Kirby Road Extension Municipal Class Environmental Assessment

Environmental Study Report

Prepared For: Rizmi Holdings Limited and City of Vaughan

SCHAEFFERS
CONSULTING ENGINEERS

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Record of Revisions

Revision	Date	Description
Draft	December 21, 2018	Submission to review agencies (MECP, TRCA, MNRF, MMAH, City of Vaughan, York Region).
Final Draft	May 13, 2019	Submission to review agencies (MECP, TRCA, MNRF, MMAH, City of Vaughan, York Region).
Final	August 28, 2019	Comments from review agencies addressed. Submission to City of Vaughan.
0	September 17, 2019	Comments from City of Vaughan.

Glossary of Terms and Acronyms

ALTERNATIVE SOLUTIONS	Means feasible alternative ways of solving an identified problem (deficiency) or addressing an opportunity, from which a preferred solution is selected." Note: alternative solutions include the "Do Nothing" alternative.
ALTERNATIVE DESIGN	Means alternative ways of designing or carrying out the preferred solution.
ARTERIAL ROADS	Means roads which move moderate to high traffic volumes over moderate distances within a municipality between principal areas of traffic generation and which gather traffic from collector roads and local roads and move it to the Provincial highway system; arterial roads are generally designed for medium speed, have capacity for 2 - 6 lanes, may be divided, with limited or controlled direct access from adjacent developments and with on-street parking discouraged.
CLASS ENVIRONMENTAL ASSESSMENT (CLASS EA)	Means a planning process, approved under the EA Act for a class or group of undertakings. Projects included in the Class EA may be implemented without further approval under the EA Act provided the approved Class EA planning process is followed.
EA ACT	Means Ontario Environmental Assessment Act (1990)
EAS	Environmental Assessment Study
ENVIRONMENT	"Environment", as defined in the EA Act, means: a) air, land or water, b) plant and animal life, including human life, c) the social, economic and cultural conditions that influence the life of humans, or a community, d) any building, structure, machine or other device or thing made by humans, e) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities, or f) any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.
ENVIRONMENTAL STUDY REPORT (ESR)	Means the documentation for a specific project planned in accordance with the procedures for Schedule C projects, setting out the planning and decision making process, including consultation practices, which has been followed to arrive at the preferred solution. The ESR also sets out the mitigating measures proposed to avoid or minimize environmental impacts.
ESA	Ontario Endangered Species Act

MECP	Ontario Ministry of the Environment, Conservation and Parks
MNRF	Ontario Ministry of Natural Resources and Forestry
MMAH	Ontario Ministry of Municipal Affairs and Housing
MUNICIPAL RIGHT-OF-WAY (ROW)	Means a dedicated strip of land intended for the accommodation of traffic movements, utilities, drainage, and other similar public uses.
NET ENVIRONMENTAL EFFECTS	Means the impacts, both positive and negative, of an alternative, which remain after mitigation measures have been applied.
NEW ROAD	Means the construction of an improved surface for vehicular traffic on a new right-of-way where the right-of-way is entirely separate from any previous right-of-way. Also refers to construction of a road on a road allowance where no road surface previously existed.
PROJECT	Means a specific activity planned and implemented in accordance with the Class EA (may also be referred to as the undertaking). The project consists of all those activities necessary to solve a specific problem (deficiency) or address an opportunity.
PUBLIC	Means the general public, individual members of the public who may be affected by or have an interest in a project and special interest groups.
PIC	Public Information Centre
PSW	Provincially Significant Wetland
REVIEW AGENCIES	Means government agencies, ministries or public authorities or bodies whose mandates require them to have jurisdiction over matters affected or potentially affected by projects planned under this Class EA.
ROAD ALLOWANCE	Means a surveyed allowance of land for roadway purposes. A road allowance can be either "opened" with an existing road surface or "unopened" in which case no travelled surface is provided.
SAR	Species at Risk
TMP	Transportation Master Plan
TRCA	Toronto and Region Conservation Authority

Executive Summary

ES1 Background

The City of Vaughan (CoV) Transportation Master Plan (TMP) - A New Path (2012), companion to the CoV Official Plan (2010), identified projects that will improve connections to local and regional infrastructure, provide access to future developments, support transit-oriented nodes and corridors, and enhance transit ridership, cycling and walking. The TMP identified Kirby Road as a key east-west arterial corridor in the City and confirmed the need to widen Kirby Road between Keele Street and Dufferin Street from two to four lanes by 2021 and to extend Kirby Road between Dufferin Street and Bathurst Street as a four lane roadway.

The CoV determined the sequence of improvements for the Kirby Road corridor and developed an action plan to complete the Kirby Road improvements. Further to the City's staff report #44 to the Committee of the Whole, on December 15, 2015 the Council of the authorized and directed staff to formalize arrangements with Rizmi Holdings Limited (RHL), a private land developer, and permit RHL to undertake a Class Environmental Assessment Study (EA Study) for the Kirby Road Extension between Bathurst Street and Dufferin Street.

Ontario Environmental Assessment Act (1990, as amended) (further referenced as EA Act) establishes an approach for reviewing the potential environmental effects of a proposed project prior to its implementation. Municipal Class EA (MCEA) document (2000, as amended) prepared by the Municipal Engineers Association (MEA) of Ontario is one of the parent Class EA documents established under the EA Act. This Class EA is a planning and design process prepared for a class or group of municipal infrastructure undertakings, including roads, water and wastewater and transit projects. The process is approved by the Ministry of the Environment, Conservation and Parks (MECP). Provided the Class EA process was followed, a study proponent has complied with requirements of the EA Act. As stipulated in the EA Act, proponent means a person who proposes or carries out an undertaking or is the owner or person having charge, management or control of an undertaking.

This Environmental Study Report (ESR) documents the planning and design process for the Kirby Road Extension between Bathurst Street to Dufferin Street as a Schedule "C" project per the MCEA document. Schedule "C" projects, such as construction of new facilities, may have significant environmental effects on the environment and require completion of Phases 1 through 4 of the process.

This EA Study took into account findings of the CoV TMP (2012), the York Region TMP (2016) and the North Vaughan and New Communities TMP (2019) studies. Phase 1 "Problem and /or Opportunity" and Phase 2 "Alternative Solutions" of the MEA MCEA process for this project have been completed and documented through these master planning efforts. Nevertheless, Phases 1 and 2 were revisited by the Project Team. The EA Study carried out the Phase 3 "Alternative Design Concepts for Preferred Solution" and Phase 4 "Environmental Study Report" of the MEA MCEA process.

The purpose of this EA study is to determine the alignment and characteristics of a planned easterly extension of Kirby Road from Dufferin Street to Bathurst Street in the CoV; to conduct an assessment of the environmental effects associated with the project; and, to select and recommend a preliminary preferred design for the project.

The Study Area is an 800m wide corridor, spanning a distance of approximately 2000m in the east-west direction. The study corridor covers an area of approximately 170 hectares, extending approximately 400m north and south of an unopened 20m wide municipal Right of Way (RoW), and is located immediately west of the City of Richmond Hill (CoRH) municipal border. The Study Area is illustrated in **ES Figure 1**.

Existing Kirby Road terminates at T- shaped intersection with Dufferin Street in the City of Vaughan. The most eastern 200 m of the municipal road allowance provide a gravel driveway access to existing properties from the Bathurst Street and Gamble Road T- shaped intersection. The balance of the road allowance is mostly forested. The Subject Lands consist primarily of active agricultural land, open meadows, disturbed areas, former aggregate extraction lands and forest habitat. Natural areas are comprised primarily of forested uplands, with pockets of tree and shrub swamp located in the bottomlands and/or along drainage features.

A number of Provincially and Regionally designated environmentally sensitive areas are found both within and proximal to the Study Area. Key Natural Heritage features identified in the Study Area include Significant Woodlands, Habitat of Endangered, Rare and Threatened Species, Significant Wildlife Habitat, Life Science Areas of Natural and Scientific Interest (ANSI), and a Provincially Significant Wetland (PSW) with related watercourse in the central part of the Study Area.

The proposed extension will be an arterial road under the jurisdiction of the CoV. As a part of broader Kirby Road improvements, the proposed road extension will support planned population growth and the orderly distribution of traffic. The road is contemplated to play an important role and function in the overall York Region road network and as such to be eventually transferred to the Regional jurisdiction.

ES2 Problem and Opportunity Statement

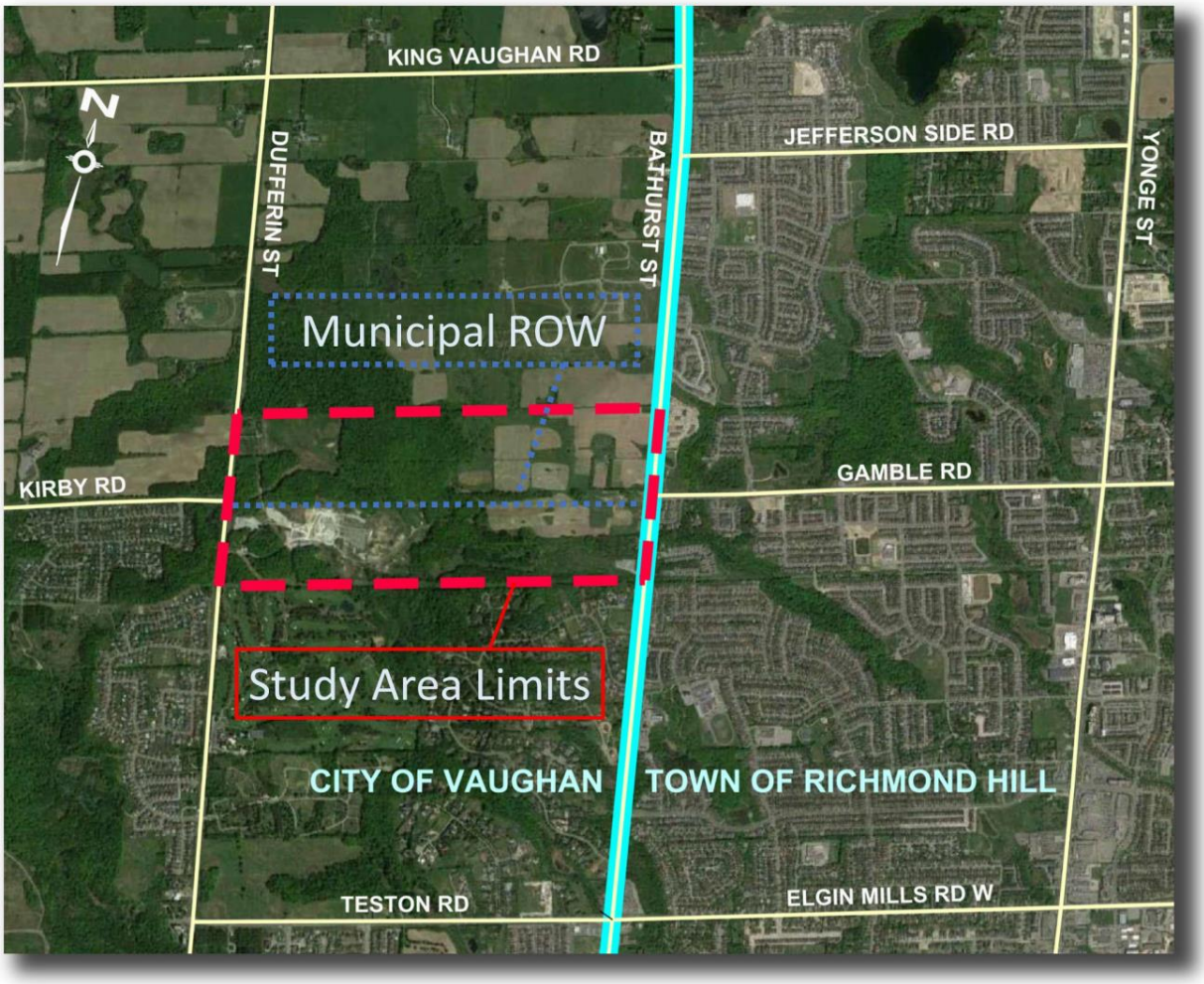
Currently, Kirby Road is a discontinuous east-west arterial road with a gap between Dufferin Street and Bathurst Street. King-Vaughan Road and Major Mackenzie Drive are the only two continuous east-west arterial roads between Highway 400 and the eastern limit of Vaughan. Commuters from the City of Richmond Hill or northern Vaughan need to travel along north-south arterial roads such as Bathurst Street and Dufferin Street to access either of these roads, causing significant peak hour congestion on these north-south arterials, as well as overloading traffic on King-Vaughan Road and Major Mackenzie Drive with long distance trips. Therefore, satisfying travel demand, providing connectivity for all modes of transportation and eliminating the gap in the existing road network is critical to addressing traffic congestion in the study area.

Problem solving provides an opportunity to:

- Improve road network connectivity needed to move people and goods;
- Provide for planned future growth and increased travel demand in the northeast quadrant of the City, including facilitation of future transit service;
- Ensure wise management of important environmental resources;
- Incorporate municipal services in the Kirby Road Extension as part of broader Kirby Road improvements and to align implementation of servicing infrastructure to support growth in North Vaughan and the adjacent Future Urban Area in the Study Area; and

- Accommodate facilities for bicyclists and pedestrians through this part of the City.

ES Figure 1: Study Area



ES3 Public and Stakeholders Engagement

Consultation and communication about the project is a mandatory part of the Class EA process. The principal consultation mechanisms and tools that were employed over the course of the study included:

- Notifications
- Technical Advisory Group (TAG) meetings
- Citizen Liaison Committee (CLC) meetings
- Public Information Centres (PICs)
- Technical review of Draft Environmental Study Report (ESR)
- Dedicated project email address
- Project webpage

The MEA MCEA guidelines define the minimum requirements for environmental planning, including minimum mandatory points of contact with stakeholders and the public. Actual consultation efforts considerably exceeded the minimal requirements for Schedule "C" Municipal Road project.

A Notice of Study Commencement (NOC) was advertised in two consecutive editions of the local newspapers on May 11, 2017 and May 18, 2017 respectively. In addition, the Notices along with a cover letter were sent out to stakeholders, agencies, municipal staff and Indigenous Peoples on the project contact list.

At the onset of the Study, SCE created a project webpage hosted on the company's website. The web page included project background, brief description, timelines, updates and the project contact information.

As part of the public consultation program, a TAG was established following publication of the NOC. The TAG provided a forum for focused discussion of the project with a broadly-based group of technical project stakeholders, including representatives from the Ministry of the Environment, Conservation and Parks (MECP), Ministry of Municipal Affairs and Housing (MMAH), Toronto and Region Conservation Authority (TRCA), York Region, York Region Transit, Richmond Hill and Vaughan.

As part of the public consultation program, a CLC was established following publication of the NOC. The CLC provided a forum for focused discussion of the project with a broadly-based group of public project stakeholders, including residents at large and ratepayers associations.

A PIC #1 was held on June 29, 2017 at the Maple Downs Golf and Country Club in Vaughan. A Notice of PIC #1 was advertised in two consecutive editions of local newspapers in advance of the event. In addition, 110 Notices along with a cover letter were sent out to stakeholders, agencies, municipal staff and Indigenous Peoples on the project contact list about the PIC #1.

The main purpose of PIC #1 was to provide information about the project and EA process, present screening of the long list of alternative road alignments. A total of twelve (12) stakeholders attended the PIC #1. A project response form was handed over to the attendees to provide their input on the project and the PIC#1. No concerns about the project were raised and no completed response forms were provided to the project team during the event.

A PIC#1 update was circulated on July 14, 2017 to the project stakeholders included in the study mailing list. The update included a cover letter, a copy of selected display boards and a Response Form.

Overall PIC#1 provided the project stakeholders a good introduction to the project, overview of the planning process, preliminary details on the undertaking and completed analysis.

A site walk was held on August 29, 2017 with representatives from MECP, TRCA, MNRF, CoV, York Region and selected members of the project team. The group included 21 persons in total.

The purpose of the site walk was to focus on the Study Area and to identify specific environmental features and constraints. Key observations noted during the site walk and specific guidance from the review agencies was used to update the short-listed road alignments and develop an additional modified version (Alignment 6A) that curves farther to the south to avoid natural heritage features.

A PIC #2 was held on June 28, 2018 at the Civic Centre Resource Library in Vaughan. A Notice of PIC #2 was advertised in two consecutive editions of the local newspapers in advance of the event. In addition, 96 Notices along with a cover letter were sent out to stakeholders, agencies, municipal staff and Indigenous Peoples on the project contact list about the PIC #2.

The main purpose of PIC #2 was to provide information on the recommended preliminary preferred design concepts including road alignment and cross-section for consultation. A total of eleven (11) stakeholders attended the PIC #2. During the event questions were raised by the attendees about the evaluation of various alignments and cross-sections which were responded to the by the project team.

A PIC#2 update was circulated on July 20, 2018 to the project stakeholders included in the study mailing list. The update included a Response Form and copy of selected display boards showing the recommended road alignment and cross-section.

A Draft ESR and a Final Draft ESR was circulated to TAG members for review and feedback on December 21, 2018 and May 13, 2019 respectively. The Final Draft ESR was also circulated to CLC members. To facilitate the review, the project team held TAG #3 and CLC #3 meetings on May 2, 2019.

Following their review of the Final Draft ESR, City staff tabled a report to the Finance, Administration and Audit Committee meeting on June 5, 2019 on the outcome of the Kirby Road Extension EA. On June 12, 2019, City of Vaughan Council authorized City staff to proceed jointly with RHL as co-proponents to issue Notice of Study Completion and file the ESR for the mandatory review period in accordance with the MCEA.

A Notice of Study Completion was advertised in two consecutive editions of the local newspapers on September 19, 2019 and September 26, 2019 respectively. In addition, the Notices along with a cover letter were sent out to stakeholders, agencies, municipal staff and Indigenous Peoples on the project contact list about the ESR available for review. The ESR was filed on public domain to mark the completion of the EA study and begin the mandatory 30-day public review period.

Indigenous Peoples are an important public body for consultation on municipal projects. Initial consultation steps with Indigenous Peoples were undertaken by the SCE staff. With gradually expanding contact list, through personalized letters the Indigenous Peoples were notified about the study commencement, PIC#1 and an update to PIC #1. In preparation to PIC #2 it was decided to engage the First Nations Engineering Services Ltd. (FNESL) in the Indigenous Peoples consultation program for the EA study. Acting as an impartial facilitator, the FNESL provided a customized consultation process between the Indigenous groups and organizations, potentially affected by the proposed development, and the RHL (EA Study Proponent).

As a result of the consultation efforts described above, numerous comments from the project stakeholders were received by the project team. At the first rounds of consultation, key comments were related to the study area limits; Need and Justification for the project; addressing Phases 1 and 2 of the Class EA process; screening of alternatives and protecting the Oak Ridges Moraine features and other legislated areas. At the concluding rounds of consultation, key comments were related to the comparative evaluation of shortlisted road alignments; equal weighting of environmental factors; anticipated magnitude of the impacts on significant Natural Environment features from the Technically

Preferred Alignment 5, and conformity of Alignment 5 to the 2017 Oak Ridges Moraine Conservation Plan.

The project team ensured that all identified concerns were addressed as appropriate and responses with supplementary information were provided to the stakeholders, agencies and Indigenous communities.

ES4 Need and Justification

The need for Kirby Road improvement was assessed in both the Vaughan TMP (2012) and the York Region TMP (2016), which recommended widening to 4 lanes, completion of the “missing link” between Dufferin Street and Bathurst Street at 4 lanes and transfer to York Region as Kirby Road will have a regional function as development occurs. It was also recommended by the North Vaughan and New Communities Transportation Master Plan (NVNCTMP) (2019) that the road should be transferred to Regional jurisdiction, requiring a ROW of 36 m to function as a 4-lane arterial road in the future.

In February 2018 the Ministry of Transportation announced that Ontario will not be proceeding with a proposed highway in the GTA West Corridor. The transportation analysis by Poulos & Chung Ltd. confirmed that by 2031 without the GTA West freeway the projected segment of Kirby Road will still require two (2) traffic lanes in each direction of travel to serve the anticipated vehicle demand. In November 2018, in their release of "A Plan for the People, Ontario Economic Outlook and Fiscal Review, 2018 Background Papers", the Province announced their intention to resume the EA for the GTA West Highway Corridor, which was suspended in 2015.

The “Transportation, Traffic and Active Transportation Need and Justification Assessment” report (2018, Poulos & Chung Ltd.) included in **Appendix C2** to the ESR summarizes the detailed analysis that was undertaken. The information contained in this report was used by the Project Team to:

- Verify the need to construct new roadway for Kirby Road Extension;
- Determine detailed engineering criteria and design basis for the road;
- Complete the screening and evaluation of alternative design concepts (road alignments and cross-sections);
- Select recommended Alternative Design Concept for the Kirby Road Extension.

ES5 Alternative Solutions

As appropriate to satisfy Phase 2 of the Municipal Class EA process, an assessment was undertaken to evaluate the Alternative Solutions to the Undertaking. Notwithstanding the significant amount of analysis completed by York Region and the CoV, the project team revisited the technical analysis. The assessment extracted relevant analysis completed by the authorities and included updated existing roadway and intersection traffic flow information. A range of Alternative Solutions were assessed to determine the Preferred Solution for the Kirby Road Extension. The following alternatives were evaluated:

- Do Nothing
- Use / Widen Parallel East – West Roads
- Provide Active Transportation Facilities including Travel Demand Management

- Construct New Roadway Extension

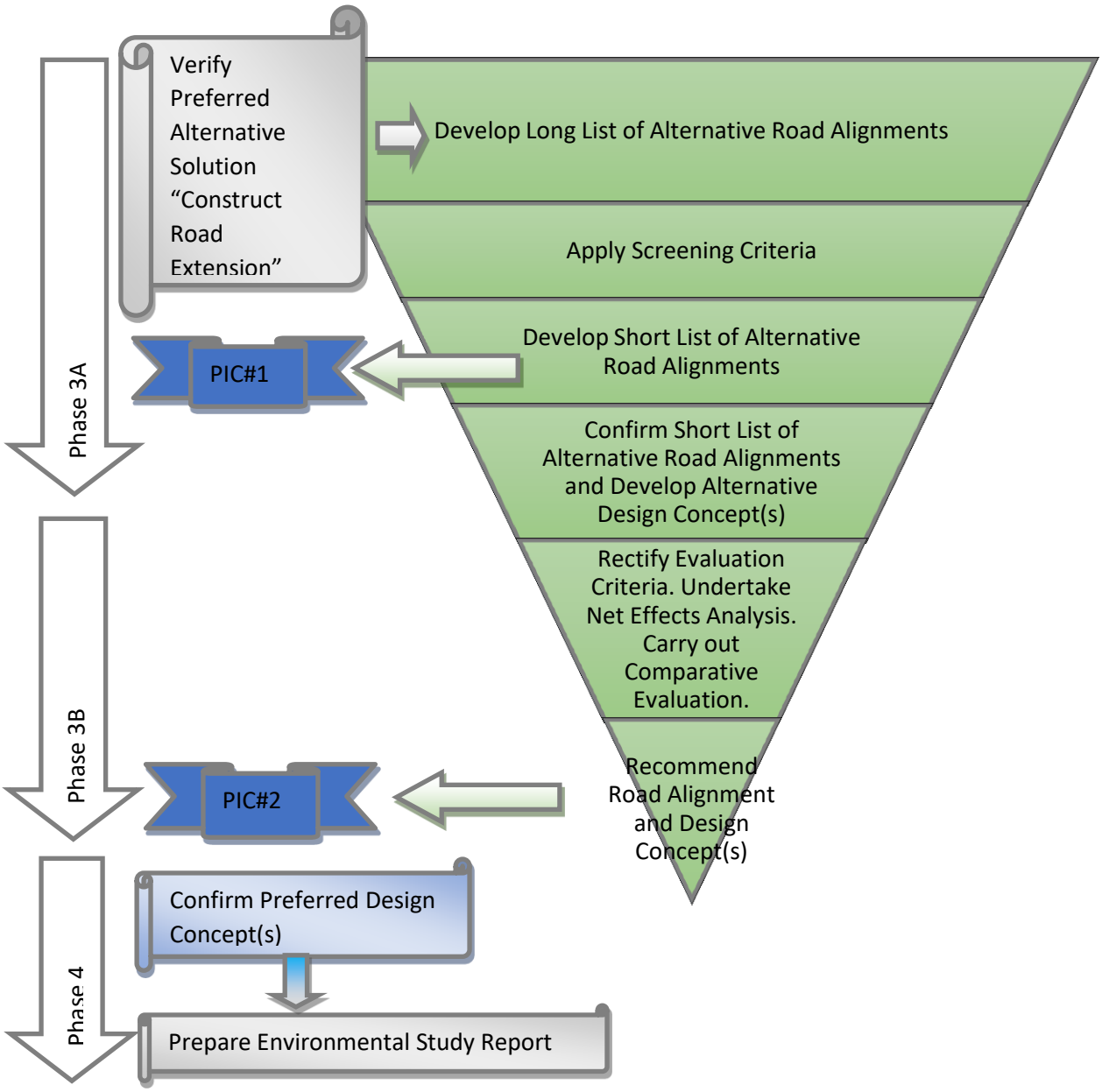
Construction of a new roadway extension with elements of active transportation was confirmed as the Preferred Alternative Solution, as it best provides the required operating capacity, supports future growth and land uses, improves east-west connectivity, supports the orderly distribution of traffic in the local area, and allows for a future easterly extension of Kirby Road in agreement with local and regional plans.

The localized Study Area assessment and updated traffic analysis undertaken by the project team corroborated the need and justification for extending Kirby Road between Dufferin Street and Bathurst Street as a 36 m wide arterial road as part of the Preferred Solution.

ES6 Alternative Design Concepts

Alternative methods of implementing the Preferred Alternative Solution were examined to satisfy Phase 3 of the Municipal Class EA process. The methodology used for selection of a Recommended Design Concept(s) included two consecutive steps: initial screening and detailed evaluation of potential road alignments. Phase 3 of the MCEA planning and design process was divided into two parts: Phase 3A – Screening and Phase 3B – Evaluation to provide broader consultation opportunities. **ES Figure 2** below illustrates how the methodology aligns with the Kirby Road Class EA decision making process and corresponds with the undertaken consultation steps.

ES Figure 2: Methodology for Selection of Alternative Design Concept(s)



The screening analysis assessed a full range of alternative design concepts against the project's rationale and need, narrowed down potential design concepts to a manageable number of options and ensured that only viable design concepts have been carried forward for detailed evaluation.

The initial screening of Alternative Road Alignments involved generation of a Long List of Alternative Road Alignments, developing and applying screening criteria, determining and confirming short-listed road alignment options.

The consequent step was a detailed evaluation. Purpose of the detailed evaluation was to identify all potential environmental effects of the short-listed Alternative Road Alignments, develop mitigation measures, confirm net effects on the environment and identify Recommended Design Concept(s).

The detailed evaluation of Alternative Design Concepts involved the following key activities: developing of Alternative Design Concepts for horizontal road alignment and road cross-section, rectifying evaluation criteria and indicators (measures) presented to the project stakeholders at PIC#1, undertaking net effects analysis and carrying out comparative evaluation.

Since ultimate jurisdiction for the Kirby Road extension has not yet been confirmed, it is necessary to consider engineering design criteria and design guidelines from both the City of Vaughan and Regional Municipality of York. Transportation Association of Canada Design Guidelines were also contemplated along with examination of existing conditions west of Dufferin Street. The design parameters from each governing agency were compared and proposed standard was established.

According to the MEA MCEA document, a reasonable range of functionally different alternatives should be considered for the "alternative methods" of implementing the preferred solution. Significant impacts to Natural, Social and Technical environments should be avoided where possible. Where the key features cannot be avoided, then effects should be minimized where possible, and every effort made to mitigate adverse impacts.

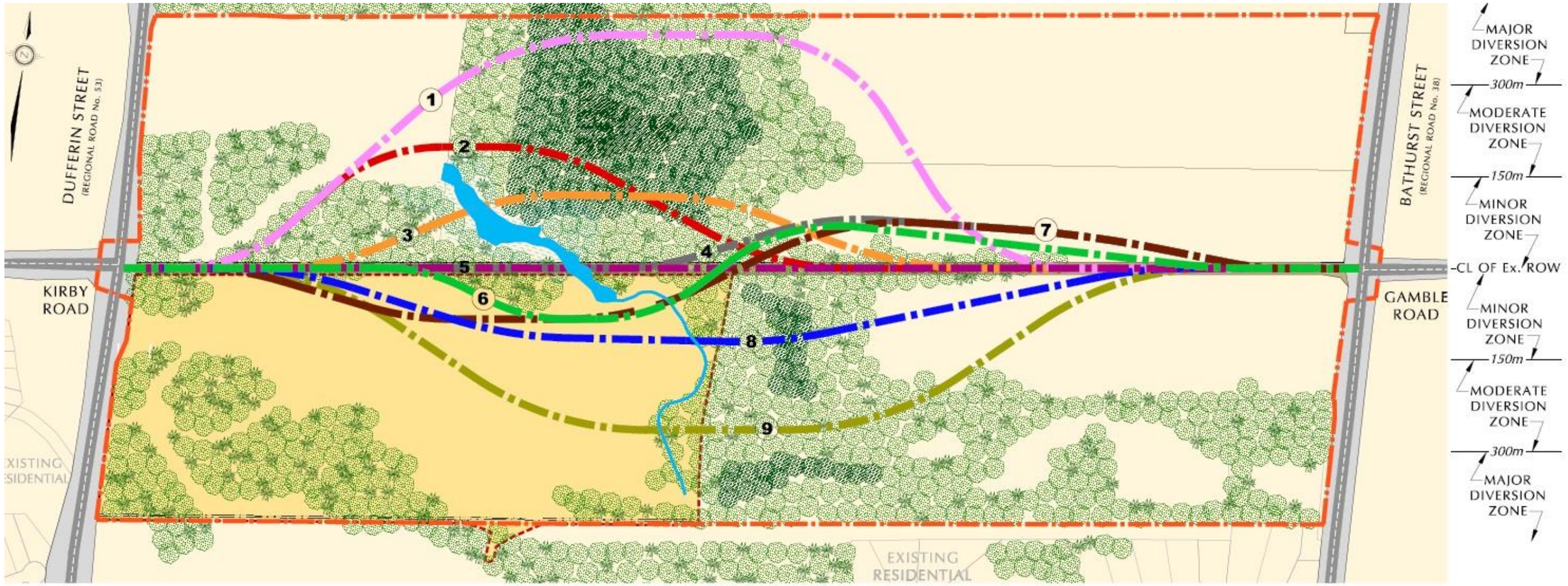
Phase 3A – Identification and Screening of Long List of Alternative Road Alignments

The purpose of screening was to ensure that only viable Alternative Road Alignments were carried forward for selection of recommended options. According to the MEA MCEA document, a reasonable range of alternatives should be considered. Significant impacts to Natural, Social and Technical (Built) environments should be avoided where possible. Where the key features cannot be avoided, then effects should be minimized where possible, and every effort made to mitigate adverse impacts.

The feasibility of the alternative designs depends, in part, on the nature and location of the transportation system, the nature and location of the problem being addressed, the comparative cost of the alternative designs, and on the municipality's capacity to finance the extension of services.

Taking into consideration sensitivities and constraints identified by the project team within the Study Area, a Long List of Alternative Road Alignments for the Kirby Road Extension was developed for screening. The list included nine Alternative Road Alignments as presented on **ES Figure 3** below.

ES Figure 3: Long List of Alternative Road Alignments



Notably, according to the MCEA guidelines, during Phase 3 of the process the Project Team is required to evaluate and not to also screen Alternative Design Concepts. However, the Project Team applied due diligence and screened the Long List of Alternative Road Alignments before carrying out a detailed evaluation. The two step approach allowed for a focused review of the short-listed options.

Phase 3B – Evaluation of Road Alignments and Cross-sections

Initial Screening of the Long List of Alternative Road Alignments resulted in sequential narrowing down to three road alignments, namely # 4, 5 and 6 out of nine initial options. On August 29, 2017, a site walk was held with representatives from MECP, TRCA, MNRF, City of Vaughan, York Region and selected members of the project team. The purpose of the site walk was to identify specific environmental features and constraints that would inform the decision making. It was recommended to bring into consideration an additional road alignment.

Consequently, the collected data was used to develop a modified version of Alignment 6 (referenced as Alignment 6A) and to update the short-listed road alignments. The additional alignment curves farther to the south compared to Alignment 6 to avoid and minimize potential impacts to the natural heritage features in the western part of the Study Area. The figure below illustrates the updated short-list of Alternative Road Alignments.

ES Figure 4: Shortlisted Road Alignments

Whereas the initial nine (9) alignment alternatives were screened using as the basis 36 m RoW for the roadway, the four (4) short-listed alignment alternatives were developed further to define their footprint based on their respective earthworks requirements. A full Ecological Land Classification (ELC) assessment was applied to units directly affected by the alignment alternatives.

Identification of Alternative Road Cross-Section Options

It was determined through a traffic analysis conducted by Poulos & Chung Ltd. that at minimum a four-lane cross section is required for the Kirby Road Extension. Building on this recommendation, five road cross-section options (read Alternative Design Concepts) were developed as described below.

Option 1 offers a 4 lane cross-section, including auxiliary lanes where required, MUP provided on both sides of the road. The design features a 14.5m paved surface for vehicular movement and 10.75m wide boulevards, fitting all the elements within a 36m RoW.

Option 2 offers a 4 lane cross-section, including auxiliary lanes where required and dedicated bike lanes and sidewalks provided on both sides of the road. The design features a 17.5m paved surface for vehicular movement and 9.25m wide boulevards, fitting all the elements within a 36m RoW.

Option 3 offers a 5 lane cross-section with continuous shared left turn lane, including right turn lanes where required and either a sidewalk or an MUP provided on one side of the road. The design features a 19.5m paved surface for vehicular movement and 8.25m wide boulevards, fitting all the elements within a 36m RoW.

Option 4 offers a 5 lane cross-section with continuous shared left turn lane, including right turn lanes where required and dedicated bike lanes and sidewalks provided on both sides of the road. The design features a 22.5m paved surface for vehicular movement and 6.75m wide boulevards, fitting all the elements within a 36m RoW.

Option 5 offers a 4 lane cross-section with green refuge strip, including auxiliary lanes where required, dedicated bike lanes provided on both sides of the road and either a sidewalk or an MUP provided on one side of the road. The design features a 17.5m paved surface for vehicular movement, a 9m center strip and 9.25m wide boulevards, fitting all the elements within a 45m RoW.

Detailed Evaluation

Purpose of the detailed evaluation was to identify all potential environmental effects of the short-listed Alternative Road Alignments, including the Alternative Design Concepts for road cross-section, develop mitigation measures, confirm net effects on the environment and identify Recommended Design Concepts. By means of the comparative evaluation, advantages and disadvantages of the design alternatives have been considered against the ability of the options to fulfill the project specific evaluation criteria, culminating with selection of a Recommended Design Concept(s).

The proposed Evaluation Criteria have been established with consideration given to the types of environment recommended by the MEA MCEA guidelines specific to municipal road projects (Part B, Section B.3.1 Description of the Environment). It was concluded that the environment associated with the Study Area would be best described through the four environmental factors: Transportation, Natural Environment, Social Environment and Economic Environment. The criterions were grouped under different aspects identified for each of the environmental factors

A summary table including the draft Evaluation Criteria was presented to the public for review and comment at PIC #1 held on June 29, 2017. Additional revisions were applied by the project team for a greater clarity.

The proposed Indicators to evaluation criteria have been established based on professional expertise of the team. The indicators provide a basis for comparison between the alternatives, i.e. they should be used to judge on degree of meeting the respective criterion.

One of the key principles of successful environmental planning requires systematic evaluation of alternatives in terms of their advantages and disadvantages helping to determine their net environmental effects. The evaluation of the Alternative Road Alignments and Road Cross-sections was documented through series of tables.

The principal advantages and disadvantages for each short-listed road alignment are summarized in **ES Table 1** below.

ES Table 1: Principal Advantages and Disadvantages for Short-Listed Road Alignments

#	Principal Advantages	Principal Disadvantages
4	• Less complex design and construction • Small earthwork quantity and grading footprint • Avoids hedgerow and cultural farmscape of interest • Minimal impact on future development	• Significant impact to PSW riparian area due to 50m crossing structure • Significant impact to and direct removal of woodlands which provide Significant Wildlife Habitat Moderate impact to habitat for Species at Risk • Significant impact on agricultural lands • Moderate private land acquisition requirements
5	• Least complex design and construction • Smallest earthwork quantity and grading footprint • Least impact on agricultural lands • Minimal private land acquisition requirements • Minimal impact on future development	• Significant impact to PSW riparian area due to 50m crossing structure • Significant impact to and direct removal of woodlands which provide Significant Wildlife Habitat Significant impact to habitat for Species at Risk • Highest potential for archaeological findings • Edge impacts to cultural farmscape of interest
6	• Minimal impact to woodlands which provide Significant Wildlife Habitat • Minimal impact to East Patterson Creek • Avoids hedgerow and cultural farmscape of interest	• Moderate impact to PSW and riparian area • Moderate impact to habitat for Species at Risk • Complex design and construction • Large earthwork quantity and grading footprint. • Significant impact on agricultural lands. • Challenge for traffic safety due to high number of curves and transition segments between curves, increased possibility for black ice conditions. • Significant impact on future development proposals • High private land acquisition requirements

#	Principal Advantages	Principal Disadvantages
6A	• Minimal impact to PSW and riparian area • Minimal impact to woodlands which provide Significant Wildlife Habitat • Minimal impact to East Patterson Creek • Avoids hedgerow and cultural farmscape of interest • Lowest potential for archaeological findings	• Most complex design and construction • Largest earthwork quantity and grading footprint. • Challenge for traffic safety due to highest number of curves and transition segments between curves, increased possibility for black ice conditions • Significant impact on agricultural lands. • Very significant impact on future development proposals • Highest private land acquisition requirements

Each Alternative Design Concept was ranked based on the identified advantages and disadvantages on a Factor-by-Factor (Transportation, Natural, Social and Economic Environments) basis.

The established Factor specific rankings range from "no net effect" (most preferred) to "very significant net effect" (least preferred). The rankings of design concept were visually illustrated through the use of the following symbols and corresponding scores:

ES Table 2: Symbols and Scores

Ranking Symbol	Ranking Description	Ranking Score
	**No Effect**	**5**
	**Minimal Effect**	**4**
	**Moderate Effect**	**3**
	**Significant Effect**	**2**
	**Very Significant Effect**	**1**

To ensure that visual presentation is accurate, the design alternatives were scored by assigning a highest score of 5 points to the alternative that would create no impacts, and indexing the remaining alternatives against the recommended alternative for each Factor (minimum score is 1 point).

As there is a different number of criterions under each environmental Factor, the Factor specific scores have been averaged up to two decimal points to arrive at a normalized score for each Factor. To signify equal importance of all the Factors to the environment, no numerical weighting was applied to the scores.

An overall ranking for each alternative was established based on combining the Factor specific rankings. Lastly, a Recommended Design Concept was identified based on the combined consideration of the overall scores. The Alternative Design(s) with the lowest overall impact, i.e. highest overall score was identified as the Recommended Design Concept(s).

The results of comparative evaluation of short-listed Road Alignments across all four environmental factors are summarized in **ES Table 3** below.

ES Table 3: Summary of Comparative Evaluation for Short-Listed Road Alignments

Evaluation Criteria		Alternative Road Alignments			
		Alignment 4	Alignment 5	Alignment 6	Alignment 6A
Transportation Ranking	Symbol				
	Average Score	4.17	**4.50**	3.50	3.67
Natural Environment Ranking	Symbol				
	Average Score	3.22	**3.11**	3.67	3.89
Social Environment Ranking	Symbol				
	Average Score	3.25	**3.38**	3.13	3.00
Economic Environment Ranking	Symbol				
	Average Score	3.67	**4.00**	3.00	2.67
TOTAL SCORE (Sum of Factors)		14.31	**14.99**	13.29	13.22
RECOMMENDED?		Recommended	Highly Recommended	Least Recommended	Not Recommended

The Project Team concluded that Alignment 5 represents an acceptable balance of advantages and disadvantages across the range of evaluation criteria and should be carried forward as the Highly Recommended Alternative Road Alignment.

The principal rationale for selection of Alignment 5 as the Recommended Design Concept is as follows:

- Least complex design without horizontal curvature does not require super-elevated sections
- Physically the easiest to construct
- Smallest earthwork quantity and environmental footprint
- Least impact on agricultural lands
- Minimal private land acquisition requirements
- Minimal impact on future development

The principal advantages and disadvantages for each road cross-section option are summarized in **ES Table 4** below.

ES Table 4: Principal Advantages and Disadvantages for Short-Listed Road Cross-Sections

#	Principal Advantages	Principal Disadvantages
1	• Provides the highest level of service for bicyclists. • Offers the greatest design flexibility in placement of utilities, street furniture and tree planting. • Entails the least structural requirements, the least infrastructure for storm water management and the least width of pavement area. • Exhibits the least potential runoff and erosion impacts to wetland and vegetation. • Offers the lowest capital, operation and maintenance costs.	• Lacks dedicated bike lane continuity from Gamble Road.
2	• Offers dedicated bike lane continuity from Gamble Road. • Entails less structural requirements, less infrastructure for storm water management and less pavement area than Options 3 and 4. • Offers the second lowest capital, operation and maintenance costs.	• Provides on road bike lane with a reduced level of service.
3	• Provides the highest level of service for bicyclists. • Entails a moderate pavement area with slightly more storm water management infrastructure. • Exhibits a slight increase of potential runoff and erosion impacts compared to Options 1 and 2.	• Includes a continuous center left turn lane that is unlikely to be needed due to land formation. • Lacks dedicated bike lane continuity from Gamble Road.
4	• Offers dedicated bike lane continuity from Gamble Road.	• Provides on road bike lane with a reduced level of service. • Includes a continuous center left turn lane that is unlikely to be needed due to land formation. • Exhibits the widest pavement area and increase of potential runoff and erosion impacts compared to Options 1, 2 and 3.
5	• Exceeds the requirements of the York and Vaughan TMPs. • Allows for “green” design.	• Entails the most complex non-standard design and structural requirements. • Exhibits the highest capital, operation and maintenance costs. • Exhibits the greatest potential for loss of edge/riparian habitat.

#	Principal Advantages	Principal Disadvantages
		• Exhibits a significant impact on existing agricultural and residentially approved lands.

The approach for scoring and ranking used for Alternative Road Alignments was also used for Alternative Road Cross-sections. The results of comparative evaluation of Alternative Road Cross-sections (Options 1 to 5) across all four environmental factors are summarized in **ES Table 5** below.

ES Table 5: Summary of Comparative Evaluation for Short-Listed Cross-sections

Evaluation Criteria		Alternative Road Cross-sections				
		Option 1	Option 2	Option 3	Option 4	Option 5
Transportation Ranking	Symbol					
	Average Score	5.00	4.00	3.67	2.83	2.33
Natural Environment Ranking	Symbol					
	Average Score	5.00	4.56	3.78	3.33	2.56
Social Environment Ranking	Symbol					
	Average Score	4.25	4.25	4.25	4.25	2.00
Economic Environment Ranking	Symbol					
	Average Score	3.67	3.67	3.00	2.33	1.00
TOTAL SCORE (Sum of Factors)		**17.92**	**16.47**	**14.69**	**12.75**	**7.89**
RECOMMENDATION		Highly Recommended	Recommended	Less Recommended	Least Recommended	Not Recommended

The Project Team concluded that Option 1 represents an acceptable balance of advantages and disadvantages across the range of evaluation criteria and should be carried forward as the Highly Recommended Alternative Road Cross-section.

The principal rationale for selection of Option 1 as the Recommended Design Concept is that this option exhibits an efficient cross-section that improves connectivity, meets all forecast modal demands, provides a maximum level of service to each mode of transportation, and entails the least design and construction complexity.

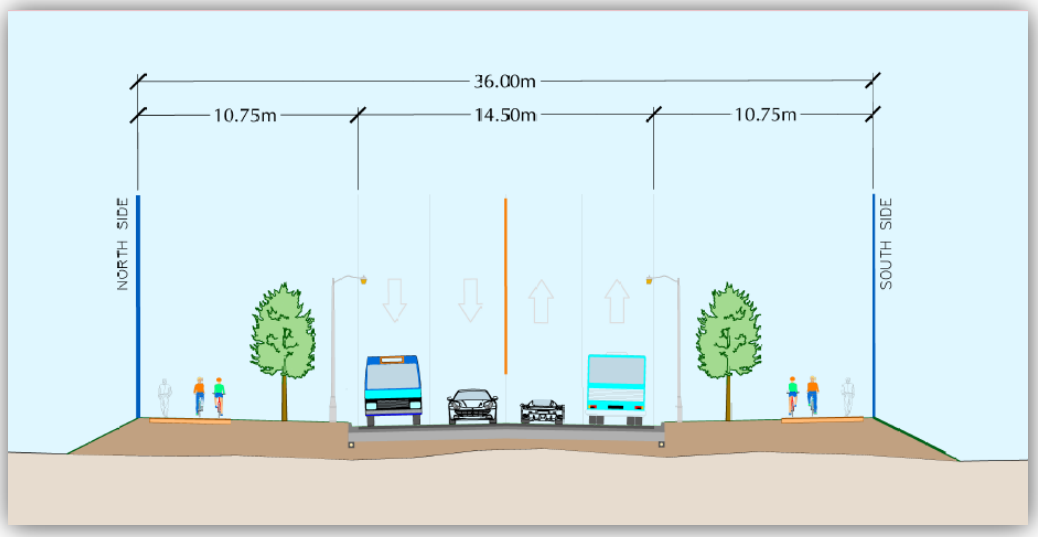
ES7 Preferred Alternative Design Concepts

According to the MEA MCEA guidelines, once all environmental impacts have been identified, mitigating measures to minimize impact on the environment have been determined, and further input from interested parties have been gained, the recommended design can be confirmed as preferred.

Following PIC #2, minor comments received with regard to selection of the Recommended Road Cross-section were addressed through individual responses to the project stakeholders. Option 1 as presented at PIC #2 did not accurately reflect the intention of the project team to define the highest level of

service for bicyclists. The graphics was further updated to indicate that the identified RoW is sufficient to maintain accessibility for both pedestrians and bicyclists. Figure below shows the Preferred Road Cross-section (Option 1).

ES Figure 5: Preferred Road Cross-section



The key concerns identified with regard to selection of the Recommended Horizontal Road Alignment included conformity to the 2017 ORMCP policies, the equal weighting of environmental factors, the variety of servicing alternatives considered and how the requirements of the 2007 Endangered Species Act (ESA) will be satisfied for preferred Alignment 5. In an effort to resolve the specific concerns, the project team held individual meetings with the TRCA (November 16, 2018) and MNRF (December 13, 2018).

Eventually, the recommended road cross-section Option 1 and horizontal Alignment 5 have been confirmed as the technically preferred design concepts. The project team prepared a Draft ESR and on December 21, 2018 circulated the document to the members of TAG (MECP, MNRF, MMAH, TRCA, York Region, CoRH and CoV) for technical review.

Following a six weeks review period, all the agencies provided their comments on the Draft ESR with exception for MMAH. The comments suggested various degree revisions to the report. The key recurring concern was regarding the magnitude of effects on Natural Environment exhibited by Alignment 5. In part, the comment letter dated February 1, 2019 from TRCA indicated that their staff would pursue adjustments to the preferred alignment with the CoV, study proponent and involved agencies.

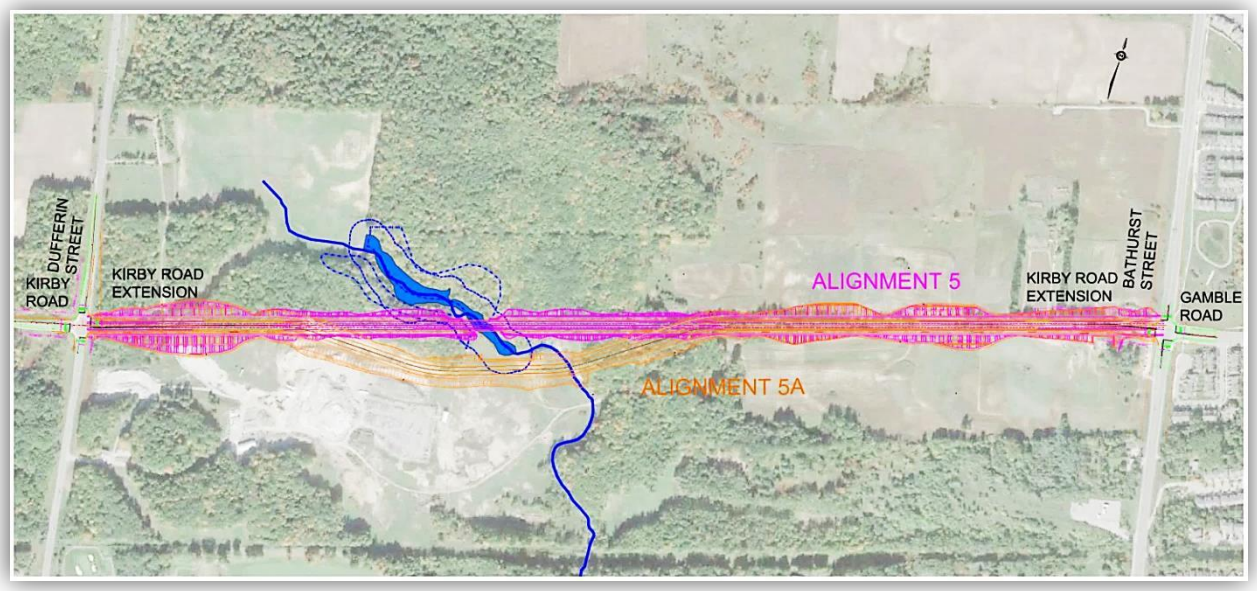
On February 27, 2019 the project team met with the MECP and CoV staff to discuss MECP comments provided on Draft ESR. It was noted during the meeting that refinements to the technically preferred road alignment could reduce adverse effects on Natural Environment and offer greater conformity with applicable ORM policies.

In response to the comments received from review agencies on the Draft ESR, the project team has committed to revisit Alignment 5. To capitalize on the evaluation effort and analysis already done, refinements to the Technically Preferred Alignment 5 were developed with the following objectives in mind:

- Avoid crossing of PSW
- Avoid crossing of interior forest within 100m from the woodland edge
- Cross Natural Core Area of the ORMCP at a narrowest possible point
- Maximize the use of existing RoW
- Minimize encroachment into private properties and property acquisition requirements
- Adhere to the engineering design criteria and match closely with the geometric design elements used to develop the shot-listed road alignments

In consideration of the above objectives, the middle segment of Alignment 5 was modified. The Refined Preferred Alignment ultimately recommended by the EA Study is further referenced as 5A. **ES Figure 6** shows the Technically Preferred Alignment 5, as selected by the Project Team and the Refined Preferred Alignment 5A, i.e. Alignment 5 amended in consultation with the review agencies addressing the need to reduce adverse effects on Natural Environment and to offer greater conformity with the applicable ORM policies.

ES Figure 6: Technically Preferred Alignment 5 and Refined Preferred Alignment 5A



As illustrated above, the Refined Preferred Alignment 5A gradually bends to the south starting at approximately 360 meters east of Dufferin Street to follow the existing forest edge for about 360 meters; then it gradually bends to the east to continue in parallel to Alignment 5 for about 170 meters straight segment while crossing the creek at approximately right angle; then Alignment 5A gradually bends to the north to follow the existing forest edge for about 360 meters and lastly it gradually bends to the east to follows Alignment 5 from approximately 820 meters east of Bathurst Street. As a result of

the refinements, the total length of the road of approximately 2020m for Alignment 5 increased to approximately 2070m for Alignment 5A.

ES8 Preliminary Cost Estimates

The preferred road alignment extends beyond the limits of existing municipal unopened road allowance and includes lands designated for future residential development subject to February 2015 Minister of Municipal Affairs and Housing Zoning Order. Based on the current local market conditions and using a median value for residential rates for the majority of blocks in the City, which are assumed to be fully serviced with servicing available at the lot frontage with low density residential development in accordance with planning and zoning policies fully in, the estimated property acquisition would cost approximately $16.6 Million.

Taking as a basis the capital cost breakdown provided for the shortlisted road alignments, a more detailed preliminary cost estimate for the Refined Preferred Alignment (5A) has been prepared. The preliminary cost estimate for the Preliminary Preferred Design including capital and property is in the order of $43.2 million. In consideration of options proposed for the stormwater treatment train, preliminary cost estimates for Option 1 Bioswale and Option 2 Tree Pits were prepared and sensitivity analysis undertaken. The difference between the two total capital costs is about 1%, i.e. it lies within estimate tolerance.

In addition to the preliminary capital cost estimates, a preliminary life cycle Removal and Replacement cost estimate and a preliminary life cycle Operation and Maintenance cost estimate have been prepared for each of the capital cost estimate options. The annual cost requirements for Option 1 are estimated at approximately $770K per year and for Option 2 at $757K per year. The preliminary cost analysis indicates that the road project with Option 1 (Bioswale) is nominally more expensive than the one with Option 2 (Tree Pits). The difference of approximately $20K per year appears within estimate tolerance.

The preliminary cost estimates are subject to update, revision and refinement through detailed design and engineering and future processes for acquiring and securing property. At detailed design stage the final cost estimate may vary according to market conditions and with respect to specific servicing, grading, piping depth, additional investigations findings, utility relocation requirements and streetscaping opportunities.

ES9 Environmental Effects, Mitigation Measures and Key Commitments

The Refined Preferred Road Alignment has been developed to the preliminary (30%) level of design. Preliminary Design drawings are presented in **Appendix D** of this ESR.

Potential exists for indirect impacts on the one unit of the King-Vaughan Provincially Significant Wetland Complex that is present within the north central area of the Subject Lands. The following measures will be implemented in consultation with review agencies to mitigate impacts to the wetland:

- Use of retaining wall and increased grade slope through sensitive features to reduce total footprint in these areas;
- Use of appropriate erosion and sedimentation measures;
- Wildlife passage structure(s) to maintain connectivity, where appropriate;

- Feature-based water balance of the PSW to inform design and mitigation options.

A total of 64 ha of significant woodlands are present within the Subject Lands. Significant woodlands will be directly impacted by vegetation removal during the construction process. Longer-term indirect effects on residual significant woodlands within the Subject Lands may occur due to the creation of new woodland edges following vegetation removal (e.g., sunscald, windthrow, increased light penetration) and potential slope stability issues. Applying the methodology outlined in the TRCA Guideline for Determining Ecosystem Compensation (2018) the estimated removal of 3.2 ha of significant woodland requires an area of woodland restoration in the amount of 20.2ha. As per the Guideline, TRCA and the Municipality can track the land area removed from the natural system from all infrastructure projects and work together to explore avenues to off-set these losses through options such as municipal land acquisition and ecological restoration programs or other means.

Significant wildlife habitat and Habitat for three Threatened or Endangered Species, including Butternut, Eastern Small-footed Myotis and Little Brown Myotis are anticipated to be impacted mostly due to habitat removal. Mitigation in the form of habitat re-creation should be explored. ESA requirements associated with removal of habitat for endangered bat species on the Subject Lands will be discussed directly with MECP. It is anticipated that a permit under Section 17(2) (c) of the ESA may be required. Additional studies have been identified for two species: American Ginseng and Eastern Whip-poor-will based on consultation with MRNF on October 13, 2017.

No direct effects to the tributary to East Patterson Creek are anticipated. Potential indirect effects could occur from the proposed road construction. Preparation and implementation of an Erosion and Sediment Control Plan; adherence to and effectiveness of spill prevention and response measures is recommended throughout the construction period. Provided water balance is maintained to this drainage feature, negative impacts are not anticipated to occur as a result in alterations in surface water runoff and infiltration associated with the proposed road.

Key future commitments resulting from this EA Study include but not limited to the following:

- Confirm the need for permits with regulatory agencies and approval authorities and obtain, as needed, during detailed design and engineering.
- Further investigate stormwater management design options for water balance, quantity and quality control in accordance with City, Region standards and all approval and regulatory authorities.
- Further investigate the impacts to the infrastructure required to convey surface runoff from external Catchment 301E including Option 1 (Intake/by-pass storm sewer) and Option 2 (Cross culvert).
- Further investigate lowering the road and storm sewer for the right of way runoff to reduce fill volume.
- Further investigate the road profile design (i.e. vertical alignment) from Dufferin Street to the watercourse crossing, including any associated modifications to grading, stormwater infrastructure, etc., during detailed design.
- Develop erosion prevention and sediment control (ESC) measures that shall be implemented to mitigate erosion and sediment processes during construction. The ESC plans should be

consistent with the TRCA's Erosion and Sediment Control Guideline for Urban Construction (2006).

- Confirm the Significant Woodlands limits through field staking (if needed) and submit to the City and TRCA during detailed design. For significant woodland impacts provide an ecosystem compensation plan and associated costs for the preferred alignment in accordance with the TRCA's Guideline for Determining Ecosystem Compensation (2018).
- Develop restoration plans, including edge management plan and other tools to mitigate identified impacts on the Natural Environment during detailed design.
- Confirm PSW limits including a 30 m vegetation protection zone through field staking and submit the results to the MNRF during detailed design. This information will be used to support the design of the road and associated infrastructure.
- Consult with MECP regarding Species at Risk impacts and permitting requirements, prior to construction.
- Complete an updated Headwater Drainage Feature Assessment as per TRCA's Evaluation, Classification and Management of Headwater Drainage Features Guidelines (2014) during detailed design.
- Conduct additional environmental studies needed to determine Significant Wildlife habitat for two species: American Ginseng and Eastern Whip-poor-will during detail design. The environmental reports will be provided to the City and TRCA for review and approval.
- Coordinate with and obtain approval from the MOECP regarding Climate Change compliance prior to construction.
- Consider separation of pedestrian and cycling facilities proposed along the road and appropriate cycling connections at the Bathurst Street and Kirby Road intersection.
- Consider increasing clear height and width relative to length, within the culvert trail underpasses subject to on-site constraints, at detailed design.
- Provide trail ramp connections from Kirby Road Extension ATF down to the proposed trail system and tunnel connections at both north and south sides of the road.
- Complete a Stage 2 Archaeological Assessment in accordance with the requirements of the Ontario Heritage Act; if recommended through the Stage 2, a Stage 3 Archaeological Assessment will be prepared.
- Notify the potentially affected Indigenous Peoples of any archaeological findings and engage these communities as needed.
- Complete a resource-specific Cultural Heritage Impact Assessment for the residence at 11490 Bathurst Street, and attain heritage permit if needed.
- Conduct an earthwork analysis to optimize the proposed preliminary vertical road alignment in consideration of the grading for the Future Urban Area.
- Identify and implement source water protection mitigation measures (i.e., salt management, temporary storage of fuels) as per the CTC Source Protection Plan regulated by the Clean Water Act, prior to construction.
- Undertake additional work through detailed design and engineering to confirm various technical components of the design, including the roadway geometry and profile, illumination, culvert crossings, wildlife crossings, utilities, construction staging, and property requirements.
- Further assess wildlife passages at detailed design and engineering.

- Develop Soil Management actions. Since the removal or movement of soils are required, undertake further assessment and testing, where and as applicable, to determine contaminant levels from previous land uses or dumping at detailed design and engineering.
- Carry out consultation and further coordination with key technical agencies, Indigenous Communities and stakeholders through detailed design pertaining to watercourse crossing(s) and fish habitat.
- Confirm the need to obtain PTTW. A PTTW may be required as some of the roadwork may intersect some shallow and coarse-grained fill soils that might require dewatering. Potential for construction dewatering is more likely to be required where deep excavations occur that intersect the shallow water table.

Modifications to the design and implementation of the Kirby Road Extension proposed in this ESR may occur due to unforeseen circumstances and result in the project being inconsistent or non-compliant with commitments made in the ESR. Significant modifications to the project proposals or changes in the environmental setting that occur after the filing of the ESR will require preparation of an addendum to the ESR. When an ESR Addendum is issued, only the project elements included in the Addendum (i.e. the proposed changes) will be open for review.

1.0 Introduction

This chapter introduces the study, describes background, presents the problem statement, explains the Municipal Class EA process and summarizes the overall approach to carrying out the study.

1.1 Background

The City of Vaughan (CoV) Transportation Master Plan (TMP) - A New Path (2012), companion to the CoV Official Plan (2010), identified projects that will improve connections to local and regional infrastructure, provide access to future developments, support transit-oriented nodes and corridors, and enhance transit ridership, cycling and walking.

The TMP identified Kirby Road as a key east-west arterial corridor in the City and confirmed the need to widen Kirby Road between Keele Street and Dufferin Street from two to four lanes by 2021 and to extend Kirby Road between Dufferin Street and Bathurst Street as a four lane roadway.

In 2016, York Region TMP has also identified the need for Kirby Road extension between Dufferin and Bathurst Streets and confirmed the requirement to construct the 4-lane missing link.

The CoV determined the sequence of improvements for the Kirby Road corridor and has authorized Rizmi Holdings Limited (RHL), a private sector developer, to act as a sole Study Proponent and undertake the necessary Environmental Assessment Study (EA Study) to address missing road network connection and capacity and establish preliminary design for the Kirby Road Extension only.

1.2 Municipal Class Environmental Assessment Process

Ontario Environmental Assessment Act (1990, as amended) (further referenced as EA Act) establishes an approach for reviewing the potential environmental effects of a proposed project prior to its implementation.

The purpose of the EA Act is "… the betterment of the people of the whole or any part of Ontario by the protection, conservation and wise management in Ontario of the environment." "Environment" is applied in a broad sense and includes the natural, social, cultural, built and economic environments.

Two types of EA planning and approval processes are established through the EA Act:

- Individual EA process (Part II of the EA Act) applies to projects for which a project-specific Terms of Reference (TOR) and a subsequent Individual Environmental Assessment (IEA) are carried out and submitted to the Minister of the Environment for review and approval.
- Class EA process (Part II.1 of the EA Act) allows for creation of specialized categories for similar or comparable projects, which have predictable and manageable environmental effects. After a parent Class EA process has been prepared and approved by the Minister of the Environment for a specific category of projects, eligible projects which follow that parent process are pre-approved.

Municipal Class EA (MCEA) document (2000, as amended) is one of the parent Class EA documents. This Class EA is a planning process prepared by the Municipal Engineers Association (MEA) of Ontario for a class or group of municipal infrastructure undertakings, including roads, water and wastewater and

transit projects. The process is approved by the Ministry of the Environment, Conservation and Parks (MECP) and through over three decades it has been proven to be an effective way of complying with requirements of the EA Act.

Applying the Class EA approach to planning and implementation of municipal infrastructure projects allows achieving considerable public, economic and environmental benefits.

The key elements of the Class EA process are incorporated in the following five consecutive phases:

- Identify the Problem and/or Opportunity
- Identify and evaluate Alternative Solutions
- Identify and evaluate Alternative Design Concepts to the Preferred Solution
- Document the above findings in an Environmental Study Report (ESR) and make it available for scrutiny by review agencies and the public
- Complete design and proceed to construction and operation

Since infrastructure projects can vary in their complexity and magnitude of environmental effects, they are classified by the Municipal Class EA in terms of schedules. Depending on the EA Schedule, a project may not be required to go through all phases of the EA process prior to implementation. For example, Schedule “A” and “A+” projects are limited in scale, have minimal adverse effects, are pre-approved and may proceed to implementation. Schedule “B” projects may have minimal environmental effects, are approved, subject to a screening process, including consultation with directly affected public and agencies. However, Schedule “C” projects such as construction of new facilities or major expansion of existing facilities that have the potential for significant environmental effects must proceed under the full Municipal Class EA procedures, including preparation of an ESR and filing of the ESR in the public record for public review.

The Class EA is a self-assessment process. In all situations where the approach is applicable to a project, it is the responsibility of a proponent to ensure that the process is carried as set out in the MCEA document prepared by MEA. As stipulated in the EA Act, proponent means a person who proposes or carries out an undertaking or is the owner or person having charge, management or control of an undertaking.

Proponents, such as municipalities acting in their own behalf or on behalf of private sector developers or private sector developers acting on their own behalf, undertake development of municipal infrastructure. Regardless of the manner in which facilities are funded, any works designated as an undertaking to which the EA Act applies must follow the Class EA process, subject to specific exemptions. Provided the approved Class EA planning process was followed, a proponent has complied with the EA Act.

As noted, certain infrastructure works can have significant impacts on the environment and such projects shall be planned under Schedule “C” of the Class EA. Therefore, it is appropriate that those projects should be subject to review prior to implementation, regardless of who (municipality or private developer) undertakes the planning, construction or who is ultimately responsible for control and maintenance of the works.

1.3 Part II Order

Part II of the EA Act grants an interested person, agency or any project stakeholder the right to appeal the completion of a Class EA study if they believe that the proposed project needs to be made subject to a more rigorous planning, design and documentation process. The reasons for requesting an appeal, known as a Part II Order request, must be submitted in writing to the Minister of the Environment, Conservation and Parks. Upon receipt, the Minister, or their delegate, will review the request and respond in one of the following ways:

- Accept the request, elevating the Class EA to an Individual EA;
- Deny the request outright, or deny the request with conditions; or,
- Refer the request to mediation for resolution.

If the Minister does not receive a Part II Order, the Class EA is considered complete and approved, and the proponent may proceed with implementing the project.

As of July 1, 2018, a Part II Order Request Form must be used to request a Part II Order. The following additional text should be included in the Notice of Study Completion:

"A Part II Order Request Form must be used to request a Part II Order. The Part II Order Request Form is available online on the Forms Repository website (http://www.forms.ssb.gov.on.ca/) by searching "Part II Order" or "012-2206E" (the form ID number)."

For Schedule "C" projects, a person or party with a concern have a responsibility to bring their concerns to the attention of the proponent early in the planning process.

1.4 PHASE 1 – Problem and Opportunity Statement

The CoV has identified the need for several additions and improvements to the existing road network under their jurisdiction. Kirby Road is one of the identified roads requiring improvement. At the same time, Kirby Road is an integral component of the regional arterial grid in northern Vaughan. The road is contemplated to play an important role and function in the overall York Region road network and as such to be transferred to the Regional jurisdiction.

Currently, Kirby Road is a discontinuous east-west arterial road with a gap between Dufferin Street and Bathurst Street. King-Vaughan Road and Major Mackenzie Drive are the only two continuous east-west arterial roads between Highway 400 and the eastern limit of Vaughan. Commuters from the Town of Richmond Hill or northern Vaughan need to travel along north-south arterial roads such as Bathurst Street and Dufferin Street to access either of these roads, causing significant peak hour congestion on these north-south arterials, as well as overloading traffic on King-Vaughan Road and Major Mackenzie Drive with long distance trips. Therefore, eliminating the gap in the existing road network is critical to addressing traffic congestion in the study area.

Future development is contemplated on the lands abutting the missing link between Dufferin Street and Bathurst Street. It is likely that the development will seek access onto the future Kirby Road Extension.

Problem solving provides an opportunity to:

- Improve network connectivity needed to move people and goods;
- Provide for approved future growth and increased travel demand in the northeast quadrant of the City, including facilitation of future transit service;
- Ensure wise management of important environmental resources;
- Incorporate municipal services in the Kirby Road Extension to serve new developments in the adjacent area; and
- Accommodate facilities for bicyclists and pedestrians through this part of the City.

1.5 Study Approach

1.5.1 Kirby Road EAS Planning and Design Process

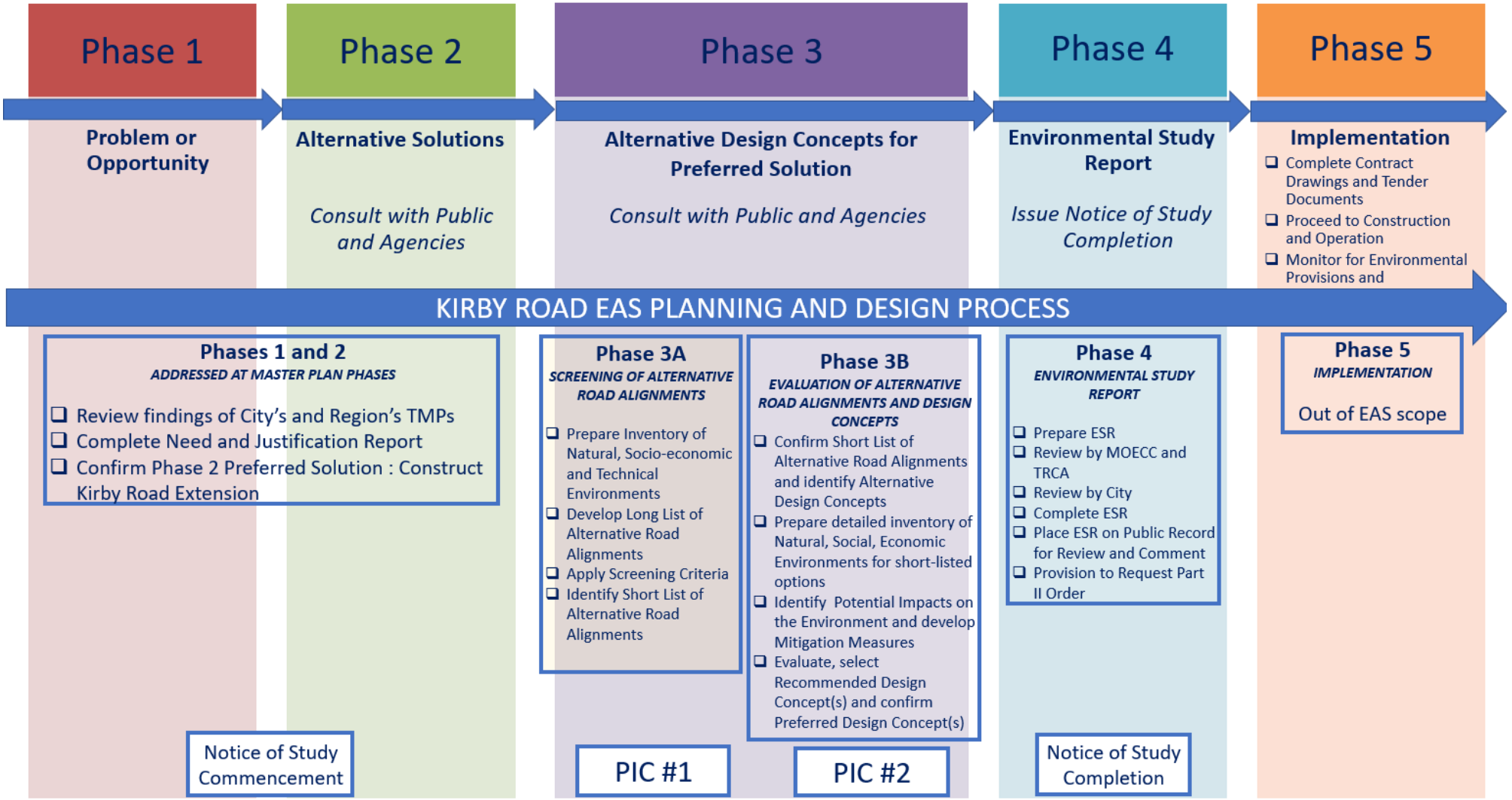
As the proposed activity requires construction of a new road costing more than $2.6 Million, in accordance with project classification criteria provided in the MEA MCEA document, this study is being conducted as a Schedule "C" undertaking. Schedule "C" undertakings are projects that may have significant environmental effects on the environment and require completion of Phases 1 through 4 of the MCEA process.

