Project File Report

Teston Road Environmental Assessment Study
from 250m West of Pine Valley Drive to
Kleinburg Summit Way

City of Vaughan

September 28, 2023

Disclaimer

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1 Introduction and Background

HDR has been retained by the City of Vaughan to undertake a Schedule 'B' Class Environmental Assessment (EA) for the Teston Road corridor between 250 m west of Pine Valley Drive and Kleinburg Summit Way. This EA study will focus on identifying improvements to address transportation needs for pedestrians, cyclists, transit users and motorists.

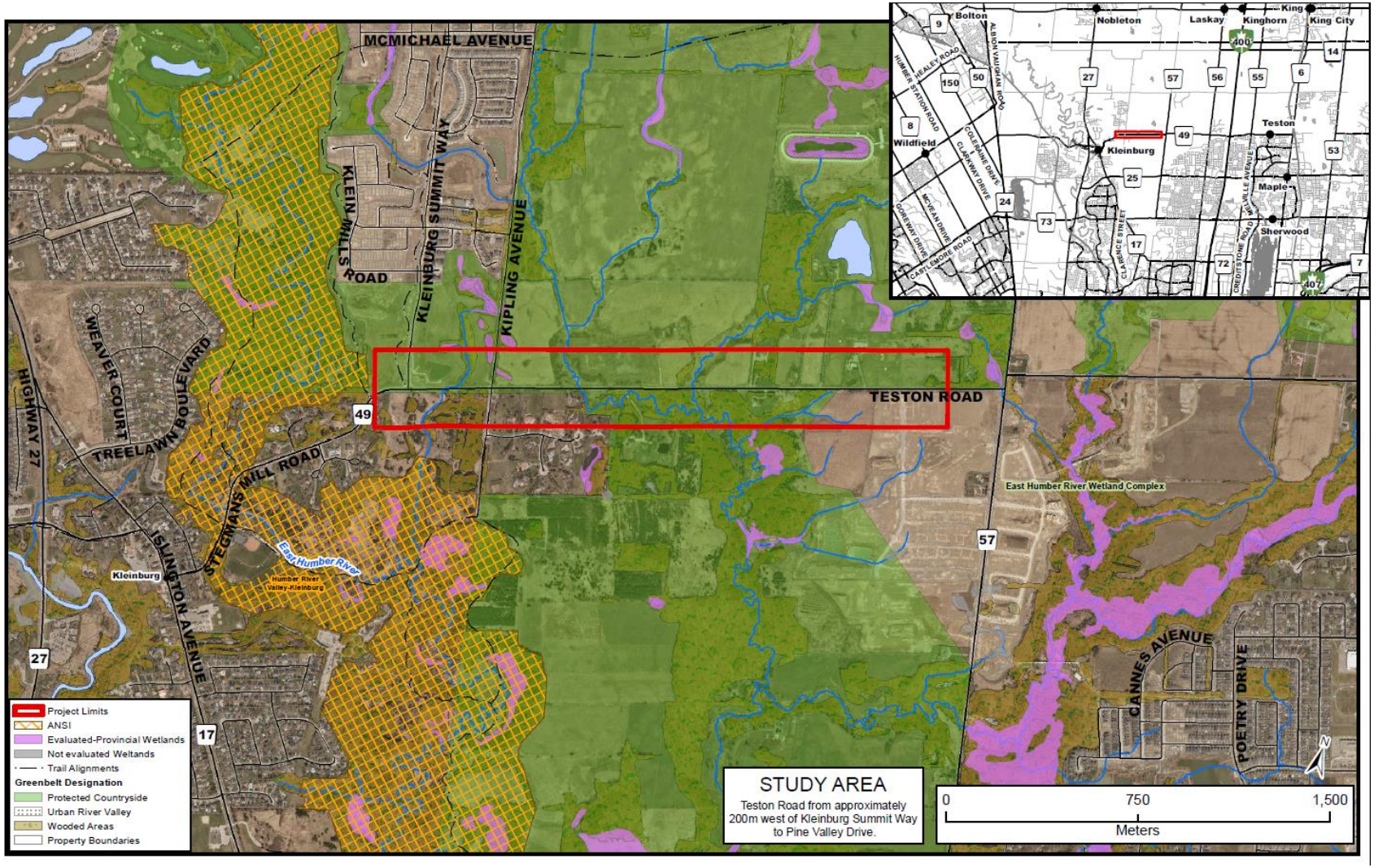
Teston Road is a two-lane rural major collector roadway with one driving lane in each direction (refer to **Figure 1-1**). The study area crosses four City planning blocks including blocks 47, 48, 54, and 55. Within the study area, Teston Road currently faces several safety and operational issues, such as narrow unpaved shoulders with restricted clear zones, hidden driveways, pavement deterioration, speeding and run-off-road collisions, limited stopping sight distance and lack of pedestrian and cycling facilities.

The purpose of the Teston Road Class EA study is to determine specific improvements to accommodate the current and future transportation needs of pedestrians, cyclists, transit users and motorists, and to improve safety for all modes of transportation along the Teston Road corridor from 250 m west of Pine Valley Drive to Kleinburg Summit Way.

1.1 Study Area

Teston Road is a two-lane rural major collector roadway with one driving lane in each direction. The EA Study corridor is illustrated in **Figure 1-1**.

Figure 1-1: Study Area



1.2 Environmental Assessment Process

An overview of the Environmental Assessment Act of Ontario (EAA), the Municipal Class Environmental Assessment (MCEA) process, and the Canadian Environmental Assessment Act, 2012 (CEAA 2012) is provided in this section as they relate to the Teston Road EA.

1.2.1 Municipal Class Environmental Assessment Process

The Environmental Assessment Act of Ontario (EAA) provides for the protection, conservation, and management of the environment in Ontario. The EAA applies to municipalities and to activities including municipal road projects. Activities with common characteristics and common potential effects may be assessed as part of a "class" and are therefore approved subject to compliance with the pre-approved Class EA process.

The Municipal Class Environmental Assessment (MCEA) process is an approved Class EA process that applies to municipal infrastructure projects including roads, water, and wastewater. This process provides a comprehensive planning approach to consider alternative solutions and evaluate their impacts on a set of criteria (e.g. transportation, environmental, social, engineering) and determine mitigating measures to arrive at a preferred alternative for addressing the problem (or opportunity). The Class EA process involves a rigorous public consultation component that includes various provincial and municipal agencies, Indigenous communities and the public, at each of the project stages.

Figure 1-2: The Class EA Process

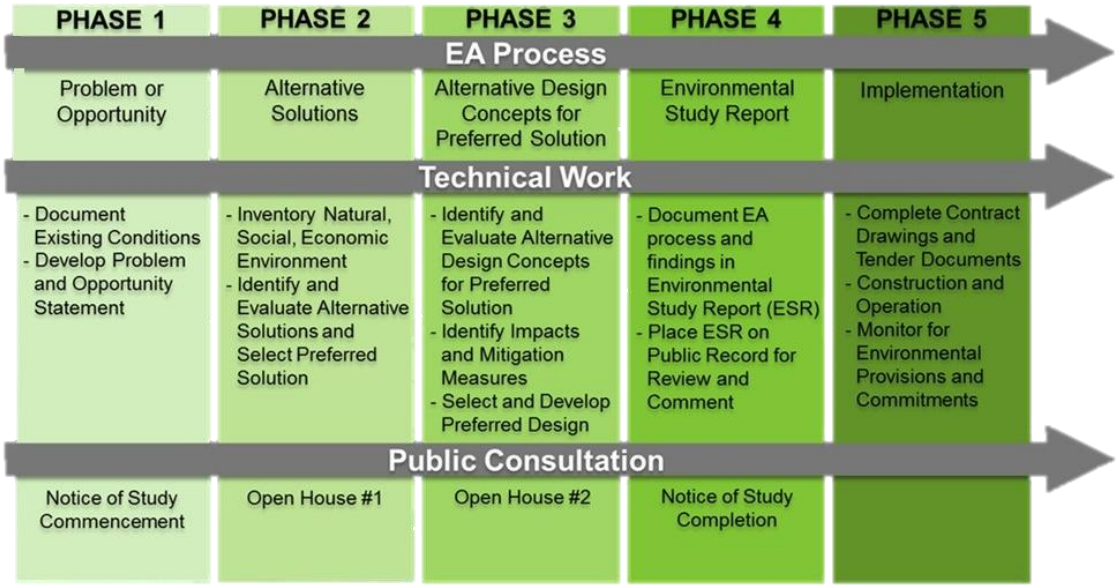


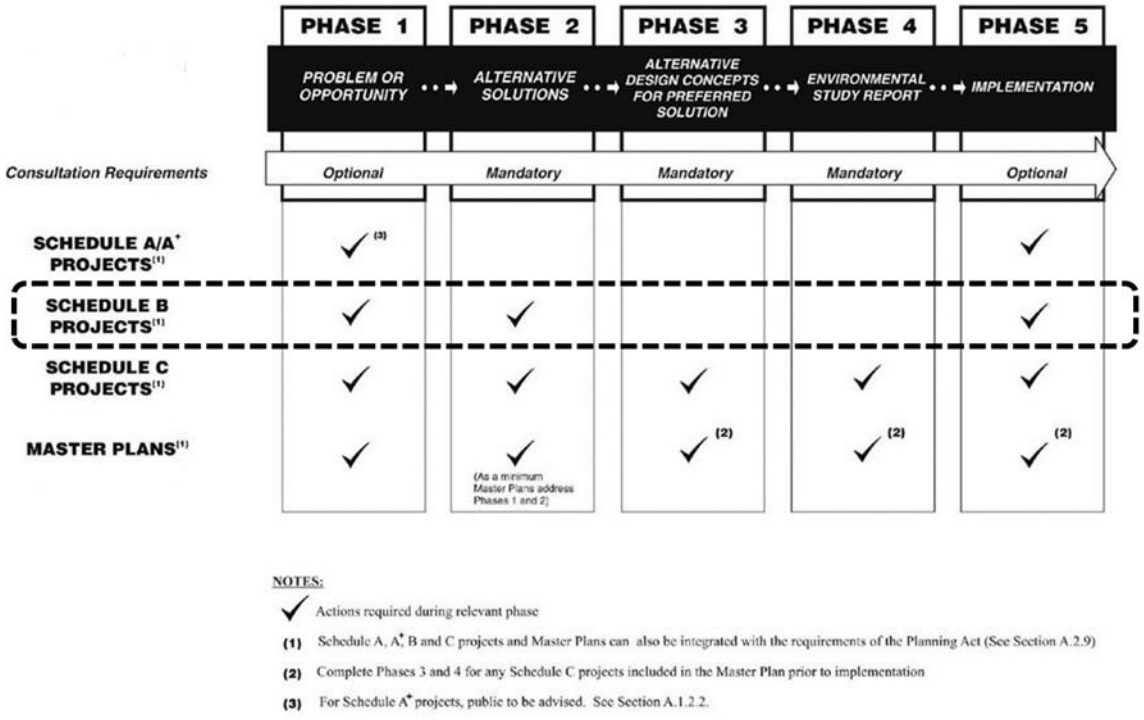
Figure 1-2 illustrates the sequence of activities within the approved Class EA process leading to project implementation. The phases for this study are described below:

- **Phase 1** (Problem and Opportunity) – Identify the problem (deficiency) or opportunity.

- **Phase 2** (Alternative Solutions) – Identify alternative solutions to address the problem or opportunity considering the existing environment and establish the preferred solution considering public and agency input.
- **Phase 3** (Alternative Design Concepts for Preferred Solution) – Examine alternative methods of implementing the preferred solution, based on the existing environment, public and agency input, anticipated environmental effects, and methods of minimizing negative effects and maximizing positive effects.
- **Phase 4** (Environmental Study Report) – Document in an Environmental Study Report (ESR) a summary of the study background, problem statement, alternative solutions, alternative designs, and the public consultation process. Place the ESR on public record for a minimum 30 calendar days for review and notify completion of the ESR and opportunity for Section 16 Order requests.
- **Phase 5** (Implementation) – This phase involves detailed design and the preparation of contract/tender documents followed by construction, operation, and monitoring.

The Teston Road EA study is being undertaken in accordance with the guidelines of the Municipal Engineers Association Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011 and 2015). Due to the type of project, anticipation for potential effects, and estimated capital costs, the Teston Road EA is defined as a Schedule 'B' project.

Figure 1-3: Schedule "B" Environmental Assessment



As shown in **Figure 1-3** above, a Schedule B project requires the completion of Phases 1 and 2 of the planning process, followed by screening and documenting into a Project File Report (PFR). If the screening process through Phases 1 and 2 results in other

requirements of this Class EA being applicable, then those requirements must be fulfilled. Schedule B projects also involve mandatory contact with directly affected public and relevant review agencies, to ensure that they are aware of the project and that their concerns are addressed. If there are no outstanding concerns, then the proponent may proceed to implementation. These projects generally include improvements and minor expansions to existing municipal facilities.

1.2.2 Section 16 Orders

The PFR is finalized, filed and placed on public record for a minimum of 30 calendar days for review by the public and review agencies. At the time the report is filed, a Notice of Study Completion is advertised, to advise the public and other stakeholders where the PFR may be seen and reviewed, and how to submit public comments. The Notice also advises the public and other stakeholders of their right to request a Section 16 Order, and how and when such a request should be submitted.

On July 21, 2020, the Ontario province passed the COVID-19 Economic Recovery Act, which included important amendments to the Environmental Assessment (EA) Act. The amendments to the EA Act included changes to the Section 16 Order request process and sets up the authority of the Ministry of Environment Conservation and Parks (MECP) to create new regulations that would replace all Class EAs, including the Municipal Class Environmental Assessment (MCEA) process.

NEW APPEAL PROCESS

As part of the new appeal process, implemented by the amendments to the EA, proponents will continue to issue a Notice of Study Completion and place the EA documentation/PFR on the public record for 30-days; however, instead of concerns being filed with the Ministry, concerns will be addressed to the proponent. The Section 16 Order process will only apply if the objective deals with aboriginal or treaty rights. The Section 16 Order process has been replaced with an additional 30-day window for the Ministry to decide if the Minister should take any action. Regional coordinators from the Ministry of Environment, Conservation and Parks (MECP) will continue their role of monitoring MCEA projects. During the additional 30 days the Minister will decide if the project will be elevated (Section 16 Order granted) or if it will be approved with conditions. If the Minister advises the proponent that the project will be approved but with conditions, the Minister has more time to draft these conditions. If there is no response from the Minister within the additional 30-days, the proponent may proceed with the project.

1.2.3 Canadian Environmental Assessment Act

Under the Canadian Environmental Assessment Act, 2012 (CEAA, 2012), a federal environmental assessment study may be required to comply with the physical activities that constitute a “designated project”, under the project list identified in the Regulations Amending the Regulations Designating Physical Activities, 2013. This project list ensures that federal environmental assessments are focused on major projects with the greatest potential for significant adverse environmental impacts to matters of federal jurisdiction.

The Teston Road EA study does not constitute a “designated project” and therefore does not require an environmental assessment under the CEAA, 2012. However, the Minister

of the Environment may order an assessment for any project not included in the project list, where there may be adverse environmental effects related to federal jurisdiction.

2 Consultation

The Municipal Class EA process for Schedule 'B' projects requires two mandatory points of contact with the public and review agencies, held at key points throughout the study. The consultation requirement ensures that interested persons have an opportunity to voice their concerns on projects that may impact them or their environment.

The consultation undertaken for the Class EA Study is outlined herein and supporting materials for consultation with the public, agencies and Indigenous Communities are provided in **Appendix A**, **Appendix B**, and **Appendix C** respectively.

2.1 Consultation Approach

Key consultation events undertaken throughout the EA study are listed in **Table 2-1** and are further described in the following sections.

Table 2-1: List of Consultation Events

Consultation Event	Date
Notice of Study Commencement	September 2020
Notice of Open House	February 2021
Open House	February-March 2021
Notice of Study Completion	September 2023

A variety of methods were used to update and inform the public, agencies, stakeholders, and Indigenous Communities about the study progress, including:

- Letters;
- Emails;
- Meetings;
- Phone calls;
- Notices;
- Newspaper advertisements;
- Project website (www.vaughan.ca/TestonRoad); and
- Open House.

All communication and consultation was conducted in compliance with the Accessibility for Ontarians with Disabilities Act (AODA).

Residents living along the study corridor were in receipt of mailed notices and letters. Following the study commencement, any individual who expressed interest in the project and as requested, was added to the project mailing list (mail or email) to receive regular updates on the study progress.

To maximize public awareness, efforts such as regular updates to the project website provided information to the "silent majority" – the members of the public interested in the project but opt for a more passive role.

A Technical Advisory Committee (TAC) consisting of key technical agencies was established for the study. In addition, a Stakeholder Group (SHG), consisting of members of the public who expressed interest in the study, was also formed to gather feedback at key project milestones. Further details are provided in **Section 2.3** and **Section 2.4**.

2.2 Consultation Events

2.2.1 Notice of Study Commencement – January 2020

The Notice of Study Commencement with an accompanying letter invitation to join the Stakeholder Group was mailed to all identified stakeholders and property owners/residents living within 200m of the study corridor in September 2020. The Notice of Study Commencement was also mailed to all identified agencies with an accompanying letter invitation to join the Technical Advisory Committee in September 2020. The general public was notified via the City's project website (www.vaughan.ca/TestonRoad) and newspaper advertisements.

Newspaper advertisements were published in newspapers with local circulation in the study area, including the King Connection Newspaper and the Vaughan Citizen Newspaper, on the dates listed in **Table 2-2**.

Table 2-2: Notice of Commencement Newspaper Advertisements

Newspaper	Date
King Connection	September 10, 2020
	September 17, 2020
Vaughan Citizen Newspaper	September 10, 2020
	September 17, 2020

The Notice of Commencement was circulated to Indigenous communities based on direction from the Ministry of the Environment, Conservation and Parks' (MECP) response to the Notice of Study Commencement.

2.2.2 Notice of Public Information Center (PIC) #1 – February 2021

The Notice of Public Information Center (PIC) was mailed to all identified stakeholders and property owners/residents living within 200m of the study corridor in February 2021. The Notice of PIC was also mailed and emailed to all identified agencies and stakeholders in February 2021. The general public was notified via the City's project website (www.vaughan.ca/TestonRoad) and newspaper advertisements.

Newspaper advertisements were published in the Vaughan Citizen Newspaper, on the dates listed in **Table 2-3**.

Table 2-3: Notice of PIC #1 Newspaper Advertisements

Newspaper	Date
Vaughan Citizen Newspaper	February 4, 2021
	February 11, 2021

The Notice of PIC was also circulated to Indigenous communities based on direction of the forthcoming Ministry of the Environment, Conservation and Parks (MECP) response to the Notice of Study Commencement.

2.2.3 Public Information Center (PIC) #1 – February/March 2021

A virtual Public Information Center (PIC) was hosted on the City's project website (www.vaughan.ca/TestonRoad). The available material, including a recorded presentation and online survey, were made available starting February 18, 2021 to March 12, 2021.

2.3 Agency Consultation

In addition to City of Vaughan technical staff, the following agencies, including federal departments, provincial ministries, municipalities, and utilities were contacted for information, comments, and input to the study. The list of agencies contacted included:

Federal Agencies and Stakeholders

- Health Canada
- Fisheries and Oceans Canada
- Environment Canada
- Canadian Pacific Rail
- Canadian National Rail

Local and Regional Municipalities and Stakeholders

- Regional Municipality of York
- City of Vaughan
- York Region Transit (YRT)
- Toronto and Region Conservation Authority (TRCA)
- York Regional Police

Provincial Agencies and Stakeholders

- Ministry of Transportation (MTO)
- Ministry of Health and Long-Term Care
- Ministry of Municipal Affairs
- Ministry of Housing
- Ministry of Natural Resources and Forestry (MNRF)
- Ministry of Infrastructure
- Ministry of the Environment, Conservation and Parks (MECP)
- Ministry of Citizenship and Multiculturalism (MCM)
- Infrastructure Ontario
- Ontario Provincial Police
- Metrolinx/GO Transit

Utilities and Services

- Hydro One Networks Inc.
- Alectra Utilities
- C/O Lehman & Associates
- Trans Canada Pipelines Limited

2.4 Stakeholder Consultation

Stakeholders, including adjacent landowners, residents, ratepayer groups, business associations, developers, and political representatives, were identified through the Stakeholder Sensitivity Analysis and/or by requests submitted to the Project Team. The contact list was updated as the study progressed and as additional stakeholders expressed their interest in the project. The list of stakeholders contacted by the team included:

Property Stakeholders

- Residents adjacent to the study corridor; and
- Property Owners adjacent to the study corridor.

Interest Groups

- Smart Commute North Toronto, Vaughan;
- York-Simcoe Naturalists;
- Canadian Automobile Association (CAA);
- York Region Cycling Coalition;
- Cycling and Pedestrian Advisory Council;
- Cycling and Pedestrian Advisory Task Force;
- Vaughan Bicycle User Group; and
- First Student Inc.

Local Business Associations

- Vaughan Chamber of Commerce; and
- Markham, Richmond Hill and Vaughan Chinese Business Association.

A Stakeholder Group (SHG) was formed consisting of select members of the public who expressed an interest in actively participating in the study. The SHG may include residents, representatives of resident associations, property owners, and commuters along the corridor. Meetings with the SHG and the project team were held to provide a forum for focused discussion and to obtain feedback at key points during the study.

2.5 Indigenous Communities Consultation

Indigenous Communities who may have an interest in the study area were identified through correspondence from Ministry of the Environment, Conservation and Parks (MECP)'s response letter to the Notice of Commencement. A summary of correspondence with Indigenous Communities is provided in **Appendix C**. The Indigenous Communities that were contacted were:

- Huron-Wendat First Nation; and
- Mississaugas of the Credit First Nation.

Representatives from Huron-Wendat First Nation and Mississaugas of the Credit First Nation contacted the project team to acknowledge receipt of Notice of Commencement. Both First Nations requested a copy of the Stage I Archaeological Assessments for review and concluded that they do not have major concerns and were interested in participating in future fieldwork for Stage II Archaeological Assessment.

3 Planning Context

This section provides context for the study in relation to planning policies and guidance at the provincial, regional and local municipal level.

3.1 Provincial Planning Context

Provincial planning policies, summarized in **Table 3-1**, were reviewed to identify their relevance to the Teston Road EA.

Table 3-1: Provincial Planning Policies

Provincial Planning Document	Directions	Impact to Teston Road EA
Provincial Policy Statement, Ontario, 2014	Description: Provides direction on land use planning and development, and the transportation system. Directions: The most relevant land use and transportation policies) include: • **1.6.7.1** Safe, energy efficient, transportation systems that move people and goods and address projected needs • **1.6.7.2** Use of travel demand management (TDM) strategies to maximize efficiency • **1.6.7.3** A multimodal transportation system that provides connections within and among transportation systems and modes including across jurisdictional boundaries • **1.6.7.4** Land use patterns that minimize length and number of vehicle trips to support transit and active transportation • **1.6.7.5** Integrate transportation and land use considerations at all stages of planning • **1.6.8.2** Protect for major goods movement facilities and corridors • **1.6.8.3** New development should be compatible with the long-term purposes of the corridor	The Teston Road EA will consider projected needs for both people and goods, encourage travel demand management, and consider all travel modes.

Provincial Planning Document	Directions	Impact to Teston Road EA
Growth Plan for the Greater Golden Horseshoe, Ministry of Municipal Affairs, 2006, 2013, 2017, 2019 **Update**	Description: The Growth Plan for the Greater Golden Horseshoe (GGH) was released on June 16, 2006, and is a long-term plan that aims to: • Revitalize downtowns • Create complete communities • Provide housing options to meet the needs of people at any age • Curb urban sprawl and protect farmland and green spaces • Reduce traffic gridlock by improving access to a greater range of transportation options The June 2013 amendment extended the growth planning horizon to 2041 while the 2016 update identified new intensification targets. Directions: The Growth Plan defines specific policies for where and how to grow, including the identification of defined urbanized areas versus a protected Greenbelt Area. The plan also identifies Urban Growth Centres across the Greater Toronto Area (GTA), Major Transit Station Areas and Intensification Corridors. There has been a 2019 update to the Growth Plan.	The EA Study will ensure adherence to the Growth Plan guidelines as it is adjacent to the greenbelt boundary.

Provincial Planning Document	Directions	Impact to Teston Road EA
2041 Regional Transportation Plan **updated in 2018 from The Big Move, Metrolinx, 2008**	Description: The Big Move is the Greater Toronto and Hamilton Area's (GTHA's) multi-modal long-range regional transportation plan. Since 2008, this plan has been providing strategic direction for planning, designing and building a regional transportation network that enhances quality of life, environment, and prosperity. Directions: The Big Move sets the context for Regional Express Rail (RER), a frequent all-day, two-way express rail service on existing GO Rail lines with 15 minute frequencies using future electrification infrastructure. In order to support the expanded services, improvement to infrastructure is needed: • Track expansion, including upgrade of existing structures within corridor such as culverts, bridges • Grade separations • Maintenance and storage facilities • Electrification infrastructure • Station Expansion (parking, building, pedestrian access, etc.) • New station(s) along corridor that will optimize ridership and minimize delay As of 2018, the 2008 Big Move has been updated to the 2041 Regional Transportation Plan (RTP).	The EA Study will assess and analyze transportation system elements that enhances quality of life and the local environment along the study corridor.

Provincial Planning Document	Directions	Impact to Teston Road EA
Transit-Supportive Guidelines, Ministry of Transportation, 2012	Description: Identifies best practices in Ontario, North America and abroad for transit-friendly land-use planning, urban design, and operations. Directions: Key directions relevant to the Teston Road EA include layout and spacing of arterial and collector streets: • Street networks are fine-grained and interconnected to provide efficient transit services and connections to transit stops • Eliminate unnecessary jogs or breaks in the network • Spacing of arterial and collector roads should support a maximum 400 m walk from the interior of a block to a transit stop, and facilitate higher levels of walking and cycling • Access routes to transit stops, such as pedestrian pathways or local roads, should be spaced no greater than 200 m apart. Key directions for planning around major transit station areas include: • A rational progression of facilities from passenger pick up and drop off / bus transfer / parking areas to ticketing and wayfinding, safe and comfortable waiting areas, and finally to transit loading areas • Organize surface parking areas into smaller modules to facilitate defined walking and cycling paths to the stations and also establish future development parcels over time • Prioritize pedestrian access • Limit free surface parking where frequent feeder transit service is available	The road analysis shall be in accordance with the Transit Supportive Guidelines.

Provincial Planning Document	Directions	Impact to Teston Road EA
#CycleON: Ontario's Cycling Strategy, Ministry of Transportation, 2013	Description: Identifies a vision for cycling in the province over the next 20 years where cycling is valued as a core mode of transportation. Directions: Key directions relevant to the Teston Road EA include: • Partner with municipalities to implement Complete Streets policies and develop active transportation plans • Partner with municipalities / transit agencies to integrate cycling and transit • Develop a funding partnership to build provincial and municipal cycling routes, including pilot program funding to gather data and test new ideas • Create communities that have a built form that supports and promotes cycling for all trips under 5 km	The Teston Road EA strives to plan for cycling infrastructure and complete communities in accordance with this plan.

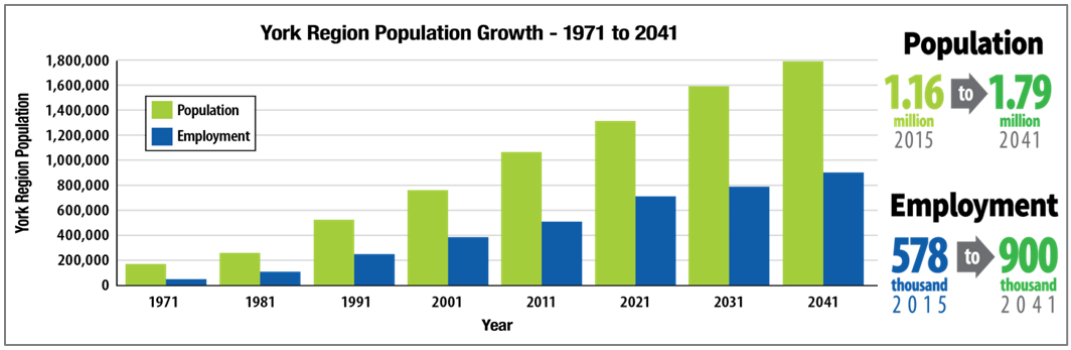
Ontario's Climate Change Action Plan	Description: Identifies a five-year plan to fight climate change, reduce greenhouse gas pollution, and transition to a low-carbon economy.
	
	Directions: Specific action areas are identified to meet specific greenhouse gas emission reduction targets:
	• Transportation: Becoming a North American leader in low-carbon and zero-emission transportation
	  ○ Increase the use of electric vehicles
	  ○ Support cycling and walking
	  ○ Support the accelerated construction of GO Regional Express Rail
	• Land use planning: Support low-carbon communities
	  ○ Strengthen climate change policies in the municipal land use planning process
	  ○ Eliminate minimum parking requirements
		The implementation of Active Transportation and Travel Demand Management (TDM) to promote sustainable modes of transportation to increase the number of active transportation trips and reduce the number of single-occupancy vehicles will be considered during the alternative analysis.

