations

Construction staging considerations will be reviewed during Detailed Design. The time of construction will be adjusted to reflect the residential environment. The staging will maintain local access to adjacent properties during construction and consider the proximity of the road improvements to residences along the corridor (specific to Harvie Road).

11.5 Permits and Approvals

It is anticipated that the following permits and approvals will be warranted for this project, but not limited to:

- Harvie Road: A Development, Interference with Wetlands and Alteration to Shorelines and Watercourses Regulation permit from the LSRCA under Ontario Regulation 179/06 to facilitate works within the regulated area associated with Whiskey Creek (i.e., culvert works);
- Ministry of the Environment and Climate Change Permit-to-Take-Water/Registration;
- Tree Preservation By-law;
- DFO self-assessment or Request for Review;
- Permits and/or approvals associated with Butternut and SAR Bats (Little Brown Myotis) will be further investigated during detailed design after consultation with Skelton Brumwell, MNRF and City representatives; and,
- Wildlife Scientific Collectors Permit for potential defishing during construction.

Please note this list is not exhaustive, and additional permits and approvals may be required depending on the preferred design. Depending on permit and approval requirements additional work may be required during detailed design to ascertain specific permit/approval requirements.

11.6 Consultation

- Additional discussions with the City's Urban Forestry Department are recommended during Detailed Design to fine-tune tree protection requirements along the road ROW.

- Exact details of compensation will be discussed with the LSCRA during Detailed Design regarding compensation for loss of woodland and wetland (LSRCA's Ecological Offsetting Plan (2017)).

12. Commitments to Further Work – Essa Road

12.1 Natural Environment

12.1.1 Natural Heritage

- A DFO self-assessment or Request for Review will be required once plans for future culvert/replacement /repair are confirmed;
- Vegetation clearing and/or grubbing should be kept to a minimum and areas should be restored to equal or better condition with native non-invasive species that are reflective of regional vegetation;
- Trees areas that shall be preserved should be protected using protective hoarding according to the City of Barrie Tree Preservation By-law;
- Proper erosion and sediment control measures, and/or spill prevention should be implemented at construction to prevent any impacts to nearby watercourses and ditches; and
- Mitigation measures should be applied to present impacts associated with proposed transportation improvements.

12.2 Cultural Environment

12.2.1 Cultural Heritage

Should future work require an expansion to the Study Area corridors, then a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed work on potential heritage resources.

12.2.2 Archaeology

A Stage 2 Archaeological Assessment will be completed following the EA, however prior to Detailed Design to confirm impacts and mitigation.

The work will entail the following:

- Lands requiring Stage 2 archaeological assessment will be completed by test pit survey at a five metre intervals prior to proposed impacts to the property.
- Given the proximity of a previously registered site within 50m of the Study Area (i.e., Tall Trees, which identified material associated with the nineteenth-century Euro-Canadian homestead), the area adjacent is subject to a Stage 2 test pit survey to determine if the site extends into the Study Area
- The former Holly Post Office known to have been located northeast of Essa Road and Mapleview Drive West was previously subject to a test pit survey by AMICK in 2016, which identified that it has been capped with a deep layer of fill material. There remains potential for deeply buried archaeological deposits below the fill layer associated with the historic post office. These lands will be subject to Stage 2

assessment by mechanical trenching at a maximum of 10 metre intervals within the areas of impact.

- Should the proposed work extend beyond the current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

12.3 Engineering Environment

12.3.1 Stormwater Management

The following measures are recommended to support the Essa Road detailed design:

- A 750 mm diameter Concrete Pipe Culvert be implemented for Culvert P.C.W-1 at Whiskey Creek Subwatershed area.
- A 1.2 m x 0.90 m Concrete Box Culvert be implemented for Culvert P.C.L-2 at Lovers Creek Subwatershed area.
- An outlet pool with rock protection will be provided as per HBBP Project at the outlet of Culvert E.C.W-1 for erosion control. Rock protection will be also provided on the upstream end of the culvert.
- Rock protection will be provided at the upstream and down stream ends of Culvert E.C.B-1 and Culvert P.C. L-2.
- Within Whiskey Creek Subwatershed:
    - Two (2) Linear Dry SWM facilities Pond 1 and Pond 2 be implemented for runoff quantity control.
    - Two (2) infiltration chambers (IC-W1 and IC-W2) be implemented at the bottom of the linear dry facilities.
    - Enhanced grassed swales are proposed to convey the outflow from SWM facilities.
    - Three (3) OGS units be implemented for runoff quality treatment.
    - Pond A be retrofitted to accommodate the infiltration requirements of Harvie Road and Bryne Drive south of Harvie Road. An infiltration chamber will be provided on the northside of Pond A to maintain the LID volume requirements.
    - Roadway runoff will be conveyed through the designed storm sewers.
- Within Hotchkiss Creek Subwatershed:
    - Pond HT06 be retrofitted to provide water quantity and LID infiltration control due to the roadway cross-section alterations of existing Bryne Drive
    - Two (2) OGS units be provided for runoff quality treatment.

- Documented storm sewers with proposed condition capacity deficiencies be upgraded to accommodate the required design flow.

- Within Lovers Creek Subwatershed:
  - Pond LV14 be retrofitted to accommodate additional quantity control volume due to the improvement and extension of existing Bryne Drive.
  - Based on MOECC water quality volume criteria (Table 3.2), the existing pond LV14 provides sufficient water quality control for overall drainage area under the proposed condition.
  - An infiltration chamber will be implemented at LV14 to satisfy the LID infiltration volume requirement for the increased net impervious area on Bryne Drive within the Lovers Creek subwatershed.
  - Enhanced grassed swales to be provided at two locations within the watershed.
  - Infiltration chambers (IC-L1 and IC-L2) be implemented within the proposed grassed swales to meet the LID volume requirements.
  - Documented storm sewers with proposed condition capacity deficiencies be upgraded to accommodate the required design flow.

- Within Bear Creek Subwatershed:
  - A Linear Dry SWM facilities Pond BR-P2 be implemented for runoff quantity control.
  - Roadway runoff will be conveyed through the designed storm sewers.
  - Enhanced grassed swale is proposed on the downstream of the dry SWM facility to convey the outflow to downstream of Culvert E.C.B-1.
  - Two (2) OGS units be implemented for runoff quality treatment.
  - One infiltration chamber IC-B1 be implemented within the linear dry SWM facility and adjacent enhanced grassed swale.
  - Outflow from existing dry Pond BR-27 be directed to Bear Creek with new set of clean water storm sewers on the east of Essa Road.

12.3.2 Geotechnical

A geotechnical Investigation will be undertaken prior to Detailed Design to support the recommendations for the reconstruction of the roadways, including roadway pavement design, underground service installation, and re-use or disposal of excavated materials. A drilling investigation will also be completed with analytical laboratory testing, as well as a foundation investigation at the proposed culvert locations.

12.3.3 Construction Staging Considerations

Construction staging considerations will be reviewed during Detailed Design. The time of construction will be adjusted to reflect the residential environment. The staging will maintain local access to adjacent properties during construction and consider the proximity of the road improvements to residences along the corridor (specific to Harvie Road).

12.4 Permits and Approvals

It is anticipated that the following permits and approvals will be warranted for this project, but not limited to:

- Essa Road: A Development, Interference with Wetlands and Alteration to Shorelines and Watercourses Regulation permit from the NVCA under Ontario Regulation 172/06 to facilitate works within the regulated area associated with Bear Creek (i.e., culvert works);
- Ministry of the Environment and Climate Change Permit-to-Take-Water/Registration;
- Tree Preservation By-law;
- DFO self-assessment or Request for Review; and
- Wildlife Scientific Collectors Permit for potential defishing during construction.

Please note this list is not exhaustive, and additional permits and approvals may be required depending on the preferred design. Depending on permit and approval requirements additional work may be required during detailed design to ascertain specific permit/approval requirements.

12.5 Consultation

- Additional discussions with the City's Urban Forestry Department are recommended during Detailed Design to fine-tune tree protection requirements along the road ROW.