Figure 1 presents an overview of the MCEA planning and design process and shows how this process was adapted for the Kirby Road Extension EA Study.

Phase 1 "Problem and /or Opportunity" and Phase 2 "Alternative Solutions" have been completed and documented in both the 2012 CoV and 2016 York Region TMPs. Nevertheless, the findings of Phases 1 and 2 were revisited by the Project Team.

This EA Study carried out the Phase 3 "Alternative Design Concepts for Preferred Solution" and Phase 4 "Environmental Study Report" of the MEA MCEA planning and design process. The methodology used for selection of a Recommended Design Concept(s) included two consecutive steps: initial screening and detailed evaluation. Therefore, Phase 3 of the MCEA process was split into two parts: Phase 3A "Screening" and Phase 3B "Evaluation". Key activities completed during the EA Study are listed on **Figure 1.**

Figure 1: Kirby Road Extension EA Study Planning and Design Process



1.5.2 Environmental Study Report

An ESR must be prepared for each project which proceeds through the Schedule "C" planning process as described in **Section 1.2**. This ESR provides a complete account and documents the planning process conducted for the Kirby Road Extension EA study.

The ESR is structured as follows:

- **Section 1** introduces the study, describes background, presents the problem statement, explains the Municipal Class EA process and summarizes the overall approach to carrying out the study
- **Section 2** provides details of the public and stakeholders consultation process, including steps undertaken to fulfil and exceed consultation requirements of the MEA MCEA process
- **Section 3** describes the existing environmental conditions in the study area within a multi-disciplinary framework used to establish the baseline conditions against which project alternatives have been assessed
- **Section 4** provides details of anticipated future conditions in the study area
- **Section 5** outlines the project's need and justification identified in the various transportation planning documents
- **Section 6** presents the assessment of alternative solutions, including identification of the Preferred Solution for the Kirby Road Extension
- **Section 7** presents the development, screening and evaluation Alternative Design Concepts that were considered for the Preferred Solution, including identification of the recommended horizontal alignment and recommended road cross-section proposed for the Kirby Road Extension
- **Section 8** describes the recommended design for the Preferred Alignment in more detail, including design standards; results of additional studies carried out for the preferred concepts and the anticipated impacts and proposed mitigation measures
- **Section 9** outlines the process of amending the ESR, future phases of the project, the permits and approvals required to implement the project and commitments to additional environmental investigations and monitoring

The ESR Appendices provide supplementary and more detailed information on the Consultation Record, documentation of study decisions, the proposed design of the roadway, and supporting technical investigations.

- **Appendix A** Consultation Record

  A1 – Notice of Study Commencement
  A2 – Technical Advisory Group
  A3 – Citizen Liaison Committee
  A4 – PIC #1 Summary Report
  A5 – PIC #2 Summary Report
  A6 – Indigenous Peoples Consultation
  A7 – Notice of Study Completion
  A8 – Selected Correspondence

A9 – Draft ESR Review

- **Appendix B** Assessment of Alternative Design Concepts

  B1 – Screening of Long List of Alternative Road Alignments
  B2 – Detailed Evaluation of Alternative Road Cross-Sections
  B3 – Detailed Evaluation of Alternative Road Alignments

- **Appendix C** Supporting Studies and Reports

  C1 – Natural Heritage
  C2 – Transportation, Traffic and Active Transportation Need and Justification Assessment
  C3 – Socio-Economic
  C4 – Archaeological Resources
  C5 – Built Heritage Resources and Cultural Heritage Landscapes
  C6 – Geomorphology
  C7 – Geotechnical
  C8 – Hydrogeology
  C9 – Air Quality
  C10 – Noise
  C11 – Stormwater Management
  C12 – Contamination Assessment
- **Appendix D** Preliminary Design

The ESR will be placed on the public record for a period of at least 30 calendar days and will be available for inspection by the public or by other interested parties.

1.5.3 Consultation Mechanisms and Tools

Consultation and communication about the project is a mandatory part of the Class EA process. At the study onset, a Consultation and Communication Plan has been prepared to present a roadmap that will be used by the Project Team to effectively engage the general public, community representatives, review agencies, municipalities and other stakeholders in the Class EA Study.

The following specific objectives have been defined for the consultation and communications:

- Meet and exceed MEA MCEA consultation requirements. Explain the requirements of the planning process set out in the MCEA as fully as possible to those seeking information;
- Provide consultation opportunities at each stage of the Study. Consult early in and throughout the process;
- Engage stakeholders in consultations that provide balanced information and elicit meaningful input;
- Time and focus public engagement and consultation activities to match decision milestones to ensure that stakeholders can contribute ideas and influence results before key decisions are made;

- Establish effective two-way communication between the study team and affected or interested stakeholders. Provide several mechanisms (i.e. internet, email, fax, phone) to disseminate information and collect feedback;
- Provide timely, clear, and understandable information so that the stakeholders can be meaningfully involved in the Class EA. Any documentation prepared for review by the public should avoid technical jargon to facilitate understanding and promote useful and informed feedback;
- Provide consistent messaging to stakeholders in order to build trust and avoid rumors;
- Foster public trust and confidence by demonstrating that the RHL is following a comprehensive process, with a highly qualified team of experts who have the experience and qualifications to complete a fair, transparent and educated evaluation of all alternatives;
- Ensure accurate documentation of comments and concerns, provide timely responses and resolve issues where possible; and
- Trace the impact of consultation on the Class EA Study.

The principal consultation mechanisms and tools that were employed to implement the Consultation and Communications Plan included:

- Notifications
- Technical Advisory Group meetings
- Citizen Liaison Committee meetings
- Public Information Centres
- ESR
- Dedicated project email address
- Project webpage

1.6 Project Team

RHL retained Schaeffers Consulting Engineers (SCE) to carry out the EA Study for the planned extension of Kirby Road. The planning process was initiated in September 2015 with submission of a proposal for conducting the EA Study to the CoV.

The Kirby Road Extension EA is a multi-disciplinary study that requires specialized knowledge in Class EA Planning and Public Consultation, Municipal Infrastructure Design, Stormwater Management, Transportation Planning and Engineering, Structural Engineering, Natural Heritage and Socio-Economic Assessments, Geotechnical Engineering, Hydrogeology, Geomorphology, Noise, Vibration, Air Quality and Climate Change Assessments, Built Heritage and Archaeological Assessments. Acting as a prime consultant, SCE assembled a strong integrated team of highly qualified professionals to address the various disciplines required as part of the EA Study process.

The Project Team and associated disciplines responsible for undertaking the study, conducting technical investigations and preparation of the ESR are summarized as follows:

Name	Expert knowledge provided
Schaeffers Consulting Engineers (Schaeffer & Associates Ltd.)	• Project Management • Class EA Planning

Name	Expert knowledge provided
	• Public Consultation • Transportation Engineering • Stormwater Management • Cost Estimates
Poulos & Chung Ltd.	• Transportation Planning
Savanta Inc.	• Natural Heritage
Lucas & Associates Ltd.	• Socio-economic
Archaeological Services Inc.	• Archaeology • Built Heritage and Cultural Landscapes
Terraprobe Inc.	• Geotechnical • Hydrogeology
GEO Morphix Ltd.	• Geomorphology
Hardy Stevenson and Associates	• Public Facilitation
Novus Environmental Inc.	• Air Quality • Noise • Climate Change
First Nations Engineering Services	• Indigenous Peoples Consultation

2.0 Public and Stakeholders Engagement

This chapter provides details of the public and stakeholders consultation process, including steps undertaken to fulfil and exceed consultation requirements integral to the MEA MCEA planning and design process for municipal infrastructure projects.

2.1 Notice of Study Commencement

The Notice of Study Commencement (NOC) was advertised in two consecutive editions of the Vaughan Citizen, Thornhill Liberal, King Connection and Richmond Hill Liberal local newspapers on May 11, 2017 and May 18, 2017 respectively.

- The Vaughan Citizen has a circulation of 59,500, serving Woodbridge, Maple, Concord and Kleinburg;
- The Thornhill Liberal has a circulation of 34,200, servicing Thornhill;
- The King Connection has circulation of 8,300, serving King City, Nobleton, Schomberg and surrounding areas; and
- The Richmond Hill Liberal has a circulation of 52,200, servicing Richmond Hill.

In addition, the Notices along with a cover letter were sent out to stakeholders, agencies, municipal staff and Indigenous Peoples on the project contact list. A copy of the Notice is provided in A1 – Notice of Study Commencement.

The NOC included information concerning the study objectives, Study Area, details of the Municipal Class EA process being followed, and contact details for study representatives.

2.2 Study Webpage

At the onset of the Study, SCE created a project webpage hosted on the company's website.

The web page included project background, brief description, timelines, updates and the project contact information. The web page allowed visitors to download posed over the course of the study communication and consultation materials and submit their feedback.

2.3 Technical Advisory Group Meetings

As part of the public consultation program, a Technical Advisory Group (TAG) was established following publication of the NOC. The TAG provided a forum for focused discussion of the project with a broadly-based group of technical project stakeholders, including representatives from the MECP, MMAH, TRCA, York Region and City of Vaughan. The TAG meetings were held to ensure that the regulatory authorities, approval agencies and municipal government were effectively engaged in the development of a sustainable design concept for the Kirby Road Extension. A TAG Terms of Reference and meeting notes can be found in **Appendix A2** – Technical Advisory Group.

2.3.1 Technical Advisory Group Meeting #1

On June 16, 2017 the Project Team hosted meeting #1. The purpose of this meeting was to review and discuss the road alignment options, screening methodology and results, and proposed evaluation criteria for short-listed road alignment options and to seek advice on Community Liaison Committee (CLC) meeting #1 and Public Information Centre (PIC) #1.

2.3.2 Technical Advisory Group Meeting #2

On June 4, 2018 the Project Team hosted meeting #2. The purpose of this meeting was to review and discuss the alternative design concepts, evaluation criteria and methodology, recommended design concepts and to seek advice in advance of the CLC meeting #2 and PIC #2.

2.3.3 Technical Advisory Group Meeting #3

On May 2, 2019 the Project Team hosted meeting #3. The purpose of this meeting was to review and discuss the Refined Preferred Alignment 5A. The Technically Preferred Alignment 5 was modified as per comments received from technical review agencies to the Draft ESR.

2.4 Citizen Liaison Committee Meetings

As part of the public consultation program, a Citizen Liaison Committee (CLC) was established following publication of the NOC. The CLC provided a forum for focused discussion of the project with a broadly-based group of public project stakeholders, including residents at large, ratepayers associations and Vaughan. The CLC meetings were held to identify public needs and concerns and address them through discussion with the Project Team.

A CLC Terms of Reference and meeting notes can be found in **Appendix A3** – Citizen Liaison Committee.

2.4.1 Citizen Liaison Committee Meeting #1

On June 22, 2017 the Project Team hosted meeting #1 at the SCE office, CoV. The purpose of this meeting was to review and discuss the road alignment options, screening methodology and results, and proposed evaluation criteria for short-listed road alignment options and to seek advice on PIC #1.

2.4.2 Citizen Liaison Committee Meeting #2

On June 19, 2018 the Project Team hosted meeting #2 in the Maple Library meeting room, CoV. The purpose of this meeting was to review and discuss the alternative design concepts, evaluation criteria and methodology, recommended design concepts and to seek advice in advance of PIC #2.

2.4.3 Citizen Liaison Committee Meeting #3

On May 2, 2019 the Project Team hosted meeting #3 at the SCE office, CoV. The purpose of this meeting was to review and discuss the Refined Preferred Alignment 5A. The Technically Preferred Alignment 5 was modified as per comments received from technical review agencies to the Draft ESR.

2.5 Public Information Centre #1

The Public Information Centre#1 (PIC #1) was held on June 29, 2017 at the Maple Downs Golf and Country Club in Vaughan. A Notice of PIC #1 outlining the study background, purpose of the study, progress of the study and PIC venue details was advertised in two consecutive editions of the Vaughan Citizen, Thornhill Liberal, King Connection and Richmond Hill Liberal local newspapers on June 15, 2017 and June 22, 2017 respectively. In addition, 110 Notices along with a cover letter were sent out to stakeholders, agencies, municipal staff and Indigenous Peoples on the project contact list about the PIC #1.

The PIC #1 provided an opportunity for the public to learn about the project and the EA Process. In addition, it provided an opportunity for the public and the stakeholders to provide their input about the project during the initial stages.

A total of twelve (12) stakeholders attended PIC #1. A project response form was handed over to the attendees to provide their input on the project and PIC#1. No concerns about the project were raised and no completed response forms were provided to the project team during the event.

A PIC#1 update was circulated on July 14, 2017 to the project stakeholders included in the study mailing list. The update included a cover letter, a copy of selected display boards and a Response Form.

As a result of the consultation efforts, comments were received by the project team from the public and agencies. The agencies provided detailed comments on the study area limits, EA Phases 1 and 2 and criteria used for screening of alternatives. Local residents indicated concerns for protecting the Oak Ridges Moraine features and other legislated areas, the technical screening criteria and a new alignment option 10 was proposed to consider.

The project team ensured that all concerns were addressed and responses with supplementary information were provided as appropriate. Additional PIC #1 details and the responses received from the PIC #1 update circulation are presented in the Public Information Centre #1 Summary Report included in **Appendix A4**.

Overall PIC#1 provided the project stakeholders a good introduction to the project, overview of the planning process, preliminary details on the undertaking and completed analysis.

2.6 Site Walk

On August 29, 2017, a site walk was held with representatives from MECP, Toronto and Region Conservation Authority (TRCA), Ministry of Natural Resources and Forestry (MNRF), City of Vaughan, York Region and selected members of the project team. The group included 21 persons in total.

The purpose of the site walk was to focus on the Study Area and to identify specific environmental features and constraints. Key observations noted during the site walk included the steep site topography on the south side of the unopened road allowance, including a large disturbed area (former aggregate production) currently used for cement recycling operations; PSW feature and condition of Upper East Patterson Creek; and presence of a core forested area.

As a result of site walk, the project team was given specific guidance from the review agencies concerning the relative importance of key features and requirements for further studies. In part, avoidance of existing features, staking of PSW limits, authorization requirements under Endangered Species Act, land acquisition issues were mentioned. Consequently, the information was used to update the short-listed road alignments and develop an additional modified version (Alignment 6A) that curves farther to the south to avoid natural heritage features (please see **Section 7.0** for the evaluation of short-listed alternatives).

2.7 Public Information Centre #2

The Public Information Centre#2 (PIC #2) was held on June 28, 2018 at the Civic Centre Resource Library in Vaughan. The main purpose of PIC #2 was to notify the public about the progress of the project since PIC #1 and provide information about the project team's recommended road alignment and cross section.

A Notice of PIC #2 outlining the study background, purpose of the study, progress of the study and PIC venue details was advertised in two consecutive editions of the Vaughan Citizen, Thornhill Liberal, King Connection and Richmond Hill Liberal local newspapers on June 14, 2018 and June 21, 2018 respectively. In addition, notices along with a cover letter were sent out to stakeholders, agencies, municipal staff and Indigenous Peoples on the project contact list about the PIC #2.

A total of eleven (11) stakeholders attended the PIC #2. A project response form was handed over to the attendees to provide their input on the project and the PIC# 2. During the event questions were raised by the attendees about the evaluation of various alignments and cross-sections which were responded to the by the project team.

A PIC#2 update was circulated on July 20, 2018 to the project stakeholders included in the study mailing list. The update included a Response Form and copy of selected display boards showing the recommended road alignment and cross-section.

As a result of the consultation efforts, comments were received by the project team from the public and agencies. In part, Keep Vaughan Green (KVG) requested further details about the methodology used for social and economic ranking, introduction of weighting for environmental factors and recommendations for conducting detailed inventory for trees including size and species affected by each of the road alignments. The City of Richmond Hill's transportation engineer requested appropriate cycling connections to be implemented at the Bathurst Road and Kirby Road intersection. Local businesses within the Study Area expressed opinions about the alignment 6 and 6A causing disruptions to their operations. Concerns from local residents pointed to consideration of eco-friendly features, traffic congestion on Kirby Road, potential environmental impacts of Alignment 5 and protection of

environmental features of the Oak Ridges Moraine. The review agencies provided comments about conformity to 2017 ORMCP and basis of scoring for alternative road alignments.

The responses received from the PIC #2 update circulation and additional PIC #2 details are presented in the Public Information Centre #2 Summary Report included in **Appendix A5**. The project team ensured that all concerns were addressed and responses with supplementary information were provided as appropriate.

2.8 Preparation of ESR

A Draft ESR and a Final Draft ESR was circulated to TAG members for review and feedback on December 21, 2018 and May 13, 2019 respectively. The Final Draft ESR was also circulated to CLC members. Both of the draft documents along with tabulated corresponding comments are included in **Appendix 9** - Draft ESR. To facilitate the review, the project team held TAG #3 and CLC #3 meetings on May 2, 2019.

Following their review of the Final Draft ESR, City staff tabled a report to the Finance, Administration and Audit Committee meeting on June 5, 2019 on the outcome of the Kirby Road Extension EA. The report recommended the City to join RHL as a co-proponent of the EA Study. The City's Council authorization and direction to proceed to issue Notice of Study Completion and file the ESR was granted on June 12, 2019. Copy of Extract from CoV Council Meeting Minutes of June 12, 2019 can be found in **Appendix A8** - Selected Correspondence.

2.9 Notice of Study Completion

A Notice of Study Completion was advertised in two consecutive editions of the local newspapers on September 19, 2019 and September 26, 2019 respectively. In addition, the Notices along with a cover letter were sent out to stakeholders, agencies, municipal staff and Indigenous Peoples on the project contact list about the ESR available for review. The ESR was filed on public domain to mark the completion of the EA study and begin the mandatory 30-day public review period.

2.10 Indigenous Peoples Consultation

Indigenous Peoples are an important public body for consultation on municipal projects. The following sections summarize the methodology used to coordinate consultations with First Nation and Aboriginal organizations, action taken and feedback received. A report titled "Kirby Road Extension Environmental Assessment Aboriginal Consultation" (April 2019, FNESL) is included in **Appendix A6** – Indigenous Peoples Consultation.

2.10.1 Identification of Indigenous Peoples

An initial contact list, including three communities: Six Nations of the Grand River Territory, Haudenosaunee Confederacy and Mississaugas of New Credit have been identified through an early consultation effort with the Ontario Ministry of Indigenous Relations and Reconciliation (MIRR).

As advised by the MECP, the project may have potential to affect aboriginal or treaty rights protected under Canada's 1982 Constitution Act, Section 35. An MECP's preliminary assessment identified five First Nations

(FNs) as potentially affected: Alderville, Curve Lake, Hiawatha, Mississaugas of Scugog Island and Mississaugas of New Credit First Nations. In addition, the CoV staff provided a list of twelve First Nations the City is committed to consult.

Based on the received feedback, the project team compiled an initial Indigenous Peoples contact list and expanded the list as follows:

- Six Nations of the Grand River Territory
- Conseil de la Nation Huronne-Wendat
- Kawartha-Nishnawbe First Nation of Burleigh Falls
- Chippewas of Rama First Nation (Mnjikaning)
- Chippewas of Georgina Island
- Beausoleil First Nation
- Haudenosaunee Confederacy Chiefs Council
- Mississaugas of the New Credit First Nation
- Alderville First Nation
- Curve Lake First Nation
- Hiawatha First Nation
- Mississaugas of Scugog Island First Nation
- Métis Nation of Ontario

Initial consultation steps with Indigenous Peoples were undertaken by the SCE staff. With gradually expanding contact list, through personalized letters Indigenous Peoples were notified about study commencement, PIC#1 and an update to PIC #1.

In preparation to PIC #2 it was decided to engage the First Nations Engineering Services Ltd. (FNESL) in the Indigenous Peoples consultation program for the EA study. FNESL's role was to essentially act as an impartial facilitator in coordinating consultations with the First Nation and Aboriginal organizations identified during the course of this study.

FNESL developed a contact list of FNs with a potential interest in the Kirby Road Extension EA, based upon their discussion with representatives of the SCE on the previous consultation efforts, and their knowledge of FNs with historical interest in the area, including those with documented treaties, potential environmental concerns, and known history within the area.

The latest FN contact list included the following organizations:

- Alderville First Nation
- Beausoleil First Nation
- Chippewas of Georgina Island
- Chippewas of Rama
- Curve Lake First Nation

- Hiawatha First Nation
- Huron Wendat Nation
- Haudenosaunee Confederacy
- Mississaugas of Scugog Island First Nation
- Mississaugas of the New Credit First Nation
- Moose Deer Point First Nation
- Mohawks of the Bay Quinte
- Six Nations of the Grand River

2.10.2 Indigenous Peoples Correspondence

Notice of Study Commencement

Personalized letters along with a copy of NoC and a response form were sent via email and mailed to the Mississaugas of the New Credit, Haudenosaunee Confederacy, Six Nations of the Grand River and Métis Nation of Ontario on May 23, 2017. The letter noted that RHL, authorized by the City of Vaughan, has initiated an EA Study for Kirby Road Extension in the City of Vaughan. The letter included information concerning the study objectives, details of the Municipal Class EA process being followed, a request for background data contributing to the understanding of existing conditions and contact details for study representatives.

Notice of PIC# 1

Personalized letters along with a copy of public notice providing details about the EA Study and notifying about the PIC #1 event were sent by SCE via email and mailed to the Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, Mississaugas of Scugog Island First Nation, Mississaugas of the New Credit, Haudenosaunee Confederacy, Six Nations of the Grand River and Métis Nation of Ontario on June 19, 2017.

PIC #1 Update Letter

A PIC #1 Update Letter was sent by SCE via email and mail to the Indigenous Peoples on the updated contact list on July 12, 2017. The letter provided an update on the PIC #1 event held on June 29, 2017 at Maple Downs Golf & Country Club. The letter noted that the PIC #1 had presented the existing and future conditions within the study area; the screening of Long List of Alternative Road Alignments; the three short-listed road alignments and the criteria proposed for further detailed evaluation of the road alignments and associated Alternative Design Concept(s). The update included copies of the selected display boards providing further details about the short-listed road alignments along with a PIC #1 Update Response Form. The letter requested the First Nation to contact SCE if they had any questions in regard to the EA Study.

Preliminary Notification Letter

A Preliminary Notification letter was sent via facsimile and mailed to the Indigenous Peoples on June 14, 2018. The letter noted that RHL, authorized by the City of Vaughan, is undertaking an Environmental Assessment Study (EA Study) to establish the preferred alignment and design for the extension of Kirby

Road between Dufferin Street and Bathurst Street. The letter further noted that SCE has been retained by RHL, as lead consultant to complete the study. The letter notified the First Nation organizations that FNESL would be facilitating engagement with First Nation communities on behalf of SCE. The letter provided further information on the study as well as map showing the approximate limits of the study area and the "Notice of Public Information Centre #2" to be hosted by RHL. The letter noted that FNESL would be in further contact and that the First Nation should contact FNESL if they have any questions.

PIC #2 Update Letter

A PIC #2 Update Letter was sent by FNESL via email and mail to the Indigenous Peoples on the contact list on July 23, 2018. The letter provided an update on the results of the RHL hosted PIC #2 held on June 28, 2018 at Civic Centre Resource Library. The letter noted that the PIC #2 had presented the study background information; assessment of remaining effects of the proposed Kirby Road extension on the environment; evaluation of alternative design concepts developed for road cross-section and short-listed alignments, and recommended design concepts. The letter included an attachment which provided the PIC #2 Update issued by RHL, on July 20, 2018. The update included copies of the selected display boards providing further details about the Recommended Design Concepts along with a PIC #2 Update Response Form. The letter requested the First Nation to contact FNESL if they had any questions in regard to the EA Study.

2.10.3 First Nation and Métis Nation Feedback

The feedback received from FN on circulation of the PIC #1 materials was as follows:

- A letter from Mississaugas of the New Credit First Nation (MNCFN) regarding the Notice of Public Information Centre # 1 indicated that MNCFN has a low level of concern about the project.
- A letter from Curve Lake First Nation regarding the Notice of Public Information Centre # 1 indicated that the First Nation requires a Special Consultation Framework for this project. The letter acknowledged receipt of the preliminary letter regarding the environmental assessment. The letter noted that the project is situated within the Traditional Territory of Curve Lake First Nation. It further noted that the First Nation's Territory is incorporated within the Williams Treaties Territory and is the subject of a claim under Canada's Specific Claims Policy.
- A completed PIC #1 Response Form from Beausoleil First Nation received by fax indicating their preference to Option 6 and interest in archaeological reports only.
- An email from Huron-Wendat First Nation regarding the Notice of Public Information Centre # 1 Update indicated their interest in archaeological assessment.

The feedback received from FN on circulation of the PIC #2 materials was as follows:

- A completed PIC#2 Response Form from Haudenosaunee Development Institute (HDI) on August 8, 2018. The submitted form included a request to ensure Haudenosaunee Confederacy involvement in Archaeological & Environmental Field Assessments.

2.10.4 Follow-up Telephone Contact

Follow-up telephone calls to the 13 First Nation organizations were made over the period of November 19 to December 4, 2018, to determine the First Nation requirement for further consultation on the Environmental Assessment Study (EA Study) to establish the preferred alignment and design for the extension of Kirby Road between Dufferin Street and Bathurst Street.

Alderville First Nation responded in a telephone conversation on December 3, 2019 that they would like to receive a copy of the archaeological report.

Huron Wendat Nation responded in a telephone conversation on December 3, 2019 that they would like to receive a copy of the archaeological report. It should be noted that shapefiles for the study area boundary were provided on July 20, 2017 and the report was provided on August 9, 2018 to Mr. Maxime Picard, Project Coordinator for Huron Wendate Nation.

Mississaugas of the New Credit First Nation requested letters of June 14, 2018 and July 23, 2018, to be resent, in telephone conversation of December 4, 2018. The First Nation was notified of preferred road alignment and that the Archaeological Report can be shared with the First Nation at their request, during this conversation. No further comments have been received from the Mississaugas of the New Credit First Nation.

Mississaugas of Scugog Island First Nation requested letters of June 14, 2018 and July 23, 2018, to be resent, in telephone conversation of December 4, 2018. The First Nation was notified of preferred road alignment and that the Archaeological Report can be shared with the First Nation at their request, during this conversation. No further comments have been received from the Mississaugas of Scugog Island First Nation.

Six Nation of the Grand River requested letters of June 14, 2018 and July 23, 2018, to be resent, in telephone conversation of December 3, 2018. The First Nation was notified of preferred road alignment and that the Archaeological Report can be shared with the First Nation at their request, during this conversation. No further comments have been received from the Six Nation of the Grand River.

Haudenosaunee Confederacy requested letters of June 14, 2018 and July 23, 2018, to be resent, in telephone conversation of December 3, 2018. The First Nation was notified of preferred road alignment and that the Archaeological Report can be shared with the First Nation at their request, during this conversation. No further comments have been received from the Haudenosaunee Confederacy.

FNESL did not receive response to telephone calls and messages left with seven First Nations over the period of November 19 to December 4, 2018. These First Nations included:

- Beausoleil First Nation
- Chippewas of Georgina Island
- Chippewas of Rama
- Curve Lake First Nation Hiawatha First Nation
- Mohawks of the Bay of Quinte
- Moose Deer Point First Nation

A copy of the Stage 1 Archaeological Assessment report prepared by ASI for the EA Study was provided to the Indigenous Peoples on the contact list on April 23, 2019.

3.0 Existing Conditions

One of the key steps required by the MEA MCEA planning and design process is preparation of a physical description of the area where the project is to occur, and a general inventory of the technical, natural, social, cultural and economic environments which are to be considered when reviewing the effects of a project in that area.

This chapter describes the existing environmental conditions in the study area within a multi-disciplinary framework used to establish the baseline conditions against which project alternatives have been assessed.

3.1 Study Area

Existing Kirby Road is currently owned by the CoV, including the untraveled existing road allowance spanning through the Study Area between Dufferin Street and Bathurst Street, in the City of Vaughan, Regional Municipality of York. The road allowance is a 20.10m wide Municipal Right of Way (RoW).

The Study Area is an 800m wide corridor, spanning a distance of approximately 2000m in the east-west direction. The study corridor covers an area of approximately 170 hectares, extending approximately 400m north and south of the municipal RoW, and is located immediately west of the Town of Richmond Hill municipal border. The Study Area is illustrated in **Figure 2**.

Figure 2: Study Area

3.2 Technical Environment

Investigations and studies completed by the Project Team to prepare inventory of the Technical Environment associated with the Study Area are summarized in the following sections.

3.2.1 Transportation Context

A transportation assessment study was prepared by Poulos & Chung Ltd. Numerous background studies were researched for information purposes to ensure that the most up-to-date data was available to complete the transportation assessment and evaluation. The background studies included:

- York Region TMP, 2016;
- City of Vaughan TMP, 2012;
- City of Vaughan Pedestrian and Bicycle Master Plan Study, January 2007;

- North Vaughan and New Communities TMP Draft Report, HDR Inc., February 2018;
- Relevant Metrolinx Studies, including:
  - ✓ Mobility Hub Guidelines, September 2011; and
  - ✓ New Station Analysis, Methodology and Process, September, 2015.

Additional background information included:

- Current background traffic – Existing vehicle turning movement information was obtained from area intersection turning movement counts conducted by York Region and Poulos & Chung Limited.
- Existing lane configurations as recorded by field observations;
- Transportation for Tomorrow Survey 2011 data information.
- EMME II transportation software model outputs as provided by York Region.

Roads

As shown on **Figure 2** existing Kirby Road terminates at T- shaped intersection with Dufferin Street in the City of Vaughan. There is an unopened Kirby Road allowance that runs in an east-west direction between Dufferin Street and Bathurst Street. The most eastern 200 m of the road allowance provide a gravel driveway access to existing properties from the Bathurst Street and Gamble Road T- shaped intersection. The balance of the road allowance is mostly forested. Both intersections are signalized.

Closest to the missing Kirby Road link parallel east-west roads are King Vaughan Road to the north and Teston Road to the south.

Transit

York Region Transit provides extensive transit service throughout York Region, including the Study Area. Currently, transit is available on Kirby Road in a short section at Keele Street and along Bathurst Street.

Active Transportation

A Multi Use Path (MUP) of approximately 2.0 meters in width is available on the south side of Kirby Road immediately west of Dufferin Street. Exclusive bike lanes are available on both sides of the roadway on Gamble Road, immediately east of Bathurst Street.

Some minor and unofficial trails are present within the Study Area and no other active transportation infrastructure is available. However, bicyclists can make use of Dufferin Street and the Bathurst Street road shoulders.

Traffic

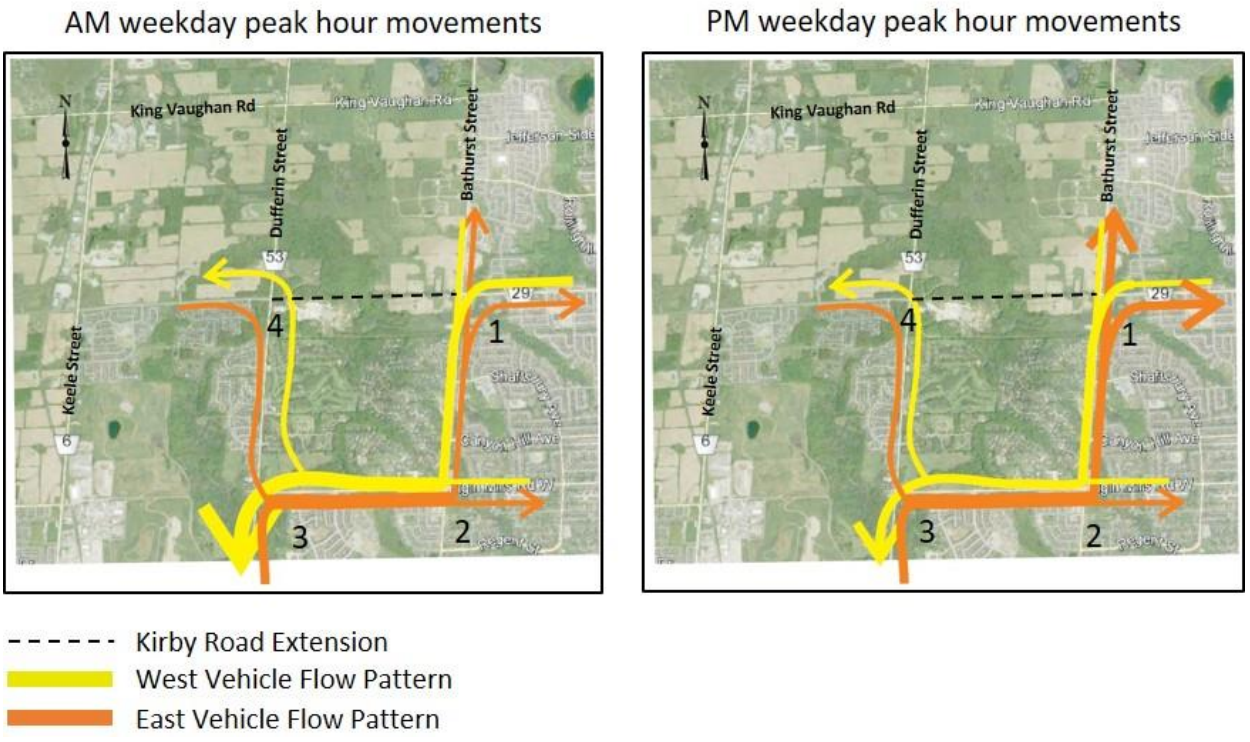
Level of Service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption and lost travel time. Based on Highway Capacity Manual (USA, National Academy of Sciences, 2000), **Table 1** is provided to explain performance of intersection operations.

Table 1: Level of Service Definitions for Intersections

LOS	Signalized Intersection Average Vehicle Control Delay	Unsignalized Intersection Average Vehicle Control Delay	LOS Recommendation
A	≤ 10 sec	≤ 10 sec	Acceptable
B	10 – 20 sec	10 – 15 sec	Acceptable
C	20 – 35 sec	15 – 25 sec	Acceptable
D	35 – 55 sec	25 – 35 sec	Somewhat Undesirable
E	35 – 80 sec	35 – 50 sec	Undesirable
F	≥ 80 sec	≥ 50 sec	Undesirable

Existing intersection vehicle turning movements were analyzed by Poulos & Chung. Traffic counts for the analysis were completed in October 2016.

Figure 3: Existing Traffic Movements



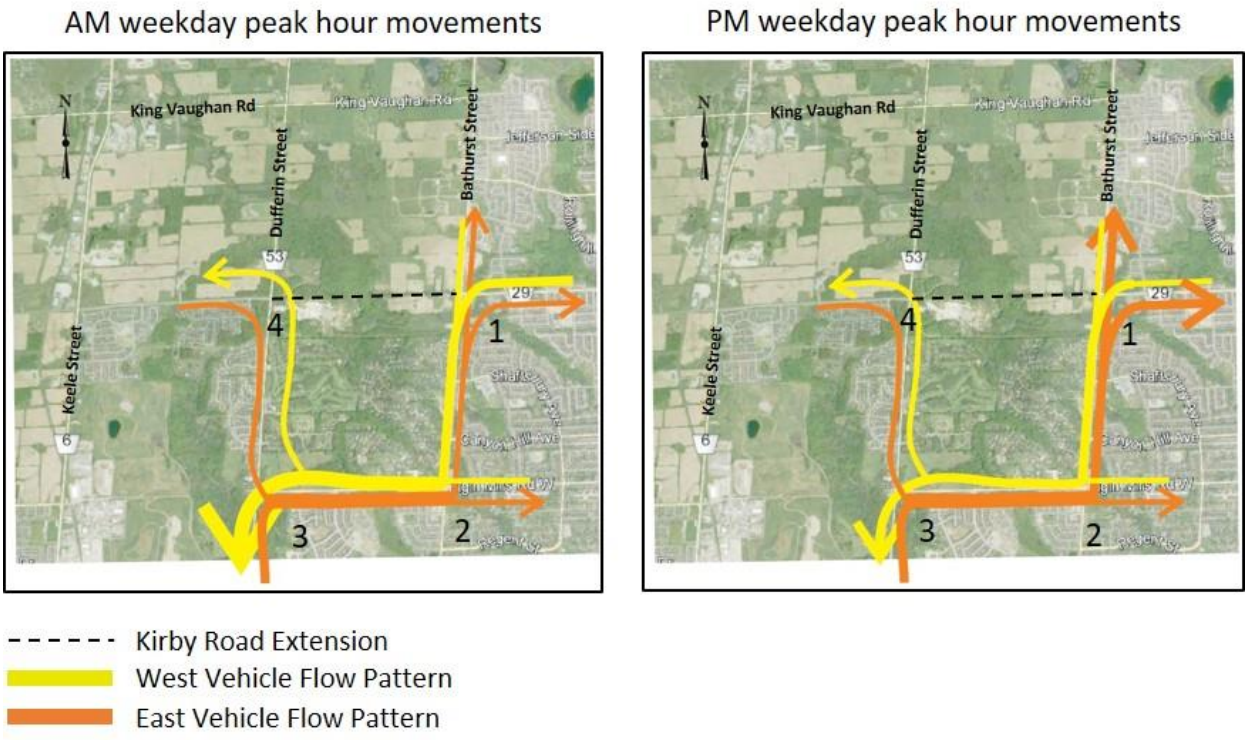


Figure 3 above demonstrates the existing traffic flow pattern (estimated diversion pattern) resulting from the lack of a Kirby Road Extension. High vehicle turning movements have been identified during typical weekday peak hours causing delays and congestion at all four of the primary intersections studied:

1. Gamble Road at Bathurst Street,
2. Teston Road/Elgin Mills Road West at Bathurst Street
3. Teston Road at Dufferin Street, and
4. Kirby Road at Dufferin Street.

The extent of vehicle delay and congestion was analyzed. It is evident during each typical weekday several of the intersections experience fairly high vehicle turning movements in each of the roadway peak hours. These fairly high vehicle turning movements form a pattern circumventing the unavailable Kirby Road segment. This circuitous vehicle flow in each of the typical weekday roadway peak hours is causing vehicle delay and congestion to all four of the primary intersections studied.

Table 2 summarizes the existing roadway intersection operating conditions and presents overall intersection level of service and vehicle delay.

Table 2: Calculated Intersection Performance

Performance Measure	Kirby Road and Dufferin Street Intersection		Kirby Road and Bathurst Street Intersection	
	AM Peak	PM Peak	AM Peak	PM Peak
Overall LOS*	B	C	B	B
Vehicle Delay (in seconds)	15	20	14	20

**Overall LOS is calculated based on the optimum signal timing in the AM and PM peak hour.*

It was concluded even though the intersections benefit from no east west opposing traffic flows to a certain extent and Kirby Road westbound at Bathurst Street employs a double left turn lane, in the PM peak hour vehicle delays are reasonable.

Over capacity condition exist in the PM roadway peak hour at the Kirby Road and Bathurst Street intersection. The Kirby Road traffic flows impose increased vehicle demands on Teston Road and the intersections with Dufferin Street and Bathurst Street.

3.2.2 Stormwater Drainage

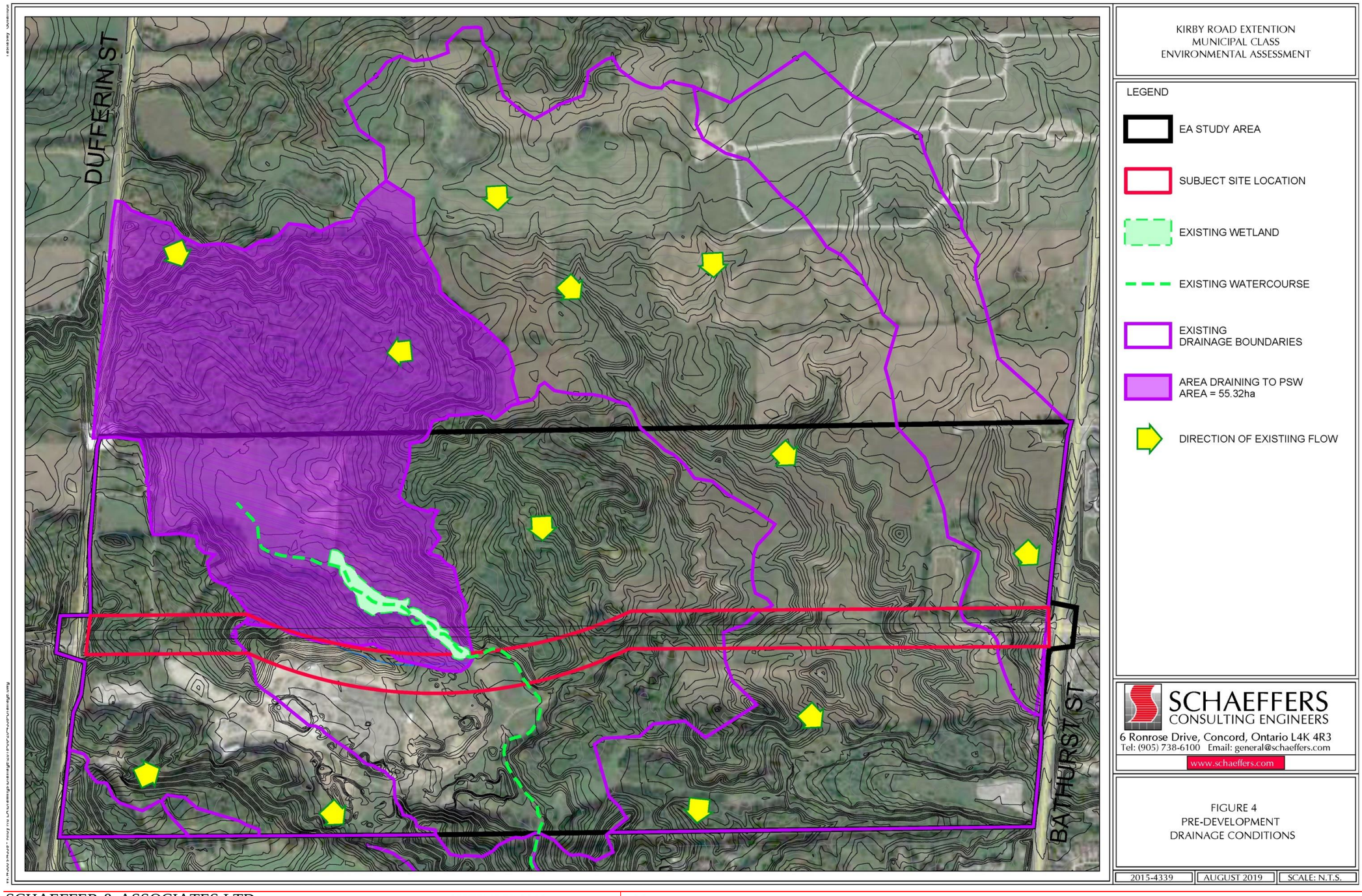
The site is located within the East Don River Watershed. Based on the available topographic mapping (aerial and survey), the site generally slopes in the southerly direction. A small portion of the proposed Kirby road extension under existing conditions flows towards the Bathurst Street. The existing topography and drainage conditions are presented in **Figure 4: Pre-development Drainage Conditions**.

The site is traversed by a number of intermittent swales. A Provincially Significant Wetland (PSW) is located within the Subject site as presented on **Figure 4**. Approximately 55.3ha is draining under existing conditions to the PSW. There is one major valley and a watercourse traversing the existing municipal road allowance. The flow in the watercourse is intermittent and at the time of site visit on September 05, 2017 by Terraprobe it was found to be dry.

The external area flowing towards the subject site was delineated based on the aerial topography and is presented in **Figure 4**. There is an existing manmade berm by the Trans Canada Pipeline south of the proposed Kirby Road Extension which prevents the natural flow from the subject site and the external area. Due to the permeable soil conditions on the site (mostly sand and silt), most of the flow is infiltrated on site. This is not shown on the aerial topography; however site visits confirmed the existence of the berm.

According to the Hydrogeologic Study and Geotechnical Report prepared by Terraprobe, the predominant soil type on the study area is Sand/Sandy-Silt to Silty Sand.

Figure 4: Pre-development Drainage Conditions



3.2.3 Geomorphic Assessment

A wetland and a watercourse were identified in the central part of the Study Area. It was concluded that the watercourse denotes an upper east tributary of Patterson Creek within the Don River watershed. Form and function of streams and the interaction between streams and the landscape around them is subject for a geomorphological study. Therefore, a geomorphic assessment of the watercourse referenced as Upper East Patterson Creek was conducted by GEO Morphix Ltd in 2016.

The purpose of the assessment was to fulfill a Class EA requirement to document natural heritage features, as well as to support the decision-making process with respect to actions that may affect the watercourse. The assessment involved both desktop and field activities including reach delineation, reach-by-reach rapid assessments, and a detailed basis for any channel modifications such as realignment or stabilization.

The 2016 geomorphic assessment concluded that the portion of Patterson Creek identified within the Study Area experienced significant changes over the period covered by historical imagery. These changes include realignment and straightening (i.e. channelization), removal of tree cover, and the disruption of channel and flow continuity as a result of construction of the TransCanada Pipeline running along the southern limit of the Study Area. The report "Upper East Patterson Creek Geomorphic Assessment" is included in the ESR as **Appendix C6.1**.

Additional desktop analysis, including planning level meander belt width delineation, determining 100-year erosion limits, and preliminary recommendations regarding potential road crossing locations was provided by GEO Morphix Ltd. in a memo letter format in May 2018. The document is included in the ESR as **Appendix C6.2**. It was concluded that Road Alignment Options 4 and 5 are not preferred as they both could potentially result in disturbance of well-established riparian cover. Clearing the riparian cover would negatively influence creek function. If this crossing location is proposed, it was recommended spanning the meander belt width and limiting vegetation removal/impact. In that case, the potential impacts can likely be mitigated.

Road Alignment Options 6 and 6A are preferred as they cross the existing watercourse at a perpendicular angle through a previously disturbed area where the reach has been realigned and channelized. Erosion was noted along the valley walls in the crossing location associated with Road Alignment Options 6 and 6A. A crossing at this location would likely provide an opportunity for stabilization.

These recommendations reflected the geomorphological considerations. Other disciplines will also need to be considered including terrestrial and aquatic biology, ecology, hydrogeology, and hydrology.

An additional memo letter along with supporting materials was prepared by GEO Morphix Ltd. (November 2018) in response to comments received from TRCA. Additional field work was completed on November 16, 2018 to verify the location of the channel centreline in the vicinity of each identified road crossing location.

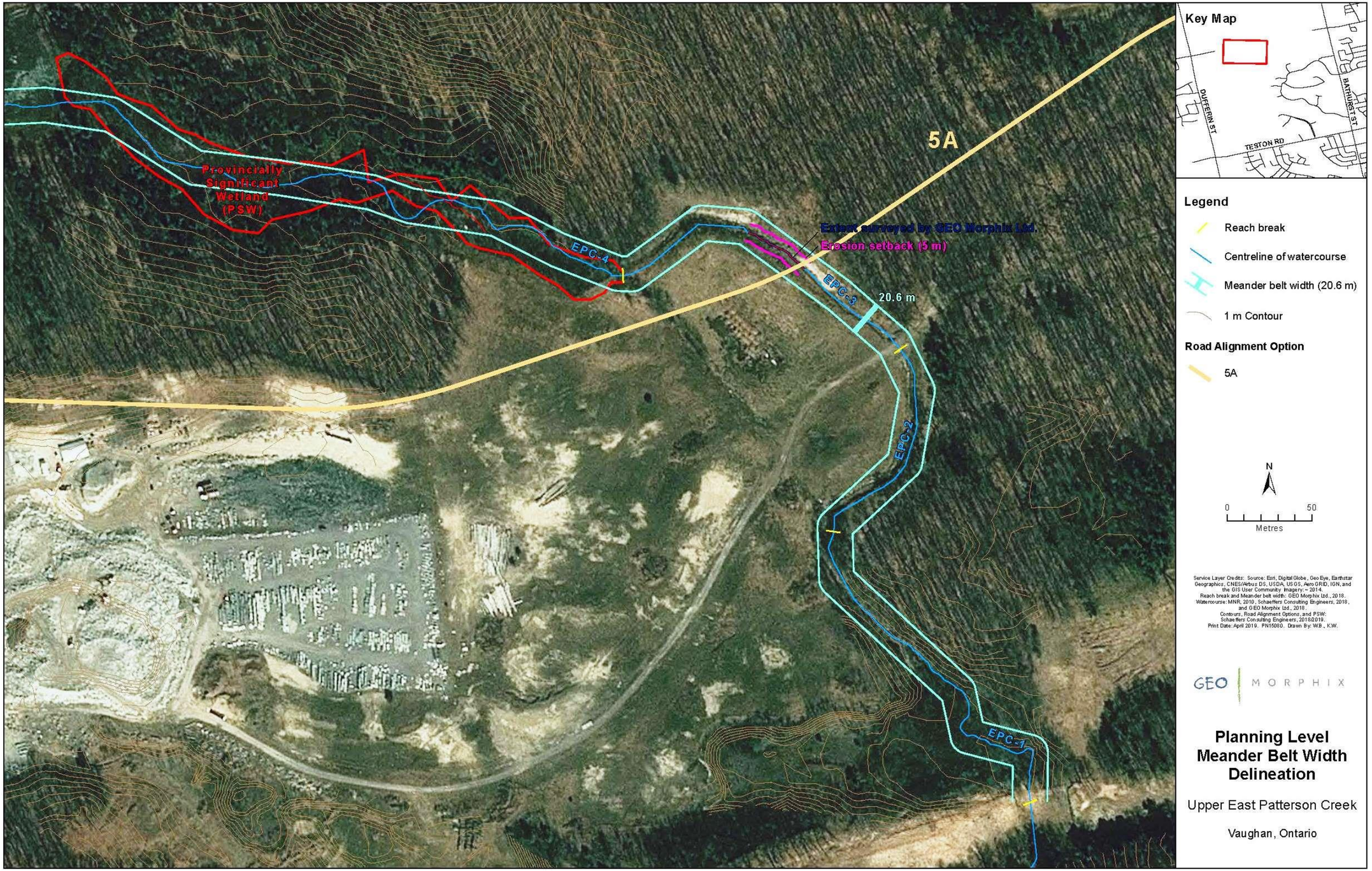
As Alignment 5 has been selected as the preferred approach, it was noted that in the vicinity of the wetland crossing, a channel centerline could not be mapped. Based on the field observations, the area is vegetation controlled with a low-gradient, evidence of aggradation, and no defined low-flow channel. As

such, there is limited erosion potential. From a geomorphological perspective, there is no future concern of erosion in the vicinity of crossing Alignment 5. Still, a meander belt width in this area was provided based on the largest channel meander amplitude measured upstream of the Alignment 5 crossing using a MNRF stream layer. Given that the feature is vegetation controlled and lacks defined bed and banks in this section, the meander belt width is an extremely conservative estimate of the erosion hazard. It was concluded that Alignment 5 is an appropriate approach for the future road crossing. If required at the detailed design stage, a low flow channel could be created as part of the crossing design. The document supplementing the overall geomorphic assessment is included in the ESR as **Appendix C6.3**.

In light of refinements to Alignment 5 in April 2019 and the shift in horizontal alignment from the wetland crossing to the creek crossing, geomorphic considerations were provided for Alignment 5A. It was found that Alignment 5A is appropriate, given it will cross the existing watercourse at a nearly perpendicular angle through a previously disturbed area where the reach has been realigned and channelized. The most recent geomorphic assessment can be found in **Appendix C6.4** - Recommendations for Alignment 5A.

A meander belt width of 20.6 m was determined for the four reaches of East Patterson Creek and included a 20% factor of safety. This meander belt width was delineated along the observed central tendency of the watercourse within the study extent. The meander belt width is conservative, given that the studied reaches are in confined or partially-confined systems. As such, the meander belt width can be further refined at detailed design, if required. The meander belt width delineation is illustrated in **Figure 5.**

Figure 5: Planning Level Meander Belt Width Delineation



3.2.4 Geotechnical Conditions

A preliminary geotechnical investigation was conducted by Terraprobe in late Fall 2017 along the short-listed proposed road alignments to determine the prevailing subsurface soil and ground water conditions, and on this basis, to provide the preliminary geotechnical engineering recommendations required for the proposed road extension, including:

- Pavement design and a water-crossing structure (culvert or bridge)
- Installation of underground utilities (sewers) and
- Deep cut and high embankment sections.

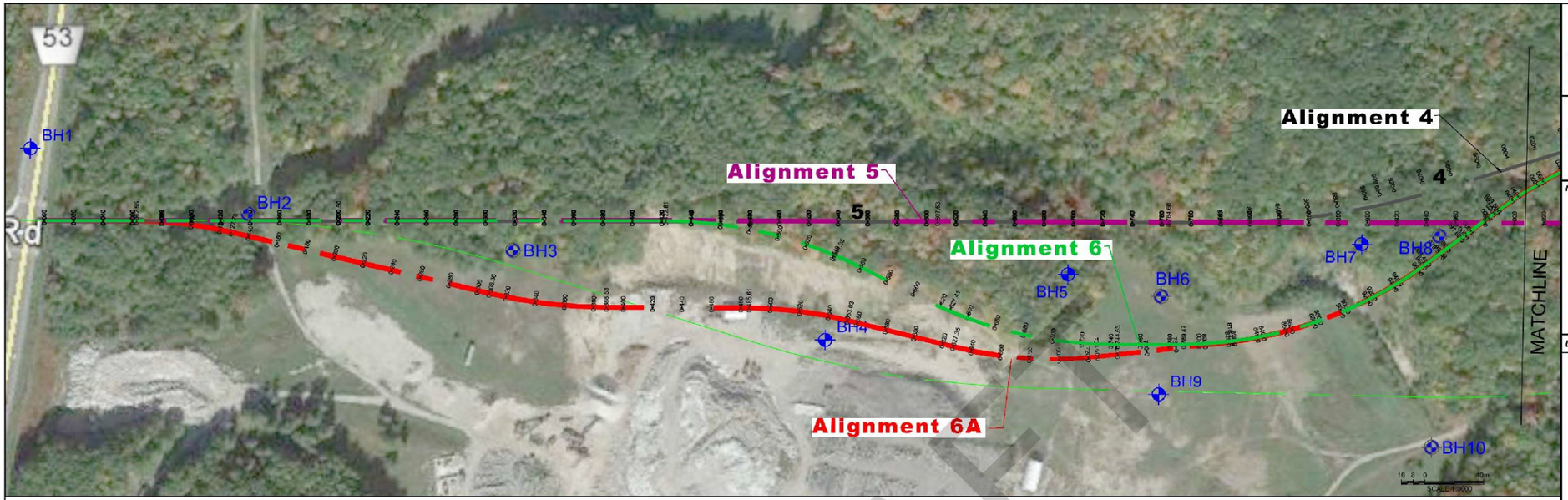
In addition, comments were provided on pertinent construction aspects including excavations, backfill and ground water control.

Borehole locations were staked out by Terraprobe generally in accordance with the borehole location plan provided by SCE, with adjustments based on the site access constraints and features. The approximate locations of the 21 boreholes are shown in **Figure 6**. The geotechnical laboratory testing consisted of natural water content determination for all samples; A Sieve, Hydrometer and Atterberg Limits analyses were conducted on selected soil samples. The test results are attached in **Appendix C7** - Geotechnical.

The following summarizes the findings from the Preliminary Geotechnical Investigation Report, which can be found in **Appendix C7.**

- A topsoil layer was encountered at the ground surface at each borehole location, with the exceptions of Boreholes 1, 40, 20 and 21. The topsoil thickness ranged from about 150 to 350 mm.
- An asphalt pavement structure was encountered in Boreholes 1 and 21, with a total pavement thickness of 800 mm and 440 mm, respectively.
- Earth fill materials, consisting of the matrix of sand and silt, gravelly sand and clayey silt, were encountered beneath the topsoil layer or at ground surface in all boreholes, with exceptions of Boreholes 1 and 21, and extended to about 0.8 m to 6.1 m depths below grade. The earth fill materials generally consist of trace amounts of organic matters.
- Based on the results of the boreholes drilled along the proposed alignments, it is expected that excavations will generally penetrate topsoil, fill materials, native sand, sandy silt to silty sand, clayey silt and silt.
- The soils encountered on site are considered to be suitable for excavation using normal trenching and excavating equipment.
- The undisturbed native materials will be suitable for support of buried services that are properly bedded.

Figure 6: Borehole/ Monitoring Well Locations



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Reference:
Cad Drawings provided by Schaeffer & Associates Ltd. via email.
Image ©2018 Google

Notes:

Legend:
- Approximate Borehole Location
- Approximate Monitoring Well Location

Project Title: Hydrogeologic Study

Site Location: Kirby Road Extension, Vaughn, Ontario

Figure Title: BOREHOLE/ MONITORING WELL LOCATIONS- GOOGLE EARTH

Designed By: AS	*File No.:* 1-15-0700-54
Drawn By: SSK	*Scale:* As Shown
Reviewed By: MS	*Figure No.:* 2A
Date: February 2018	

From Preliminary Geotechnical Investigation Report by Terraprobe, dated February 2018

3.2.5 Hydrogeological Conditions

A hydrogeological study was conducted by Terraprobe Inc. to establish local and regional hydrogeological conditions and assess potential impacts of the proposed Kirby Road Extension on the ground water system.

A summary of the work program conducted for the study is provided below:

- A review of available background geologic and hydrogeological information and the surrounding areas was conducted. This allowed for characterization of regional hydrogeological conditions.
- A detailed site inspection was conducted to review existing conditions, including identification of any hydrogeological features such as significant areas of potential ground water recharge or areas of ground water discharge. In particular, the area in the vicinity of the creek bank was inspected for evidence of ground water seepage or springs.
- A total of twenty one (21) boreholes were drilled to depths varying from 6m to 20m below existing grade. The approximate locations of the boreholes are shown in **Figure 6**. Seven (7) of the boreholes were instrumented with monitoring wells. These boreholes and monitoring wells were completed to obtain subsurface soil and ground water data. Three (3) additional monitoring wells were installed for the hydrogeological assessment. In addition, four (4) drive point piezometers will be installed in the vicinity of the creek crossing.
- A private well survey was conducted for properties within 1 km of the Site boundary. Well information was obtained from the property owner where possible.
- In-situ hydraulic conductivity tests were conducted in select monitoring wells to assess hydraulic conductivity of the strata and to determine potential dewatering requirements.
- Installation of data loggers in monitoring wells and drive point piezometers to measure water levels.
- An assessment of ground water discharge volumes was conducted to ensure safe and dry working conditions for construction activities and ground water control plan.
- Calculation of water balance for pre-development and post-development conditions, along with recommendations for appropriate LID measures to maintain ground water infiltration rates.

Findings of the hydrogeological investigation were documented through the report named “Hydrogeologic Study Kirby Road Extension City Of Vaughan, Ontario” prepared by Terraprobe Inc. The report can be found in **Appendix C8**.

The hydrogeologic study indicates that the Study Area is located within an area of predominantly High Aquifer Vulnerability, ORM Conservation Area and a Wellhead Protection Area (WHPA) Q1 and Q2 for water quantity with moderate stress.

In a broader context, the Site is situated on the south slope of the Oak Ridges Moraine, approximately 2 km south of the height of land for the moraine. In this area, the moraine forms a zone of regional ground water recharge. Ground water recharge is particularly pronounced in the sandy moraine deposits. Ground water recharge in the glacial till materials is relatively limited.

The regional hydrogeological conditions of the Site comprise of three ground water flow systems: shallow intermediate and deep aquifer system. The shallow flow system occurs in the upper kame deposits, in an unconfined aquifer setting and follows the local topography of the area and discharges into topographically lower areas, such as short intermittent water courses and headwaters of the Don River, within approximately 1 km of the Site. The intermediate and deep ground water flow systems are found beneath confining layers of glacial till, and they follow the regional topography.

The principal drainage feature located at the Site is the Tributary of the East Don River, which is located in its central portion. It is likely that ground water will contribute base flow to the Tributary of the East Don River.

The Site is characterized by a surficial layer of asphalt pavement and/or topsoil underlain by sand and silt, gravelly sand and clayey silt earth fill which in turn is underlain by undisturbed native soil extending to the full depth of investigation. The native soils consist of sand/sandy silt to silty sand with inconsistent layers/lenses of silt or clayey silt.

During precipitation events, water will tend to flow overland and drain along the ground surface following the Site topography. The ground water level at the Site was found to be approximately 1.6m to 17.9 meters below ground surface. The shallow ground water flow at the Site is expected to follow the local topography. Long term ground water monitoring of the wells would be required to determine the changes in the ground water levels as a result of seasonal fluctuations.

The subsurface soils at the Site have hydraulic conductivities ranging between 10^{-6} to 10^{-7} m/s. The medium to high permeability of the subsurface soils at the Site will allow for infiltration, ground water recharge and base flow to the tributary of the East Don River at the Site. The recharge rate for this type of soil is typically on the order of 200 mm/year.

Based on the private water well survey, the surrounding area within a 500 m radius (study area) of the subject site is predominantly on municipal water. There are four (4) private residences or wells situated in the immediate vicinity of the Site. There is no significant use of ground water in the area.

Conventional low impact development storm water management measures should be applied to maintain water balance in the post-development conditions. Final design of the above measures should be reviewed in conjunction with the storm water management plan for the Site.

The development of the Site will result in an overall reduction of ground water recharge and a significant increase in surface water runoff unless appropriate mitigation measures are provided at the design stage. The following mitigation measures can be implemented for the Site.

- Directing and controlling runoff water towards the road-side swales along the boulevard/easement area of the proposed Kirby Road development through gradual outward sloping of the road from its centre.

Based on the measured ground water elevation across the Site, the excavation for the road construction is not likely to extend below the water table; however, perched ground water may be excavated into the excavation. Perched ground water entering the excavation can be controlled by pumping from filtered sumps at the base of the excavation.

The March 2018 report was further updated in December 2018 to address comments received from TRCA. The updated report includes:

- Groundwater quality assessment
- Water balance revision
- Seepage assessment

Requirements for dewatering and ground water seepage rates must be further estimated at the detailed design stage.

The December 2018 report was further updated in April 2019 to address comments received on the Draft ESR review. A discussion on source water protection is included in **Section 8.3**.

3.2.6 Contaminated Sites

SCE conducted a contamination overview study to identify properties or areas with the potential for site contamination either within the proposed road extension corridor or in adjacent areas with the potential contamination to migrate into the anticipated work area. An Environmental Risk Information Services (ERIS) database search was commissioned by SCE to obtain information from federal, provincial and private databases that may be relevant to the project area associated with Alignment 5A, including a 250m buffer. The report can be found in **Appendix C12.**

The ERIS database report identified a total of 24 records within the subject area: 1 Pesticide Register, 1 Environmental Compliance Approval, 2 Ontario spills, 1 waste generator, 2 ERIS historical searches and 17 Water Well Information System.

The Icon Pest Control & Wildlife Removal has 2 reports - Environmental Compliance Approval (active status) and Pesticide Register. The reports are focused on the location south east of Bathurst Street and Kirby Road.

A pipe/hose leak occurred from equipment failure in October 1998 on a development site. The leak was located west of the proposed Kirby Road extension alignment on Dufferin Street. Approximately 80m^3 of sewage and water leaked into the ground with a possibility for soil contamination. Also, a sewage spill from a broken forcemain occurred in December 2004 on the site located west of the Kirby Road and Dufferin Street intersection. The environmental impact is determined to be not anticipated by ERIS.

A waste generation site registered under Ontario Regulation 347 Waste Generators is occupied by Rizmi Aggregates Inc. The approval year indicated is 2011. This site is located east of Dufferin Street and south of the proposed Kirby Road extension.

Historical searches (site reports) were reported for two locations - eastern portion of the study area (January 7, 2013) and the second location at Bathurst Street and Bamble Road (November 28, 2011). Further details of the reports can be determined during the detailed design stage.

The remaining 17 records are regarding Water Well Information System, which include both currently active and abandoned status wells.

Based on the findings provided above, the potential for contaminated soils present within the project area is low. Conducting a Phase 1 Environmental Site Assessment is recommended for the waste generator site at the detailed design.

3.3 Natural Environment

Numerous Natural Heritage studies were carried out from 2010 to 2017 to prepare an inventory of the Natural Environment associated with the Study Area, to assess significance and sensitivity of identified features against existing policies, and to inform the decision making process.

Savanta Inc. has also relied upon supporting background information to provide insight into the overall character of the lands within the Subject Lands. These include:

- Ministry of Natural Resources and Forestry (MNRF) Land Information Ontario (LIO) database;
- MNRF Natural Heritage Information Centre (NHIC) Rare Species (2016) and Vegetation Communities (2013) data;
- Ontario Breeding Bird Atlas Data;
- MNRF wetlands and fisheries information;
- Toronto and Region Conservation Authority (TRCA) natural areas, species of concern and hazard land mapping;
- Region of York Official Plan;
- City of Vaughan Official Plan;
- City of Vaughan Natural Heritage Network Study;
- Oak Ridges Moraine Conservation Plan (ORMCP);
- Environmentally Sensitive Area (ESA) studies, natural areas reports; and
- Various provincial wildlife atlases (i.e. butterflies, amphibians, reptiles, breeding birds, mammals).

3.3.1 Natural Heritage Planning Considerations

This work has been completed with consideration for relevant municipal and provincial standards and best practices. These are summarized in the following subsections.

Provincial Policy Statement

The Provincial Policy Statement (MMAH 2014) provides direction on matters of provincial interest related to land use planning and development. It "…supports a comprehensive, integrated and long-term approach to planning…". Section 2.1 of the PPS, which deals with policies specific to Natural Heritage, was relied up to guide the identification of features or significance associated with the Subject Lands.

Eight types of natural features are defined in the Provincial Policy Statement (PPS):

- Significant wetlands;
- Significant coastal wetlands;
- Habitat of endangered and threatened species;

- Fish habitat;
- Significant woodlands;
- Significant valleylands;
- Significant Areas of Natural and Scientific Interest (ANSI); and
- Significant wildlife habitat.

Oak Ridges Moraine Conservation Plan

The Study Area occurs within the Oak Ridges Moraine (ORM) physiographic region and includes the designations "Natural Core Area", "Natural Linkage Area" and "Countryside Area" identified on the Land Use Designation Map included in the 2017 ORMCP.

According to Section 41(5) of the ORMCP infrastructure may be permitted to cross a key natural heritage feature or key hydrologic feature subject to meeting certain conditions.

The ORMCP defines Key Natural Heritage Features (KNHF) and Hydrologically Sensitive Features (HSF) and stipulates where development is/is not permitted.

Key Natural Heritage Features in Section 22(1) are defined as one or more of the following:

- Wetlands;
- Significant portions of the habitat of endangered, rare and threatened species;
- Fish habitat;
- Areas of natural and scientific interest (life science);
- Significant valleylands;
- Significant woodlands;
- Significant wildlife habitat; and/or
- Sand barrens, savannahs and tallgrass prairies.

Hydrologically Sensitive Features in Section 26(1) are defined as:

- Permanent and intermittent streams;
- Wetlands;
- Kettle Lakes; and
- Seepage areas and springs.

The Subject Lands were reviewed and considered for the presence of the natural features and functions as they related to these definitions.

Provincial Endangered Species Act

The provincial Endangered Species Act (ESA) 2007 was developed to:

- Identify species at risk, based upon best available science;
- Protect species at risk and their habitats and to promote the recovery of species at risk; and
- Promote stewardship activities that would support those protection and recovery efforts.

The ESA protects all threatened, endangered and extirpated species itemized on the Species at Risk in Ontario (SARO) list. These species are legally protected from harm or harassment and their associated habitats are legally protected from damage or destruction, as defined under the ESA 2007 (MNR 2007).

York Region Official Plan

The 2010 York Region Official Plan (YROP) is "… a document that outlines policies of the Regional Municipality of York to guide economic, environmental and community building decisions."

Maps included in the YROP show that portions of the Subject Lands are designated as part of the "Region Greenlands System", Environmentally Significant Areas (ESA), Life and Earth Science ANSIs and woodlands.

The Region of York interactive map was accessed to confirm the presence of natural heritage features. The mapping indicates that the following features area located within the Subject Lands:

- Woodlands;
- Greenlands;
- ORMCP designations;
- ESAs; and
- Life and Earth Science ANSIs.

There were no Key Hydraulic Features identified in the Study Area.