Provincial Planning Document	Directions	Impact to Teston Road EA
Greenbelt Plan (2017)	Description: In concert with the Growth Plan, Niagara Escarpment Plan (NEP) and Oak Ridges Moraine Conservation Plan (ORCMP), and further to the PPS, the Greenbelt Plan establishes land use planning framework for the GGH to support a clean and healthy environment, a thriving economy and social equity. Directions: Identifies areas where urbanization should not occur in order to protect the ecological, agricultural, and hydrological land use. Lands identified in the NEP and ORCMP are also included in the Greenbelt Plan.	Teston Road EA strives to support the achievement of complete communities and community hubs that are conveniently accessible by active transportation and transit. Infrastructure improvements will integrate with land use planning while minimizing environmental impacts in the Protected Countryside of the Greenbelt Area.

3.2 Regional Planning Context

York Region is one of the fastest growing municipalities in the GTA. Since 1971, York Region's population has increased nearly seven-fold. Population and employment growth are expected to continue across the Region. As such, the transportation system and other infrastructure must be prepared to accommodate future growth. As illustrated in **Figure 3-1**, by 2041, regional population will reach 1.79 million, while employment will reach 900,000.

Figure 3-1: York Region Population and Employment Growth - 1971 to 2041



Source: Regional Municipality of York

3.2.1 Regional Official Plan (April 2019)

The Regional Official Plan represents the Region's vision and plan for the way communities are designed, serviced, and supported. The objectives of the Plan include: Sustainable Natural Environment, Healthy Communities, and Economic vitality.

The plan emphasizes interconnected and accessible mobility systems, with a priority on pedestrian movement, and transit use and access. Some of objectives related to the Teston Road EA Study include: create an active transportation system and programs

that encourage walking and cycling, ensure streets support all modes of transportation including walking, cycling, automobile use, planning and protecting future urban and rural streets to accommodate transportation demands, and promote a linked and efficient network for goods movement that supports economic vitality and minimizes conflicts with sensitive land uses.

3.2.2 Regional Transportation Master Plan (November 2016)

York Region's Transportation Master Plan (YRTMP) addresses the Region's mobility needs to 2041. It provides a 25-year outlook to:

Create an advanced interconnected system of mobility in the GTHA in order to give York Region residents and businesses a competitive advantage, making York Region the best place to live, work and play in the GTHA.

The YRTMP has five objectives:

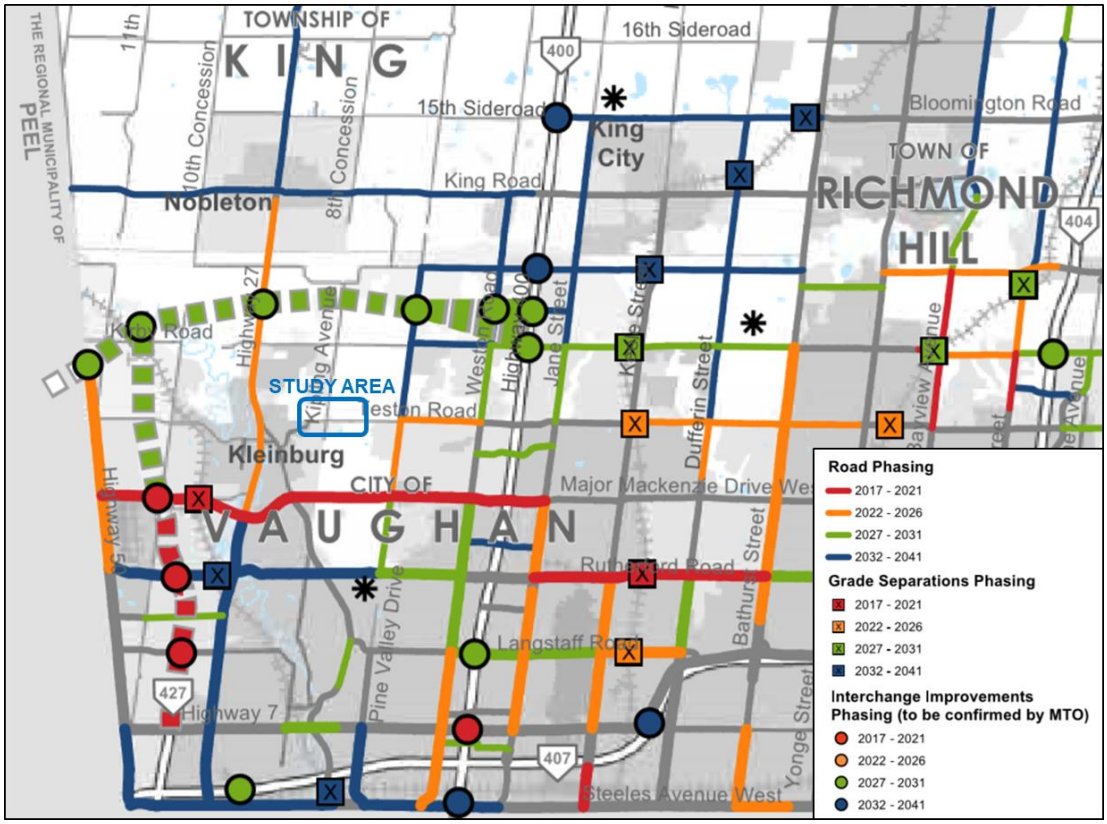
1. Create a world class transit system;
2. Develop a road network fit for the future;
3. Integrate active transportation in Urban Areas;
4. Maximize the potential of employment areas; and
5. Make the last mile work.

Additional mode-specific details on YRTMP recommendations are provided in the following sections.

Road Network Recommendations

Figure 3-2 illustrates the 2041 road network from the YRTMP. As shown, no road improvements are planned for the study area.

Figure 3-2: YRTMP Proposed 2041 Road Network

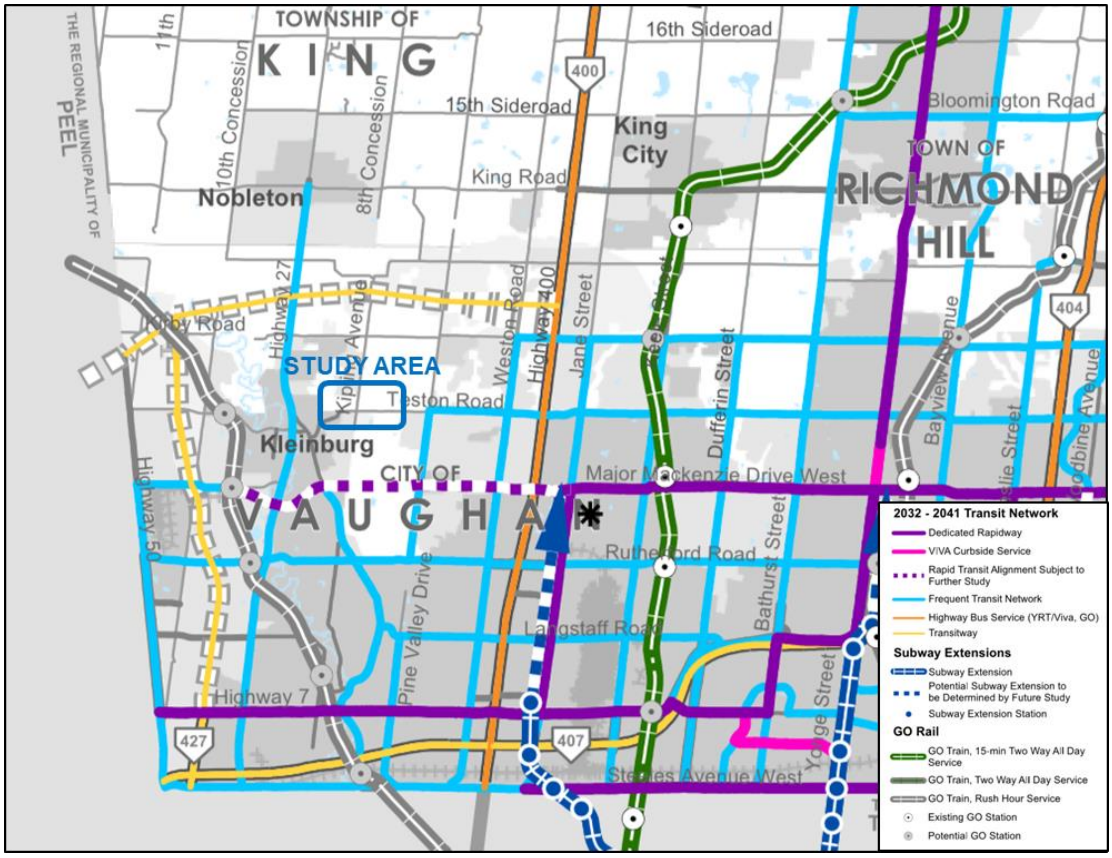


Source: York Region Transportation Master Plan 2016

Transit Network Recommendations

Figure 3-3 illustrates the Region's currently planned long-term 2041 transit network. As shown below, the planned Frequent Transit Network (15-minute service or better as defined in the YRTMP) is not planned for this section of Teston Road. It should be noted, however, that local routes may still be identified to serve this area in the future.

Figure 3-3: YRTMP Proposed 2041 Transit Network

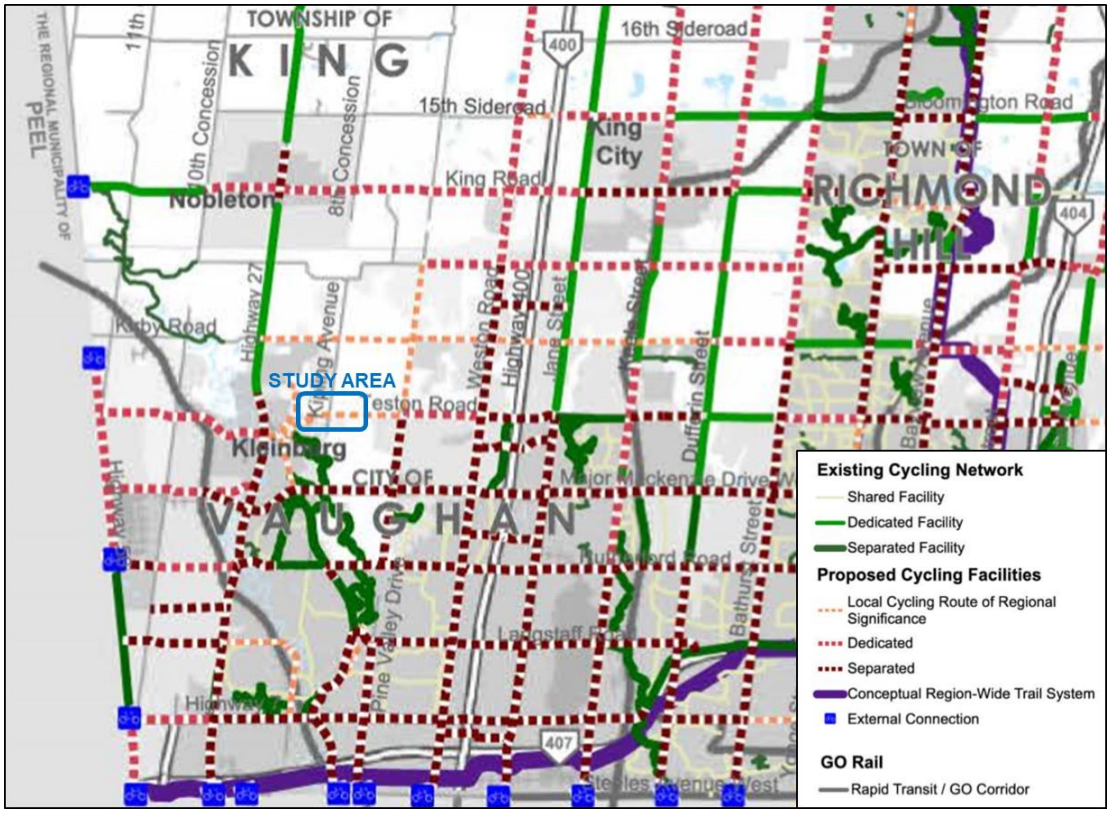


Source: York Region Transportation Master Plan 2016

Cycling Network Recommendations

The York Region TMP recommended cycling infrastructure for a 10-year horizon and for a 25-year horizon. For the 2041 network, the York Region TMP recommended a local cycling route through the study area as shown in **Figure 3-4**.

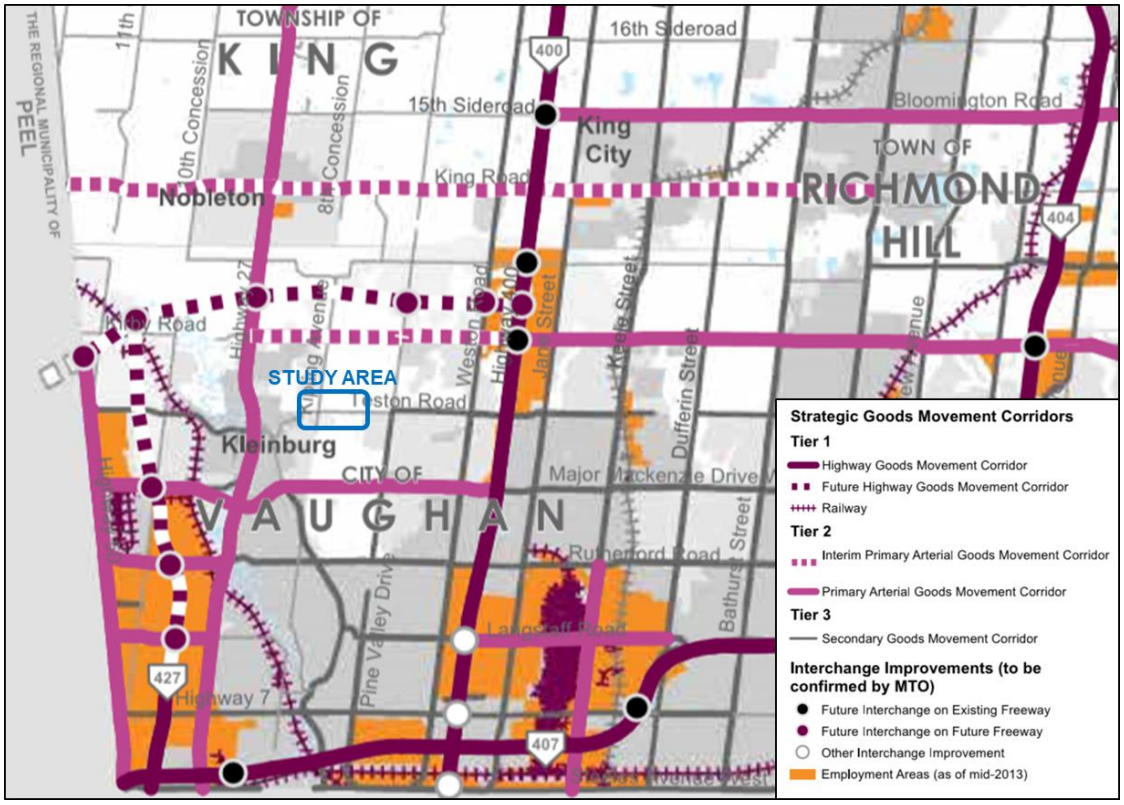
Figure 3-4: YRTMP Proposed 2041 Cycling Network



Goods Movement Network Recommendations

York Region's Strategic Goods Movement Network provides a framework for future goods movement. It consists of a hierarchy of corridors, identifying all freeways as Tier 1 corridors, strategic arterial roads as Tier 2 corridors, and all other Regional roadways as secondary goods movement corridors. The Region's Proposed Strategic Goods Movement Network is illustrated for the study area in **Figure 3-5**.

Figure 3-5: YRTMP Proposed Strategic Goods Movement Network



3.3 Municipal Planning Context

3.3.1 City of Vaughan Official Plan

The City of Vaughan Official Plan 2010 (VOP 2010) was approved by Council on September 7, 2010. The Plan was endorsed by Regional Council on June 28, 2012. VOP 2010 is part of a Growth Management Strategy "that will shape the future of the City and guide its continued transformation into a vibrant, beautiful and sustainable City."

The following policies, with VOP 2010 references in brackets, are of relevance to the study area:

- To establish a comprehensive transportation network that allows a full range of mobility options, including walking, cycling and transit (4.1.1.1);
- That the street network will be the basis for enhanced transportation opportunities, including transit, walking, cycling, and place making initiatives. Existing rights-of way should be designed to optimize the efficient movement for a variety of modes, potentially resulting in reduced capacity for cars where overall capacity increases can be achieved (4.1.1.5);
- To support the development of a comprehensive network of on-street and off-street pedestrian and bicycle routes, through the implementation of the City's Pedestrian and Cycling Master Plan and York Region's Pedestrian and Cycling Master Plan; and to facilitate walking and cycling and to promote convenience and connectivity (4.1.1.6); and

- To plan for a street network that prioritizes safe and efficient pedestrian travel while effectively accommodating cyclists, transit and other vehicles, and to create more pedestrian and transit-friendly street cross-sections (4.2.1.2).

Schedule 9 (**Figure 3-6**) and Schedule 10 (**Figure 3-7**) in the VOP 2010 identify the City's Future Transportation Network and Major Transit Network, respectively. It is noted that these schedules were developed prior to the completion of the 2016 York Region TMP and, as such, incorporate Regional plans based upon the previous version of the York Region TMP.

Figure 3-6: Schedule 9 - Future Transportation Network

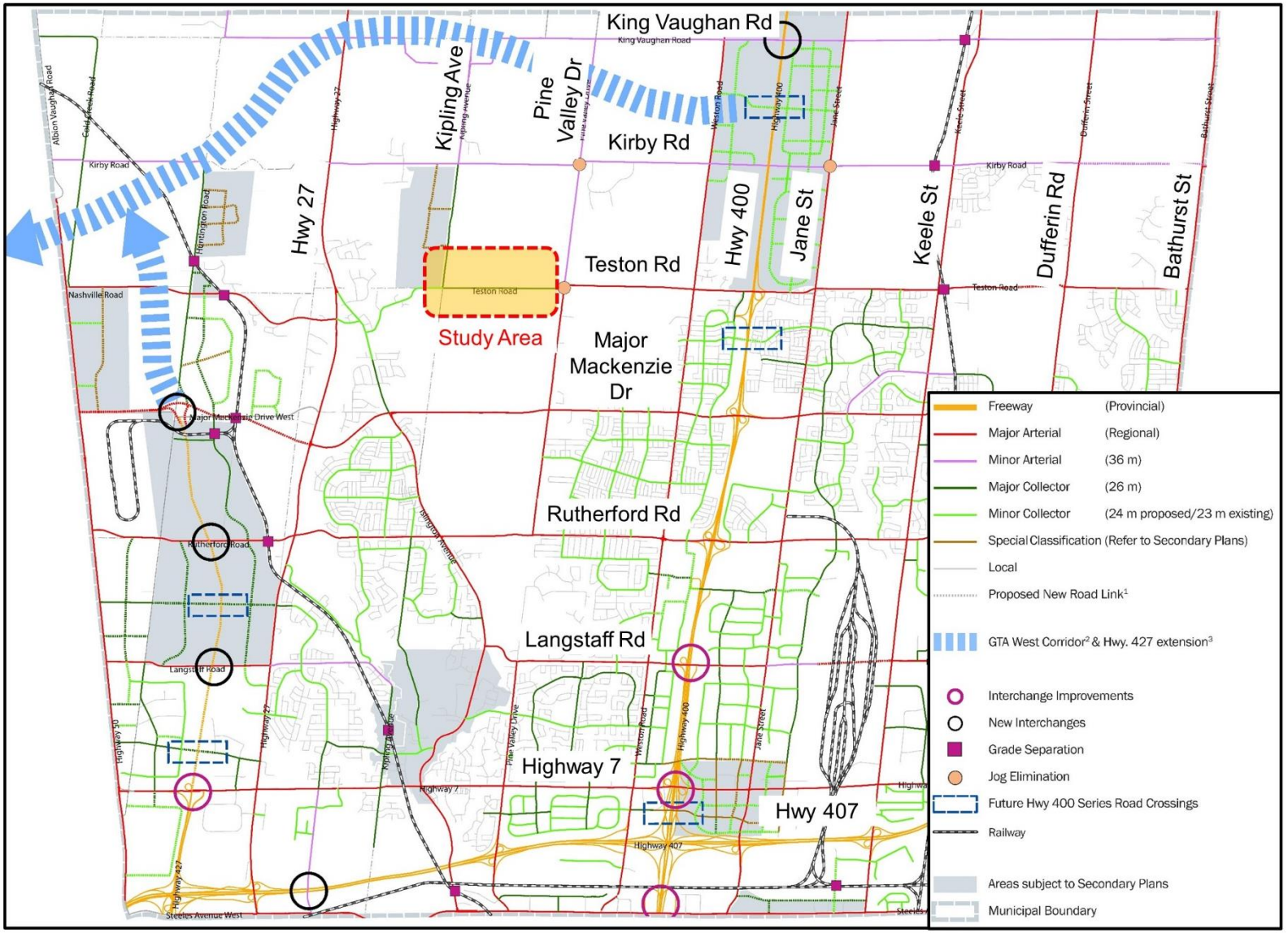
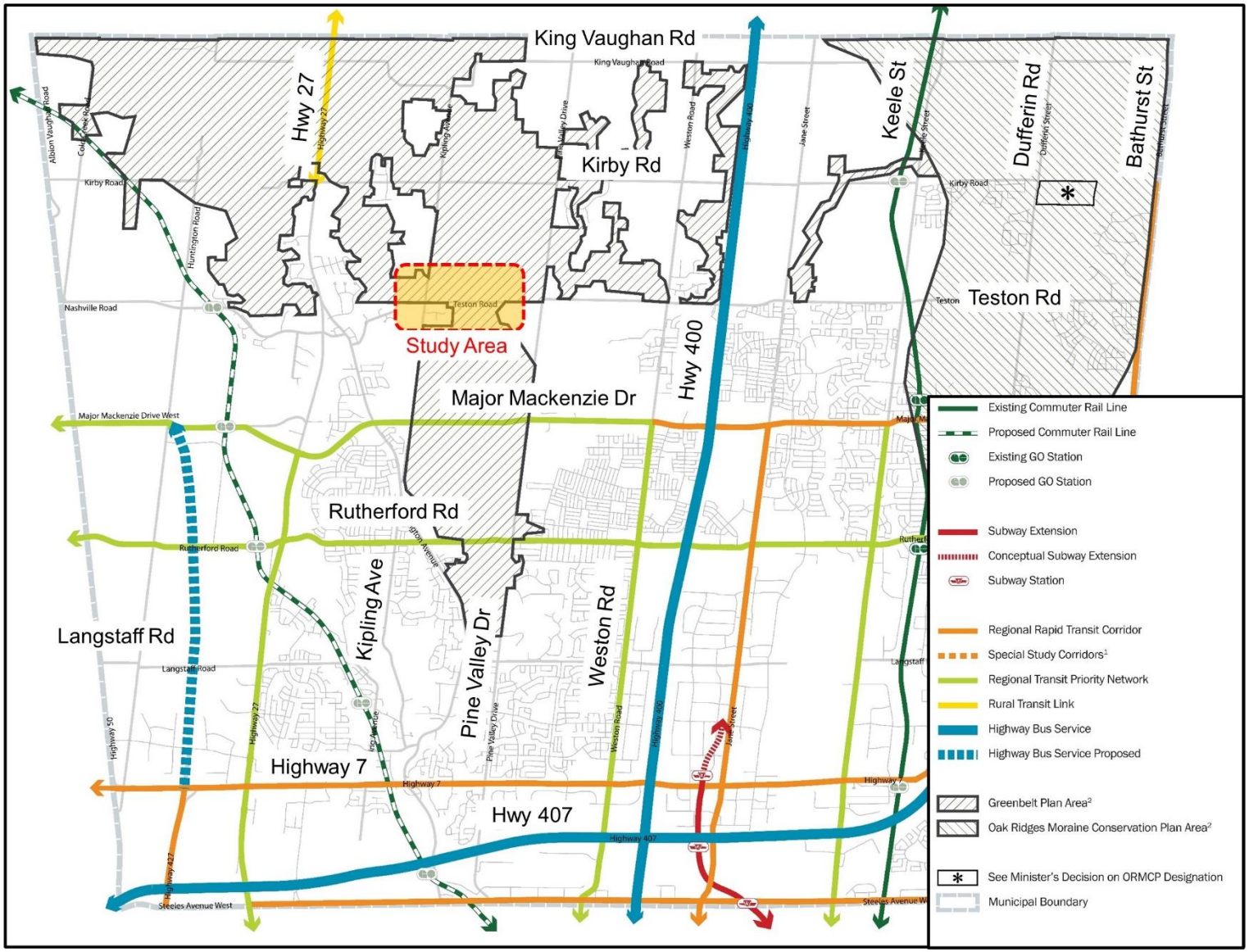


Figure 3-7: Schedule 10 – Major Transit Network



3.3.2 Green Directions Vaughan

Green Directions Vaughan is the City's community sustainability and environmental master plan. It identifies actions to ensure the health, well-being and vitality of the community. In relation to the Teston Road EA, this plan provides direction to ensure that getting around Vaughan is easy and has a low environmental impact. The Teston Road EA will look to promote sustainable and active transportation in accordance with Green Directions Vaughan.

3.3.3 City of Vaughan Transportation Master Plan 2013: A New Path

The Vaughan Transportation Master Plan (VTMP) identifies city-wide transportation needs to the year 2031, including local improvements, strong Regional investments in transit service, arterial road improvements, sidewalks, on-street and off-street bicycle facilities, and a mix of land uses. It should be noted that the VTMP is currently being updated.

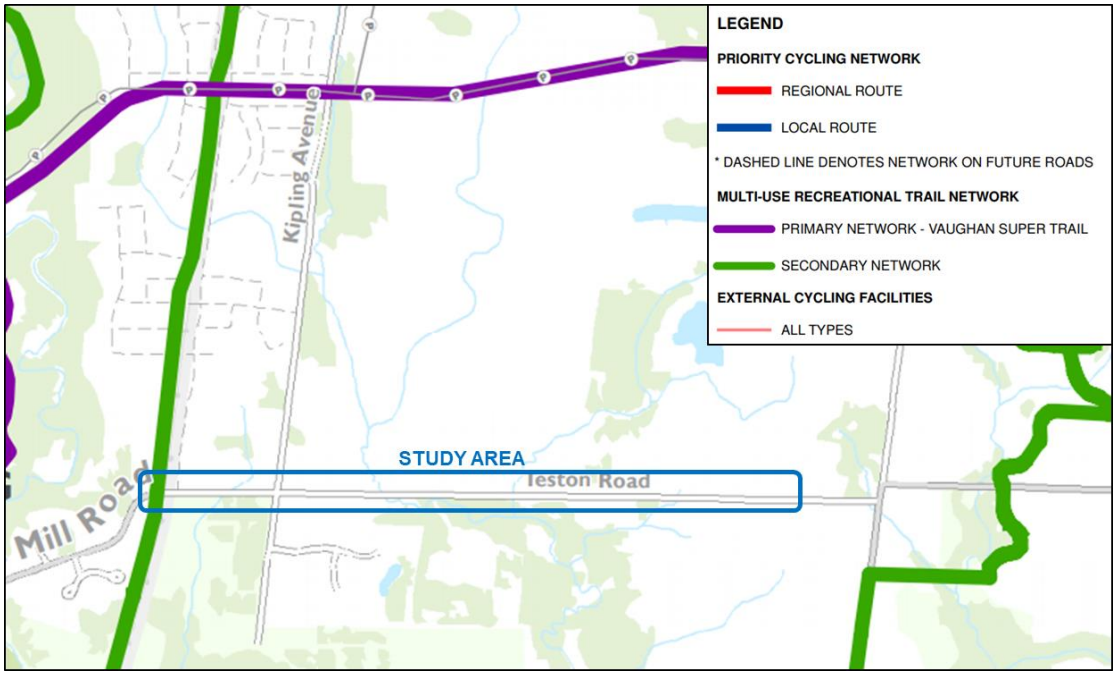
3.3.4 City of Vaughan Pedestrian and Bicycle Master Plan

The City of Vaughan adopted the Pedestrian and Cycling Master Plan in January 2007 and is currently undertaking an update. The Plan has a 20-year horizon. The central intent of the plan is to guide improvements to existing and proposed pedestrian and cycling infrastructure to create a friendlier environment for residents. The two central goals of the plan are:

- To create new environments and enhance existing ones for both pedestrians and cyclists in the City of Vaughan. These environments should be supported by developing a visible and connected pedestrian and cycling network in Vaughan that integrates, enhances and expands the existing on- and off-road pedestrian and cycling facilities; and
- To facilitate an increase in walking and cycling for leisure and utilitarian purposes.