13. Commitments to Further Work – Bryne Drive

13.1 Natural Environment

13.1.1 Natural Heritage

- A DFO self-assessment or Request for Review will be required once plans for future culvert/replacement /repair are confirmed;
- Vegetation clearing and/or grubbing should be kept to a minimum and areas should be restored to equal or better condition with native non-invasive species that are reflective of regional vegetation;
- Trees areas that shall be preserved should be protected using protective hoarding according to the City of Barrie Tree Preservation By-law;
- Proper erosion and sediment control measures, and/or spill prevention should be implemented at construction to prevent any impacts to nearby watercourses and ditches; and
- Mitigation measures should be applied to present impacts associated with proposed transportation improvements.

13.2 Cultural Environment

13.2.1 Archaeology

A Stage 2 Archaeological Assessment will be completed following the EA, however prior to Detailed Design to confirm impacts and mitigation.

The work will entail the following:

- Lands identified in the AMICK report will be subject to Stage 2 Archaeological Assessment prior to proposed impacts to the property.
- Given the location of five ancestral Huron-Wendat villages for which five ossuaries have not been identified, are located within one kilometer of the Study Area. To minimize the risk of impacting an ossuary during the proposed construction, a licensed archaeologist must be present to monitor the removal of topsoil for all areas within the proposed construction impacts that are within both 1,000 metres from these sites and 300 metres from water; and
- Should the proposed work extend beyond the current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

13.3 Engineering Environment

13.3.1 Stormwater Management

The following measures are recommended to support the Bryne Drive detailed design:

- A 750 mm diameter Concrete Pipe Culvert be implemented for Culvert P.C.W-1 at Whiskey Creek Subwatershed area.
- A 1.2 m x 0.90 m Concrete Box Culvert be implemented for Culvert P.C.L-2 at Lovers Creek Subwatershed area.
- An outlet pool with rock protection will be provided as per HBBP Project at the outlet of Culvert E.C.W-1 for erosion control. Rock protection will be also provided on the upstream end of the culvert.
- Rock protection will be provided at the upstream and down stream ends of Culvert E.C.B-1 and Culvert P.C. L-2.
- Within Whiskey Creek Subwatershed:
    - Two (2) Linear Dry SWM facilities Pond 1 and Pond 2 be implemented for runoff quantity control.
    - Two (2) infiltration chambers (IC-W1 and IC-W2) be implemented at the bottom of the linear dry facilities.
    - Enhanced grassed swales are proposed to convey the outflow from SWM facilities.
    - Three (3) OGS units be implemented for runoff quality treatment.
    - Pond A be retrofitted to accommodate the infiltration requirements of Harvie Road and Bryne Drive south of Harvie Road. An infiltration chamber will be provided on the northside of Pond A to maintain the LID volume requirements.
    - Roadway runoff will be conveyed through the designed storm sewers.
- Within Hotchkiss Creek Subwatershed:
    - Pond HT06 be retrofitted to provide water quantity and LID infiltration control due to the roadway cross-section alterations of existing Bryne Drive
    - Two (2) OGS units be provided for runoff quality treatment.
    - Documented storm sewers with proposed condition capacity deficiencies be upgraded to accommodate the required design flow.
- Within Lovers Creek Subwatershed:

- Pond LV14 be retrofitted to accommodate additional quantity control volume due to the improvement and extension of existing Bryne Drive.
- Based on MOECC water quality volume criteria (Table 3.2), the existing pond LV14 provides sufficient water quality control for overall drainage area under the proposed condition.
- An infiltration chamber will be implemented at LV14 to satisfy the LID infiltration volume requirement for the increased net impervious area on Bryne Drive within the Lovers Creek subwatershed.
- Enhanced grassed swales to be provided at two locations within the watershed.
- Infiltration chambers (IC-L1 and IC-L2) be implemented within the proposed grassed swales to meet the LID volume requirements.
- Documented storm sewers with proposed condition capacity deficiencies be upgraded to accommodate the required design flow.