City of Vaughan Official Plan

The 2010 Vaughan Official Plan (VOP) "… addresses the City's long-term planning requirements to the year 2031, in addition to consolidating all former land use policy into one document, this Plan brings the City into conformity with recent Provincial and Regional land use policy direction."

The VOP identifies the following natural heritage designations to be present within and immediately adjacent to the Subject Lands:

- Natural Core Area and Natural Linkage Area;
- ESA;
- ANSI;
- ORM Natural Core, Natural Linkage and Countryside; and
- Category 1 and 2 Landform Conservation Area.

Toronto and Region Conservation Authority Policies

The TRCA conducts reviews of planning processes associated with future development of properties within its jurisdictional boundaries. In addition, the TRCA provides planning and technical advice to planning authorities to assist them in fulfilling their responsibilities regarding natural hazards, natural heritage and other relevant policy areas pursuant to the Planning Act, as both a watershed-based resource management agency and through planning advisory services, in addition to their Regulatory responsibilities.

The TRCA administers the Development, Interference with Wetlands, Alterations to Shorelines and Watercourses Permit process, under Ontario Regulation (O.Reg.) 166/06. This regulation defines the areas of interest that allow conservation authorities to:

- Prohibit, regulate, or provide permission for straightening, changing, diverting or interfering in any way with the existing channel of a river, creek, stream, watercourse or changing or interfering with a wetland; and
- Prohibit, regulate, or provide permission for development if the control of flooding, erosion, dynamic beaches, pollution or the conservation of land may be affected by the development.

TRCA administers 2014 The Living City Policies (LCP) for Planning and Development in the Watersheds of TRCA, issued under Section 20 of the Conservation Authorities Act. The LCP contains the principles, goals, objectives, and policies for the administration of TRCA's legislated and delegated roles and responsibilities in the planning and development approvals process. It includes sections pertaining to the TRCA's role under the Planning Act (LCP Section 7) and policies associated with their administration of O. Reg. 166/06 (LCP Section 8).

Based on the TRCA's interactive web mapping, a wetland and a watercourse identified on the Subject Lands are located within the draft TRCA area regulated under O.Reg. 166/06.

Canada Fisheries Act

The Department of Fisheries and Oceans (DFO) administers the federal 2013 Fisheries Act which defines fish habitat as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes" (Sec. 31.5). Under the Fisheries Act fish do not need to directly use aquatic habitat in order for it to be considered 'fish habitat'. The Act prohibits serious harm to fish, which is defined as the death of fish or any permanent alteration to, or destruction of, fish habitat.

In terms of potential involvement of the DFO, the Fisheries Act shifts the onus to the proponent to ensure that a project is in compliance with the federal Fisheries Act and use a self-assessment form to determine the need for a DFO review.

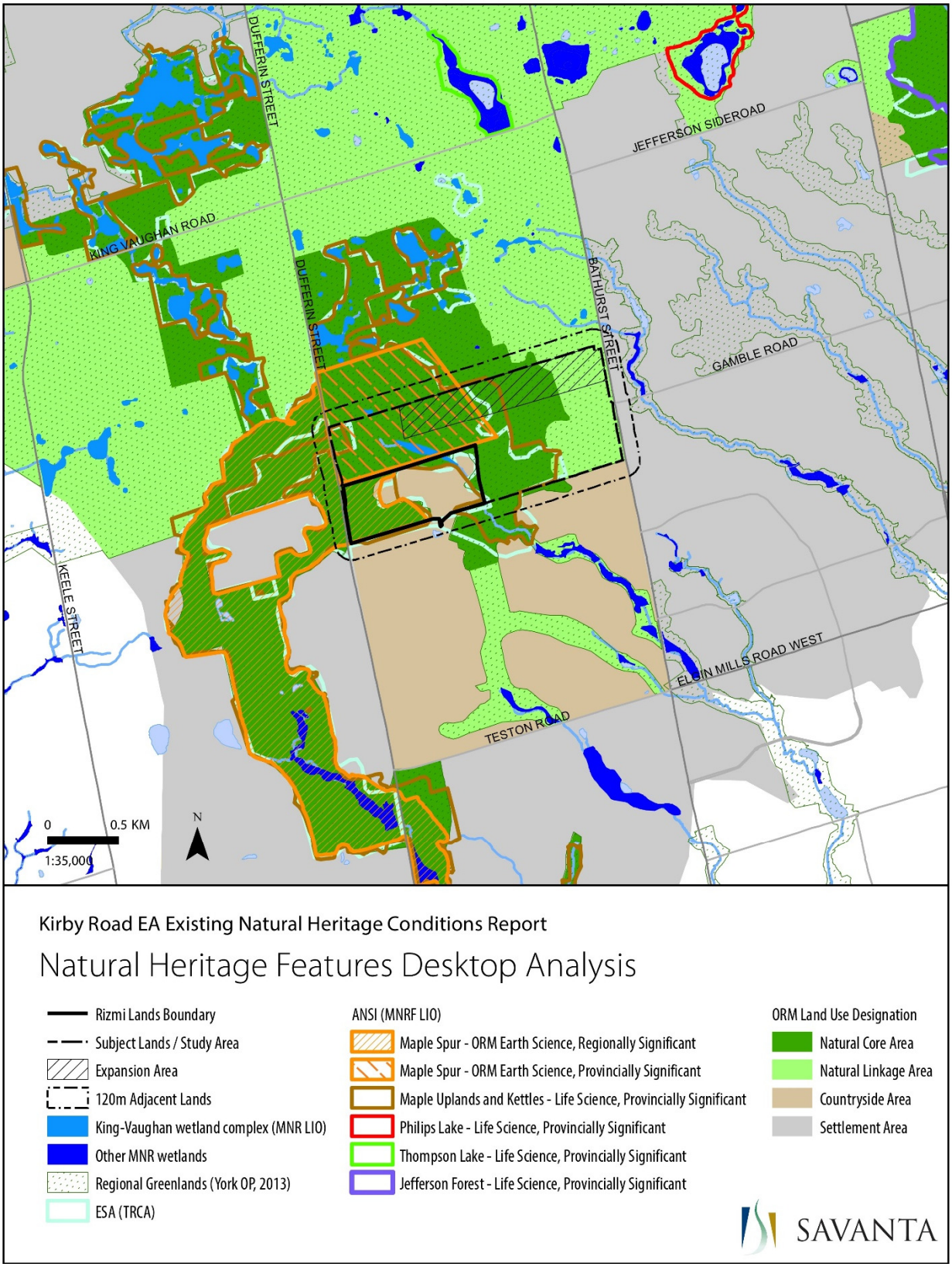
3.3.2 Designated Environmentally Sensitive Areas

A number of Provincially and Regionally designated environmentally sensitive areas are found both within and proximal to the study area. Areas of Natural and Scientific Interest (ANSIs) are lands and waters with features that are important for natural heritage protection, appreciation, scientific study or education. **Figure 7** and **Figure 8** illustrate the Natural Heritage Features described in the following section.

Oak Ridges Moraine

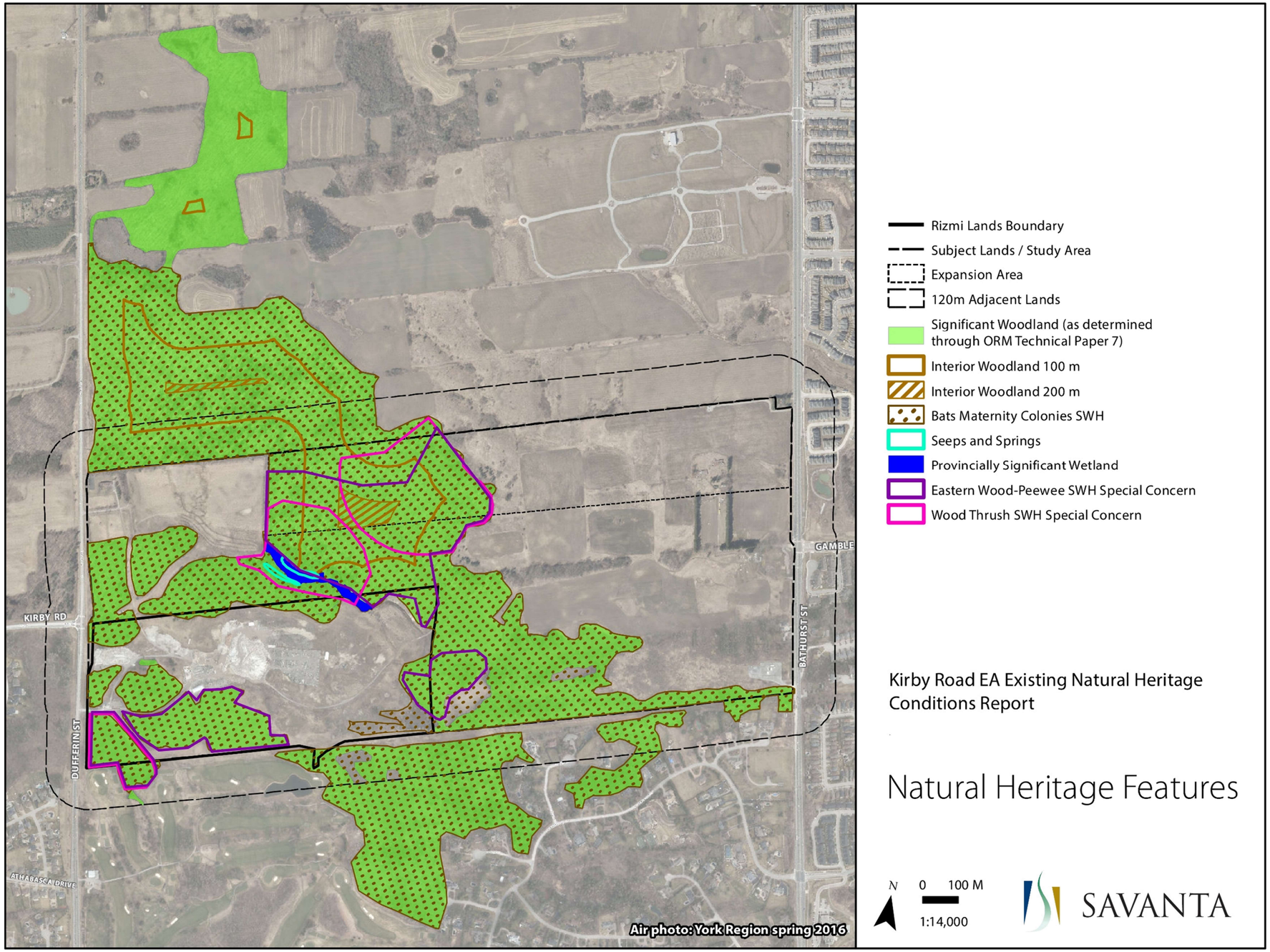
The Oak Ridges Moraine (ORM) is an ecologically and hydrologically important geological landform that was formed through the advancement and retreat of glaciers, and the deposition of stratified sediment. It is this deposition of sand and gravel within the Subject Lands that supported historic aggregate extraction activities.

Figure 7: Natural Heritage Features Desktop Analysis



Adapted from Natural Heritage Existing Conditions Report (Figure 2) by Savanta, dated March 2018

Figure 8: Natural Heritage Features



From Natural Heritage Existing Conditions Report (Figure 11) by Savanta dated March 2018

King-Vaughan Wetland Provincially Significant Wetland Complex

The Subject Lands include one of the 23 wetland units mapped in the King-Vaughan Provincially Significant Wetland Complex. A review of general landscape features and wetland mapping identifies a series of kettle wetlands beginning just north of the Subject Lands. These features are concentrated south of the King-Vaughan Road on both the west and east sides of Dufferin Street. The Wetland Complex is dominated by swamp (83%) with some marsh communities present (17%). The majority of the Wetland Complex is palustrine (outflow with no defined inflow), with the rest as isolated units (reliant on surface water and /or groundwater inputs). Clay, loam and silt soils are present.

Maple Uplands and Kettle Wetlands Provincially Significant Life Science ANSI

The Maple Uplands and Kettle Wetlands Provincially Significant ANSI are comprised of forests dominated by a mixture of Maple, Beech, Birch, Hemlock and/or White Pine trees. The ANSI has the largest forest interior habitat (200 m from forest edge, closed canopy tree cover, successional habitat excluded) in the Don River Watershed. In particular, the forest present on and north and south of the Subject Lands is noted as having the largest interior habitat (92 ha).

Maple Spur Channel Regionally and Provincially Significant Earth Science ANSI

The Maple Spur ANSI is located within the western portion of the Subject Lands, extending west to northwest. Large sand or gravel deposits, 30 m to 60 m above the Halton Till Plain to the south, are present, some of which were extracted from the former aggregate extraction lands.

McGill Area Environmentally Significant Area

The McGill Area ESA has been designated by Toronto and Region Conservation Authority (TRCA) and includes the King-Vaughan Wetland Complex, Maple Uplands and Kettle Wetlands Life Science ANSI, Cook's Area Life Science ANSI and the Maple Spur of the Oak Ridges Moraine Earth Science ANSI described above.

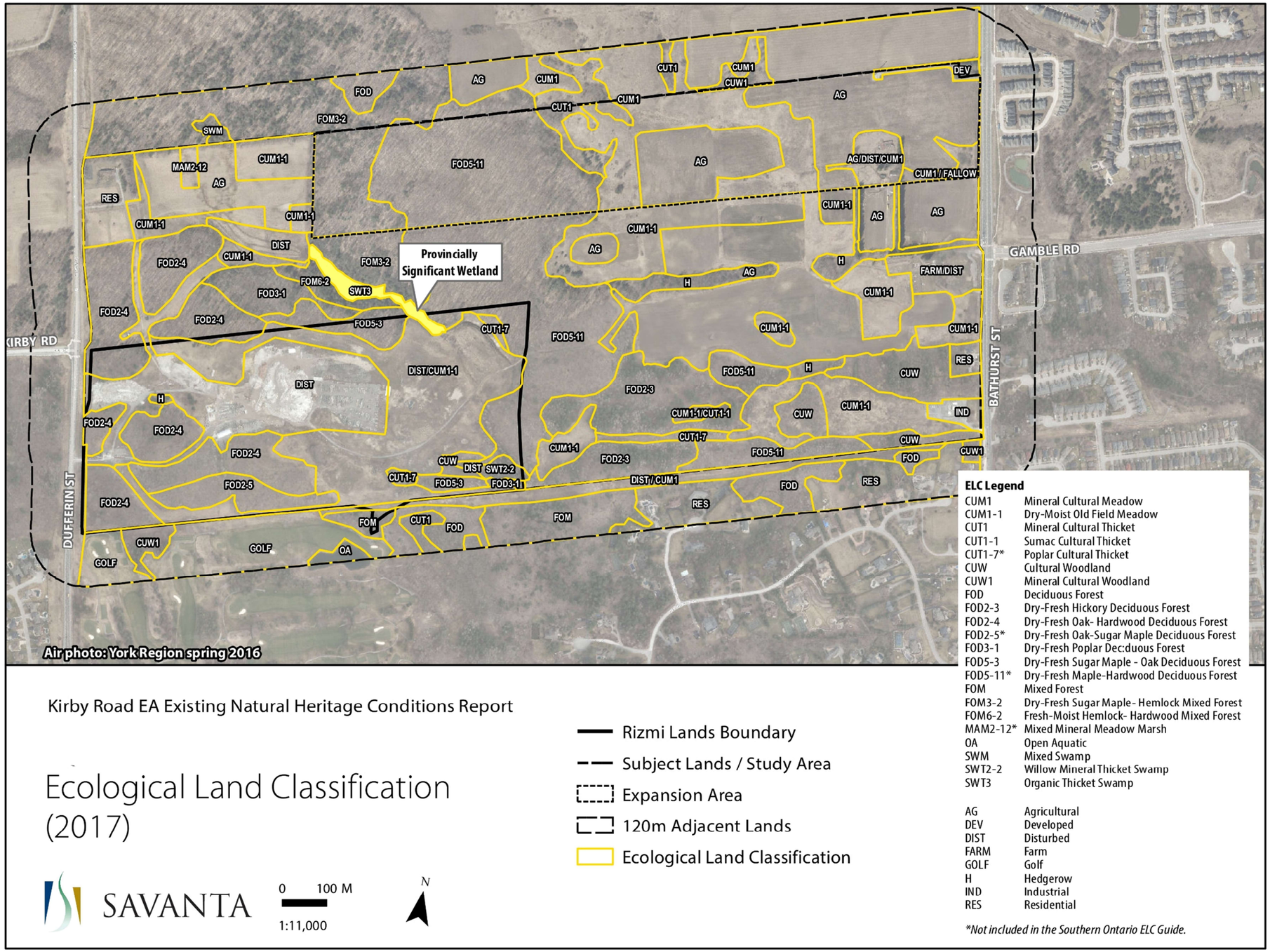
3.3.3 Wetlands

Wetlands are present on the Subject Lands and within 120 m of the Subject Lands, as shown on **Figure 9**. Within Ontario, Significant Wetlands are identified by the MNRF or by their designates. Other evaluated or unevaluated wetlands may be identified for conservation by the municipality or the conservation authority.

The Subject Lands contain a PSW unit that is part of the King-Vaughan PSW Complex. The PSW unit on the Subject Lands is an organic thicket swamp.

There are also wetland units within the Subject Lands that have not been evaluated in accordance with the Ontario Wetland Evaluation System (2014). At the southern end of the drainage feature on-site, there is a wetland unit comprised of a disturbed mineral meadow marsh (removed in 2016) and willow mineral thicket swamp.

Figure 9: Ecological Land Classification



From Natural Heritage Existing Conditions Report (Figure 4) by Savanta, dated March 2018

3.3.4 Groundwater

Broad level TRCA mapping from the Don River Watershed studies shows that the Halton Aquitard overlays the Oak Ridge's Aquifer in some places from Kirby Road and east of Dufferin Street to just south of Langstaff Road. Bedrock groundwater flow is predominately lateral towards regional discharge zones such as Lake Ontario. Regional groundwater flow in the aquifers within the general area is south-southeast from the ORM towards Lake Ontario, except where major river valleys exist. Locally, groundwater flow paths bend into river valleys and isolated topographic depressions (AECOM 2010).

AECOM (2010) defines the hydrogeological character of most of the Subject Lands as "Highly Sensitive", with moraine and fringe areas. The southwestern margin of the Subject Lands is assigned a "Moderately Sensitive" designation, with thin till over moraine.

Evidence of groundwater seeps was noted in the PSW unit along the edges of the organic swamp thicket and near the southern boundary of the Subject Lands. The seepage zones associated with this wetland are shown on **Figure 10**. Several areas of groundwater discharge associated with the surface water drainage feature were also observed with evidence provided by the presence of watercress and iron hydroxide precipitates.

3.3.5 Surface Water

An intermittent surface water drainage feature runs through a portion of the Subject Lands. The feature originates in the King-Vaughan Wetland Complex and flows south before encountering the TransCanada Pipeline (TCPL) corridor at the southern end of the Subject Lands where further downstream flow is prevented by the berm. Water pools upstream from the berm where it is either infiltrated into the ground or evaporated.

The portion of the feature between the upstream and downstream wetlands does exhibit characteristics consistent with the definition of an intermittent stream provided in Appendix 1 of ORMCP Technical Paper 12 (Hydrological Evaluations for Hydrologically Sensitive Features). However, the definition does not provide any criteria regarding connection of surface water drainage features to other downstream surface water features.

The area downstream from the berm, on the adjacent property which is owned by the City of Vaughan, was investigated on June 8, 2016 to determine if a watercourse was present immediately downstream from the berm. The first evidence of surface water within the low lying area of the woodland was found approximately 150 m downstream from the pipeline in the form of wet soils with some standing water. Downstream from this location, the woodland valley floor alternated between dry and standing water. Based on the observations, the downstream watercourse appears to originate in the woodland approximately 320 m downstream from the pipeline. Those origins appear to be a combination of groundwater inputs and surface water drainage from the tablelands within the woodland.

Given that the water drainage feature on the Subject lands does not have a direct surface water connection to any downstream permanent or intermittent stream, and therefore does not provide any of the contributing functions normally attributed to headwater intermittent streams, its value is

significantly reduced compared to that which may be provided by connecting intermittent streams. Therefore, for the purposes of this assessment, it is not considered to be an intermittent stream. However, this drainage feature does provide local functions (flow conveyance from and to the upstream and downstream wetlands, including groundwater discharges, localized habitat for benthic invertebrates and salamanders).

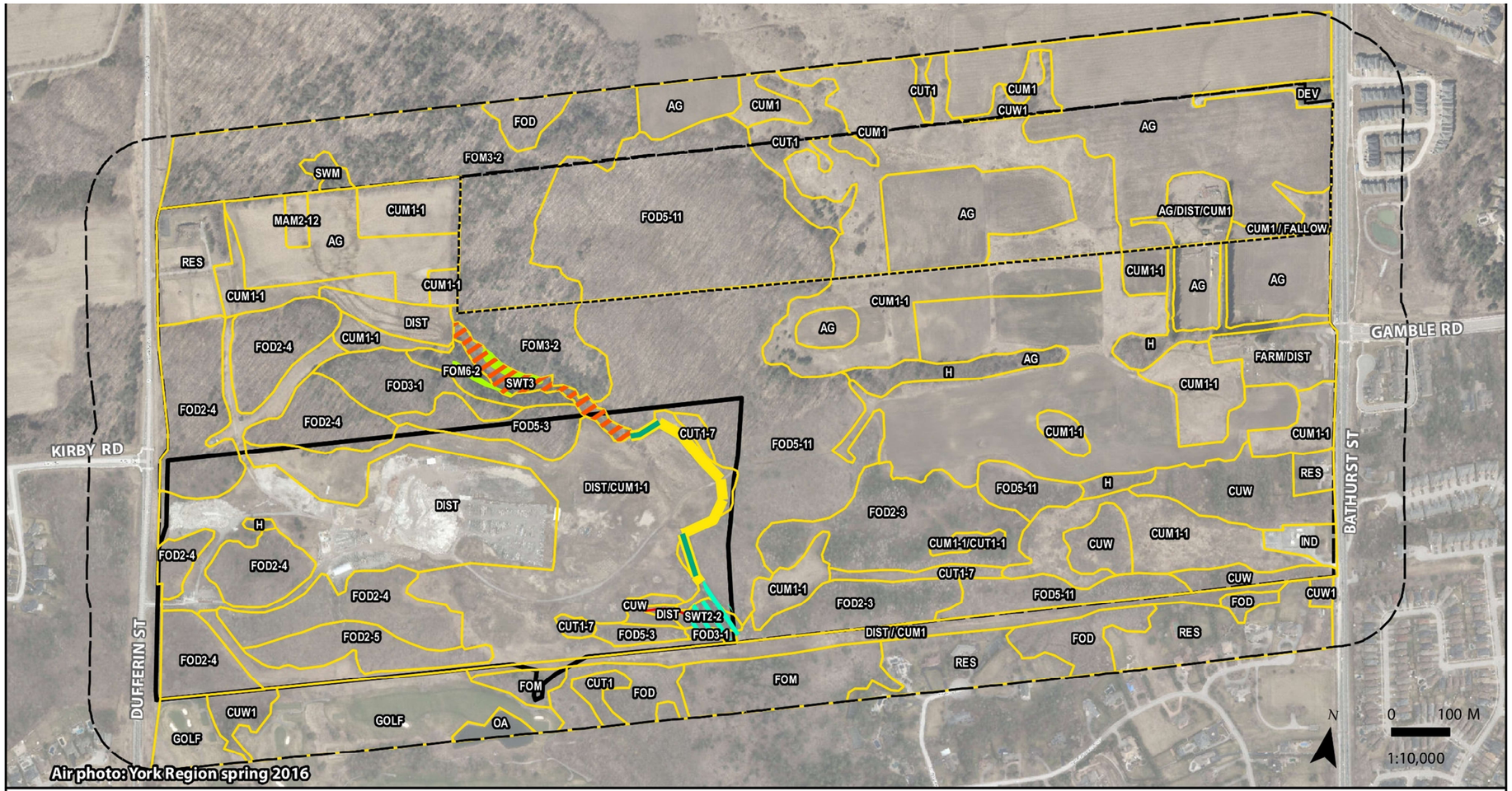
The surface water drainage feature has been the subject of a Headwater Drainage Feature Assessment (HDFA) and a Fluvial Geomorphological Assessment.

The HDFA was conducted by Savanta Inc. in the Subject Lands on August 11, 2011 to identify and classify potential headwater drainage features. Seven reach segments were identified in the drainage that traverses the central portion of the Subject Lands. These reaches are described in **Table 3** of the Natural Heritage Existing Conditions (NHEC) report (May 2019, Savanta Inc.) included in **Appendix C1.1**. This drainage feature has been altered from its original alignment and there is a culvert between reaches 3 and 4. The headwaters of the drainage feature commence at the north end of a wetland feature within a wooded area. Reaches 1 and 2 were the only portions of the feature where water was present during the assessment. Water was also present within a small wetland area at the connection of Reaches 5 and 6, which also formed part of the original watercourse. This feature is considered to be a headwater drainage feature, and as noted previously, likely formed the headwaters of Patterson Creek, although since construction of the TCPL at the southern end of the Subject Lands, there has been no direct surface water connection with Patterson Creek. Therefore, the primary function of this watercourse is to convey flow to the wetland at the southern end of the Subject Lands where it pools and either infiltrates into the ground, evapotranspirates or evaporates.

The fluvial geomorphological assessment of the surface water drainage feature was completed by GEO Morphix Ltd. in 2015. The historical aerial photograph review, which examined aerial photographs taken between 1946 and 2015, concluded that the drainage feature, originally identified as the East Tributary of Patterson Creek, has experienced significant changes over the period covered by the imagery, including realignment, channelization, removal of tree cover and the disruption of channel and flow continuity by TCPL corridor.

Within the shrub thicket wetland where the drainage feature originates, no defined flow pattern was observed. The downstream reach runs within a constructed, V-shaped valley feature, with no bankfull indicators and limited evidence of stable channel morphology. The top of the pipeline is located approximately 2 m above the wetland bed and there was no evidence of flow spilling over the top of the pipeline. Further details of the assessment can be found in the Upper East Patterson Creek Geomorphic Assessment report (January 2016, GEO Morphix Ltd.) included in **Appendix C6.1** of the ESR.

Figure 10: Headwater Drainage Features and Benthic Invertebrate Sampling Locations



Kirby Road EA Existing Natural Heritage Conditions Report

Headwater Drainage Features and Benthic Invertebrate Sampling Locations

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification
- Groundwater Discharge Channel
- Benthic Invertebrate Sampling Locations
- Headwater Assessment Points
- Organic Thicket Swamp
- Willow Mineral Thicket Swamp

SAVANTA

From Natural Heritage Existing Conditions Report by Savanta dated March 2018

3.3.6 Aquatic Ecology

The Subject Lands are located within the Patterson Creek subwatershed of the overall Don River watershed. As discussed in **Section 3.3.5**, the historically realigned surface water drainage feature in the Subject Lands is not hydraulically connected with downstream reaches of Patterson Creek, a tributary of the East Don River. Patterson Creek, the mapped portions of which commence on the lands south of the Subject Lands, is designated as intermittent coldwater habitat.

There is no direct or indirect fish habitat present in the Subject Lands. The TCPL berm represents a distinct and definite barrier to any fish movement to reaches upstream of the berm. Further, the berm also acts as a flow barrier for any drainage coming from the upstream catchment area. The lack of a culvert at the berm and the height of the berm itself create an effective flow dam that prevents flows moving to reaches downstream of the TCPL corridor. Given these conditions, the defined surface water drainage feature in the Subject Lands is not considered fish habitat from either a direct or contributing perspective.

Benthic invertebrates (benthos) are organisms that live in or on the bottom sediments of rivers, streams, and lakes. The Subject Lands were sampled for benthos on May 30, 2012 by Entomogen Inc. A complete report from Entomogen Inc. is provided in Appendix D to the NHEC report.

Suitable sampling sites were limited by low water levels. Samples were successfully taken from two locations. Sampling followed the methodology recommended in the Ontario Benthos Biomonitoring Network (OBBN) Protocol Manual. Picked individuals were identified to a mix of Classes, Orders, and Families in accordance with the Ministry of the Environment Rapid Bioassessment Levels and were enumerated.

A total of 39 different taxa were observed across the two sites. Both sites possessed good diversity, with a variety of invertebrates found. Samples from one site also contained salamander larva indicating that this area is also a breeding area for salamanders.

The MNRF indicated Redside Dace (*Clinostomus elongatus*) fish, which is Endangered in Ontario and Canada, is present in the East Branch of the Don River approximately 2.5 km downstream of the Subject Lands. Based on mapping from Fisheries and Oceans Canada (DFO 2015), entitled “Distribution of Fish Species at Risk”, the watercourse is identified as Occupied or Recovery habitat for Redside Dace. Based on the overall observations within and outside of the Subject Lands, given that there is no direct surface water connection to the downstream watercourse which eventually flows into Occupied or Recovery habitat for the species, the drainage feature in the Subject Lands should not be considered as part of Redside Dace Regulated habitat (per Section 29.1 of the Ontario Regulation (O.Reg) 242/08). Also, the surface drainage feature does not meet the requirements to be considered Contributing Habitat, since it does not appear to “augment or maintain the baseflow, coarse sediment supply or surface water quality” of the downstream occupied Redside Dace habitat in the East Don River.

3.3.7 Terrestrial Ecology

The Subject Lands consist primarily of active agricultural land, open meadows, disturbed areas, former aggregate extraction lands and forest habitat. Natural areas are comprised primarily of forested

uplands, with pockets of tree and shrub swamp located in the bottomlands and/or along drainage features. Deciduous forest communities dominate woodland areas, with mixed communities present as well. Vegetation communities have been and continue to be affected by ongoing site practices. Single family residential homes are present in the northwest and southeast corners of the Subject Lands, also a small industrial/commercial facility is present in the southeast corner.

Landscape Ecology

The local landscape is dominated by existing development, open space/natural areas, disturbed quarry areas, farmland, a golf course and an existing and established road network. The Subject Lands provide opportunity for wildlife movement/linkage in an east to west direction with the existing Kirby Road allowance helping to facilitate this movement between Dufferin and Bathurst Streets. However, beyond the Subject Lands these connections are limited with existing residential development immediately west of Dufferin Street and East of Bathurst Street. The tributary of East Patterson Creek provides limited north to south connection beyond the Subject Lands due to the pipeline berm preventing hydrological connection to the Don River valley to the south and east.

It is anticipated that culverts associated with existing roadways facilitate the minor movement of wildlife on a local scale for small to medium sized wildlife (frogs, toads, snakes, turtles, raccoons, skunks, rabbits, squirrels, opossums, voles, etc.).

Vegetation Communities and Vascular Plants

In Ontario, the MNRF defines ecological units on the basis of bedrock, climate (temperature, precipitation), physiography (soils, slope, aspect) and corresponding vegetation, creating an Ecological Land Classification (ELC) system. Vegetation assessments completed on the Subject Lands consisted of spring, summer and fall vascular plant inventories and the application of the ELC system. The purpose of these surveys was to document natural and anthropogenic vegetation features on the Subject Lands and to determine their provincial and regional significance. Current vegetation community types are depicted in **Figure 9**.

The Land Information Ontario (LIO) database was accessed to determine if any wetlands known to the MNRF occur on or in the vicinity of the Subject Lands. Such wetlands could include PSWs, MNRF evaluated wetlands, unevaluated wetlands, or wetlands identified as “other”.

One of the 23 wetland units mapped in the King-Vaughan Provincially Significant Wetland Complex occurs within the Subject Lands. This unit, defined as an organic thicket swamp ecosite (SWT3) was further delineated through field verification.

A total of 290 species of vascular plants were recorded from the Subject Lands. Of that number, 197 (or 68%) species are native, and 93 (or 32%) species are exotic. The majority of the native species are found in the natural forests and wetlands.

The majority of the native species, 178 (or 90%) are ranked S5 (secure in); 18 species (or 9%) are ranked S4 (apparently secure in Ontario); and one species is ranked S2 (imperiled) discussed below. Thirteen species are considered rare in York Region (Varga et al. 2005). None of the regionally rare species are considered rare in Ontario. One of the species Small Yellow Water-crowfoot (*Ranunculus gmelinii*) recorded from the Subject Lands had a Co-efficient of Conservation (CC) value of 10. This CC value,

ranging from 0 (low) to 10 (high), is based on a species tolerance of disturbance and fidelity to a specific natural habitat. Species with a CC value of 9 or 10 generally exhibit a high degree of fidelity to a narrow range of habitat parameters.

One Species at Risk plant was recorded on the Subject Lands: Butternut (Juglans cinerea), which is Endangered in Ontario and Canada, and ranked as S2 (imperiled in Ontario).

An NHIC data search was conducted for the Subject Lands using the MNRF Biodiversity Explorer. No rare species have been historically documented (within the last 20 years) on or in the vicinity of the Subject Lands.

Birds

Breeding bird surveys were conducted in 2010 to 2012, 2014 and 2015 (Appendix E, 2018 NHEC, Savanta) on the Rizmi lands, which extend east to Bathurst Street and more recently in 2017 (Appendix B, 2018 NHEC, Savanta) within the entire Subject Lands. During the surveys, vegetation was assessed for potential presence of Species at Risk (SAR) habitat. If suitable habitat was encountered or individuals were observed standard protocols were utilized.

Both the 2016 Natural Heritage Information Centre (NHIC) database and the Species at Risk in Ontario (SARO) list (O. Reg. 230/08) were reviewed to determine the current provincial status for each bird species.

Eight bird surveys were conducted from 2010 to 2012, from which a total of 67 species of birds were observed in the Subject Lands (**Table 4, Appendix E**). Of these, 57 species exhibited evidence of breeding on the Subject Lands, with the remaining ten species considered non-breeders, flyovers or migrants.

Four Species at Risk (SAR) were recorded with breeding evidence on the Subject Lands: Bank Swallow, Barn Swallow, Wood Thrush and Eastern Wood-Pewee. Observations of the species noted above are similar to records from subsequent years.

A targeted search for Species at Risk birds and associated habitats was conducted in the Subject Lands on May 28, 2014. A total of 52 bird species were recorded, of which 49 species are confirmed, probable or possible breeders on the Subject Lands. The remaining three bird species are considered non-breeders, flyovers or migrants.

A total of 46 (94%) of the species that demonstrated breeding evidence in the Subject Lands are provincially ranked S5 (common and secure) and S4 (apparently common and secure) or SNA (introduced species not native to Ontario). Three Species at Risk birds were also recorded in 2014 that were observed previously during the 2010-2012 period: Eastern Wood-Pewee, Bank Swallow, and Wood Thrush.

SWH indicator species observations in 2014 were similar to those noted during complete, two-round breeding bird surveys in 2017.

One survey was conducted on July 8, 2015 and included 10 point-count locations that were placed in all represented habitats in the Rizmi owned portion of the Subject Lands. A total of 37 bird species were observed within the Subject Lands. Of this total, five species are confirmed, 16 are probable and 16 are possible breeders.

A total of 37 (100%) of the confirmed, probable or possible breeders are provincially ranked S5 (secure in Ontario), S4 (apparently secure in Ontario) or SNA (species not native to Ontario). The Subject Lands were screened for potentially suitable habitat for Bobolink and Eastern Meadowlark (two Threatened species that rely on grassland/open habitats). Four Species at Risk were recorded: Bobolink, Bank Swallow, Wood Thrush and Eastern Wood-Pewee.

SWH indicator species observations in 2015 were similar to those noted during complete, two- round breeding bird surveys in 2017.

A total of 63 bird species were observed within the Subject Lands in 2017. Of this total, 11 species are confirmed, 36 are probable and 15 are possible breeders. The remaining species is considered a non-breeder, flyover or migrant.

A total of 63 (100%) of the confirmed, probable or possible breeders are provincially ranked S5 (secure in Ontario), S4 (apparently secure in Ontario) or SNA (species not native to Ontario). No bird species are considered provincially rare (S1-S3; NHIC 2016).

The following Species at Risk were observed within the Subject Lands: Bobolink, Bank Swallow, Barn Swallow, Wood Thrush and Eastern Wood-Pewee.

Fifteen species that exhibited breeding evidence on the Subject Lands in 2017 are listed as indicator species according to the Province's significant wildlife habitat (SWH) criteria for ecoregion 6E (MNRF 2015).

Insects

Insect surveys were conducted within the Subject Lands in the summer of 2017. Previous surveys were conducted within a portion of the Subject Lands by Entomogen Inc. in 2011. Insect surveys were conducted to identify the presence and abundance of two, targeted insect Orders: Butterflies (*Lepidoptera*) and Dragonflies (*Odonata*).

Butterflies and dragonflies are excellent indicators of habitat diversity and quality (Hall et al. 2014, Catling and Brownell 2000). Dragonflies are particularly noted as indicators of water quality (Needham et al. 2014) and several Species at Risk in both groups are identified in Ontario.

A total of 23 lepidopteran species and 17 odonate species were collected during the 2011 surveys. All species observed are ranked S4 (secure in Ontario) or S4 (apparently secure in Ontario) or SNA (not native to Ontario). Species at Risk and locally rare species observed (according to Halton Region Checklist and Toronto Entomological Society information) include: Monarch, Black-tipped Darner, Racket-tailed Emerald, Northern Bluet. The complete report from Entomogen Inc. is provided in Appendix D of the NHEC.

There were 29 butterfly and 19 dragonfly species recorded on the Subject Lands during the 2017 insect surveys, as listed in Table 8, Appendix B of the NHEC. In addition, two bumblebee species, one moth, one wasp and three tiger beetle species were recorded during insect and breeding bird surveys.

All but one species observed are provincially ranked S5 (secure in Ontario), S4 (apparently secure in Ontario) or SNA (species not native to Ontario). Monarch (*Danaus plexippus*) is Special Concern in

Ontario and Endangered in Canada. Monarch was observed during all three insect surveys at various old field/meadow locations.

Amphibians

Amphibian call-count surveys (AMC) and amphibian Egg Mass Surveys (EMS) were conducted across several years on the Subject Lands:

- AMC surveys completed on a portion of the Subject Lands in 2010.
- AMC and EMS completed on a portion of the Subject Lands in 2016; and
- AMC and EMS completed across the Subject Lands in 2017;

These surveys were conducted to identify the presence and abundance of amphibian species in open water, marsh, swamp and vernal pool habitats, to contribute to an understanding of wetland diversity and quality. Species at Risk and/or significant wildlife habitat may be identified through these methods. Six amphibian stations were surveyed in 2010, four stations in 2016 and five stations in 2017.

Three amphibian species were recorded within the Subject Lands during three rounds of AMC assessments conducted within the Subject Lands (American Toad, Green Frog and Spring Peeper). No formal egg mass surveys were conducted on the Subject Lands in 2010.

Three rounds of AMC and three rounds of EMS surveys were completed in April, May and June within the Rizmi portion of the Subject Lands in 2016. Four amphibian species were recorded in total (Spring Peeper, Gray Treefrog, Green Frog, and Northern Leopard Frog). All of the species observed are common and secure or apparently secure in Ontario (S5 or S4; NHIC 2016)

Five amphibian stations were surveyed in 2017. Six amphibian species were recorded within the Subject Lands during the AMC and EMS assessments (American Toad, Spring Peeper, Green Frog, Gray Treefrog, Wood Frog, and Spotted Salamander). All of the amphibian species are provincially ranked S5 (secure in Ontario) or S4 (apparently secure in Ontario) (NHIC 2016).

Reptiles

The surveys helped to identify the presence and abundance of often-elusive reptile species and their habitats. Species at Risk and/or significant wildlife habitat may be identified through these methods.

Visual encounter snake transect surveys were completed on the Subject Lands during the spring emergence period in April and during the period when snakes return to hibernacula (i.e., about September 2017). During these periods, the probability of observing snake species is generally higher.

A total of sixteen snake transects were surveyed on the Subject Lands in April 2017. During subsequent vegetation surveys, three potential snake hibernacula were found and, as a result, snake survey transects were adjusted to target these locations and other areas of interest during September 2017 snake surveys. The Fall snake surveys also included transects along the internal roads in the western portion of the Subject Lands (associated with the aggregate recycling area).

No snakes were observed during spring 2017 snake surveys. During Fall 2017 snake surveys, low numbers (1 to 2 individuals) of one snake species, Eastern Gartersnake (*Thamnophis sirtalis sirtalis),*

were recorded within the Subject Lands. This species is common and secure in Ontario (NHIC 2016). The results of snake transect surveys and wildlife road-crossing surveys are provided in **Table 11** and **Table 12** in **Appendix B** of the NHEC, respectively.

Three potential snake hibernacula sites (overwintering areas) were identified. Of the three potential hibernacula sites, snakes were observed only in the vicinity of the potential hibernacula (small mammal burrow in a south-facing slope) located in the woods east of the aggregate portion of the Subject Lands. No snakes were observed entering/exiting any of the potential hibernacula.

Winter Wildlife

Winter wildlife field surveys were conducted on February 26, 2012. The purpose of the investigation was to establish presence/absence and relative importance of winter wildlife habitat within the Subject Lands by recording wildlife tracks, trails, signs, species observations, and other significant habitat details.

Winter wildlife surveys that were conducted along transects throughout a portion of the Subject Lands. Surveys were concentrated along existing access routes, trails, habitat edges, hedgerows, and streams, as long as habitat was safely accessible by snowshoes.

Ten mammal and three bird species were identified during this winter survey of the Subject Lands. All species observed are considered provincially and globally common (S5/G5; NHIC 2016).

Bats

Suitable bat roosting tree density surveys were completed in May 2016. Bat roosting tree density surveys are completed in association with qualitative assessments as snags are indicators of high quality potential maternity roost habitat. Bat maternity colonies are considered by the MNRF to be a type of significant wildlife habitat as per the Provincial Policy Statement (PPS) (MMAH, 2014). Further, the four provincially protected bat species are known to establish maternity roosts in trees, both within woodlands and hedgerows.

Based on the survey results, candidate Significant Wildlife Habitat for Bat Maternity Colonies is present within most of the polygons on the Subject Lands.

Given that suitable roosting trees were identified within numerous polygons on the Subject Lands, follow-up acoustic monitoring surveys in June 2016 were undertaken to determine which species of bats are present on the Subject Lands. Additional surveys were conducted in June-July, 2017.

The surveys were completed in and adjacent to natural features meeting criteria provided in "Survey Protocols for Species at Risk Bats within Treed Habitats: Little Brown Myotis, Northern Myotis, and Tri-Coloured Bat" (MNRF 2017), and as described in Province's Significant Wildlife Habitat Criterion Schedule for Ecoregion 6E (MNRF 2015).

Bat species can be identified using sonographic characteristics from calls used by bats to echolocate. During the passive acoustic surveys, six bat species were confirmed to be present on the Subject Lands: Big Brown Bat *(Eptesicus fuscus),* Hoary Bat (*Lasiurus cinereus*), Silver-haired Bat *(Lasionycteris noctivagans),* Eastern Red Bat *(Lasiurus borealis)*, Eastern Small-footed Bat *(Myotis leibii),* and Little Brown Bat *(Myotis lucifugus).*

3.3.8 Endangered and Threatened Species

The Ontario Endangered Species Act (ESA) 2007 was developed to:

- Identify species at risk, based upon best available science;
- Protect species at risk and their habitats and to promote the recovery of species at risk; and
- Promote stewardship activities that would support those protection and recovery efforts.

The provincial ESA protects all threatened, endangered and extirpated species itemized on the SARO list. These species are legally protected from harm or harassment and their associated habitats are legally protected from damage or destruction, as defined under the ESA.

Information about SAR and their habitats is considered provincially sensitive. The survey methods, results and potential impacts to SAR species and their habitats will be submitted to the MECP through the Information Gathering Form (IGF) process. Due to the sensitive nature of this information, all correspondence and outcomes will remain with the MECP and its jurisdiction. Two endangered species, three threatened species and two species of special concern were recorded within the Subject Lands and are discussed below.

Presence of Butternut (*Juglans cinerea*) tree, which is Endangered in Ontario and Canada, and ranked as S2 (imperiled in Ontario) was recorded on the Subject Lands. Butternut trees are divided into 3 categories:

- Category 1: in the advanced stages of disease as a result of butternut canker (“non-retainable”)
- Category 2: the tree does not have butternut canker or disease is not as advanced (“retainable”)
- Category 3: could be useful in determining how to prevent or resist butternut canker (“archivable”)

A Butternut inventory and health assessment conducted in 2017 documented 23 trees, of which 20 were Category 1, three were Category 2, and none were Category 3. Detailed survey locations are maintained on file to protect the confidentiality around SAR. The results of the Butternut survey will be reviewed with the MECP.

Eastern Small-footed Myotis (*Myotis leibii*) bat, which is Endangered in Ontario and Canada, was recorded in 2017 in the large contiguous woodland that extends north-south through the Subject Lands. The forest communities on the Subject Lands contain suitable roosting trees for bats and, therefore, the forests should be considered habitat for Eastern Small-footed Myotis.

Little Brown Myotis (*Myotis lucifugus*) bat, which is Endangered in Ontario and Canada, was identified during 2017 field investigations in woodlands east of Dufferin Street. These woodlands contain suitable roosting trees for bats and, therefore, provide habitat for Little Brown Myotis.

Additional discussions will be held with MECP to determine the requirements to address these species under the ESA.

Presence of Bank Swallow (*Riparia riparia*) bird, which is Threatened in Ontario and Canada, was observed. A nest colony (239 nest holes counted) was first recorded in 2012 within an aggregate pile in

the Subject Lands. Breeding evidence was observed in 2014 (25 appeared to be in active use by 20 to 30 birds) and 2015 (6 birds observed near nest site).

Up to 35 individuals were observed in 2017 within the aggregate portion of the Subject Lands. The birds were unsuccessfully attempting to excavate holes for breeding (habitat characteristics/slope were unsuitable). The Subject Lands do not appear to provide suitable breeding habitat for this species.

Presence of Barn Swallow (*Hirundo rustica*) bird, which is Threatened in Ontario and Canada, was recorded. Multiple birds were observed foraging over the Subject Lands during 2010, 2011, 2015 and 2017 surveys. However, no nesting structure was observed that was associated with breeding by this species. It was determined that these birds were coming from off-site nesting areas to forage over the lands. This species may nest in small outbuilding structures associated with the residence in the northwest corner of the Subject Lands or on other residences along Bathurst Street.

Breeding habitat for Bobolink (*Dolichonyx Oryzivorus*) bird, which is Threatened in Ontario and Canada, was confirmed within the Subject Lands during 2017 surveys. Probable and confirmed breeding evidence was noted in one habitat polygon in the northeast portion of the Subject Lands, and possible breeding evidence was recorded within on cultural meadow at the east end of the Subject Lands. This species was previously observed within the Subject Lands in 2011 and 2015. Surveys following the MNRF (2012) Bobolink survey protocol were conducted in 2017 only.

Monarch (*Danaus plexippus*) butterfly is Special Concern in Ontario and Endangered in Canada. Monarch was observed during three insect surveys at various old field/meadow locations. The habitat of this species on the Subject Lands is identified as candidate significant wildlife habitat (MNRF 2015).

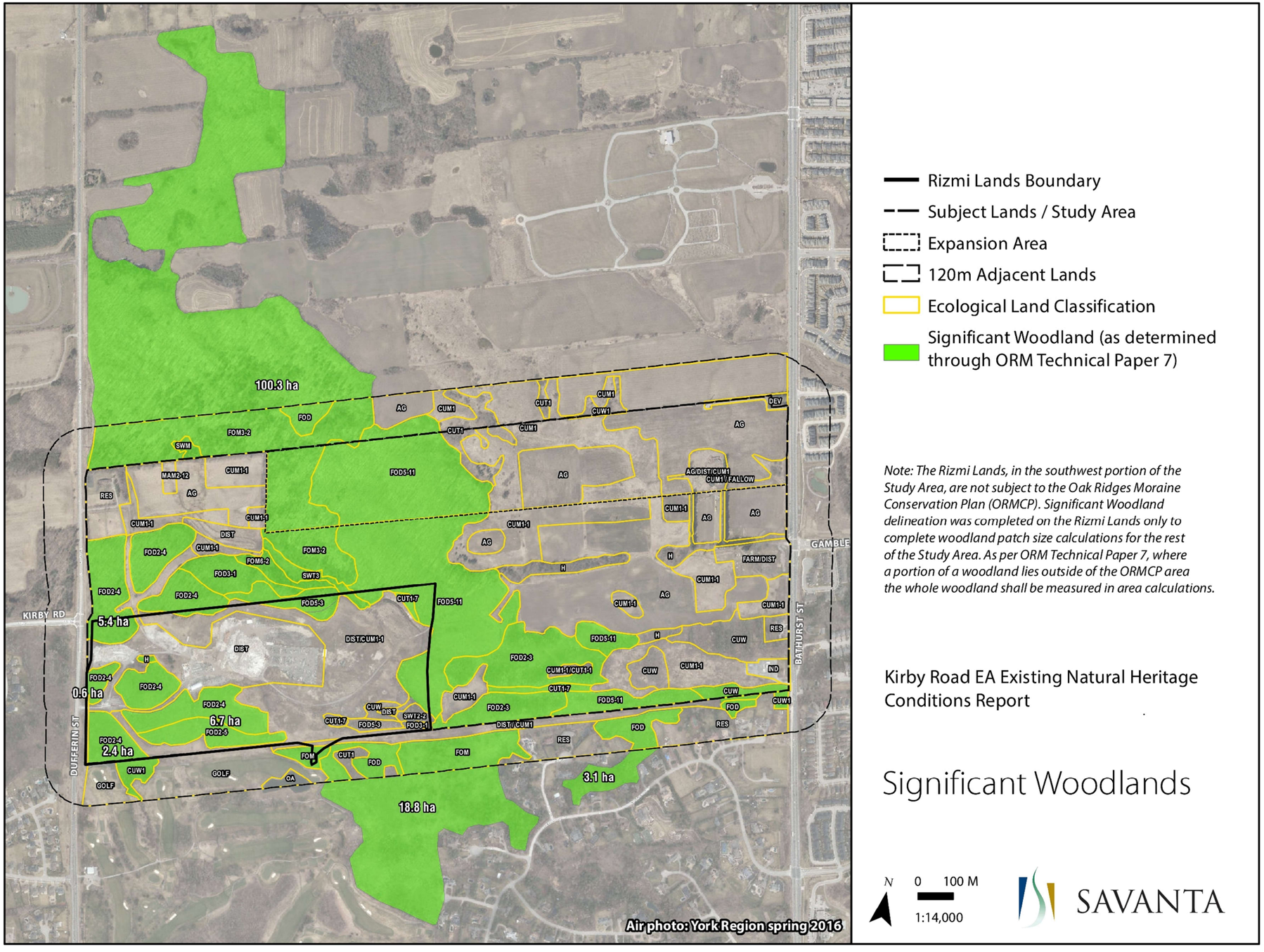
Wood Thrush (*Hylocichla mustelina*) bird is Special Concern in Ontario and Threatened in Canada. The habitat of this species on the Subject Lands is confirmed as significant wildlife habitat (MNRF 2015).

Eastern Wood-Pewee (*Contopus virens*) bird is Special Concern in Ontario and Canada. The habitat of this species on the Subject Lands is confirmed as significant wildlife habitat (MNRF 2015).

3.3.9 Analysis of Ecological and Natural Heritage Significance

The Natural Heritage Reference Manual (NHRM) (MNR, 2010) provides guidance regarding the interpretation of significance of natural heritage features and associated functions. Sections below provide summary of the natural features found in and adjacent to the Subject Lands and their ecological functions. **Figure 11** illustrates significant woodlands in the Subject Lands.

Figure 11: Significant Woodlands



From Natural Heritage Existing Conditions Report by Savanta dated March 2018

Significant Natural Heritage Features Under PPS

Of the eight types of significant natural heritage features defined in the PPS (MMAH, 2014), the following occur and are subject to impact assessment:

- Habitat of Endangered and Threatened Species;
- Significant Wetlands (One PSW unit that is part of the King-Vaughan PSW complex. The unit is an organic thicket swamp identified as SWT3);
- Maple Uplands and Kettles Provincially Significant Life ANSI;
- Significant Woodlands;
- Significant Wildlife Habitat (relevant SWH criteria are met for habitat size, vegetation and indicator species):
    - ✓ Bat Maternity Colonies;
    - ✓ Area-Sensitive Bird Breeding Habitat; and
    - ✓ Special Concern Species Habitat (Eastern Wood-Pewee and Wood Thrush).
- Candidate Significant Wildlife Habitat (habitat criteria are met however data is insufficient to confirm Significance):
    - ✓ Raptor Wintering Area;
    - ✓ Seeps and Springs;
    - ✓ Woodland Amphibian Breeding Habitat;
    - ✓ Snake Hibernacula; and
    - ✓ Special Concern Species (Monarch).

Neither direct nor indirect fish habitat is not present in the Subject Lands.

None of the identified features meet standard and accepted definitions of significant valleylands.

The NHRM states that for the purposes of the PPS policies, significant ANSIs include only ANSIs identified as provincially significant.

Significant Natural Heritage Features Under ORMCP

Of the eight types of Key Natural Heritage Features and four types of Hydrologically Sensitive Features defined in the ORMCP, the following occur and are subject to impact assessment:

- Wetlands;
- Watercourse;
- Significant Portions of the Habitat of Endangered, Rare and Threatened Species;
- Significant Woodland;
- Life Science Areas of Natural and Scientific Interest (ANSI): Maple Uplands and Kettle Wetlands Provincially Significant Life Science ANSI
- Significant Wildlife Habitat:
    - ✓ Bat maternity colonies;
    - ✓ Woodland area-sensitive breeding bird habitat; and
    - ✓ Rare wildlife habitat of two Special Concern bird species (Eastern Wood-Pewee and Wood Thrush).

As noted previously, an intermittent surface water drainage feature runs through a portion of the Subject Lands so it was added to the list of features above.

TRCA defers to the MNRF regarding the interpretation of "intermittent stream" as per the ORMCP Technical Paper 12. The feature meets the definition of a watercourse as per the Conservation Authorities Act, and would be furthermore described as intermittent as per TRCA's definition as per the Headwater Drainage Features Guideline; development and alterations to the watercourse are therefore regulated under Ontario Regulation 166/06.

While Savanta's specialists agree that the nature of the feature on the Subject Lands is consistent with the definition of an intermittent stream in the ORMCP Technical Paper 12 and a watercourse under the Conservation Authorities Act, the presence of the downstream pipeline that completely blocks all downstream flow at all times renders this a highly atypical situation. For all intents and purposes, this is an isolated surface water feature that does not function as a typical watercourse connected to a larger drainage network and therefore, should not necessarily be managed as a typical watercourse.

3.4 Social Environment

3.4.1 Planning Context

In Ontario, land use planning policies are outlined in several documents including the PPS, and for specific geographic areas, in provincial plans such as the Growth Plan for Greater Golden Horseshoe and the ORMCP, both of which affect the Study Area. It should be noted that Provincial plans are to be read in conjunction with PPS and take precedence over policies in this PPS to the extent of any conflict, except where legislation establishing provincial plans provides otherwise.

Provincial Policy Statement

The 2014 PPS provides province-wide policy direction on matters of provincial interest related to land use planning and development to promote strong communities, a strong economy, and a clean and healthy environment. The PPS includes policies on key issues that affect our communities, such as:

- Efficient use and management of land and infrastructure;
- Protection of the environment and resources; and
- Ensuring appropriate opportunities for employment and residential development.

With respect to Transportation, Subsection 1.6.7 states the following:

> *1.6.7.1 Transportation systems should be provided which are safe, energy efficient, facilitate the movement of people and goods, and are appropriate to address projected needs.*
>
> *1.6.7.2 Efficient use shall be made of existing and planned infrastructure, including through the use of transportation demand management strategies, where feasible.*

With respect to Natural Heritage, Subsection 2.1 states the following:

> *2.1.4 Development and site alteration shall not be permitted in:*
> *a. significant wetlands in Ecoregions 5E, 6E and 7E1; and*

b. significant coastal wetlands.

2.1.5 Development and site alteration shall not be permitted in:

a. significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E1;

b. significant woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River);

c. significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River);

d. significant wildlife habitat;

e. significant areas of natural and scientific interest; and

f. coastal wetlands in Ecoregions 5E, 6E and 7E that are not subject to policy 2.1.4(b) unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.

2.1.6 Development and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements.

2.1.7 Development and site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements.

2.1.8 Development and site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.4, 2.1.5, and 2.1.6 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

It should be noted that the PPS defines "development" to exclude activities that create or maintain infrastructure authorized under an environmental assessment process. In addition, the PPS defines Significant Areas of Natural and Scientific Interest (ANSI) as areas identified as provincially significant by the Ontario MNRF and not regionally significant ANSIs such as those found within the Study Area.

Growth Plan for the Greater Golden Horseshoe

The Growth Plan for the Greater Golden Horseshoe was prepared under the Places to Grow Act, 2005. The Plan, which was amended in 2017, provides a framework for implementing the Province's vision of building stronger, prosperous communities by better managing growth.

In essence, the purpose of the Plan is to mitigate urban sprawl through policies that direct growth to built-up areas, promote transit-supportive densities and a healthy mix of residential and employment land uses, and preserves employment uses for future economic opportunities.

Guiding principles include building compact, vibrant and complete communities, optimizing the use of existing and new infrastructure to support growth in a compact efficient form, and reducing dependence on the automobile through development of mixed-use, transit supportive, pedestrian-friendly urban environments. In addition, cities and towns are encouraged to develop as "complete communities" with a diverse mix of land uses, a range and mix of employment and housing types, high quality public open space and easy access to local stores and services.

Subsection 3.2.2 states the following regarding transportation:

The transportation system within the GGH will be planned and managed to:

a. provide connectivity among transportation modes for moving people and for moving goods;
b. offer a balance of transportation choices that reduces reliance upon the automobile and promotes transit and active transportation;
c. be sustainable and reduce greenhouse gas emissions, by encouraging the most financially and environmentally appropriate mode for trip-making and supporting the use of zero and low-low emission vehicles;
d. offer multi-modal access to jobs, housing, schools, cultural and recreational opportunities, and goods and services;
e. offer multinodal access to jobs, housing, schools, cultural, and recreational opportunities, and goods and services;
f. provide for the safety of system users.

Oak Ridge Moraine Conservation Plan

The ORMCP is an ecologically based plan established by the Ontario government in 2002 and amended in 2017 to provide land use and resource management direction for the 190,000 hectares of land and water within the Moraine.

The purpose of the ORMCP is to provide land use and resource management planning direction to provincial ministers, ministries, and agencies, municipalities, municipal planning authorities, landowners and other stakeholders on how to protect the Moraine's ecological and hydrogeological features and functions.

The Plan divides the Moraine into four land use designations: Natural Core Areas, Natural Linkage Areas, Countryside Areas, and Settlement Areas. In general terms, the disturbed area within Parcel 6 is designated Countryside, the most eastern portion of the Study Area is designated Natural Linkage Areas and the balance of the Study Area is designated Natural Core Areas.

Policy 41(2) of the ORMCP states the following with respect to infrastructure in a Natural Linkage Area:

An application for the development of infrastructure in or on land in a Natural Linkage Area shall not be approved unless,

(a) the need for the project has been demonstrated and there is no reasonable alternative; and
(b) the applicant demonstrates that the following requirements will be satisfied, to the extent that is possible while also meeting all applicable safety standards:

1. *The area of construction disturbance will be kept to a minimum.*
2. *Right of way widths will be kept to the minimum that is consistent with*
   - *i. meeting other objectives such as stormwater management and erosion and sediment control, and*
   - *ii. locating as much infrastructure uses within a single corridor as possible.*
3. *The project will allow for wildlife movement.*
4. *Lighting will be focused downwards and away from Natural Core Areas.*

5. The planning, design and construction practices adopted will keep any adverse effects on the ecological integrity of the Plan Area to a minimum.

Policy 41(3) states the following with respect to infrastructure in a Natural Core Area:

An application for the development of infrastructure in or on land in a Natural Core Area shall not be approved unless the applicant demonstrates that,

(a) the requirements of subsection (2) have been met;
(b) the project does not include and will not in the future require a highway interchange or a transit or railway station in a Natural Core Area; and
(c) the project is located as close to the edge of the Natural Core Area as possible.

Policy 41(4) states:

Except as permitted in subsection (5), with respect to land in a key natural heritage feature or a key hydrologic feature, the development of new and the upgrading or extension of existing infrastructure, including the opening of a road within an unopened road allowance, is prohibited.

Policy 41(5) states the following:

Infrastructure may be permitted to cross a key natural heritage feature or a key hydrologic feature if the applicant demonstrates that,

(a) the need for the project has been demonstrated and there is no reasonable alternative;
(b) the planning, design and construction practices adopted will keep any adverse effects on the ecological integrity of the Plan Area to a minimum;
(c) the design practices adopted will maintain, and where possible improve or restore, key ecological and recreational linkages, including the trail system referred to in section 39;
(d) the landscape design will be adapted to the circumstances of the site and use native plant species as much as possible, especially along rights of way; and
(e) the long-term landscape management approaches adopted will maintain, and where possible improve or restore, the health, diversity, size and connectivity of the key natural heritage feature or key hydrologic feature.

The Study Area is located in either a Category 1 or Category 2 Landform Conservation Area. Policy 30 of the ORMCP sets out the requirements for development or site alteration with respect to land in a landform conservation area. However, the ORMCP defines "development" to exclude activities that create or maintain infrastructure authorized under an environmental assessment process.

York Region Official Plan

The York Region Official Plan (YROP) 2010 describes how York Region plans to accommodate future growth and development while meeting the needs of existing residents and businesses in the Region. It sets out directions and policies that guide economic, environmental and community planning decisions.

With the exception of Parcel 6, the Region of York Official Plan designations that apply to the Study Area lands conform and reflect the designations of the ORMCP designations. Parcel 6 is subject to an Order

issued in February 2015 by the Minister of Municipal Affairs and Housing that modifies the Official Plan to permit the development of urban uses. Details of the Minister's order are discussed in **Section 4.1** of this Report.

The YROP 2010 identifies that lands within the Study Area are Woodlands, form part of an ESA and ASNSI that contain a PSW. In addition, the entire Study Area is located within a Primary Mineral Aggregate Resource Area, a Significant Groundwater Recharge Area, Highly Vulnerable Aquifers, and in either a Category 1 or Category 2 Landform Conservation Area. With the exception of disturbed area in Parcel 6, the entire Study Area is located within York's Regional Greenland System. A detailed summary of the various land use designations that apply to the Study Area land parcels is attached as Appendix A.

City of Vaughan Official Plan 2010

The Vaughan Official Plan 2010 (VOP 2010) was adopted by Vaughan Council in 2010. The Plan addresses all elements of effective, sustainable and successful city-building, while managing projected growth to 2031.

The VOP 2010 designations that apply to the Study Area lands also conform to and reflect the designations of the ORMCP designations, and the Minister's Order that applies to Parcel 6. Details of the Minister's order are discussed in **Section 4.1.**

The VOP 2010 identifies that lands within the Study Area form part of an ESA and ASNSI, and that the entire Study Area is located within a Secondary Sand and Gravel Resource area, located in either High and Low Vulnerability Aquifer area, and in either a Category 1 or Category 2 Landform Conservation area. A detailed summary of the various land use designations that apply to the Study Area land parcels is attached as **Appendix A.**

Schedule 9 Future Transportation Network identifies the Kirby Road extension between Dufferin Street and Bathurst Street as a proposed 36m Minor Arterial Road. Under Subsection 3.4.10 Transportation, Infrastructure and Utilities in the Oak Ridge Moraine, policies regarding the extension of existing transportation including the opening of a road within an unopened road allowance such as Kirby Road reflect the policies found in the ORMCP.

Under Subsection 4.2 The Transportation network, the Plan states in Subsection 4.2.1.6 that it is a policy of Council:

> *To implement the various improvements to the street network identified on Schedule 9 in coordination with the York Region, appropriate agencies, utility providers and adjacent municipalities and secure land for such purposes through the development approvals process, improvements include widening as per the right-of ways identified on Schedule 9; completion of incomplete grid connections such as Langstaff Road over the rail corridor, Kirby Road and Teston Road; jog eliminations at intersections; new and improved interchanges with 400-series highways; mid-block crossings of 400- series highways; and grade separated rail and highway crossings.*

3.4.2 Land Use

The study area includes all properties and land uses within ±400 m of the centre line of the Kirby Road unopened road allowance. The Study Area has an area of approximately 166 hectares comprised of 10 parcels of land and the unopened road allowance between Lots 30 and 31, Concession 2 as illustrated on **Figure 12**. All of the land parcels are privately owned, with the exception of the unopened road allowance which is owned by the Corporation of the City of Vaughan.

Figure 12: Existing Land Use

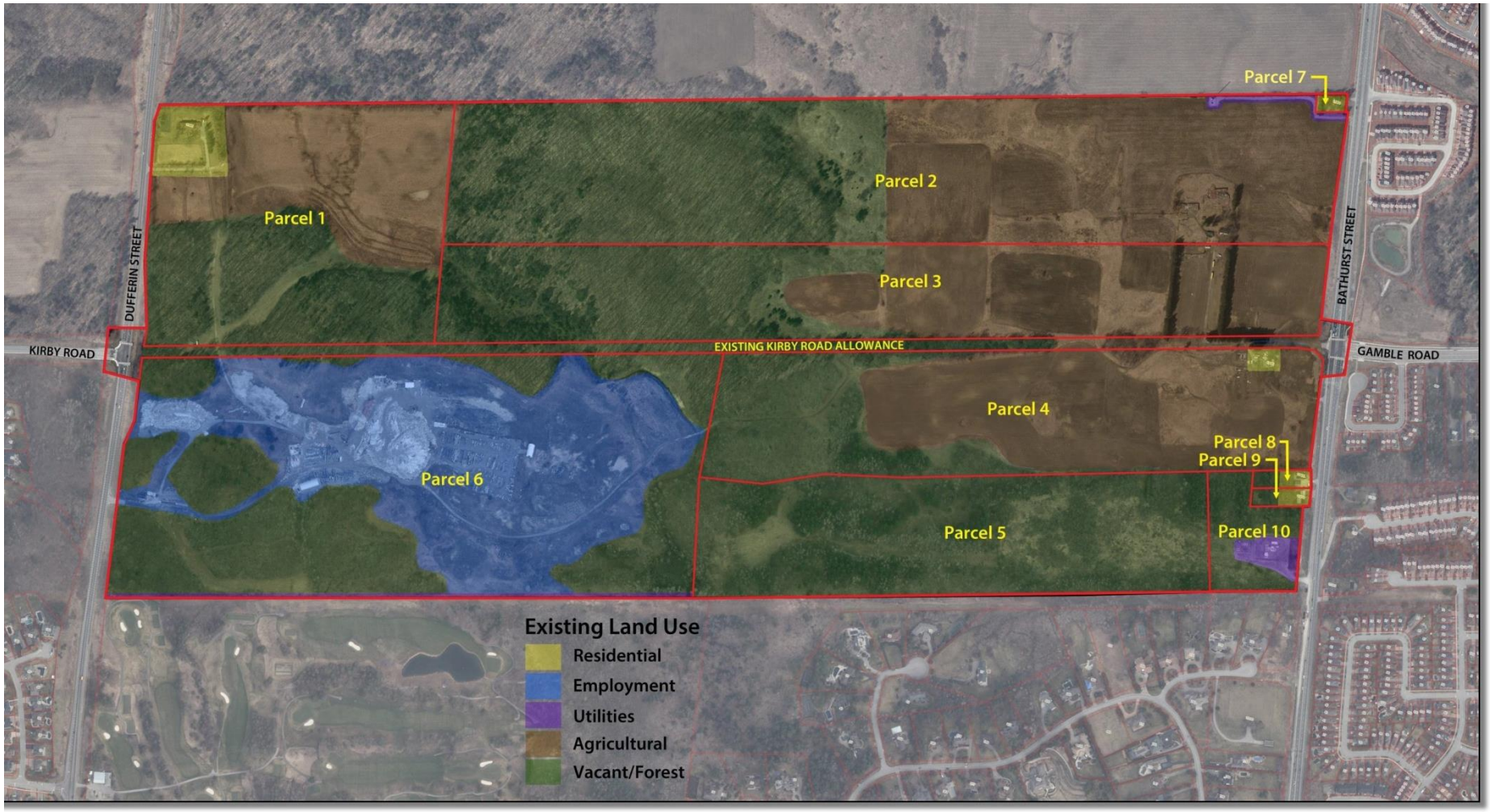


Table 3 summarizes the composition and existing land use of the parcels.

Table 3: Study Area Composition

Parcel No.	Address	Area (m^2)	Existing Land Use
1	11641 Dufferin Street	203,612	Residential, Agricultural, Vacant
2	(Not Assigned)	359,922	Agricultural, Utility, Vacant
3	(Not Assigned)	240,126	Agricultural, Vacant
4	11490 Bathurst Street	212,980	Residential, Agricultural, Vacant
5	11400 Bathurst Street	173,391	Vacant
6	11333 Dufferin Street	399,274	Concrete Recycling, TransCanada Pipeline, Vacant, (Future
7	11654 Bathurst Street	1,404	Residential
8	11426 Bathurst Street	2,994	Residential, Vacant
9	11414 Bathurst Street	3,049	Residential, Vacant
10	(Not Assigned)	24,575	Utility, Vacant
Unopened Road	N/A	40,004	Vacant, Residential Driveway

Adapted from Socio-Economic Impact Assessment Report by Lucas & Associates, dated April 2018

Employment Uses

Parcel 6 is a former aggregate extraction site, and while aggregate extraction no longer occurs on the lands, the parcel is being used for concrete recycling.

Parcel 6 has been approved for residential development subject to the submission of a plan of subdivision application and zoning by-law amendment application. The future development of Parcel 6 is discussed in more detail in **Section 4** of this report.