The Pedestrian and Bicycle Master Plan update endorses the Vaughan Super Trail, a signature active transportation facility that links communities to one another and increases accessibility for residents and visitors to important cultural, natural, heritage, and public space destinations. Cycling facilities are not identified on Teston Road as shown in **Figure 3-8**. However, the City of Vaughan policy is to explore active transportation facilities on all arterial/collector roads and this study will explore the need for cycling facilities on Teston Road.

Figure 3-8: Pedestrian and Bicycle Master Plan Update (Draft)



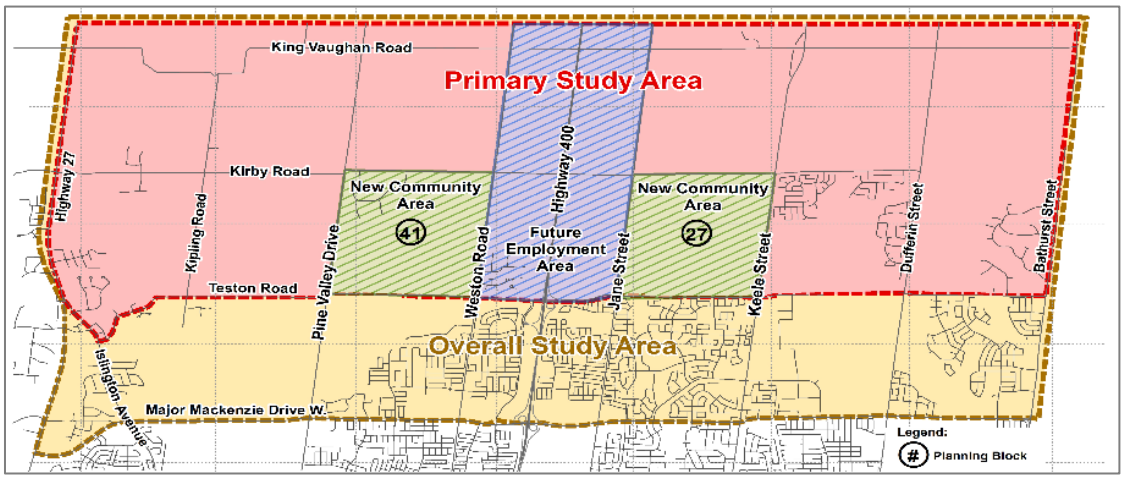
Source: Pedestrian and Bicycle Master Plan Update
https://www.vaughan.ca/projects/projects_and_studies/pedestrian_master_plan/Pages/default.aspx

3.3.5 North Vaughan and New Communities Transportation Master Plan

The North Vaughan and New Communities Transportation Master Plan (NVNCTMP) is a long-range plan that supports policies, programs and infrastructure required to meet existing and future mobility needs and provide context for transportation decisions within North Vaughan. The primary and overall study areas are shown in **Figure 3-9**.

The objective of the plan is to look at both internal and external factors that contribute to achieving sustainable transportation for residents and businesses while ensuring recommendations of the plan address the transportation network needs from immediate to future growth.

Figure 3-9: NVNCTMP Primary and Overall Study Area



Source: North Vaughan and New Communities Transportation Master Plan, August 2019

4 Transportation Conditions

This section provides an overview of existing conditions within the study area. Data was obtained from various sources including City of Vaughan, York Region, Ministry of Transportation (MTO), Transportation Tomorrow Survey (TTS), Google Maps, and the City's GIS and travel data.

4.1 Existing Transportation Infrastructure

4.1.1 Existing Road Network

The Teston Road corridor (shown in **Figure 4-1**) is designated as an east-west major arterial. It is under the jurisdiction of the City of Vaughan within the study area. It has a posted speed limit of 40 km/h west of Kipling Avenue and 60 km/h east of Kipling Avenue within the study area.

Figure 4-1: Existing Transportation Conditions along Teston Road

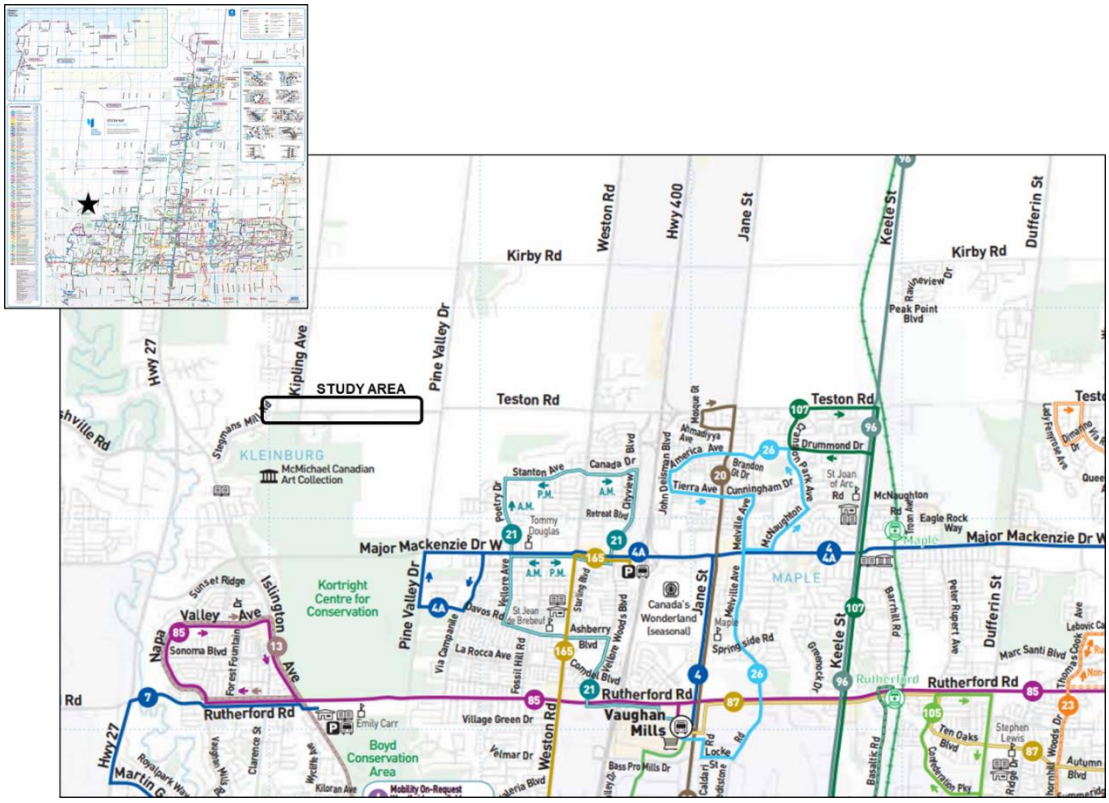
Image Source: Google Maps

The corridor within the study area has two (2) unsignalized intersections at Kleinburg Summit Way and at Kipling Avenue. Kipling Avenue and Kleinburg Summit Way are designated as collectors.

4.1.2 Existing Transit Network

City of Vaughan is serviced by York Region Transit (YRT). There are currently no transit routes within the study area as shown in **Figure 4-2**.

Figure 4-2: Existing Transit Network

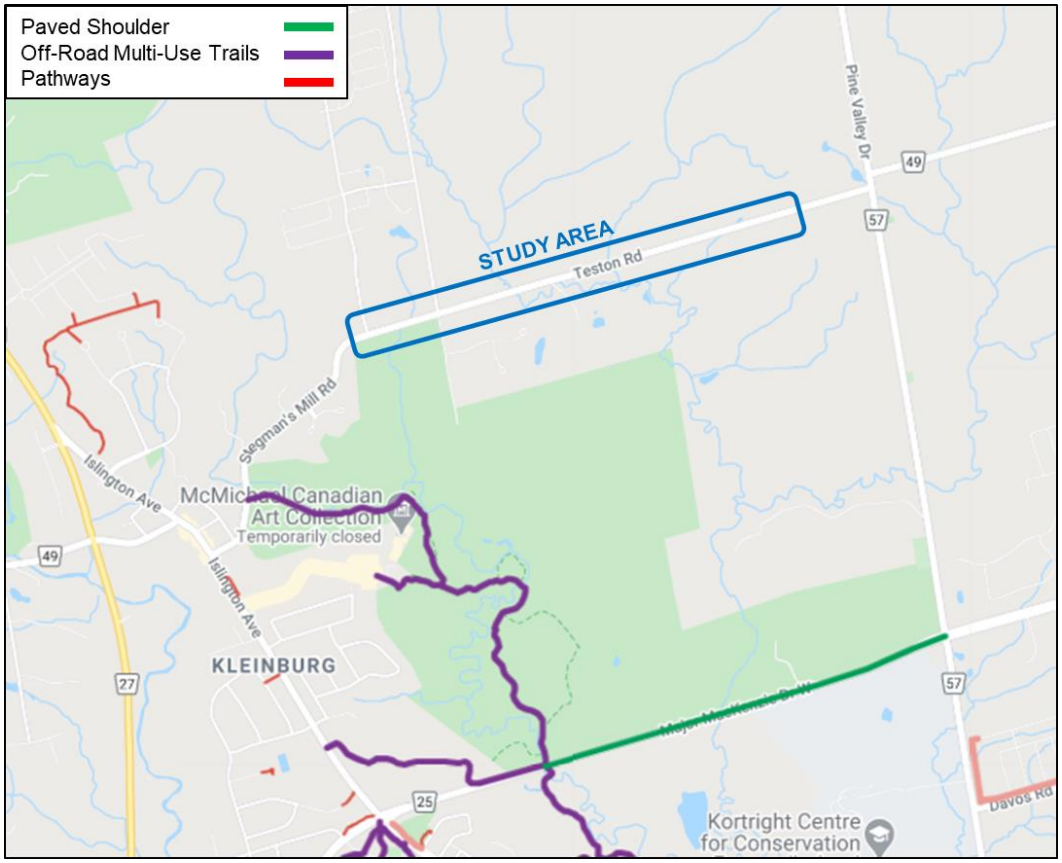


Source: York Region Transit System Map, April 2020

4.1.3 Existing Pedestrian / Cyclist Network

There are currently no pedestrian facilities on Teston Road within the study area. As illustrated in **Figure 4-3**, there is currently an off-road multi-use trail in the Kortright Conservation Lands south of the study area. In addition, a new off-road, north-south multi-use trail has been constructed on the west side of Kleinburg Summit Way, terminating at the Teston Road and Kleinburg Summit Way intersection.

Figure 4-3: Existing Pedestrian / Cycling Network



Source: Vaughan Cycling Map, June 2015

4.2 Travel Patterns and Mode Share

The following section summarizes travel and mode share data from the 2016 Transportation Tomorrow Survey (TTS) for trips made by residents within the broader secondary study area (shown in **Figure 4-4**). The secondary study area includes the adjacent traffic zones (zones 2019, 2020, 2021, 2046, 2047, 2048. 2051, 2052, and 2053), bounded by Kirby Road to the north, Major Mackenzie Drive to the south, Weston Road to the east, and Highway 27 to the west.

During a typical day, approximately 4,990 trips were completed during the AM Peak Period by people residing within the area. The trips were destined for various locations across the GTA as shown in **Figure 4-4**. Of the total trips, 86% were made by car (including 11% passengers), 5% by transit and 5% by active modes such as walking or cycling, as illustrated in **Figure 4-5**.

Figure 4-4: Distribution of Study Area AM Work Trips (TTS 2016)

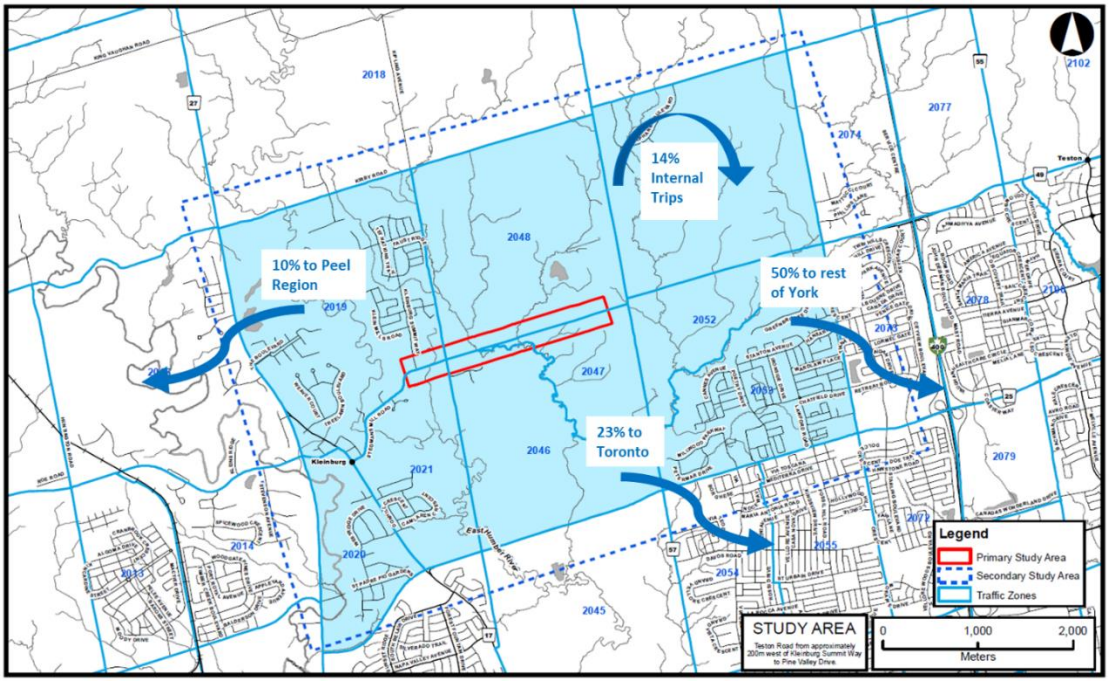
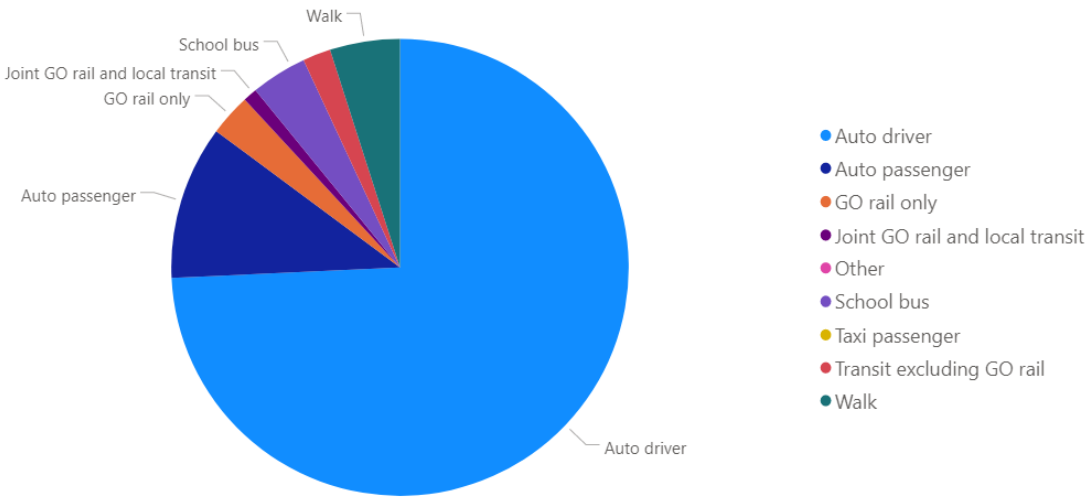


Figure 4-5: Mode Share – Secondary Study Area



4.3 Transit Level of Service

York Region's Transportation Mobility Plan Guidelines for Development Applications (2016) was used for the multimodal (Transit, Pedestrian, Bicycle) level of service analysis. Transit level of service (shown in **Table 4-1**) is determined by the access to transit stops, transit headways and transit vehicle performance approaching the intersection.

Table 4-1: Transit Level of Service Criteria

Level of Service	Access to Transit Stops	Transit Headways	Intersection Approach (transit or curb lanes)	
			Delay (seconds/veh)	v/c
A	90% within <=200m	<=5 minutes	<=10	0 to 0.60
B	90% within <=500m and 70% within <=200m	>5-10 minutes	>10-20	0.61 to 0.70
C	90% within <=500m and 50% within <=200m	>10-15 minutes	>20-35	0.71 to 0.80
D	100% within <=600m	>15-20 minutes	>35-55	0.81 to 0.90
E	100% within <=800m	>20-30 minutes	>55-80	0.91 to 1.00

The transit level of service result summary is shown in **Table 4-2**. As there is no transit service within the study area, the existing transit level of service is poor (LOS F).

Table 4-2: Transit Level of Service Summary

Intersection	Direction	Access to Transit Stops LOS	Transit Headways LOS	Intersection Approach (transit or curb lanes) LOS
Teston Road / Kleinburg Summit Way	Eastbound	F	F	F
	Westbound	F	F	F
	Southbound	F	F	F
Teston Road / Kipling Avenue	Eastbound	F	F	F
	Westbound	F	F	F
	Northbound	F	F	F
	Southbound	F	F	F

4.4 Pedestrian / Cyclists Level of Service

The pedestrian level of service (**Table 4-3**) is based on sidewalk width and buffer width. The pedestrian level of service is calculated for each intersection and road segment as the pedestrian's experience is determined by both the conditions between intersections and at intersection crossings themselves.

Table 4-3: Bicycle Level of Service Criteria

Level of Service	Segment	Intersection
A	Separated cycling facilities (e.g. cycle tracks, multi-use path)	Separated cycling facilities Bicycle box or clearly delineated bicycle treatment or bicycle signal head
B	≥1.8 m dedicated cycling facilities (e.g. bicycle lanes with and without buffer)	>1.8 m dedicated cycling facilities (e.g. bicycle lanes with and without buffer), Bicycle box, clearly delineated bicycle treatment or bicycle signal head
C	<1.8 m dedicated cycling facilities with no buffer	<1.8 m dedicated cycling facilities with no buffer, Bicycle box, clearly delineated bicycle treatment or bicycle signal head
D	≤1.5 m bicycle lane with no buffer	≤1.5 m bicycle lane and no buffer Bicycle treatment
E	Shared facilities (e.g. signed routes, sharrows or paved shoulder with minimum 1.2 m in constrained area)	Shared facilities (e.g. signed routes, sharrows or paved shoulder with minimum 1.2 m in constrained area) No clearly delineated bicycle treatment
F	No bicycle provision	No bicycle provision

The bicycle level of service result summary is shown in **Table 4-4**. The study corridor currently does not accommodate for cyclists along the road segments or at intersections resulting in poor level of service (LOS F). There are, however, opportunities to provide a connection to the Kortright Conservation trails in the future.

Table 4-4: Bicycle Level of Service Summary

Intersection	Direction	Segment Description	Segment LOS	Intersection LOS
Teston Road / Kleinburg Summit Way	Eastbound	Teston Road	F	F
	Westbound	Teston Road	F	F
	Southbound	Kleinburg Summit Way	F	F
Teston Road / Kipling Avenue	Eastbound	Teston Road	F	F
	Westbound	Teston Road	F	F
	Northbound	Kipling Avenue	F	F
	Southbound	Kipling Avenue	F	F

4.5 Vehicle Traffic Operations

This section describes the existing vehicle traffic operations at the unsignalized intersections along the study corridor. It should be noted that Teston Road at Pine Valley

Drive is not within the study area and the analysis for this intersection has been previously completed as part of York Region's Teston Road (Pine Valley Drive to Weston Road) EA in 2016.

4.5.1 Data Collection

The turning movement counts (TMC) and signal timing plans for the study area were provided by the City of Vaughan. **Table 4-5** lists the traffic volume counts used for the existing condition analyses. Detailed TMCs are provided in **Appendix D**.

Table 4-5: Turning Movement Counts Inventory

No.	Intersection	Intersection Control	Date	Source
1	Teston Road at Kleinburg Summit Way	Unsignalized	October, 2019	Provided by City of Vaughan
2	Teston Road at Kipling Avenue	Unsignalized	December, 2019	Provided by City of Vaughan

4.5.2 Existing Peak Hour Traffic Analysis

Traffic analysis was conducted to determine existing conditions at key intersections within the study area using performance metrics such as level of service (LOS) and volume-to-capacity (v/c) ratio.

Traffic operations for all the intersections within the study area were analyzed using Synchro software. The Synchro software was developed based on the Highway Capacity Manual (HCM 2000) methodologies and provides a detailed assessment of traffic operations including levels of service (LOS), delays and volume to capacity ratios for overall, approaches, as well as individual movements at unsignalized and signalized intersections. LOS describes the "driver experience" on a transportation facility, with each LOS associated with the average delay each driver would experience at an intersection (**Table 4-6**).

Table 4-6: Level of Service Descriptions

LOS	Signalized Intersections		Unsignalized Intersections	
	Description	Delay	Description	Delay
A	Very seldom does a vehicle wait longer than one red light. The approach appears open, turns are easily made and drivers have freedom of operation.	≤10 sec	Little or no traffic delay occurs. Approaches appear open, turning movements are easily made, and drivers have freedom of operation.	≤10 sec

LOS	Signalized Intersections		Unsignalized Intersections	
	Description	Delay	Description	Delay
B	An occasional green light is fully used and many greens approach full use. Many drivers begin to feel somewhat restricted within groups of vehicles approaching the intersection.	≤20 sec	Short traffic delays occur. Many drivers begin to feel somewhat restricted in terms of freedom of operation.	≤15 sec
C	Intersection operation is stable but often has fully used greens. Drivers feel more restricted and occasionally may wait more than one red light. Queues may develop behind turning vehicles.	≤35 sec	Average traffic delays occur. Operations are generally stable, but drivers emerging from the minor street may experience difficulty in completing their movement. This may occasionally impact on the stability of flow on the major street.	≤25 sec
D	Drivers experience increasing restriction and instability of traffic flow. There are substantial delays to vehicles during short peaks within the peak hour, but there is enough time with lower demand to permit occasional clearing of queues and prevent excessive backups.	≤55 sec	Long traffic delays occur. Drivers emerging from minor streets experience significant restriction and frustration. Drivers on the major street will experience congestion and delay.	≤35 sec
E	The capacity of the road is reached. There are long queues of vehicles waiting upstream of the intersection and delays to vehicles may extend to several signal cycles.	≤80 sec	Very long traffic delays occur. Operations approach the capacity of the intersection.	≤50 sec
F	Vehicle demand exceeds the available capacity and delays extending through the peak hour are experienced.	>80 sec	Vehicle demand exceeds the available capacity. Very long traffic delays occur frequently.	>50 sec

The v/c ratio represents how full a road or intersection movement is, based on actual volumes versus the maximum number of vehicles that can be served by the intersection. A v/c ratio between 0.00 and 0.49 means that less than half the capacity is being used by vehicles; this is generally associated with good operating conditions. As the v/c ratio approaches 1.00, traffic conditions worsen, and at 1.00, the theoretical maximum capacity is reached, and operations are generally poor. The v/c ratio can exceed 1.00, indicating very poor operations and extended traffic delays.

The “critical movements” identified in the capacity analyses summary tables are those having an LOS of E or F and/or a v/c ratio of 0.85 or greater for signalized intersections. Since the analysis is based on actual volumes, v/c ratios greater than 1.00 indicates that

the counted traffic volumes exceeded the capacity calculated by the analysis procedure/software. Individual movements at intersections with calculated v/c ratios greater than 1.00 are operating essentially above capacity and can be expected to experience severe recurring queuing and congestion during both the AM and PM peak periods.

The existing traffic volumes were analyzed using existing lane configuration and signal timings provided by the City of Vaughan. The traffic operational analysis results of the study area intersections are summarized in

Table 4-7. Detailed Synchro outputs are provided in **Appendix D**.

Table 4-7: Synchro Results – Existing Conditions

Intersection	Approach/Movement		AM Peak Hour			PM Peak Hour		
			Delay (s)	LOS	v/c	Delay (s)	LOS	v/c
Teston Road at Kleinburg Summit Way (Unsignalized)	EB	EBL	7.8	A	0.03	8.4	A	0.05
		EBT	0.0	A	0.17	0.0	A	0.16
	WB	WBT	0.0	A	0.12	0.0	A	0.19
		WBR	0.0	A	0.03	0.0	A	0.06
	SB	SBL	12.3	B	0.15	15.6	C	0.21
		SBR	12.3	B	0.15	15.6	C	0.21
	Overall Intersection		**2.6**	**A**	**0.27**	**2.6**	**A**	**0.33**
Teston Road at Kipling Avenue (Unsignalized)	EB	EBLTR	0.3	A	0.01	0.5	A	0.01
	WB	WBLTR	0.0	A	0.00	0.1	A	0.00
	NB	NBLTR	12.1	B	0.01	16.8	C	0.02
	SB	SBLTR	12.5	B	0.18	16.9	C	0.06
	Overall Intersection		**2.2**	**A**	**0.41**	**0.8**	**A**	**0.35**

Based on the intersection capacity analyses results presented in

Table 4-7, the two intersections within the study area are operating at overall LOS A.

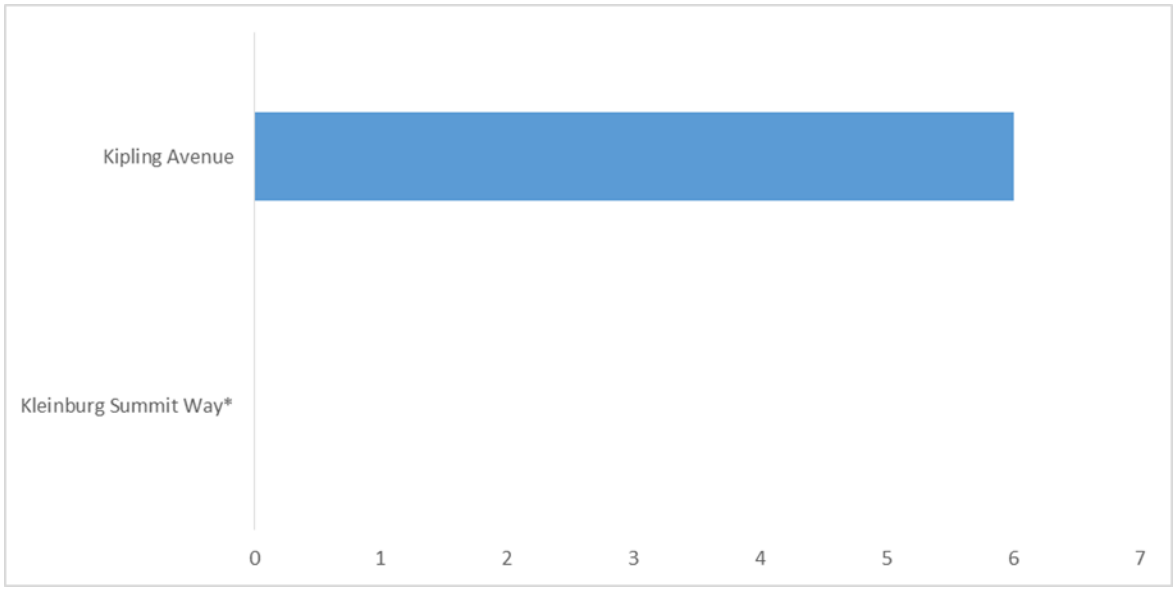
4.6 Traffic Collision Review

Intersection collision data was provided by York Region and City of Vaughan for collisions spanning the five years between January 1, 2015 and December 31, 2019.

4.6.1 Total Collisions

A total of 6 collisions were reported for the intersection at Teston Road and Kipling Avenue as summarized in **Figure 4-6**. It is noted that no data is available for the intersection at Teston Road and Kleinburg Summit Way and 13 mid-block collisions were also identified between Kleinburg Summit Way and Pine Valley Drive.

Figure 4-6: Number of Collisions by Intersection (2015-2019)



(*) Data not available

Collisions were analyzed by year, weekday, month of occurrence, severity, initial impact type, environmental condition, and light condition to identify trends and patterns in the collisions.

4.6.2 Study Area Collisions

Overall collision statistics for the mid-block between Kleinburg Summit Way and Pine Valley Drive are provided in **Figure 4-7**. As shown, the number of collisions has increased since 2015. The majority of collisions are single-vehicle collisions with a relatively high number of collisions resulting from loss of control (27%) and animal (deer) (18%) collisions.