- Within Bear Creek Subwatershed:
  - A Linear Dry SWM facilities Pond BR-P2 be implemented for runoff quantity control.
  - Roadway runoff will be conveyed through the designed storm sewers.
  - Enhanced grassed swale is proposed on the downstream of the dry SWM facility to convey the outflow to downstream of Culvert E.C.B-1.
  - Two (2) OGS units be implemented for runoff quality treatment.
  - One infiltration chamber IC-B1 be implemented within the linear dry SWM facility and adjacent enhanced grassed swale.
  - Outflow from existing dry Pond BR-27 be directed to Bear Creek with new set of clean water storm sewers on the east of Essa Road.

13.3.2 Geotechnical

A geotechnical Investigation will be undertaken prior to Detailed Design to support the recommendations for the reconstruction of the roadways, including roadway pavement design, underground service installation, and re-use or disposal of excavated materials. A drilling investigation will also be completed with analytical laboratory testing, as well as a foundation investigation at the proposed culvert locations.

13.3.3 Construction Staging Considerations

Construction staging considerations will be reviewed during Detailed Design. The time of construction will be adjusted to reflect the residential environment. The staging will maintain

local access to adjacent properties during construction and consider the proximity of the road improvements to residences along the corridor (specific to Harvie Road).

13.4 Permits and Approvals

It is anticipated that the following permits and approvals will be warranted for this project, but not limited to:

- Bryne Drive: A Development, Interference with Wetlands and Alteration to Shorelines and Watercourses Regulation permit from the LSRCA under Ontario Regulation 179/06 to facilitate works within the regulated area associated with Whiskey Creek, Lovers Creek and Hotchkiss Creek (i.e., culvert works);
- Ministry of the Environment and Climate Change Permit-to-Take-Water/Registration;
- Tree Preservation By-law;
- DFO self-assessment or Request for Review
- Permits and/or approvals associated with Butternut and SAR Bats (Little Brown Myotis) will be further investigated during detailed design following consultation with Skelton Brumwell, MNRF and City representatives; and,
- Wildlife Scientific Collectors Permit for potential defishing during construction.

Please note this list is not exhaustive, and additional permits and approvals may be required depending on the preferred design. Depending on permit and approval requirements additional work may be required during detailed design to ascertain specific permit/approval requirements.

13.5 Consultation

- Additional discussions with the City's Urban Forestry Department are recommended during Detailed Design to fine-tune tree protection requirements along the road ROW.
- Exact details of compensation will be discussed with the LSCRA during Detailed Design regarding compensation for loss of woodland and wetland (LSRCA's Ecological Offsetting Plan (2017)).

14. References

1. Lake Simcoe and Region Conservation Authority (LSRCA). 2016. *Our Watershed [online].* Accessed 12 April 2017 at http://www.lsrca.on.ca/our-watershed

2. Hoffman, D.W., Wicklund, R.E., Richards, N.R. 1962. Soil Survey of Simcoe County Ontario. Report No. 29 of the Ontario Soil Survey. Research Branch, Canada Department of Agriculture and the Ontario Agricultural College. http://sis.agr.gc.ca/cansis/publications/surveys/on/index.html

3. LGL Limited. 2005. Natural Heritage Report: Bryne Drive Extension from Veteran's Drive to Commerce Park Drive and North Along Bryne Drive to Essa Road.

4. Ontario Partners in Flight. 2008. Ontario Landbird Conservation Plan: Lower Great Lakes/St. Lawrence Plain, North American Bird Conservation Region 13. Ontario Ministry of Natural Resources, Bird Studies Canada, Environment Canada

5. AMICK. 2005. Report on the 2005 Stage 1 Archaeological Background Research – Bryne Drive Class EA, Part of Lots 6 & 7, Concessions 11, Part of Lots 6& 7, Concession 12, Part of Lots 6 & &, Concession 13, City of Barrie

6. Morrison Hershfield Ltd. 2015. Havie Road / Big Bay Point Road / Highway 400 Transportation Improvements (Bryne Drive to Bayview Drive) Municipal Class Environmental Assessment, Phases 3 and 4.

7. Ainley Group. 2016. Bryne Drive (Caplan Avenue to Essa Road) Master Plan Update Addendum #1, Municipal Class Environmental Assessment Phase 1 & 2.