Residential Uses

There are five existing rural residential uses located within the Study Area; one on Dufferin Street and four on Bathurst Street. Three of the five residences are located on the relatively small Parcels 7, 8 & 9 and two on the larger Parcels 1 & 4.

Agricultural Uses

A significant portion of the Study Area is under agricultural use. The agricultural uses are limited to the growing of crops and there are no livestock operations within the Study Area.

Utility Uses

There are three utility uses found in the Study Area. The first is a Bell Mobility tower located in the northeast corner of the Parcel 2. The second utility use is a natural gas gate station operated by Enbridge Gas Distribution and gas metre station operated by TransCanada located adjacent to Bathurst Street in the southeast corner of the Study Area (Parcel 10).

The third utility use is a gas pipeline that runs in an east west direction adjacent to the south limits of the Study Area. This pipeline, owned by TransCanada Corporation, forms part of the Canadian Mainline that carries natural gas from Alberta and Saskatchewan to Ontario and beyond.

Unopened Kirby Road Allowance

The unopened Kirby Road allowance is approximately 20 m wide and 2000 m long and runs in an east-west direction between Dufferin Street and Bathurst Street. The most eastern 200 m of the unopened road allowance provides a gravel driveway access to Parcels 3 and 4. The balance of the road allowance is vacant and mostly forested.

Vacant and Forested Lands

A relatively large forested area generally bisects the Study Area in north south direction in the central part. This forested block, which also contains a PSW, forms part of the McGill Area ESA and the Regionally Significant Oak Ridges Moraine Maple Spur ANSI. The Study Area also contains a number of fragmented forest blocks.

3.4.3 Archaeological Resources

ASI was contracted by SCE, on behalf of Rizmi Holdings Ltd., to conduct a Stage 1 Archaeological Assessment as part of the Kirby Road Extension MCEA, connecting Kirby Road between Dufferin Street and Bathurst Street in the City of Vaughan. The extension will allow for continuous east-west traffic along Kirby Road in Vaughan and Gamble Road in the Town of Richmond Hill.

In advance of the Stage 1 Archaeological Assessment report, ASI conducted a desktop review of the existing conditions for archaeological resources captured within Study Area to help inform the screening of alternatives process.

Following the selection of the four short-listed road alignments, the archaeological Study Area corridor illustrated on **Figure 13** was defined as the four proposed alignments within a larger buffer:

- Alignment 4 – Minor northerly diversion
- Alignment 5 – Direct extension
- Alignment 6 – South to north minor jog diversion
- Alignment 6A – South to north minor jog diversion

The Stage 1 background study determined that seven previously registered archaeological sites are located within one kilometre of the Study Area. The property inspection and subsequent analysis determined that parts of the Study Area exhibit archaeological potential within Alignments 4, 5, 6, and 6A study corridor. Once a Preferred Road Alignment has been confirmed, these areas will require Stage 2 archaeological assessment, prior to any impacts.

The full Existing Conditions Memorandum and Stage 1 Archaeological Assessment report are included in **Appendix C4.1** and **Appendix C4.2** respectively.

3.4.4 Built Heritage and Cultural Landscapes

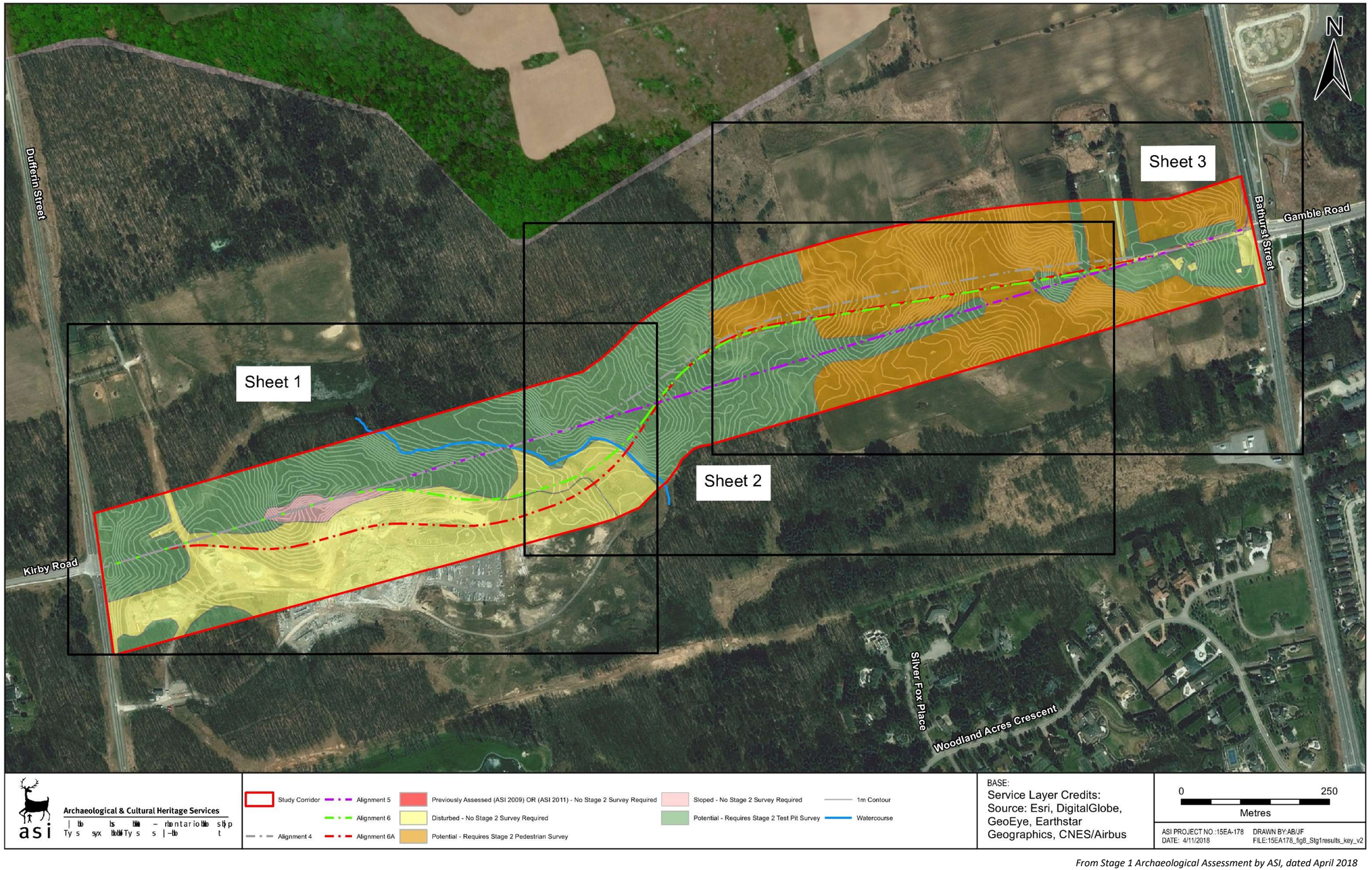
ASI conducted a Cultural Heritage Resource Assessment as part of the EA Study.

The results of background historical research and a review of secondary source material, including historical mapping, revealed a study area with a rural Euro-Canadian land use history dating back to the late-eighteenth century. A review of federal registers and municipal and provincial inventories revealed that there is one previously identified feature of cultural heritage value within the Kirby Road Extension Study Area, a farmscape at 11490 Bathurst Street (CHL 1). A field review was conducted to confirm the location of previously identified cultural heritage resources and to document any newly discovered ones. The cultural heritage resource location mapping is shown in **Figure 14**.

Based on the results of the background research, data collection, and field review, no additional cultural heritage resources were noted.

The full Preliminary Cultural Heritage Resource Assessment: Built Heritage Resources And Cultural Heritage Landscapes report are included in **Appendix C5.**

Figure 13: Results of the Property Inspection



From Stage 1 Archaeological Assessment by ASI, dated April 2018

Figure 14: Location of Cultural Heritage Resources in the Study Area

From Preliminary Cultural Heritage Resource Assessment Report by ASI, dated June 2018

3.5 Economic Environment

For the purposes of establishing a shortlist of road alignment options from a socio-economic context, it was assumed that existing land values generally fall in two categories: natural heritage and agricultural lands, and the future residential lands (Parcel 6). Based on a preliminary analysis of land values in the area, the difference between the two categories appears to be significant.

A 73 hectare parcel of land located in the northwest corner of the Kirby Road and Dufferin Street intersection (11724 Dufferin Street) was sold in 2017 for approximately $124,000 per hectare. This parcel includes both natural heritage lands and agricultural lands and is similar in composition to lands located within the study area.

The sale of three residentially designated parcels in the general vicinity of the Study Area reveals values that range between $9.5 Million and $10.9 Million per hectare. Assuming a value of $10.2 Million per hectare for lands designated for residential development in the Study Area makes the residentially designated lands approximately $10.1 Million per hectare more expensive to acquire than natural heritage/agricultural lands in the Study Area.

4.0 Future Conditions

This chapter provides details of anticipated future conditions in the study area.

4.1 Land Use

In February 2015, the Minister of Municipal Affairs and Housing issued an Order made under Section 18(1) of the 2001 Oak Ridges Moraine Conservation Act (ORMCA). Under Section 18(1), if a matter relating to land to which the ORMC Plan applies was appealed to the Ontario Municipal Board, the Minister may by order amend the relevant official plan or zoning by-law with respect to the matter. The Order applies to Parcel 6 and amends the Region of York Official Plan, the City of Vaughan Official Plan and the City of Vaughan Zoning By-law 1-88.

The Minister's Order amends specific sections in the Region of York Official Plan to indicate that the lands identified as Parcel 6 in this report are intended to be developed for urban uses and that the lands shall only be developed on the basis of full municipal services, an approved and registered draft plan of subdivision and implementing zoning by-law.

The Order amends the City of Vaughan Official Plan by designating the lands "Low Density Residential" and "Valley and Stream Corridor". In addition, the Official Plan is amended to indicate that the lands shall only be developed on the basis of full municipal services, an approved and registered draft plan of subdivision and implementing zoning by-law. Uses permitted are limited to detached houses, semi-detached houses, school, parks and open space, private home daycare, home occupations, and local convenience centres. The maximum average density permitted is limited to 18.0 units per residential hectare. The amendment also includes implementation measures.

Lastly, the Order amends City's Zoning By-law 1-88 by rezoning the lands Future Urban Area (FUA) Zone. This site specific zone is intended to recognize the intent of the Official Plan policies for the lands to develop for urban purposes. A further zoning amendment is required to provide the appropriate zone categories and standards that will permit the development of the lands.

Parcel 6 also referenced in the report as FUA or future development is shown on **Figure 15**.

Figure 15: Parcel 6 City of Vaughan Official Plan Designations

4.2 Transportation Analysis

4.2.1 Population and Employment Growth

York Region provided currently available information for the forecast growth in population and employment in the immediate vicinity of the study area.

Considering the planned growth in population and employment estimates provided for four time periods: 2016, 2021, 2031 and 2041, it is evident that the growth will continue in the immediate area surrounding the undertaking, particularly in the area of Kirby Road and Hwy 400 area, while York Region, as a whole, will continue to experience growth in population and employment.

Table 4 presents a summary of the population and employment growth within York Region.

Table 4: York Region Growth Plan Forecasts

Horizon	2014	2031	2036	2041
Population	1,133,900	1,590,000	1,700,000	1,790,000
Employment	564,600	790,000	840,000	900,000

Source: Growth Plan for the Greater Golden Horseshoe (2017)

4.2.2 Planned Transportation System Improvements and Additions

The City of Vaughan and York Region have both identified significant planned improvements and additions to the transportation system.

City of Vaughan Master Transportation Plan

The City of Vaughan TMP approved in 2012 serves as the City's transportation "blueprint" that will assist with addressing growth in a sustainable manner through to 2031.

The road network serving Vaughan is comprised of 400-series highways, arterial, collector and local roadways. Kirby Road serves as one of Vaughan's east-west arterials, while Dufferin Street and Bathurst Street serve as north-south arterials.

Subsection 2.3.1 identifies the discontinuity of Kirby Road between Dufferin Street and Bathurst Street as one of several discontinuities that impact the efficiency of travel in Vaughan. As a result, there are few continuous arterials that cross from one end of Vaughan to the other in an east-west direction.

Subsection 6.4 Strategic Road Improvements identifies the Kirby Road extension as an important Plan Element in order to improve network connectivity, to provide east-west vehicular access and provide safer walking and cycling opportunities. The Action Plan outlined in Exhibit 7-5 identifies that the initiation of the class EA, funding, and construction of the extension to occur during the period between 2016 and 2021.

North Vaughan Communities Transportation Master Plan

Building on the City-wide 2012 TMP, the North Vaughan and New Communities TMP recommendations and conclusions were approved in principle by City of Vaughan Council in June 2018. A Notice of Study Completion was issued in February 2019. This study is a long range plan that recommends policies, programs and infrastructure required to meet existing and future mobility needs and provide context for transportation decisions within North Vaughan. The North Vaughan area (essentially the study area is bounded by King – Vaughan Road to the north, Bathurst Street to the east, Major Mackenzie Drive to the south and Highway 27 to the west. A key transportation corridor essentially in the middle of the study area is Kirby Road.

The study followed the Transportation Master Plan (TMP) process, an open public process following the Municipal Class Environmental Assessment Guidelines, so that the study results can properly serve as direct input to any subsequent Environmental Assessment (EA) studies for specific infrastructure projects.

The study utilized York Region's updated EMME Transportation software model as the starting point in preparing transportation forecasts and conducting analyses. Poulos & Chung Limited in conducting this Transportation, Traffic and Active Transportation Need & Justification Assessment, Kirby Road (Dufferin Street to Bathurst Street) also used the same transportation model. Poulos & Chung Limited can confirm that the forecast traffic flows on the Kirby Road corridor for each area roadway network and transit condition examined is very comparable and almost identical in both studies.

The North Vaughan and New Communities Transportation Master Plan detailed:

- The transportation system requirements for numerous communities within the study area;
- The operational performance of the study area arterial grid network with and without the GTA Freeway;
- A assessment and evaluation of the missing links in the arterial grid network including the Kirby Road missing link between Dufferin Street and Bathurst Street;
- The active transportation system (bicycles and pedestrian infrastructure including transit services to provide total mobility options;
- A recommended phasing plan to implement the transportation system (roads, transit, pedestrian and bicycle) improvements and additions.

Specific to Kirby Road the North Vaughan and New Communities Transportation Master Plan identified that the addition of the Kirby Road missing link (between Dufferin Street and Bathurst Street:

- Helps alleviate traffic from parallel arterial roads;
- Minimizes the kilometres travelled and hours spent in congestion;
- Assists to accommodate increased public transit services; and
- Facilitates pedestrian and bicycle flows through the inclusion of sidewalks and bicycle lanes.

The TMP confirmed the need for York Region to assume jurisdiction of Kirby Road in the City of Vaughan and the timing to improve Kirby Road from Highway 27 to Bathurst Street (including elimination of the missing link) in the period from 2017 to 2026.

Region of York Transportation Master Plan

The Region of York TMP was adopted in December of 2016 and establishes the vision for transportation services, assesses existing transportation system performance, forecasts future travel demand and defines actions and policies to address road, transit and active transportation needs in York Region to 2041.

Traffic congestion continues to be identified as the top issue facing York Region residents according to an annual survey conducted by an independent third party organization. Furthermore, in that same survey, residents identified traffic as the greatest threat to quality of life in York Region, followed closely by the high rate of development taking place.

The TMP identifies that travel demand is increasing more rapidly than infrastructure is constructed and that the Region is falling behind the pace of growth. In the Introduction to the TMP, the report states the following:

> *The future success of York Region as the number one destination within the GTHA for people to live, work and play is dependent on the Region's ability to build an interconnected system for mobility. This TMP update sets out the infrastructure and policy updates to enable the Region to build and maintain such a system. This includes additional transit infrastructure, roads infrastructure and a system of sidewalks and trials to further enable active transportation.*

Section 5 of the Report describes in detail the objective to develop a road network fit for the future. Under Subsection 5.3.2 Finer Grid Network Strategy, the Report states the following:

> *Missing links. The Regional road network is set on a grid with several missing links, leading to circuitous routing by users and contributing to more congestion. This TMP strives to fix the gaps and complete the grid network by planning for construction of the following Regional road connections:*
>
> - *Kirby Road (Dufferin Street to Bathurst Street)*
> - *Langstaff Road (Jane Street to Keele Street)*
> - *Teston Road (west of Dufferin Street)*
> - *15th Sideroad (east and west of Jane Street)*

The Report also states:

> *Road Assumptions. As York Region grows, there is an ongoing need to regularly review the function of the road network. In some instances, roads currently under the jurisdiction of local municipalities will need to take on a more Regional role while other roads operated by the Region may better serve local needs.*

Based on the road network assessment carried out as part of the TMP, as well as a review of the above policy, the Kirby Road corridor from Highway 27 to Bathurst Street was identified as a candidate to be added to the Regional road network.

Further review of the TMP indicated that Kirby Road is considered as an integral component of the regional arterial grid in northern Vaughan. TMP figures show the long term roadway network including a potential Kirby Road interchange with Highway 400. Kirby Road is also identified as a primary arterial goods movement corridor and it will be served by frequent transit service. The long term cycling network shows dedicated cycling facilities between Dufferin Street and Bathurst Street. It is evident that the Kirby Road extension is to contain dedicated bicycle lanes.

It is also evident that Kirby Road is planned to be improved in years 2027 to 2031. This includes the missing link which is the subject of this EA Study.

4.2.3 Transportation, Traffic and Active Transportation Need and Justification Assessment

In addition to the municipal long term planning studies noted above, Poulos & Chung Ltd. conducted an analysis of options to the undertaking and completed the need and justification component of the EA Study. The report named “Transportation, Traffic and Active Transportation Need and Justification Assessment” is included in **Appendix C2**.

York Region provided EMME II (Transportation Model) software outputs for horizon years 2021 and 2031. A specific select link analysis was conducted in order to identify the forecast vehicle flows on Kirby Road. The select link analysis effectively identifies how forecast traffic arrives to and departs from Kirby Road in the AM roadway peak hour. As these vehicle flows complete their direction of travel, a total accumulated vehicle flow is predicted along each segment of Kirby Road.

The select link analysis for horizon years 2021 and 2031 with and without the GTA West freeway shows that Kirby Road will accommodate significant vehicle flows in both 2021 and 2031. The 2031 forecast does not diminish the Kirby Road vehicle flows, it is evident that vehicle flows are still significant.

A further analysis was done to specifically identify the forecast vehicle flows and vehicle directions of travel on Kirby Road between Dufferin Street and Bathurst Street. Examining the magnitude of vehicle flow movements shows that the 2021 AM peak hour peak direction of travel (westbound on Kirby Road between Dufferin Street and Bathurst Street) is in excess of 1,400 vehicles. The typical vehicle carrying capacity of a single arterial traffic lane is in the order of 900 to 950 vehicles per hour. As a result, it is evident that two (2) traffic lanes will be required in the westbound direction on Kirby Road by 2021. The 2021 roadway PM peak hour will accommodate a vehicle flow in the reverse direction (eastbound). The magnitude of this vehicle flow will be equal or greater than the forecast AM roadway peak hour vehicle flow. As a result, it is evident that two (2) traffic lanes will be required in the eastbound direction on Kirby Road by 2021. By 2031 the peak hour peak direction vehicle flows on Kirby Road will not diminish. This re-confirms the need for two (2) traffic lanes in each direction of travel.

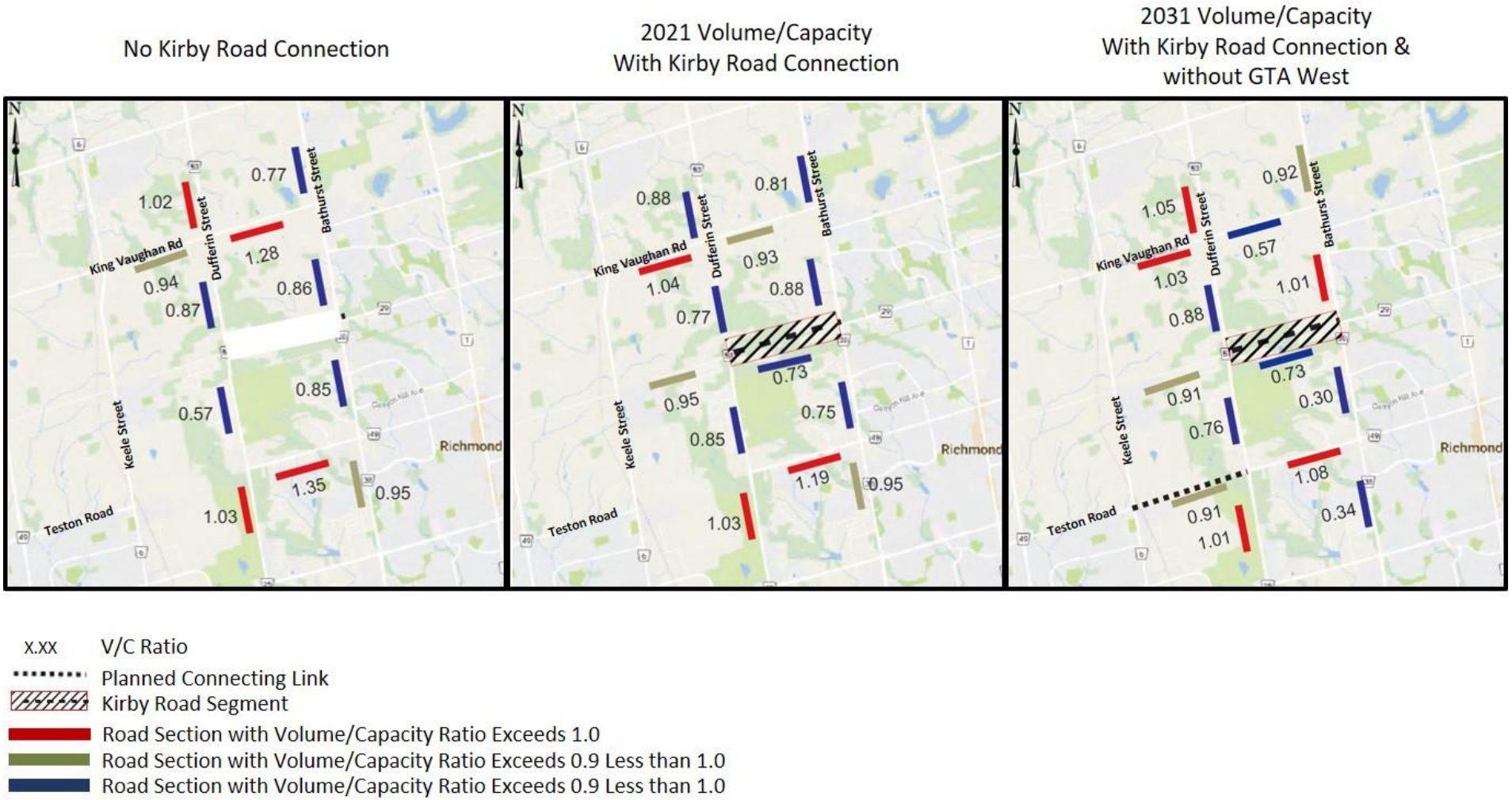
Link traffic flow volumes describe the number of cars that pass through a certain segment (mid – block) of a roadway network over a period of time. This link traffic volume is divided by the capacity of the roadway segment to develop ratios for each roadway link during the AM and PM peak hours. The Volume – to – Capacity (V/C) ratio reflects peak hour traffic demand measured against the roadway capacity. A description of the V/C ratios with associate LOS and operating conditions is provided in **Table 5** below.

Table 5: Link Volume to Capacity Ratios and Operating Condition

Volume to Capacity Ratio	Level of Service (LOS)	Operating Condition
Less than 0.85	LOS A – C	Free Flow Very Little to Moderate Delay
Between 0.85 and 0.99	LOS D – E	Approaching or at Capacity, Users Experience Delays and
Greater than 1.0	LOS F	Over Capacity, Severe Delays and Queuing

The available EMME II transportation software outputs were evaluated for the roadway AM peak hour traffic flow volumes in horizon years 2021 and 2031. The results of the comparison are illustrated on **Figure 16** below**.**

Figure 16: Comparison of Roadway Conditions



The forecast horizon year 2021 operating condition with and without the Kirby Road segment between Dufferin Street and Bathurst Street was modelled. The condition without the link is considered as a "Do Nothing" option. It was concluded that without the Kirby Road connection the parallel arterial roads north and south of Kirby Road will experience significant delay and congestion. It is evident that the existing roadway segments have V/C ratios of 1.28 (King Vaughan Road between Dufferin and Bathurst Streets) and greater. Introduction of the Kirby Road connection materially benefits the immediate east west arterial roads. As a result, the V/C ratios by roadway segment on the immediate surrounding road network have been reduced to reasonable operating levels.

The forecast horizon year 2031 operating condition with and without the GTA West freeway was modelled for the roadway AM peak hour condition with the Kirby Road connection in place. It was assumed that the currently missing connecting link on Teston Road from Keele Street to Dufferin Street will be in place by 2031.

It is evident from the analysis that the area roads examined prove to be capable of accommodating primary peak hour peak direction demand flows. Of importance is the fact that growth in population and employment has continued to the year 2031. However, the north-south and east-west roads examined continue to operate with comparable levels of service between 2021 and 2031. Some re – orientation of vehicle flows has occurred because the GTA West freeway is not in place but overall the performance is acceptable. Optimum boundary road operations are secured. Compared to the 2021 forecast with the Kirby Road connection in place, the V/C ratios by roadway segment in horizon year 2031 have been reduced to reasonable operating levels.

As part of the assessment, Poulos & Chung Ltd. verified travel demands for the Kirby Road Extension.

York Region TMP indicates that Kirby Road will be an integral component of the overall transit network for the Region. It's designation as a corridor with frequent transit service requires and justifies the need to incorporate design standards sufficient to accommodate buses in mixed traffic. Therefore, the City of Vaughan, York Region and Transportation Association of Canada standards will be used to provide appropriate lane widths, curb radii, centre line radius, and sufficient boulevard dimensions.

As Kirby Road will be a component of the overall bicycle network for York Region, the typical York Region standards for arterial roads sidewalks must be included within the Kirby Road ROW. The design standards employed must follow typical York Region standards for the inclusion of exclusive bike lanes in both directions of travel.

As Kirby Road is designated to accommodate goods movement demands, the design standards employed must follow typical York Region standards to satisfactorily accommodate the geometric requirements of tractor trailer trucks.

As noted, the EMME II outputs provided by York Region formed the basis to determine the vehicle turning movements at the intersections of Kirby Road with Dufferin Street and Bathurst Street.

The EMME II select link analysis was used as the basis to calculate forecast turning movements for the roadway AM peak hour in horizon years 2021 and 2031. To calculate the roadway PM peak hour turning movements it was assumed that the magnitude of AM vehicle trips would be reversed. Additional adjustments were introduced reflecting existing turning movement demand. A scenario considering the

potential development in place (explained in **Section 4.1**) with these traffic flows added to the calculated 2021 and 2031 vehicle flows has been analyzed as well.

It was concluded that all left turn movement demands at each Kirby Road intersection will require exclusive left turn lanes.

The analysis technique of the Transportation Association of Canada as contained in the Transportation Geometric Design Guidelines for Canadian Roads was used to calculate left turn storage lengths. This calculation is a direct function of vehicle demand.

The Synchro Software Program, Version 8 by Trafficware Inc. was used to calculate the performance of the Kirby Road intersections in horizon years 2021 and 2031.

Table 6 below presents the overall intersection level of service, vehicle delay and volume to capacity ratio.

Table 6: Calculated Intersection Performance for Horizon Years 2021 and 2031

Performance Measure	Kirby Road and Dufferin Street		Kirby Road and Bathurst Street	
	AM Peak	PM Peak	AM Peak	PM Peak
Year 2021				
Overall Level of Service	D	D	E	D
Vehicle Delay (in Seconds)	48	43	59	52
Year 2031 (with GTA West)				
Overall Level of Service	D	E	F	D
Vehicle Delay (in Seconds)	36	76	82	50
Year 2031 (without GTA West)				
Overall Level of Service	D	E	F	D
Vehicle Delay (in Seconds)	36	76	86	40

The operating conditions are a direct result of the increased traffic flows generated by continued growth in the area immediate to Kirby Road Extension and throughout York Region. The forecast traffic flows are much higher than the existing flows hence, even with improvements, the overall LOSs degrade but still are considered acceptable.

The assessment of the Kirby Road segment between Dufferin Street and Bathurst Street concluded:

- Kirby Road must be connected between Dufferin Street and Bathurst Street by 2021;
- Kirby Road connection must have two (2) lanes of traffic in each direction of travel and the resultant four (4) lanes of traffic are sufficient to meet the forecast total modal demands for 2031;

- Exclusive left turn lanes with satisfactory storage, taper lengths and centre medians to permit installation of traffic signal hardware must be provided at each of the Kirby Road intersections with Dufferin Street and Bathurst Street.
- Right turn lanes will be required in the eastbound and westbound directions of travel on the Kirby Road intersections with Dufferin Street and Bathurst Street.
- Design standards of City of Vaughan, York Region and Transportation Association of Canada can be applied to permit the proper operations of automobiles, buses, trucks, bicyclists and pedestrians.
- Exclusive bicycle lanes are to be provided in both directions of travel (either on pavement or in boulevard);
- Sidewalks are to be provided on both sides of the road extension; and
- Satisfactory space must be made available in the boulevards for transit facilities and infrastructure as required by York Region Transit.

5.0 Project Need and Justification

This chapter summarizes the project's need and justification identified in the various transportation planning documents prepared by municipalities and verified by the transportation analysis study prepared by Poulos & Chung Ltd.

Kirby Road today is designated as a minor arterial road in the Vaughan Official Plan 2010. The role and function of Kirby Road through the Study Area will change significantly with the development of the new communities and Highway 400 North employment lands.

A summary of the planning steps and findings concerning the Kirby Road corridor and the missing road link from the transportation assessments conducted by Vaughan and York Region is provided in **Table 7** below.

Table 7: Summary of Municipal Transportation Planning for Kirby Road Corridor

Planning Document	PHASE 1 Problem or Opportunity	PHASE 2 Alternative Solutions	TMP's Conclusion / Recommendation
2012 City of Vaughan TMP	To serve future Highway 400 North employment area and support provision of enhanced pedestrian /cycling infrastructure; improve network continuity and the effectiveness of the existing network.	• Transit Improved transit services in the Kirby Road corridor are not warranted given that the immediate area is not being proposed for urbanization. • Roads Regional road improvements along King-Vaughan Road and Teston Road were considered in the corridor needs analysis, and have also been incorporated into the recommended TMP road network.	Corridor improvements will be required by 2031, with some being required by 2021. 4 Lane Link is required by 2021. Further study with the Region is needed to determine the sequence of corridor improvements. Recommended for Phase 3 and 4 EA Study.
2016 York Region TMP	Improved network connectivity needed to move people and goods. Network improvements needed to accommodate future travel demands. Network improvements needed to support walking and cycling.	• Do Nothing Does not address Problem or Opportunity Statement. • Widen parallel/adjacent corridor May not fully address	Construct 4-lane missing link. Phases 1 and 2 alternatives to be revisited as part of subsequent Environmental Assessments and network analysis.

Planning Document	PHASE 1 Problem or Opportunity	PHASE 2 Alternative Solutions	TMP's Conclusion / Recommendation
	Network improvements needed to support transit.	travel demand needs as adjacent corridor is at capacity. No improvements to walking and cycling. No improvement to transit service. • Construct missing link Addresses travel demand. Opportunity to provide walking and cycling facilities. Potential to improve transit service.	
February 2019 City of Vaughan North Vaughan and New Communities Transportation Master Plan (NVNCTMP)	To increase east-west capacity and to meet the travel demands for growth in the NVNCTMP study area including Blocks 41 and 27 New Communities and Highway 400 North Employment Lands, and the future Kirby GO station.	• Transit Improved transit services are already planned in the Region and are accounted for in the assessment, including Viva Silver on Major Mackenzie Drive. Without the road network in place there are limited opportunities for improving east-west transit connectivity due to the missing links of both Kirby Road and Teston Road. • Roads Road network options considered alternative improvements to Kirby Road widening and new construction. This included no construction of the Kirby Road missing link. Without the missing link and road widening, total AM peak hour	Kirby Road from Weston Road to Dufferin Street widening, Dufferin Street to Bathurst Street new construction by 2026. Widening from 2 to 4 lanes to a 36m right-of-way width between Keele Street to Dufferin Street is needed only with the completion of the Kirby missing link. The missing link to be considered in conjunction with the Keele to Dufferin section. Recommended for Phase 3 and 4 EA study.

Planning Document	PHASE 1 Problem or Opportunity	PHASE 2 Alternative Solutions	TMP's Conclusion / Recommendation
		congested VKT grows by 4,000 while congested VHT grows by 150. Improvements to roadways other than Kirby Road will not benefit east-west travel demand generated by the New Communities and 400 North Employment Lands.	

As illustrated above, the need for Kirby Road improvement was assessed and recommended in both the Vaughan TMP and the York Region TMP, which include widening to 4 lanes and completion of the "missing link" between Dufferin Street and Bathurst Street at 4 lanes. Kirby Road will have a regional function as development occurs. It was recommended by the NVNCTMP that the road should be transferred to Regional jurisdiction, requiring a ROW of 36 m to function as a 4-lane arterial road in the future.

In February 2018 the Ministry of Transportation announced that Ontario will not be proceeding with a proposed highway in the GTA West Corridor and would be moving forward with an assessment of infrastructure needs through the Northwest GTA Corridor Identification Study. The transportation analysis by Poulos & Chung Ltd. confirmed that by 2031 without the GTA West freeway the projected segment of Kirby Road between Dufferin Street and Bathurst Street will still require two (2) traffic lanes in each direction of travel to serve the anticipated vehicle demand. In November 2018, in their release of "A Plan for the People, Ontario Economic Outlook and Fiscal Review, 2018 Background Papers", the Province announced their intention to resume the EA for the GTA West Highway Corridor, which was suspended in 2015.

The "Transportation, Traffic and Active Transportation Need and Justification Assessment" report (2018, Poulos & Chung Ltd.) summarizes the detailed analysis that was undertaken. The information contained in this report was used by the Project Team to:

- Verify the need to construct new roadway for Kirby Road Extension;
- Determine detailed engineering criteria and design basis for the road;
- Complete the screening and evaluation of alternative design concepts (road alignments and cross-sections);
- Select recommended Alternative Design Concept for the Kirby Road Extension.

6.0 PHASE 2 - Alternative Solutions

This chapter presents the assessment of alternative solutions, including the identification of the Preferred Solution for the Kirby Road Extension conducted by the project team.

Notwithstanding the significant amount of analysis completed by York Region and the City of Vaughan, the project team revisited the technical analysis. This assessment extracts relevant analysis completed by the authorities and includes updated existing roadway and intersection traffic flow information. Such an approach permitted a detailed examination of all potential Alternative Solutions to the undertaking in accordance with Phases 1 and 2 of the MEA MCEA planning and design process.

Alternative Solutions examined included:

- Do Nothing
- Use / Widen Parallel East – West Roads
- Provide Active Transportation Facilities including Travel Demand Management
- Construct New Roadway Extension

The detailed evaluation of Alternative Solutions to the undertaking is summarized below.

6.1 Examination of "Do Nothing"

The "Do Nothing" condition has severe implications on both existing and future vehicle travel demands. This can be ascertained by examining the following:

- Existing roadway AM and PM peak hour area traffic flow patterns

It is evident that the traffic flows in order to complete their direction of travel causes increased vehicle turning movements at several area intersections. Please refer to **Figure 3: Existing Traffic Movements**. These turning movements today cause increased vehicle delay and congestion. The delay and congestion will continue to increase over time as growth continues in the City of Vaughan and York Region.

- Forecast 2031 accumulated AM peak hour traffic flow

It is evident with or without the GTA West Freeway the proposed Kirby Road Extension is forecast to carry a significant amount of traffic flow. If this project segment was not available this projected significant traffic flow would have to find alternate routes. Please refer to **Figure 16**: Comparison of Roadway Conditions. The forecast volumes indicate that two lanes of traffic in each direction of travel would have to be found in an adjacent roadway corridor.

In summary, it is evident from examining existing roadway and intersection operations and reviewing forecast traffic flow demands that the "Do Nothing" condition is not a viable option. Attempting to "throw – off" the existing and forecast Kirby Road traffic flow demand will have a detrimental impact on the operations of numerous area roads and intersections.

6.2 Examination of "Use/Widen Parallel East – West Roads"

Figure 16 in this report illustrates the parallel east – west roads. The analysis was conducted for the roadway AM peak hour in horizon year 2021. The analysis indicates that the King – Vaughan Road to the north and Teston Road to the south would both experience a vehicle demand significantly higher than

the available roadway capacity that can be provided. The available capacity on these roads was assumed to be derived by widening each of the parallel roads to four lanes. In effect this assumption is based upon accelerating the timing of the planned Teston Road improvements between Keele Street and Yonge Street which is planned for beyond 2022. As planned growth continues the identified volume to capacity operating deficiency would be much worse in horizon year 2031.

It is evident that the parallel east – west roads cannot provide additional operating capacity to serve increased traffic flow demands resulting from the lack of a continuous Kirby Road condition. It can also be stated that the area intersections serving the disrupted traffic flows would provide degraded operating conditions serving to increase vehicle delay and congestion.

6.3 Examination of "Provide Active Transportation Facilities, including TDM"

Transit and Active Transportation to Accommodate Forecast Demand Including
Travel Demand Management (TDM)

There is no doubt that transit and active transportation (bicycling and walking) are important modes of transportation and must be available as viable options of travel. The City of Vaughan and York Region have both incorporated standards and on – going facilities, services and infrastructure in their respective jurisdictions to accommodate these modes.

Although it is evident that transit and active transportation will have an on – going important role in serving travel demands it is evident that they cannot satisfy the total travel demands.

Figure 17 illustrates the existing modal characteristics of this area of the City of Vaughan. The statistics are available from the Data Management Group and based upon the 2011 Transportation for Tomorrow Survey results.

The 2016 York Region Transportation Planning Study Update has incorporated an increase in the usage of transit and continued growth in walking and bicycling during the roadway AM peak hour.

As shown in **Figure 17** the current uptake of transit and active transportation during the AM peak period is in the order of twenty – four (24) percent of all trips. Even if this percentage of non-automobile travel were to double by 2031 over half of all trips will still be taken by the automobile.

It is therefore concluded that increased usage of transit and active transportation, though most welcomed, is not capable of serving the total travel demand needs.

A roadway solution must be a part of the overall transportation system to satisfactorily serve total forecast demands.

TDM will be an important tool to be used by Authorities and interested parties to continue to educate, encourage and incentivize people to use other modes of transportation instead of the single automobile / single driver to complete trips during the typical weekday roadway peak periods. TDM will continue to

grow and evolve and will be complimented by the planned infrastructure both within planned communities, municipal and regional transportation systems.

6.4 Examination of "Construct New Roadway Extension"

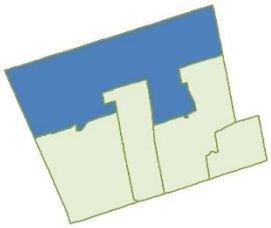
The ability to complete the existing and planned arterial grid system is an important consideration. This project immediately benefits the arterial grid by completing a missing section of Kirby Road.

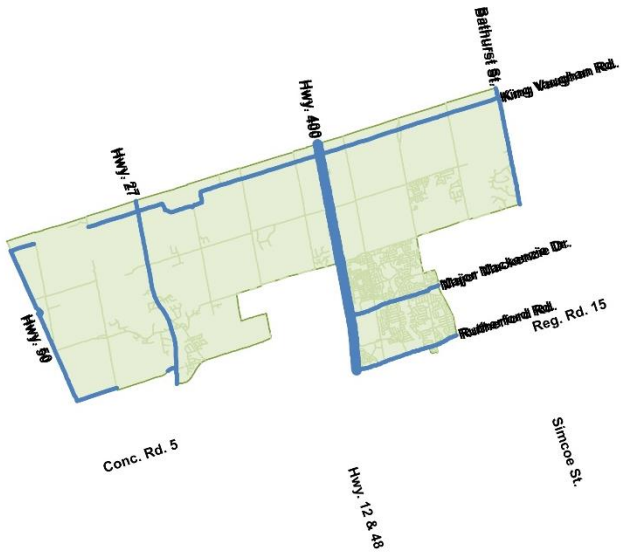
Such an undertaking not only benefits traffic flows but also permits transit to efficiently implement direct route patterns and allows active transportation infrastructure to be implemented as part of the overall system.

Figure 18 illustrates the forecast traffic flows on this project and this segment of Kirby Road. The new roadway permits organization of traffic flows. The intersections with appropriate lane configuration permits turning movement demand to be organized and accommodated in a balanced and efficient manner. All critical modes of transportation are accommodated in a safe and efficient manner.

Figure 17: Transportation Tomorrow Survey Area Summary

CITY OF VAUGHAN
WARD 1





HOUSEHOLD CHARACTERISTICS																		
Households	Dwelling Type			Household Size					Number of Available vehicles					Household Averages				
	House	Townhouse	Apartment	1	2	3	4	5+	0	1	2	3	4+	Persons	Workers	Drivers	vehicles	Trips/day
18,300	80%	10%	10%	9%	22%	21%	29%	18%	4%	29%	49%	13%	5%	3.3	1.9	2.2	1.9	7.1

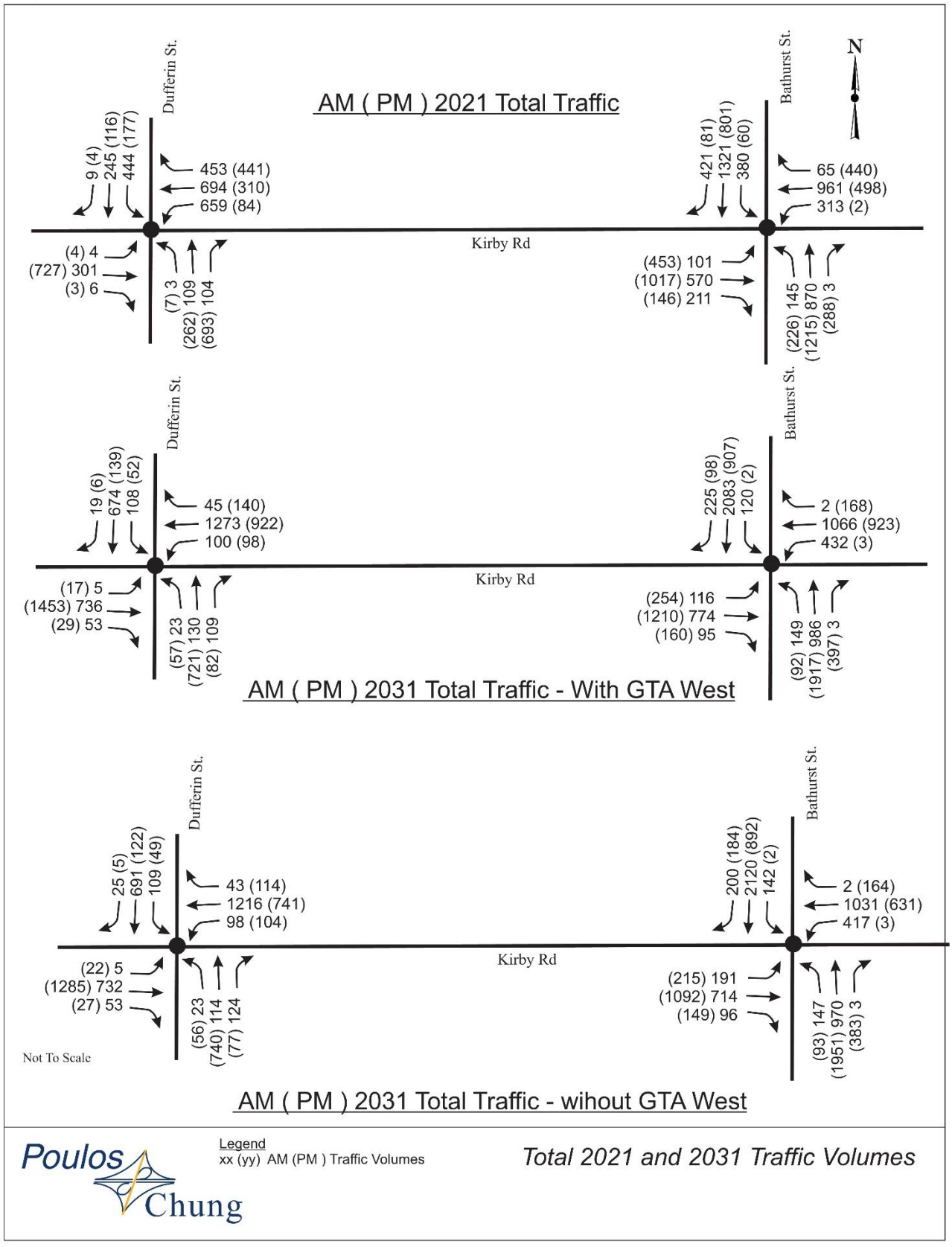
POPULATION CHARACTERISTICS																
Population	Age							Daily Trips per Person (age 11+)	Daily Work Trips per Worker	Population	Employment Type			Student	Licenced	Transit
	0 - 10	11 - 15	16 - 25	26 - 45	46 - 64	65+	Median				Full Time	Part Time	At Home			
										Male						
										29,300	45%	7%	5%	29%	70%	8%
										Female						
61,100	13%	9%	15%	28%	25%	10%	37.6	2.5	0.75	31,800	33%	12%	3%	28%	64%	7%

TRIPS MADE BY RESIDENTS OF CITY OF VAUGHAN - WARD 1																
Time Period	Trips	% 24 hr	Trip Purpose				Mode of Travel						Median Trip Length (km)			
			HB-W	HB-S	HB-D	N-HB	Driver	Pass.	Transit	GO Train	Wlk & Cy	Other	Driver	Pass.	Transit	GO Train
6-9 AM	34,400	26.4%	43%	25%	22%	11%	63%	15%	6%	3%	7%	5%	8.6	3.1	17.5	25.3
24 Hours	130,100		32%	15%	38%	15%	68%	17%	6%	2%	4%	3%	7.4	4.7	11.1	25.1

TRIPS TO CITY OF VAUGHAN - WARD 1																
Time Period	Trips	% 24 hr	Trip Purpose				Mode of Travel						Median Trip Length (km)			
			Work	School	Home	Other	Driver	Pass.	Transit	GO Train	Wlk & Cy	Other	Driver	Pass.	Transit	GO Train
6-9 AM	18,600	19.4%	32%	30%	10%	28%	62%	18%	3%	*	11%	6%	3.6	1.7	2.8	*
24 Hours	96,300		10%	6%	57%	27%	68%	18%	5%	1%	6%	3%	6.1	3.7	10.0	25.4

From Transportation, Traffic and Active Transportation Assessment Report (Figure 26) by Poulos & Chung Limited, Dated September 2018

Figure 18: Total 2021 and 2031 Traffic Volumes



From Transportation, Traffic and Active Transportation Assessment Report (Figure 24) by Poulos & Chung Limited, Dated September 2018

6.5 Evaluation of Alternative Solutions

As appropriate to satisfy Phase 2 of the Class EA process, an assessment was undertaken to evaluate the Alternative Solutions to the undertaking. The following **Table 8** shows the evaluation of the Alternative Solutions considered from a transportation perspective.

Table 8: Evaluation of Alternative Solutions

Environmental Factor	Alternative Solutions			
	"Do - Nothing"	**"Use / Widen Parallel East West Roads"**	**"Provide Active Transportation Facilities including TDM"**	**"Construct New Roadway Extension"**
Transportation/ Technical	Not Preferred	Not Preferred	Neutral	Preferred
Advantages and Disadvantages	• Does not address the problem • Prevents completion of the arterial grid	• Does not accommodate increased traffic flow demand • Does not support completion of a balanced transportation system	• Does not fully address the problem • Contributes to completion of balanced transportation system	• Provides the additional operating capacity required • Supports connection of FUA • Incorporates and organizes key modes of transportation • Supports completion of a balanced transportation system
Conclusion	• In agreement with Municipal and Regional TMP findings. • Eliminate from further consideration	• In agreement with Municipal and Regional TMP findings. • Eliminate from further consideration	• In agreement with Municipal and Regional TMP findings. • Eliminate from further consideration	• In agreement with Municipal and Regional TMP findings. • Carry forward to Phase 3 and 4 EA Study with elements from Alternative Solution 3

6.6 Preferred Alternative Solution "Construct New Roadway Extension"

The construction of a new roadway extension was determined to be the Preferred Alternative Solution, as it best provides the required operating capacity, supports future growth and land uses, improves east-west connectivity, supports the orderly distribution of traffic in the local area, and allows for a future easterly extension of Kirby Road in agreement with local and regional plans.

7.0 PHASE 3 - Alternative Design Concepts

Sections 1 through **6** of this report documented the technical analysis and evaluation process undertaken to fulfil Phases 1 and 2 of the Class EA process, namely Problem and Opportunity and Alternative Solutions. As noted, the phases were also completed through the City's and Region's master planning initiatives and revisited by the Project Team.

This chapter presents the methodology, development, screening and evaluation Alternative Design Concepts that were considered for the Preferred Solution "Construct New Roadway Extension", including identification of the recommended horizontal alignment and recommended road cross-section proposed for the Kirby Road Extension.

7.1 Methodology for Selection of Recommended Design Concept(s)

The methodology used for selection of a Recommended Design Concept(s) includes two consecutive steps: initial screening and detailed evaluation. Accordingly, Phase 3 of the MCEA planning and design process was divided into two parts: Phase 3A – Screening and Phase 3B - Evaluation.

Purpose of the screening analysis is to assess full range of alternative design concepts against the project's rationale and need, narrow down potential design concepts to a manageable number of options and ensure that only viable design concepts will be carried forward for detailed evaluation.

The initial screening of Alternative Road Alignments involves generation of a Long List of Alternative Road Alignments, applying screening criteria, determining and confirming short-listed road alignment options.

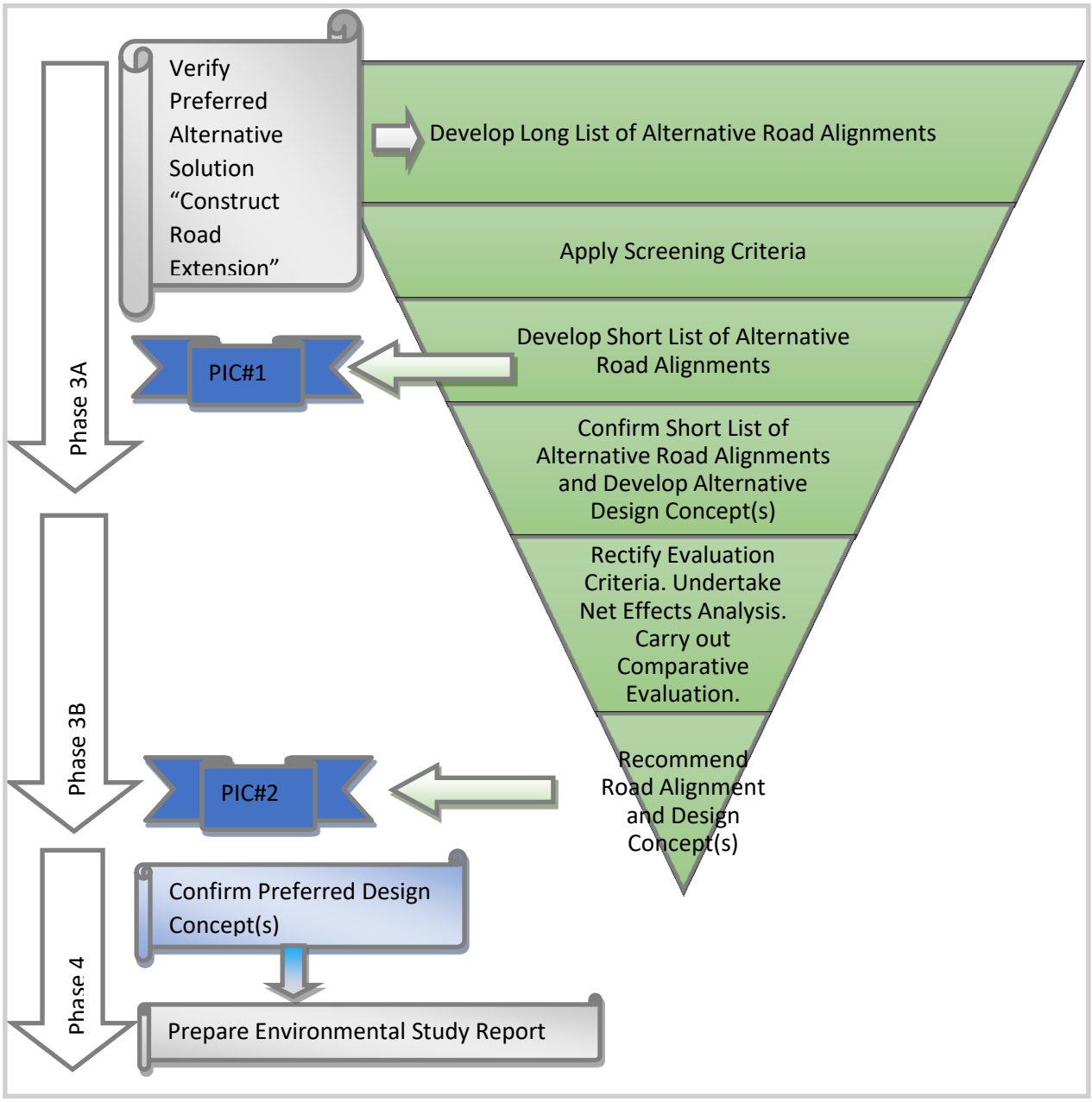
The screening of the Long List results in selection of short-listed road alignments. The consequent step is a detailed evaluation. Purpose of the detailed evaluation is to identify all potential environmental effects of the short-listed Alternative Road Alignments and Design Concepts for road cross-section, develop mitigation measures, confirm net effects on the environment and identify Recommended Design Concept(s).

The detailed evaluation of Alternative Design Concepts involves the following key activities: developing of Alternative Design Concepts, rectifying evaluation criteria and indicators (measures) presented to the project stakeholders at PIC#1, undertaking net effects analysis and carrying out comparative evaluation.

By means of comparative evaluation, advantages and disadvantages of the design alternatives are considered against the ability of the options to fulfill project specific evaluation criteria, culminating with selection of a Recommended Design Concept(s).

Figure 19 below illustrates how the methodology aligns with the Kirby Road Class EA decision making process and corresponds with the undertaken consultation steps.

Figure 19: Methodology for Selection of Alternative Design Concept(s)



Having identified all environmental impacts, having determined mitigating measures to minimize impact on the environment and having gained further input from interested parties (discretionary public consultation at PIC#1 and mandatory at PIC#2) in reviewing the screening and evaluation steps and arriving at the best decision, the Recommended Design Concept(s) can be confirmed as the Preferred Design Concept(s).

7.2 Development of Alternative Design Concepts

7.2.1 Establishment of Engineering Design Criteria

Prior to preparation of various road alignment alternatives, it was necessary to establish design parameters which would govern and set out constraints for all potential road alignment options. Since ultimate jurisdiction for the Kirby Road extension has not yet been confirmed, it is necessary to consider engineering design criteria and design guidelines from both the City of Vaughan and Regional Municipality of York. Transportation Association of Canada Design Guidelines were also contemplated along with examination of existing conditions west of Dufferin Street. The design parameters from each governing agency were compared and appropriate, generally the most conservative, proposed standard was established for right-of-way width, design speed, minimum stopping sight distance, minimum 'K' factor, grade range, minimum radius, pavement width, edge treatment, median requirements, intersection geometrics, minimum curb radius, minimum curb grade, maximum super elevation and minimum intersection spacing.

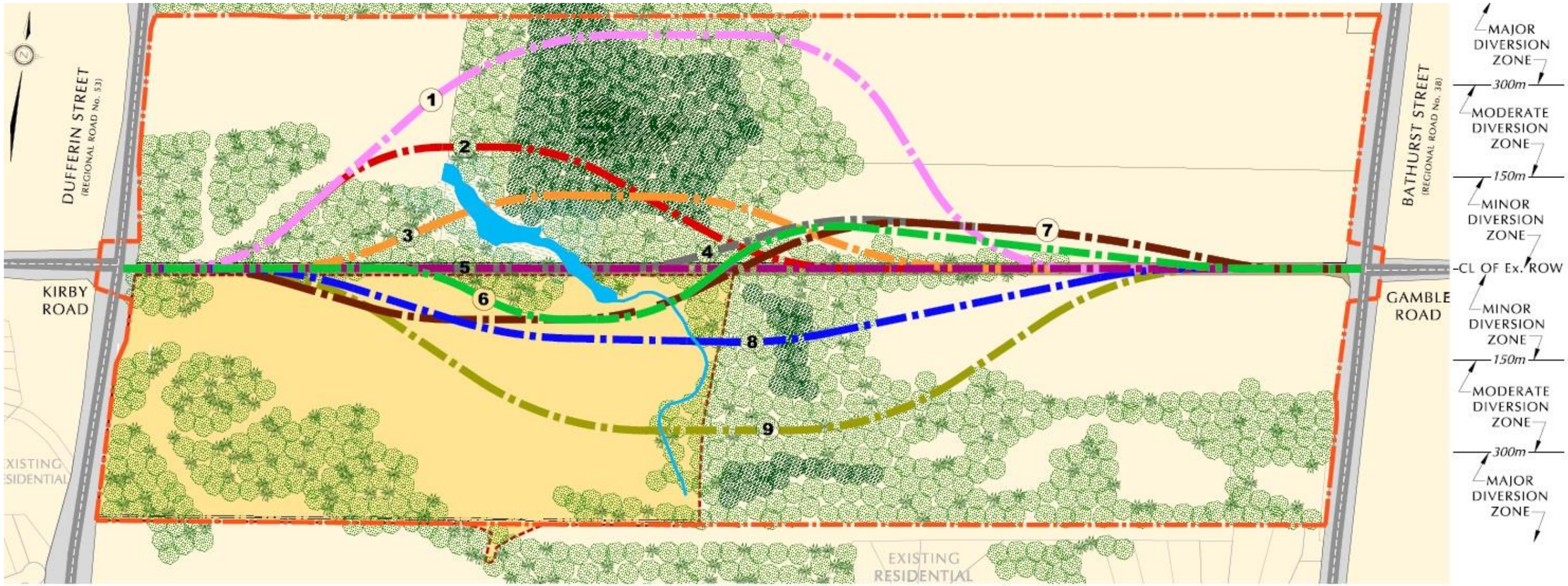
7.2.2 Long List of Alternative Road Alignments

According to the MEA MCEA guidelines, a reasonable range of alternatives should be considered. Significant impacts to Natural, Social and Technical environments should be avoided where possible. Where the key features cannot be avoided, then effects should be minimized where possible, and every effort made to mitigate adverse impacts.

The feasibility of the alternative designs depends, in part, on the nature and location of the transportation system, the nature and location of the problem being addressed, the comparative cost of the alternative designs, and on the municipality's capacity to finance the extension of services.

With the above in mind, a Long List of Alternative Road Alignments for the Kirby Road Extension was developed for screening. The list included nine Alternative Road Alignments (read Alternative Design Concepts) as described below and presented on **Figure 20**.

Figure 20: Long List of Alternative Road Alignments for the Kirby Road Extension



Alignment 1 Major Northerly Diversion

The road alignment spans the Study Area to the north most of all other options and travels the longest distance across the area. The primary goal of this alignment alternative was to avoid the interior forest patch, the wetland and groundwater discharge area, and the watercourse; minimize overall woodland impact, while conforming to most northerly extent possible.

Alignment 2 Moderate Northerly Diversion

The road alignment fits moderate route diversion limits just somewhat over 150m from the existing road allowance centerline. The primary goal of this alignment alternative was to avoid crossing the wetland or groundwater discharge area, and the watercourse while crossing the interior forest patch to the south, thereby making less of a northerly diversion than Alignment 1.

Alignment 3 Minor Northerly Diversion

The road alignment offers less than 150m minor northerly diversion mostly through the western part of the Study Area. The goal of this alignment alternative was to avoid impacts to the watercourse, explore the opportunity of crossing the wetland area at its northern limit while avoiding the interior forest patch to the south and impacts to hedgerow.

Alignment 4 Minor Northerly Diversion

The road alignment offers less than 150m minor northerly diversion mostly through the eastern part of the Study Area. The primary goal of this alignment was to avoid impacts to the watercourse and hedgerow, and to FUA; to minimize impacts and cross the central woodland through its shortest span while crossing the wetland at its southern limit. Also, to minimize land acquisition requirements and utilize the existing road allowance to the greatest extent possible through the west half of the alignment.

Alignment 5 Direct Route Extension

As a direct extension, the road alignment spans the Study Area over the shortest distance. The primary goal of this alignment alternative was to avoid impacts to the watercourse, to prime agricultural lands, to FUA; to minimize land acquisition requirements and fully utilize the existing road allowance, and to see how compatible this alignment is with all other environmental features.

Alignment 6 Minor Jog Diversion

The road alignment offers a minor tight south to north diversion. This additional road alignment was developed and included in the Long List to satisfy the recommendation of TAG members provided at meeting #1 held on June 16, 2017.

The primary goal of this alignment alternative was to swing the alignment first south to avoid crossing the wetland, then drive the alignment north of the existing road allowance to cross the central forested area through its shortest span and avoid impact to existing hedgerow; also, to minimize impact to prime agricultural lands compared to Alignment 4.

Alignment 7 Minor Jog Diversion

The road alignment offers an alternate south to north diversion to avoid impacts to wetland and minimize impact to forest in the western part of the Study Area.

This jog diversion was different than Alignment 6 in that it held less tightly to the edges of the existing wooded area thereby reducing ecological impact to the forest.

Alignment 8 Minor Southerly Diversion

The road alignment offers less than 150m minor southerly diversion. The primary goal of this alignment alternative was to fully avoid a 200m interior forest area, including its buffer and existing hedgerow; to minimize impacts to central woodland.

Alignment 9 Moderate Southerly Diversion

The road alignment spans the Study Area to the south most of all other options and offers an alternative crossing point of the watercourse. This second longest alignment is a more extreme southerly diversion of Alignment 8 and it eliminates the need to cross interior forest patches at the expense of creating a less appealing socio-economic scenario.

7.2.3 Alternative Road Cross-sections

The geometric road cross-section is composed of multiple lateral design elements such as lanes, shoulders, medians, bike facilities, and sidewalks.

It was determined through a traffic analysis conducted by Poulos & Chung Ltd. that at minimum a four-lane cross section is required for the Kirby Road Extension between Dufferin Street and Bathurst Street. Building on this recommendation, five road cross-section options (read Alternative Design Concepts) were developed and considered for the Kirby Road Extension as described below.

It is good design practice, particularly for arterial (high volume) road, to provide a continuous 5.0m center lane, in order to:

- Provide refuge for vehicles making an emergency stop;
- Provide a refuge lane for vehicles entering the regional road from private properties or stop controlled intersections;
- Allow for future installation of left turn lanes (including medians and signal utilities) without the need for pavement widening;
- Provide a buffer area for emergency or maintenance vehicles, and
- Provide a buffer area for the purpose of any maintenance or construction activity.

Bike lanes are a dedicated space for cyclists located in the traveled portion of the roadway for one-way cyclist traffic where motorists are not allowed to park, stand or drive. Bike lanes are typically located on urban streets.

MUPs are wider versions of a sidewalk, ranging in 3 to 5 metres in width and often constructed of asphalt. MUPs offer a wider corridor for various modes of active transportation, including walking,

jogging, dog-walking, rollerblading, and cycling. The introduction of MUP's is an ongoing effort by York Region and each of the Municipalities in the Region and a defined standard has not yet been set.

In consideration of possible assumption of Kirby Road by York Region, the Transportation Mobility Plan Guidelines (November 2016, York Region) were consulted, in part **Table 6** and **Table 8**. In **Table 6**, to secure a LOS "A" for pedestrians, a sidewalk of greater than 2.0m or an MUP greater than 3.0m is required. As per **Table 8**, to secure a LOS "A" a bicycle space of greater than 1.8m is required.

The requirements can be rounded off to an MUP of 4.0m consisting of 2.0m sidewalk, 0.5m painted line (to provide safety buffer separating cyclists and pedestrian) and 1.5m bicycle lane. This in effect replicates the York Region Level of Service "A" criteria. Since the Kirby Road Extension represents new construction, it was concluded such a cross –section can be secured.

Also in consideration of possible assumption by York Region, a 36m wide road RoW for minor arterial road was assumed as a basis for development of the design concepts for road cross-section for the Kirby Road Extension. Therefore, four out of five proposed concepts utilized the 36m road allowance. An additional concept was developed based on a 45m RoW, which is typical for major arterial roads. The increased RoW allows for a greater flexibility in utility, tree placement and active transportation (i.e. MUPs placed in the boulevards on both sides of the road). Also this option provides protection for 6 lanes, which involves possible widening in the long term to include HOV lanes in addition to required 4 lanes.

Road Cross-section Option 1

This Option offers a 4 lane cross-section, including auxiliary lanes where required, MUP provided on both sides of the road. The design features a 14.5m paved surface for vehicular movement and 10.75m wide boulevards, fitting all the elements within a 36m RoW.

The designs for mid-block and intersections are illustrated on **Figure 21** and **Figure 22.**

Figure 21: Road Cross-Section at Mid-block for Option 1

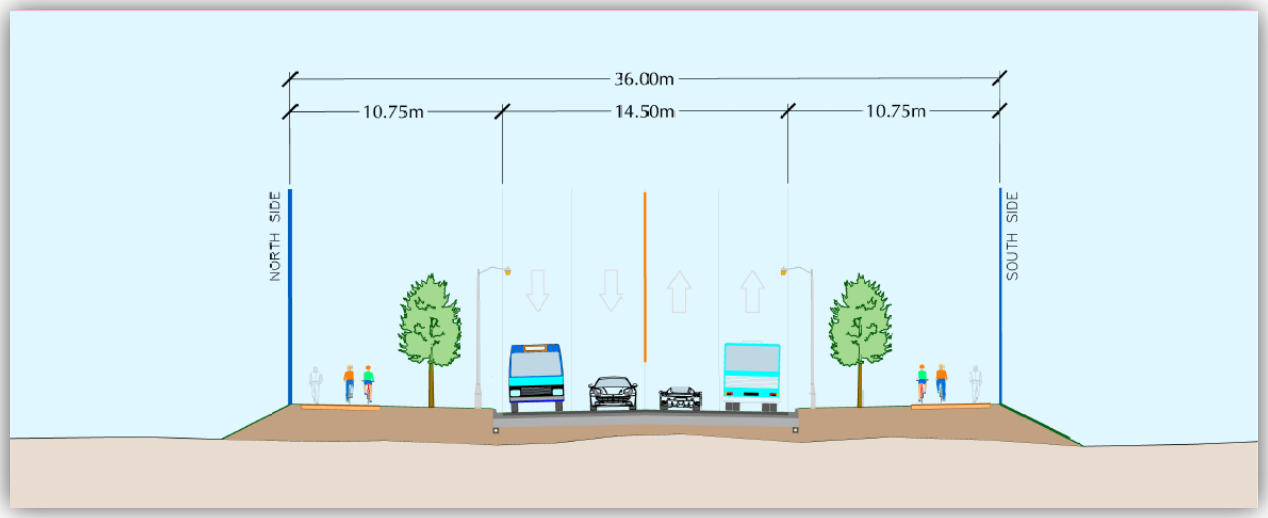
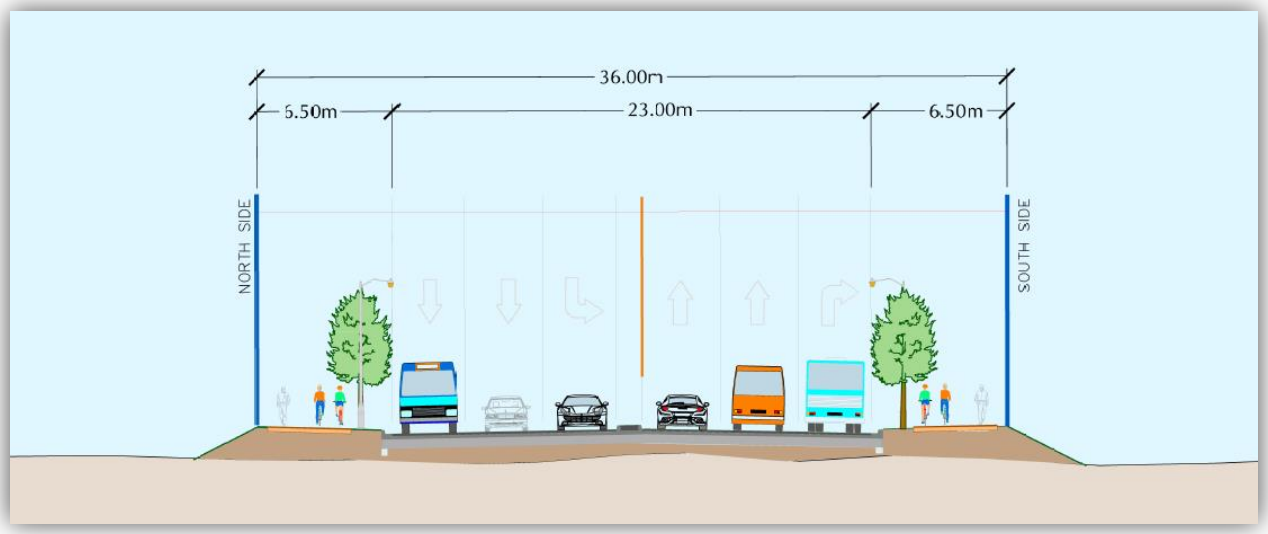


Figure 22: Road Cross-Section at Intersection with Auxiliary Lanes for Option 1



Road Cross-section Option 2

This Option offers a 4 lane cross-section, including auxiliary lanes where required and dedicated bike lanes and sidewalks provided on both sides of the road. The design features a 17.5m paved surface for vehicular movement and 9.25m wide boulevards, fitting all the elements within a 36m RoW.