Figure 4-7: Kleinburg Summit Way to Pine Valley Drive Mid-block Collisions (January 2015 to December 2019)

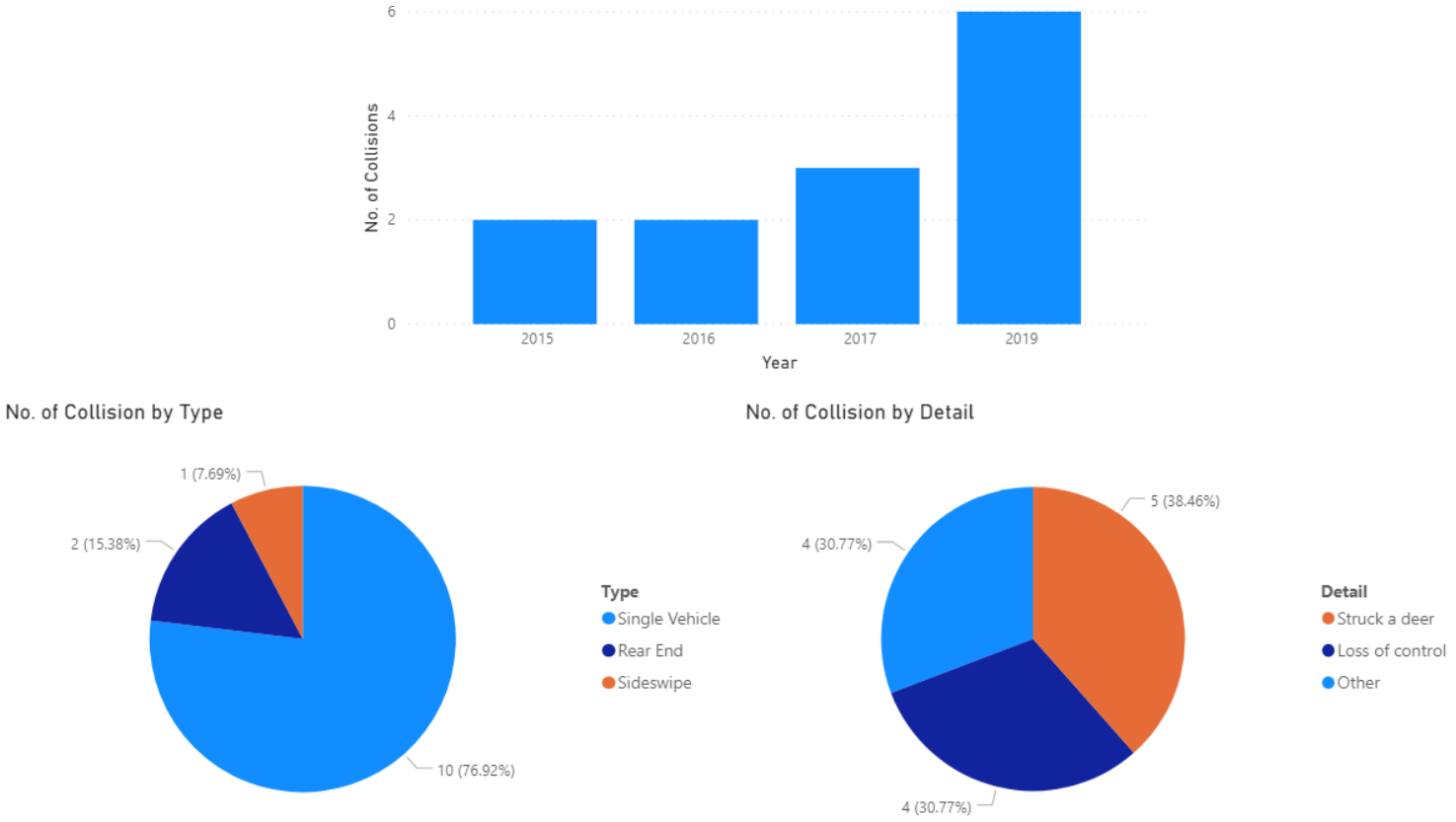
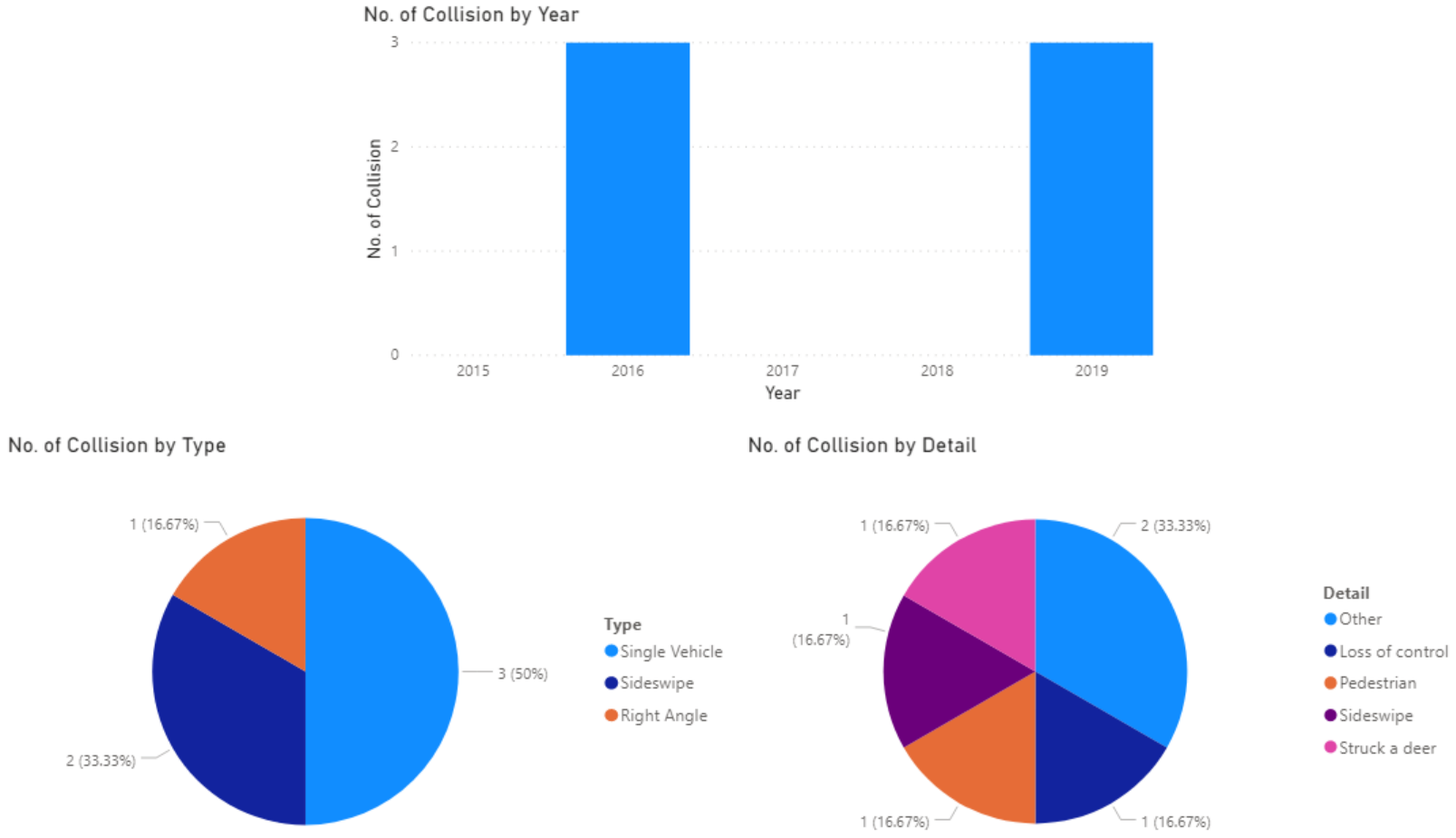


Figure 4-8 illustrates the number of collisions at the intersection at Teston Road and Kipling Avenue. As shown in the figure, there has been an equal number of collisions in both 2016 and 2019, with half involving only a single vehicle.

Figure 4-8: Kipling Avenue Intersection Collisions (January 2015 to December 2019)



4.6.3 Average Collision Rate

Average collision rates were calculated to identify any critical intersection that would not have been otherwise identified due to the low number of collisions at the study intersections. Collision rates per million vehicle-kilometres (MVK) for each of the intersections is calculated using the following formula:

$$Intersection\ Collision\ Rate = \frac{Number\ of\ Collisions\ \times 1{,}000{,}000}{AADT\ \times 365\ \times Years}$$

For this calculation, the Annual Average Daily Traffic (AADT) was estimated to be ten times the average of the AM and PM peak hour volumes. The collision rate for the study intersections is presented in **Table 4-8**.

Table 4-8: Average Collision Rates of Intersections

Intersection	Total Collisions (2015-2019)	Intersection Collision Rate
Teston Road & Kipling Avenue	6	1.10
Teston Road & Kleinburg Summit Way*	n/a	n/a

(*) Data not available

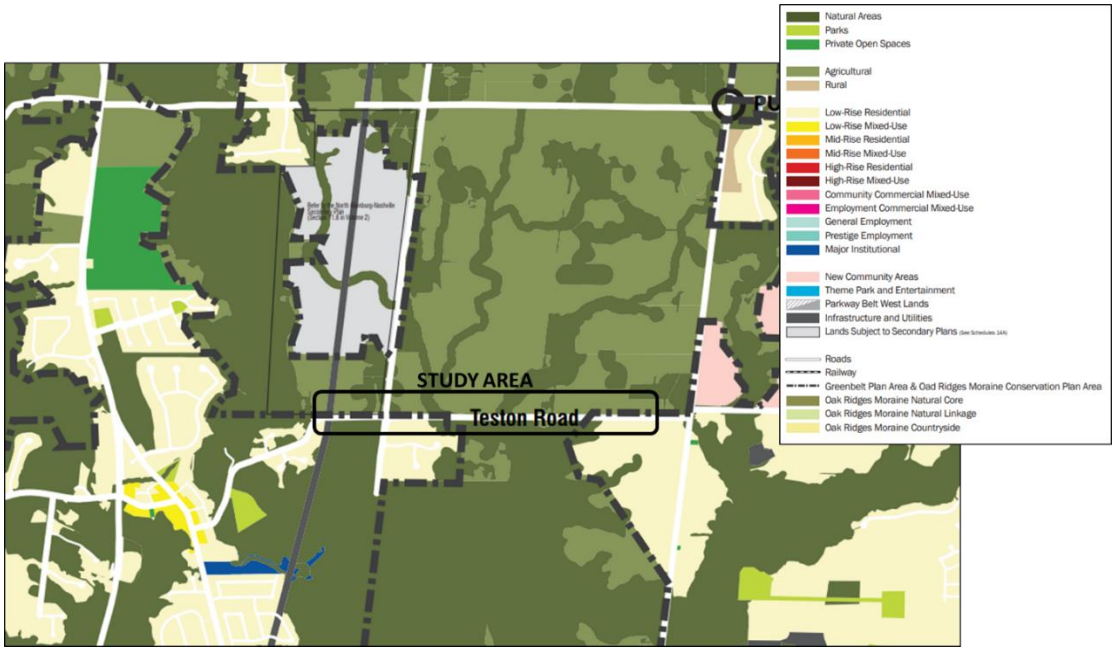
4.7 Future Transportation Conditions

This section presents the analysis methodology and results for operations under future conditions. The future conditions horizon year is 2031, consistent with NVNCTMP, with a sensitivity analysis for the year 2041, which is the ultimate horizon year for the Teston Road EA study. Travel demand in the study area was forecast using the Regional travel demand model. Intersection operational performance analysis was conducted using Synchro/SimTraffic.

4.7.1 Land Use and Future Development Context

Land uses adjacent to Teston Road through the study limits currently consist of the Greenbelt, natural areas with agricultural land, as well as low-rise residential houses located on the southeast corner of Teston Road and Kipling Avenue. **Figure 4-9** shows the future planned land use designations along the corridor and surrounding area as identified in the Vaughan Official Plan. Future development in Blocks 47 and 55 are adjacent to the study corridor.

Figure 4-9: Land Use – Schedule 13 Official Plan (2019)



2031 Population and Employment Growth

The 2031 population and employment forecasts for this study are consistent with the NVNCTMP, and the breakdown by traffic zone in the travel demand model for the Teston Road EA secondary study area are presented in **Table 4-9**. York Region's interim 45% intensification land use scenario is being used in this analysis and it is noted that York Region is currently undertaking a Municipal Comprehensive Review, which will update the Regional population and employment growth forecasts to align with new targets set forth by the 2017 Provincial Growth Plan Amendment.

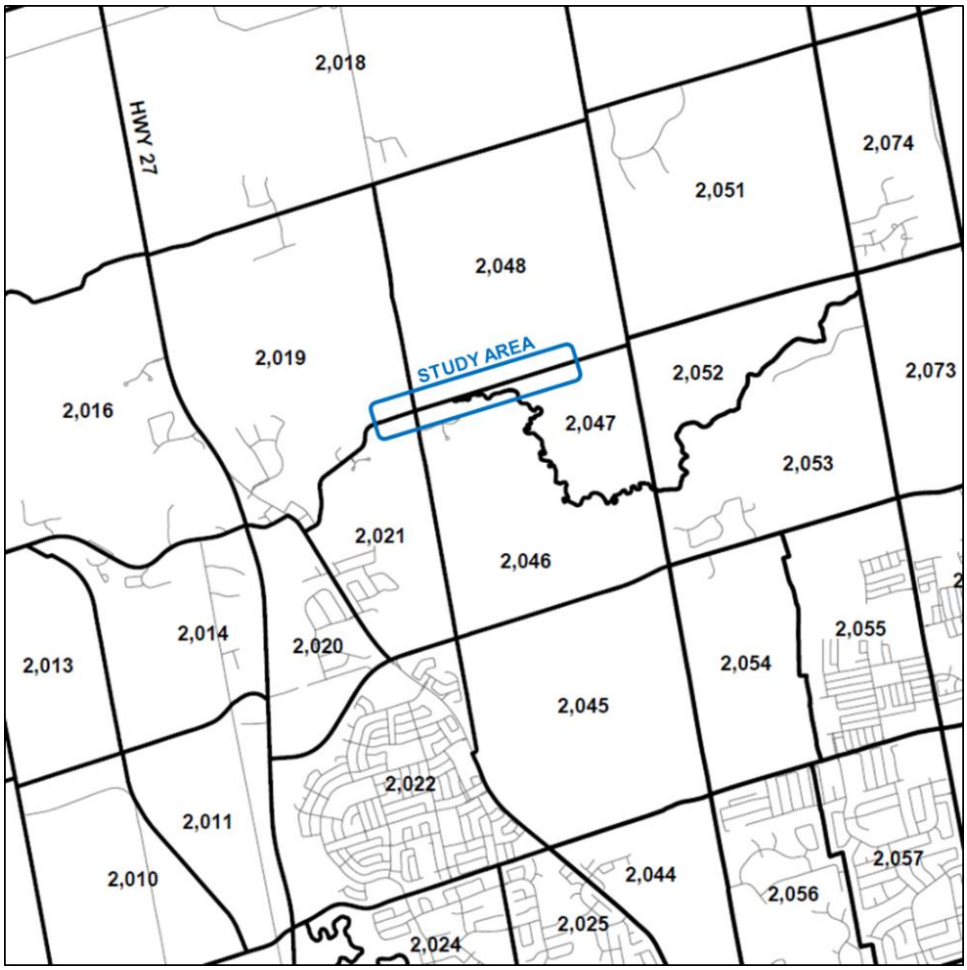
Table 4-9: Secondary Study Area Population and Employment, 2011 and 2031

Traffic Zone	Planning Block	2011 Population	2031 Population	2011 Employment	2031 Employment
2019	55	1,348	3,465	387	373
2020	54	1,209	3,465	419	373
2021	54	799	1,304	172	486
2046	47	93	36	5	115
2047	47	19	90	1	5
2048	48	93	2,542	104	144
2051	41	279	10,180	52	1,982
2052	40	0	3,167	0	451
2053	40	1,810	8,954	63	1,316
TOTAL	**-**	**5,650**	**33,203**	**1,203**	**5,245**

Source: NVNCTMP October 2019, York Region 45% Intensification Scenario

A map of the traffic zones in the study area is shown in **Figure 4-10**.

Figure 4-10: Traffic Zones within the Study Area



Source: University of Toronto – Data Management Group – 2006 Traffic Zone Boundaries

4.7.2 Emme Travel Demand Model Calibration

The Emme travel demand model includes a 2011 base year and a future horizon year of 2031. The 2011 model was compared against observed traffic volumes at locations across “screenlines” to understand the model’s ability to replicate actual traffic patterns.

Calibration Methodology

The modelled link volumes from the Emme model were compared to the observed turning movement counts using the ratio of model to observed traffic and GEH statistic, which is an empirical formula named after its inventor, Geoffrey E. Havers, who developed it in the 1970s.

The GEH statistic is able to address both the absolute and relative difference between the modelled and observed volume. It avoids some pitfalls that occur when simply using the relative difference, primarily by allowing for greater variance between modelled and observed data at lower values but requiring lesser variance at higher values.

The GEH statistic is calculated as:

$$GEH = \sqrt{\frac{2(M-C)^2}{M+C}}$$

Where M is the hourly modelled volume and C is the observed volume (count).

A GEH value less than 5 is considered a good match between the modelled and observed volume; a value between 5 and 10 is acceptable; and a value higher than 10 usually requires further attention for model calibration. Typically, when 80% to 85% of GEH values are less than 5, it is considered as very close match between the modelled and observed volume.

Through an iterative process, modifications to the network assumptions were made to improve model calibration. Specifically, the capacity assumption on Major Mackenzie Drive, from Islington Avenue to Highway 27, was increased from 700 vehicles per hour per lane to 900 vehicles per hour per lane, to be consistent with the other segments of Major Mackenzie Drive.

The GEH and the model to observed traffic volume ratio are provided in **Table 4-10** for east-west traffic and in **Table 4-11** for north-south traffic.

Table 4-10: East-West Traffic Model to Observed Comparison

East-West Traffic Screenline: East of Highway 27	AM Peak Hour Volumes - Peak Direction WB			
	2011 Counts	2011 Model	Model / Observed	GEH
Kirby Rd	143	224	1.57	6
Teston Rd	299	177	0.59	8
Major Mackenzie Dr	657	762	1.16	4
Total	**1,099**	**1,163**	**1.06**	**2**
West of Weston Road				
Kirby Rd	63	144	2.29	8
Teston Rd	253	157	0.62	7
Major Mackenzie Dr	1,199	902	0.75	9
Total	**1,515**	**1,203**	**0.79**	**8**
Legend				
Model / Observed within 25%				
GEH <= 10				

Table 4-11: North-South Traffic Model to Observed Comparison

North-South Traffic Screenline: North of Teston Road	AM Peak Hour Volumes - Peak Direction SB			
	2011 Counts	2011 Model	Model / Observed	GEH
Hwy 27	1,110	909	0.82	6
Kipling Ave	198	159	0.80	3

North-South Traffic Screenline: North of Teston Road	AM Peak Hour Volumes - Peak Direction SB			
	2011 Counts	2011 Model	Model / Observed	GEH
Pine Valley Dr	198	270	1.36	5
Total	**1,506**	**1,338**	**0.89**	**4**
North of Major Mackenzie Drive				
Hwy 27	1,206	1,380	1.14	5
Islington Ave	558	698	1.25	6
Pine Valley Dr	299	285	0.95	1
Total	**2,063**	**2,363**	**1.15**	**6**
Legend				
Model / Observed within 25%				
GEH <= 10				

4.7.3 2031 Travel Demand Forecasting

The York Region travel demand forecasting model used for the NVNCTMP was utilized for this study. The model includes all Regional road and transit improvements by 2031 as per the York Region TMP, with the following exceptions:

- No GTA West Corridor Freeway
- No new freeway interchange at Kirby Road at Highway 400
- No new freeway interchange at 19th Avenue at Highway 404

These improvements are unlikely to be in place by 2031 and the decision was made to exclude these improvements in the analysis for 2031.

Screenline Analysis

To assess the current level of traffic congestion on roadways throughout the study area, a link (road segment) and screenline (grouping of road segments) volume-to-capacity (v/c) analysis was conducted. The link volume describes the number of cars that travel along a specific segment of the network over a period of time and is collected through traffic counts in the field. These link volumes were divided by the capacity of the roadway to develop v/c ratios for each roadway link during the AM peak hour. Road network conditions at the mid-block or link level were also assessed using the v/c ratios and are shown in **Table 4-13**. The v/c ratio reflects peak hour traffic demand measured against roadway capacity. A description of the v/c ratios is provided in **Table 4-12**.

Table 4-12: Link V/C Ratios and Operating Condition

V/C 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 queuing

V/C Ratio	Level of Service (LOS)	Operating Condition
Greater than 1.00	LOS F	Over capacity, severe delays, and queuing

For a particular link or screenline, a v/c ratio of less than 0.85 represents near free flow conditions in which little delay is experienced. Between 0.86 and 0.99, as the link approaches capacity, a moderate to high amount of delay is experienced. Above 0.99, the link is at capacity, and major delays and queuing are occurring consistently during the peak periods. The capacity of roadways within the study area are based on the roadway type definitions from the York Region model and are a function of the existing roadway conditions including free-flow speed and density of access points.

A screenline capacity analysis was completed for Teston Road and the two parallel arterial roads, Kirby Road and Major Mackenzie Drive. **Table 4-13** summarizes the screenline analysis.

Table 4-13: Screenline Analysis

Screenline:	AM Peak Hour Volume		Capacity		V/C Ratio	
East of Highway 27	Existing	2031 Model	Existing	2031 Model	Existing	2031 Model
Kirby Rd	224	311	700	900	0.32	0.35
Teston Rd	177	189	700	700	0.25	0.27
Major Mackenzie Dr	762	1,717	900	2,700	0.85	0.64
Total	986	2,028	1,600	3,600	0.62	0.56
West of Weston Road						
Kirby Rd	144	510	700	900	0.21	0.57
Teston Rd	157	1,133	700	1400	0.22	0.81
Major Mackenzie Dr	902	2,130	900	2,700	1.00	0.79
Total	1,046	2,640	1,600	3,600	0.65	0.73

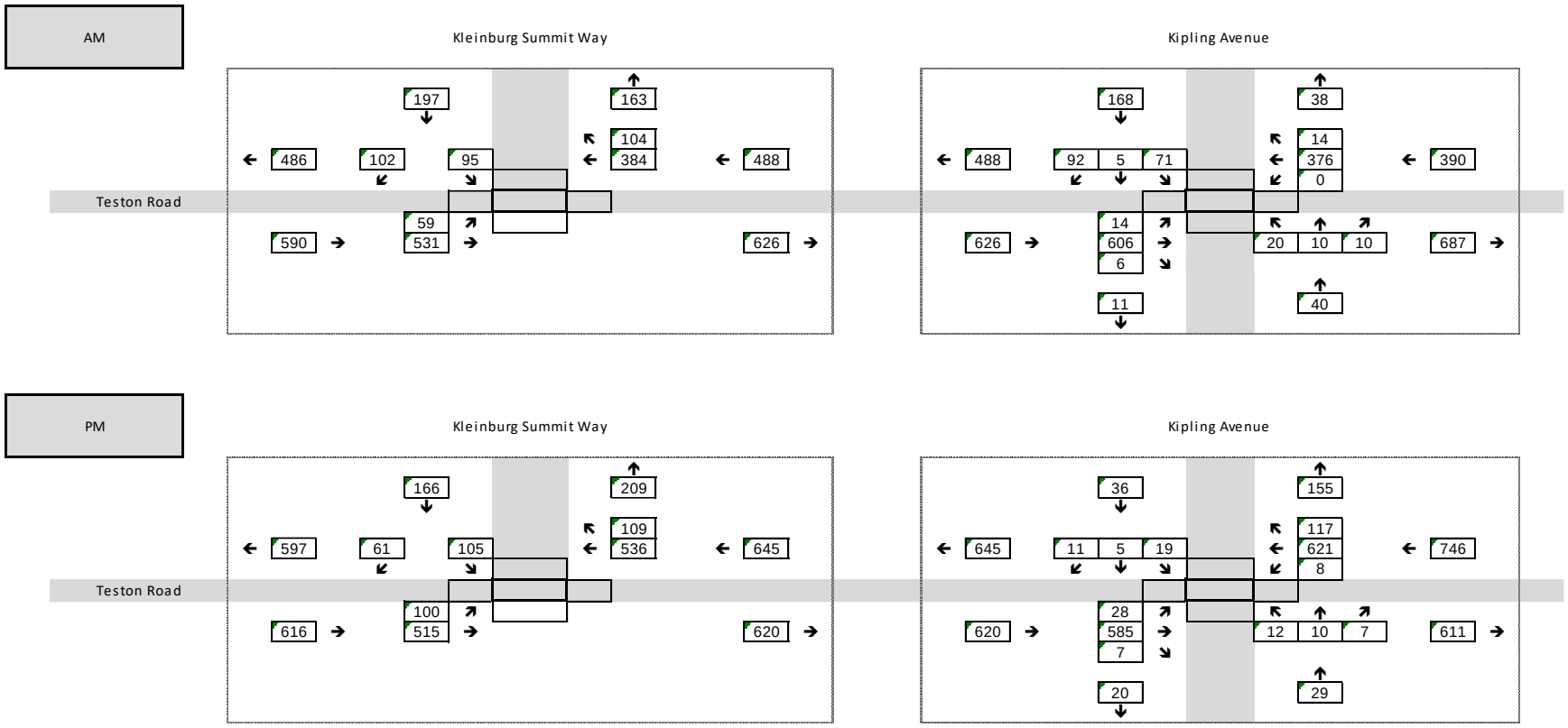
Based on projected demand by 2031, the screenline locations are operating below capacity in 2031and therefore no additional capacity is required along the study corridor.

Intersection Volumes

Once the model was refined, 2011 to 2031 traffic growth (AM peak hour) was extracted from the refined model and applied to observed turning movement counts (TMCs) along Teston Road. A two-lane cross-section (no widening for Teston Road) was assumed in model runs that generated the growth rates.

Various adjustments were then made to observe traffic counts to account for the re-distribution of traffic and balancing along Teston Road. **Figure 4-11** illustrates forecast traffic volumes at key study area intersections.

Figure 4-11: Future (2031) Turning Movement Volumes



4.7.4 2031 Intersection Operations Analysis

Synchro/SimTraffic 9 was utilized to conduct a Highway Capacity Manual (HCM) and queue analysis at each intersection. A detailed assessment, including level of service (LOS), delay, volume to capacity (v/c) ratios, as well as queue and storage length analysis for turn lanes, was conducted at the study intersections for AM and PM peak hours**.**

The traffic operational analysis results for the intersections along Teston Road are summarized in **Table 4-14**. Critical delays (LOS E or F) and v/c ratios greater than 1.00 are highlighted. Detailed Synchro reports are provided in **Appendix D**.

Table 4-14: Synchro Results – 2031

Intersection		Approach/ Movement	AM Peak Hour			PM Peak Hour		
			Delay (s)	LOS	v/c	Delay (s)	LOS	v/c
Teston Road at Kleinburg Summit Way (Unsignalized)	EB	EBL	8.7	A	0.06	9.5	A	0.12
		EBT	0.0	A	0.34	0.0	A	0.33
	WB	WBT	0.0	A	0.25	0.0	A	0.34
		WBR	0.0	A	0.07	0.0	A	0.07
	SB	SBL	28.8	D	0.56	89.2	F	0.94
		SBR	28.8	D	0.56	89.2	F	0.94
	Overall Intersection		**4.8**	**A**	**0.40**	**11.0**	**B**	**0.50**
Teston Road at Kipling Avenue (Unsignalized)	EB	EBLTR	0.4	A	0.02	1.3	A	0.05
	WB	WBLTR	0.0	A	0.00	0.3	A	0.01
	NB	NBLTR	31.1	D	0.22	0.20	E	0.20
	SB	SBLTR	36.6	E	0.63	43.5	E	0.29
	Overall Intersection		**6.1**	**A**	**0.60**	**2.4**	**A**	**0.59**

Based on the intersection capacity analyses results presented in **Table 4-14**, the intersections within the study area are operating at overall LOS B or better. Traffic signals may be installed at the intersections to improve the operations. Based on the projected volumes, signals are not warranted, however, they are recommended to provide opportunity for pedestrian crossings and improve pedestrian safety at the intersections.

The traffic operational analysis results for the intersections along Teston Road are summarized in **Table 4-15**. Critical delays (LOS E or F) and v/c ratios greater than 1.00 are highlighted. Detailed Synchro reports are provided in **Appendix D**.

Table 4-15: Synchro Results – 2041

Intersection	Approach/ Movement		AM Peak Hour			PM Peak Hour		
			Delay (s)	LOS	v/c	Delay (s)	LOS	v/c
Teston Road at Kleinburg Summit Way (Unsignalized)	EB	EBL	9.1	A	0.08	10.3	B	0.16
		EBT	0.0	A	0.40	0.0	A	0.39
	WB	WBT	0.0	A	0.30	0.0	A	0.41
		WBR	0.0	A	0.08	0.0	A	0.08
	SB	SBL	140.8	F	1.14	588.6	F	2.11
		SBR	140.8	F	1.14	588.6	F	2.11
	Overall Intersection		**24.3**	**C**	**0.47**	**76.9**	**F**	**0.58**
Teston Road at Kipling Avenue (Unsignalized)	EB	EBLTR	0.6	A	0.02	2.0	A	0.07
	WB	WBLTR	0.0	A	0.00	0.3	A	0.01
	NB	NBLTR	48.9	E	0.40	77.2	F	0.40
	SB	SBLTR	211.6	F	1.29	103.2	F	0.61
	Overall Intersection		**34.2**	**D**	**0.76**	**5.1**	**A**	**0.69**

Based on the intersection capacity analyses results presented in **Table 4-15**, the intersections within the study area require the installation of traffic signals which are anticipated to significantly improve the traffic operation to LOS C and better at both intersections.