The designs for mid-block and intersections are illustrated on **Figure 23** and **Figure 24** below.

Figure 23: Road Cross-Section at Mid-block for Option 2

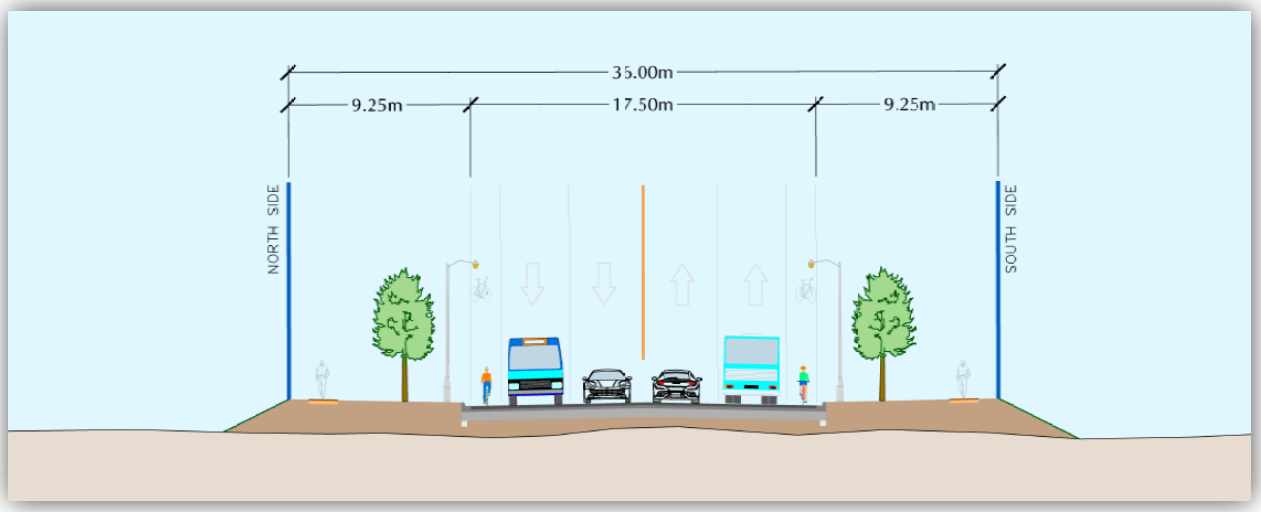
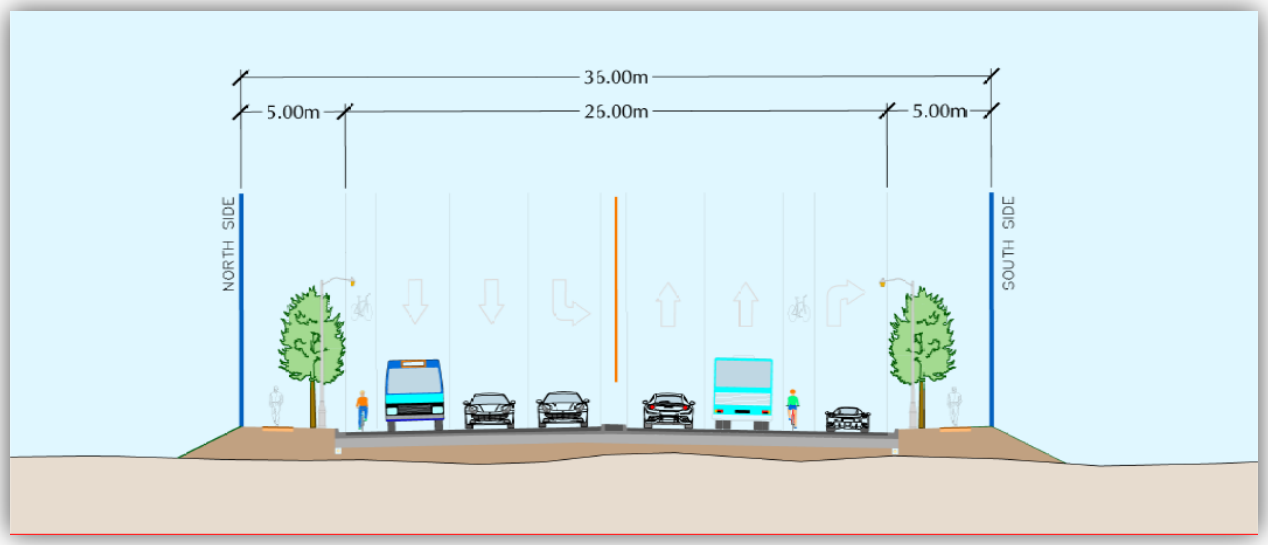


Figure 24: Road Cross-Section at Intersection with Auxiliary Lanes for Option 2



Road Cross-section Option 3

This Option offers a 5 lane cross-section with continuous shared left turn lane, including right turn lanes where required and either a sidewalk or an MUP provided on one side of the road. The design features a 19.5m paved surface for vehicular movement and 8.25m wide boulevards, fitting all the elements within a 36m RoW.

The designs for mid-block and intersections are illustrated on **Figure 25** and **Figure 26.**

Figure 25: Road Cross-Section at Mid-block for Option 3

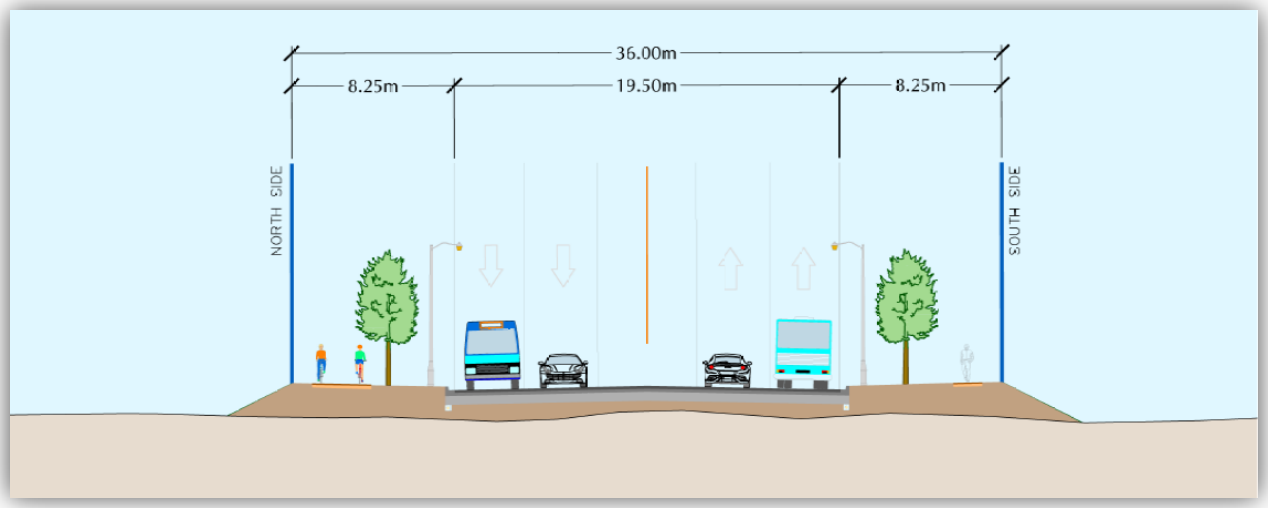
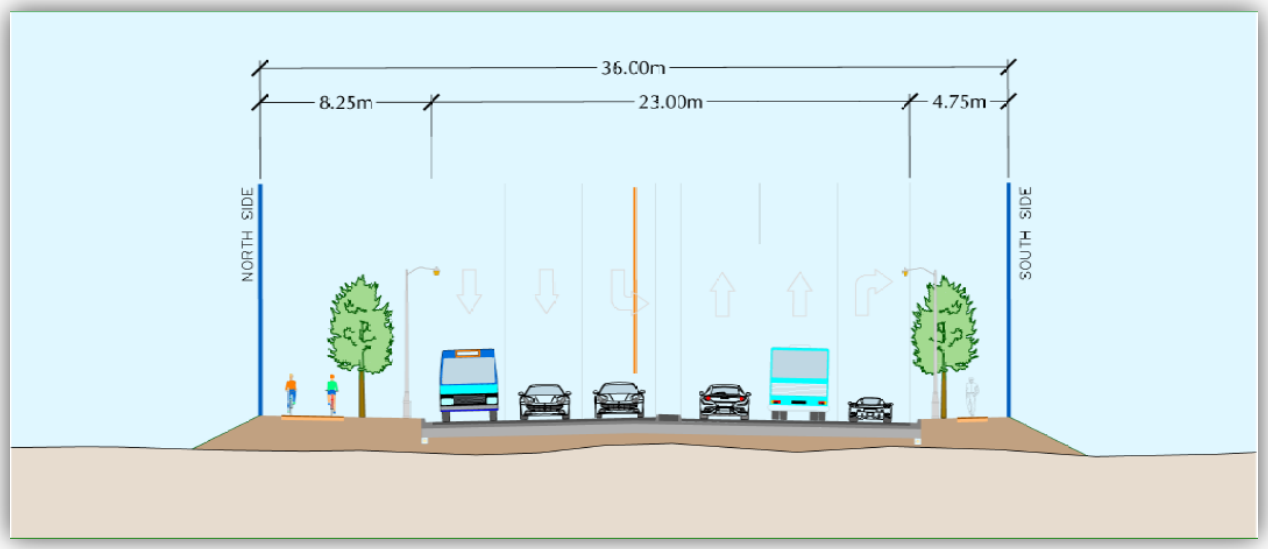


Figure 26: Road Cross-Section at Intersection with Auxiliary Lanes for Option 3



Road Cross-section Option 4

This Option offers a 5 lane cross-section with continuous shared left turn lane, including right turn lanes where required and dedicated bike lanes and sidewalks provided on both sides of the road. The design features a 22.5m paved surface for vehicular movement and 6.75m wide boulevards, fitting all the elements within a 36m RoW.

The designs for mid-block and intersections are illustrated on **Figure 27** and **Figure 28**.

Figure 27: Road Cross-Section at Mid-block for Option 4

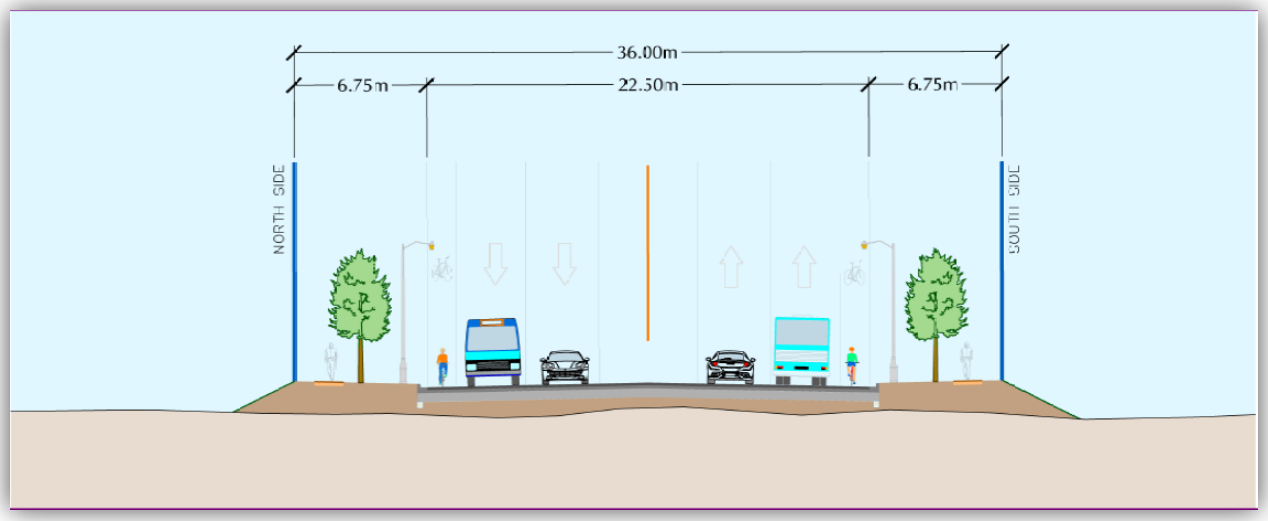
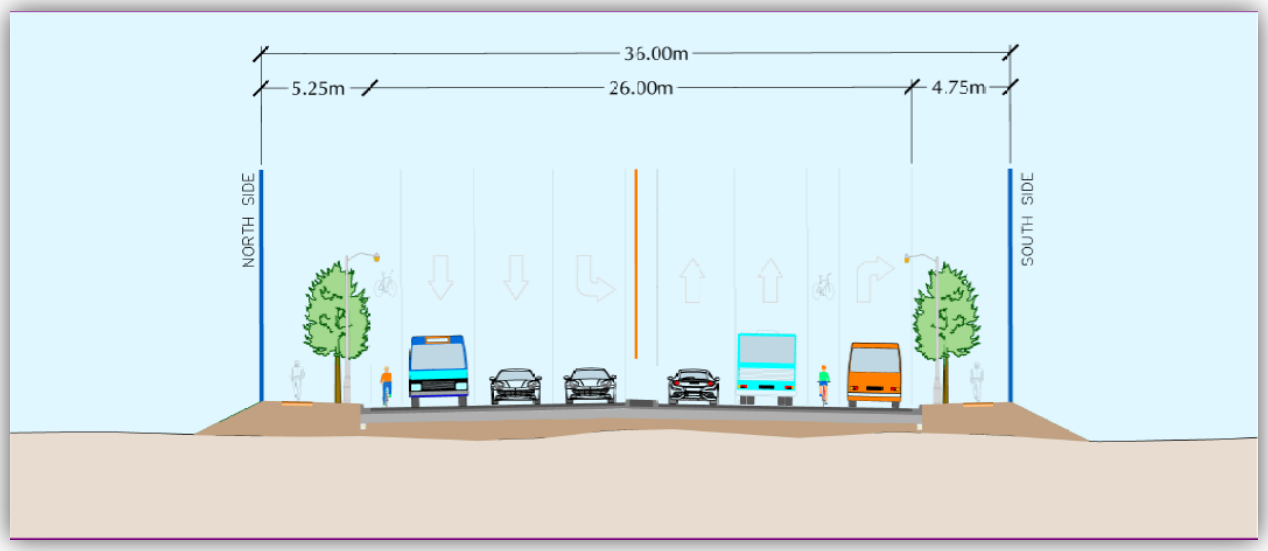


Figure 28: Road Cross-Section at Intersection with Auxiliary Lanes for Option 4



Road Cross-section Option 5

This Option offers a 4 lane cross-section with green refuge strip, including auxiliary lanes where required, dedicated bike lanes provided on both sides of the road and either a sidewalk or an MUP provided on one side of the road. The design features a 17.5m paved surface for vehicular movement, a 9m center strip and 9.25m wide boulevards, fitting all the elements within a 45m RoW.

The designs for mid-block and intersections are illustrated in **Figure 29** and **Figure 30**.

Figure 29: Road Cross-Section at Mid-block for Option 5

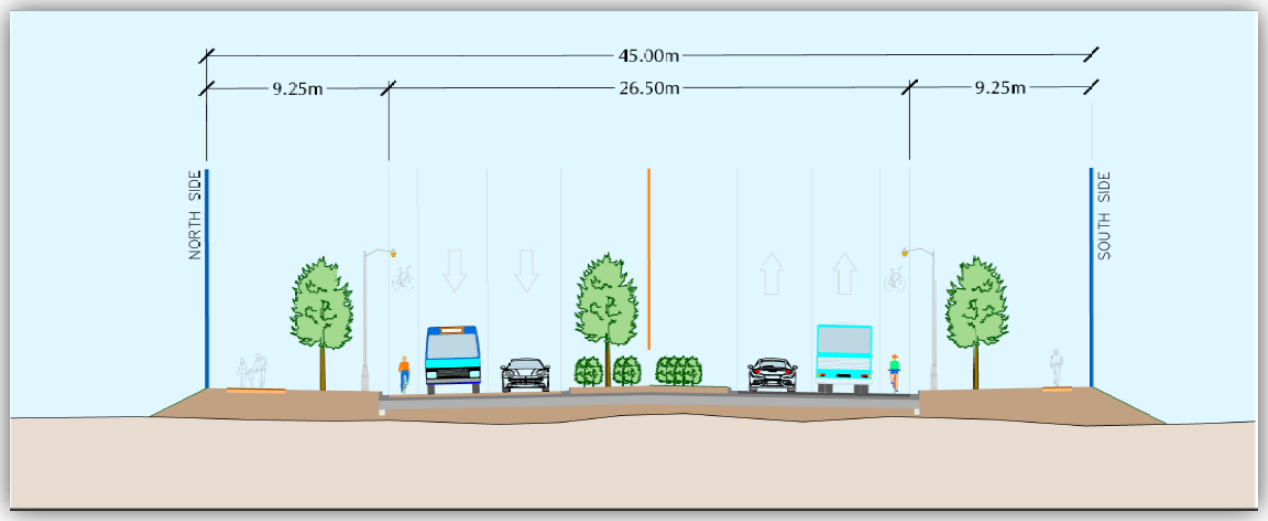
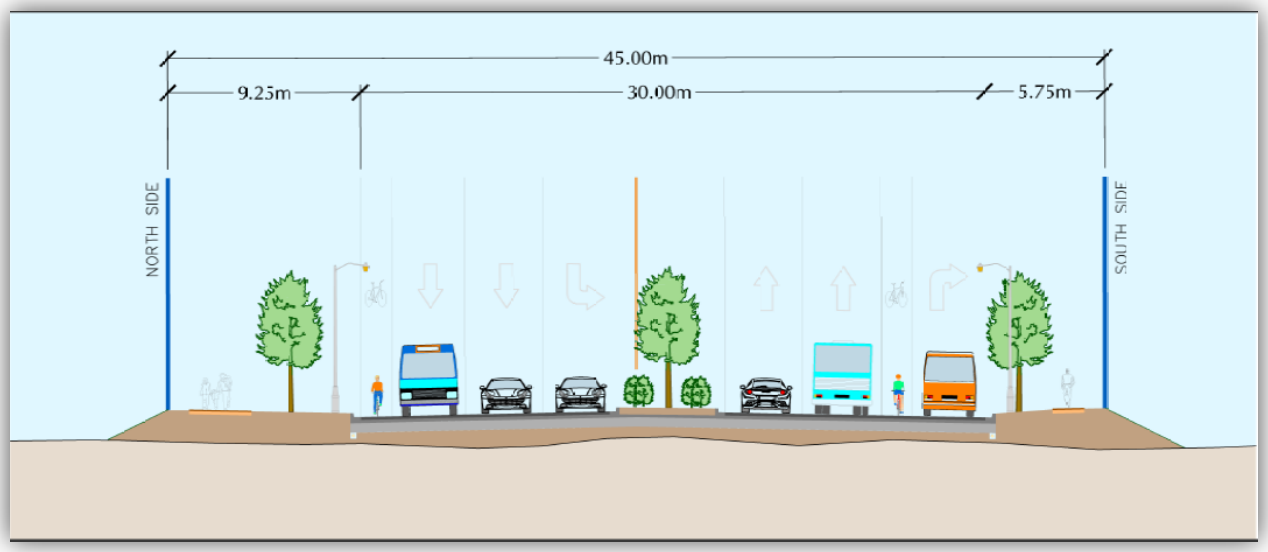


Figure 30: Road Cross-Section at Intersection with Auxiliary Lanes for Option 5



7.3 PHASE 3A – Screening of Long List

As earlier noted, the purpose of screening is to ensure that only viable road alignments were carried forward for selection of recommended options. Detailed evaluation of the entire Long List would require tremendous effort from the team, produce unreasonable amount of information to consider and affect transparency of the decision making.

Notably, according to the MCEA recommendations, during Phase 3 of the process the Project Team is required to evaluate and not to also screen Alternative Design Concepts. However, the Project Team applied due diligence and screened the Long List of Alternative Road Alignments before carrying out a detailed evaluation. The approach allowed for a focused review of the short-listed options.

7.3.1 Screening Criteria

Proposed screening criteria reflect critical aspects of the Preferred Solution "Construct New Roadway Extension". The criteria and rationale for selection of alternatives are summarized in **Table 9** below.

Table 9: Screening Criteria and Rationale

Screening Criteria	Rationale
Technical Environment	
Ability to provide highest level of transportation and municipal services to proposed new development	**Identify** most effective and sustainable design concepts
Optimum footprint promoting compatibility with existing elevations while minimizing the amount of grading required	**Minimize** impact to surrounding environment
Optimum crossing point of the East Patterson Creek/Provincially Significant Wetland (PSW)	**Reduce** complexity of design and cost of overpass structure
Socio-Economic Environment	
Compatibility with existing and proposed provincial, regional and municipal long range planning land use policies	**Ensure** that proposed concepts meet applicable planning policy requirements
Gross impacts on existing and future land use	
Need and extent of alterations to the existing unopened Right of Way (RoW)	**Avoid** or minimize need for land acquisition
Natural Environment	
Gross impacts to aquatic resources	**Avoid** impact on critical Natural Heritage features
Gross impacts to terrestrial resources	**Avoid** impact on critical Natural Heritage features

7.3.2 Screening Approach

The following steps were followed.

1. **Generate a Long List of Alternative Design Concepts**

Alternative Road Alignments were developed having in mind the following considerations:

- Area sensitivities identified by the project team
- Existing Kirby Road Extension corridor

2. **Apply screening criteria**

Each alternative was given a score depending on how well it fulfilled each screening criterion as follows:

✓ Meets criterion ✓ Partially meets criterion ✗ Does not meet criterion

3. **Summarize the results**

For technical consideration, a conservative maximum road footprint for the proposed road alignment was assumed, including construction buffer.

Single line presentation of alternative road alignments was used for public presentation.

A screening matrix was used to summarize the results of assessment. Only the options that in combination fully and/or partially meet the screening criteria were carried forward for detailed evaluation.

TAG #1 meeting recommended to not introducing a typical road cross-section to the public at the first consultation round, as it may not be easily understandable at that time. Therefore, the design concepts for road cross-section were considered later in the planning process during evaluation of the design concepts.

7.3.3 Screening Results

As noted above the details and results of screening were documented in a matrix. The full screening matrix is included in **Appendix B1**. A summary of the screening matrix is shown below.

Table 10: Summary Screening Matrix for Alternative Road Alignments

SCREENING CRITERIA	**Option 1** Major Northerly Diversion to Avoid Wetland and Dense Forest	**Option 2** Moderate Northerly Diversion to Avoid Wetland and Groundwater Discharge Area	**Option 3** Minor Northerly Diversion with Wetland Crossing and Avoid Dense Forest	**Option 4** Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Option 5** Direct Extension with Wetland Crossing	**Option 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Option 7** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Option 8** Minor Southerly Diversion to Avoid Wetland	**Option 9** Moderate Southerly Diversion to Avoid Wetland and Minimize Impacts to Dense Forest
TECHNICAL ENVIRONMENT									
Ability to provide highest level of transportation and municipal services to proposed new development	✗	✓	✓	✓	✓	✓	✓	✓	✓
Optimum footprint promoting compatibility with existing elevations while minimizing the amount of grading required. Minimizes impact to surrounding environment	✗	✓	✓	✓	✓	✓	✓	✓	✗
Optimum crossing point of the East Patterson Creek/Provincially Significant Wetland (PSW)	✓	✓	✗	✓	✓	✓	✓	✓	✓
SOCIO-ECONOMIC ENVIRONMENT									
Compatibility with existing and proposed provincial, regional and municipal long range planning land use policies	✗	✓	✓	✓	✓	✓	✓	✓	✓
Gross impacts on existing and future land use	✗	✓	✓	✓	✓	✓	✗	✗	✗

Screening Methodology: ✓ Meets criterion ✓ Partially meets criterion ✗ Does not meet criterion

Table 10: Summary Screening Matrix for Alternative Road Alignments

SCREENING CRITERIA	**Option 1** Major Northerly Diversion to Avoid Wetland and Dense Forest	**Option 2** Moderate Northerly Diversion to Avoid Wetland and Groundwater Discharge Area	**Option 3** Minor Northerly Diversion with Wetland Crossing and Avoid Dense Forest	**Option 4** Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Option 5** Direct Extension with Wetland Crossing	**Option 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Option 7** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Option 8** Minor Southerly Diversion to Avoid Wetland	**Option 9** Moderate Southerly Diversion to Avoid Wetland and Minimize Impacts to Dense Forest
Need and extent of alterations to the existing unopened Right of Way (RoW)	✗	✓	✓	✓	✓	✓	✗	✗	✗
NATURAL ENVIRONMENT									
Gross impacts to aquatic resources	✓	✓	✗	✓	✓	✓	✓	✓	✓
Gross impacts to terrestrial resources	✗	✗	✗	✓	✓	✓	✓	✓	✓
Screening Results	Strongly satisfies 2 major components. Does not satisfy 6 major components.	Strongly satisfies 3 major components and acceptably satisfies 4 components. Does not satisfy 1 major component.	Strongly satisfies 2 major components and acceptably satisfies 3 components. Does not satisfy 3 major components.	Strongly satisfies 3 major components and acceptably satisfies 5 components. **Carried forward for further consideration.**	Strongly satisfies 4 major components and acceptably satisfies 4 components. **Carried forward for further consideration.**	Strongly satisfies 2 major components and acceptably satisfies 6 components. **Carried forward for further consideration.**	Strongly satisfies 1 major component and acceptably satisfies 5 components. Does not satisfy 2 major components.	Strongly satisfies 1 major component and acceptably satisfies 5 components. Does not satisfy 2 major components.	Strongly satisfies 1 major component and acceptably satisfies 4 components. Does not satisfy 3 major components.

Screening Methodology: ✓ Meets criterion ✓ Partially meets criterion ✗ Does not meet criterion

Natural Environment Impact Assessment

Alignment 3 was found the most impactful, as it creates greatest aquatic impacts to groundwater discharge areas. It also creates greatest impacts to terrestrial resources. Alignments 4 through 8 were found having moderate gross impacts on both aquatic and terrestrial resources.

Alignment 9 was ranked the highest from the Natural Environment perspective as it would have least impacts to terrestrial resources and moderate aquatic impacts due to the watercourse crossing.

Socio-economic Environment Impact Assessment

Alignment 1 was found the most impactful, as it is compatible with planning policies to the least extent, creates major impacts on existing and future land use and requires major alterations to the existing road allowance. Alignment 1 is followed by Alignments 7 through 9 which were found less compatible with planning policies but still having major impacts on both land use and existing road allowance.

Alignment 5 was ranked the highest from the Socio-economic Environment perspective as it would have minimal impact on existing and planned land use and least impacts to terrestrial resources and moderate aquatic impacts due to the watercourse crossing.

Technical Environment Impact Assessment

Alignment 1 was found the most impactful, as it exhibits least ability to provide highest level of transportation and generates a largest grading area footprint.

Alignments 4, 5 and 6 were ranked the highest from the Technical Environment perspective as these routes exhibit a minor or no horizontal realignment; offer good to most design flexibility, ease of maintenance; generate small to smallest grading area footprint; and anticipate a moderate degree of interference with the wetland or watercourse.

Overall Screening

The screening indicated that three out of nine Alternative Road Alignments, namely Alignments 4, 5 and 6 should be carried forward for further consideration.

Alignment 4 strongly satisfied 3 major components and acceptably satisfied 5 components.

Alignment 5 strongly satisfied 4 major components and acceptably satisfied 4 components.

Alignment 6 strongly satisfied 2 major components and acceptably satisfied 6 components.

7.4 Confirmation of Short-listed Road Alignments

The screening results were presented to the public at PIC #1 in June 2017. Additional PIC #1 details and the responses received from the PIC #1 update circulation are presented in the Public Information Centre #1 Summary Report in **Appendix A4.**

The comments received challenged the need and justification for the project, criteria used for screening of the alternatives, economic impacts on the FUA and protecting ORM features and other legislated areas.

7.4.1 Scoring of Alignments Traversing Future Development

During evaluation of alternatives, the EA process requires the proponent to consider impacts on all aspects of the environment, including the economic/financial environment. Therefore, consideration of land acquisition costs is supported by the accepted practice. It should be noted that the eastern segment of all road alignment alternatives, including Alignments 7, 8 and 9 traverse the lands not designated for future development and cost is a valid consideration in this case.

With regard to the cost consideration for the western segment of road alignments which traverse the Future Urban Zone area, the EA process should not assume that lands required for the extension of Kirby Road can be obtained at no cost through a condition of draft plan of subdivision approval.

Under Section 51, the Planning Act provides municipalities the authority to impose a condition of draft plan approval that requires that the roads created by the subdivision (those related to and serve the subdivision) be conveyed to the municipality at no costs, and a condition that requires that road widenings for existing highways (roads) that abut the proposed subdivision be conveyed at no costs. In addition, Section 51 states that all conditions of draft plan approval must be fair and reasonable.

Neither of these requirements seems to apply to the proposed Kirby Road Extension. Divisional Court has held numerous times that conditions must relate to the subdivision lands and not the municipality's objectives at large. Furthermore, conditions deemed unfair or unreasonable can be overruled. The need for the Kirby Road Extension has been identified by both York's and Vaughan's TMPs. It has also been verified by the analysis carried out by Poulos & Chung Ltd. The requirement for the new road is based on a transportation demands assessment and population growth and not on the development of the future subdivision.

In summary, it would be irresponsible for the EA process not to consider the economic impact of the Kirby Road Extension on the lands in question.

7.4.2 Examining Various Road Connection Points

In an effort to minimize impact to the forest located at the western part of the Study Area, it has been suggested by MNRF at the August 29, 2017 site visit that consideration should be given to connecting the new segment of Kirby Road at an intermediate point on Dufferin Street, further south of the existing T-intersection of Kirby Road and Dufferin Street, and not necessarily forming a four-way intersection. Similar comment was received from a public member on the PIC #1 presentation. In response to these requests, SCE conducted a review of the jogged intersection approach.

Both the Kirby Road/Dufferin Street intersection and Gamble Road/Bathurst Street intersection currently operate as signalized and will continue to operate as such after the Kirby Road extension link is provided. The "Access Guideline for Regional Roads" issued by York Region Transportation and Works Department (September 2007) was used to determine feasibility for creating an additional signalized T-intersection in proximity to the existing signalized T-intersections on Dufferin Street and Bathurst Street. According to Appendix 'A' - Road Classification Chart of the guideline, Dufferin Street is classified as CLASS I roadway having a rural 2 lane cross section and Bathurst Street is classified as CLASS II roadway having a rural 4 lane cross section along the study area frontage. According to **Table 2 – Spacing**

Between Signalized Intersections, the desirable spacing between signalized intersections on Class I and II Regional roads is 800 metres and the minimum spacing is 400 metres. On Class I and II roadways the desirable intersection spacing may only be reduced from 800 metres to 400 metres if the subject signal, to the satisfaction of the Region, maintains the capacity and safety of the arterial corridor, or if the signal does not impact progression excessively. Therefore, proposing a non-continuous Kirby Road connection to Dufferin Street or Bathurst Street less than 400 metres from the existing T-intersection as an effort to reduce impact to wooded area is not a feasible alternative. If implemented, it would compromise the operation of the auxiliary lanes between the two proposed T-intersections under signalized condition.

Furthermore, the connection point would be located close to or beyond the southern limit of the FUA. In case the new road would traverse the southern part of the future development, two road crossings of the Valley and Stream corridors within the FUA should be mitigated. Dissecting the FUA by the new road would also result in creation of an inefficient development block and produce an undesirable physical barrier through the future community; the barrier which would also require costly mitigating measures.

Having screened and examined various road connection points, a connecting point necessitating a new signalized intersection with Dufferin Street south of the existing T-intersection was dismissed and not carried forward as part of the horizontal alignments under the short-listed Alternative Road Alignments. Broadly, any corridor alignments that would otherwise necessitate new signalized intersections under offset intersections and/or jogged configurations with the existing Bathurst Street and Dufferin Street signalized intersections, as fixed points, were dismissed.

7.5 PHASE 3B – Evaluation of Short List

Initial Screening of the Long List of Alternative Road Alignments resulted in selection of three road alignments, namely # 4, 5 and 6 out of nine initial options. On August 29, 2017, a site walk was held with representatives from MECP, TRCA, MNRF, City of Vaughan, York Region and selected members of the project team. The purpose of the site walk was to identify specific environmental features and constraints that would inform the decision making. It was recommended to bring into consideration an additional road alignment.

Consequently, the collected data was used to develop a modified version of Alignment 6 (referenced further in the ESR as Alignment 6A) and to update the short-listed road alignments. The additional alignment curves farther to the south compared to Alignment 6 to avoid and minimize potential impacts to the natural heritage features in the western part of the Study Area. **Figure 31** illustrates the updated short-list of Alternative Road Alignments.

Whereas the initial nine (9) alignment alternatives were screened using as the basic 36 m RoW for the roadway, the four (4) short-listed alignment alternatives were developed further to define their footprint based on their respective earthworks requirements.

A full ELC assessment was applied to units directly affected by the alignment alternatives. The short-listed alignment alternatives were subjected to a detailed assessment by the Project Team. Purpose of the detailed evaluation is to identify all potential environmental effects of the short-listed Alternative Road Alignments, including the Alternative Design Concepts for road cross-section, develop mitigation

measures, confirm net effects on the environment and identify Recommended Design Concepts. By means of the comparative evaluation, advantages and disadvantages of the design alternatives have been considered against the ability of the options to fulfill the project specific evaluation criteria, culminating with selection of a Recommended Design Concept(s). The criteria used for the assessment, the approach taken and the results of the evaluation are explained in the subsequent sections.

Figure 31: Short-Listed Road Alignments Study Corridor

7.5.1 Evaluation Criteria and Indicators

The proposed Evaluation Criteria have been established with consideration given to the types of environment recommended by the MEA MCEA guidelines specific to municipal road projects (Part B, Section B.3.1 Description of the Environment). It was concluded that the environment associated with the Study Area would be best described through the four environmental factors: Transportation, Natural Environment, Social Environment and Economic Environment. The criterions were grouped under different aspects identified for each of the environmental factors

A summary table including the draft Evaluation Criteria was presented to the public for review and comment at PIC #1 held on June 29, 2017. Revisions to the criteria suggested by the City of Vaughan staff through a memorandum dated July 31, 2017 were incorporated in the final version as deemed fit. Additional revisions were applied by the project team for a greater clarity.

The proposed Indicators to evaluation criteria have been established based on professional expertise of the team. The indicators provide a basis for comparison between the alternatives, i.e. they should be used to judge on degree of meeting the respective criterion. Initially, the proposed indicators were referenced in the presentation materials as “measures”. Recognizing that using the word “measure” may be confused with the frequently referenced in the comparative evaluation “measure” as an act of mitigation, the term “indicator” was introduced where appropriate.

In the summary table below, the evaluation criterions are grouped under the key environmental factors and related aspects helping to describe the existing environment that could be affected by the project and to assess potential effects on significant features which comprise each type of environment.

Table 11: Evaluation Criteria and Indicators

Evaluation Criteria	Indicators
TRANSPORTATION ENVIRONMENT FACTOR	
Planning Aspect	
Network Connectivity	- Improvement in Network Connectivity - Capability to support regulatory framework, including regional and municipal plans, policy initiatives, standards and guidelines
Network Capacity	- Improvement in Future Congestion (meeting of projected travel demands) - Improvement in Traffic Operations for commuters, local businesses (reduced congestion)
Engineering Aspect	
Mode of Transportation	- Ability to accommodate Transit, Cycling, Pedestrian, Vehicular modes

Evaluation Criteria	Indicators
Design Complexity	- Use of substandard design components (i.e. horizontal/vertical curves) - Improvement in roadway geometry
Construction Complexity	- Constructability (structural requirements, retaining walls, earth balance, watercourse/wetland crossing) - Construction staging challenges - Geotechnical challenges (soil/ground conditions)
Operation	- Improvement in road safety and accessibility (sight distance; turning movements) - Reduction in maintenance requirements
SOCIAL ENVIRONMENT FACTOR	
Land Use Aspect	
Resource Designations and Policies	- Degree of compatibility with provincial, regional and municipal growth/development goals/objectives
Agricultural Operations	- Physical resource consumption - Facility resource consumption - Operational impacts
Approved Development Proposals	- Accommodating existing/future development proposals (public access/intersecting streets/connections for all modes of transportation)
Community Aspect	
Quality of Life	- Encroachment on individual properties (number/area) - Improvement in traffic operations for commuters and active transportation
Existing Wells	- Effects on water quality and quantity - Number of affected wells
Noise	- Change in sound levels over pre-existing conditions
Cultural Aspect	
Archaeological Resources	-Degree of interference with known areas of archaeological potential
Built Heritage Resources	- Degree of interference with cultural heritage features

Evaluation Criteria	Indicators
NATURAL ENVIRONMENT FACTOR	
Terrestrial Features Aspect	
Wetlands	- Effects on Provincially Significant Wetland and other wetlands
Vegetation	- Encroachment on Designated Environmentally Sensitive Areas / Areas of Natural and Scientific Interest - Effects on Significant Terrestrial Features (encroachment, reduction of area) - Fragmentation/Connectivity of features - Species at Risk (rare, endangered and threatened) - Opportunities for enhancement
Wildlife Habitat	- Effects on Significant Wildlife Habitat (encroachment, reduction of area) - Fragmentation/Connectivity of features - Species at Risk (rare, endangered and threatened) - Opportunities for enhancement
Aquatic Features Aspect	
Surface Water Quantity and Quality	- Degree of interference with water quality, thermal regime or baseflow
Aquatic Habitat	- Effects on extent (area) and function of riparian habitat
Surface Drainage Aspect	
Watercourses	- Requirements for crossing of East Patterson Creek (reduction of area)
Stormwater Management	- Effects on catchment area - Operation and maintenance requirements
Groundwater Aspect	
Recharge/Discharge Areas	- Degree of interference with groundwater recharge/discharge areas
Groundwater Quality	- Effects on vulnerable areas (area)
ECONOMIC ENVIRONMENT FACTOR	

Evaluation Criteria	Indicators
Cost Estimates	- Capital Costs - Operation and Maintenance Costs - Property acquisition requirements

7.5.2 Evaluation Approach

The evaluation approach included the following two steps:

1. **Undertake Net Effects Analysis**

The MCEA process requires to identify potential impacts on the environment and where possible to avoid them. In some cases this may not be possible and measures will have to be taken to minimize or offset negative effects. The remaining impacts (both positive and negative) of the project after mitigation measures have been applied are called “Net Effects”.

The potential environmental effects were identified through review of existing (before project implementation) and anticipated future conditions (after project implementation) within the Study Area and assessed against the proposed evaluation criteria and indicators.

Once the potential environmental effects were identified for each Alternative Design Concept, appropriate avoidance/mitigation/enhancement measures are developed where possible to address the potential effects. The measures were developed based on recommendations included in Appendix 2 Typical Mitigation Measures for Potential Environmental Effects of MCEA and professional expertise of the project team.

Following application of the measures to potential environmental effects, the remaining Net Effects (negative or positive) have been determined. In cases where the potential effects could not be addressed through the mitigation measures, they remain unchanged and still identified as the net effects on the environment.

2. **Carry out Comparative Evaluation**

Having the net effects identified for each Alternative Design Concept, the concepts then were compared to one another in order to identify a Recommended Design Concept(s). The comparison of Net Effects was completed in two consecutive steps: identifying advantages or disadvantages and establishing scores and rankings.

An advantage or disadvantage was determined for each design concept by comparing the net effects associated with each concept to one another in the context of proposed evaluation criteria/indicators.

Next, each Alternative Design Concept was ranked based on the identified advantages and disadvantages on a Factor-by-Factor (Transportation, Natural, Social and Economic Environments) basis.

The established Factor specific rankings range from “no net effect” (most preferred) to “very significant net effect” (least preferred). The rankings of design concept were visually illustrated through the use of the following symbols and scores:

Table 12: Symbols and Scores

Ranking Symbol	Ranking Description	Ranking Score
	**No Effect**	**5**
	**Minimal Effect**	**4**
	**Moderate Effect**	**3**
	**Significant Effect**	**2**
	**Very Significant Effect**	**1**

To ensure that visual presentation is accurate, the design alternatives were scored by assigning a highest score of 5 points to the alternative that would create no impacts, and indexing the remaining alternatives against the recommended alternative for each Factor (minimum score is 1 point).

As there is a different number of criterions under each environmental Factor, the Factor specific scores have been averaged up to two decimal points to arrive at a normalized score for each Factor. To signify equal importance of all the Factors to the environment, no numerical weighting was applied to the scores.

An overall ranking for each alternative was established based on combining the Factor specific rankings. Lastly, a Recommended Design Concept was identified based on the combined consideration of the overall scores. The Alternative Design(s) with the lowest overall impact, i.e. highest overall score was identified as the Recommended Design Concept(s).

7.5.3 Evaluation Results

One of the key principles of successful environmental planning requires systematic evaluation of alternatives in terms of their advantages and disadvantages helping to determine their net environmental effects. The evaluation of the Alternative Road Alignments was documented through series of tables. The Advantages and Disadvantages matrixes for each environmental factor as well as detailed Net Effects analysis matrixes are included in **Appendix B3** – Detailed Evaluation of Alternative Road Alignments. A detailed cost estimate is provided in **Appendix C3.3** – Cost Estimates. An overview of the evaluation results is provided below.

Natural Environment Impact Assessment

Alignment 5 will result in the most amount of impact to woodlands and wildlife habitat and a moderate impact to the wetland whereas alignment 6A will result in the least amount of impact to these features and a minimal impact to the wetland.

Alignments 4 and 5 will result in similar (moderate) impacts to surface water quality and no effects to aquatic habitat and Alignments 6 and 6A will result in less impacts to surface water quantity and quality and minimal effects to aquatic habitat.

Alignments 4 and 5 will result in moderate impacts to the watercourse and recharge/discharge areas and minimal impacts to stormwater management.

Alignments 6 and 6A will result in the least amount of impact to the watercourse and recharge/discharge areas and moderate impacts to stormwater management.

No impact to groundwater quality is anticipated with all of the proposed alignments.

Alignment 5 was ranked the lowest as it will result in the greatest amount of removal of woodlands and encroaches within PSW riparian areas.

Alignment 6A was ranked the highest as it avoids most woodlands, the PSW and associated riparian area. **Figure 32** illustrates the natural environment impact assessment for alternative road alignments.

Transportation Environment Impact Assessment

Based on the proposed mitigation measures, the preliminary Alternative Design Concepts for the short-listed road alignments were updated to highlight introduction of design features such as wetland/creek crossing structures, potential surface drainage crossings (culverts) and retaining walls proposed to reduce environmental effects and footprint.

Figure 33 illustrates the short-listed road alignments for the transportation impact assessment. A summary of alignment characteristics is provided in **Table 13**.

Table 13: Key Alignment Design Characteristics

Alternative Road Alignment	Alignment Characteristics
Alignment 4 Minor Northerly Diversion	• Approximately 50 m wetland crossing structure • Five surface drainage crossings • Retaining walls: 770 square meters • Footprint: 11.21 ha
Alignment 5 Direct Route Extension	• Approximately 50 m wetland crossing structure • Four surface drainage crossings • Retaining walls: 770 square meters • Footprint: 11.14 ha
Alignment 6 South and North Minor Jog Diversion	• Approximately 12 m wide creek crossing structure based on preliminary geomorphic analysis • Five surface drainage crossings • Retaining walls: 943 square meters • Footprint: 12.00 ha
Alignment 6A Modified South and North Minor Jog Diversion	• Approximately 12 m wide creek crossing structure based on preliminary geomorphic analysis • Five surface drainage crossings • Retaining walls: 770 square meters • Footprint: 12.05 ha

All alignments improve the overall road network operational capability.

Alignment 6 and Alignment 6A introduce a varying center line curvature including the formation of back to back curves in order to connect to required north south arterial road intersections. Although network capacity is not directly affected, operating differences will occur.

The introduction of curves in Alignments 6 and 6A lengthens the total travel distance for all modes of transportation between Bathurst Street and Dufferin Street. Transit will experience increased travel times and increased operating costs due to additional travel distance. Similarly, pedestrians and bicyclists will take longer to traverse the alignment. Automobiles and trucks again due to the increased travel distance will take a bit longer travel time and experience increased fuel consumption.

Alignment 5 is ranked the highest as it exhibits no or minimal effects with regards to the technical evaluation criteria. Alignments 6 and 6A are ranked the second lowest and the lowest as they exhibit moderate or significant effects with respect to the Engineering Aspect.

Social Environment Impact Assessment

Alignments 4 and 5 are the same except Alignment 4 avoids the hedgerow located in the existing ROW in the eastern portion of the Study Area and as a result, Alignment 4 has a significant impact on agricultural lands.

Alignment 5, which uses the entire existing ROW has the least impact on existing and approved land uses and requires the acquisition of the least amount of privately owned lands.

Alignments 6 and 6A have the least impact on existing environmental features and the greatest impact on existing and approved land uses

Alignments 6 has a significant impact on privately owned lands requiring the acquisition of approximately 11.35 ha of land including approximately 3.21 ha of lands designated for residential development.

Alignment 6A has a very significant impact on privately owned lands requiring the acquisition of approximately 14.53 ha of land including approximately 6.19 ha of lands designated for residential development.

From a cultural perspective, Alignments 6 and 6A are preferred over Alignments 4 and 5 as they interfere to lesser degree with areas of known archaeological potential.

Alignments 4, 6 and 6A would have moderate direct impacts on one previously identified cultural heritage resource of interest (11490 Bathurst St., farmhouse).

Alignment 5 would have a more significant direct impact to one previously identified cultural heritage resource of interest (11490 Bathurst St., farmscape).

In conclusion, Alignment 5 is ranked the highest and Alignment 6A is ranked the lowest.

Figure 34 illustrates the social environment impact assessment for alternative road alignments.

Economic Environment Impact Assessment

For the purpose of this evaluation, residentially designated lands were valued at $8,030,640 per ha based on a development charges study for the City of Vaughan and non-residentially designated lands were valued at $124,000 per ha based on property sales in the adjacent area.

A summary of cost estimates is provided in **Table 14**.

Table 14: Preliminary Cost Estimates for Alignments

Item	Alignment 4	Alignment 5	Alignment 6	Alignment 6A
Land Acquisition Totals	$12.2 Million	$11.6 Million	$26.8 Million	$50.7 Million
Capital Costs*	$21.7 Million	$20.4 Million	$15.5 Million	$15.7 Million
Grand Total	**$33.9 Million**	**$32.0 Million**	**$42.3 Million**	**$66.4 Million**

** Capital cost includes Engineering Fees, Site Preparation, Earthworks, Services, Roadworks, Structures, Miscellaneous, and Contingency costs.*

Alignment 4 utilizes the existing ROW in the western portion of the Study Area, requires the acquisition of agricultural land in the eastern portion, resulting in a slightly higher total land acquisition cost.

Alignment 5 utilizes the entire existing ROW, requires the least amount of land acquisition resulting in the lowest total land acquisition cost.

Alignments 6 and 6A require the acquisition of residentially designated land and represent the more expensive options. Alignment 6A requires the most, resulting in a total land acquisition of over $50 Million.

Alignment 6A is ranked the lowest due to moderate relative operation and maintenance cost and the highest property acquisition costs.

Alignment 5 is ranked the highest due to a moderate capital cost and the lowest property acquisition costs.

Overall Evaluation

The principal advantages and disadvantages for each short-listed road alignment are summarized in **Table 15** below.

Table 15: Principal Advantages and Disadvantages for Short-Listed Road Alignments

	Principal Advantages	Principal Disadvantages
4	• Less complex design and construction • Small earthwork quantity and grading footprint • Avoids hedgerow and cultural farmscape of interest • Minimal impact on future development	• Significant impact to PSW riparian area due to 50m crossing structure • Significant impact to and direct removal of woodlands which provide Significant Wildlife Habitat Moderate impact to habitat for Species at Risk • Significant impact on agricultural lands • Moderate private land acquisition requirements
5	• Least complex design and construction • Smallest earthwork quantity and grading footprint • Least impact on agricultural lands • Minimal private land acquisition requirements • Minimal impact on future development	• Significant impact to PSW riparian area due to 50m crossing structure • Significant impact to and direct removal of woodlands which provide Significant Wildlife Habitat Significant impact to habitat for Species at Risk • Highest potential for archaeological findings • Edge impacts to cultural farmscape of interest
6	• Minimal impact to woodlands which provide Significant Wildlife Habitat • Minimal impact to East Patterson Creek • Avoids hedgerow and cultural farmscape of interest	• Moderate impact to PSW and riparian area • Moderate impact to habitat for Species at Risk • Complex design and construction • Large earthwork quantity and grading footprint. • Significant impact on agricultural lands. • Challenge for traffic safety due to high number of curves and transition segments between curves, increased possibility for black ice conditions. • Significant impact on future development proposals • High private land acquisition requirements
6A	• Minimal impact to PSW and riparian area • Minimal impact to woodlands which provide Significant Wildlife Habitat • Minimal impact to East Patterson Creek • Avoids hedgerow and cultural farmscape of interest • Lowest potential for archaeological findings	• Most complex design and construction • Largest earthwork quantity and grading footprint. • Challenge for traffic safety due to highest number of curves and transition segments between curves, increased possibility for black ice conditions • Significant impact on agricultural lands. • Very significant impact on future development proposals • Highest private land acquisition requirements

The results of comparative evaluation of short-listed Road Alignments across all four environmental factors are summarized in **Table 16** below.

Table 16: Summary of Comparative Evaluation for Short-Listed Road Alignments

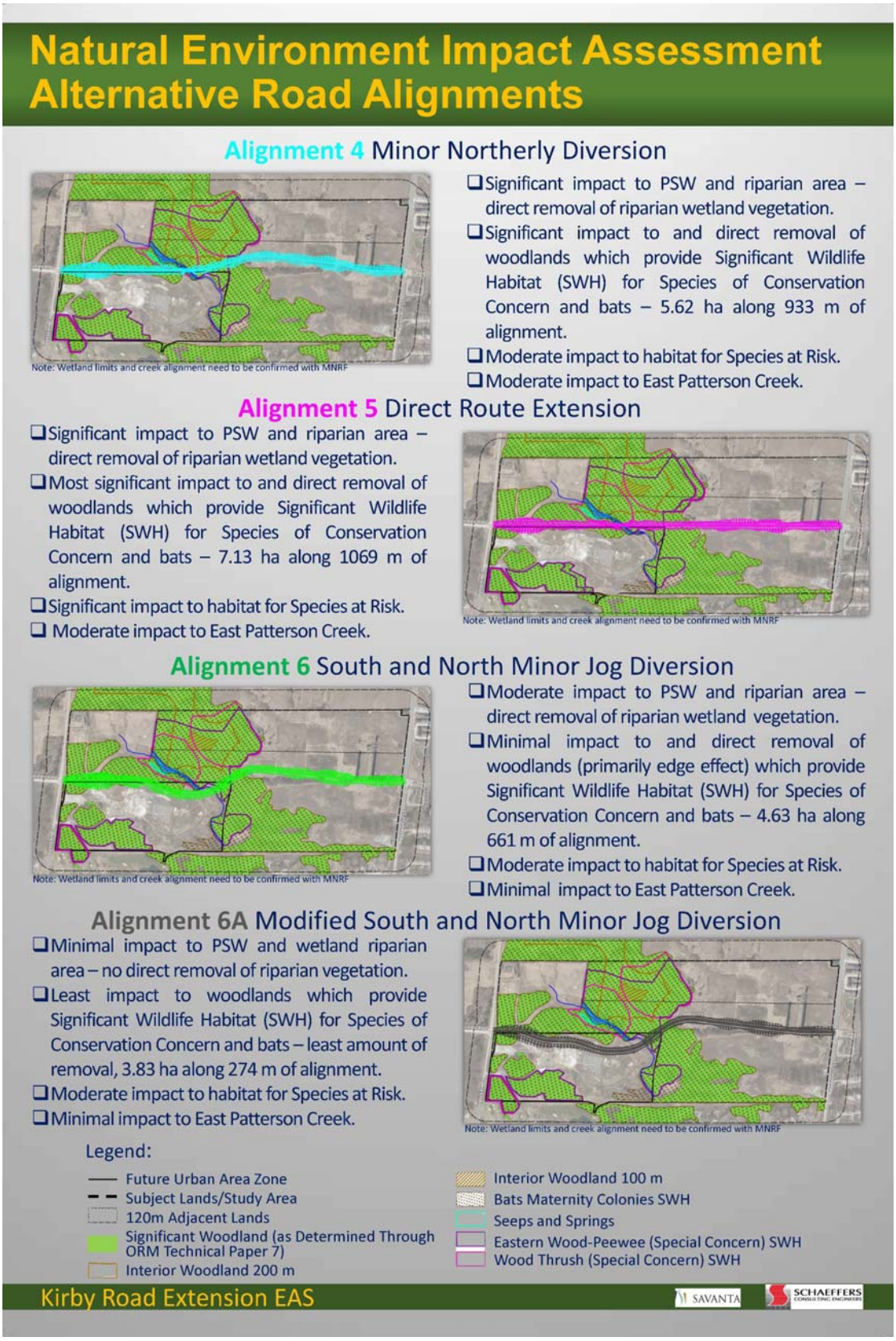
Evaluation Criteria		Alternative Road Alignments			
		Alignment 4	Alignment 5	Alignment 6	Alignment 6A
Transportation Ranking	Symbol				
	Average Score	4.17	**4.50**	3.50	3.67
Natural Environment Ranking	Symbol				
	Average Score	3.22	**3.11**	3.67	3.89
Social Environment Ranking	Symbol				
	Average Score	3.25	**3.38**	3.13	3.00
Economic Environment Ranking	Symbol				
	Average Score	3.67	**4.00**	3.00	2.67
TOTAL SCORE (Sum of Factors)		14.31	**14.99**	13.29	13.22
RECOMMENDED?		Recommended	Highly Recommended	Least Recommended	Not Recommended

Alignment 5 received the highest scores from the Project Team. **Appendix D** shows the Recommended Road Alignment (Alignment 5) in isolation from the other alignment alternatives. The Project Team concluded that Alignment 5 represents an acceptable balance of advantages and disadvantages across the range of evaluation criteria and should be carried forward as the Highly Recommended Alternative Road Alignment.

The principal rationale for selection of Alignment 5 as the Recommended Design Concept is as follows:

- Least complex design without horizontal curvature does not require super-elevated sections
- Physically the easiest to construct
- Smallest earthwork quantity and environmental footprint
- Least impact on agricultural lands
- Minimal private land acquisition requirements
- Minimal impact on future development

Figure 32: Natural Environment Impact Assessment for Alternative Road Alignments



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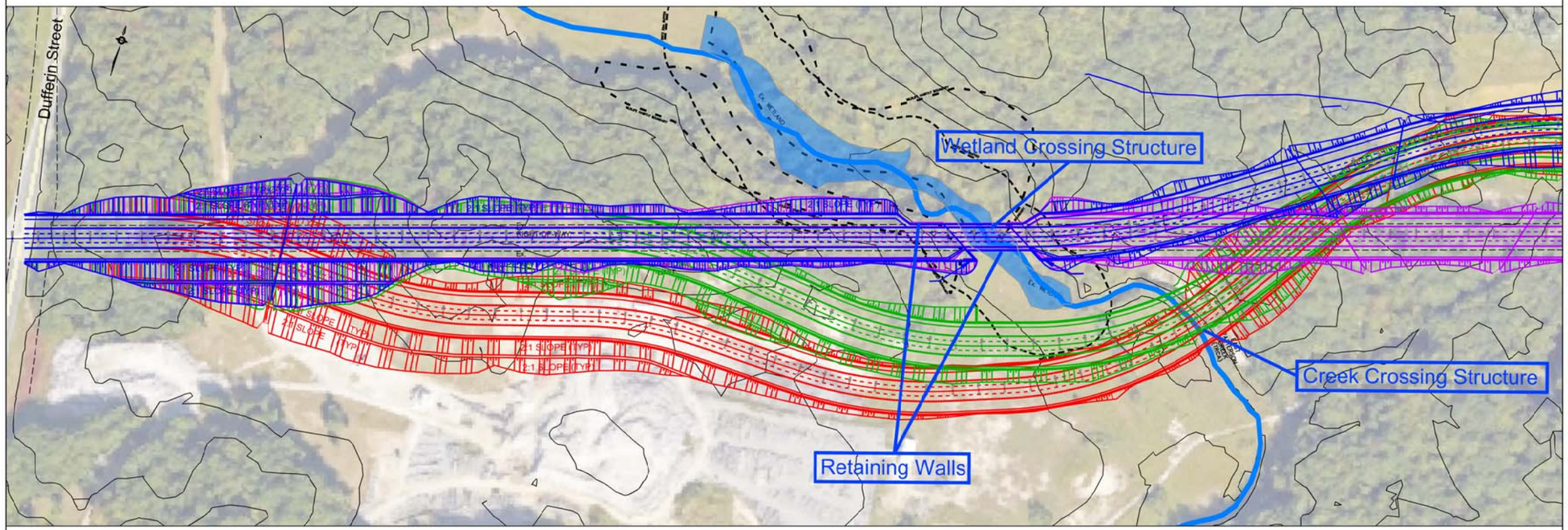

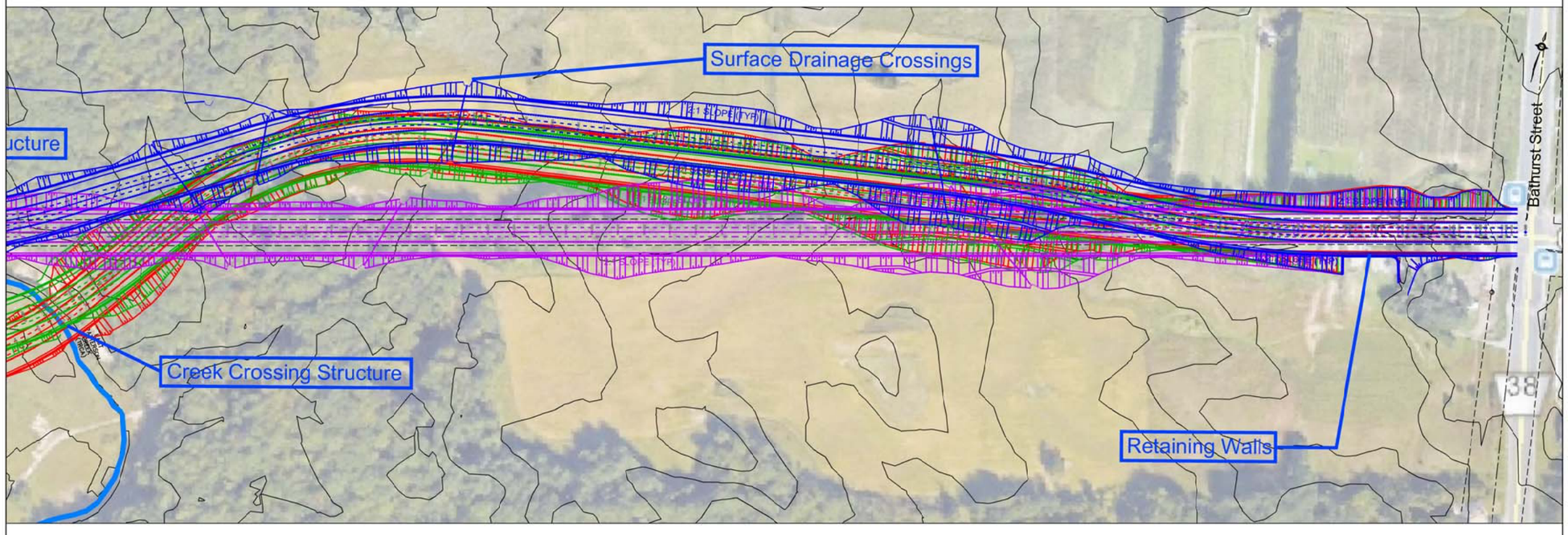

KIRBY ROAD EXTENSION
MUNICIPAL CLASS
ENVIRONMENTAL ASSESSMENT

LEGEND

- ALIGNMENT 4
- ALIGNMENT 5
- ALIGNMENT 6
- ALIGNMENT 6A

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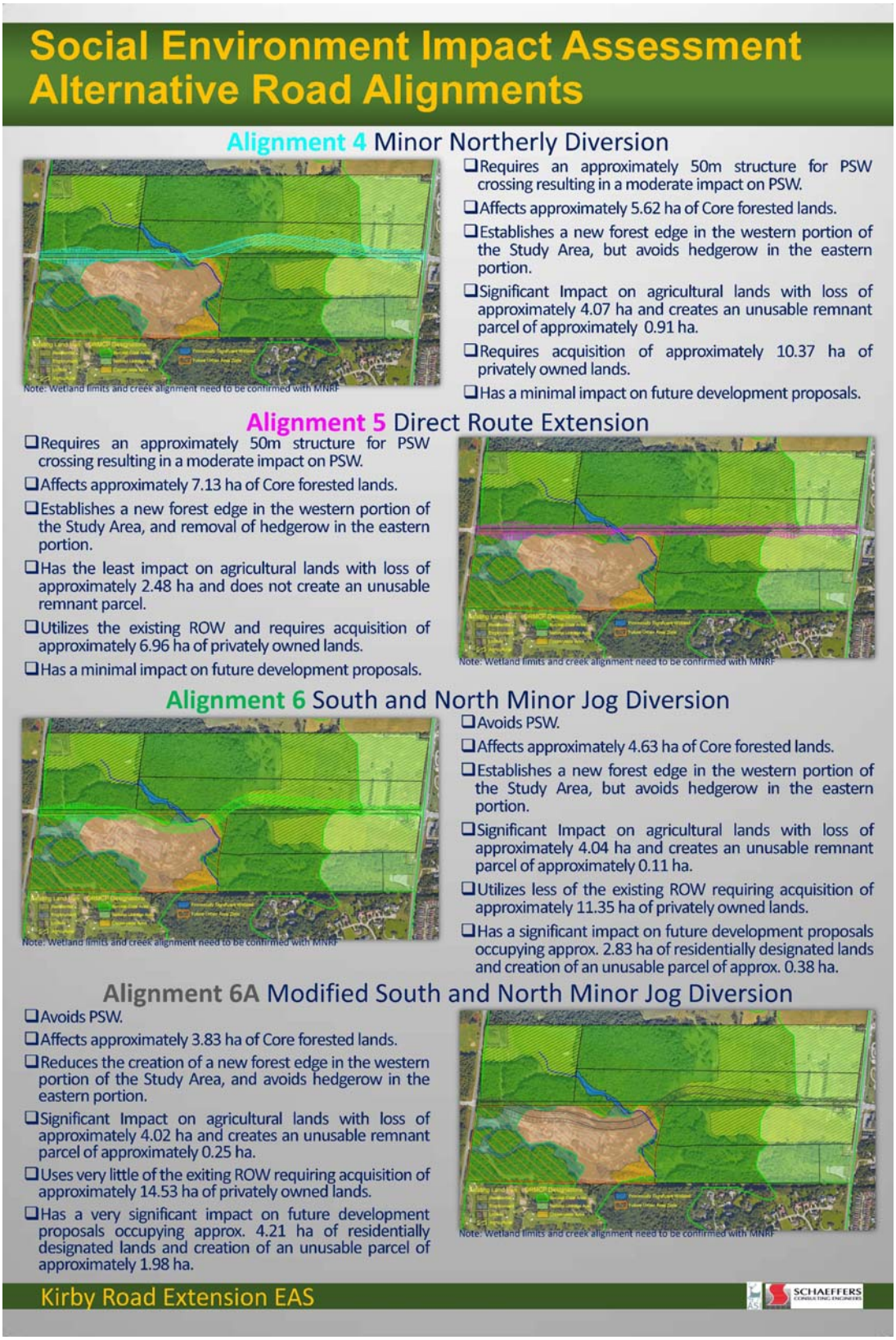
www.schaeffers.com

FIGURE 33
TRANSPORTATION IMPACT ASSESSMENT:
ALTERNATIVE ROAD ALIGNMENTS

2015-4339	DECEMBER 2018	SCALE: N.T.S.

W:\4300's\4339 - Kirby Rd EA\Drawings\Alignment\2018-12-20-4339-Alignment.dwg

Figure 34: Social Environment Impact Assessment for Alternative Road Alignments



7.6 PHASE 3B – Evaluation of Road Cross-Sections

As explained in **Section 7.2.3** Alternative Road Cross-sections, five options were developed for the comparative evaluation.

7.6.1 Evaluation Criteria

The set of evaluation criteria used for the assessment of Alternative Road Alignment was also used for the assessment of Alternative Road Cross-sections. Please refer to **Section 7.5.1.**

7.6.2 Evaluation Approach

The approach to evaluation is described in detail in **Section 7.5.2.**

7.6.3 Evaluation Results

The systematic evaluation of alternatives in terms of their advantages and disadvantages assists with determining their net environmental effects. Series of tables were used to document the evaluation of the Alternative Road Cross-sections. The Advantages and Disadvantages matrixes for each environmental factor as well as detailed Net Effects analysis matrixes are included in **Appendix B2** – Detailed Evaluation of Alternative Road Cross-Sections. An overview of the evaluation results is provided below.

Natural Environment Impact Assessment

Option 1 has the least amount of impact to the wetlands, woodlands/wildlife habitat and surface water quality as it has the least amount of impervious pavement and is the preferred ROW width of 36m.

Option 5 will result in the most impacts to adjacent woodlands/wildlife habitat and wetland due to the wider road ROW width of 45 m.

All Options affect the watercourses equally except for Option 5 which will have greater impacts due to the wider road ROW width of 45 m.

Option 1 will result in the least amount of impact to stormwater management whereas Option 5 will result in the most.

Option 5 is ranked the lowest as it will result in the greatest amount of encroachment into adjacent natural heritage features (45 m).

Option 1 is ranked the highest as it will result in the least amount of encroachment into adjacent natural heritage features (36 m) and has the least amount of impervious surface area (pavement).

Transportation Environment Impact Assessment

No development is expected north of the Kirby Road Extension. Therefore, a continuous center left turn lane is not needed from an operations perspective.

The minimal 4 lane mid-block cross-section can be strategically modified to incorporate westbound exclusive left turn lanes at Future Urban Zone intersections.

Option 5 is ranked the lowest as it creates significant overall environmental effects, exhibits the highest level of design and construction complexity and the highest operation requirements.

Option 1 is the most efficient cross-section that improves connectivity, meets all forecast modal demands, provides a maximum level of service to each mode of transportation, and exhibits the least design and construction complexity.

Option 1 is ranked the highest as it creates the least environmental effects compared to other options.

Social Environment Impact Assessment

Options 1 - 4 propose a road allowance width of 36 m.

Option 5 proposes a road allowance width of 45 m.

The social effects of Option 1 – 4 do not differ amongst these options.

The social effect of Option 5 is greater than Options 1 - 4 due to its larger footprint, which results in a greater impact on existing environmental features, agricultural operations, approved development proposals and the amount of private land that must be acquired.

Options 1 - 4 are ranked equally and Option 5 is ranked the lowest as it requires more Stage 2 archaeological survey, includes the widest grading limit and poses very significant impacts to the identified cultural farmscape.

Economic Environment Impact Assessment

The Alternative Road Cross-sections were evaluated in terms of relative cost estimates.

Options 1 and 2 are ranked the highest as they exhibit lowest construction, operation and maintenance costs.

Option 5 is ranked the lowest as it exhibits the highest costs for construction, operation, maintenance and land acquisition.

Overall Evaluation

The principal advantages and disadvantages for each road cross-section option are summarized in **Table 17** below.

Table 17: Principal Advantages and Disadvantages for Short-Listed Road Cross-Sections

	Principal Advantages	Principal Disadvantages
1	• Provides the highest level of service for bicyclists. • Offers the greatest design flexibility in placement of utilities, street furniture and tree planting. • Entails the least structural requirements, the least infrastructure for storm water management and the least width of pavement area. • Exhibits the least potential runoff and erosion impacts to wetland and vegetation. • Offers the lowest capital, operation and maintenance costs.	• Lacks dedicated bike lane continuity from Gamble Road.
2	• Offers dedicated bike lane continuity from Gamble Road. • Entails less structural requirements, less infrastructure for storm water management and less pavement area than Options 3 and 4. • Offers the second lowest capital, operation and maintenance costs.	• Provides on road bike lane with a reduced level of service.
3	• Provides the highest level of service for bicyclists. • Entails a moderate pavement area with slightly more storm water management infrastructure. • Exhibits a slight increase of potential runoff and erosion impacts compared to Options 1 and 2.	• Includes a continuous center left turn lane that is unlikely to be needed due to land formation. • Lacks dedicated bike lane continuity from Gamble Road.
4	• Offers dedicated bike lane continuity from Gamble Road.	• Provides on road bike lane with a reduced level of service. • Includes a continuous center left turn lane that is unlikely to be needed due to land formation. • Exhibits the widest pavement area and increase of potential runoff and erosion impacts compared to Options 1, 2 and 3.
5	• Exceeds the requirements of the York and Vaughan TMPs. • Allows for “green” design.	• Entails the most complex non-standard design and structural requirements. • Exhibits the highest capital, operation and maintenance costs. • Exhibits the greatest potential for loss of edge/riparian habitat. • Exhibits a significant impact on existing agricultural and residentially approved lands.

The results of comparative evaluation of Alternative Road Cross-sections (Options 1 to 5) across all four environmental factors are summarized in **Table 18** below.

Table 18: Summary of Comparative Evaluation for Short-Listed Cross-sections

Evaluation Criteria		Alternative Road Cross-sections				
		Option 1	Option 2	Option 3	Option 4	Option 5
Transportation Ranking	Symbol					
	Average Score	5.00	4.00	3.67	2.83	2.33
Natural Environment Ranking	Symbol					
	Average Score	5.00	4.56	3.78	3.33	2.56
Social Environment Ranking	Symbol					
	Average Score	4.25	4.25	4.25	4.25	2.00
Economic Environment Ranking	Symbol					
	Average Score	3.67	3.67	3.00	2.33	1.00
TOTAL SCORE (Sum of Factors)		**17.92**	**16.47**	**14.69**	**12.75**	**7.89**
RECOMMENDATION		**Highly Recommended**	**Recommended**	**Less Recommended**	**Least Recommended**	**Not Recommended**

Option 1 received the highest scores from the Project Team. The Recommended Road Cross-section (Option 1) is illustrated on **Figure 35** and **Figure 36.**

Figure 35: Recommended Road Cross Section at Mid-block

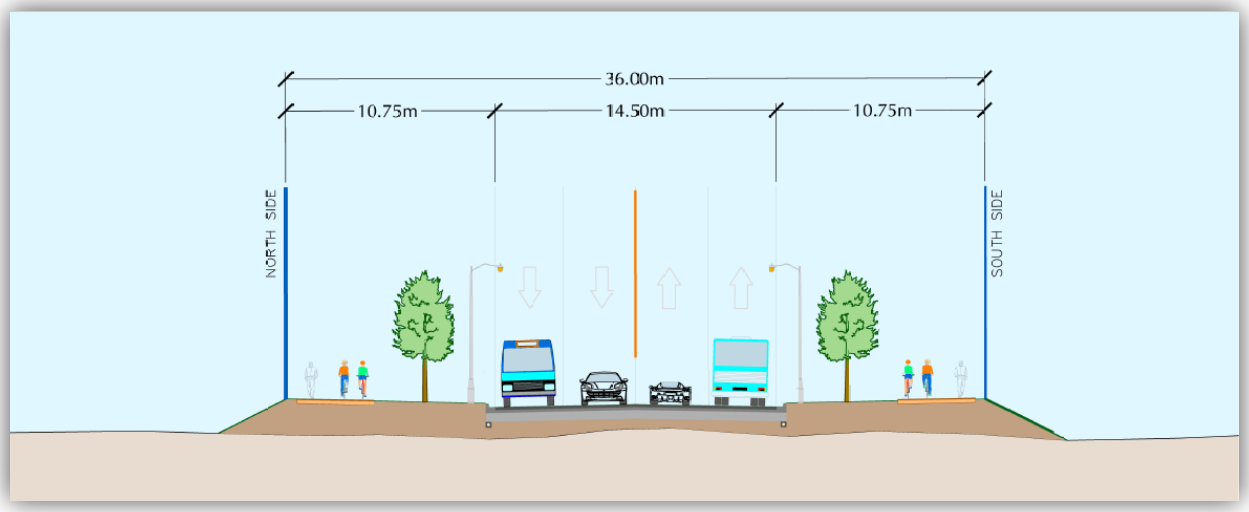
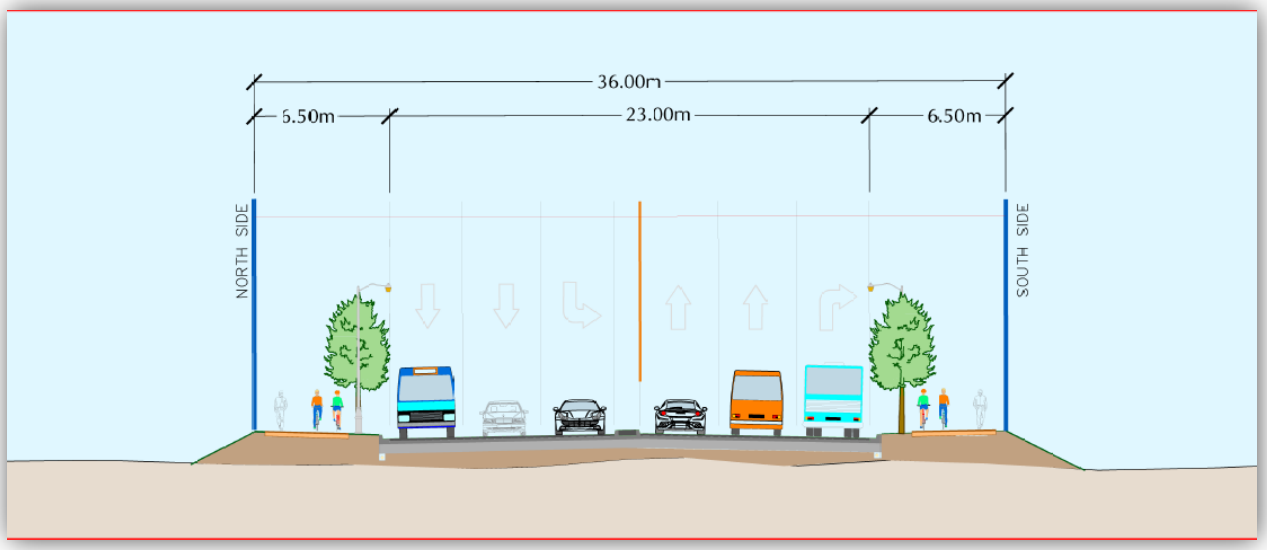


Figure 36: Recommended Road Cross Section at Intersection with Auxiliary Lane



The Project Team concluded that Option 1 represents an acceptable balance of advantages and disadvantages across the range of evaluation criteria and should be carried forward as the Highly Recommended Alternative Road Cross-section.

The principal rationale for selection of Option 1 as the Recommended Design Concept is that this option exhibits an efficient cross-section that improves connectivity, meets all forecast modal demands, provides a maximum level of service to each mode of transportation, and entails the least design and construction complexity.

7.7 Selection of the Preferred Design

According to the MEA MCEA guidelines, once all environmental impacts have been identified, mitigating measures to minimize impact on the environment have been determined, and further input from interested parties have been gained, the recommended design can be confirmed as preferred.

Minor comments received with regard to selection of the Recommended Road Cross-section were addressed through individual responses to the project stakeholders. The correspondence is included in **Appendix A8** – Selected Correspondence. Option 1 as presented at PIC #2 did not accurately reflect the intention of the project team to define the highest level of service for bicyclists. The graphics was further updated to indicate that the identified RoW is sufficient to maintain accessibility for both pedestrians and bicyclists.

The key concerns identified with regard to selection of the Recommended Horizontal Road Alignment included conformity to the 2017 ORMCP policies, the equal weighting of environmental factors, the variety of servicing alternatives considered and how the requirements of the 2007 ESA will be satisfied for preferred Alignment 5. In an effort to resolve the specific concerns, the project team held individual meetings with the TRCA (November 16, 2018) and MNRF (December 13, 2018).

To achieve an early resolution of differences of points of view, insights of the project team on the issues of concern are provided below.

7.7.1 Conformity to Oak Ridges Moraine Policies

The ORCMP is set out in O.Reg. 140/02 approved under the 2001 ORMCA. It is understood that the MMAH is responsible for the administration of the ORMCA and Plan. Other agencies engaged in the EA Study provide their technical advice on policy matters pertaining to natural heritage and other aspects to the project team. **Figure 37** illustrates the existing land uses and ORMCP designations.

In summary, the ORMCP policies regarding infrastructure require the following:

- Demonstrate Need and No Reasonable Alternative;
- Keep Adverse Effects on the Environment to a minimum;
- Minimize Impact on Prime Agricultural Lands; and,
- Ensure that infrastructure is supported by the Necessary Studies and is Economically Feasible and Sustainable.

The need and justification for the Kirby Road Extension has been demonstrated by multiple transportation planning studies. Please see **Section 5.0** for further details.

The 2017 ORMCP requires that adverse effects on the ecological integrity of the plan area be kept to a minimum. That requires an examination of the effects on the natural, technical, social and economic environments. Integrity suggests consideration of the inclusive effects. The ecological effects of the preferred alternative have been minimized in the context of that broad view of the environment.

The 2017 ORCMP specifically permits infrastructure to cross and/or alter the protected areas, if authorized under an EA process. Notably, the ORCMP does not provide any impact assessment tools for the infrastructure planning and design, including a systematic evaluation of alternatives, while the municipal Class EA approved under the EA Act stipulates the requirements for sound environmental assessment. It is construed that conformity of the proposed infrastructure with the ORMCP policies can be achieved through satisfying requirements of the EA Act.

The natural environment and policies related to the development of infrastructure in the ORM were a major consideration in the screening of the Long List of Alternative Road Alignments, including avoidance of key environmental features. These policies were also given due consideration in the more detailed evaluation of the four short-listed road alignments, including mitigation of key environmental features. In the assessment of effects on all types of the environment associated with the Study Area, Alignment 5 exhibits minimal overall effects and this was confirmed through a scoring evaluation where it scored the highest.

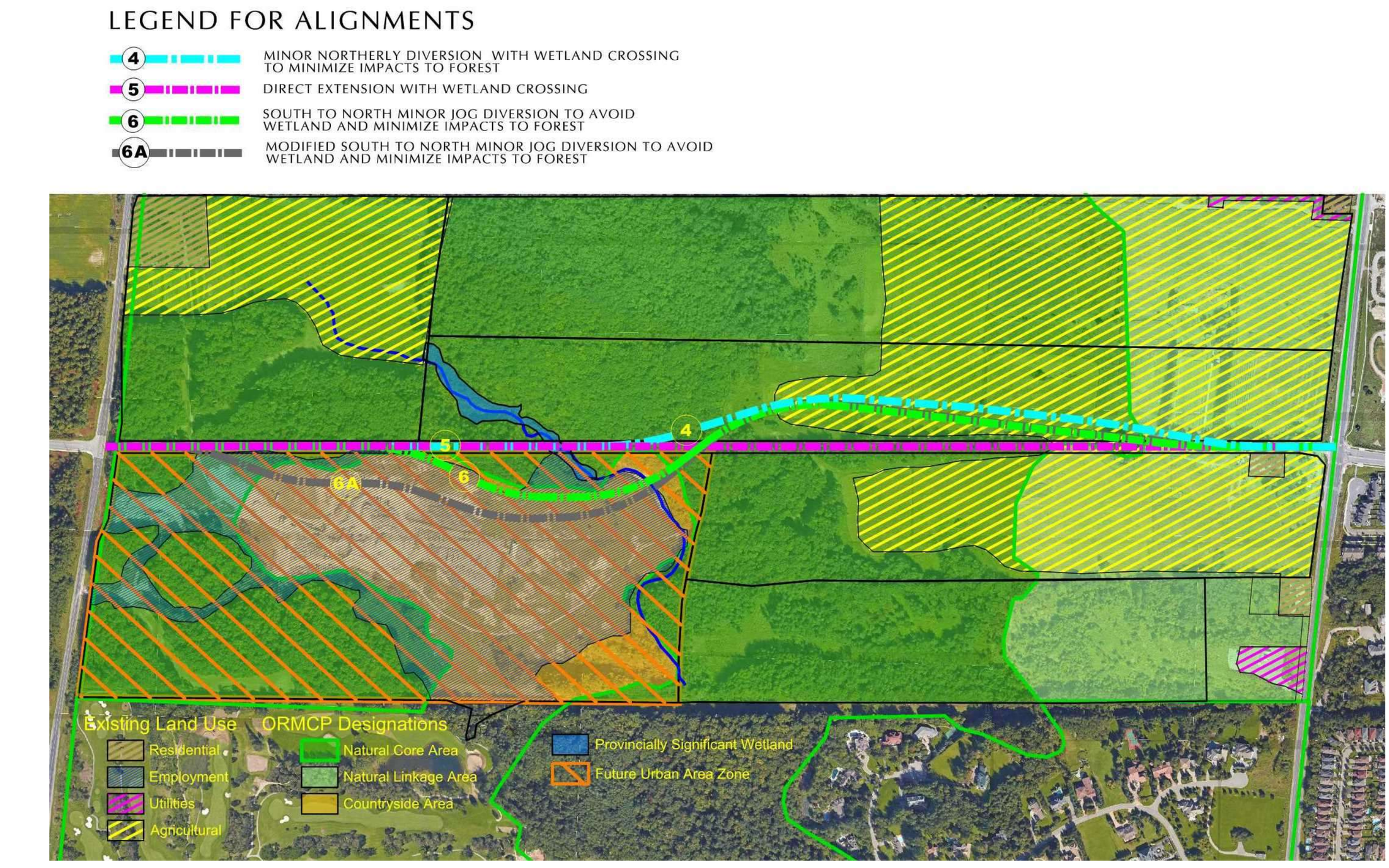
Alignment 5 utilizes all of the existing road allowance and therefore has the least impact on existing agricultural operations.

It should be noted that Policy 41(1.2) concerning financial feasibility was not found in the original 2002 ORMCP and the requirement was added when the ORMCP was amended in 2017. The City of Vaughan estimates the cost to extend Kirby Road at approximately $38 Million in their 2018 Development

Charges Background Study. Alignment 5, which utilizes all of the existing road allowance, and requires the least amount of land acquisition, is the most cost effective and the most economically feasible alternative. The preliminary cost of this option estimated at approximately $32 Million aligns well with the City's budget.

A Technical Paper "Oak Ridges Moraine Policy Conformity", prepared by Lucas & Associates, considering selection of the preliminary preferred road alignment against the policies of the 2017 ORMCP is included in **Appendix C3.2**. The document was prepared to ensure the ORCMP requirements have been fully considered during the EA study. The technical paper provides an overview of decision making and in depth analysis of the ORMCP policies relevant to the proposed undertaking. The project team is confident that there is no conflict between the ORMCA and any other legislation considered through the EA process with regard to the preferred alignment. Alignment 5 is deemed to be in conformance with the 2017 ORMCP policies.

Figure 37: Existing Land Uses and ORMCP Designations



7.7.2 Importance Weighting of Environmental Factors

Comments received from review agencies and public members following PIC #2 recommended to consider a higher weighting of impacts to Natural Environment. Such practice is commonly known as "Importance Weighting".

The importance weighting usually involves application of a weighting factor to a specific decision criterion compared to the other decision criteria. In other words, more weight can be assigned to impact assessment criteria based on their relative significance.

Weighting also requires a solid justification of how much weight and why should be applied to a specific criterion. This approach is best suited when planning for infrastructure within a substantial geographic area where interdependent decisions made will impact servicing and environment in a very broad context (e.g. Highway 407 East extension for over 50 km).

It should be noted that none of the comments received with regard to weighting has provided any justification or rationale for the weighting factor to be applied to the Natural Environment criteria.

As demonstrated in this ESR, the environmental significance of the Kirby Road extension study area is supported by numerous policies and the ORM land designations. At the same time, the missing Kirby Road link is approximately 2 km long and the Study Area is comprised of 10 parcels of land and an unopened road allowance. Existing land uses consist of 6 residences, a concrete recycling operation, agricultural uses, utility uses, and forested lands. The environmental footprints of short-listed road alignments are in the order of 10 hectares or less compared to the 190,000 hectares of land and water protected under the 2017 ORCMP policies. Therefore, the ecological effects under consideration are applicable to about 0.005% of the ORM protected area in the worst case scenario.

A significant part (approximately 25%) of the Study Area is occupied by the concrete recycling facility (former aggregate production site) which corresponds to about 50% of the entire length of the proposed road extension. The recommended road alignment runs along the forest edge half way through the Study Area and this way keeps the effects to ecological integrity of the area to a minimum.

The parcel abutting the alignment on the south side is subject to the Minister's of Municipal Affairs and Housing Order issued in February 2015 under Section 18(1) of the 2001 ORMCA. Further details are provided in **Section 4.1**. As noted, the Order amended specific sections in the Region of York Official Plan, the City of Vaughan Official Plan, and City of Vaughan Zoning By-law to permit urban uses developed on the basis of full municipal services. Therefore, the environmental effects on the future development are essential to consider.

The four environmental factors (Transportation, Natural, Social and Economic) are equally important to the impact analysis as they efficiently describe all aspects of the environment potentially affected by the proposed design alternatives.

Recognizing the unique composition and character of the area, the project team is certain that equal weighting of the environmental factors is appropriate for the evaluation of Alternative Design Concepts in order to recommend the best overall solution for the environment.

7.7.3 Consideration of a New Road Alignment

Consideration of an additional road alignment is a recurring comment received by the project team at different stages of the study. Most recently, following PIC #2, in their letter of September 12, 2018 TRCA staff requested the consideration of a preferred alignment that is south of the forest and PSW in the western half as per 6 or 6A, and blends back into the existing right of way through the central woodland and the eastern half of the alignment without extending north of the existing ROW. TRCA mentioned that while this new blended alignment would cross the central woodland at a wider section as compared to 6 or 6A, the alignment would maintain a larger distance to the interior forest. A recommendation to consider an additional alignment was included in a letter from the MNRF received by the project team on December 4, 2018.

It should be noted that a wide range of servicing alternatives (ten horizontal road alignments in total) was examined through the step-wise screening and evaluation process adopted for the Kirby Road Extension EA to ensure the environmental constraints identified within the study area were considered in sufficient detail and an integrated fashion.

Further to the site meeting with review agencies in August of 2017, including TRCA staff, a fourth alignment (Alignment 6A) was added to the short list of three (Alignments 4, 5 and 6) carried forward to detailed evaluation. The new alignment was created in response to agency input with respect to avoiding existing natural features. Alignment 6A is similar to Alignment 6 but swings to the south sooner to avoid additional wooded areas within the exiting road allowance in the western part of the study area. Alignment 6A travels south into the Parcel 6, which is exempt from the ORMCP by the Minister's Order, farther than Alignment 6 to avoid potential impacts to the PSW, including its buffer. Then this alignment crosses the central woodland at a short section and swings to the north to protect an existing hedgerow.

In terms of advantages, the new alignment contemplated by the TRCA staff would offer avoidance of impacts to the prime agricultural land and use of unopened road allowance exactly as Alignment 5 already does. In terms of disadvantages, the key difference between the proposed road alignment compared to Alignments 6 & 6A would be an escalation of ecological impact to the central woodland due to the wider crossing and to the existing hedgerow in the eastern part of the study area. Notably, most Technical, Social and Economic concerns with the new alignment would repeat those identified for Alignments 6 & 6A. Therefore, it can be concluded that the blended alignment would overall be ranked lower than preferred Alignment 5.

Consideration of a reasonable range of alternatives, both the functionally different "alternatives to" and the "alternative methods" of implementing the solution is a key principle of successful EA planning. In the opinion of the project team, the ESR demonstrates that the requirement was fulfilled.

7.7.4 Satisfying Requirements of Endangered Species Act

The MNRF encourages that the EA Study consider potential impacts of the project on SAR early in the planning process, including alternatives that avoid and minimize impacts and consider opportunities to mitigate impacts to SAR.

The adopted EA Study decision making process is progressively narrowing to the preferred alternative through screening and evaluation steps. Avoidance of environmental features was a major consideration in selection of the short-listed road alignments. Notably, Alignment 5 avoids impacts to the interior and minimizes impacts to the exterior woodland, avoids direct impacts to the PSW and affects trees at the edge of the core forest.

While the EA objective is to avoid or minimize negative environmental effects, it may not be possible to manage all the impacts despite the best efforts of the study team. Under the 2007 ESA, a Permit may be issued authorizing the impact on an endangered or threatened species, where the Minister of Natural Resources and Forestry is of the opinion that three conditions can be met:

- Achievement of an overall benefit to the species within a reasonable timeframe;
- Reasonable alternatives have been considered including alternatives that would not adversely affect the species; and
- Conditions of a Permit will require reasonable steps to minimize adverse effects on individuals of a species.

All short-listed alignments will result in impacts to threatened and endangered Species At Risk (SAR). Although Alignment 5 was ranked the least preferred for natural environment, it was carried forward as the preferred alignment based on the advantages and disadvantages determined for each design concept and scoring across the four environmental factors. In consideration of its selection, a review of SAR has been conducted, including potential impacts and preliminary consideration for requirements under the ESA (registration/permitting) as well as proposed mitigation and compensation measures. Additional studies have been identified for two species: American Ginseng and Eastern Whip-poor-will.

A detailed letter of opinion from Savanta Inc. providing further details on the consideration of SAR during the EA process and proposed mitigation measures is included in **Appendix C1.2** – Species at Risk Discussion. It should be noted that Ontario is currently in the process of transitioning the SAR program from MNRF to MECP.

7.7.5 Wetland Crossing Structure

The Technically Preferred Road Alignment 5 involves a wetland crossing. The potential crossing options are discussed below.

The Ontario Bridge Code refers to the Geometric Design Standards for Ontario Highways and Roadways in terms of establishing bridge cross-section criteria. Widening of bridges after initial installation is a more costly exercise than providing sufficient width from the start. The Code indicates that bridges should be designed for future reasonable road widening where practical and planned.

The Code indicates that the number and width of lanes on a bridge should be the same as the approaches. The requirement for two travelled lanes in each direction was confirmed through the multiple transportation assessments discussed in this report in preceding sections.

Recognizing that a custom made bridge system for the wetland crossing would have significant cost implications, application of precast bridge structures was considered first. The benefits of using precast concrete elements in bridge construction are the reduced installation time, and the quality of the product that is manufactured in the controlled conditions. The Contech Engineered Solutions structures product guide was reviewed in search for the crossing solution. The review revealed that CON/SPAN Bridge System offers maximum product span of 18m. The maximum span for BEBO Concrete Arch System is 31m. The width of the PSW at the crossing point is currently estimated at 36m. Therefore, the precast systems were found not suitable for the crossing.

With regard to the custom made bridge, typical maximum single span for a girder bridge crossing is approximately 50m long. A longer bridge will require substantial increase in the girder thickness, which in turn will decrease the opening below the bridge. For example, a 50m long span requires a 2m high girder and a +/- 1m high layer for the road structure. Therefore, a 6m tall bridge structure will provide a 3m tall bottom opening.

The span over 50m long will require a middle pier or will need to be designed as a cable bridge or a truss bridge.

Figure 38: Girder Bridge Illustration

Cable bridges utilize spreading cables to hold the weight of bridge deck and traffic. The bridges are not suitable for the span less than 100m.

Truss bridges utilize a very popular bridge design that uses a diagonal mesh of most often triangle-shaped posts above the bridge to distribute forces across almost entire bridge structure.

Figure 39: Truss Bridge Illustration

The following recommendations to the bridge design were provided by Savanta:

- Reduce the size of impact/footprint within the wetland buffer area
- Consider increasing the size of the bridge span to pull the footings and any retaining walls out of the wetland buffer.
- Minimize potential hydrologic impacts to the groundwater seepage/recharge areas identified adjacent to the wetland.
- Complete a feature based water balance for the wetland to understand the potential impacts to the hydrologic regime of the wetland from the bridge structure (footings and retaining wall proposed within and adjacent to seepage areas of wetland) as well potential impacts to surface water hydrology of wetland from road runoff etc.
- Reduce amount of vegetation removed in the area surrounding the wetland and within the wetland buffer.
- Ensure the bridge structure would be at least 1 m tall off the ground to allow for the movement of small to medium sized wildlife.
- Consider incorporating of a grated skylight to allow for natural lighting for wildlife movement under the bridge. If feasible, the grated skylight should be contained within a vegetated traffic island.
- Provide minimum 1:1 compensation for vegetation that is removed as a result of the proposed bridge structure.

It should be clarified that the wetland limits and creek alignment shown on the display boards differ from those shown on available official MNRF maps. The current limits have been verified by Savanta Inc. based on aerial imaging and their field work. This data is deemed sufficient for the EA planning purposes.

Notwithstanding the above, subject matter experts from Savanta did initiate early discussions with the MNRF regarding the staking of the updated wetland limits. Field staking of the features will be conducted during detailed design stage of the project.

Detailed evaluation and impact analysis of the design concepts for the wetland crossing should be completed at the detailed design stage. Based on current analysis, it was concluded that a single span truss bridge structure for the crossing of wetland should be evaluated in further detail.

7.8 Appropriateness of the Planning Process

According to Section A.2.4 PHASE 3 - ALTERNATIVE DESIGN CONCEPTS FOR THE PREFERRED SOLUTION of the MEA MCEA guidelines, certain steps should be taken during the Phase 3 planning process to achieve its goals. In part, Step 6 “Selection or confirmation of the preferred design” requires the proponent to review and confirm that the planning process for the project is appropriate. To fulfil the requirement, the project team has reviewed the environmental significance of the preferred designs.

The impact assessment review revealed that the potential environmental effects of the undertaking have been identified to the most possible extent and mitigating measures to minimize impact on the environment have been determined. The EA Study has confirmed that there is no reasonable Alternative Solution other than constructing the missing road link. The executed public consultation program provided numerous opportunities for the agency and public participation. The efforts to consider and address comments included in part preparation of detailed personalized letters, individual meetings with the project stakeholders and the opportunity for all TAG members to review and comment on the draft report prior to finalization of the ESR.

The project team is certain that the concerns and issues raised by the review agencies and public has been and can be resolved through the Class EA process. Given the proposed mitigating measures will be implemented in full, the preferred design concepts for the Kirby Road Extension create minimal overall effects to the environment associated with the Study Area.

Based on the magnitude of the anticipated environmental effects, it was concluded that the MEA MCEA planning process for Schedule C municipal road projects is appropriate for the Kirby Road Extension EA Study and that the remaining procedures in Phases 4 and 5 should be followed.

7.9 PHASE 4 – Environmental Study Report

Following PIC #2 at the end of June 2018 and associated round of public and agencies consultation, the recommended road cross-section Option 1 and horizontal Alignment 5 have been confirmed as the preferred design concepts. With this in mind, the project team prepared a Draft ESR providing a complete account and documenting the planning process conducted for the Kirby Road Extension EA Study.

Before presenting findings and recommendations of the EA study to the general public, an opportunity to review and comment on the document was provided to all technical agencies -members of the TAG to provide input to the Project Team to identify, understand and address through discussion any

outstanding issues and/or concerns related to the Project. On December 21, 2018 the Draft ESR was circulated to the MECP, MNRF, MMAH, TRCA, York Region, CoRH and CoV for a six weeks review period.

Following the Draft ESR review period, all the agencies provided their comments with exception for MMAH. The comment letters are included in **Appendix A8** - Selected Correspondence.

7.9.1 Key Comments to the Draft ESR

All submitted comments suggested various degree revisions to the Draft ESR. Key comments were as follows.

Comparative Evaluation of Short-listed Road Alignments

Recurring concern with the evaluation of short-listed alternatives was raised suggesting that placing a greater weight in the evaluation criteria for the Natural Environment Factor relative to Transportation, Social and Economic Factors would demonstrate conformity with the ORCMP policies.

The Study Proponent (Rizmi) and project team members are of view that the importance weighting becomes very subjective when applied to environmental assessments due to difficulty with providing a scientific basis for how much weight and to what criteria should be applied.

Notably, neither legislation governing the EA process nor the ORM Act includes a requirement for different weighting of environmental factors. The ORMCP is an ecologically and hydrologically based plan. The Natural Core and Linkage Areas are sensitive areas of the Moraine. Key Natural Heritage Features are also very important features protected under the Plan. At the same time, infrastructure uses are permitted with respect to land in these areas subject to satisfying Section 41 of the Plan. Due to a unique composition of the study area, any reasonable road alignment will have to cross the protected areas. The Study Proponent (Rizmi) and project team members are of view that placing a greater weight in evaluation criteria to Natural Environment Factor is subjective and may otherwise prejudice the systematic evaluation of alternatives.

Conformity to ORM Policies

Recurring concern was raised with conformity of the preferred road alignment to the ORMCP policies and, specifically, to satisfying the requirements included in Section 41 Infrastructure. Two key policies of Section 41 are:

- 41(3)(c) The project should be “located as close to the edge of the Natural Core area as possible”
- 41(5) (b) The project should “keep any adverse effects on the ecological integrity of the plan area to a minimum” when crossing of a key natural heritage or hydrologic feature is required.

As protection of the key Natural Heritage features remained as a concern with the preferred road alignment, in response to the comments, Alignment 5 was revisited to satisfy individual policies of the ORMCP and to avoid/minimize adverse effects on the existing environments to a greater extent.

Further details on the comments received and responses provided by the project team are summarized in comment tracking matrixes included in **Appendix A9** - Draft ESR Review.

7.9.2 Refinements to the Technically Preferred Alignment

The comments received from review agencies on the Draft ESR suggested various degree revisions to the report. The key recurring concern was regarding the magnitude of effects on Natural Environment exhibited by Alignment 5. In part, the comment letter dated February 1, 2019 from TRCA indicated that their staff would pursue adjustments to the preferred alignment with the CoV, study proponent and involved agencies. Appendix A to the letter included a sketch with suggested modifications to both Alignment 5 and Alignment 6A. The comment letter can be found in **Appendix A8** - Selected Correspondence.

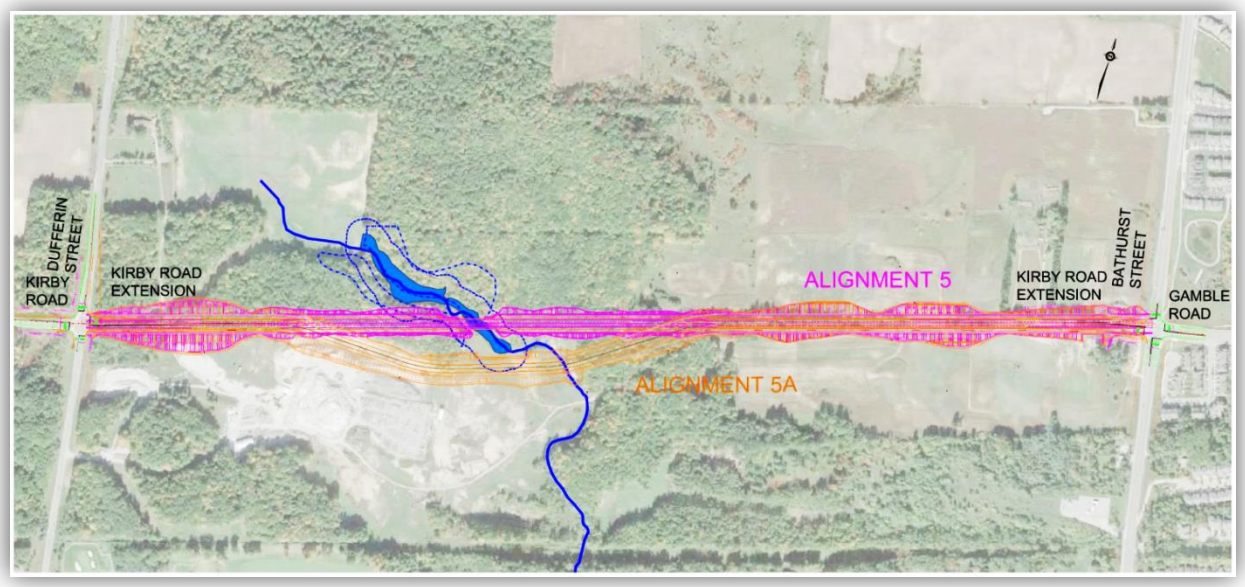
On February 27, 2019 the project team met with the MECP and CoV staff to discuss MECP comments provided on Draft ESR. It was noted during the meeting that refinements to the technically preferred road alignment could reduce adverse effects on Natural Environment and offer greater conformity with applicable ORM policies.

In response to the comments received from review agencies on the Draft ESR, the project team has committed to revisit Alignment 5. To capitalize on the evaluation effort and analysis already done, refinements to the Technically Preferred Alignment 5 were developed with the following objectives in mind:

- Avoid crossing of PSW
- Avoid crossing of interior forest within 100m from the woodland edge
- Cross Natural Core Area of the ORMCP at a narrowest possible point
- Maximize the use of existing RoW
- Minimize encroachment into private properties and property acquisition requirements
- Adhere to the engineering design criteria and match closely with the geometric design elements used to develop the shot-listed road alignments

In consideration of the above objectives, the middle segment of Alignment 5 was modified. The Refined Preferred Alignment ultimately recommended by the EA Study is further referenced as 5A. **Figure 40** below illustrates the changes. It shows side by side the Technically Preferred Alignment 5, as selected by the Project Team and the Refined Preferred Alignment 5A, i.e. Alignment 5 amended in consultation with the review agencies addressing the need to reduce adverse effects on Natural Environment and to offer greater conformity with the applicable ORM policies.

Figure 40: Technically Preferred vs. Refined Preferred Road Alignments



In terms of the shift from Alignment 5, Alignment 5A gradually bends to the south starting at approximately 360 meters east of Dufferin Street to follow the existing forest edge for about 360 meters; then it gradually bends to the east to continue in parallel to Alignment 5 for about 170 meters straight segment while crossing the creek at approximately right angle; then Alignment 5A gradually bends to the north to follow the existing forest edge for about 360 meters and lastly it gradually bends to the east to follows Alignment 5 from approximately 820 meters east of Bathurst Street. As a result of the refinements, the total length of the road of approximately 2020m for Alignment 5 increased to approximately 2070m for Alignment 5A.

To conclude, as per further examination and consultation with relevant agencies, the Refined Preferred Alignment 5A was carried forward as the basis for the Preliminary Preferred Design.

Ecosystem Compensation Assessment

To ensure the refinements to road alignment effectively reduce ecological impact, an ecosystem compensation assessment was conducted. In March 2019 Savanta completed basal area surveys within the Study Area. Basal area is the common term used to describe the average amount of an area occupied by tree stems. The collected basal area data was used to determine forest stand density and to provide a basis for estimating forest regeneration needs and wildlife habitat requirements. Alignment 5A was overlaid on the Ecological Land Classification (ELC) mapping and the area of impact to each ELC community was determined as per the TRCA Guideline for Determining Ecosystem Compensation (June 2018), including recommended restoration ratios. The calculations indicate that the total estimated area of 5.09ha affected by Alignment 5 has decreased to 3.2ha affected by Alignment 5A, i.e. proving about 38% reduction in the affected ELC communities. **Figure 41** illustrates the difference in ecological footprint between the Technically Preferred Alignment (5) and Refined Preferred Alignment (5A).

On April 11, 2019 the project team met with the TRCA staff to discuss comments received from TRCA on the Draft ESR; present the Refined Preferred Road Alignment (5A) and discuss next steps. It was agreed that majority of the comments had been addressed and the adjustments to road alignment were satisfactory with TRCA.

Figure 41: ELC Comparison of Alignment 5 vs. 5A

Satisfying Requirements of Endangered Species Act

The MECP encourages that the EA Study consider potential impacts of the project on threatened and endangered species early in the planning process, including alternatives that avoid and minimize impacts and consider opportunities to mitigate impacts to Species at Risk (SAR).

Avoidance of environmental features was a major consideration in the selection of the short-listed road alignments and ultimately the Refined Preferred Alignment 5A minimizes impacts to interior and exterior woodlands, avoids direct impacts to the PSW and affects trees at the edge of the core forest which is identified as interior breeding bird habitat.

While the EA objective is to avoid or minimize negative environmental effects, it may not be possible to manage all the impacts despite the best efforts of the study team. Under the 2007 ESA, a Permit may be issued authorizing the impact on an endangered or threatened species, where the Minister of Environment Conservation and Parks is of the opinion that three conditions can be met:

- Achievement of an overall benefit to the species within a reasonable timeframe;
- Reasonable alternatives have been considered including alternatives that would not adversely affect the species; and
- Conditions of a Permit will require reasonable steps to minimize adverse effects on individuals of a species.

Alignment 5A has been carried forward as the preferred alignment based on the completed studies and additional consultation with the TRCA with respect to avoidance and minimizing impacts to natural heritage features to the extent possible. In consideration of its selection, a review of SAR has been conducted, including potential impacts and preliminary consideration for requirements under the ESA (registration/permitting) as well as proposed mitigation and compensation measures. Additional studies have been identified for two species: American Ginseng and Eastern Whip-poor-will that will be carried out in the spring and summer of 2019.

Details with respect to consideration of SAR and proposed mitigation measures are included in **Section 8.6.1** Natural Environment and **Appendix C.1.3** - Detailed Impact Assessment for Alignment 5A.

7.9.3 Key Updates to the Draft ESR

Draft ESR along with tabulated comments can be found in **Appendix A9**. Key updates to the Draft ESR are summarized below.

Indigenous Peoples Consultation

Section 2.10 was revisited to provide details on how the comments/concerns raised by Indigenous communities have been addressed.

Geomorphic Assessment

Section 3.2.3 was updated to reflect the refinements to Alignment 5. The most recent geomorphic assessment can be found in **Appendix C6.4** Recommendations for Alignment 5A.

Hydrogeological Assessment

New **Section 8.3** includes a discussion on source water protection. The updated hydrogeological report is included in **Appendix C8**.

Contaminated Sites

New **Section 3.2.6** includes a discussion on contaminated sites based on an Environmental Risk Information Services (ERIS) report ordered by the SCE.

Accuracy of Social Environment Net Analysis

The analysis provided under the "Quality of Life" criterion originally discussed impacts on privately owned lands. The analysis was revisited to discuss community impacts instead. Discrepancies in scoring of the effects under "Approved Development Proposals" and "Agricultural Operations" criterions evaluating the effects as "no effects" where could be "minimal effects". Respective sections in the "Social Net Effects Analysis" matrix were revisited. Also **Table 16** "Summary of Comparative Evaluation for Short-Listed Road Alignments" in **Section 7.5.3** Evaluation Results was updated. The edits led to slight changes in the numerical scores but did not change the overall ranking of alternatives.

Vaughan Super Trail

Further to their comments on the Draft ESR, on April 25, 2019 the City provided a conceptual trail mark-up on Alignment 5A to allow for a trail underpass at two specified locations. Feasibility of the underpass connections was considered by the project team. Further details are provided in **Section 8.5.4**.

Natural Environment

The Natural Heritage Existing Conditions Report was updated as per received comments (see **Appendix C1** - Natural Heritage). **Section 8.6.1** Natural Environment of the Draft ESR was revisited. A summary table, included in the ESR as **Appendix C.1.3** - Detailed Impact Assessment for Alignment 5A, was prepared to provide a comprehensive review of the natural heritage features and associated functions and their significance and sensitivity.

Social Environment

The Socio-economic Impact Assessment Report (April 2018) was updated as per received comments. An addendums to the Oak Ridges Moraine Policy Conformity Technical Paper (September 2018) was prepared to address Alignment 5A. **Section 8.5.6** Preliminary Cost Estimate and **Section 8.6.2** Social Environment of the Draft ESR were revisited. The updated reports can be found in **Appendix C3**.

Wildlife Crossing

Suitability of the proposed conceptual design for Alignment 5A in terms of safe wildlife movement was assessed by Savanta. The assessment considered species and functional groups of wildlife known to be present within the Study Area. The discussion and recommendations are provided in **Section 8.6.1** Natural Environment.

Air Quality and Noise Impact Assessments

Sections 8.6.3 and **8.6.4** were updated to reflect the route modification and revisions to sensitive receptors. The updated reports can be found in **Appendix C9** – Air Quality and **Appendix C10** – Noise.

Stormwater Management

Section 8.6.6 was revisited to reflect changes in the drainage area and include additional analysis. Three options are proposed to meet the required stormwater infiltration volume through LID measures (Bioswale or Tree pits). As requested by TRCA, a floodplain analysis was conducted to establish the regulatory flood limits along the tributary of East Patterson Creek and to demonstrate that there is no adverse impacts to the upstream and downstream floodplain due to the proposed watercourse crossing.

Cost Estimate

In consideration of the agencies' comments, the budgetary level cost estimate developed for comparison purposes for the short-listed road alignments was further refined for Alignment 5A. The estimate incorporates additional capital cost breakdown items as well as a 50 year life cycle cost analysis. Further details are provided in **Section 8.5.6 Preliminary Cost Estimate**.

8.0 Detailed Project Description

This chapter describes the conceptual design for the Refined Preferred Alignment referenced as 5A in more detail, including design standards; results of additional studies carried out for the preferred concepts and the anticipated impacts and proposed mitigation measures. Preliminary design drawings with functional level of detail are included in **Appendix D** - Preliminary Design.

8.1 Engineering Design Criteria

Table 19 displays the engineering design criteria used to evaluate and determine the preferred alignment.

Table 19: Engineering Design Criteria

DESIGN PARAMETERS	PRESENT CONDITIONS (WEST OF DUFFERIN STREET)	DESIGN STANDARDS (CITY OF VAUGHAN ROAD DESIGN CRITERIA)	DESIGN STANDARDS (YORK REGION ROAD DESIGN GUIDELINES)	TRANSPORTATION ASSOCIATION OF CANADA DESIGN MANUAL	PROPOSED STANDARDS
R.O.W. Width	48 m	35 m	36 m	N/A	**36 m**
Posted Speed	60 km/h	60 km/h	60 km/h	60 km/h	**60 km/h**
Design Speed	N/A	70 km/h	80 km/h	70 km/h	**80 km/h**
Minimum Stopping Sight Distance	N/A	110 m	N/A	115 - 140 m	**140 m**
Minimum 'K' Factor	N/A	15 Sag 22 Crest	N/A	25 - 32 Sag 24 - 36 Crest	**32 Sag** **36 Crest**
Grade Range	N/A	0.5 % - 5.0 %	0.5 % - 8.0 %	0.5 % - 5.0 %	**0.5 % - 5.0 %**
Minimum Radius	N/A	190 m	N/A	280 m	**280 m**
Pavement Width	7m - 12m	19.7 m (4 x 3.75m, 1 x 4.7m)	19.5 m (2 x 3.5m, 2 x 3.75m, 1 x 5.0m)	3.5 m - 3.7 m lane width	**14.5 m** **(2 x 3.5m, 2 x 3.75m)**
Boulevard Width	N/A	7.65 m	Varies	2.3m or greater	**10.75 m Typical** **(5.00 m minimum)**
Edge Treatment	Gravel Shoulder	Curb & Gutter & 1.2 m splash pads	Curb & Gutter (Urban) Paved Shoulder (Rural)	N/A	**Curb & Gutter** **(OPSD 600.040)**
Medians	None		As required	N/A	**At Signalized Intersections Only**
Intersection Geometrics	Intersection Angle 90 deg.	Intersection Angle 90 deg.	Intersection Angle 90 deg.	Intersection Angle 70 - 110 deg.	**90 deg.**
Minimum Curb Radius at Intersection with Arterial Road	15.0 m (West leg of Kirby Rd. & Dufferin St.)	15 m	15 m	10.7 m	**15.0 m**
Minimum Curb Radius at Intersection with Collector Road	12.0 m (Ravineview Dr. & Kirby Rd.)	15 m	10 m - 12 m	10.7 m	**15.0 m**
Minimum Curb Grade	N/A	0.50 %	0.50 %	N/A	**0.50 %**
Maximum Superelevation	N/A	N/A	0.04 m/m	0.04 m/m	**0.04 m/m**
Minimum Intersection Spacing	N/A	N/A	400 m	780 m	**400 m**

8.2 Geotechnical Conditions and Pavement Features

A geotechnical investigation in support of the Kirby Road EA was conducted by Terraprobe, between October and December of 2017. A report titled "Preliminary Geotechnical Investigation Class Environmental Assessment (EA) Study Kirby Road Extension" dated February 16, 2018 can be found in **Appendix C7**.

It encompasses the results of the geotechnical investigation conducted along the proposed alignments to determine the prevailing subsurface soil conditions and provides the preliminary geotechnical engineering recommendations for the project. The recommendations provided in the following section

s are preliminary for the purpose of Class EA study and alignment feasibility review. Further geotechnical works and review will be required to provide final and updated geotechnical design recommendations for the selected alignment.

The proposed pavement structure for the roadway is summarized as follows:

Table 20: Recommended Pavement Structure

Pavement Structure	Depth
HMA Surface Course, OPSS 1150 HL1	50 mm
HMA Binder Course, OPSS 1150 HL8 HS	100 mm
Granular Base Course, OPSS MUNI 1010 Granular A	150 mm
Granular Subbase Course, OPSS MUNI 1010 Granular B Type I	600 mm
Total thickness	900 mm

The recommended pavement structure for the extension has a Constructed Pavement Structural Number of 138, which is equal to the Design Structural Number of 138. As such, the pavement is structurally adequate for the expected traffic loads within a 20-year design life period.

The soils encountered at this site are considered to be suitable for excavation using normal trenching and excavating equipment. The undisturbed native materials will be suitable for support of buried services that are properly bedded.

8.3 Source Water Protection

Based on the Source Protection Information Atlas, the Site is located within a Wellhead Protection Area (WHPA) Q1 and Q2 for water quantity with moderate stress. As described in Credit Valley, Toronto and Region and Central Lake Ontario (CTC) Source Protection Plan, WHPA-Q1 refers to the area where activities that take water without returning it to the same source may be a threat and WHPA-Q2 refers to the area where activities that reduce recharge may be a threat.

The proposed development on Site includes excavation for the culvert for the road crossing across the creek that will require dewatering to ensure the excavation area is dry. However, considering the size of the structure the dewatering will be insignificant and would unlikely pose any threat to the groundwater.

The existing ground water recharge rate at the Site is approximately 287 mm/a. This recharge occurs in a broad diffuse manner over the entire Site. Mitigation measures are available to maintain recharge rates. Appropriate Low Impact Development (LID) techniques which can be applied include maintenance of overall ground water recharge across the Site area. In order to maintain ground water recharge for the Site, LID measures should be implemented. Based on the property conditions, the following typical LID measures may be suitable for the proposed development:

- Directing and controlling runoff water towards the road-side swales along the boulevard/easement area of the proposed Kirby Road development through gradual outward sloping of the road from its center

The Site is located within an area of predominantly High Aquifer Vulnerability and Oak Ridges Moraine Conservation Area. During the construction period, appropriate mitigation measures will be required to ensure protection of the aquifer underlying the Site. Mitigation measures during the construction period may include the following:

- Road Salting

There may be a requirement for the application of road salt in the proposed Kirby Road Extension for road de-icing purposes during the winter months. The Transportation Association of Canada (TAC) has produced a document titled Syntheses of Best Practices – Road Salt Management (2013). These should be generally flowed at the Site unless prohibited. In addition, best management practices for contractors, residents, and the community are provided by the not-for-profit organization Smart About Salt Council and their recommendations may be of benefit in reducing salt loads. The salt management plan should strive to minimize the amount of road salt entering the environment. Alternative method for road de-icing should be considered (e.g., use of sand)

- Temporary Storage of Fuels and Chemicals during Construction

During construction of the proposed Kirby Road Extension, it may be necessary to temporarily store fuels and/or chemicals at the Site. This represents a potential threat to ground water quality, as spills of significant size may potentially impact the underlying aquifer.

To prevent and mitigate any spills at the Site, it is recommended to place temporary fuel and chemical storage containers of significant size into secondary containment such that a leak can be contained. Appropriate spill kits should be maintained at various locations throughout the site and an emergency response plan should be developed to outline actions to be taken in case of a spill or leak.

It is recommended that temporary fuel and chemical storage locations be inspected on a regular basis to ensure integrity of storage containers. Any spills or leaks related to the temporary storage of fuels and chemicals located on the property will be reported to the Spills Action Centre. Contact information for the Spills Actions Centre, as well as information detailing the requirement for reporting any spills will occur should be available at the Site.

8.4 Preferred Road Cross-section

The Alternative Road Cross-section Option 1 was confirmed as the preferred road cross-section design concept. Please refer to **Figure 35** and **Figure 36** for the general mid-block and intersection layouts. A typical road cross-section for the proposed Kirby road extension including required surface and below ground infrastructure with functional level of detail is presented in **Figure 42: Typical Road Cross-section** below. Preliminary design drawings for Alignment 5A cross-sections (DET-1, SEC-5A and SEC-1) are provided in **Appendix D**.

As there are no published MUP standards available at this time, the cross-sections show a shared pedestrian and cycling facility for Kirby Road on both sides of the road. The MUP concept suggests a 4.0m wide MUP consisting of 2.0m sidewalk, 0.5m painted line (to provide safety buffer separating cyclists and pedestrian) and 1.5m bicycle lane. This in effect replicates the York Region Level of Service "A" criteria.

From a broader context, there is the need for separate pedestrian and cycling facilities as this area is expected to grow and see higher active transportation demand with the upcoming North Maple Regional Park and the potential future Kirby GO Station (at Kirby Road and Keele Street). It is recommended to consider the separation of pedestrian and cycling facilities at detail design stage.

8.5 Preferred Road Alignment

As discussed in Section 7.9.2 in detail, the Refined Preferred Road Alignment 5A is carried forward as the Preliminary Preferred Design. Please refer to **Figure 42: Typical Road Cross-section**

Figure **43: Refined Preferred Road** Alignment 5A below for a general layout.

The alignment features an oversized 6.1m wide culvert for the watercourse crossing and retaining walls protecting the PSW and 200m buffer to interior forest. The proposed culverts are designed to address TRCA's requirements for wildlife crossing and connective function. Additional culverts are proposed to address City's requirements for trail system connections. Plan and profile views for the Preliminary Preferred Design (Alignment 5A) with functional level of detail for all elements in the ROW are provided in **Figure 44** through **Figure 49** below.

Plans for residential development contemplated on the lands abutting the road extension on the south west quadrant of the Study Area are yet to be confirmed. It is recommended to conduct an earthwork analysis at detailed design to optimize the proposed preliminary vertical road alignment in consideration of the grading for future subdivision.

Preliminary design drawings for Alignment 5A are provided in **Appendix D**.

Figure 42: Typical Road Cross-section

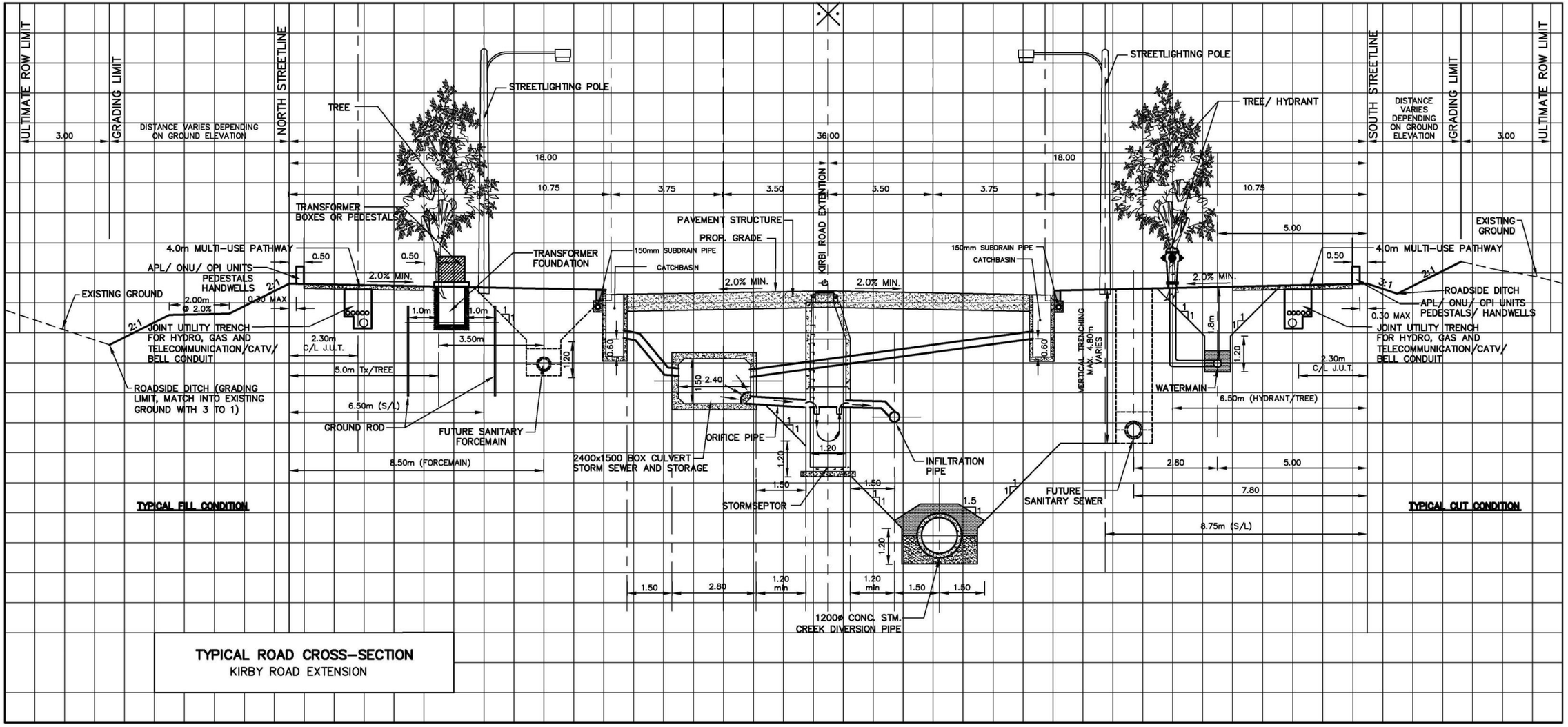


Figure 43: Refined Preferred Road Alignment 5A

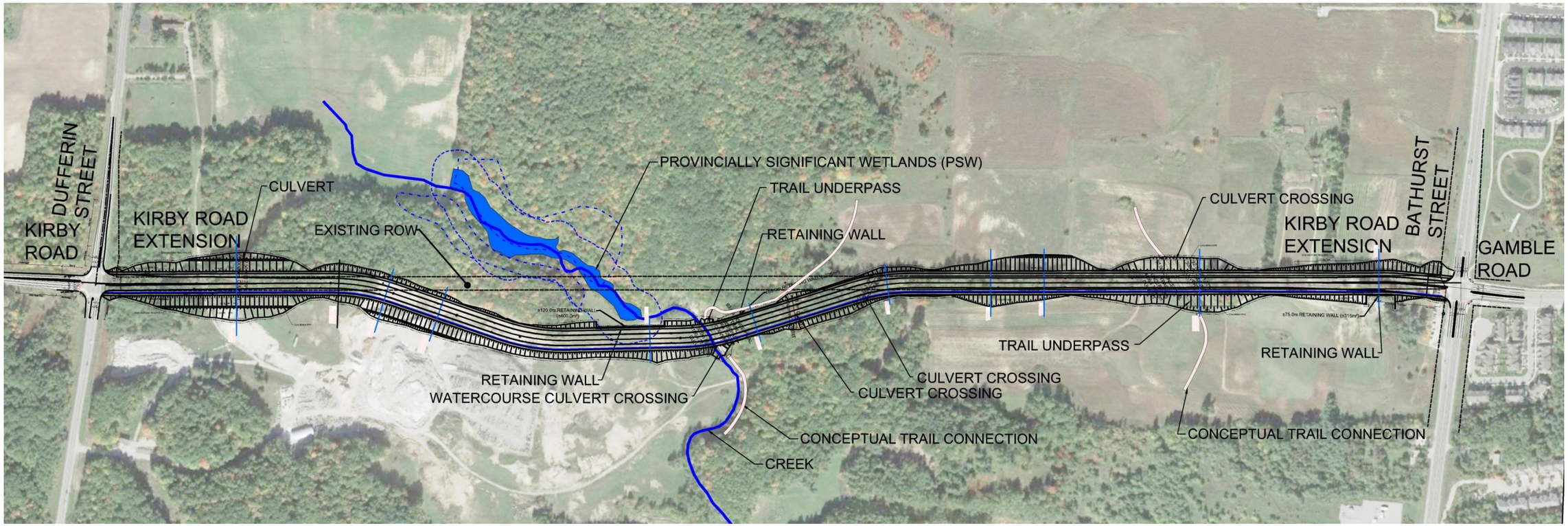


Figure 44: Preliminary Design Plan and Profile PP-1 (FROM STA.0+040.000 TO STA. 0+340.000)

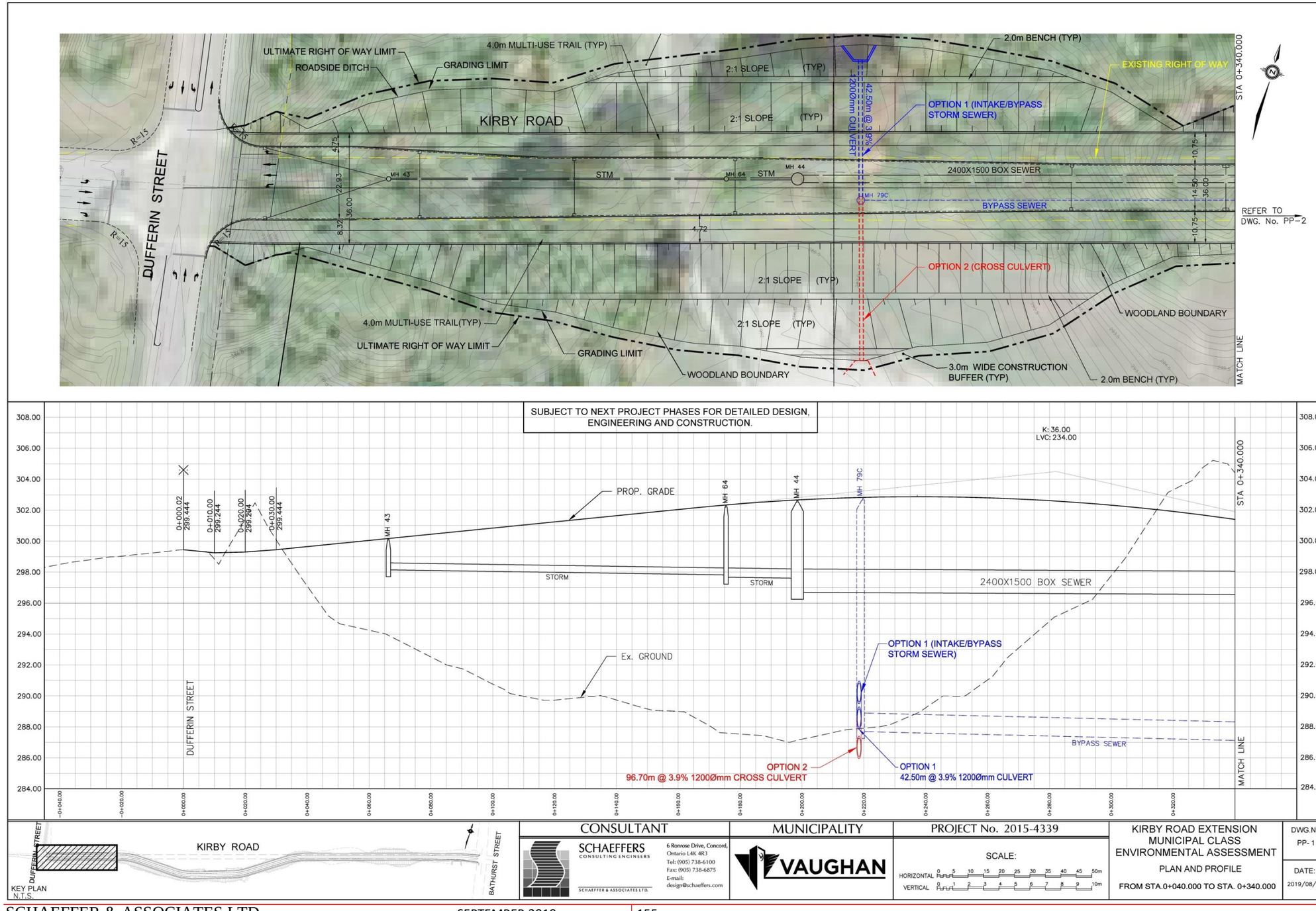


Figure 45: Preliminary Design Plan and Profile PP-2 (FROM STA. 0+340.000 TO STA. 0+700.000)

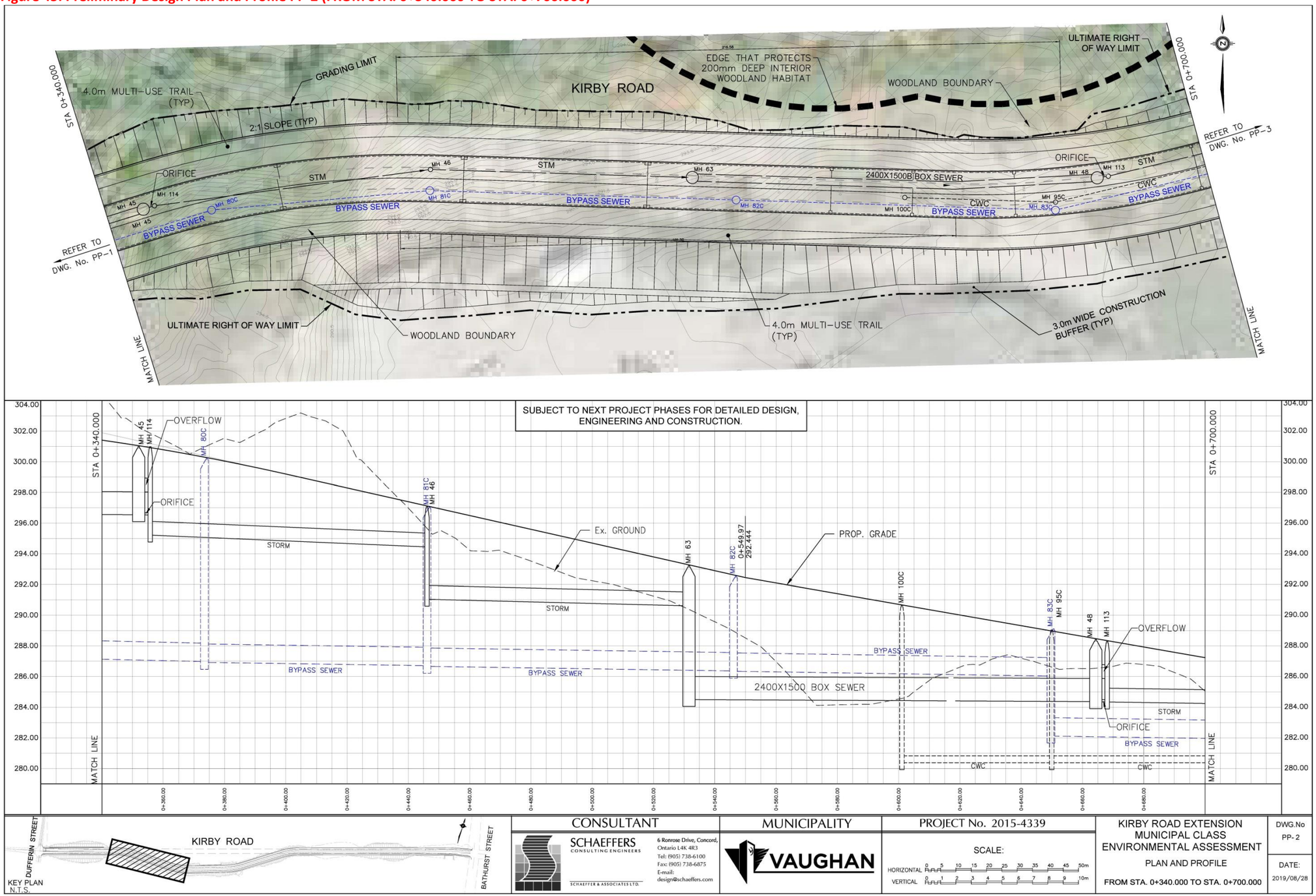


Figure 46: Preliminary Design Plan and Profile PP-3 (FROM STA. 0+700.000 TO STA. 1+040.000)

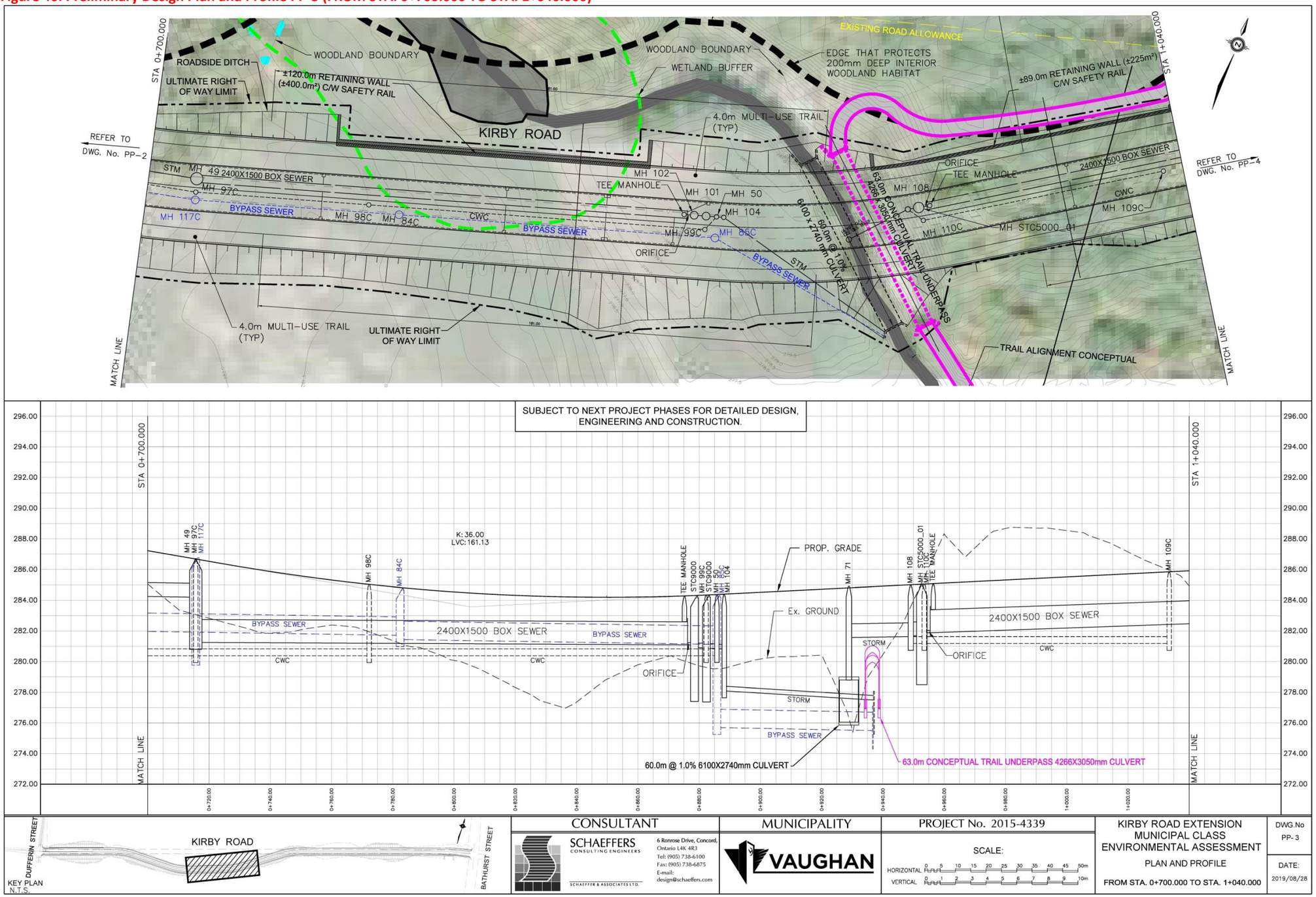


Figure 47: Preliminary Design Plan and Profile PP-4 (FROM STA. 1+040.000 TO STA. 1+400.000)

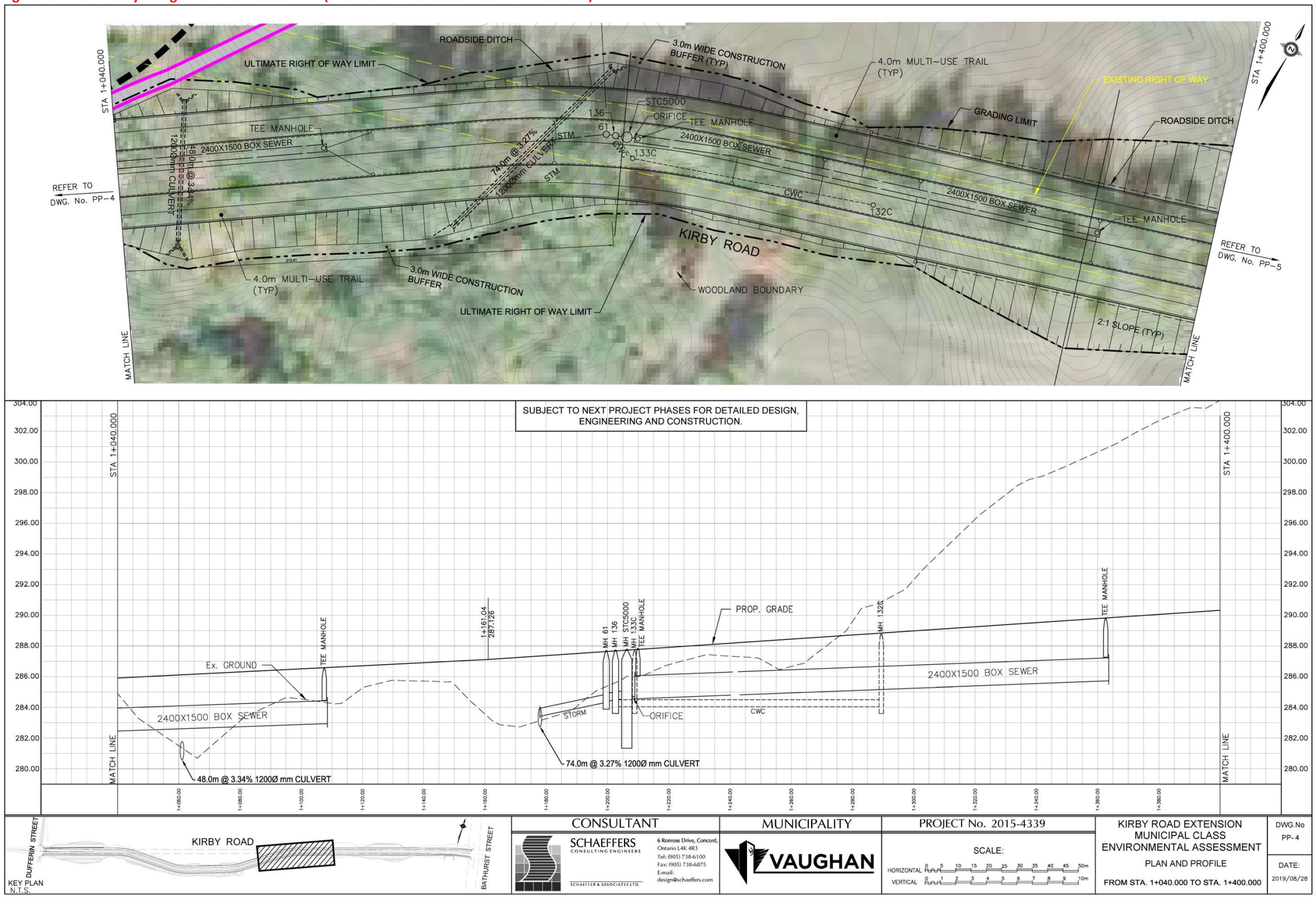


Figure 48: Preliminary Design Plan and Profile PP-5 (FROM STA. 1+400.000 TO STA. 1+760.000)