4.7.5 Future Transit and Active Transportation Conditions

As documented in **Section 4.1.2**, there is no existing transit service along the study corridor. There are also no known plans for future transit service along the study corridor based on the information available at the time of this EA.

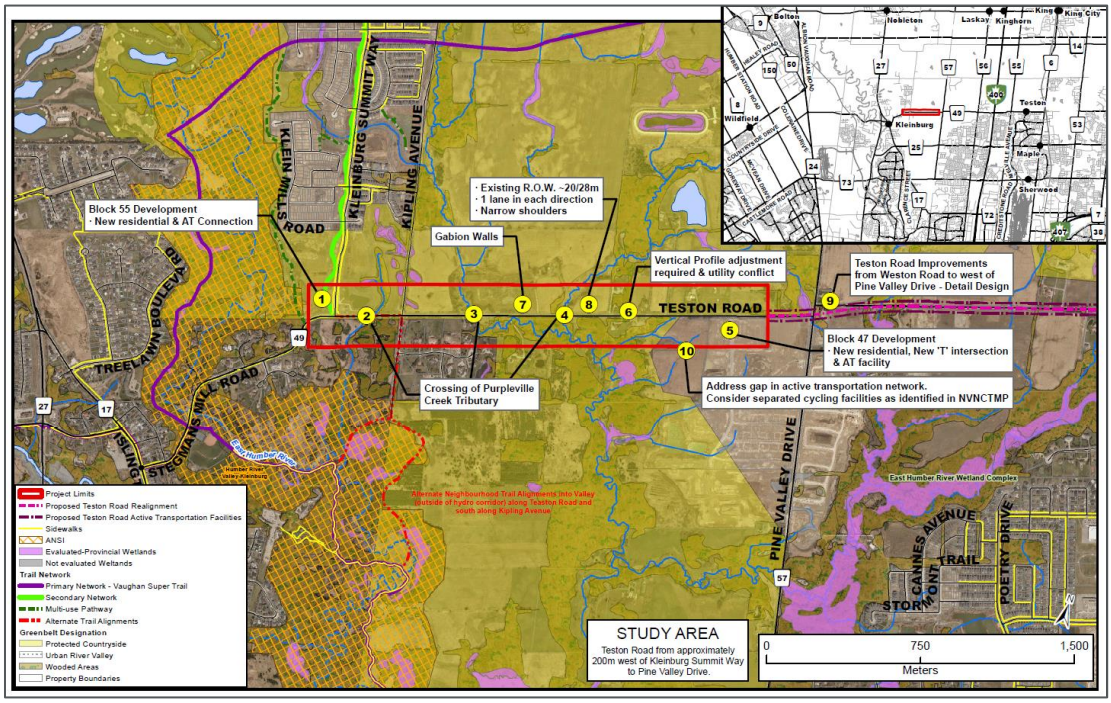
As noted in **Section 3.3.4**, the City's Pedestrian and Bicycle Master Plan (PBMP) Update is developing a visible and connected pedestrian and cycling network in Vaughan that integrates, enhances and expands the existing on- and off-road pedestrian and cycling facilities. While the PBMP did not identify cycling facilities on Teston Road, the City of Vaughan policy is to explore active transportation facilities on all arterial roads. Sidewalks and cycling facilities will be considered across the entire study corridor in the next phase of the study. York Region's Teston Road (Pine Valley Drive to Weston Road) detailed design will implement a multi-use path on the south side of Teston Road between Weston Road and 250m west of Pine Valley Drive. There are opportunities to provide a facility along the current Teston Road study corridor to tie into this soon-to-be constructed facility to provide continuity with the adjacent segment.

5 Physical and Environmental Constraints

5.1 Overview of Existing Features and Constraints

The existing features and constraints are shown in **Figure 5-1**.

Figure 5-1: Existing Features and Constraints

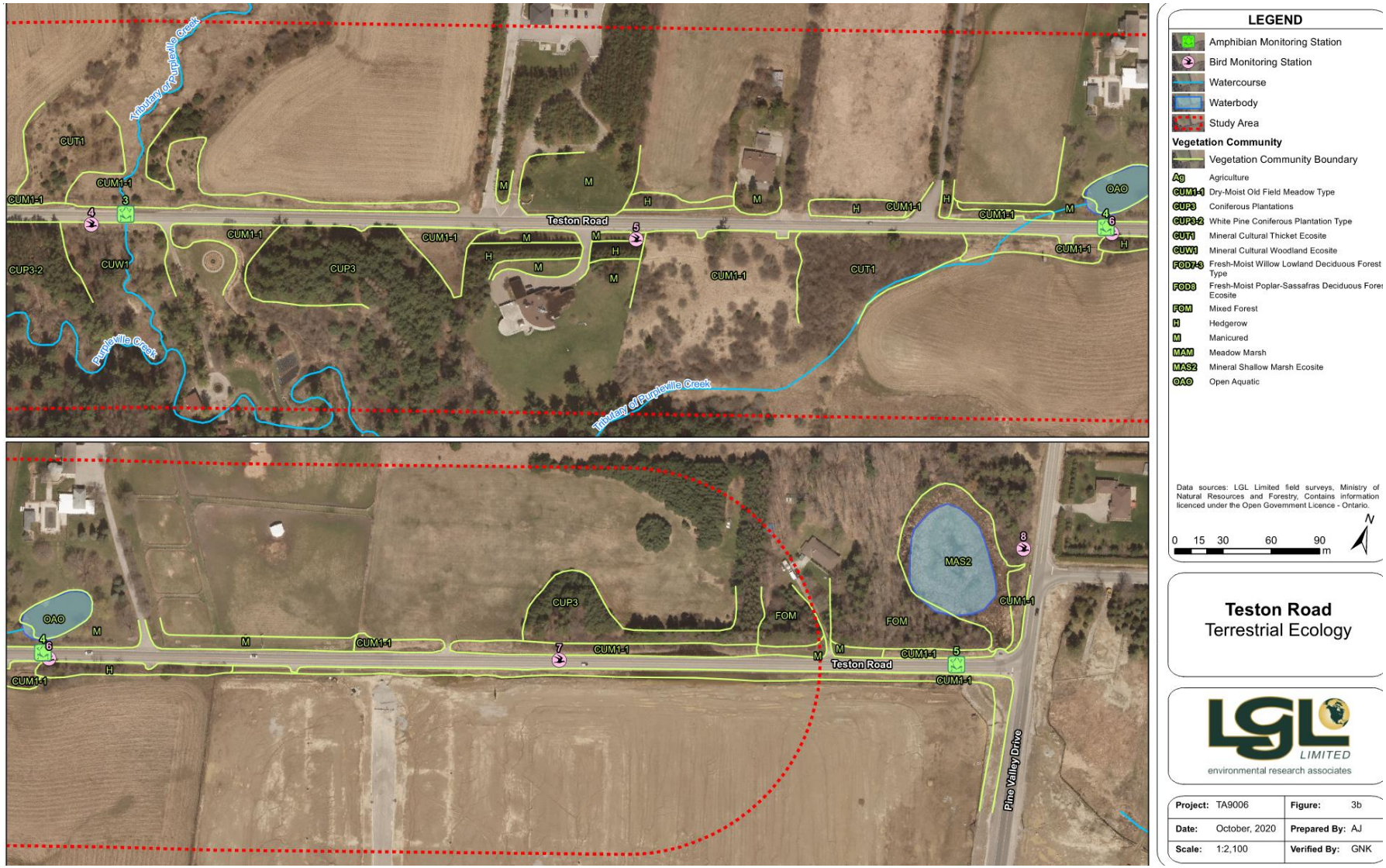


5.2 Natural Environment

This section describes the existing natural heritage conditions in the study area including: physiography, bedrock and surficial geology and soils; fish and fish habitat; vegetation and vegetation communities; wildlife and wildlife habitat; and, designated natural areas. Please refer to **Appendix A** for the Natural Environmental Report. The natural environmental constraints are presented in **Figure 5-2** and **Figure 5-3**.

Figure 5-2: Natural Environmental Constraints (1 of 2)

Figure 5-3: Natural Environmental Constraints (2 of 2)



5.2.1 Physiography, Bedrock and Surficial Geology and Soils

A secondary source investigation was undertaken to identify physiography, bedrock and surficial geology and agricultural soils within the study area. The study area is located within the South Slope physiographic region. The South Slope is characterized by low-lying, fine-grained, undulating ground moraine and knolls. The till is part of the Halton Till layer which has low permeability and groundwater infiltration is limited.

Bedrock geology comprises the Georgian Bay Formation consisting of interbedded grey-green to dark grey shale and fossiliferous calcareous siltstone to limestone of Upper Ordovician age. The quaternary geology includes Halton Till comprised of brown loam to silt loam till glacial deposits, Modern Alluvium comprised of silt, sand and gravel fluvial deposits, Deltaic and Lacustrine Sand comprised of sand, some silt and gravel glaciolacustrine deposits, and Lacustrine-Wildfield Complex comprised of glaciolacustrine deposits of stratified or non-stratified silt loam, silty clay loam or clay deposits which may contain grits and pebbles, interbedded with till-like materials and often high in carbonate content (MRNF 2019). The Lacustrine-Wildfield Complex occurs as thin discontinuous veneer over Wildfield Till (deposits of glacial Lake Eversley) (MRNF 2019).

The agricultural soils found within the study area are a mix of different soils comprised of King Clay loam, Peel Clay, Bottom Land and Pontypool Sandy loam. Both King Clay loam and Pontypool Sandy loam soils are considered to drain well, while Peel Clay soils have ‘imperfect’ drainage, and Bottom Land soils have poor drainage, according to the Ontario Soil Survey Complex (MNRF 2019).

5.2.2 Fish and Fish Habitat

A secondary source investigation and field surveys were carried out to characterize fisheries and aquatic ecosystems within the study area. The study area is located in the East Humber River watershed and the Purpleville Creek and East – Nobleton to Kleinburg subwatersheds. All watercourses lie within the jurisdiction of the Toronto and Region Conservation Authority (TRCA) and the Ministry of Natural Resources and Forestry (MNRF), Aurora District Office. There are four watercourses that cross Teston Road within the study area including: Tributary of the East Humber River, Purpleville Creek, and two Tributaries of Purpleville Creek.

TRCA (2005) reports that the Tributary of the East Humber River is found in Fisheries Management Zone 3, a small riverine warmwater thermal regime with Redside Dace and Rainbow Darter as target fish species. Purpleville Creek and its tributaries are found in Fisheries Management Zone 4, a small riverine coldwater thermal regime with Brook Trout, Redside Dace and Rainbow Trout as target fish species.

The NHIC database (MNRF 2020) and the DFO Aquatic Species at Risk mapping (DFO 2020) indicate that Purpleville Creek and its tributary are habitat for Redside Dace. If these watercourses are occupied habitat, these areas are likely only seasonally used by this species, as Purpleville Creek has intermittent flows and the tributary has limited habitat.

5.2.3 Vegetation and Vegetation Communities

The geographical extent, composition, structure and function of the vegetation communities were identified through air photo interpretation and field investigations. Air photos were interpreted to determine the limits and characteristics of the vegetation communities in the study area. Multi-season botanical field investigations were undertaken within the study area on June 11, July 22, and August 28, 2020. The field investigations of the vegetation communities were undertaken within the Teston Road right-of-way and adjacent habitat, to the extent possible.

The vegetation communities were classified according to the Ecological Land Classification for Southern Ontario: First Approximation and Its Application (Lee et al. 1998). A plant list and a description of the general structure of vegetation were obtained during the field investigations. Plant species status was reviewed for Ontario (Oldham 2009), York Region (Riley 1989 and Varga 2000), and the Toronto and Region Conservation Authority (TRCA 2009). Vascular plant nomenclature follows Newmaster et al. (1998) with a few exceptions that have been updated to Newmaster et al. (2005).

Vegetation communities located within the study area consist of a mixture of wetland, forest and cultural communities. A total of eleven Ecological Land Classification (ELC) vegetation community types were identified within the study area including: Open Aquatic (OAO), Mineral Shallow Marsh (MAS2), Meadow Marsh (MAM), Mixed Forest (FOM), Fresh-Moist Poplar-Sassafras Deciduous Forest (FOD8), Fresh-Moist Lowland Willow Deciduous Forest (FOD7-3), Coniferous Forest (CUP3), White Pine Coniferous Forest (CUP3-2), Dry-Moist Old Field Meadow (CUM1-1), Mineral Cultural Woodland (CUW1), and Mineral Cultural Thicket (CUT1). All of the vegetation communities identified within the study area are considered widespread and common in Ontario and are secure globally.

The natural/semi-natural features within the study area consist of wetland and forest communities. The wetland communities within the study area are generally associated with the riparian areas of the watercourses with the exception of a large shallow marsh community (MAS2) located east of the study area on the west side of Pine Valley Drive. This shallow marsh community is identified as Provincially Significant Wetland and supports a large diversity of native plant species. The wetlands are considered to be moderate quality shallow marsh and meadow marsh communities. A large deciduous forest community is located on the south side of Teston Road and is associated with Purpleville Creek. This community is part of a larger forest community that extends beyond the study area and is considered to be of moderate to higher quality. A mixed forest community was identified on the north side of Teston Road and is considered to be of moderate quality. In general, the forest communities within the study area support a higher proportion of native plant species.

The cultural vegetation communities within the study area contained a high proportion of non-native plant species that are well adapted to persist in areas that are regularly disturbed including species that are adapted to high light conditions, limited soil moisture and species that are tolerant of salt spray. The cultural vegetation communities within the study area are considered to be low quality.

There are several areas that are not identified as ELC vegetation communities including manicured areas (M) which include mown lawns, gardens and planted trees, and

hedgerows (H), which includes trees that have been planted or that have been maintained for the purposes of preserving windbreaks between agricultural fields and screens between residential units and local roadways.

A total of 143 plant species have been recorded within the study area. One of these plants could only be identified to genus and are not included in the following calculations. Of the 142 plant species identified, 80 (56%) plant species identified are native to Ontario and 62 (44%) plant species are considered introduced and non-native to Ontario.

No plant species that are regulated under the Ontario Endangered Species Act (ESA) or the Canada Species at Risk Act (SARA) were encountered during the botanical investigation within the study area (those plant species regulated as Endangered, Threatened, or Special Concern).

A review of the MNRF Natural Heritage Information Centre (2020) identified records of butternut (Juglans cinerea) within the vicinity of the study area. Butternut is regulated as Endangered under the ESA. No butternut individuals were identified during the botanical field investigation.

Two plant species that are rare in York Region and three plant species that are TRCA species of concern were identified within the study area.

5.2.4 Wildlife and Wildlife Habitat

A secondary source investigation and field surveys were carried out to characterize wildlife and wildlife habitat within the study area. The Study Area falls within a mostly rural area with very few houses adjacent to the road, but the road frequently has high traffic volume of motorists passing through. All wildlife surveys were completed from the Teston Road right-of-way, and therefore may under-represent species that are typically found further away from roads.

Northeast of the junction of Teston Road and Kleinburg Summit Way is an area of land that has been re-naturalized with wetlands, grasses, trees and shrubs. Although the trees are still young, herbaceous vegetation has been successfully established and now provides wildlife habitat already being used by various species that are quick to inhabit new areas, like Red-winged Blackbirds (Agelaius phoeniceus), Green Frog (Lithobates calamitans) and muskrat (Ondatra zibethicus). A natural area of forest and wetland is also present northwest of Teston and Pine Valley Drive, used by many wildlife species. Tributaries of the East Humber River and Purpleville Creek cross Teston Road at four locations, where riparian habitat is provided for wildlife and a potential movement corridor. Between these areas, north of Teston Road is predominantly agricultural land, but some of the hay and pasture fields provide grassland habitat.

South of Teston Road, there are forested areas west of Kipling Avenue and between Kipling Avenue and Pine Valley Drive, where wildlife can seek refuge, breeding habitat and movement across the landscape. The area southwest of Teston Road at Pine Valley Drive is currently under development as a residential area but was open mud with very little vegetation or habitat at the time of investigation. While the construction area provides little habitat for wildlife, tracks are easily visible and some species such as Killdeer (Charadrius vociferus) will readily use the mudflats for nesting and other shorebirds will stop at these types of areas while on migration.

Bindertwine Park and Glassco Park are south of Teston Road, within which there are extensive natural areas that host a broad diversity of wildlife. Natural areas such as these are likely the source of many existing wildlife and SAR records for the area. These parks were not surveyed for this project because the habitat is unlikely to be disturbed directly for this project.

The Study Area falls within the southern boundary of Ecoregion 6E-7: Mixedwood Plains, Lake Simcoe-Rideau. The Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E describe 38 habitat types that are considered significant within four categories. There is no habitat which meets the criteria or Rare Vegetation Communities or Animal Movement Corridors, although the East Humber River may function as a movement corridor. Seasonal Concentration Areas of Animals include 16 types, of which there is the potential for candidate Raptor Wintering Area and Bat Maternity Colonies. Specialized Habitat for Wildlife includes eight types, of which there are no candidate habitat identified within the Study Area. The wetland at the northwest corner of Teston Road and Pine Valley Drive (Frog Station 5) meets the criteria for Significant Amphibian Breeding Habitat (Woodland) but is outside of the Study Area.

There are five categories of Habitat for Species of Conservation Concern, of which there are none identified within the Study Area. Although there are some indicator bird species for Open Country and Shrub/Early Successional Bird Breeding Habitats, the fields are regularly disturbed by agricultural activities and the remnant areas are not large enough to be considered candidate Significant Wildlife Habitat (SWH).

Candidate Raptor Wintering Area is a combination of fields and woodlands that comprise at least 30 hectares. Several of the fields north of Teston Road would be suitable for winter use by raptors and are located adjacent to woodlands of various types and sizes. The riparian habitat associated with the East Humber River also contributes to this habitat. An evaluation of significant wildlife habitat based on winter raptor surveys was not completed.

Bat Maternity Colonies may exist within the woodlands that are adjacent to Teston Road and within the Study Area, even if the bat roosts themselves are not at the road where they may be disturbed by the development. Survey access was only available for the roadside, so it was not possible to determine the overall habitat quality for bat maternity roosting and no targeted bat surveys were completed. Based on field observations and secondary source data from TRCA, 62 species of wildlife could be verified in the study area and the majority of these records came from identification (through calls and sightings) of bird species with more modest numbers of herpetofauna and mammal species identified. This includes 48 birds, 7 mammals, 6 amphibians and 1 reptile, discussed in more detail below. The wildlife assemblage is, for the most part, typical of rural settings and includes wildlife species that are tolerant of human activity and habitat disturbance.

Of the 48 bird species recorded, 39 are protected under the Migratory Birds Convention Act (MBCA) and two bird species are protected under the Fish and Wildlife Conservation Act (FWCA). Seven bird species are not afforded any legislative protection. All seven of the recorded mammal species are afforded protection under the FWCA and one of the amphibians is protected under the FWCA.

Anuran breeding evidence was documented for four species during 2020 surveys. Vocalizing male American Toad (Anaxyrus americanus), Gray Treefrog (Hylaversicolor), Spring Peeper (Pseudacris crucifer), and Green Frog (Rana clamitans) were noted within the study area or in the immediate vicinity. In addition to these species documented during the anuran breeding surveys, Western Chorus Frog (Pseudacris maculata) and the Wood Frog (Lithobates sylvatica) were also previously recorded by the TRCA. Midland Painted Turtle was also observed within the Study Area on other surveys.

The study area contained a moderate number of breeding bird species representing several habitat types. Forty-six bird species were observed during the Breeding Bird Surveys, with varying evidence of breeding success across the study area. Of these 46 species, breeding evidence was confirmed in one, probable for seventeen species, possible for twenty species and three species were observed with no indication of breeding (see Table 8).

Confirmed breeding by bird species was documented based on used nests, including species such as the Red-winged Blackbird (Agelaius phoeniceus). The species most frequently recorded were the American Robin (Turdus migratorius) and Song Sparrow (Melospiza melodia), both of which were recorded at all eight monitoring stations. Four species were recorded at seven of the eight stations: American Crow (Corvus brachyrhynchos), Black-capped Chickadee (Poecile atricapilla), Red-winged Blackbird (Agelaius phoeniceus) and American Goldfinch (Spinus tristis).

Data provided by TRCA identified four species previously identified in/near the study area including Bobolink (Dolichonyx oryzivorus), Eastern Meadowlark (Sturnella magna), Blue-winged Warbler (Vermivora pinus) and Field Sparrow (Spizella pusilla).

Of all bird species documented, three are SAR: Bobolink, Eastern Meadowlark and Barn Swallow (Hirundo rustica).

Documentation of mammals were made through visual observation of the animals themselves or tracks and signs of the animals while conducting targeted surveys for other taxonomic groups (i.e. bird surveys). Through these observations, seven species of mammals were observed. A bat was also observed flying over the pond at the frog monitoring station 4, but the species could not be identified because no recording device was used at the time. The mammal species or signs observed include the following:

- Eastern Cottontail (Sylvilagus floridanus);
- Eastern Chipmunk (Tamias striatus);
- Grey Squirrel (Sciurus carolinensis);
- Coyote (Canis latrans);
- Northern Raccoon (Procyon lotor);
- Striped Skunk (Mephitis mephitis); and,
- White-tailed Deer (Odocoileus virginianus).

The study area is located within a rural and agricultural area with residential area nearby where there are houses and other buildings of many different types and ages. Bats, particularly the Big Brown Bat and Little Brown Myotis, are well-adapted to gain access into constructed buildings and use them as maternity roosts. Similarly, these species, as

well as many other bat species, will use trees for roosting. The existing shoulder on this road is very narrow, so there are many trees that are close to or overhang the road. If any buildings or large trees must be removed for the project, they should be investigated further for the presence of bats.

The Study Area has many remnant natural areas that are suitable for wildlife movement, particularly along the East Humber River tributaries. The mammal species documented represent an assemblage that readily utilizes human influenced landscapes. Secondary source data from TRCA did not include any mammals for the study area.

A desktop-based was conducted to review species at risk (SAR), followed by a field survey to determine if suitable habitat exists for each species. The databases were reviewed to determine these constraints include the following:

- Natural Heritage Information Centre (NHIC);
- Bat Conservation International Species Profiles;
- Atlas of the Breeding Birds of Ontario (OBBA);
- eBird;
- iNaturalist;
- Rare Vascular Plants of Ontario (Oldham and Brinker 2009);
- Vascular Plants at Risk in Ontario (Leslie 2018);
- Butterfly Atlas of Ontario; and,
- Bumblebee Watch.

Through the SAR screening 24 species were identified, of which 18 are listed as endangered or threatened under the Ontario Endangered Species Act, 2007 (ESA). Of these, nine species have moderate or high potential or were confirmed to occur in the Study Area.

5.2.5 Designated Natural Areas

Designated natural areas include areas identified for protection by the Ontario Ministry of Natural Resources and Forestry (MNRF), Toronto and Region Conservation Authority, York Region and the City of Vaughan. A review of relevant background data was undertaken to identify designated natural areas within and adjacent to the study.

Provincially Significant Wetlands (PSWs)

Pockets of the East Humber River Provincially Significant Wetland Complex (PSW) are located within or near the study area. Several small pockets are located north of Teston Road at Kipling Avenue and a large pocket is located east of the study area at Pine Valley Drive. These wetland pockets typically comprise shallow marsh community (MAS2) based on the botanical field investigations.

Greenbelt Plan

The entire study area is identified as ‘Protected Countryside’ under the Greenbelt Plan.

York Region Official Plan

Based on a review of the Regional Greenlands System of the York Region Official Plan (2010) the entire study area is within the Regional Greenlands System of York Region. In addition, based on a review of Woodlands the forest and woodland communities within the study area are identified as 'woodland cover'.

City of Vaughan Official Plan

Based on a review of Schedule 2 (Natural Heritage Network) of the City of Vaughan Official Plan (2010), a portion of the study area is identified as 'Core Feature' of the Natural Heritage Network of the City of Vaughan.

TRCA Terrestrial Natural Heritage System

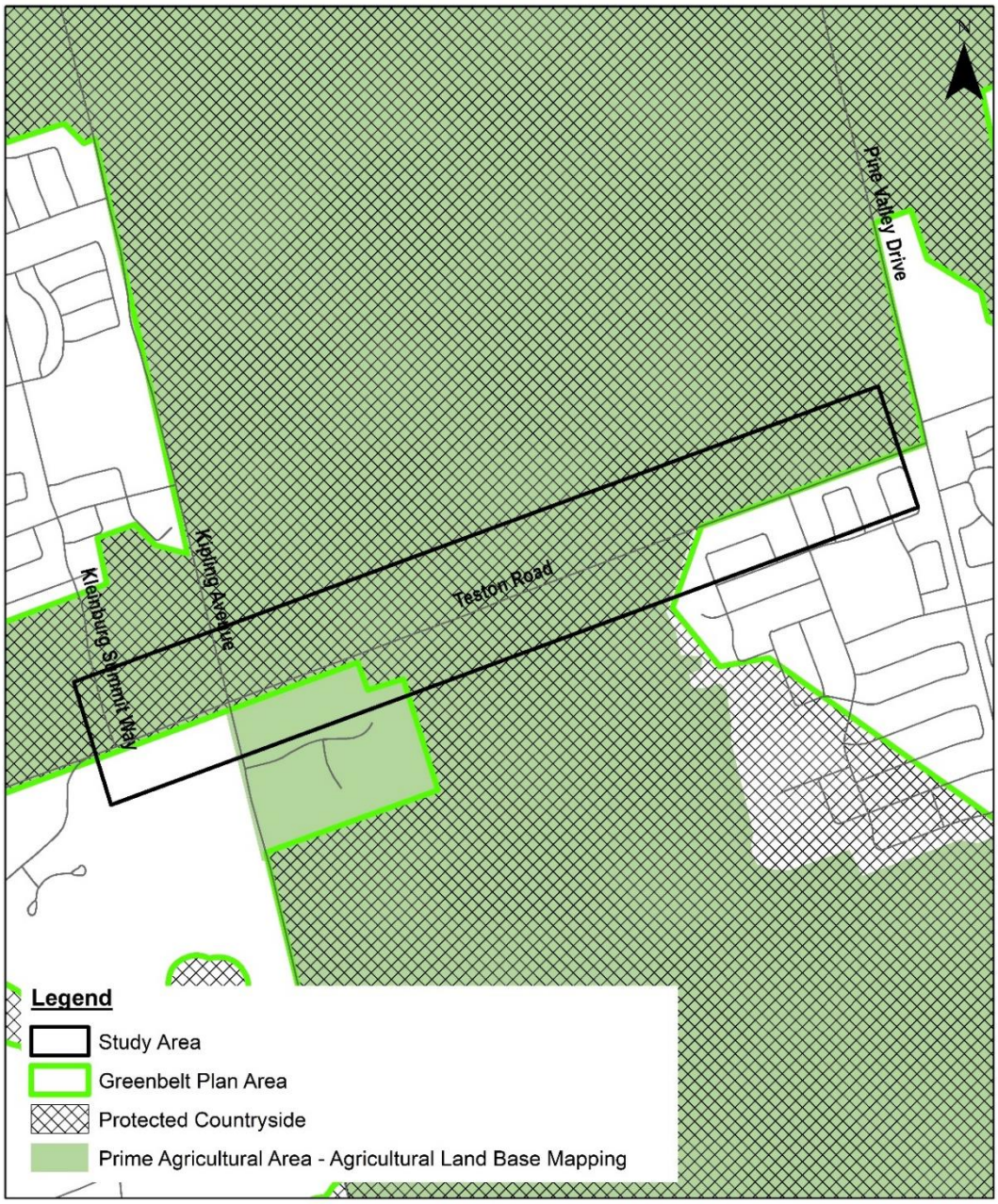
A portion of the study area is identified as a component of the TRCA Terrestrial Natural Heritage System, including 'Existing Natural Cover' and 'Potential Natural Cover.' Existing natural cover is identified as four different habitat types: forest, meadow, successional, and wetland.

5.3 Agriculture

5.3.1 Provincial Land Use Plan

A review of the OMAFRA Agricultural Systems Portal has indicated that portions of the study area are within the Greenbelt Plan Area, Prime Agricultural Area as defined within the Agricultural System for the Greater Golden Horseshoe and within the Growth Plan for the Greater Golden Horseshoe Area. Additionally, the study area is not within a provincially designated Specialty Crop area as per the OMAFRA Agricultural Systems Portal for the Agricultural Land Base. **Figure 5-4** presents the approximate Agricultural Land Base, Prime Agricultural Area for the Growth Plan for the Greater Golden Horseshoe (2019), and the boundary of the Greenbelt Plan (2017).