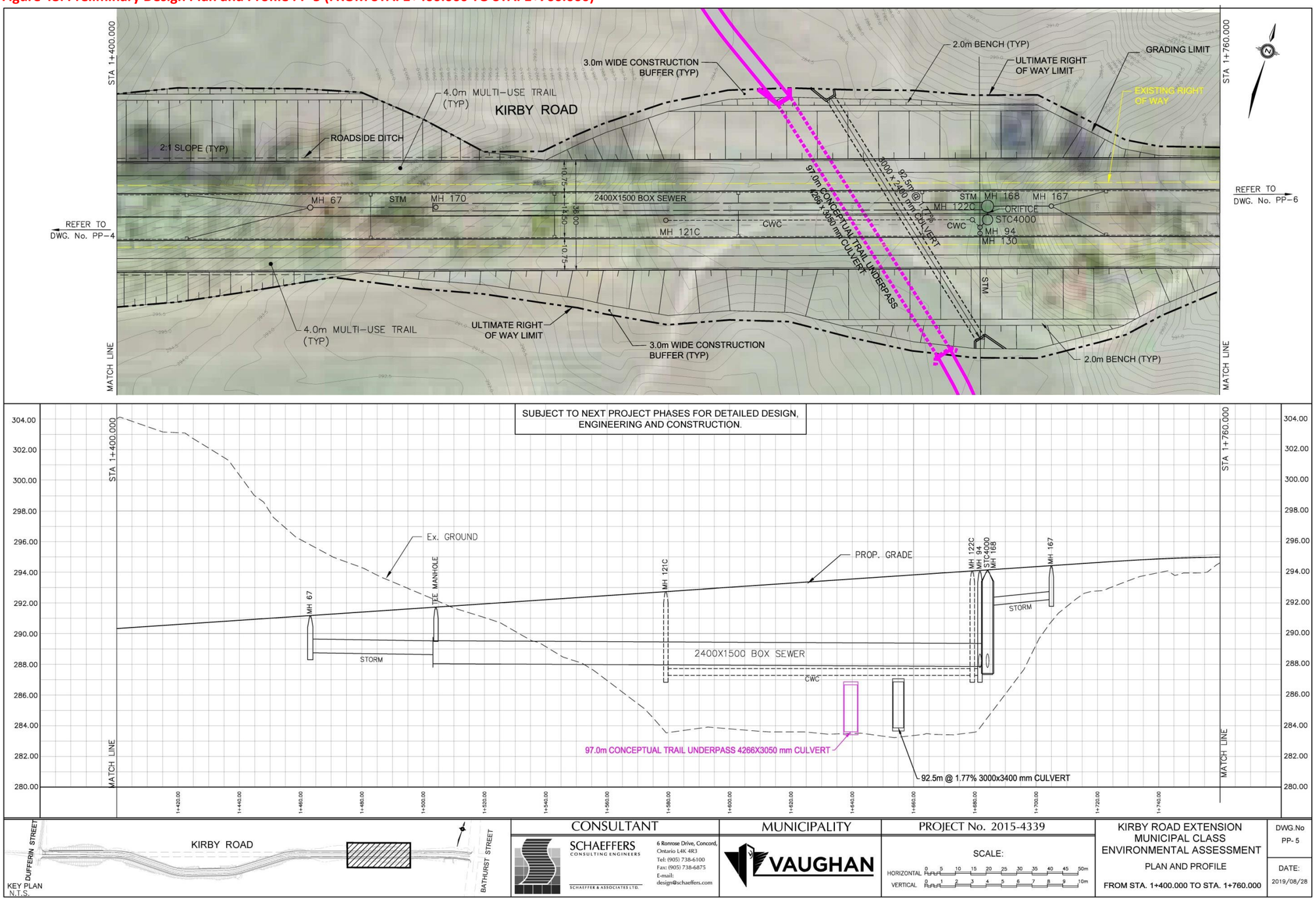


Figure 49: Preliminary Design Plan and Profile PP-6 (FROM STA. 1+760.000 TO STA. 2+060.000)

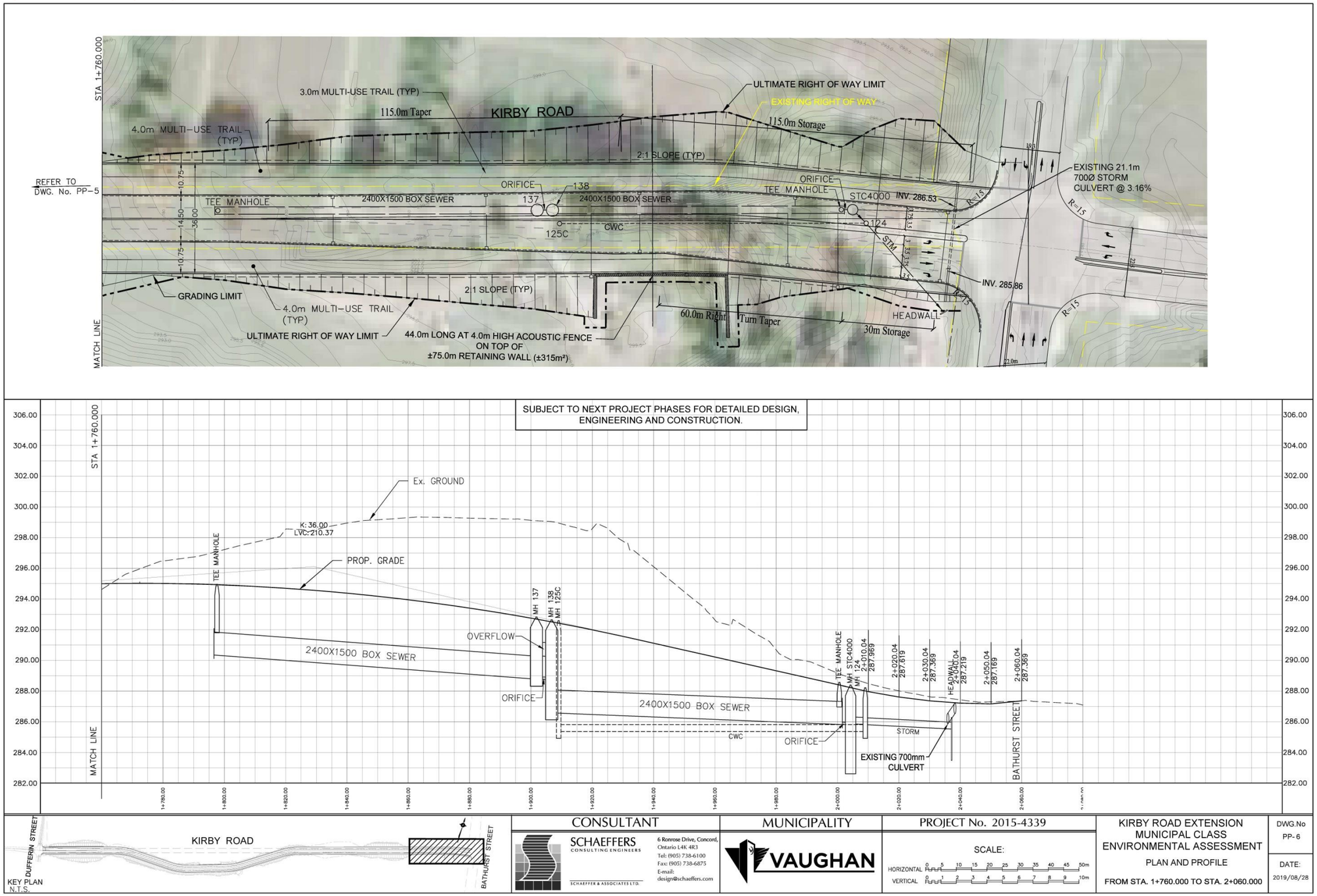


Figure 50: Preliminary Intersection Layout at Dufferin Street

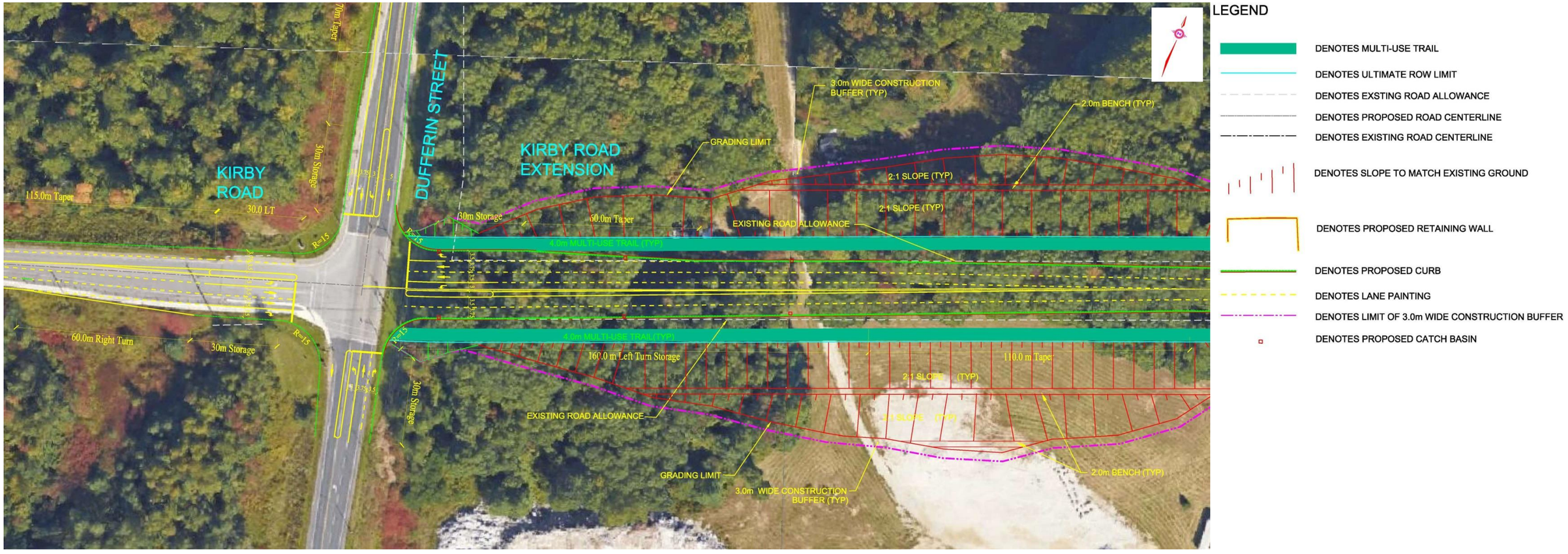
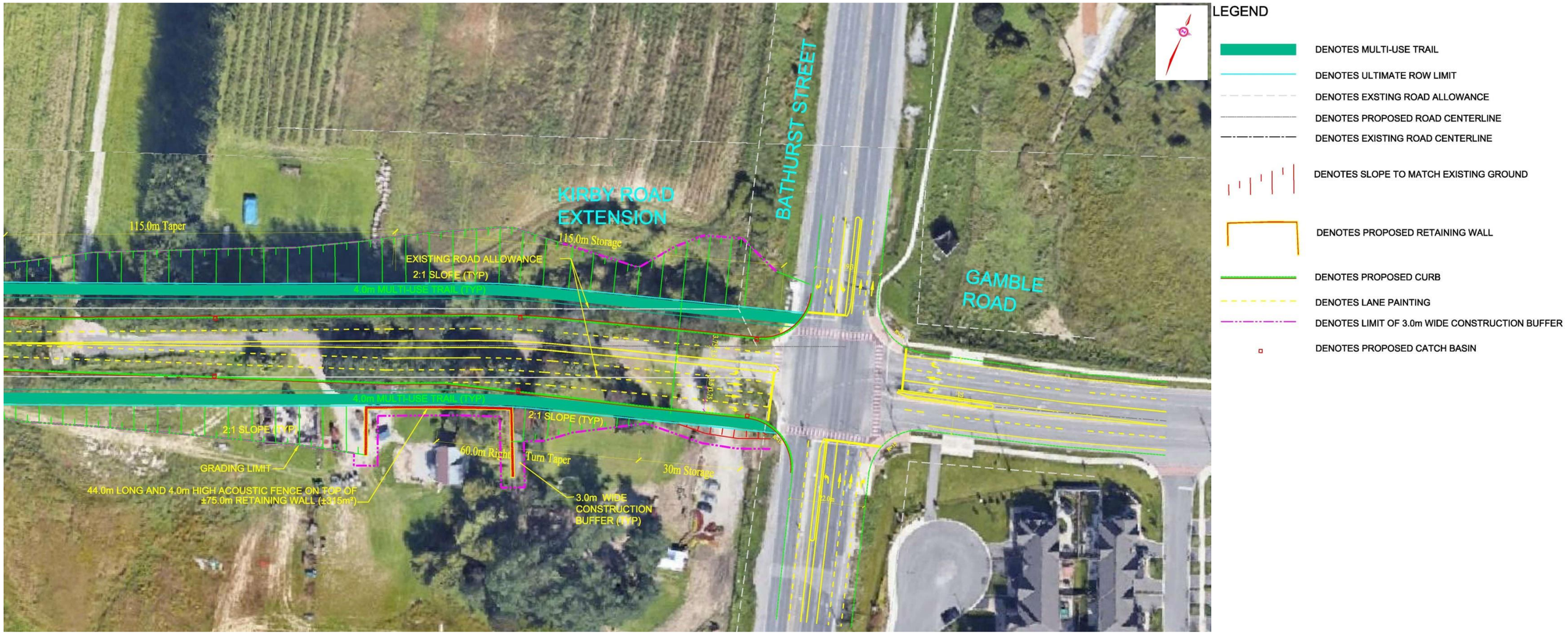


Figure 51: Preliminary Intersection Layout at Bathurst Street



8.5.1 Intersection Design

The Kirby Road extension will require intersection improvements at both Dufferin Street and Bathurst Street. It should be noted that the conceptual approaches and intersection design for the Kirby Road Extension fit within a 36m RoW. The approach allows for two 3.5m center lanes, two 3.75m curb lanes, a 3.5m right turn lane and a 3.0m left turn lane with a 2.0m traffic island. Please refer to the preliminary intersection functional plans (INT-1 and INT-2) included in **Appendix D**.

The Dufferin Street and Kirby Road intersection currently consists of one northbound and one south bound through lane with dedicated north bound left turn lane and dedicated southbound right turn lane on Dufferin Street. Existing Kirby Road consists of 1 west bound lane, one east bound left turn and one east bound right turn lane and one painted center median. Under the ultimate condition, Dufferin Street painted center median will be converted to a dedicated southbound left turn lane and a dedicated north bound deceleration right turn lane will be added. On the exiting Kirby Road, the pavement will be widen to accommodate two east bound through lanes and additional west bound through lanes tapered back to a single lane at each direction. Concrete median will be incorporated to the existing intersection and traffic signal to be upgraded and relocated to suit new lane configuration. The preliminary intersection layout at Dufferin Street is illustrated in **Figure 50** above.

The Bathurst Street and Gamble Road intersection currently consists of 2 northbound and 2 southbound lanes, one dedicated left turn lane at both north and south directions and one dedicated northbound right turn lane on Bathurst Street. On Gamble Road, there are 2 east bound and 2 west bound though lanes with one dedicated west bound left and right turn lanes. The intersection is signalized. The only improvement required for this intersection is to convert the existing southbound through lane to dedicated right turn lanes. The preliminary intersection layout at Bathurst Street is illustrated in **Figure 51** above.

It should be noted that Dufferin Street and Bathurst Street are under York Region's jurisdiction. The Kirby Road intersections at Dufferin Street and Bathurst Street, as shown in the ESR (Appendix D), are considered preliminary and conceptual. The configuration and design of these intersections will be subject to York Region approval during the detailed design phase.

Appropriate cycling connections (e.g., cross-ride, combined cross-ride/cross-walk) at the Bathurst Street and Kirby Road intersection should be considered at detailed design to accommodate cyclists transitioning to and from the existing dedicated bicycle lanes on Gamble Road in Richmond Hill. Also suitable traffic signalization, street lighting and signage should be developed at detailed design.

8.5.2 Retaining Walls

Retaining walls will be required to accommodate grade separation between the proposed road and existing ground elevations to minimize impact to the PSW, existing natural heritage features and a cultural heritage house.

A 120m long retaining wall ranging in height approximately from 3m to 7m will be required on the north side of the road to protect the wetland and minimize encroachment to the wetland buffer. Based on a geomorphic assessment it was determined to be a low-energy and stable location with limited channel

definition and no evidence of erosion. The retaining wall sits approximately 1 to 1.5m outside the meander belt width. Due to the limited potential for erosion and the factor of safety included in the meander belt width delineation, the proposed retaining wall location is appropriate to the site. For additional erosion protection, minor bioengineering treatments or offset protection can be installed. The recommendation should be explored and implemented at detailed design.

A 100m long retaining wall from ground elevation to approximately 6m in height will be required on the north side of the road along the edge that protects the 200m deep interior woodland habitat to protect the forest.

A 75m long retaining wall ranging in height from approximately 5m to 8m will be required along the south side of the road to preserve the existing cultural heritage house located at the east end of the Kirby Road extension in the southwest quadrant of the future Kirby Road and Bathurst Street intersection.

8.5.3 Watercourse Crossing

The Preferred Road Alignment 5A includes a watercourse crossing located downstream and immediately east of the PSW. Recommendations regarding the crossing design and implementation have been provided by GEO Morphix. Please refer to **Appendix C6.4** for the Upper East Patterson Creek Geomorphic Assessment by GEO Morphix, dated April 2019 for further details.

Recommendations to the watercourse crossing are based on geomorphological and erosion considerations. The TRCA's Crossing Guideline for Valley and Stream Corridors (2015) recommends using sizing and design to avoid damage to infrastructure and minimizing channel contact with any crossing infrastructure to reduce erosion hazards. It was found that Alignment 5A is suitable to the site since it will cross the watercourse at a nearly perpendicular angle through a previously disturbed area where the reach has been realigned and channelized. Minor erosion would occur along the valley walls within the crossing location of the 5A Alignment. It is to be noted that a crossing at this location would provide stabilization.

Two options were considered for the crossing span sizing at Alignment 5A. The first is calculated as three times the bankfull channel width. The second option is calculated as bankfull width plus two times the erosion limit. The average bankfull channel width was identified at 1.9m, with crossing sizes of 5.7m and 11.9m respectively.

In the event of potential disturbance of riparian vegetation, it is recommended to install a channel reinforced with hydraulically sized materials to stabilize the channel under the crossing allowing for fish passage across a wide range of conditions. As for hydraulic sizing, the Ministry of Transportation (MTO) Highway Drainage Design Standards (2008) suggests 100-year event scour protection (standards WC-1/WC-3) for local road conditions with FS=1.

Based on the geomorphic analysis recommending a minimum 5.7m width, a 60m long 6.1x2.74m open bottom box culvert is proposed for the watercourse crossing. A floodplain analysis conducted by SCE has confirmed that the sizing satisfies hydraulic conveyance requirements during the regional flood.

As previously mentioned, the recommendations from the geomorphological assessment demonstrate that the preferred road alignment is suitable for the Kirby Road extension. Further details will be addressed during the detailed design stage.

8.5.4 Vaughan Super Trail Connection

Consideration was given for creation of trail connections across the proposed road extension. Impacts of preferred design concepts on connectivity of the FUA to the Vaughan Super Trail and the remaining components of the City's Pedestrian and Bicycle Master Plan (2007) were assessed by Poulos & Chung. Map 4 "Pedestrian and Bicycle Network: Facility Types" from the Master Plan has been used as the basis for their analysis.

The key recommendations are as follows:

There is a Class 1 Multi Use Recreation or Boulevard Pathway on Dufferin Street extending from King – Vaughan Road to Kirby Road, which then branches off in a south west direction to connect through an open space area and down to Teston Road. The preferred cross – section Option 1 for Kirby Road Extension contains a MUP in the boulevards on both sides of the road. Therefore, a direct connection to this Class 1 Network will be provided. In addition, the proposed Kirby Road boulevard MUPs will permit a future continuous connection westerly along existing Kirby Road;

Another major component of the Pedestrian and Bicycle Network is the proposed MUP on the Trans Canada Gas Pipeline Corridor. This corridor is located south of Kirby Road Extension and along the southern boundary of the proposed subdivision. It is assumed that the City's comments direct a MUP connection from this corridor to Kirby Road Extension through the proposed subdivision. The north-south MUP connection would intersect Kirby Road where the main entrance to the residential area would be. This intersection in all likelihood can be justified to be controlled by a traffic signal. This traffic signal would allow users of the north-south MUP to efficiently and properly cross Kirby Road and connect with the primary Vaughan Super Trail Pipeline Corridor.

In the opinion of Poulos & Chung Ltd. the north – south MUP crossing is best located with the intersection serving the proposed development. At this location the installation of traffic signals provides the operating service for all modes including vehicles, bicyclists and pedestrians.

As the plans for a residential development in FUA are not yet confirmed, the requirement for at grade crossing opportunities should be confirmed at the detailed design.

In addition to the above analysis, conceptual connections to the trail system were considered at two locations as per the mark-up provided by the City. Underpass crossings may offer seamless and desirable connection for users as opposed to directing trail users to crossings located out of the natural trail route.

The conceptual underpass crossings for proposed connections to the trail system are illustrated on the drawing **"PP-ALIGNMENT-5A"** included in **Appendix D**. An approximately 97m long 4266 x 3050 mm open bottom box culvert is proposed immediately east of the watercourse crossing. Another approximately 63m long 4266 x 3050 mm open bottom box culvert is proposed at approximately 420m west of Bathurst Street. Engineering details of the conceptual crossings should be confirmed at detailed design.

The details for underpass and trail connections should be confirmed at detailed design. There may likely be a desire to increase clear height (greater than 3.05 metres) within the culvert underpass relative to the proposed length and width of the proposed underpasses. This is to ensure the experience is safe and desirable subject to on-site constraints, including availability of sufficient cover and noting that this height increase may likely increase footprint of the road and/or size of the retaining wall in the vicinity to PSW.

In addition, trail ramp connections from Kirby Road Extension Active Transportation Facility (ATF) down to the proposed trail system and tunnel connections at both north and south sides of the road shall be considered at detail design and engineering. The connections design criteria should be a minimum 3m wide and consider Accessibility for Ontarians with Disabilities Act, 2005 and Accessibility Design Guidelines for York Region Forest Trail for grading, rest areas, railing, etc.

8.5.5 Utilities

There is no existing municipal utility infrastructure within the study area except for Bathurst Street and Dufferin Street intersections. The actual location of all existing utilities shall be confirmed at the detailed design stage. A subsurface utility engineering investigation will be required to confirm all existing utility locations and identify potential conflicts that might have impact to the design of the underground services. Proposed utility within the road way to services the roadway extension will be provided by the respected utility companies.

There are 500mm watermains on the east and west sides of Bathurst Street at Gamble Road that need to be protected during construction of the intersection.

No HydroOne distribution infrastructure (≤ 115kV) of concern was identified within the Study Area and/or along Bathurst Street. However, the HydroOne distribution wires are running along Dufferin Street (≤ 44kV) in the vicinity of the Study Area. It should be noted that HydroOne owns the distribution circuits and Alectra Utilities owns the poles. Therefore, future design and construction of the Kirby Road extension should be coordinated with both stakeholders. The study area falls under the HydroOne's Newmarket Operations Center (contact Dereck.Pringle@HydroOne.com for any inquiries). Appropriate contact at Alectra Utilities (former PowerStream) is yet to be identified.

8.5.6 Preliminary Cost Estimate

Property

The Preliminary Preferred Design traverses beyond the limits of existing municipal road allowance and includes lands that are designated Low Density Residential and Valley and Stream Corridor, and lands that are used for agricultural purposes or are open space. The estimated property acquisition would cost approximately $16.6 Million.

A formal site-specific appraisal has not been conducted on the subject lands in respect of the cost estimate for the lands. For the purposes of estimating a preliminary cost for property required for the Preliminary Preferred Design (Refined Alignment 5A), a land value of $8,030,640 per hectare has been

applied to lands areas designated Low Density Residential. A land value of $124,000 per hectare has been applied for all other lands based on a recent sale of similar lands located west of the Study Area.

The values used in this ESR for the cost of the land designated Low Density Residential (in an amount over 8 million/Ha) represent residential rates for the majority of blocks in the City, which are assumed to be fully serviced with servicing available at the lot frontage with low density residential development in accordance with planning and zoning policies fully in place. Therefore, the land values are for purposes of the EAS only and do not reflect site specific land values.

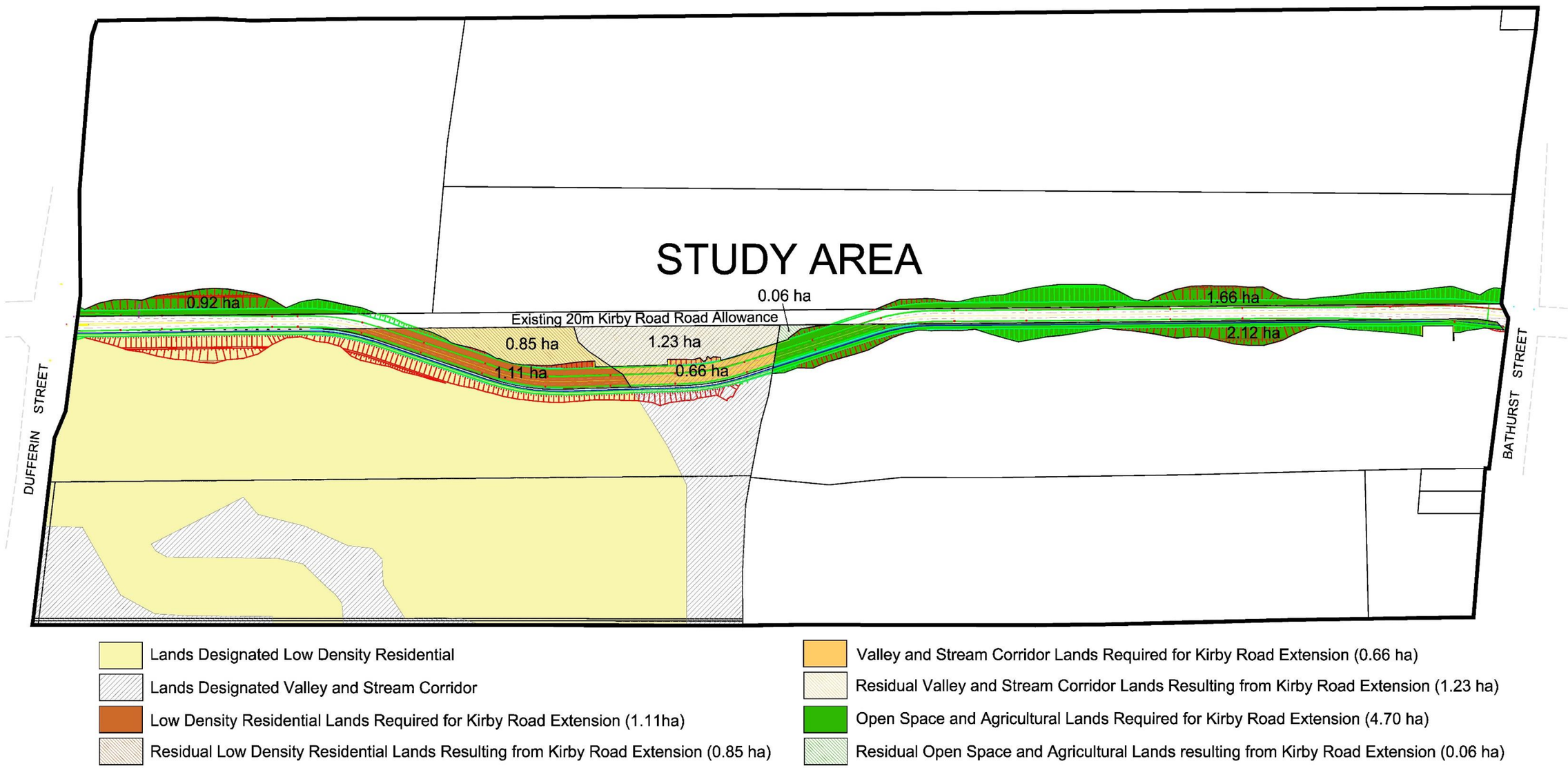
Recognizing that acquisition of lands for the right of way is subject to separate and future processes, once the limits of the lands to be acquired are defined, a formal site-specific appraisal will be undertaken by the CoV using an accredited independent third party appraisal firm.

The preliminary land costs associated with the Preliminary Preferred Design were estimated as follows:

Low Density Residential lands	1.11 ha x $8,030,640 = $8,914,010
Residual Low Density Residential lands	0.85 ha x $8,030,640 = $6,826,044
Valley and Stream Corridor lands	0.66 ha x $124,000 = $81,840
Residual Valley and Stream Corridor lands	1.23 ha x $124,000 = $152,520
Agricultural or Open Space lands	4.70 ha x $124,000 = $582,800
Residual Agricultural or Open Space lands	0.06 ha x $124,000 = $7,440
TOTAL	**$16,564,654**

Figure 52: Property Requirements below illustrates the breakdown.

Figure 52: Property Requirements



The Preliminary Preferred Design will generally occur within a road 36 meters plus lands required for associated right-of- way needs including but not limited at and for structures, intersections ditching, and grading . Recognizing the existing 20 meter wide unopened road allowance, land areas as itemized above and shown in **Figure 52** were estimated for purposes of this ESR. Where applicable, the widening from the current 20 m wide road allowance is expected to occur through an 8 meter widening on the north side of the existing road allowance and an 8 meter widening on the south side of the existing road allowance.

In respect of the quantity of land to be acquired, the quantities used in this ESR are estimates for the purposes of this study only and recognizing that the acquisition of land for the right of way is subject to separate and future processes, once the limits of the lands to be acquired are defined, the determination of how much land will be acquired without compensation through the development process (with the policies and practices which apply in that process) and how much will be acquired with compensation (whether residual or otherwise) will be determined.

It should be noted that land requirements at Dufferin Street and Bathurst Street will be specified by York Region in conditions of approval for development plans, including right-of-way widening to the York Region Official Plan limits, plus daylighting triangles at intersections and grading slopes as applicable.

This preliminary cost estimate is excluding costs that may be associated with business loss or additional considerations resulting from the required acquisition. The property requirements will be finalized during detailed design.

Capital Cost and Life Cycle Analysis

Taking as a basis the capital cost breakdown provided for the shortlisted road alignments as well as considering comments received from the City, a preliminary cost estimate including capital, property and lifecycle analysis for the Refined Preferred Alignment (5A) has been prepared and included in **Appendix C.3.3** - Cost Estimates.

The preliminary cost estimate for the Preliminary Preferred Design (Refined Preferred Alignment 5A) including capital and property is in the order of $43.2 million. The refined estimate accounts for: engineering (20%), tree removal, site preparation, earthworks, roadway construction items, updated services, updated structures, including additional structures providing for trail underpass, updated land acquisition and reduced contingency (15%) costs. The estimate is prepared based on current unit rates for similar type projects and the 2016 Parametric Estimate Guide by Ontario MTO. However, the preliminary cost estimate is excluding landscaping works, illumination, utilities and other potential costs and is subject to the next phases of the project for detailed design and engineering.

In consideration of three options proposed and to be investigated in detailed design for the stormwater treatment train, preliminary capital cost estimates for Option 1 (Bioswale) and Option 2 (Tree Pits) were prepared and sensitivity analysis undertaken. The difference between the two total capital costs is about 1%, i.e. it lies within estimate tolerance.

The preliminary cost estimates are subject to update, revision and refinement through detailed design and engineering and future processes for acquiring and securing property. At detailed design stage the final cost estimate may vary according to market conditions and with respect to specific servicing,

grading, piping depth, additional investigations findings (including for stormwater management design options for water balance, quantity and quality control), utility relocation requirements and streetscaping opportunities.

In addition to the preliminary capital cost estimates, a preliminary life cycle Removal and Replacement cost estimate and a preliminary life cycle Operation and Maintenance cost estimate have been prepared for each of the capital cost estimate options. Detailed life cycle cost analysis matrixes are included in **Appendix C3.3**.

The Removal and Replacement costs considered the construction of a similar road project occurring in a 50 years period. The future project costs were based on the respective preliminary cost estimates for Option 1 (Bioswale) and Option 2 (Tree Pits) with non-amortizing items excluded from the consideration. The costs were adjusted for inflation based on the Statistics Canada Index (Table 327-0043) and then for comparison purposes annualized to determine the required annual reserve fund contribution required to cover the projected costs under each Option. The future costs projected to be incurred over the years under both Options involve replacing various cost components of differing lifespans. Some of the initial implementation costs (i.e. non-amortizing items) were excluded from the lifecycle cost analyses. The lifecycle cashflows projected for each Option were amortized on a uniform annual basis using sinking fund factors. Similarly, Operation and Maintenance costs were adjusted for inflation and annualized to determine the required average annual contributions. As presented in **Table 21** below, the annual cost requirements for Option 1 are estimated at approximately $770K per year and for Option 2 at $757K per year.

Table 21: Preliminary Annual Reserve Fund Contribution Summary

Cost Estimate	Item	Annual Reserve Contribution
Option 1	Removal and Replacement	$343,637
	Operation and Maintenance	$426,656
Total		**$770,293**
Option 2	Removal and Replacement	$338,282
	Operation and Maintenance	$418,426
Total		**$756,707**

The preliminary cost analysis indicates that the road project with Option 1 (Bioswale) is nominally more expensive than the one with Option 2 (Tree Pits). The difference of approximately $20K per year appears within estimate tolerance.

At detailed design stage, the final cost estimate may vary according to market conditions and with respect to specific servicing, grading, piping depth, additional investigations findings, utility relocation requirements and streetscaping opportunities.

8.6 Anticipated Impacts and Mitigation Measures

8.6.1 Natural Environment

For purposes of this evaluation, the details of the impact assessment are provided within a summary table, included in the ESR as **Appendix C.1.3** - Detailed Impact Assessment for Alignment 5A. This table provides a comprehensive review of the natural heritage features and associated functions and their significance and sensitivity. Impactors (potential sources of impact) are identified along with potential effects without any form of mitigation. Impact avoidance, mitigation and/or restoration measures are identified along with predicted net effects. Monitoring measures are identified to measure the effectiveness of mitigation.

Some key points are discussed in the following sections.

Provincially Significant Wetlands – King-Vaughan Provincially Significant Wetland

Potential exists for impacts on the one unit of the King-Vaughan Provincially Significant Wetland Complex that is present within the north central area of the Subject Lands. This unit is identified as an Organic Thicket Swamp (SWT3). Direct impacts may result from construction encroachments (equipment and material) into the wetland and construction of retaining wall adjacent to the wetland within the wetland buffer. Indirect effects may occur as a result of impacts from erosion, sedimentation, accidental spills, potential hydrologic changes and/or human impacts in the post development setting.

A retaining wall is proposed within the buffer area adjacent to the south edge of the wetland. Limit of work devices (e.g., silt fence or other of temporary fencing) will be installed prior to the commencement of vegetation removal and grading adjacent to the wetland to prevent accidental encroachment into the wetland area during construction. A vegetation restoration plan for the wetland buffer setback area will be developed during the detailed design stage, and will incorporate native species as appropriate.

Potential indirect impacts associated with stormwater runoff will be addressed through the preparation and implementation of an Erosion and Sedimentation Control (ESC). The ESC Plan will be developed based on the guidance provided in the *Erosion and Sediment Control Guideline for Urban Construction* (GGHCA 2006).

To minimize the potential for negative impacts on the wetland due to accidental spills during construction, it is recommended that the contractor prepare a spill prevention and response plan to outline the material handling and storage protocols, mitigation measures (e.g., spill kits on-site), monitoring measures and spill response plans (i.e., emergency contact procedures, including MECP Spills Action Centre, and response measures including containment and clean-up).

Potential hydrologic impacts on the significant wetland may occur as a result of:

- Potential pumping required to facilitate construction;
- Changes in surface and groundwater delivery to the wetland due to stormwater management and changes in infiltration associated with increased imperviousness;
- Effects on water quality associated with runoff from urban areas.

The significant wetland is known to receive surface inputs from the agricultural field upstream, as tile drainage was observed discharging from the field to the upstream end of the wetland. No changes in surface water delivery from the adjacent lands will occur as a result of development on the Subject Lands.

The wetland also likely receives surface drainage from the adjacent valley and tablelands. Portions of this drainage area will likely be altered due to the proposed construction of the road. A detailed water balance, assessing both existing and proposed post-construction conditions, would be required to assess potential changes in surface water runoff from the tablelands and valley slopes adjacent to the wetland occurring due to grading and stormwater management.

The wetland is also known to receive direct groundwater inputs due to seepage from the adjacent valley slopes. No information on the volume and seasonal timing of this seepage, and its importance in maintaining wetland characteristics, is available. As such, additional hydrogeological study may be required to identify existing groundwater inputs to the wetland. Post-construction, groundwater delivery to the wetland may be negatively impacted by increased imperviousness and decreased infiltration of surface runoff into the groundwater. Infiltration may continue to occur but the increased impervious areas resulting from the road may result in decreased infiltration. Decreased infiltration on the Subject Lands could potentially result in decreased groundwater discharge into the wetland, and associated impacts on the wetland form and function. A detailed groundwater balance will be required to identify existing groundwater delivery and potential post-development changes.

Stormwater management systems will be designed to prevent and/or mitigate negative impacts, with focus on maintaining surface and groundwater balance to the wetland. Provided that the ground and surface water balance can be maintained, no long-term impacts on the wetland water volumes are anticipated to occur due stormwater management associated with the proposed construction of the road.

The following measures will be implemented to mitigate impacts to the wetland:

- Use of retaining wall and increased grade slope through sensitive features to reduce total footprint in these areas;
- Use of appropriate erosion and sedimentation measures;
- Wildlife passage structure(s) to maintain connectivity, where appropriate;
- Feature-based water balance of the PSW to inform design and mitigation options.

Other Wetlands

One unevaluated wetland unit (Willow Mineral Thicket Swamp, SWT2-2) is present in the southeastern corner of the Study Area. The feature is maintained by seepage water from an adjacent area and inputs from the surface water drainage feature draining the King-Vaughan Wetland PSW Complex.

No direct impacts to the wetland will occur as a result of the proposed road alignment. Potential construction and post-construction impacts on this unevaluated wetland are generally similar to those that could occur to the King-Vaughan Significant Wetland Complex, discussed above.

Potential indirect effects to the significant King-Vaughan Wetland PSW (impervious, changes to surface or ground water inputs), which provides surface water to this wetland (via that watercourse) could result in alterations to the surface water inputs to the wetland.

No net effects on this wetland are anticipated provided that stormwater management and/or LID measures are effective in maintaining water balance to the PSW.

Significant Woodlands

Significant woodlands are present on and within 120 m of the Subject Lands. A total of 64 ha of significant woodlands are present within the Subject Lands. Significant woodlands are also associated with the following designated features:

ANSIs

- Maple Spur ORM Earth Science Provincially Significant ANSI;
- Maple Uplands and Kettles Life Science Provincially Significant ANSI;

ORCMP

- Natural Core area and Natural Linkage area.

Regional Greenlands (York OP, 2013)

- Impact to woodlands identified as Regional Greenlands in the York OP.

The proposed road footprint and grading limits will result in the direct removal of 3.2 ha of significant woodlands. The following ELC communities and areas of impact are provided as follows:

- FOD5-11 – 1.14 ha;
- FOD5-3 – 0.14 ha; and
- FOD2-4 – 1.92 ha.

Significant woodlands will be directly impacted by vegetation removal during the construction process. Longer-term indirect effects on residual significant woodlands within the Subject Lands may occur due to the creation of new woodland edges following vegetation removal (e.g., sunscald, windthrow, increased light penetration) and potential slope stability issues.

Direct removal of significant woodlands can potentially result in negative impacts including overall reduction in significant woodland within the planning area and loss/reduction in the ecological, biophysical and economic functions provided by woodlands (e.g., significant or general wildlife habitat, SAR habitat, hydrological functions, erosion prevention, carbon sequestration, and aesthetics).

Applying the methodology outlined in the TRCA Guideline for Determining Ecosystem Compensation (2018) the area of woodland compensation required to mitigate the removal of 3.2 ha of significant woodland was determined. The detailed methodology is provided in **Appendix C1.4 Ecosystem Compensation for Alignment 5A** and is summarized below.

- The Ecological Land Classification for Southern Ontario (ELC) vegetation types impacted by the proposed road alignment were identified to determine the area (ha) of impact to each vegetation type.
- Basal area surveys were conducted in March of 2019 to determine the basal area for each vegetation type impacted. If only a portion of a feature was impacted, the average basal area was calculated based on the entire feature, and not just the portion being removed.
- Using the basal area calculations the compensation ratio for each vegetation type being removed was determined to calculate the area of required compensation/restoration.
- The required area of restoration/compensation is 20.2 ha.

According to the TRCA compensation guideline land based compensation does not need to be addressed on an individual project basis. The TRCA and the Municipality can track the land area removed from the natural system from all infrastructure projects and work together to explore avenues to off-set these losses through existing municipal land acquisition and ecological restoration programs or other means.

Stormwater management will consider water balance needs of residual woodlands to ensure they are maintained.

In addition, the following indirect effects may result from the removal of significant woodlands:

- Potential increased introduction of invasive species; and,
- Potential impacts associated with salt and other contaminants from the introduction of a roadway through these features.

Significant Wildlife Habitat

Confirmed Significant Wildlife Habitat is present within the Subject Lands:

- Bat Maternity Colonies;
- Seeps and Springs;
- Area-Sensitive Bird Breeding Habitat; and,
- Species of Conservation Concern.

The potential impacts of the proposed development on each of these Significant Wildlife Habitat types, as well as any mitigation measures to prevent or minimize negative impacts, are discussed in the following paragraphs.

Bat Maternity Colonies

Approximately 3.2 ha of Bat Maternity Colony SWH will be removed from the Subject Lands, while approximately 60 ha of this SWH type will be retained within the Subject Lands. This will result in the reduction of this habitat type present on the Subject Lands although residual areas will remain within the Subject Lands. Reductions in the amount of habitat present, as well as potential effects to residual woodland areas will result.

Mitigation in the form of habitat re-creation will be explored. For every five suitable roosting trees (i.e. >25 cm DBH) removed, one replacement bat roosting box should be installed on poles in a suitable

location within the Subject Lands or on any lands where woodland compensation might be completed. This will ensure that sufficient roosting habitat remains present on the Subject Lands or in the general area to continue to provide maternity roosting opportunities for bat species. Public access should be discouraged in areas where bat roosting boxes are installed. A detailed compensation/ecological restoration plan could be prepared at future stages in the development process to position actions for implementation.

Open space areas within the Subject Lands could also be planted with native vegetation to increase habitat for night-flying insects, which providing foraging opportunities for bats. MNRF (2014) indicates that maintenance of foraging areas is important to maintaining the viability of maternity colonies. Tree removal within the SWH should occur outside the known bat roosting period (generally April through the end of September) to avoid direct effects on roosting bats.

Seeps and Springs

This type of SWH is present within and adjacent to the King-Vaughan Significant Wetland Complex. The identified groundwater seepage areas at the base of the valley slopes adjacent to the wetland may support important wildlife functions for Wild Turkey during the winter, when they may provide a source of drinking water and winter/early spring forage (MNR 2014). This type of SWH consists of a direct area of seepage, as well as an adjacent recharge area supporting the seepage. Hydrogeological assessment will be required to confirm the recharge area/seepage area.

Development is proposed within the proposed seepage area (retaining wall) and within adjacent lands (road construction, grading) that support the recharge of groundwater that ultimately discharges at the seepage location could result in changes to the hydrologic characteristics of the seepage. A feature-based water balance should be completed to confirm hydrogeologic conditions supporting the seeps. Some mitigation measures may be suitable to address potential impacts depending upon the completion of hydrogeologic studies (e.g., Low Impact Development measures).

In addition, fencing should be considered in to discourage public access into the area.

Area Sensitive Breeding Bird Habitat

Area sensitive breeding bird habitat is present within the interior forest on the adjacent lands in the north central portion of the Subject Lands, this interior habitat (i.e., at least 200 m from the forest edge) is maintained, in part, by woodland communities on the Subject Lands.

Approximately 1.14 ha of the woodland supporting this type of habitat that will be removed of the large 100.3 ha woodland on and adjacent to the Subject Lands is not anticipated to reduce the amount of actual interior forest habitat.

A reduction in the amount of woodland habitat around the edge of the larger forest will occur. This may include minor reductions in nesting habitat for species dependent on this type of habitat. Indirect effects could include increased predation, parasitism and disturbance (MNRF 2014).

MNRF (2014) notes that minimizing the encroachment of the proposed development within the habitat, and situating it at the edge of the forest will assist in mitigating negative impacts on the habitat. Public access into the area should also be discouraged through fencing and public trails should not be constructed through the woodland block containing this type of habitat.

Bird Species of Conservation Concern

Two Special Concern bird species were observed in association with the woodlands on and adjacent to the Subject Lands; Eastern Wood-Pewee and Wood Thrush.

Woodland removal on the Subject Lands will result in the overall removal of 3.2 ha of woodlands that provide SWH for Eastern Wood-Pewee and Wood Thrush resulting in a decrease of habitat for these species. Approximately 60 ha of woodlands will remain within the Subject Lands for use by these species.

Off-site compensation may be required to ensure no negative impact on the SWH. Woodland restoration and compensation plans may need to account for the habitat needs of these species.

Habitat of Endangered and Threatened Species

Habitat for three Threatened or Endangered Species, including Butternut, Eastern Small-footed Myotis and Little Brown Myotis was confirmed to be present on and/or within 120 m of the Subject Lands. Additional studies have been identified for two species: American Ginseng and Eastern Whip-poor-will based on consultation with MRNF on October 13, 2017.

A summary of threatened and endangered species anticipated to be impacted, potential impacts and preliminary consideration for requirements under the ESA (registration/permitting), mitigation and compensation is provided in Table 22: Summary of Species at Risk Impact Assessment below and each of these species are discussed in more detail in the following sections.

Little Brown Myotis and Eastern Small-footed Myotis

The proposed road alignment will result in the removal of habitat on the Subject Lands for these endangered bat species.

Mitigation to prevent additional impacts on residual woodlands (e.g., due to water balance, erosion and sedimentation, slope stability and edge effects) should be implemented as discussed above with respect to significant woodlands. These measures will assist in preventing impacts on residual woodlands such that these areas could potentially continue to provide suitable habitat for endangered bat species.

ESA requirements associated with removal of habitat for endangered bat species on the Subject Lands will be discussed directly with MECP. It is anticipated that a permit under Section 17(2)(c) of the *ESA* may be required. A Permit would be expected to include compensatory measures to achieve an overall benefit for these species. This could include installation of bat roosting boxes in suitable areas to temporarily replace roosting trees removed, at a specific ratio to be discussed with MECP. Tree planting would likely also be required to replace removed trees over the long-term. In addition, open spaces on

the Subject Lands could be planted with native plant species that will support night-flying insect populations, which would provide foraging opportunities for bats.

A Permit would likely impose timing restrictions on tree removals in those areas (i.e., removal only between October 1 and March 31).

Butternut

The proposed road alignment will result in impacts to one Category 2 (retainable) Butternut (Endangered) tree and 8 Category 1 trees. A Butternut health assessment (BHA) was completed and submitted to MNRF in August of 2018.

No protective measures or mitigation for the removal of Category 1 trees under section 23.7 of O. Reg 242/08 of the ESA. The one Category 2 tree that will be impacted will require further discussion with MECP through the completion of an Information Gathering Form (IGF).

Bobolink

Probable and confirmed breeding bird habitat for Bobolink was identified within a cultural meadow (CUM1-1) in the northeastern portion of the Subject Lands. No impact is predicted to Bobolink as the breeding habitat for this species is located approximately 150 m north of the proposed road alignment as confirmed by Emily Funnel (MNRF, Aurora) during a Dec. 13, 2018 meeting.

Table 22: Summary of Species at Risk Impact Assessment

SAR Species	Predicted Impact	Expected Process Under The ESA	Proposed Mitigation And/Or Compensation
Bobolink	• No direct impact to this species is anticipated. Habitat it located 150 m north of the proposed road alignment as confirmed with Emily Funnel (MNRF, Aurora) at a meeting on Dec. 13, 2018.	N/A	N/A
Butternut	• The proposed road alignment will result in impacts to one Category 2 (retainable) Butternut (Endangered) tree	• No protective measures or mitigation would be required under section 23.7 of the O.Reg 242/08 of the ESA for the removal of Category 1 trees.	• No mitigation or compensation required for the Category 1 trees • Impacts to Category 2 tree are addressed by giving the Minister notice of the activity by submitting a

SAR Species	Predicted Impact	Expected Process Under The ESA	Proposed Mitigation And/Or Compensation
	and 8 Category 1 trees	• The Category 2 tree will require further review. The determination of required compensation and mitigation measures required under section 23.7 of the O.Reg 242/08 of the ESA will be determined through detailed design	notice of butternut impact form. Mitigation and compensation measures may be required
Eastern Small-footed Myotis and Little Brown Myotis	• The proposed road alignment will result in the direct removal of 3.2 ha of woodland that provides habitat for Eastern Small-footed Myotis	• Completion of an IGF with the MECP • Permit under 17(2)(c) of the ESA	**Mitigation:** • Minimize/narrow Right-of-Way (ROW) to the extent possible through confirmed habitat • Minimize the removal of trees where possible • Restrict tree removal to periods outside the active period for bats, approximately October 1st to March 31st, or as agreed to be appropriate by the MECP • Restoration of temporary work spaces as soon as possible to pre-construction conditions where appropriate • Measures as determined through the permitting process under 17(2)(c) of the ESA **Compensation:** • Creation of bat replacement habitat structures • Measures as determined

SAR Species	Predicted Impact	Expected Process Under The ESA	Proposed Mitigation And/Or Compensation
			through the permitting process under 17(2)(c) of the ESA to achieve Overall Benefit for the Species
American Ginseng	• To be determined • Potentially suitable habitats are impacted by the preferred alignment • Additional assessment is required to confirm presence/absence of this species	• Presence is unknown at this time • There is no registration for this species at this time. If present and impacted by the proposed alignment, a permit would be required	• Confirmation of species presence/absence is required to determine if species specific mitigation, permitting and/or compensation is required **Next Steps:** • Targeted surveys will be conducted along the proposed road alignment to confirm presence/absence of this species
Eastern Whip-poor-will	• To be determined • Potentially suitable habitats are impacted by the preferred alignment • Additional assessment is required to confirm presence/absence of this species	• Presence is unknown at this time • There is no registration for this species at this time. If present and impacted by the proposed alignment, a permit would be required	• Confirmation of species presence/absence is required to determine if species specific mitigation, permitting and/or compensation is required. **Next Steps:** • Targeted surveys following the MNR protocol for Eastern Whip- poor-will surveys (MNR 2013); to be completed between May 18 and June 30

Tributary of East Patterson Creek

There is no direct fish habitat present within the drainage feature identified as a tributary to East Patterson Creek. A berm associated with the Trans Canada Pipeline (TCPL) located downstream at the south east limit of the Subject Lands represents a distinct and definite barrier to any fish movement to reaches upstream of the berm. Further, the berm also acts as a flow barrier for any drainage coming from the upstream catchment area. The lack of a culvert at the berm and the height of the berm itself create an effective flow dam that prevents flows moving to reaches downstream of the TCPL corridor.

No direct effects to this drainage feature are anticipated. Potential indirect effects that could occur from the proposed road construction include:

- Negative impacts on aquatic biota (e.g. benthic invertebrates), including deteriorated health or mortality, due to erosion and sedimentation from site alteration and construction;
- Mortality or health impacts due to accidental spills of toxic materials during or post-construction;
- Alterations in water quality due to pumping and discharge of pumped water during construction;
- Alterations in water balance to drainage feature (e.g., timing and volume of flows) and associated negative impacts on aquatic habitat; and
- Long-term impairment of drainage feature water quality (including chemical contaminants, suspended solids and temperature) due to surface runoff from road.

Key avoidance and mitigation measures to be implemented include:

- Preparation and implementation of an ESC plan with associated mitigation measures to minimize the potential for negative impacts (i.e., silt fencing);
- Preparation and implementation of a spill prevention and response plan to prevent or minimize the potential for spills of potentially toxic materials during construction;
- If pumping of groundwater or accumulated surface water from excavations is required, water will be appropriately treated (e.g., in a sediment filtration bag) prior to discharge, with erosion protection at the discharge point (if required); and
- Installation of plant material (shrubs and trees) within vegetated buffer zone of the drainage feature to further enhance and strengthen riparian functionality (e.g., enhanced soil stability, shading and increased allochthonous inputs).

Construction monitoring of ESC measures and adherence to and effectiveness of spill prevention and response measures is recommended throughout the construction period. Provided water balance is maintained to this drainage feature, negative impacts are not anticipated to occur as a result in alterations in surface water runoff and infiltration associated with the proposed road.

Light Effects on Wildlife

Light impacts on nature has been the subject of extensive scientific study. Ecological light pollution may interrupt natural behaviors, expose individuals to higher predation levels, and/or disrupt navigational abilities. Most recently, evidence has pointed to the effects of light on pollinators, a group of species already under substantial pressure from the application of neonicotinoid pesticides on some crops and landscape stock (Knop et al 2017).

Primary sources for “new light” will be from road lighting. In particular, the use of larger light standards can be problematic by allowing light penetration into forested blocks, which could inhibit or affect wildlife use.

To minimize light being directed into the adjacent ecological features, outdoor common area lighting should be located and directed away from the retained wooded areas. Public pathways should be discouraged in proximity to retained natural areas. Finally, to minimize impacts on birds, direct upward

light should be eliminated, spill light should be minimized, and all lighting sources should illuminate only non-reflective surfaces (e.g., as per City of Toronto Green Development Standard, 2007).

Landscape Ecology/Wildlife Crossings

The dominant features in terms of the potential movement of organisms, matter and energy across the landscape are the series of natural areas associated with the Study Area (e.g., Earth and Life Science ANSI's, PSW, ESA's) and the Oak Ridges Moraine Conservation Plan (ORMCP) Natural Core and Linkage areas. This system of natural areas and functions are generally well-linked to the north and west with the broad ORMCP area and its concentration of ecosystem features and functions and are generally more interrupted by the concentration of residential development to the south and east, and regional/local roads located east west and south of the Subject Lands.

The local landscape is dominated by agricultural fields, natural areas, commercial operations and an established road network. The Subject Lands provide an opportunity for wildlife movement/linkage in both a north south and east west direction through the natural areas associated with the ORMCP area. Beyond the Subject Lands the connections are more limited due to the internal road structure (Dufferin St, Bathurst St and Teston Road), and residential development located to the south, east and west. It is anticipated that the open areas associated with the Maple Downs Golf Course which borders the southern boundary of the Subject Lands provides some opportunities for local movement of wildlife species. In addition, the culverts associated with existing roadways may facilitate the localized movement of small to medium-sized wildlife (frogs, toads, snakes, turtles, raccoons, skunks, rabbits, squirrels, opossums, voles, etc.).

The proposed extension of Kirby Road will create a north south barrier to the movement of wildlife across the current landscape. Fish, mammals, birds, reptiles and amphibians are all vulnerable to the impacts of roads (CVC, 2017). As such an assessment of the functional needs of wildlife groups using the Subject Lands was undertaken in order to assess wildlife crossing needs for incorporation into the proposed road design.

Based on ecological studies completed by Savanta (between 2010 and 2017) the following species and functional groups of wildlife are known to be present within the Subject Lands:

Amphibians

- American Toad
- Gray Treefrog
- Wood Frog
- Green Frog
- Spring Peeper
- Northern Leopard Frog
- Spotted Salamander

Reptiles

- Eastern Garter Snake

Mammals

- Eastern Cottontail
- Shrew
- Chipmunk
- Squirrel
- Mouse
- Red Fox
- Raccoon
- Coyote

The significance and sensitivity of identified natural features within the Subject Lands was also assessed in accordance with the definitions in the PPS (MMAH 2014), and the ORMCP (MMAH 2017) as detailed within the Kirby Road Natural Heritage Existing Conditions Report (2018, revised March 2019). Based on this assessment it was determined that the proposed road crossing will directly and indirectly impact the following significant features:

- Provincially Significant Wetlands (PSW);
- ORMCP lands;
- Earth and Life Science ANSI's;
- Significant Wildlife Habitat (SWH);
- Habitat for Species at Risk (SAR);
- Watercourse; and
- Significant Woodlands.

In order to assess potential wildlife crossing locations existing and future land use was considered i.e. a wildlife crossing may not be appropriate in a location where natural heritage features have been permitted for removal on one or both sides of the road or where future development will negate the benefits of their construction (i.e. proposed residential development of lands to the south). Background and site level field data was analyzed to inform the location of potential wildlife crossing locations within the Subject Lands as well as areas where crossing systems are necessary to limit road impacts.

Crossing systems were identified where adjacent habitat considered sensitive or significant (e.g. wetlands, watercourses, woodlands, habitat that supports significant wildlife habitat or habitat for species at risk) was located on at least one side of the road. Fish passage was also considered for the watercourse crossing.

The function and crossing needs of wildlife using the Subject Lands was assessed in detail according to a number of parameters (wildlife group, preferred habitat, openness ratio, and culvert sizes) based on guidance provided in the TRCA Crossing Guideline for Valley and Stream Corridors (2015) as well as the Credit Valley Conservation Authority Fish and Wildlife Crossing Guidelines (2017).

The proposed road design includes five culvert crossings of various sizes with four of these crossings which abut sensitive NHS features. Two of the culvert crossings that are located adjacent to the center core woodland and PSW have been designed to accommodate wildlife passage. A summary of the culvert size, openness and wildlife group accommodated to utilize these two crossing is summarized in **Table 23** below as well as some recommended design criteria which can be considered during detailed design.

Table 23: Proposed Wildlife Crossings

Culvert Location	Culvert Size in Meters	Openness Ratio	Functional Wildlife Group that will be accommodated	Design Considerations
• Crossing over East Patterson Creek • Adjacent to PSW and core woodlands	6 .1 (width) by 2.74 (high) 60 (length) concrete open bottom box culvert	0.27	• Large mammals (not ungulates) • Small to medium wildlife • Amphibians and Reptiles	• Natural, dry substrate that is vegetated where possible • Install natural substrate with some cover (e.g. branches, debris) to provide refuge from predators • Incorporate dry terrestrial passage zone at least 0.5-0.7 m in width (preferably 1 m) on either side of a watercourse • Use of directional fencing to funnel wildlife into culvert • Planting of native vegetation adjacent to culvert ingress and egress
• Adjacent PSW and core woodlands • Just east of culvert crossing of East Patterson Creek • Conceptual Trail location	4.27 (width) by 3.05 (height) 63 (length) concrete open bottom box culvert	0.21	Large mammals (not ungulates) Small to medium wildlife Openness ratio and length not suitable for amphibians and reptiles	• Natural, dry substrate that is vegetated where possible • Install natural substrate with some cover (e.g. branches, debris) to provide refuge from predators • Use of directional fencing to funnel wildlife into culvert • Planting of native vegetation adjacent to culvert ingress and egress

Target wildlife species for wildlife crossings through the culverts (wet crossing where associated with the watercourse) and underpasses (dry crossings) are amphibians (Spring Peeper, American Toad, Gray Tree Frog, Green Frog, Northern Leopard Frog, Spotted Salamander), potentially reptiles (i.e., snake and turtle species), small to medium sized mammals (voles, shrews, mice, Gray Squirrel, Striped Skunk, Common Raccoon, Eastern Cottontail, Red Fox and Shrew) and large mammals (Coyote). The wildlife crossings are not appropriate to provide for the passage of Ungulates (i.e., White-tailed Deer) which will cross over the road and measures (i.e., signage, vegetation planting at ROWs) to avoid collisions with road traffic should be explored during detailed design.

Studies of small-medium mammals, amphibians and reptiles have determined that movement of these species through culverts is most highly correlated with presence of vegetative cover at culvert entrance as well as abundance of these species on either side of the culvert (Forman 2003; Clevenger and Waltho 2005). Small to medium-sized mammals, amphibian and reptiles were observed to use a wide variety of culvert diameter and/or width for passage (Brehm 1989; Krikoswki 1989; Yanes et al. 1995; Clevenger et al 2001; Forman 2003; Woltz et al. 2008). Krikoswki (1989) observed amphibians using 0.3 m tunnels that were up to 42 m in length. Clevenger et al. (2001) found that 1.0 m to 1.5 m diameter culvert facilitates passage for medium mammals, while 0.5 m to 1.0 m diameter culverts were suitable for movement of small mammals. Woltz et al. (2008) found that amphibians and reptiles avoid using culverts less than 0.5 m in diameter. Substrate embankment material within the culvert/tunnel is important; amphibians and small mammals will avoid rip-rap (difficult terrain); smaller substrate should be placed on top of rip-rap (where rip-rap is needed) to support amphibian and small mammal movement.

Other Predicted Indirect Impacts

The proposed road construction will result in potential indirect impacts and resultant effects may include:

- Noise, vibration and lighting and potential effects on wildlife behaviour and/or reproductive success (i.e., during construction and post development);
- Localized micro-drainage changes that could cause localized ponding and inundation of rooting systems;
- Introduction of non-native plant species in the disturbed margins of the developed footprint, displacing some native flora;
- Stress/dieback of retained vegetation along developed edges (root/stem/crown impacts, sediment); and
- Impacts on wildlife and plant populations associated with anticipated increased human impacts on retained natural areas (i.e., proposed trails).

Recommended Measures to Avoid and Mitigate Potential Effects

The extent to which construction will affect the edge conditions can be limited by the implementation of the following measures:

- Locate and flag development limits prior to construction;
- Pre-construction erection of erosion and sedimentation control fencing along confirmed protection edges and specific trees (at outer limit of the dripline) for proposed retention along the woodland edge closest to the development;
- Appropriate pre-construction briefing of site workers to advise regarding the sensitivity of the development edge conditions (i.e., SAR habitat, locally uncommon flora, etc.); and
- Matching of tree retention areas at existing grade (i.e., feathered grades from development edges).

Next Steps

- Staking of PSW and submission to MNRF at the detailed design stage. As left to next steps of implementation, it will not change the evaluations and Preliminary Preferred Design.
- A compensation plan and associated costs should be provided as part of detailed design for the preferred alignment in accordance with TRCA's 2018 Compensation Guideline.
- The HDFA was conducted by Savanta Inc. in the Study Area on August 11, 2011 to identify and classify potential headwater drainage features. As the HDFA assessment was conducted over 7 years ago but not during seasonally higher flow spring conditions, an updated HDFA is being completed in the spring and summer of 2019.
- Additional studies with the MECP required for two species: American Ginseng and Eastern Whip-poor-will will be completed in 2019.

8.6.2 Social Environment

A summary of anticipated impacts and proposed mitigation measures on the social environment are provided below.

Land Use Designations and Policies

Potential Effects

- Encroaches in the 30 m wide buffer south of the PSW;
- Requires removal of approximately 2.93 ha on the of Core forested lands;
- Establishes a new forest edge in the western portion of the Study Area;
- Requires removal of the hedgerow in the eastern portion of the Study Area;
- Affects approximately 1.96 ha of residentially designated lands;
- Affects approximately 1.89 ha of lands designated Valley and Stream Corridor; and,
- Affects approximately 2.48 ha of agricultural land.

Mitigation

- A retaining wall within the 30m buffer south of the PSW will provide protection to the feature;
- Kirby Road in the western portion of the Study Area impacts the existing edge of the core forested lands and not interior forested lands;
- Shifting the alignment south in the western portion of the Study Area avoids the PSW and provides a minimum 200m setback from existing interior forests;
- The alignment of Kirby Road through the core forested area generally occurs at its narrowest;
- The proposed residential subdivision south of Kirby Road in the western portion of the Study Area will be graded to match the proposed grade of Kirby Road, reducing the amount of lands needed to be acquired and associated acquisition costs.

ORMCP Conformity

A summary how the preferred alignment conforms to the policies of the Oak Ridges Moraine Conservation Plan is provided in the following.

Demonstration of Need and There is no Reasonable Alternative (Policy 41(2)(a), 41(5)(a))

- The need for the project has been demonstrated in both the Region of York Transportation Master Plan (2016) and the City of Vaughan Master Transportation Plan (2012). The need for the project was also confirmed through a Transportation Analysis Study undertaken by Poulos and Chung Ltd. The study verified the need for Kirby Road extension, concluded that it must be completed by 2021, and that it must have two lanes in each direction.
- There is no reasonable alternative to the proposed Kirby Road extension. A new road between Dufferin Street and Bathurst Street north or south of the proposed extension would still require that traffic use Dufferin and Bathurst Streets and congestion and travel time concerns would remain unresolved.

The area of construction disturbance be kept to a minimum (Policy 41(2)(b)(1))

- The screening of the potential alignments included an examination of grading impacts outside of the right-of-way and alignments that required a significant amount of grading were removed from further consideration.
- The preferred alignment results in minimal grading and measures to ensure that construction disturbance will be kept to a minimum will be outlined in the final design of the extension.

The project will allow for wildlife movement" (Policy 41(2)(b)(3))

- Then preferred alignment includes measures to permit wildlife movement including eco-passes. A refinement of these measures will be addressed through detailed design.

Lighting will be focused downwards and away from Natural Core Areas (Policy 41(2)(b)(4))

- Lighting will generally be focused downwards and away from Natural Core Areas and addressed through detailed design.

The planning, design and construction practices adopted will keep any adverse effects on the ecological integrity of the Plan Area to a minimum (Policy 41(2)(b)(5), 41(5)(b))

- The ORCMP definitions state that “ecological integrity”, which includes hydrological integrity, means the condition of ecosystems in which,
  (a) the structure, composition and function of the ecosystems are unimpaired by stresses from human activity,
  (b) natural ecological processes are intact and self-sustaining, and
  (c) the ecosystems evolve naturally.
- The evaluation system scored Alignment 5 as the most preferred alignment considering the net effects within the 4 environments, including socio-economic and transportation environments.
- Although Alignment 5 scored highest overall, it did not score highest with respect to effects on the natural environment.
- To minimize the effects on the natural environment, consideration was given to measures that would reduce the effects of Alignment 5 and Alignment 5a was created that shifts a portion of the Kirby Road extension south to avoid the PSW and to maintain a 200 setback from existing interior forest.

The project does not include and will not in the future require a highway interchange or a transit or railway station in a Natural Core Area" (Policy 41(3)(b))

- The proposed extension of Kirby Road does not and will not require a highway interchange or transit or railway station.

The project is located as close to the edge of the Natural Core Area as possible (Policy 41(3)(c))

- The eastern portion of the Kirby Road extension must align with the existing intersection of Kirby Road and Dufferin Street, requiring utilization of the existing Kirby Road right-of-way. Although the existing right-if-way is largely forested, it is located at the edge of the core feature
- It is inevitable that the extension of Kirby Road will pass through lands designated Natural Core Area and lands designated Natural Linkage Area in the centre of the Study Area. Alignment 5a crosses the Natural Core Area where it is narrow and avoids key natural heritage features.

The design practices adopted will maintain, and where possible improve or restore, key ecological and recreational linkages, including the trail system referred to in section 39 (Policy 42(5)(c))

The landscape design will be adapted to the circumstances of the site and use native plant species as much as possible, especially along rights of way (Policy 41(5)(d))

The long-term landscape management approaches adopted will maintain, and where possible improve or restore, the health, diversity, size and connectivity of the key natural heritage feature or key hydrologic feature (Policy 41(5)(e))

- The three requirements above will be addressed and incorporated through the detailed design and mitigation measures.

The need for the project has been demonstrated and there is no reasonable alternative that could avoid the development occurring in prime agricultural areas 41(2.1)(a).

An agricultural impact assessment or equivalent analysis carried out as part of the environmental assessment, is undertaken that demonstrates that there will be no adverse impact on the prime agricultural areas or that such impacts will be minimized and mitigated to the extent possible41(2.1)(b).

- Agricultural lands occur in the eastern portion of the Study Area. The Ontario Ministry of Agriculture, Food and Rural Affairs identifies that only the lands located in the northeast portion of the Study Area are within a prime agricultural area and does not include the Kirby Road right-of-way and the lands immediately surrounding the right-of-way. The preferred alignment in the eastern portion of the Study Area follows the existing right-of-way and is exempt from the ORMCP requirement for a separate Agricultural Impact Assessment.

Demonstrate that infrastructure will be financially feasible and sustainable over the long-term (Policy 41(1) (1.2) (a)

- Although, the preferred alignment requires the acquisition of higher value residentially designated lands, a significant portion of the additional costs will be offset by savings not buildings a bridge structure over the PSWs. It should also be noted that there will be no need to acquire residentially designated lands south of the alignment for grading purposes as the proposed residential development will be designed to match the grade of the Kirby Road extension. Removal of the bridge structure will eliminate the life cycle costs to maintain and eventually replace the structure over time.
- It is anticipated that the cost associated with the preferred alignment will be feasible and sustainable.