Figure 5-4: Growth Plan for the Greater Golden Horseshoe (2019) and Greenbelt Plan (2017)



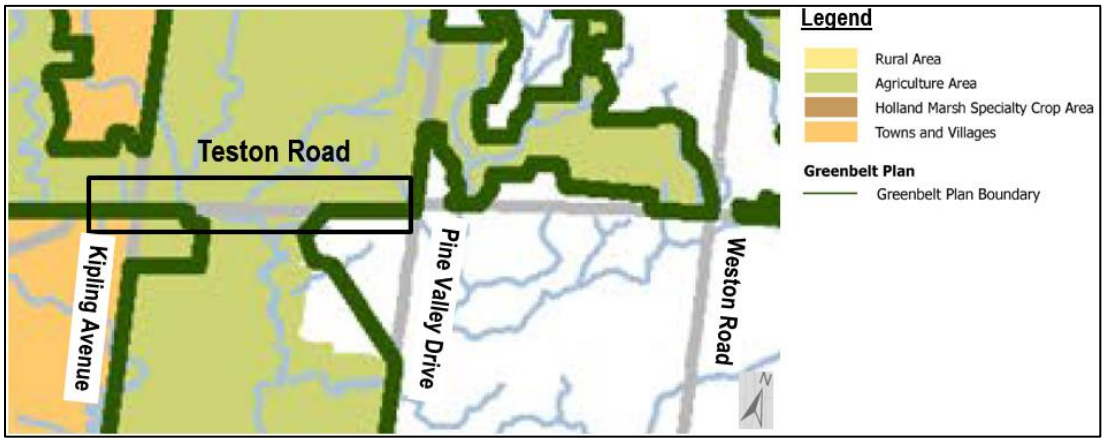
5.3.2 Regional Land Use Plans

Regional Municipality of York Official Plan 2019

The Regional Municipality of York Official Plan 2019 Office Consolidation (April 2019) (Modified York Region Official Plan – 2010) was reviewed for agricultural policy as it relates to the development of infrastructure.

Map 8 – Agricultural and Rural Area (**Figure 5-5**) identifies that portions of the study area are designated as an Agriculture Area. The areas designated as Agriculture Area are located north and south of Teston Road. The approximate location of the study area is illustrated as a black outline.

Figure 5-5: York Region Official Plan (2019) - Map 8 Agricultural and Rural Area

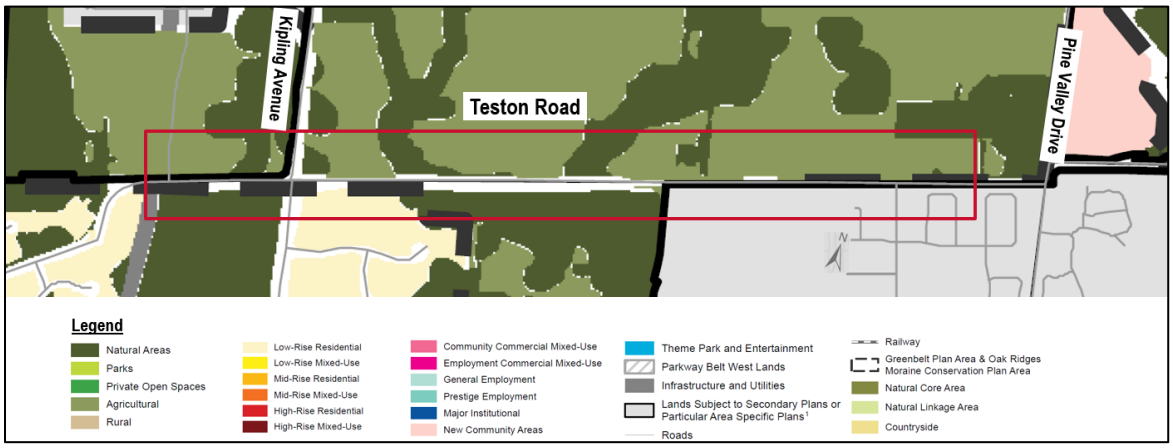


5.3.3 Municipal Land Use Plans

City of Vaughan Official Plan 2010

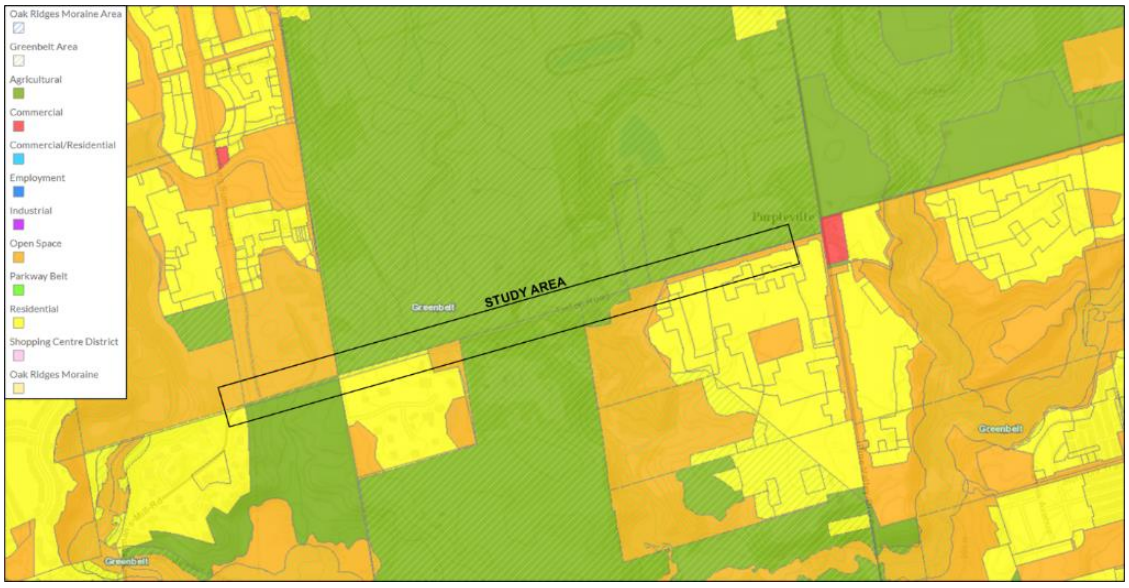
The City of Vaughan Official Plan 2010 (2019 Office Consolidation) was reviewed for agricultural policy and mapping/schedules related to infrastructure development. Schedule 13 – Land Use was reviewed to determine the extent of agriculture designations within the study area. Policies related to the designated Agricultural and Rural Area with respect to transportation infrastructure were reviewed. The approximate location of the study area is illustrated as a red outline in **Figure 5-6**.

Figure 5-6: City of Vaughan Official Plan 2010 - Schedule 13 Land Use



A review of the City of Vaughan's Geographic Information Systems (GIS) mapping that presents Vaughan's zoning designations was conducted. The study area is predominantly surrounded by rural agricultural land use as shown in **Figure 5-7**.

Figure 5-7: City of Vaughan Zoning By-Law



5.3.4 Land Use

The land use for the study area was completed by reviewing the OMFRA Land Use Systems mapping. Agricultural and non-agricultural land uses are presented in **Figure 5-8**.

Figure 5-8: Existing Land Use

The study area compromises built-up/urban areas, hay systems, and wood lots. The northwest corner of Kipling Avenue and Teston Road intersection represents the on-going Block 55 East (Kleinburg Summit) residential development, while the southwest corner of Pine Valley Drive and Teston Road represents the on-going Lindvest (Zzen) residential development.

There are no artificial drainage tiles installed within the study area to denote any agricultural improvements/investments had taken place. Water well surveys were completed to determine the location and extent of water wells within the study area. Based on the OMAFRA Agricultural Systems Portal, there are existing water wells within the study area. It is assumed that existing water wells located within the existing Teston Road right-of-way are misplaced/have been capped and closed.

5.3.5 Existing Soils

The Canada Land Inventory (CLI) system classifies soil attributes for their agricultural capability for crop harvesting. The following is the classification system and sub-classifications from CLI:

Table 5-1: CLI Soil Classification System

Class	Description
Class 1	Soils in this class have no significant limitations in use for crops. Soils in Class 1 are level to nearly level, deep, well to imperfectly drained and have good nutrient and water holding capacity. They can be managed and cropped without difficulty. Under good management they are moderately high to high in productivity for the full range of common field crops
Class 2	Soils in this class have moderate limitations that reduce the choice of crops, or require moderate conservation practices. These soils are deep and may not hold moisture and nutrients as well as Class 1 soils. The limitations are moderate and the soils can be managed and cropped with little difficulty. Under good management they are moderately high to high in productivity for a wide range of common field crops.
Class 3	Soils in this class have moderately severe limitations that reduce the choice of crops or require special conservation practices. The limitations are more severe than for Class 2 soils. They affect one or more of the following practices: timing and ease of tillage; planting and harvesting; choice of crops; and methods of conservation. Under good management these soils are fair to moderately high in productivity for a wide range of common field crops.
Class 4	Soils in this class have severe limitations that restrict the choice of crops, or require special conservation practices and very careful management, or both. The severe limitations seriously affect one or more of the following practices: timing and ease of tillage; planting and harvesting; choice of crops; and methods of conservation. These soils are low to medium in productivity for a narrow to wide range of common field crops, but may have higher productivity for a specially adapted crop.
Class 5	Soils in this class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible. The limitations are so severe that the soils are not capable of use for sustained production of annual field crops. The soils are capable of producing native or tame species of perennial forage plants and may be improved through the use of farm machinery. Feasible improvement practices may include clearing of bush, cultivation, seeding, fertilizing or water control.
Class 6	Soils in this class are unsuited for cultivation, but are capable of use for unimproved permanent pasture. These soils may provide some

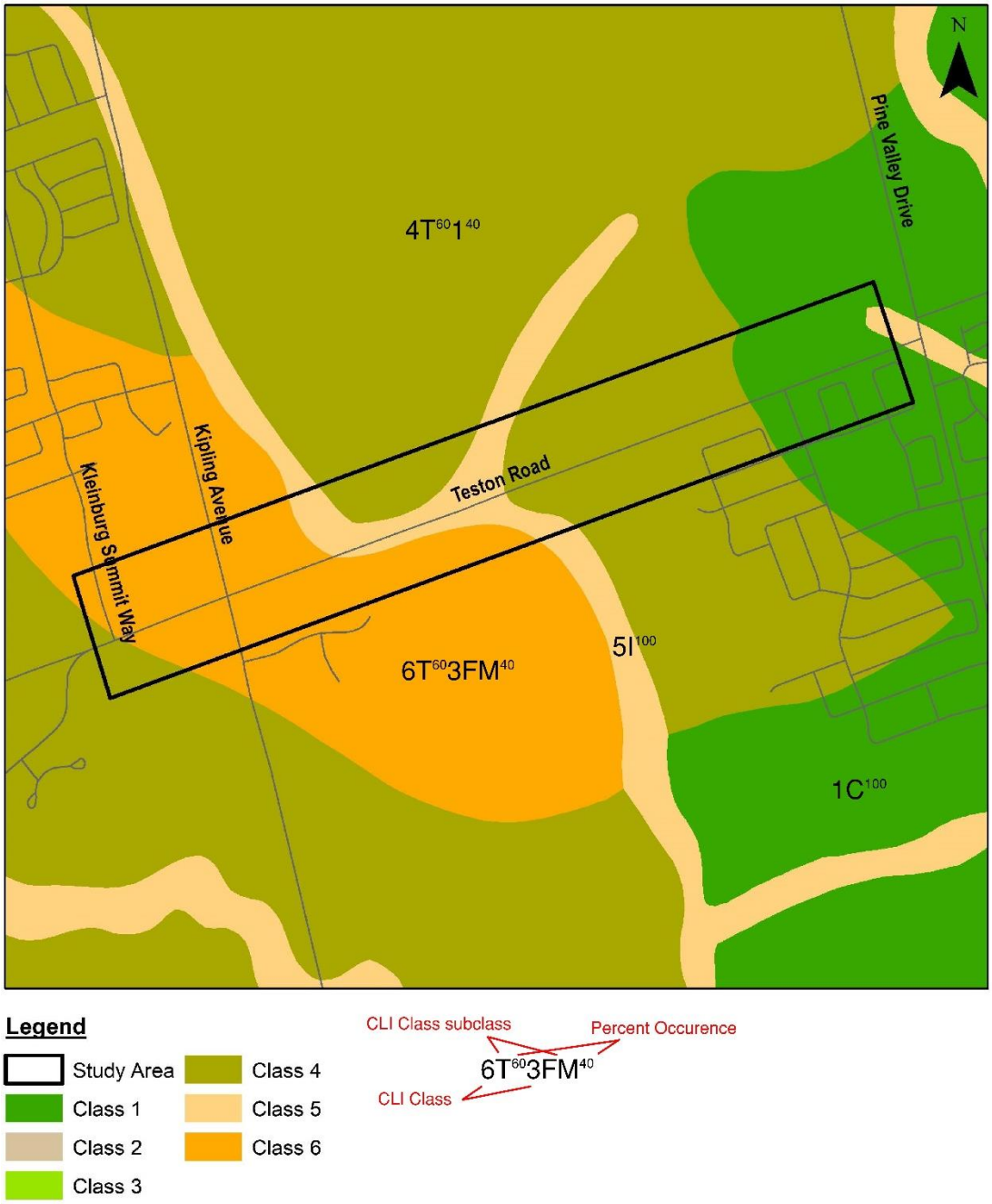
	sustained grazing for farm animals, but the limitations are so severe that improvement through the use of farm machinery is impractical. The terrain may be unsuitable for the use of farm machinery, or the soils may not respond to improvement, or the grazing season may be very short.
Class 7	Soils in this class have no capability for arable culture or permanent pasture. This class includes marsh, rockland and soil on very steep slopes."

Table 5-2: CLA Soil Subclassification

Subclass	Description
Subclass F	Low Natural Fertility Denotes soils having low fertility that is either correctable through fertility management or is difficult to correct in a feasible way. Low fertility may be due to low cation exchange capacity, low pH, presence of elements in toxic concentrations (primarily iron and aluminum), or a combination of these factors.
Subclass I	Inundation by Streams or Lakes Denotes soils having periodic flooding by streams and lakes which causes crop damage or restricts agricultural use.
Subclass M	Moisture Deficiency Denotes soils which have low moisture holding capacities and are more prone to droughtiness.
Subclass S	Adverse Soil Characteristics Denotes a combination of limitations of equal severity. In Ontario it has often been used to denote a combination of fertility (F) and moisture (M) when these are present with a third limitation such as topography (T) or stoniness (P).
Subclass T	Topography The steepness of the surface slope and the pattern or frequency of slopes in different directions are considered topographic limitations if they: 1) increase the cost of farming the land over that of level or less sloping land; 2) decrease the uniformity of growth and maturity of crops; and 3) increase the potential of water and tillage erosion.
Subclass W	Excess Water The presence of excess soil moisture (other than that from inundation) may result from inadequate soil drainage, a high water table, seepage, or runoff from surrounding areas. This limitation only applies to soils classified as poorly drained or very poorly drained.

Figure 5-9 represents the existing soil and their soil classifications in the study area using information obtained from Canada Land Inventory (CLI). A large area, near Kipling Avenue and Teston Road intersection, exhibits a combination of soils that are unsuited for cultivation (Class 6) due to the existing topographic constraints and soils with moderately severe limitations for crop harvesting (Class 3) due to low natural fertility and moisture deficiency. There is also a sliver area denoting soils with severe limitation to produce forage crops (Class 5) due to the periodic flooding by streams and lakes. Near the midblock area of Teston Road (north and south) exhibits soils with a combination of soils with no significant limitation for crop use (Class 1) and soils with severe limitations that restrict choice of crop (Class 4) due to topographic constraints.

Figure 5-9: Existing Soils and Canada Land Inventory (CLI)



5.4 Built Heritage Resources and Cultural Heritage Landscapes

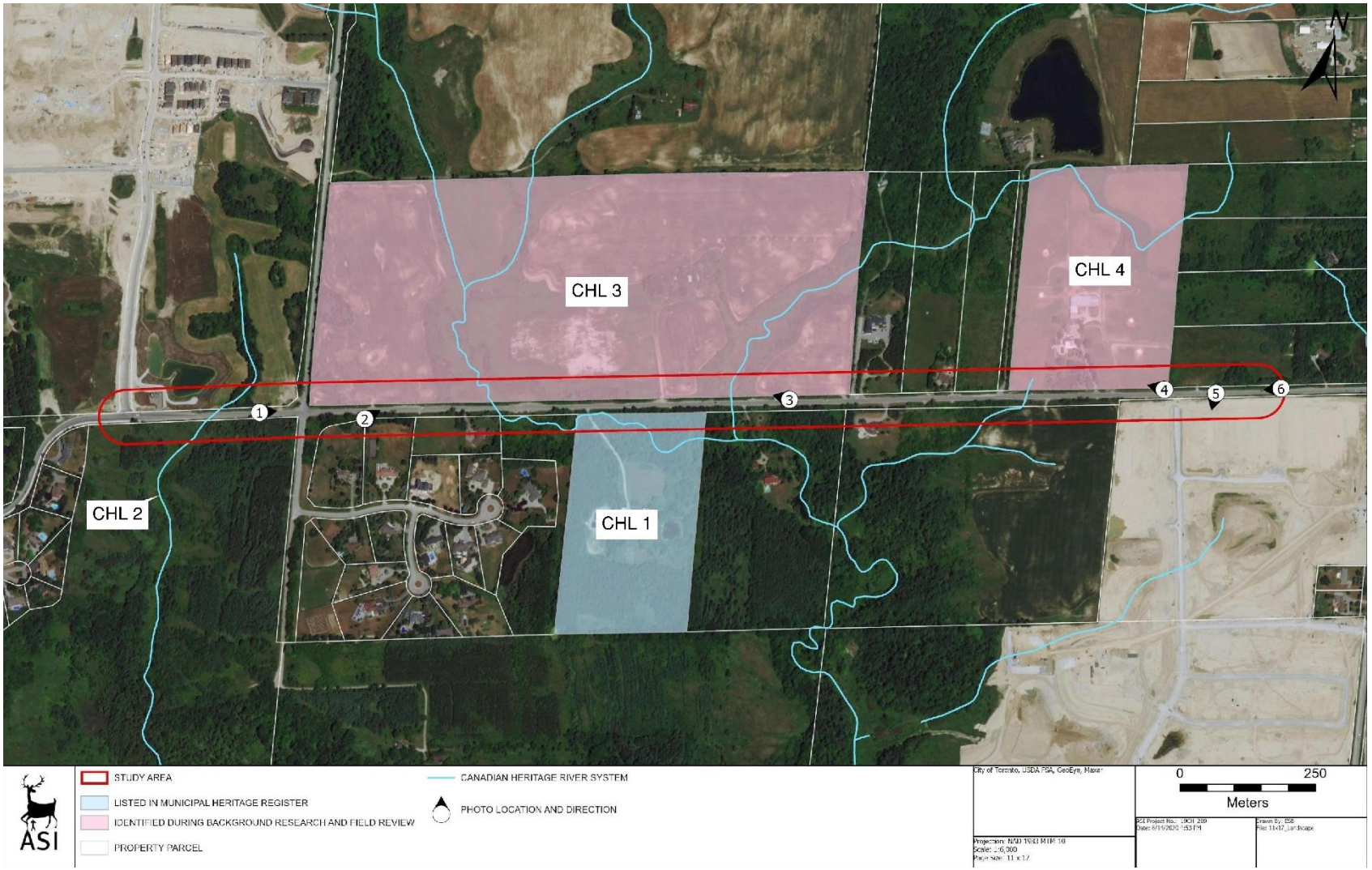
A Cultural Heritage Resource Assessment (CHRA) was undertaken as part of the Teston Road Environmental Assessment. The purpose of the report was to describe the existing conditions of the study area and present an inventory of above ground built heritage resources and cultural heritage landscapes.

Based on the results of the background research and field review, two cultural heritage resources and two potential cultural heritage resources were identified within and/or adjacent to the Teston Road study area (shown below). These resources are all identified as cultural heritage landscapes (CHLs). A cultural heritage resource number has been assigned to each resource (CHR #).

CHR #	Location/Name	Heritage Recognition	Description
CHL 1	5011 Teston Road	Listed on the City of Vaughan's *Heritage Inventory*	A late nineteenth-century farmscape.
CHL 2	Humber River	Canadian Heritage River System	Tributaries of the East Branch of the Humber River.
CHL 3	5000 Teston Road	Identified during background research and field review	A twentieth-century farmscape.
CHL 4	4720 Teston Road	Identified during background research and field review	A mid-nineteenth-century farmscape.

The results of background historical research and a review of secondary source material, including historical mapping, indicate a study area with a rural land use history dating back to the early nineteenth century. A review of federal, provincial, and municipal registers, inventories, and databases revealed that there are two previously identified features of cultural heritage value within the Teston Road study area. An additional two features were identified during the desktop review and fieldwork. Their locations are shown in **Figure 5-10**. The Cultural Heritage Resource Assessment Report is in **Appendix F**.

Figure 5-10: Cultural Heritage Resources Identified on Teston Road



Key Findings

A total of two cultural heritage resources and two potential cultural heritage resources were identified within the study area.

Four cultural heritage landscapes (CHLs) were identified within the study area. One property is listed in the City of Vaughan's Heritage Inventory (CHL 1) and one river is identified as a Canadian Heritage River System (CHL 2). Two farm properties were identified during background research and field review (CHL 3 – CHL 4).

Identified cultural heritage resources are historically, architecturally, and/or contextually associated with land use patterns in the City of Vaughan.

Based on the results of the assessment, the following recommendations have been developed:

1. Construction activities and staging should be suitably planned and undertaken to avoid impacts to identified cultural heritage resources;
2. Once a preferred alternative or detailed designs of the proposed work are available, this report will be updated with a confirmation of impacts of the undertaking on the cultural heritage resources identified within and/or adjacent to the study area and will recommend appropriate mitigation measures. Mitigation measures may include, but are not limited to, completing a property-specific heritage impact assessment or documentation report, or employing suitable measures such as landscaping, buffering or other forms of mitigation, where appropriate. In this regard, provincial guidelines should be consulted for advice and further heritage assessment work should be undertaken as necessary; and,
3. 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.

5.5 Archaeology

A Stage 1 Archaeological Assessment was completed in accordance with the Ontario Heritage Act (1990, as amended in 2018) and the 2011 Standards and Guidelines for Consultant Archaeologists (S & G), administered by the Ministry of Citizenship and Multiculturalism (MCM), previously known as Ministry of Tourism, Culture and Sports (MTCS).

The Stage 1 background study determined that 65 previously registered archaeological sites are located within one kilometre of the Study Area. The Damiani (AlGv-231) and Skandatut site (AlGv-193) are ancestral Huron-Wendat village sites within one kilometre of the Study Area. An associated ossuary has not yet been identified for the Damiani site. The property inspection determined that parts of the Study Area exhibit archaeological potential and will require Stage 2 assessment.

In light of these results, the following recommendations are made:

1. The Study Area exhibits archaeological potential. These lands require Stage 2 archaeological assessment by test pit/pedestrian survey at five metre intervals, where appropriate, prior to any proposed construction activities;
2. The Damiani (AlGv-231) site is an ancestral Huron-Wendat village site within 100 metres of the Study Area. An associated ossuary has not yet been identified for the site. To minimize the risk of impacting an ossuary within the project limits, a licensed archaeologist should be engaged to conduct a program of archaeological monitoring during the removal of topsoil for all parts of the Study Area that are within both 1000 metres of the Damiani site and 300 metres of water (see Supplementary Documentation);
3. The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance, low and wet conditions, or being previously assessed. These lands do not require further archaeological assessment; and,
4. 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.

A summary of Stage 1 Archaeological Assessment results is shown in **Figure 5-11** and **Figure 5-12** on the following pages. Photo numbers shown in the figures can be found in **Appendix E**.

Figure 5-11: Results of Stage 1 AA (1 of 2)

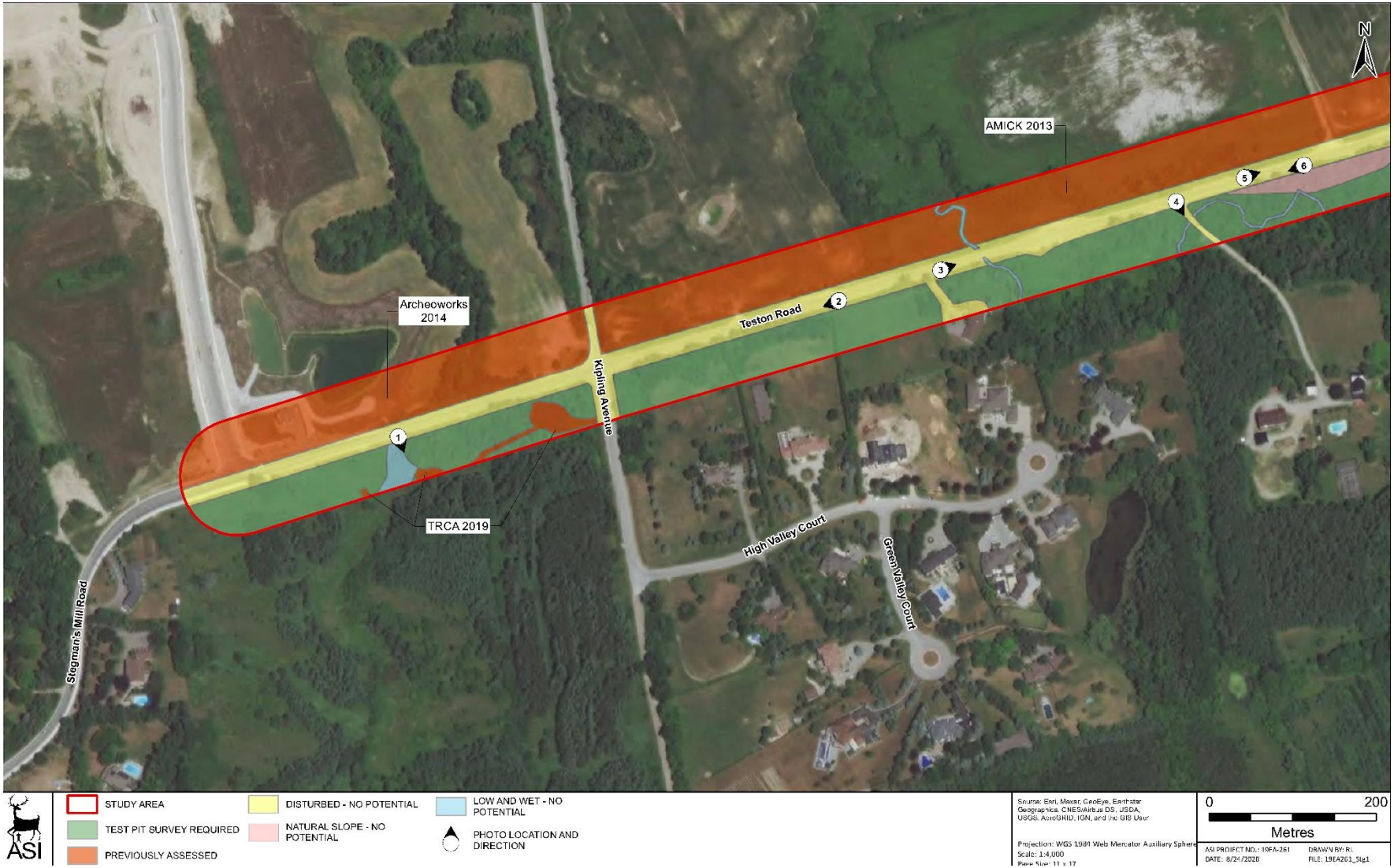
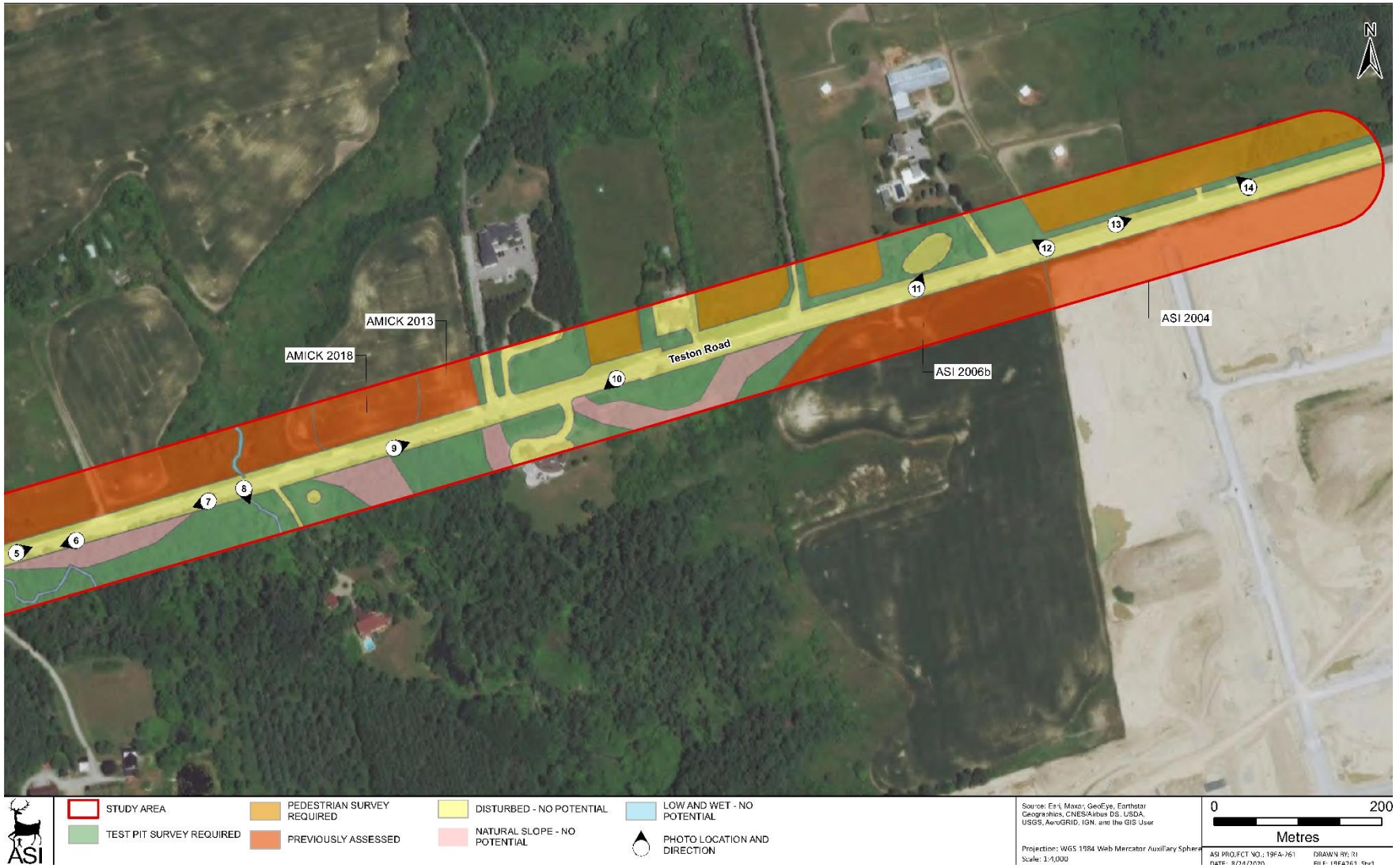


Figure 5-12: Results of Stage 1 AA (2 of 2)

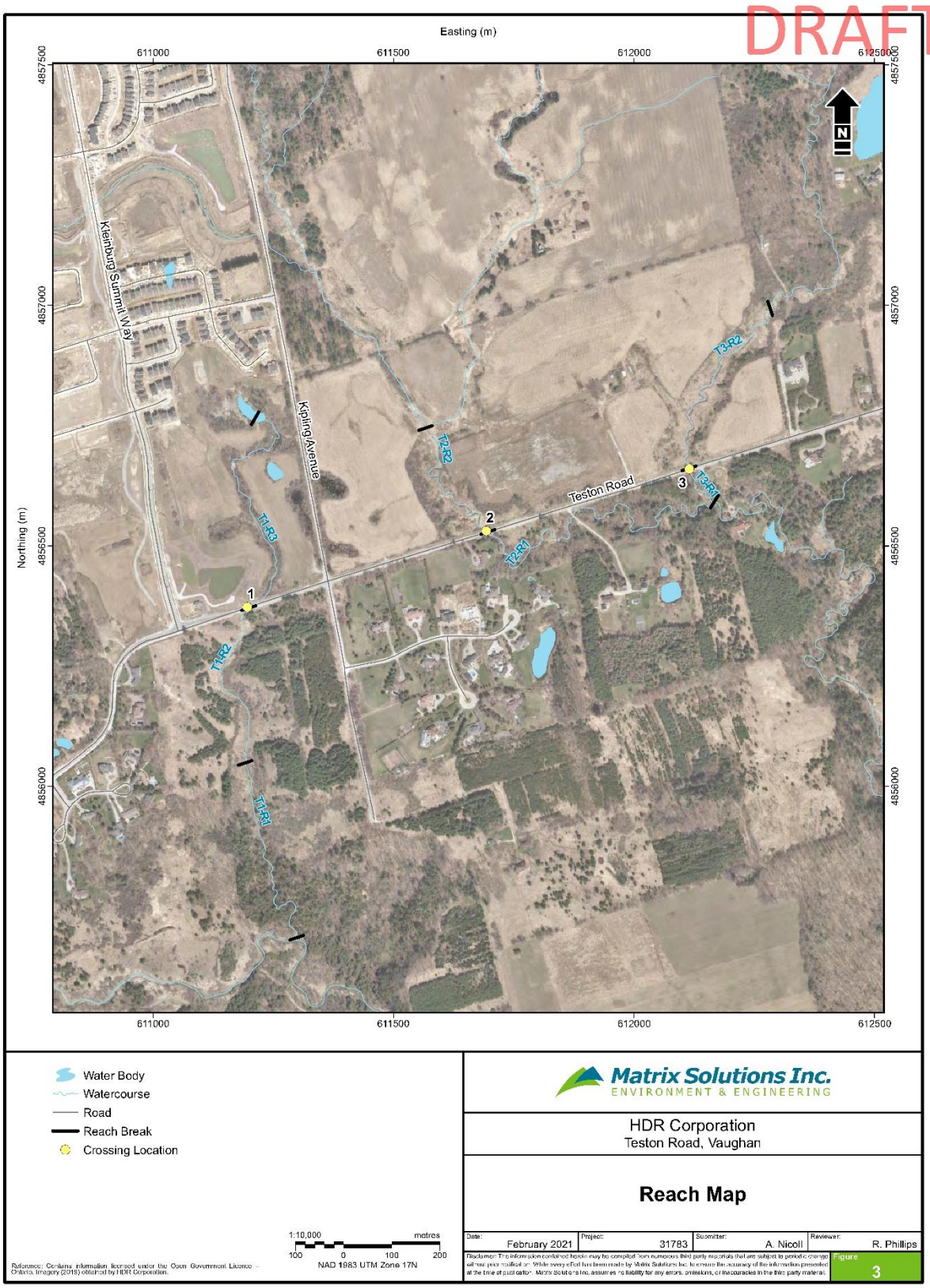


5.6 Fluvial Geomorphology

A fluvial geomorphological assessment was undertaken to assess geomorphic conditions at the watercourse crossings within the study area. The purpose of the geomorphic assessment was to characterize the crossings, identify erosion hazards, and provide design recommendations that will accommodate channel dynamics. Design considerations are also provided for areas in which the watercourse runs along the existing road embankment. The recommendations in this assessment will be considered to evaluate and select a preferred design alternative for the Teston Road improvements.

Three watercourse crossings and features were identified for assessment in the study and are shown in **Figure 5-13**. The Fluvial Geomorphology Report is in **Appendix I**.

Figure 5-13: Watercourse Crossings and reaches within the Teston Road Study Area



Tributary 1: Tributary to the East Humber River, approximately 180 m west of Kipling Avenue, associated with Crossing 1 (C1). At Crossing 1, no natural channel definition was observed upstream or downstream of the crossing right-of-way. Within the right-of-way, the feature had been ditched upstream and downstream of the crossing. The upstream ditch runs parallel to Teston Road for approximately 40 m, is choked with reeds, and appears to be backwatered by the undersized existing CSP culvert. The ditch meets and enters the culvert at a 90-degree angle. At its outlet, the culvert is perched by approximately 20 cm. At the outlet, the feature flows through a short (less than 5 m long) channelized area with a width of 1.3 m, which disperses into opportunistic flow within a re-naturalized wetland feature immediately downstream of the right-of-way. Approximately 35 m downstream of the culvert outlet, a 0.6 m drop in floodplain grade was observed, which was constructed as part of the re-naturalization of the area. The feature was flowing at the time of the site visit (less than 5 cm of water within the CSP). A SWM outfall culvert is located approximately 6 m west of the existing culvert.

It is recommended that the existing CSP culvert is replaced with an open-foot culvert containing a low flow channel (to be sized based on hydraulic modeling) flanked on both sides by wildlife benches, with substrate composed of a gradation of native material and hydraulically sized pea gravel or river stone. The elevation of the low flow channel should be constructed to provide a continuous bed through the crossing to eliminate the 20 cm perch at the existing culvert outlet.

Tributary 2: west branch of Purpleville Creek, approximately 340 m east of Kipling Avenue, associated with Crossing 2 (C2). Upstream of C2, there is a well-defined 0.75 to 1.0 m wide channel. The channel approaches the culvert at a slight angle from the west, and a gradual meander with an amplitude of 9 m is found upstream of the crossing. Downstream of the crossing, evidence of bed and bank scour was observed during the field assessment. Within several meters of the outlet, the creek locally widens to up to 3.6 m where it runs along the toe of the west valley slope. There is evidence of erosion and undercutting along the toe of slope, and a private residence is located west of the valley slope. The creek is unconfined to the east at the culvert outlet. The existing culvert is an open footing structure but is in poor condition: the guardrails are leaning at the inlet and outlet, and the concrete is cracked. The inlet and outlet are almost in line with the edges of the concrete on Teston Road. As such, the structure will require replacement and extension if the road is widened.

It is recommended that the existing culvert be replaced with a new culvert containing a low flow channel (to be sized based on hydraulic modeling) flanked on both sides by wildlife benches, with substrate composed of a gradation of native material and hydraulically sized pea gravel or river stone. It is also recommended that the culvert skew be increased slightly by angling the culvert outlet further to the east, which would better align the structure with the channel axis upstream and would redirect flow away from the downstream valley slope. As well, local erosion protection works could be considered along the toe of the valley slope. The skew could be adjusted without requiring major channel works. It is recommended that any tie-in works maintain the existing channel length.

Tributary 3: tributary to Purpleville Creek, approximately 800 m east of Kipling Avenue, associated with Crossing 3 (C3). During the field assessment, there was a well-defined 1.5 m wide channel upstream and downstream of the culvert. The upstream reach (T3-

R2) is in regime. The creek approaches the culvert from the west, and a meander with an amplitude of 6 m is located upstream of the crossing. The west bank of this meander is entrenched and is eroding. At the inlet of the culvert there is a small hollow which poses a minor risk of potential scour; however, this area is currently stable. Several boulders have been placed in the channel on the outer bank of the meander near the inlet, and the road embankment is stabilized with riprap and vegetation. The existing culvert is a 2.3 m wide corrugated steel pipe (CSP) which appears to be new and in good condition.

The culvert inlet and outlet extend beyond the existing edge of pavement. No scour was observed at the culvert outlet. From the outlet, the channel meanders slightly to the west. Approximately 50 m downstream of the crossing, there is a drop in channel elevation of 1.5 m that is armoured with stone. Downstream of the drop, the creek is entrenched and widens to 2 m at bankfull elevation and 3 m top width.

5.7 Contamination Overview Study

Areas of Potential Environmental Concern (APECs) were identified for the Site. The approximate areas are depicted in **Figure 5-14**. The APECs are ranked according to the following Risk Levels:

- High Risk – Confirmed contaminant impacts being present on-Site;
- Medium Risk – A potential for contaminant impacts being present on-Site; and
- Low Risk – No potential for contaminant impacts to be present on-Site.

The summary of areas including the rankings of potential are as follows:

Location of PCA	PCA	Media Impacted	APEC Number	APEC Ranking by Risk Level (High/ Medium/Low)	Potential Contaminant of Concern
Kleinburg Summit Way and Teston Road North adjacent to COS Site	#55 – Transformer Manufacturing, Processing and Use	Soil	APEC 1	Medium	PCBs

Notes – Contaminant of Concern Abbreviations
PCBs- Polychlorinated Biphenyls

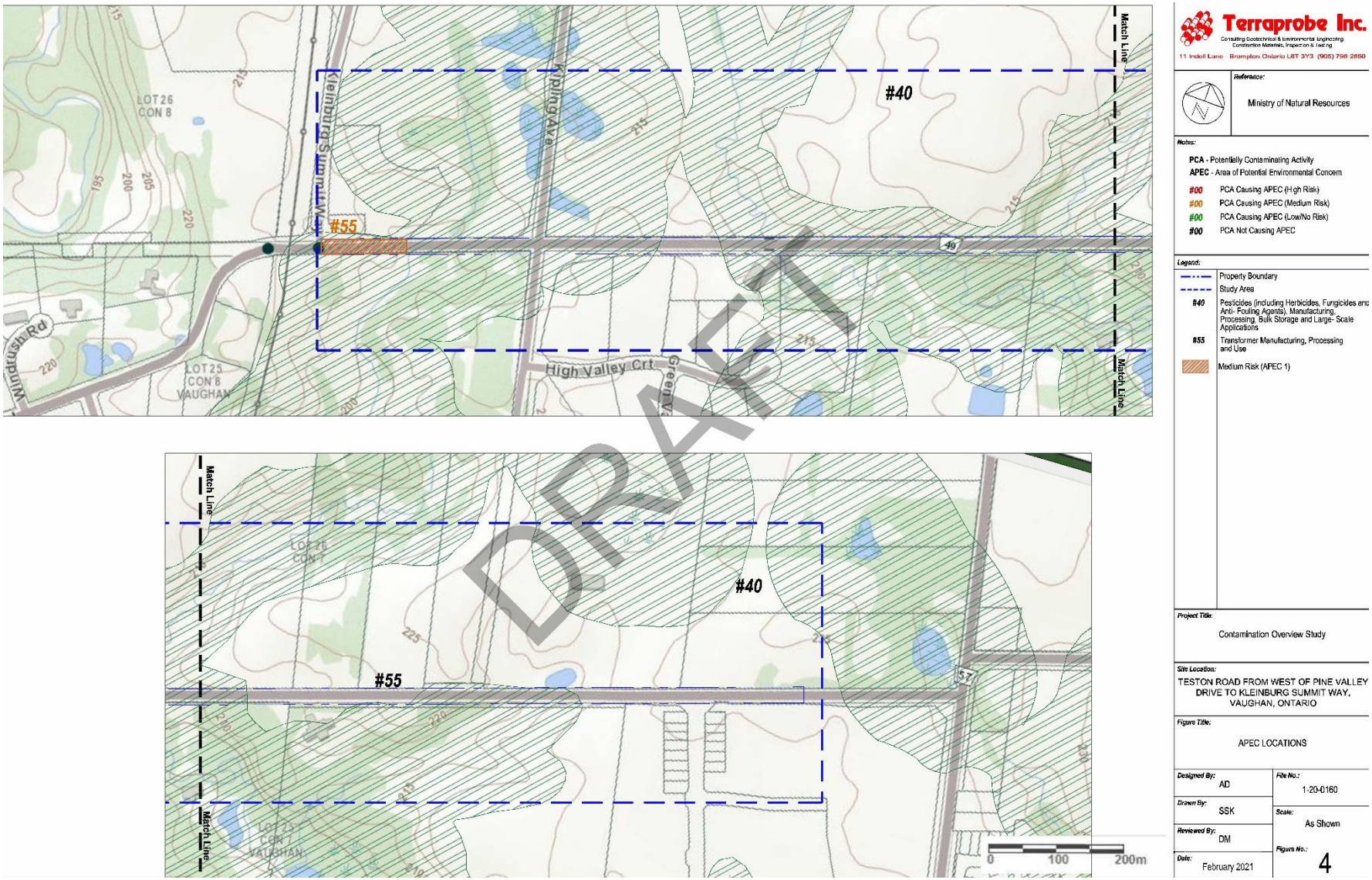
Environmental Site Assessments including soil and groundwater investigations are recommended to investigate the potential impacts on the Site caused by APECs identified as high risk, if any, especially within lands requiring expropriations for the road improvement project. For medium risk APECs, the soil and/or groundwater may be investigated during future earthworks at the Site. For low risk APECs, it is unlikely that the PCS has resulted in an impact to the lands at Site.

At the time of this study, no high risk APECs have been identified at the Site or within the Study Area. One medium risk APEC, resulting from PC #55 – Transformer Manufacturing, Processing and Use, was identified and is associated with a transformer located in the northeast quadrant of the intersection of Kleinburg Summit Way and Teston Road North. No low risk APECs were identified on-site.

During the site reconnaissance conducted as part of the Contamination Overview Study (COS), areas likely to have exceedances of salt related contaminants were identified. These areas included residential driveway entrances and along the Teston Road COS Site. No sampling was conducted as part of the COS, however, during future earthworks for the road improvement project, soil management activities may warrant chemical analysis of soil conditions for salt related contaminants to support re-use on-Site and/or off-site disposal. However, no sampling is required as per Ontario Regulation 153/04, as amended.

Figure 5-14 summarizes the identified PCAs and APECs within the study area. The COS Report is in **Appendix L**.

Figure 5-14: Areas of Potential Environmental Concerns within the Teston Road Study Area



5.8 Socio-Economic

5.8.1 Local Businesses

No local businesses were identified to abut the study area. The land adjacent to the study corridor right-of-way consists primarily of residential (single detached housing) properties, woodlots, private open spaces and undeveloped land.

5.8.2 Future Development

As of April 2021, no future developments are planned within and on the boundary of the study area.

5.9 Geotechnical Engineering

A geotechnical investigation was undertaken on December 8th to December 13th, 2021, which consisted of:

- Six (6) foundation boreholes;
- Ten (10) pavement boreholes;
- Asphaltic concrete coring at two (2) locations; and,
- Fifteen (15) shallow test pits.

A visual examination of the roadway surface was carried out in January 2022 to obtain a general overview of the existing pavement conditions. The visual condition survey was completed in general accordance with the Manual for Condition Rating of Flexible Pavements (SP-024). The observed pavement distresses and pavement condition of the evaluated pavement sections are summarized in **Table 5-3**.

Table 5-3: Existing Pavement Distress Manifestations

Section	Overall Condition	General Distresses
Teston Road Sta. 1+000 to Sta. 1+180	PCR* = 95 RCR** = 9.5 Excellent	• Few very slight ravelling and coarse aggregate loss; and • Few very slight random/map cracking.
Teston Road Sta. 1+180 to Sta. 2+720	PCR* = 65 RCR** = 6.5 Good	• Frequent slight ravelling and coarse aggregate loss; • Intermittent slight wheel track rutting; • Few slight distortion; • Few slight single and multiple longitudinal wheel track cracking; • Intermittent moderate single and multiple centre line cracking; • Intermittent slight alligator centre line cracking; • Frequent slight single and multiple pavement edge cracking; • Intermittent slight alligator pavement edge cracking;

		• Few slight half, full and multiple transverse cracking; • Few slight alligator transverse cracking; and • Intermittent slight random/map cracking.
Teston Road Sta. 2+720 to Sta. 3+175	PCR* = 95 RCR** = 9.5 Excellent	• Few very slight ravelling and coarse aggregate loss.

** PCR = Pavement Condition Rating. ** RCR = Ride Condition Rating.*

The pavement subgrade, as encountered in the 1.5 m deep pavement boreholes, generally consist of sand and gravel, silty sand, and silty clay soils.

Groundwater conditions were observed in the boreholes during and upon completion of drilling. Boreholes C1, C2 and C3 were instrumented with a 50 mm diameter standpipe piezometer. Tabulated below are the groundwater levels that were measured on separate visits after the completion of drilling.

Table 5-4: Existing Groundwater Conditions

Borehole Number	Date	Water Level Depth (m)	Water Level Elevation (m)
BH C1	January 06, 2022 January 31, 2022	5.7 5.8	199.8 199.7
BH C2	January 06, 2022 January 31, 2022	1.4 1.6	202.2 202.0
BH C3	January 06, 2022 January 31, 2022	2.1 2.3	200.5 200.3

The groundwater is expected to follow the topography along the alignment and the phreatic surface is expected to fall gradually from high ground to the watercourse crossings. The groundwater in the vicinity of the watercourse crossings will also be controlled by the free water levels in these waterbodies. Groundwater is also expected to fluctuate seasonally and can be expected to rise during wet periods of the year and perched water can also be expected to occur where more permeable deposits overlie relatively impermeable deposits.

The geotechnical investigations report is provided in **Appendix I**.

5.10 Stormwater, Drainage and Hydrology

The study corridor is located within the East Humber River watershed. The Toronto and Region Conservation Authority (TRCA) has jurisdiction with respect to drainage and stormwater management of the East Humber River Watershed. The study corridor crosses a tributary of East Humber River, Purpleville Creek, and two (2) tributaries of Purpleville Creek.

Within most of the study limits, Teston Road has a rural cross-section and is drained by roadside ditches. The ditches convey flows to the four (4) watercourse crossings along the corridor.

As part of the Zzen-Lindvest Residential Subdivision development, Teston Road has been reconstructed from 260 m west of Ballantyne Boulevard to the east end of the study limits. From 260 m to 100 m west of Ballantyne Boulevard, Teston Road has a rural

cross-section on the north side and curb and gutter along the south side. From 100 m west of Ballantyne Boulevard to the east end of the study limits, Teston Road has an urban cross-section on both sides of the road. The existing storm sewers drain to various municipal systems constructed as part of the Zzen-Lindvest Residential Subdivision.

Based on the Zzen-Lindvest Residential Subdivision Final Stormwater Management Report prepared by Urban Ecosystems Limited (June 2017), the Teston Road right-of-way from 260 m west of Ballantyne Boulevard to the east end of the study limits has already been accounted for in the stormwater management strategy.

Under existing conditions, there are four (4) transverse culvert crossings of Teston Road, which are a tributary of East Humber River, Purpleville Creek, and two (2) tributaries of Purpleville Creek. Crossings 2 and 3 are regulated by the TRCA. There is also an existing concrete box culvert immediately west of Crossing C-1 that will be extended by 3.0 m on the south side to accommodate the proposed works. Since this culvert is only receiving flow from the existing stormwater management pond servicing the subdivision north of Teston Road, this culvert has been excluded from the hydrologic and hydraulic analysis. **Table 5-5** summarizes the size, type, and location of the culvert structures.

Table 5-5: Summary of Transverse Culvert Crossings

Crossing ID	Watercourse Crossing	Location of Crossing	Culvert Description	Crossing Length (m)
C-1	Tributary of East Humber River	180 m west of Kipling Avenue	0.9 m diameter circular CSP	15.9
C-2	Purpleville Creek	360 m east of Kipling Avenue	3.0 m span x 1.0 m rise concrete box	8.4
C-3	Tributary of Purpleville Creek	790 m east of Kipling Avenue	2.4 m diameter circular CSP	18.4
C-4	Tributary of Purpleville Creek	670 m west of Pine Valley Drive	0.75 m diameter circular CSP	15.1

For Crossings C-1 and C-4, the hydraulic analysis was completed using a HY-8 hydraulic model, utilizing the culvert information (size, length, invert elevations and road elevation) obtained from the record drawings and the survey data. For Crossing C-2 and C-3, the Estimated HEC-RAS model for Purpleville Creek, obtained from the TRCA, was reviewed and updated to reflect the existing crossing conditions based on the available survey data completed for this EA study and used to conduct the hydraulic assessment. As part of the update to the hydraulic model, cross-sections upstream and downstream of the Teston Road crossing, as well as the driveway culvert downstream of the crossing, were included.

As per the MTO Highway Drainage Design Standards, hydraulic capacities were assessed based on the 25-year storm event peak flow for structure with spans less than 6.0 m, and the 50-year design storm event peak flow for structure with spans greater than 6.0 m to determine the available freeboard and clearance.

Table 5-6 summarizes the hydraulic analysis results for the transverse crossings along the study corridor.

Table 5-6: Hydraulic Analysis Results for Transverse Culverts (Existing Condition)

Crossing ID	U/S Invert (m)	D/S Invert (m)	Length (m)	Road Elev. (m)	Water Surface Elev. (m) 25-yr	50-yr	Reg./ Check Flow	Free-board (m)	HW/D	Remarks
C-1	203.99	203.72	15.9	205.44	204.99	205.20	205.50[1]	0.45	1.11	Does not meet MTO freeboard criteria. Check Flow overtops road.
C-2	201.95	201.91	8.4	203.58	202.77	202.83	203.65	0.81	0.82	Does not meet MTO freeboard criterion. Regional overtops road
C-3	199.05	198.97	18.4	202.51	200.02	200.06	200.81	2.49	0.18	Meets MTO freeboard and clearance criteria.
C-4	215.76	215.33	15.1	217.88	216.20	216.26	216.37[1]	1.68	0.59	Meets MTO freeboard and clearance criteria.

[1] Check Flow equal to 115% of the 100-yr storm, according to WC-1 of the MTO Highway Drainage Design Standards (2008)

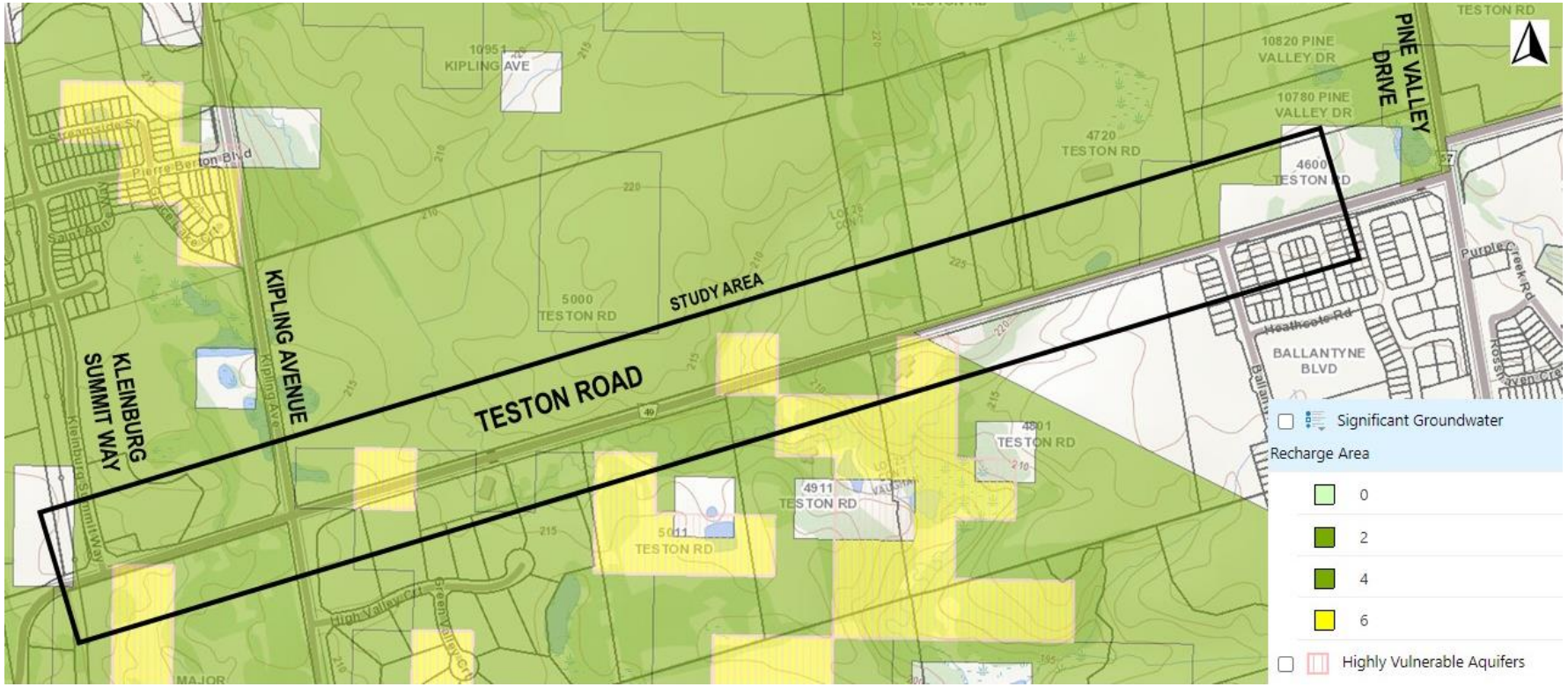
Crossing C-1 does not meet MTO freeboard criterion, and the water surface level generated by the Check Flow overtops Teston Road by approximately 0.06 m. Crossing C-2 also does not meet MTO freeboard criterion, and the water surface level generated by the Regional storm overtops Teston Road with a depth of approximately 0.07 m. Crossing C-3 and C-4 meet MTO freeboard and clearance criteria and no overtopping occurs under Check Flow/Regional storm event condition.

5.11 Source Water Protection

Based on correspondence from Toronto and Region Conservation Authority (TRCA), the Teston Road corridor transects the following vulnerable areas identified under the Clean Water Act, 2006, as illustrated in **Figure 5-15**:

- Significant Groundwater Recharge Area (SGRA); and,
- Highly Vulnerable Aquifers (HVA).

Figure 5-15: MECP Source Water Protection Information Atlas



The potential threat associated with the Teston Road improvements, per the CTC Source Protection, include application of road salt, which would be a moderate or low drinking water threat. Mitigation strategies to minimize impacts associated with road salt threat are listed in **Table 8-1**.

5.12 Utilities

5.12.1 Enbridge Gas

There is an existing high pressure nominal pipe size 6 inch steel coated gas main located on the north side of Teston Road between Kleinburg Summit Way to approximately 80m east of Ballantyne Boulevard where the gas main transitions to the south side to Pine Valley Drive. There is an existing service connection to 4911 Teston Road. There is a tie-in connection to the northwest development at Teston Road and Kipling Avenue and a tie-in connection to the southwest development at Teston Road and Pine Valley Drive.

5.12.2 Bell

There are buried Bell conduits on the south side of Teston Road between Kipling Avenue and Pine Valley Drive. There is a service connection transition from the south side of Teston Road to the north side approximately 350m west of Ballantyne Boulevard. There are four Bell-owned hydro poles on the south side of Teston Road approximately 360m east of Kipling Avenue.