Address stormwater management at appropriate scales throughout the land use planning process" (Policy 41(1) (1.2) (c))

- Then preferred alignment includes preliminary consideration of stormwater management measures and a comprehensive Stormwater Management Plan will be prepared during detailed design.

Utilize appropriate low impact development techniques and green infrastructure" (Policy 41(1) (1.2) (d))

- Then preferred alignment includes preliminary consideration of low impact development techniques and green infrastructure and will be finalized during detailed design.

Assess actions to reduce greenhouse gas emissions and to adapt to climate change impacts (Policy 41(1) (1.2) (e))

- Then preferred alignment includes consideration of actions to reduce greenhouse emission and adapt to climate change impacts. Measures will be addressed during detailed design.

Archaeology

Potential Effects

- The Study Area exhibits archaeological potential within all proposed Alignments 4, 5, 5A, 6, and 6A. These lands require Stage 2 archaeological assessment by test pit/pedestrian survey, both at five metre intervals, where appropriate, prior to any proposed impacts to the property;
- Part of the Study Area has been previously assessed and does not require Stage 2 survey;
- The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance, and/or slopes in excess of 20 degrees. These lands do not require further archaeological assessment; 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.

Notwithstanding the results and recommendations presented in their study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Cultural Programs Unit of the MTCS should be immediately notified.

Mitigation

A Stage 2 Archaeological Assessment will be completed during detailed design to identify the presence of any archaeological resources.

A significant portion of Kirby Road will pass through lands that have a very low potential for archaeological resources due to past construction and aggregate extraction activities.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licenced consultant archaeologist to carry out additional fieldwork, in compliance with Section 48 (1) of the Ontario Heritage Act.

The Cemeteries Act, R.S.O. 1990 c.C4 and the Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

Built Heritage and Cultural Landscape

Potential Effects

Background research, data collection, and field review was conducted for the study area and it was determined that one cultural heritage resource is located within or adjacent to the Kirby Road Extension EA Study Area.

Mitigation

- Construction activities and staging should be suitably planned and undertaken to avoid impacts to contributing elements of identified cultural heritage resources. Specifically, structures and landscape elements associated with the farmscape at 11490 Bathurst Street (CHL 1) should be avoided during construction and staging activities. As a retaining wall is anticipated to be constructed adjacent to the residence at 11490 Bathurst Street, instructions should be issued to workers and no-go limits established to ensure construction and excavation activities are conducted in a way that prevents any impacts to the residence;
- CHL 1 should be subject to photographic documentation and compilation of a resource-specific cultural heritage impact assessment report by a qualified heritage consultant. Where cultural heritage resources are expected to be impacted through alteration to their setting, a resource–specific cultural heritage impact assessment report should be prepared in advance of construction activities;

- CHL 1 is expected to be impacted through alteration to setting by the removal of replaceable landscape features (i.e. vegetation, and mature trees). The feasibility of implementing tree protection zones should be investigated for all identified cultural heritage resources where tree removals are planned. If possible, tree protection zones should be implemented for CHL 1;
- Post-construction landscaping and rehabilitation plans should be undertaken in a manner that is sympathetic to the overall setting. Wherever possible, landscaping with appropriate or sympathetic historic plant materials is recommended. Post-construction landscaping is recommended for CHL 1 where feasible, which will be subject to the removal of vegetation or replaceable landscape features (i.e. established trees, shrubs) during construction; and,
- Should future work require an expansion of the study area then a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed work on potential heritage resources.

8.6.3 Air Quality Impact Assessment

Novus Environmental Inc. prepared an air quality report under the cover "Local Air Quality Assessment". The report can be found in **Appendix C9** - Air Quality.

The main objective of this study was to assess the impacts of the new roadway at nearby sensitive receptors, including the future residential development proposed at the southeast corner of Dufferin Street and Kirby Road. This study also included an assessment of total Greenhouse Gases (GHG) emissions and an overview of construction impacts.

To meet the study objectives, an assessment of the future air quality conditions for the proposed roadway was considered for the scenario 2031 Future Build. Predicted contaminant concentrations from the proposed roadway were combined with hourly measured ambient concentrations to determine the combined impact.

The contaminants of interest for this study have been chosen based on the regularly assessed contaminants of interest for transportation assessments in Ontario, as determined by the MTO and MECP.

A summary of these contaminants is provided in Table 24 below.

Table 24: Contaminants of Interest

Contaminants		Volatile Organic Compounds (VOCs)	
Name	**Symbol**	**Name**	**Symbol**
Nitrogen Dioxide	NO_2	Acetaldehyde	C_2H_4O
Carbon Monoxide	CO	Acrolein	C_3H_4O
Fine Particulate Matter (<2.5 microns in diameter)	$PM_{2.5}$	Benzene	C_6H_6
Coarse Particulate Matter (<10 microns in diameter)	PM_{10}	1,3-Butadiene	C_4H_6
Total Suspended Particulate Matter (<44 microns in diameter)	TSP	Formaldehyde	CH_2O

In order to assess the impact of the project, the predicted effects at sensitive receptors were compared to guidelines established by government agencies and organizations. Relevant agencies and organizations in Canada and their applicable contaminant guidelines are:

- MECP Ambient Air Quality Criteria (AAQC);
- Canadian Ambient Air Quality Standards (CAAQS).

Within the guidelines, the threshold value for each contaminant and its applicable averaging period were used to assess the maximum predicted impact at sensitive receptors derived from computer simulations.

The contaminants of interest are compared against 1-hour, 8-hour, 24- hour, and annual averaging periods. The threshold values and averaging periods used in this assessment are presented in **Table 25** below.

Table 25: Applicable Contaminant Guidelines

Contaminant	Averaging Period (hrs)	Threshold Value ($\mu g/m^3$)	Source
NO_2	1	400	AAQC
	24	200	AAQC
	1	79 (42 ppb)[1]	CAAQS (standard is to be phased-in in 2025)
	Annual	23 (12 ppb)[2]	CAAQS (standard is to be phased-in in 2025)
CO	1	36,200	AAQC
	8	15,700	AAQC
$PM_{2.5}$	24	27[3]	CAAQS (standard is to be phased-in in 2020)
	Annual	8.8[4]	CAAQS
PM_{10}	24	50	Interim AAQC
TSP	24	120	AAQC
Acetaldehyde	24	500	AAQC
Acrolein	24	0.4	AAQC
	1	4.5	AAQC
Benzene	Annual	0.45	AAQC
	24	2.3	AAQC
1,3-Butadiene	24	10	AAQC
	Annual	2	AAQC
Formaldehyde	24	65	AAQC

[1] The 1-hour NO_2 CAAQs is based on the 3-year average of the annual 98th percentile of the NO_2 daily-maximum 1-hour average concentrations
[2] The average over a single calendar year of all the 1-hour average NO_2 concentrations
[3]The 24-hr $PM_{2.5}$ CAAQS is based on the annual 98th percentile concentration, averaged over three consecutive years
[2] The annual $PM_{2.5}$ CAAQS is based on the average of the three highest annual average values over the study period

**From Local Air Quality Assessment Report by Novus Environmental, dated April 2019*

The worst-case contaminant concentrations due to motor vehicle emissions from the roadways were predicted at nearby receptors using dispersion modelling software on an hourly basis for a five-year

period. 2012-2016 historical meteorological data from Toronto Pearson Airport was used. Five years were modelled in order to capture the worst-case meteorological conditions. One emission scenario was assessed: 2031 Future Build. The scenario includes the following activities:

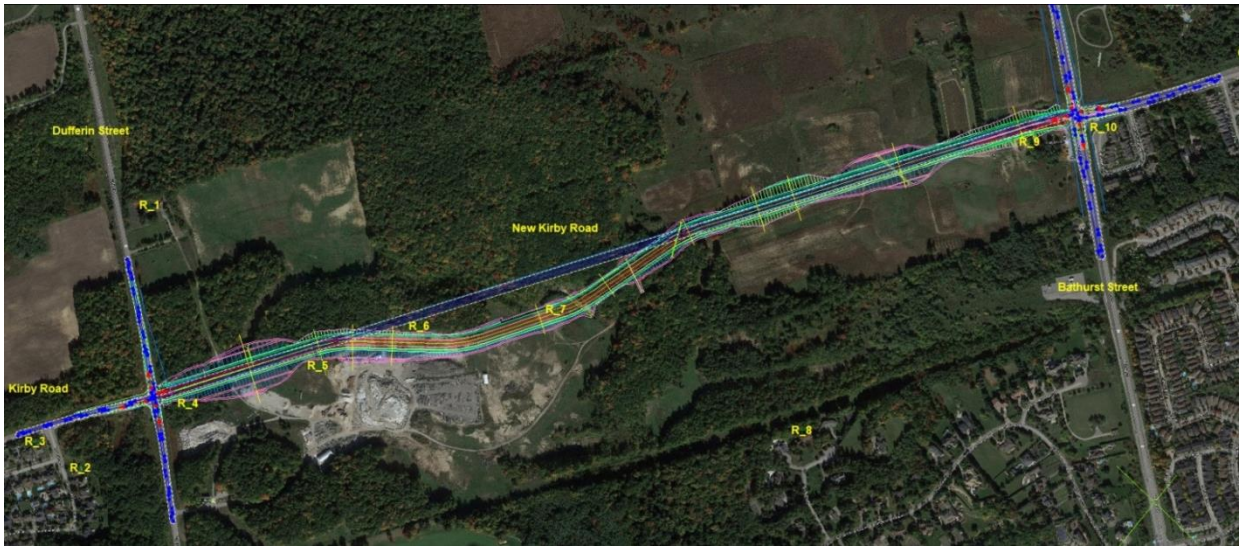
2031 Future Build (FB): Projected vehicle volumes on the new Kirby Road and arterial roads for the proposed alignment.

The assessment was performed using U.S. EPA approved vehicle emission and air dispersion models to predict worst-case impacts at representative sensitive receptor locations. The assessment was conducted in accordance with the MTO *Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects*.

Ten sensitive receptors were evaluated to represent worst-case impacts surrounding the project area. All receptors represent the nearest existing residential properties, as well as the future residential development at the southeast corner of Dufferin Street and Kirby Road. An application for approval of this new subdivision has been submitted to the City of Vaughan. Therefore, it was included as a sensitive receptor in the air quality assessment, in the case that it gets approved. Note that the preferred roadway alignment was modified in 2019, with the new alignment referred to as Alignment 5A. The figure below shows the new roadway alignment 5A (multi-coloured), with the previously assessed Alignment 5 shown in blue. Also shown are the receptor locations included in the assessment. The change in alignment includes shifting a portion of the road to the south, near the proposed subdivision; however, near the intersections of Kirby Road with Dufferin Street and Bathurst Street, the alignment remains the same. Plans for the new residential development are not yet confirmed. Receptors R5, R6 and R7 were placed at representative distances of 30m, 15m and 65m south of the roadway, respectively, to represent the proposed subdivision. It is expected that residences will remain a minimum distance of 15m south of the roadway, as modelled in the original assessment. Therefore, the results of the original assessment predicted at location R6 would remain representative of worst-case predicted impacts at the proposed subdivision, provided that a separation distance of 15m to the roadway is maintained.

The receptor locations are identified in **Figure 53**.

Figure 53: Receptors R1-R10 Locations within the Study Area



CAL3QHCR, U.S. EPA's dispersion model was used to calculate hourly concentrations. This model requires the input of roadway geometry, sensitive receptor locations, meteorology, traffic volumes, and motor vehicle emission rates as well as some contaminant physical properties such as settling and deposition velocities. Table 26: CAL3QHCR Model Input Parameters provides the model input parameters. The emission rates used in the model were the outputs from the MOVES and AP-42 models, weighted for the vehicle fleet distributions provided.

Table 26: CAL3QHCR Model Input Parameters

Parameter	Input
Free-Flow and Queue Link Traffic Data	Hourly traffic distributions were applied to the AADT traffic volumes in order to input traffic volumes in vehicles/hour. Emission rates from the MOVES output were input in grams/VMT or grams per vehicle hour. Signal timings for the traffic signal were input in seconds.
Meteorological Data	2012-2016 data from Pearson International Airport
Deposition Velocity	$PM_{2.5}$: 0.1 cm/s PM_{10}: 0.5 cm/s TSP: 0.15 cm/s NO_2, CO and VOCs: 0 cm/s
Settling Velocity	$PM_{2.5}$: 0.02 cm/s PM_{10}: 0.3 cm/s TSP: 1.8 cm/s CO, NO_2, and VOCs: 0 cm/s
Surface Roughness	The land type surrounding the project site is categorized as 'low intensity residential'. The average surface roughness height for low intensity residential for all seasons of 52 cm was applied in the model.
Vehicle Emission Rate	Emission rates calculated in MOVES and AP-42 were input in g/VMT

**From Local Air Quality Assessment Report by Novus Environmental, dated November 2018*

Presented below are the modelling results for the 2031 Future Build scenarios based on 5-years of meteorological data. For each contaminant, combined concentrations are presented along with the relevant contribution due to the background and roadway. Results are presented for the worst-case sensitive receptors for each contaminant and averaging period, which were identified as the maximum combined concentration for the 2031 Future Build scenario. Note that the worst-case sensitive receptors are located near the intersection of Kirby Road with Bathurst Street. Table 27 and Table 28 below provide the results of this modelling.

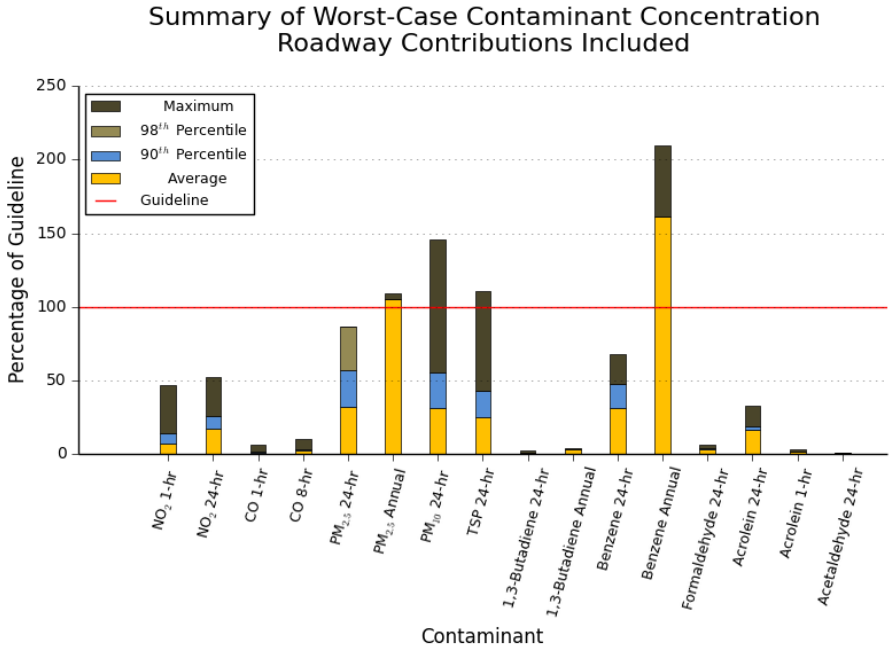
Table 27: Worst-Case Sensitive Receptors for 2031 Future Build Scenario

Contaminant	Averaging Period	Sensitive Receptor
NO_2	1-hour	10
	24-hour	9
CO	1-hour	10
	8-hour	10
$PM_{2.5}$	24-hour	10
	Annual	10
PM_{10}	24-hour	10
TSP	24-hour	9
Acetaldehyde	24-hour	10
Acrolein	1-hour	3
	24-hour	9
Benzene	24-hour	9
	Annual	10
1,3-Butadiene	24-hour	9
	Annual	10
Formaldehyde	24-hour	10

**From Local Air Quality Assessment Report by Novus Environmental, dated November 2018*

Table 28: Summary of 2031 Future Build Results

5 Year Statistical Summary



Note: The $PM_{2.5}$ results are in compliance with the CAAQS. The highest 3 year rolling average of the yearly 98th percentile combined concentrations was calculated to be 23.35 µg/m³ or 86% of the CAAQS.

% of Guideline	
2031 Future Build	
NO_2 (1-hr)	46%
NO_2 (24-hr)	52%
CO (1-hr)	6%
CO (8-hr)	10%
$PM_{2.5}$ (24-hr See Note)	86%
$PM_{2.5}$ (Annual)	109%
PM_{10}	145%
TSP	110%
Acetaldehyde	<1%
Acrolein (1-hr)	3%
Acrolein (24-hr)	33%
Benzene (24-hr)	68%
Benzene (Annual)	209%
1,3-Butadiene (24-hr)	2%
1,3-Butadiene (Annual)	4%
Formaldehyde	6%

Best management practices should be followed during construction of the roadway to reduce any air quality impacts that may occur. Dust is the primary contaminant of concern. Other contaminants including NOx and VOC's may be emitted from equipment used during construction activities. Common mitigation techniques include material wetting or use of chemical suppressants (non-chloride) to reduce dust, use of wind barriers, and limiting exposed areas which may be a source of dust and equipment washing.

The results of the air quality impact assessment can be summarized into the following:

- The 2031 Future Build scenario indicates that the maximum combined concentrations are all below their respective MECP guidelines or Canadian Ambient Air Quality Standards (CAAQS), with the exception of annual $PM_{2.5}$, 24-hr PM_{10}. 24-hr TSP and annual benzene. However, it should be noted that for each of these contaminants, background concentrations alone exceeded the guideline.
- Exceedances of the guideline occur less than 1% of the time, for PM_{10} and TSP.
- No mitigation measures are required, due to the small number of days which are expected to exceed the guideline.
- In comparison to the provincial and Canada-wide targets, the total GHG emissions in the study area are predicted to be negligible.
- The roadway contributes less than 0.004% of the province target and sector target.

8.6.4 Noise Impact Assessment

Novus Environmental Inc. prepared a noise assessment report that can be found in **Appendix C10** - Noise.

The objectives of this study are as follows:

- Assess future "build" and "no-build" sound levels from road traffic noise sources in the area (i.e., noise levels with and without the proposed project taking place);
- Use the predictions to assess potential impacts according to the applicable guidelines;
- Specify mitigation measures where required; and,
- Assess the potential for construction noise and provide a Code of Practice to minimize potential impacts.

For roadway projects, operational noise is of primary importance. Ontario has several guidelines and documents related to assessing road traffic noise impacts. The document most applicable to municipal roadway projects is:

- Ontario MECP/MTO, "Joint Protocol", *A Protocol for Dealing with Noise concerns during the Preparation, Review and Evaluation of Provincial Highway's Environmental Assessments* (MTO & MECP, 1986)

In the absence of a specific City of Vaughan noise policy, the York Region policy and operating procedure has been applied to this project because it is more stringent than the Joint Protocol. Following are the policy and operating procedure that are applied to this project:

- Regional Municipality of York, *York Region Traffic Noise Mitigation Policy for Regional Roads*, (March 23, 2006) (York Policy).
- Regional Municipality of York, *Standard Operating Procedures (SOP's) for Traffic Noise Mitigation on Regional Roads*, (July 2010) (York SOP's).

Noise mitigation requirements specified under the York Policy are summarized in **Table 29** below**.**

Table 29: Summary of Mitigation Efforts Under the York Policy

Future Sound Levels	Change in Noise Level Above "No-Build" Ambient (dBA)	Mitigation Effort Required
< 55 dBA	Any	N
55 dBA to 60 dBA	0 to 5	
	> 5	Investigate noise control measures within right-of-way Noise control measures where used must provide a minimum of 6 dBA of attenuation, averaged over the first row of receivers in the area where there is an impact.
> 60 dBA	Any	

Notes: Values are overall daytime energy equivalent sound levels, Leq (16h) in dBA, between 7 am and 11 pm.
**From Environmental Noise Assessment Report by Novus Environmental, dated April 2019*

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 mature state of development or at the start of construction. Accordingly, a design year of 2031 applies to this project, corresponding to the traffic forecasts provided by Poulos & Chung Limited.

The York Policy requires that the higher of the posted speed limit and actual driving speed (based on the 85th percentile) shall be used in the calculation of the sound levels. Given that the proposed Kirby Road Extension is a new road, the 85th percentile speeds were not available for this study, thus posted speed limits were used in this assessment.

Several NSAs have been used in the analysis to represent worst-case potential noise impacts at all nearby noise sensitive land uses within the study area. NSAs were picked to assess areas with similar overall noise levels and similar changes in noise ("build" versus "no-build"). The overall location of the receptors can be seen in **Figure 54**. These NSAs and modelled receptor locations are described in **Table 30** below.

Table 30: Representative NSAs Considered in Analysis

Receptor Location	Description	Distance to Kirby/Gamble Rd. Centreline (m)	Approximate Number of NSAs Represented
Receptor 1	25 Laurentian Boulevard	107	3
Receptor 2	11,641 Dufferin Street	389	1
Receptor 3	64 Silver Fox Place	476	5
Receptor 4	Home in Southwest Corner of Bathurst Street and Kirby Road Extension	35	1
Receptor 5	64 Jenny Thompson Court	36	4

**From Environmental Noise Assessment Report by Novus Environmental, dated April 2019*

All areas zoned for residential uses between Dufferin Street and Bathurst Street were included in the study.

Under the York Policy a "noise impact" is defined as the difference in projected noise levels at the start of construction "no build" and the projected noise levels at the Mature State of Development "build". The year 2031 is the best available traffic volume to model the future "no build" scenario and for the future "build" condition to assess possible noise impacts. Traffic volumes for the 2031 "no-build" and "build" scenarios for multiple roadways were provided by Poulos & Chung Limited.

Road traffic noise levels were modelled at Receptor 2 using the "Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT)" (MECP 1989). The STAMSON v5.04 computer program produced by the MECP (MECP 2000) was used for this receptor for comparison purposes. Results from the STAMSON and STAMINA 2.0 calculations are equivalent and produced an identical sound level for the 2031 "no-build' scenario for this receptor.

Due to the complexity of the terrain, and the number of noise barriers used in the analysis, the United States Federal Highway Administration Method was used as the highway noise prediction model for the remainder of the modelling. The STAMINA 2.0 highway noise prediction model is a computerized version of this method. This model is jointly approved by the MTO and the MECP.

Table 31 presents a comparison of "no build" versus future "build" sound levels at receptors in the study area during the 16-hour day.

Table 31: "No Build" and "Build" 2031 Noise Levels

Receptor Location	"No-Build" L_{eq} (16h)[1]	"Build" L_{eq} (16h)[1]	Change ("Build" minus "No-Build")	"Build" Sound Levels >60 dBA	Increase Above 5 dBA
Receptor 1	54.6	59.3	4.7	No	No
Receptor 2	56.2	55.6	-0.6	No	No
Receptor 3	50	50	0	No	No
Receptor 4	50	59.6	9.6	No	Yes
Receptor 5	56.2	60.3	4.1	Yes	No

**From Environmental Noise Assessment Report by Novus Environmental, dated April 2019*

Receptor 4 will have a significant increase in sound levels of approximately 10 dBA. Noise mitigation at this location should be constructed as is outlined in Table 32 below.

Table 32: Details of Proposed Noise Barrier for Receptor 4

Noise Barrier Height (m)	Noise Wall Length (m)	Square Metres of Noise Barrier	Approximate Noise Barrier Cost at $500/m^2
4.0	44	176	$88,000

The following construction activities are anticipated as part of this project:

- Removing existing surface pavements
- Earth grading
- Construction and rehabilitation of the base course
- Paving (and repaving) of the roadway surfaces
- Culvert construction or extensions
- Construction of new roadway including removal of overburden

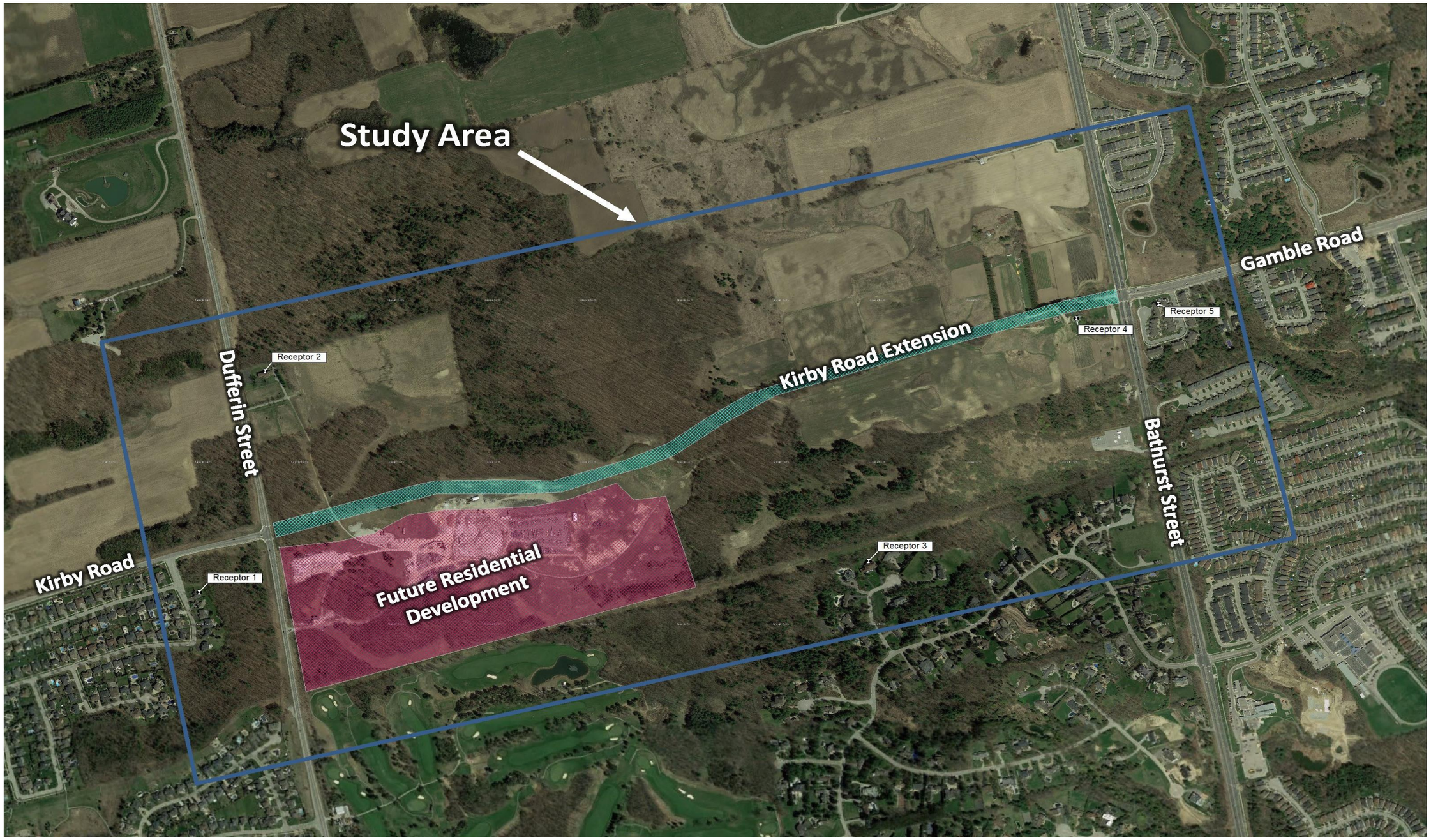
To minimize the potential for construction noise impacts, it is recommended that provisions be written into the contract documentation for the contractor, as outlined below:

- Where possible construction should be carried out during the hours the normally allowed hours specified in the CoV By-Law # 139-2018.
- 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.

In summary, the potential environmental noise impacts of the proposed undertaking have been assessed. Both operational and construction noise impacts have been considered. The conclusions and recommendations are as follows:

- The results show that changes in sound levels resulting from the proposed project are expected to be no higher than 4.7 dBA with mitigation in place.
- Noise mitigation will be required for the area in the southwest quadrant of Dufferin Street and Kirby Road if residential units are to be constructed here. It can either be incorporated into the subdivision by the developer at the time of the construction of the homes or constructed on the new Kirby Road Extension right-of-way at the time of construction of the roadway. No noise analysis of this area was included in this project impact analysis.
- Additional acoustical analysis will need to occur by either the subdivision developer or the constructor of the roadway. Who will do the analysis and construct the noise barriers will depend upon the final location of the noise barriers.
- Receptors 2 and 3 will have no noise impacts as a result of this project.
- Receptor 4 will have a significant increase in sound levels of approximately 10 dBA. Noise mitigation at this location should be constructed as is outlined in Table 32. The exact and design of the noise barrier can be determined in detail design, provided the building remains a home. If the proposed noise mitigation is constructed, noise impacts can be reduced to less than 4 dBA.
- Construction noise impacts are temporary in nature but will be noticeable at times at residential NSAs. Methods to minimize construction noise impacts should be included in the Construction Code of Practice**.** It is unlikely that the construction of the Kirby Road Extension would need to occur at times not allowed in the City of Vaughan By-law. Some construction operations will need to occur during night- time hours on Dufferin Street and Bathurst Street to minimize unreasonable disruptions to traffic.

Figure 54 Noise Assessment – Location of Receptors



8.6.5 Climate Change Impact Assessment

Ontario is leading the fight against climate change through the 2016 Climate Change Action Plan. The five year plan lays out the specific actions Ontario will take to meet its 2020 greenhouse gas reduction targets and establishes the framework necessary to meet its long-term targets. As a commitment of the action plan, in August 2016 the province has prepared a draft Guide "Consideration of Climate Change in Environmental Assessment in Ontario" for projects and undertakings under the EA Act. The Guide sets out the MECP's expectations for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The version of the Guide available online at https://www.ontario.ca/page/considering-climate-change-environmental-assessment-process#section-1 was consulted in preparation of this assessment.

Climate change is a multi-disciplinary, multi-faceted set of issues. A climate change consideration during the environmental assessment process results in a project that has taken into account greenhouse gas emissions, future changes in climate and the impacts a changing climate could have on the project. The MECP expects proponents through the evaluation of project alternatives to consider:

- Reducing project's impacts on climate change by evaluating the expected production of greenhouse gas emissions and impacts on carbon sinks from the project (climate change mitigation)
- Increasing the resilience (decreasing vulnerability) of the project and local ecosystem to changing climatic conditions (climate change adaptation)

A reference to anticipated climate risks, such as the severity of increased extreme weather events, health impacts, or ecosystem impacts from a changing climate in the local environment associated with the project is not available at the moment. Also standards for the consideration of the impacts of climate change in project-level environmental assessments are yet to be developed and formalized in Ontario. Therefore, a best practices approach has been taken by the project team to integrate climate change considerations in this EA study. A qualitative and quantitative analysis of climate changes due to the implementation of the Kirby road extension project is provided below.

Climate Change Mitigation

Carbon dioxide is one of approximately two dozen greenhouse gases present in significant concentration in the Earth's atmosphere. Others include water vapor, methane, nitrous oxide, ozone and certain carbon compounds. Greenhouse gases can exhibit heat-trapping properties in the Earth's atmosphere and are rated according to their Global Warming Potential over different atmospheric time frames. The "Greenhouse Gas Assessment" section included in the report "Local Air Quality Assessment" prepared by Novus Environmental provides a detailed discussion on the potential impacts on the climate change due to Greenhouse Gas (GHG) emissions generated by the proposed road extension. The report can be found in **Appendix C9** - Air Quality.

The potential impacts were assessed by contrasting the relative total emissions predicted from the new Kirby Road link in the 2031 Future Build scenario to the 2030 provincial and Canada-wide GHG targets.

Length of the roadway, traffic volumes, and predicted emission rates were used to predict the total GHG emissions from the roadway. The contaminants that are of main concern from motor vehicle emissions include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The Global Warming Potential is a multiplier developed for each GHG, which allows comparison of the ability of each GHG to trap heat in the atmosphere, relative to carbon dioxide. Using these multipliers, total GHG emissions can be classified as CO2 equivalent emissions.

The total predicted annual GHG emission for the 2031 Future Build scenario is shown in **Table 33** below.

Table 33: Predicted GHG Emissions

Source	Total CO_2 Equivalent (tonnes/year)
New Kirby Road Extension	4,485
Comparison to Canada-wide Target	0.00087%
Comparison to Ontario-wide Target	0.0044%
Comparison to Transportation Target	0.0035%
Canada-Wide 2030 GHG Target[1]	**517,000,000**
Ontario-Wide 2030 GHG Target[2]	**102,350,000**
Transportation Sector GHG 2030 Target[3]	**130,000,000**

It was concluded that GHG emissions due to this project are only 0.004% of the provincial target and 0.0009% of the Canada wide target. Hence, the contribution of GHG emissions from the project is small in comparison to these provincial and national targets.

Climate change mitigation for the road project is considered largely in relation to the natural heritage and water management systems. Climate change is exacerbating stressors on both systems. The goal of climate change mitigation techniques is to make the systems more resilient. Proposed mitigation such as habitat fragmentation through enhanced wildlife passage under the road, edge management techniques making the natural heritage system more resilient, and water management approaches that emphasize low impact development and green infrastructure techniques to mitigate downstream flooding and erosion are discussed in greater detail in Section 8.6.1 Natural Environment and Section 8.6.6 Stormwater Management respectively.

Climate Change Mitigation issues to consider during detailed design of the road are summarized as follows:

- Route design should minimize impacts to natural heritage, other green infrastructure, and existing pervious surfaces. Maintaining green infrastructure will address climate mitigation by maintaining or enhancing ecosystem services related to carbon sequestration and evapotranspiration cooling that reduces energy loads for cooling.

- Route design should encourage transit uptake and active transportation. This will reduce GHG emissions from operations by reducing single occupancy vehicle use, given that the transition to zero emission vehicles will take time.
- Route design should reduce embodied energy and embodied carbon of construction materials. This relates more to the use of construction materials, such as reclaimed materials and construction products manufactured using less energy-intensive processes.

Climate Change Adaptation

The potential impact of climate change itself on the Kirby Road extension is also important to consider. In order to reduce future climate-related risks to the local environment, due consideration must be given to climate adaptation measures that will increase resilience of any aspect of the proposed project's function, design, operation and maintenance which could be susceptible to climate variability. The road extension should be designed, built and operated in a way that avoids or minimizes potential service disruption due to climate change related events.

The potential climate change effects identified for the road project include heavy rain, fog, hail and lighting. The corresponding mitigation measures are summarized below:

- Design standards for the watercourse crossing structure must be based on the Regional Storm event (Hurricane Hazel) to prevent flooding effects.
- Reflective markers must be installed on the roadway to guide drivers during foggy weather.
- Identify restrictions to operations in accordance with standard Ministry of Transportation practices to address increased frequency and potential impacts from hail storms.
- Back-up systems for critical electrical systems and appropriate design must be in place to reduce chances of malfunction of light standards and other tall structures.

Climate Change Adaptation issues to consider during detailed design, construction, operation and maintenance of the road are summarized as follows:

- Develop a checklist of climate parameters with potential to impact performance of design and corresponding mitigating measures. For example, the parameters such as more frequent intense rainfall events that may damage infrastructure, more freeze-thaw cycles in winter that may buckle pavement and reduce the lifespan of the road support material, more extreme heat events in summer that may deteriorate the road surface, etc.
- Avoid or minimize impacts to vulnerable ecosystem components. Intense rainfall is a highly likely extreme weather event. Hence, route design that minimizes impacts to the existing watercourse and PSW will improve the likelihood of persistence of these ecosystem components that may otherwise be impacted by climate change.
- Utilize green infrastructure practices and elements that intercept rainfall to reduce potential flooding, provide shade to reduce heat stress, reduce the size of paved surfaces, etc.
- Avoid road design elements that may be more susceptible to the changing climate parameters.
- Develop extreme weather and natural disaster emergency response procedures for road construction, operation and maintenance.

8.6.6 Stormwater Management

A Stormwater Management Report, August 2019 prepared by SCE can be found in **Appendix C11** - Stormwater Management. The stormwater management plan for the Refined Preferred Road Alignment 5A was prepared to comply with the City of Vaughan's Design Criteria (2018), MOE Stormwater Management Planning and Design Manual (March 2003) and the TRCA Stormwater Management Criteria (August 2012).

The applicable stormwater management guidelines and criteria for the subject site are presented below:

1. **Quantity Control**

For areas less than 5ha, post-development release rates should be controlled to pre-development flow rates. If post development catchment area is greater than 5ha, then the unitary flow rates presented in the TRCA manual are to be used.

2. **Quality Control**

Enhanced Level 1 stormwater quality must be provided for the site (80% removal of TSS).

3. **Erosion Control**

5mm runoff retention is required on site to meet erosion control.

4. **Water Balance**

The subject site is located in the WHPA-Q1 and Q-2 region. Therefore, the post-development infiltration must meet pre-development annual volumes.

5. **Provincially Significant Wetland (PSW)**

The new roadway is traversing close to the PSW. Therefore, the base flows to the PSW should be maintained in the post-development conditions.

External Drainage Areas

The existing drainage pattern is discussed in detail in Section 3.2.2 Stormwater Drainage and illustrated in **Figure 4: Pre-development Drainage Conditions**. As shown on the figure, under existing conditions the area of approximately 55.32ha drains to the PSW.

Based on the Alignment 5A and the proposed surface grading, the post-development drainage areas for the proposed roadway (Catchments 201-206) and external drainage areas (Catchments 301E-306E) were delineated. As shown on **Figure 55**, approximately 55.38ha out of the total Catchment 302E area of 57.77ha would drain to the PSW in post development conditions. Therefore, the base flow to the PSW would be maintained.

As under post-development conditions the new roadway will create a physical barrier for the existing stormwater flow pattern, the external drainage areas upstream of the road (Catchments 301E-306E) are proposed to be conveyed to the south via five (5) culverts.

The culverts were sized to safely convey the greater of the 100 year and regional storm event flow and took into consideration sizing recommendations from the natural heritage consultant for wildlife crossing.

The proposed culvert sizes along with corresponding drainage areas are summarized in **Table 34** below. The flow calculations and culvert sizing reports can be found in the SWM Report included in **Appendix C11** - Stormwater Management.

Table 34: Proposed Culverts Sizing Summary

Catchment	Area (ha)	Proposed Culvert Size (mm)
301E	7.42	1200
302E	57.77	6100 x 2740
303E	11.88	1200
304E	13.93	1200
305E	72.56	3000 x 2400

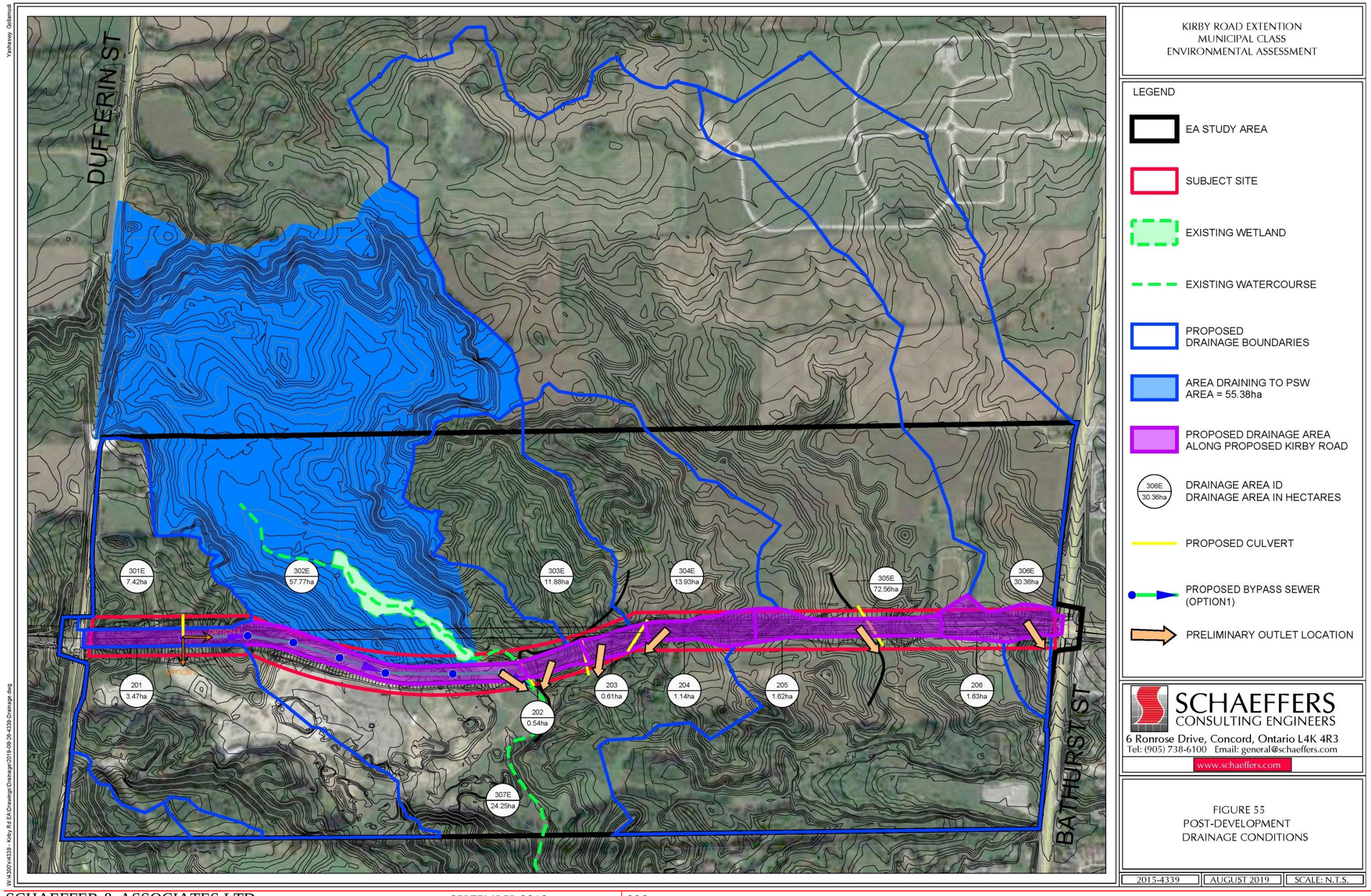
As the drainage areas for catchments 302E and 305E are relatively large, additional geomorphic and engineering analysis should be undertaken at the detailed design stage to confirm the appropriate crossing spans.

As follows from the Order dated February 3, 2015 issued by the Minister of Municipal Affairs and Housing under the Oak Ridges Moraine Conservation Act (2001), the lands south east of the proposed Kirby Road Alignment may be developed as urban areas. The stormwater flow from the external drainage area (Catchment 301E) coming to the FUA from the north could be either diverted towards the existing watercourse through the proposed storm sewer bypass (Option 1) or it could directly outlet towards the FUA through a cross culvert placed at this reach of the road (Option 2). The options are illustrated in **Figure 55** below. For both options, a separate storm sewer will capture, detain and convey runoff from the right of way to the creek. **Figure 44** to **Figure 46** illustrate the separate infrastructure for the external catchment 301E and the public right of way for both Option 1 and 2.

The proposed vertical profile of road at this reach of the road dictates a relatively deep storm sewer, which raises constructability and operation and maintenance concerns. Lowering of the road profile may address the concerns and should be further investigated.

Using the cross culvert at this location allows to maintain the existing condition runoff drainage pattern. However, it would require a downstream conveyance solution to be developed through the design of future residential subdivision, involving a large pipe extending along the local roads for a longer distance. It is recommended that both of the options for flow conveyance from Catchment 301E should be further studied during engineering and detail design stage of the project.

Figure 55: Post-development Drainage Conditions



Stormwater drainage areas for the proposed roadway ROW (Catchments 201-206 shown in **Figure 55**) were delineated based on the proposed grading to mimic the existing drainage pattern. Quantity and quality control for the catchments will be provided using a treatment train approach.

Water Quantity and Quality Control

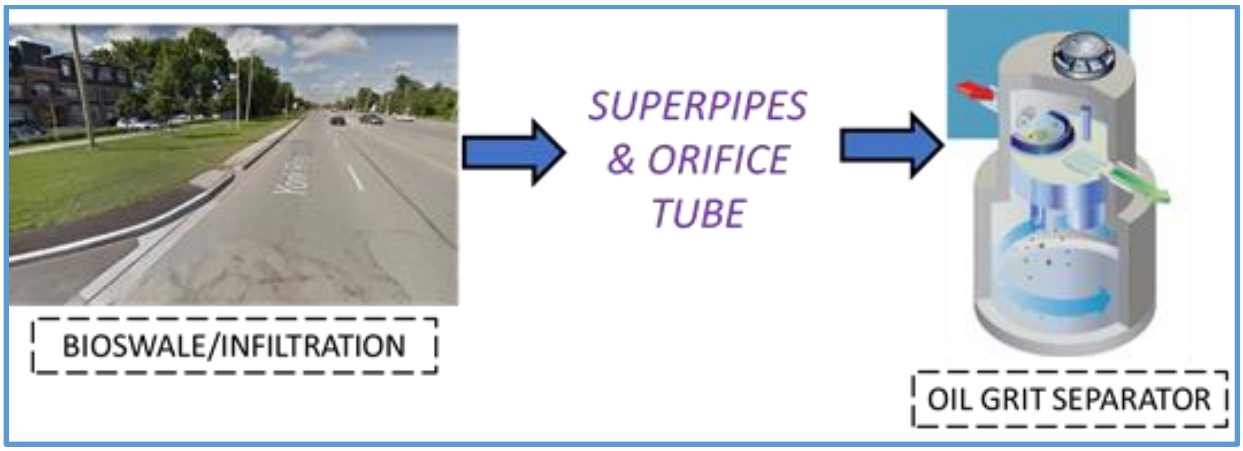
The development of an effective stormwater management plan requires consideration of various best management and LID technologies in order to create a comprehensive strategy for achieving water quality and water quantity control objectives. It should be noted that the sandy soils along with low groundwater levels present in the study area help in enabling surface runoff infiltration within the proposed roadway.

Various conveyance controls and end of pipe solutions were examined to provide the best treatment train approach for the proposed roadway. The following treatment train options were considered and refined based on feedback received from the TRCA and City of Vaughan:

- **Option 1:** Bioswale/Infiltration-> Superpipes -> Oil and Grit Separator (OGS)
- **Option 2:** CB Shield -> Tree Pits/Soil Cells -> Superpipes & Orifice Tube
- **Option 3:** Superpipes & Orifice Tube -> OGS -> Clean Water Collector (CWC) system

The detailed descriptions of each option are provided below.

Figure 56: Treatment Train Option 1



The quality control for the Road ROW in Option 1 can be achieved through the use of bioswales and an Oil Grit Separator (OGS). The runoff from the Road ROW is proposed to be directed towards the bioswales installed along the boulevards via curb cuts where infiltration is proposed. The overflow from the bioswale will be then directed towards the proposed storm sewer system and eventually to the OGS. The bioswales will be sized to provide the greater of the water balance requirements and quality control (60% TSS removal). Before releasing into the OGS, the flow is proposed to be controlled with the help of an orifice control structure. The OGS will provide the additional 50% TSS removal required to meet the quality control requirements.

Bioswales are a common practice utilized within the public ROW by many municipalities to achieve the required quality control volume. The proposed 36m ROW will feature roadside bioretention swales on

either side of the road.The swales will consist of two components, the upper filtration layer, consisting of low maintenance vegetation materials planted into a 0.5m thick sand layer followed by 0.1m of pea gravel, and finally the clear stone (gravel storage reservoir).

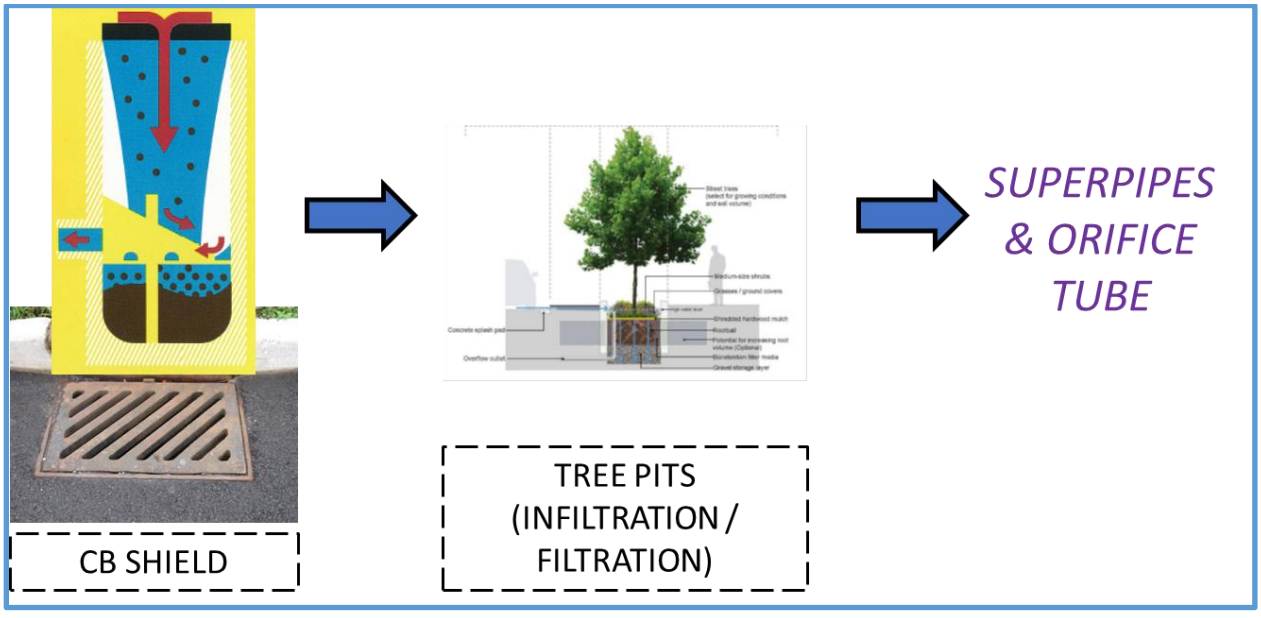
Preliminary infiltration volumes required with the bioswales to achieve the 60% TSS removal are presented in the **Table 35** below.

Table 35: Required Quality Control Volume

Catchment	Area (ha)	Required Storage Volume (m^3/ha) *	Required Infiltration Storage Volume (m^3)
201	3.47	20	69
202	0.54	20	11
203	0.61	20	12
204	0.76	20	15
205	2.00	20	40
206	1.63	20	33

** Based on March 2003 MOE Stormwater Management Planning and Design Manual, Table 3.2*

Figure 57: Treatment Train Option 2



This option involves stormwater runoff from the road ROW to drain into manholes equipped with specially designed catch basin shields, further referred as CB Shields. The CB Shields technology allows sediments from the runoff to be retained at the bottom of the CB Shield sump and the water flow to be further directed to soil cells/tree pits. Based on an Environmental Technology Verification evaluation, application of catch basin shields can provide 50% TSS removal.

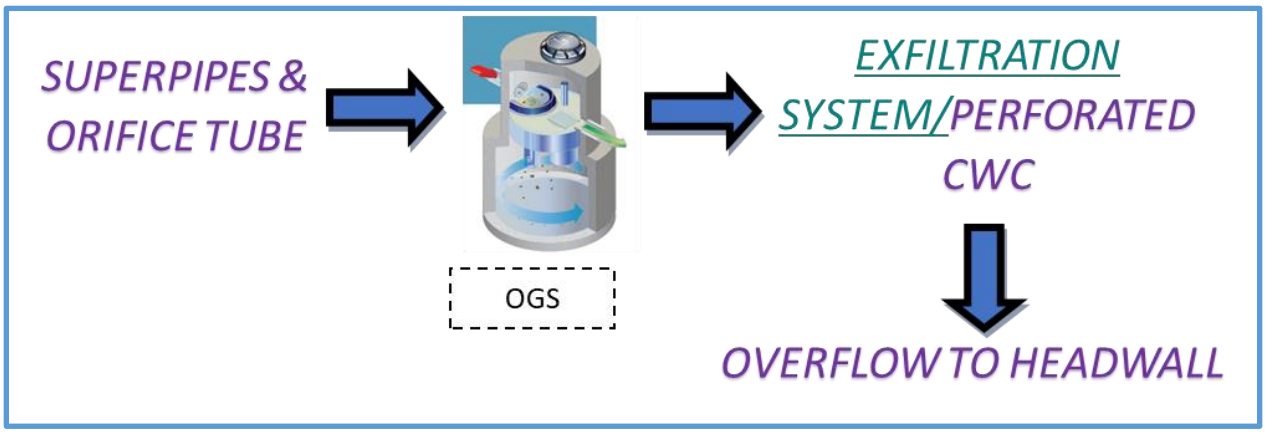
The bioretention facilities such as tree pits and soil cells can be incorporated within ROW and parking lots to provide quality control and infiltration for the site. The 36m wide proposed Kirby Road extension ROW can include soil cells either Tree Pits (Filterra from Imbrium Systems) or Soil Cells (Cupolex Soil Cells) installed in the boulevards to provide the required quality control.

The infiltration bed within the soil cells/tree pits will be sized to provide the additional 60% TSS removal.

Overflow from the underground bioretention facility will be directed into a superpipe where flows will be chocked before being discharged into the creek.

The required infiltration volumes for each catchment are summarized in **Table 35**: **Required Quality Control Volume**.

Figure 58: Treatment Train Option 3



The third option involves an exfiltration system (Perforated Clean Water Collector) to provide the required quality control and to promote infiltration. The surface runoff from the proposed ROW will be captured by catch basins and directed towards the proposed super pipe equipped with an orifice control at the end to provide the required quantity control. The controlled flow would be directed towards the OGS to achieve a 50% TSS removal. From the OGS the flow will be directed towards the proposed Perforated Clean Water Collector (CWC) pipe system promoting infiltration. The perforated CWC pipes will be sized to provide the maximum of the water balance requirements and 60% TSS removal. Overflow from the CWC system will be directed towards outlets with headwalls. Please refer to **Figure 55: Post-development Drainage Conditions** for the preliminary locations of the outfalls.

The anticipated combined TSS removal efficiency of the OGS and CWC would be greater than 80% overall TSS removal. The required infiltration volumes to satisfy the quality control (60% TSS removal) for each catchment are presented in **Table 35**: **Required Quality Control Volume** above.

The drainage from the proposed road alignment (Catchments 201-206) is proposed to be controlled to the pre-development flow rates established in Section 4.2 of the SWM Report included in **Appendix C11** - Stormwater Management. However, since it is not feasible to control each storm to its pre-development rates without using multiple orifice controls, it is proposed to control the post-development flows to pre-development 5-year release rates and based on a minimum orifice size of 100mm.

The required quantity control will be provided by the super pipes and orifice controls. The preliminary sizing of the super pipes was included in Section 4.3 of the SWM Report included in **Appendix C11** - Stormwater Management. The sizing of the superpipes will be further refined during detail design stage.

Water Balance

Based on the existing soil conditions and Environment Canada climate data, water balance calculations for Alignment 5A were completed by Terraprobe. A water balance summary extracted from the "Final Draft Hydrogeological Study, Kirby Road Extension, City of Vaughan" (May 2019) report (see **Appendix C8**) is provided in the table below.

Table 36: Water Balance Summary

Condition	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Runoff (m^3)
Pre-development	73222	68475	34854	21015	9006
Post-development	73222	64875	13738	8283	42854

According to the Terraprobe's calculations, approximately 12,732 m3 of volume is required to be infiltrated in the post-development stage. The SCE's calculations included in Appendix C of the SWM report show that infiltrating approximately 8mm rainfall within the Road ROW will satisfy the water balance requirements. The estimated volume to be infiltrated on site is approximately 372m^3. The proposed LID measures – Bioswales, Tree Pits or Perforated CWC will preliminary sized based on the required infiltration volume. Preliminary calculations show that the required footprint of Bioswales, Tree Pits or Soil Cells is approximately 1300m^2.

A bioretention cell with a total length of approximately 1000m (500m on either side of the road) and width of 1.5m would provide an infiltration volume of 432m3 (1000m x 1.5m x 0.72m x 0.40 = 432m^3) which is greater than the required 372 m^3. As the proposed facilities will be placed along the boulevards within the proposed 36m ROW, no impact on the proposed width of the ROW is anticipated.

With regard to the Perforated CWC pipe system, the required infiltration volume can be provided by installing a 450mm diameter perforated pipes within 2m wide trenches. The calculations can be found in the Stormwater Management Report, August 2019 included in **Appendix C11** - Stormwater Management.

The LID sizing calculations presented above and included in Appendix C of the SWM report are preliminary estimates based on a drawdown time of 48 hours. The preferred surface runoff treatment train option as well as the water balance calculations and mitigation strategies should be further confirmed and refined during the detail design stage.

Floodplain Analysis

A floodplain study has been carried out to establish the regulatory flood limits along the tributary to East Patterson Creek flowing from the PSW to demonstrate that there are no adverse impacts to the upstream and downstream floodplain due to the proposed watercourse crossing. As discussed previously, the proposed Kirby road extension disturbs the drainage flow path of the tributary to East Patterson Creek which conveys drainage from the lands north of the proposed road extension. In order

to safely convey this drainage, the proposed culvert was sized to satisfy hydraulic requirements as well as watercourse crossing requirements.

A hydraulic model was developed using HEC-RAS software and a Steady Flow analysis was performed under existing and proposed conditions with the road extension in place. The regional peak flow rate calculated for post development drainage areas (Catchments 301E-304E, 307E, 201-204) draining to the creek was used for the floodplain analysis.

The results of the analysis revealed that the difference in water surface elevations between the pre-development and the post-development conditions was negligible. Results of the hydraulic modelling revealed that the proposed culvert (6.10 m x 2.74 m) will not be overtopped during the 100 year and Regional flood. A technical report entitled "Floodplain analysis report, Kirby Road Extension" dated August 2019, provided in **Appendix D** of the SWM Report included in **Appendix C11** of the ESR provides details of the floodplain study.

The floodplain analysis was completed by including the additional flows from the Catchment 301E that are tentatively proposed to be conveyed to the creek in the post development conditions. As mentioned above, the increase in water elevations is negligible, therefore no constraints are expected. At the detailed design stage, crossing of Catchment 305E also needs to be investigated from a flood plain management perspective to demonstrate there are no adverse impacts to water surface elevations.

8.6.7 Construction, Operation and Maintenance

Potential Effects

The construction of the Kirby Road extension will require connection to the existing roadways on Dufferin Street and Bathurst Street. Traffic on Dufferin Street and Bathurst Street is subject to potential temporary impacts to undertake the required construction works. The previously mentioned streets will require lane closures to make the connection. The existing house fronting onto the proposed Kirby Road extension will also be impacted by the construction with a local access required to maintain at all times.

Construction at and in the vicinity to intersections will result in interference or obstruction to pedestrian, bicycle or vehicular traffic, including potential transit impacts. It is to be noted that the impacts are temporary and mitigation measures will be implemented to reduce the impacts as much as possible.

Appropriate erosion and sediment control measures will be required during construction when soils are exposed as a result of the removal of natural vegetative cover. There is a potential to cause large magnitude, short-term sediment export from the site.

The ongoing operation of the roadway will also generate pollutants and contaminants that will need to be trapped and prevented from being transported to the downstream receiving waters.

As part of winter maintenance, road salt (sodium chloride) will likely be used as an anti-icing agent. The use of salt on has the potential to impact the PSW and has the potential to impact groundwater quality through the infiltration of road salt into the aquifer.

Mitigation

During detailed design, a Traffic Management Plan should be developed, in accordance with Ontario Health and Safety Book 7, to appropriately direct local traffic as the proposed works are undertaken. Provisions for dust suppression, litter cleanup / street sweeping adjacent to the construction site should be made. Adequate signage to give advanced notice of disruptions and/or traffic detours is also to be provided.

During construction, on-site sediment controls will be necessary and a sediment and erosion control plan will be developed as part of the detailed design phase. The sediment and erosion control plan will identify measures to be installed prior to the start of construction that will remain in place through to the end of construction period, when the site has been stabilized.

All disturbed areas must be stabilized as quickly as possible. Stabilization of disturbed areas can be accomplished by sodding, seeding, mulching, hydroseeding and planting. Temporary measures may employ the use of biodegradable erosion control blankets. The proposed stormwater management system for the roadway will address any long term pollutant and contaminant loadings associated with the operation of the roadway.

The proposed extension will be a municipal arterial road. Reducing salt use is the best way to protect environment. The responsible municipality should:

- Update their Salt Vulnerable area mapping;
- Review the LOS for the road to appropriately minimize salt use while meeting the primary goal of safety;
- Look at reducing salt use through enhanced weather forecasting, monitoring of pavement temperature, use direct liquid application, or use salt alternatives; and,
- Integrate the above into their existing Salt Management Plan.

Activities involving the management of excess soil will be completed in accordance with the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

All waste generated during construction will be disposed of in accordance with MECP's requirements.

Since the removal or movement of soils is required, appropriate tests to determine contaminant levels from previous land uses or dumping will be undertaken. If the soils are contaminated, it will be determined how and where they are to be disposed of, consistent with Part XV.1 of the Environmental Protection Act (EPA) and Ontario Regulation 153/04, Records of Site Condition. The MECP's District Offices will be consulted if contaminated sites are present.

9.0 Project Implementation

This chapter outlines the process of amending the ESR, future phases of the project, the permits and approvals required to implement the project and commitments to additional environmental investigations and monitoring.

9.1 Amending Environmental Study Report

The MEA MCEA process includes a revision process for proponents to make changes to a project after completion of the ESR review stage (Phase 4).

Modifications to the design and implementation of the Kirby Road Extension proposed in this ESR may occur due to unforeseen circumstances and result in the project being inconsistent or non-compliant with commitments made in the ESR. Significant modifications to the project proposals or changes in the environmental setting that occur after the filing of the ESR will require preparation of an addendum to the ESR.

Changes to the project may also be required if there is a significant lapse of time between the filing of the ESR and the start of construction, since the proposed project and related environmental mitigation measures may no longer be valid or appropriate. According to the MEA MCEA process, if the period of time from the end of the public review period following filing of the ESR in the public record or the Minister's decision of any Part II Order request to the proposed commencement of construction for the project exceeds ten (10) years, the proponent shall review the planning and design process and current environmental setting to ensure that the project and mitigation measures are still valid. The review will also be documented in an addendum to the ESR.

The ESR Addendum will describe the circumstances requiring the changes to the project, the environmental implications of the changes, and measures proposed to mitigate any associated negative effects. The Addendum will be filed with the ESR in the public record, and the same notification and review process and public right to request a Part II Order as described in **Section 1.3** of this ESR will apply. The Notice shall be given to all potentially affected members of the public and review agencies, including those notified of the original ESR. When an ESR Addendum is issued, only the project elements included in the Addendum (i.e. the proposed changes) will be open for review.

9.2 Permits and Approvals Required Prior to Construction

Permits and approvals will be confirmed during the detailed design stage.

9.2.1 Municipal Permits and Approvals

- City Council approvals for capital budget and tendering.
- Municipal Consent Applications for proposed new utility infrastructure and equipment location within the City's roadways, boulevards or open spaces.
- Road Cut (Road Occupancy) Permits for the temporary occupation or construction within the City's roadways, boulevards or open spaces.

9.2.2 Provincial Permits and Approvals

- An Overall Benefit Permit from the MECP under clause 17(2)(c) of the ESA.
- A Permit to Take Water (PTTW) from the MECP, if water taking exceeds 400,000 L/day. Construction dewatering requiring water taking over 50,000 L/day but less than 400,000 L/day requires registration in the Environmental Activity Sector Registry.
- Environmental Compliance Approvals from the MECP for new sewers and stormwater management outfalls.
- A permit under Ontario Regulation 166/06 from the TRCA will be required for development within the TRCA regulated areas associated with the wetland, watercourse and associated hazard limits, and for interference or alteration to the wetland or watercourse.

9.2.3 Federal Approvals

There are currently no federal environmental assessment or other approvals identified that the City must obtain for the project.

9.2.4 Future Commitments

Key future commitments resulting from this EA Study include but not limited to the following:

- Confirm the need for permits with regulatory agencies and approval authorities and obtain, as needed, during detailed design and engineering.
- Further investigate stormwater management design options for water balance, quantity and quality control in accordance with City, Region standards and all approval and regulatory authorities.
- Further investigate the impacts to the infrastructure required to convey surface runoff from external Catchment 301E including Option 1 (Intake/by-pass storm sewer) and Option 2 (Cross culvert).
- Further investigate lowering the road and storm sewer for the right of way runoff to reduce fill volume.
- Further investigate the road profile design (i.e. vertical alignment) from Dufferin Street to the watercourse crossing, including any associated modifications to grading, stormwater infrastructure, etc., during detailed design.
- Develop erosion prevention and sediment control (ESC) measures that shall be implemented to mitigate erosion and sediment processes during construction. The ESC plans should be consistent with the TRCA's Erosion and Sediment Control Guideline for Urban Construction (2006).
- Confirm the Significant Woodlands limits through field staking (if needed) and submit to the City and TRCA during detailed design. For significant woodland impacts provide an ecosystem compensation plan and associated costs for the preferred alignment in accordance with the TRCA's Guideline for Determining Ecosystem Compensation (2018).
- Develop restoration plans, including edge management plan and other tools to mitigate identified impacts on the Natural Environment during detailed design.

- Confirm PSW limits including a 30 m vegetation protection zone through field staking and submit the results to the MNRF during detailed design. This information will be used to support the design of the road and associated infrastructure.
- Consult with MECP regarding Species at Risk impacts and permitting requirements, prior to construction.
- Complete an updated Headwater Drainage Feature Assessment as per TRCA's Evaluation, Classification and Management of Headwater Drainage Features Guidelines (2014) during detailed design.
- Conduct additional environmental studies needed to determine Significant Wildlife habitat for two species: American Ginseng and Eastern Whip-poor-will during detail design. The environmental reports will be provided to the City and TRCA for review and approval.
- Coordinate with and obtain approval from the MOECP regarding Climate Change compliance prior to construction.
- Consider separation of pedestrian and cycling facilities proposed along the road and appropriate cycling connections at the Bathurst Street and Kirby Road intersection.
- Consider increasing clear height and width relative to length, within the culvert trail underpasses subject to on-site constraints, at detailed design.
- Provide trail ramp connections from Kirby Road Extension ATF down to the proposed trail system and tunnel connections at both north and south sides of the road.
- Complete a Stage 2 Archaeological Assessment in accordance with the requirements of the Ontario Heritage Act; if recommended through the Stage 2, a Stage 3 Archaeological Assessment will be prepared.
- Notify the potentially affected Indigenous Peoples of any archaeological findings and engage these communities as needed.
- Complete a resource-specific Cultural Heritage Impact Assessment for the residence at 11490 Bathurst Street, and attain heritage permit if needed.
- Conduct an earthwork analysis to optimize the proposed preliminary vertical road alignment in consideration of the grading for the Future Urban Area.
- Identify and implement source water protection mitigation measures (i.e., salt management, temporary storage of fuels) as per the CTC Source Protection Plan regulated by the Clean Water Act, prior to construction.
- Undertake additional work through detailed design and engineering to confirm various technical components of the design, including the roadway geometry and profile, illumination, culvert crossings, wildlife crossings, utilities, construction staging, and property requirements.
- Further assess wildlife passages at detailed design and engineering.
- Develop Soil Management actions. Since the removal or movement of soils are required, undertake further assessment and testing, where and as applicable, to determine contaminant levels from previous land uses or dumping at detailed design and engineering.
- Carry out consultation and further coordination with key technical agencies, Indigenous Communities and stakeholders through detailed design pertaining to watercourse crossing(s) and fish habitat.
- Confirm the need to obtain PTTW. A PTTW may be required as some of the roadwork may intersect some shallow and coarse-grained fill soils that might require dewatering. Potential for

construction dewatering is more likely to be required where deep excavations occur that intersect the shallow water table.

9.3 Monitoring Environmental Effects

Purpose of the monitoring is to assess the effectiveness of environmental mitigation, enhancement and compensation measures implemented to limit the net effects of the project, as well as the degree of compliance with environmental protection measures committed to during the construction period.

9.3.1 Environmental Monitoring during Construction

A qualified Contract Administrator should be retained to oversee all aspects of construction at the field level conducted by the Contractor selected to construct the new roadway.

The Contract Administrator will be responsible for retaining the appropriate specialists to ensure that all construction activities are carried out in conformity with applicable environmental legislation, regulations and industry standards, and are consistent with provisions in the Contract Documents, which will reflect the commitments contained in this ESR and those developed during the Detail Design phase of the project. The Contract Administrator will also ensure that the conditions of approval specified in site-specific permits, approvals and authorizations secured from regulatory agencies for this project are adhered to, including documentation, reporting and on-site retention of such permits, as required.

Periodic on-site inspections should be conducted involving, when deemed necessary, environmental specialists to ensure the proper implementation of site-specific mitigation or remediation measures (e.g. monitoring of earthworks for discovery of archaeological resources).

In addition, the effectiveness of the environmental protection measures will be assessed to ensure that:

- Environmental protection measures are implemented and monitored during the construction activities in the site preparation phase;
- Individual mitigation measures are providing the expected control and protection (e.g. dust and noise control);
- Composite control and/or protection provided by the mitigating measures is adequate (e.g. erosion and sediment control plan); and
- Additional mitigating measures are provided, as required, for any unanticipated environmental problems that may develop during construction (e.g., spills control, discovery of archaeological artefacts, etc.)

9.3.2 Post-Construction Environmental Monitoring

Environmental monitoring after construction normally involves follow-up inspection and may include scientific monitoring. In the period immediately following construction, the following should be assessed:

- Stability of new earthworks; and,
- Removal of all debris and excess materials as part of final site clean-up.

In addition, any environmental issues and problems that have developed or remain unresolved after construction should be identified and addressed.

For this project, the following long term post-construction monitoring requirements are anticipated:

- Function of stormwater management controls;
- Effectiveness of landscaping components and/or salt management plans;
- Health of retained wildlife habitat and communities (may be assessed through vegetation community monitoring); and,
- Success of ecological restoration plantings.