5.12.3 Rogers

There is an existing Rogers aerial coaxial cable located on the north side of Teston Avenue from Kleinburg Summit Way and Kipling Avenue and transitioning southerly on the east side of Kipling Avenue.

5.12.4 Alectra

There are existing hydro poles with overhead lines located on the north side of Teston Road between Kleinburg Summit Way and Pine Valley Drive. There are three hydro poles located on the south side of Teston:

- One located on the southwest corner of Teston Road and Kipling Avenue;
- One located on the mid-block between Kipling Avenue and Pine Valley Drive; and
- One located 300m west of Ballantyne Boulevard.

5.12.5 Streetlighting

Existing streetlighting arms are mounted on the existing hydro poles on the north side of Teston Road, from Kleinburg Summit Way to Kipling Avenue. Existing streetlighting poles are located on the northwest, southwest, and southeast quadrant of Teston Road and Kipling Avenue intersection. New streetlighting poles were installed on the south

side of Teston Road from Ballantyne Boulevard to 200m west of Pine Valley Drive through the Lindvest (Zzen) residential development.

6 Alternative Solutions

The Municipal Class EA process requires documentation and examination of all reasonable alternatives, or means to address the problem, referred to as Alternative Solutions (Phase 2).

For the Teston Road corridor, the Alternative Solutions considered, evaluation methodology, evaluation of Alternative Solutions, and selection of the Preferred Solution were completed and documented in this report. The following section highlights the overall methodology, key findings and recommendations, as it relates to Phase 2 of the Teston Road corridor.

6.1 Development of Alternative Solutions

The Teston corridor-specific alternative solutions were developed, each approaching the Problems and Opportunities of Teston Road in a different way and are described in **Table 6-1**.

Table 6-1: List of Alternative Solutions Considered

Alternative Solution	Description
1. **"Do Nothing"**	This option is a benchmark to compare other alternative solutions and represents the maintenance of existing conditions with no changes implemented.
2. **Limit/Reduce Development**	Limit transportation demand in the study area.
3. **Improve Other Roadways**	This option involves widening the corridors adjacent to the study corridor without any improvements to the Teston Road corridor. The objective of this option is to divert traffic from the study corridor.
4. **Widen Teston Road Additional Vehicular Lanes**	This option involves widening the road from two to four lanes to accommodate general purpose vehicles.
5. **Provide Continuous physically separated Active Transportation Facilities**	Provide Continuous Cycling and Pedestrian Facilities, but preclude road widening.
6. **Operational Improvements**	This option involves maintaining existing road widths while improving traffic flow at intersections, through the optimization of traffic signal timing and phasing, and improvements to turn-lane configurations at intersections.

6.2 Evaluation Methodology and Criteria

To determine the most appropriate solution for the Teston Road corridor, an evaluation framework was developed to evaluate each alternative solution using information collected from the existing conditions assessment. This framework includes criteria that addresses the transportation needs and the broader social, economic, and

environmental to ensure that alternative solutions are compatible with, and supportive of, existing and planned land uses. A list of criteria to compare alternatives was developed; the measure of the alternative's success was its ability to correct, minimize or mitigate impacts and/or meet the study goals. The evaluation criteria are shown in **Table 6-2**.

Table 6-2: Evaluation Criteria for Alternative Solutions

Consideration	Criteria
Transportation Service	• Create a Pedestrian-Friendly Environment • Create a Cyclist-Friendly Environment • Reduce Traffic Congestion and Delays • Improve Safety for all Travel Modes • Improve Viability of Travel Mode Choice
Social Environment	• Minimize Impacts and Improve Access by all modes of transportation to Residential, Institutional, Business and Recreational Dwellings / Properties and key destinations such as Kleinburg Historic Village, Bindertwine District Park, etc. • Minimize Traffic Noise • Preserve Archaeological and Cultural Heritage Features • Improve Public Realm and create an environment that is enjoyable
Infrastructure Design and Economic Environment	• Minimize Utility Relocation • Accommodate Planned Development and Growth • Minimize Property Acquisition • Cost-Benefit Comparison • Minimize Operating Costs • Minimize Disruption due to Construction
Natural Environment	• Protect Designated Areas • Protect Vegetation • Protect Wildlife • Protect Aquatic Habitat • Improve Air Quality • Protect Surface Water and Ground Water • Minimize Effects on Climate Change • Minimize Flooding and Erosion and Protect Slope Stability

An evaluation was conducted using the evaluation criteria to compare the proposed alternative solutions to determine a preferred solution for the Teston Road corridor and was evaluated on a scale from Preferred to Not Preferred. The detailed evaluation is presented in **Table 6-3**.

Table 6-3: Detailed Evaluation of Alternative Solutions

Evaluation Criteria	**Alternative 1:** Do Nothing	**Alternative 2:** Limit / Reduce Development	**Alternative 3:** Improve other roadways	**Alternative 4:** Widen Teston Road for Additional Vehicular Lanes	**Alternative 5:** Provide Continuous physically separated Active Transportation Facilities	**Alternative 6:** Operational Improvements
Description of Alternative	Maintain Existing Conditions	Restrict future development in the area	Widen other parallel roadways	Provide two continuous lanes in each direction only	Provide continuous physically separated cycling and pedestrian facilities, such as sidewalks, cycle tracks or multi-use paths	Provide improvements such as roadway profile corrections and pavement rehabilitation, intersection improvements, safety improvements, visibility improvements, signage improvements, culvert upgrades and trail crossings
Transportation Service						
Create a Pedestrian-Friendly Environment	• Does not accommodate pedestrians or create a pedestrian-friendly environment as there are currently no pedestrian facilities on Teston Road	• Does not accommodate pedestrians or create a pedestrian-friendly environment	• Does not accommodate pedestrians or create a pedestrian-friendly environment along Teston Road	• Does not accommodate pedestrians or create a pedestrian-friendly environment	• Accommodates pedestrians and creates a pedestrian-friendly environment by providing continuous physically separated pedestrian facilities and builds on upcoming active transportation investments east and west of study corridor along Teston Road and Stegman's Mills, respectively as well as north and south along Kleinburg Summit Way and Pine Valley Drive, respectively. In addition, Teston Road will serve as an interim route for the Vaughan Super Trail until such time that the City can secure lands through the Trans Canada Pipe Line corridor	• Potential for accommodation of pedestrians and creation of a pedestrian-friendly environment by providing improvements to the roadway profile and intersection improvements that accommodate dedicated pedestrian crossings
Create a Cyclist-Friendly Environment	• Does not accommodate cyclists or create a cyclist-friendly environment as there are currently no formal cycling facilities on Teston Road or sufficient	• Does not accommodate cyclists or create a cyclist-friendly environment	• Does not accommodate cyclists or create a cyclist-friendly environment along Teston Road	• Does not accommodate cyclists or create a cyclist-friendly environment	• Accommodates cyclists and creates a cyclist-friendly environment by providing continuous physically separated cycling facilities and builds on upcoming active	• Potential for accommodation of cyclists and creation of a cyclist-friendly environment by providing improvements to the roadway profile and intersection improvements

Evaluation Criteria	**Alternative 1:** Do Nothing	**Alternative 2:** Limit / Reduce Development	**Alternative 3:** Improve other roadways	**Alternative 4:** Widen Teston Road for Additional Vehicular Lanes	**Alternative 5:** Provide Continuous physically separated Active Transportation Facilities	**Alternative 6:** Operational Improvements
	roadway shoulder space to allow cyclists to safely ride				transportation investments east and west of study corridor along Teston Road and Stegman's Mills, respectively as well as north and south along Kleinburg Summit Way and Pine Valley Drive, respectively. In addition, Teston Road will serve as an interim route for the Vaughan Super Trail until such time that the City can secure lands through the Trans Canada Pipe Line corridor	that accommodate dedicated cycling crossings
Reduce Traffic Congestion and Delays	• Congestion is not a major concern along this segment of Teston Road • The existing roadway is anticipated to adequately accommodate existing and future traffic demand without significant congestion and delays	• Potential to marginally limit increase in traffic congestion by limiting growth in trip making; however, congestion is not a major concern along this segment of Teston Road	• Potential to decrease traffic congestion along Teston Road by redirecting traffic to other roadways; however, congestion is not a major concern along this segment of Teston Road	• Increases corridor capacity; however, congestion is not a major concern along this segment of Teston Road and therefore additional capacity is not anticipated to be required	• Potential to marginally limit increase in traffic congestion by shifting some trips to active travel modes; however, congestion is not a major concern along this segment of Teston Road	• Potential to improve conditions at intersections including improved Level of Service
Improve Safety for all Travel Modes	• Does not address existing or potential safety concerns for all travel modes	• Does not address existing or potential safety concerns for all travel modes	• Does not address existing or potential safety concerns for all travel modes along Teston Road	• Does not address existing or potential safety concerns for all travel modes	• Potential improvements to cyclist and pedestrian safety as continuous, physically separated space for active transportation modes increases separation from and reduces conflicts with motorized vehicles	• High potential for improvements to safety as a result of roadway profile corrections, improved operations at intersections, and other safety/operational improvements
Improve Viability of Travel Mode Choice	• Does not improve travel mode choice due to existing lack of separated pedestrian and cycling facilities	• Does not improve travel mode choice due to existing lack of separated pedestrian and cycling facilities	• Does not improve travel mode choice along Teston Road due to existing lack of separated pedestrian and cycling facilities	• Does not improve travel mode choice due to existing lack of separated pedestrian and cycling facilities	• Improves travel mode choice by providing continuous physically separated cycling and pedestrian facilities. However, intersection improvements to provide dedicated pedestrian and cycling crossings would	• Marginally improves travel mode choice if intersection improvements include dedicated pedestrian and cycling crossings. Linear infrastructure would need to accompany these improvements to fully support travel mode choice

Evaluation Criteria	**Alternative 1:** Do Nothing	**Alternative 2:** Limit / Reduce Development	**Alternative 3:** Improve other roadways	**Alternative 4:** Widen Teston Road for Additional Vehicular Lanes	**Alternative 5:** Provide Continuous physically separated Active Transportation Facilities	**Alternative 6:** Operational Improvements
					need to accompany the linear infrastructure improvements.	
Summary of Transportation Service	**Not Preferred**	**Not Preferred**	**Not Preferred**	**Not Preferred**	**Preferred**	**Preferred**
Social Environment						
Minimize Impacts and Improve Access by all modes of transportation to Residential, Institutional, Business and Recreational Dwellings / Properties and key destinations such as Kleinburg Historic Village, Bindertwine District Park, etc.	• No impacts or benefits	• No impacts or benefits	• No impacts or benefits along Teston Road	• Potential for property acquisition required to accommodate wider roadway platform • Potential for impacts to access to existing properties as a result of having to travel across additional vehicular lanes to enter/exit a property	• Minor potential for property acquisition required to accommodate active transportation facilities • Improvements to access for active transportation modes	• Potential for property acquisition required to accommodate grading from roadway profile corrections or larger intersections • Improvements to access as a result of improved sightlines associated with roadway profile corrections
Minimize Traffic Noise	• No anticipated impacts	• No anticipated impacts	• No anticipated impacts along Teston Road	• Potential for noise impacts associated with additional vehicular lanes closer to private properties	• No anticipated impacts	• No anticipated impacts
Preserve Archaeological and Cultural Heritage Features	• No impacts	• No impacts associated with Teston Road • May reduce impacts within adjacent parcels if they are no longer developed	• No impacts associated with Teston Road • Potential impacts to archaeological or cultural heritage resources on other roads	• Potential impacts associated with a wider roadway platform; however, impacts may be limited as widening would occur predominantly within previously disturbed areas • Any potential impacts can be mitigated	• Potential for minor impacts associated with a marginally wider roadway platform; however, impacts may be very limited as widening would occur predominantly within previously disturbed areas • Any potential impacts can be mitigated	• Potential impacts associated with grading from roadway profile corrections or larger intersections; however, impacts may be limited as improvements would occur predominantly within previously disturbed areas • Any potential impacts can be mitigated
Improve Public Realm and create an environment that is enjoyable	• No anticipated impacts or benefits	• No anticipated impacts or benefits	• No anticipated impacts or benefits along Teston Road	• Wider roadway may be perceived as a negative impact on the visual aesthetics and rural character of the corridor	• Addition of active transportation facilities will add to the public realm and look/feel of the corridor providing people an enjoyable and	• Roadway profile corrections and intersection improvements may be perceived as a negative impact on the visual

Evaluation Criteria	**Alternative 1:** Do Nothing	**Alternative 2:** Limit / Reduce Development	**Alternative 3:** Improve other roadways	**Alternative 4:** Widen Teston Road for Additional Vehicular Lanes	**Alternative 5:** Provide Continuous physically separated Active Transportation Facilities	**Alternative 6:** Operational Improvements
					aesthetically pleasing safe space to walk or ride their bike to Bindertwine and or Kleinburg.	aesthetics and rural character of the corridor
Summary of Social Environment	**Preferred**	**Preferred**	**Preferred**	**Not Preferred**	**Less Preferred**	**Less Preferred**
Infrastructure Design and Economic Environment						
Minimize Utility Relocation	• No utility relocation required	• No utility relocation required	• No utility relocation required along Teston Road	• Utility relocation anticipated as a result of a wider roadway platform	• Potential for utility relocation associated with a marginally wider roadway platform	• Utility relocation anticipated at some locations as a result of grading from roadway profile corrections or larger intersections
Accommodate Planned Development and Growth	• Does not accommodate planned development and growth in terms of active transportation users • Roadway capacity can accommodate planned vehicular growth	• Does not accommodate planned development and growth and does not support the City's vision	• Does not accommodate planned development and growth along Teston Road	• the existing roadway capacity is anticipated to be sufficient to accommodate future vehicular growth	• Accommodates planned development and growth, including accommodation of active transportation users	• Accommodates planned development and growth by improving operations and safety for all modes
Minimize Property Acquisition	• No property acquisition	• No property acquisition	• No property acquisition along Teston Road	• Potential for property acquisition required to accommodate wider roadway platform	• Minor potential for property acquisition required to accommodate active transportation facilities	• Potential for property acquisition required to accommodate grading from roadway profile corrections or larger intersections
Cost-Benefit Comparison	• No capital costs • No benefits	• No capital costs • No benefits	• High capital costs for improvements to other roads • No benefits to Teston Road	• High capital costs for improvements to Teston Road • Benefits focus on increased vehicular capacity, which is not required	• Moderate capital cost • Significant benefits to active transportation modes	• High capital costs for improvements to Teston Road • Benefits focus on operations and safety improvements for all modes
Minimize Operating Costs	• No change to operating costs	• No change to operating costs	• No change to operating costs on Teston Road	• Moderate increase in operating costs due to additional vehicular lanes to be maintained	• Minor increase in operating costs due to addition of cycling and pedestrian facilities to be maintained	• Minor increase in operating costs associated with intersection improvements (as well as new infrastructure e.g. retaining walls and storm drainage systems)

Evaluation Criteria	**Alternative 1:** Do Nothing	**Alternative 2:** Limit / Reduce Development	**Alternative 3:** Improve other roadways	**Alternative 4:** Widen Teston Road for Additional Vehicular Lanes	**Alternative 5:** Provide Continuous physically separated Active Transportation Facilities	**Alternative 6:** Operational Improvements
Minimize Disruption due to Construction	• No construction disruption	• No construction disruption	• No construction disruption along Teston Road	• Significant construction disruption associated with wider platform and addition of vehicular lanes	• Minor construction disruption associated with addition of active transportation facilities	• Significant construction disruption associated with roadway profile adjustments including utility relocation, new storm drainage facilities, retaining systems and larger intersections
Summary of Infrastructure Design and Economic Environment	**Preferred**	**Preferred**	**Preferred**	**Not Preferred**	**Preferred**	**Less Preferred**
Natural Environment						
Protect Designated Areas	• There are no provincially significant wetlands (PSWs), areas of natural and scientific interest (ANSIs) or environmentally sensitive areas located within the study area					
Protect Vegetation	• No impacts • However, no opportunities to enhance natural environment	• No impacts • However, no opportunities to enhance natural environment	• No impacts • However, no opportunities to enhance natural environment along Teston Road	• Potential for significant impacts to vegetation along the corridor, including significant woodlands adjacent to Teston Road, as a result of wider roadway platform	• Potential for minor impacts to vegetation along the corridor, including significant woodlands adjacent to Teston Road, as a result of addition of active transportation facilities	• Potential for significant impacts to vegetation along the corridor, including significant woodlands adjacent to Teston Road, as a result of grading from roadway profile corrections and larger intersections
Protect Wildlife	• No opportunities to protect wildlife • Collisions involving wildlife have been reported along the corridor	• No opportunities to protect wildlife	• No opportunities to protect wildlife along Teston Road	• Opportunities to protect wildlife as part of roadway widening; however, larger roadway footprint may increase wildlife conflicts with motorized vehicles	• Opportunities to protect wildlife as part of active transportation facility implementation	• Opportunities to protect wildlife as part of operational improvements • Greatest potential for safety improvements related to collisions involving wildlife
Protect Aquatic Habitat	• No impacts • However, no opportunities to enhance aquatic habitat	• No impacts • However, no opportunities to enhance aquatic habitat	• No impacts • However, no opportunities to enhance aquatic habitat along Teston Road	• Potential for significant impacts to aquatic habitat along the corridor, including longer culverts, as a result of wider roadway platform; however, there are opportunities to enhance aquatic habitat as part of the roadway widening	• Potential for minor impacts to aquatic habitat along the corridor, including marginally longer culverts, as a result of active transportation facility implementation; however, there are opportunities to enhance aquatic habitat	• Potential for significant impacts to aquatic habitat along the corridor, including longer culverts, as a result of grading from roadway profile corrections; however, there are opportunities to enhance aquatic habitat as part of the improvements

Evaluation Criteria	**Alternative 1:** Do Nothing	**Alternative 2:** Limit / Reduce Development	**Alternative 3:** Improve other roadways	**Alternative 4:** Widen Teston Road for Additional Vehicular Lanes	**Alternative 5:** Provide Continuous physically separated Active Transportation Facilities	**Alternative 6:** Operational Improvements
					as part of the improvements	
Improve Air Quality	• No improvements to air quality	• No improvements to air quality	• No improvements to air quality along Teston Road	• Negative impacts to air quality as improvements focus on vehicular travel mode which is a key contributor to GHG emissions	• Potential for improvements to air quality as improved travel mode choice may reduce reliance on motorized vehicles for some trips and GHG emissions	• Potential for improvements to air quality associated with improved operations
Protect Surface Water and Ground Water	• No anticipated impact to stormwater quality or quantity • No anticipated impact on groundwater	• No anticipated impact to stormwater quality or quantity • No anticipated impact on groundwater	• No anticipated impact to stormwater quality or quantity along Teston Road • No anticipated impact on groundwater along Teston Road	• Moderate impact with increased roadway width and hard surface area to accommodate additional vehicular lanes, stormwater quantity will increase and quality mitigation may be required; however can be addressed through design • Moderate impact to shallow groundwater system due to potential increase in contaminants related to increased roadway width (i.e. road salt, etc.)	• Minor impact with marginally increased hard surface area to accommodate active transportation facilities, stormwater quantity will increase and quality mitigation may be required; however can be addressed through design • No anticipated impact on groundwater resources	• Minor impact with marginally increased hard surface area to accommodate larger intersections, stormwater quantity will marginally increase and quality mitigation may be required; however can be addressed through design • No anticipated impact on groundwater resources
Minimize Effects on Climate Change	• High reliance on automobiles will result in increased vehicle emissions and worsen effects on climate change • No improvements to study corridor resiliency to climate change	• No improvements to study corridor resiliency to climate change	• Potential for improvements to other corridors' resiliency to climate change, but no improvements along Teston Road	• High reliance on automobiles will result in increased vehicle emissions and worsen effects on climate change • Potential for improvements to study corridor resiliency to climate change	• Additional mode choice as a result of active transportation facility implementation may reduce reliance on automobiles, resulting in decreased vehicle emissions and minimized effects on climate change • Potential for improvements to study corridor resiliency to climate change	• Potential for improvements to study corridor resiliency to climate change
Minimize Flooding and Erosion and Protect Slope Stability	• No improvements to drainage, erosion or slope stability	• No improvements to drainage, erosion or slope stability	• No improvements to drainage, erosion or slope stability along Teston Road	• Opportunity for improvements to drainage, erosion and	• Opportunity for improvements to drainage, erosion and slope stability as part of	• Opportunity for improvements to drainage, erosion and slope stability

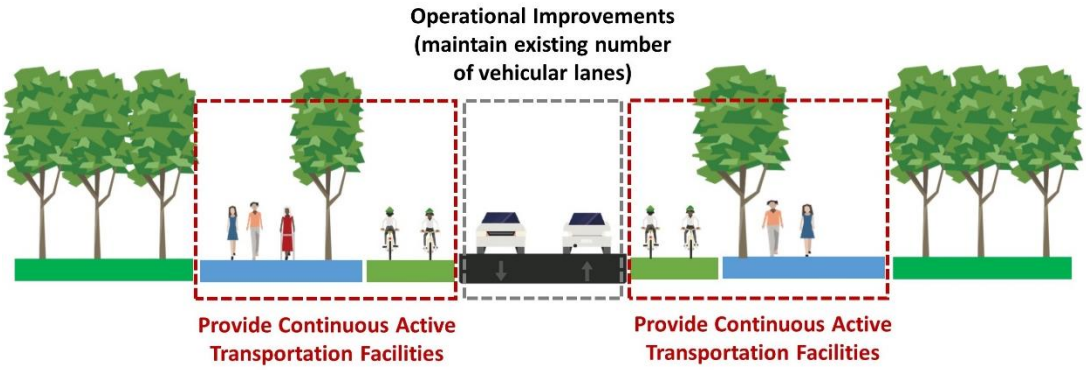
Evaluation Criteria	**Alternative 1:** Do Nothing	**Alternative 2:** Limit / Reduce Development	**Alternative 3:** Improve other roadways	**Alternative 4:** Widen Teston Road for Additional Vehicular Lanes	**Alternative 5:** Provide Continuous physically separated Active Transportation Facilities	**Alternative 6:** Operational Improvements
			• Potential improvements on other roads	slope stability as part of road widening • Will not improve roadway flooding conditions at watercourse crossings	active transportation improvements • Will not improve roadway flooding conditions at watercourse crossings, however increasing culvert size will significantly reduce flood potential	as part of operational improvements • Significant improvements to roadway flooding conditions at watercourse crossings with culvert upgrades
Summary of Natural Environment	**Not Preferred**	**Not Preferred**	**Not Preferred**	**Not Preferred**	**Preferred**	**Preferred**
OVERALL SUMMARY	**Less Preferred**	**Less Preferred**	**Less Preferred**	**Not Preferred**	**Preferred**	**Preferred**
Recommendation	**Not Carried Forward** for further consideration as part of this study	**Not Carried Forward** for further consideration as part of this study	**Not Carried Forward** for further consideration as part of this study	**Not Carried Forward** for further consideration as part of this study	**Carried Forward** as part of the recommended solution in combination with Alternative 6	**Carried Forward** as part of the recommended solution in combination with Alternative 5

6.3 Selection of Preferred Solution

Based on the evaluation presented above, Alternatives 1, 2, 3, and 4 are not recommended to be carried forward as they do not address the current and future transportation needs of the corridor. Alternative 5 – Provide Continuous physically separated Active Transportation Facilities and Alternative 6 – Operational Improvements was recommended to be carried forward to address the needs of all travel modes while considering the contextual aspect of the Teston Road corridor.

The preferred solution is presented in **Figure 6-1**.

Figure 6-1: Summary of Preferred Alternative Solution



7 Recommended Design Concept

7.1 Description of the Recommended Design Concept

The preferred design of Teston Road includes the following elements:

- Two 3.50m general purpose lanes (one in each direction);
- A 1.80m boulevard cycle track (traveling in the same direction as the road) on both the north and south side;
- A 1.80m sidewalk;
- A 0.50m curb-and-gutter with 0.50m rounding;
- Accessibility for Ontarians with Disabilities (AODA) compliant intersections;
- Illumination along the corridor;
- Property requirements with grading generally contained within the proposed right-of-way on the east side where feasible. Temporary and permanent easements for construction, maintenance, and grading purposes; and,
- Utility relocations.

7.2 Design Criteria

The geometric design for this road project was designed in accordance with the approved design criteria, standards and manuals. If there is any difference between the approved design criteria and standards and manuals, the following shall apply in descending order of precedence:

1. The approved design criteria for this road design;
2. City of Vaughan Design Criteria, March 2004;
3. York Region Road Design Guidelines, Dec. 2020;
4. TAC Geometric Design Guidelines;
5. MTO Design Supplement for TAC; and,
6. York Region Pedestrian and Cycling Planning & Design Guidelines.

Road Design Parameters

Road Design Parameters	Present Conditions	Design Standards	Proposed Standards	Source
Design Classification	N/A	RCU60	N/A	TAC - Table 2.6.2
R.O.W. Width	20m - 26m	26 m	TBD	City of Vaughan Official Plan, Schedule 9
Posted Speed	60 km/h (Note a)	50 km/h	50 km/hr	CoV Design Criteria Table 3.0
Design Speed	N/A	50 km/h	50 km/hr	York Region Road Design Guidelines Table 1
Minimum Stopping Sight Distance		65 m	65 m	City of Vaughan Design Criteria 2004 – Table 3.0
Equivalent Minimum 'K' Factor (m)	4 Crest Curve 7 Sag Curve	7 Crest Headlight Control 11 Sag Comfort Control 6 Sag	7 Crest 7 Sag	Vaughan Design Criteria – Table 3.0
Grades Maximum	9.3%	6.0% (TAC) 5.0% (CoV)	8.0 %	TAC, Chapter 3, Pg. 55 City of Vaughan, Design Criteria, Table 3.0
Grades Minimum	0.2%	0.5%	0.5%	City of Vaughan, Design Criteria, Table 3.0
Radius Minimum	1200 m	115 m	115 m	City of Vaughan, Design Criteria, Table 3.0
Maximum Rate of Super Elevation	N/A	4.0%	4.0%	TAC Chapter 3, Pg. 8

Road Design Parameters	Present Conditions	Design Standards	Proposed Standards	Source
Lane Width	3.75m - 4.0m Through Lane 3.7m Left Turn Lane 3.4m Right Turn Lane	3.5m Through Lane 3.0m-3.3m Left Turn Lane 3.5m Right Turn Lane 3.5m Curb Lane (to face-of-curb)	3.5m	York Region Road Design Guidelines Pg. 17 City's AT group email dated August 9, 2021
Shoulder Width and Rounding	0.8m-1.5m	2.5 m	2.5 m	York Region Road Design Guidelines, Pg. 17
Intersection Angle	82 – 98 degrees	70 – 110 degrees	70 – 110 degrees	TAC Chapter 9, Pg. 42

a) The posted speed limit is 40 Km/h from west end of the study limit to Kipling Avenue and 60 Km/h from Kipling Avenue Way to the east end of the study limit.

Turning Lane Design Parameters

Turning Lane		Present Conditions	Design Standards	Proposed Standards	Source
Right Turn Lane	Parallel Lane	30.0	30m minimum	30m	York Region Std Dwg DS-104
	Taper	40 m	40 m	40 m	York Region Std Dwg DS-104
Left Turn Lane	Storage	N/A	15 m	15 m	York Region Road Design Guidelines, Appendix E
	Taper	N/A	85 m	85 m	York Region Std Dwg DS-104

Turning Lane		Present Conditions	Design Standards	Proposed Standards	Source
	Parallel Lane	N/A	20 m	20 m	York Region Std Dwg DS-104

Cycling and Pedestrian Design Parameters

Cycling And Pedestrian Design	Present Conditions	Design Standards	Proposed Standards	Source
Cycling Facility Type (e.g. on-street, off-street, MUP)	N/A	Cycling Facility-Paved Shoulder: 1.5m minimum with 0.5m buffer	1.8m Cycle Track (In-Boulevard) 0.8m hard-surface buffer between back-of-curb to edge of cycle track *(as per City's AT group email dated August 9, 2021)*	York Region Pedestrian and Cycling Planning and Design Guidelines, Pg. 72
		Multi-use path (MUP): 3.0 m minimum, 4.0m preferred, with 0.5 m minimum Lateral Clearance		York Region Pedestrian and Cycling Planning and Design Guidelines, Pg. 73
		Multi-use Boulevard Pathways (MBP): 3.0 m		Vaughan Pedestrian and Bicycle Master Plan, Pg. 4-4 & 4-5
		Class 2 Bicycle Lane with Parallel Sidewalk: 1.2 m minimum, 1.5 m preferred [1]		Vaughan Pedestrian and Bicycle Master Plan Study, Pg. 4-5 & 4-6
		Paved Shoulder Bikeways (PSBs) 1.5 m – 2.0 m [1]		Vaughan Pedestrian and Bicycle Master Plan Study, Pg. 4-5 & 4-6

Cycling And Pedestrian Design	Present Conditions	Design Standards	Proposed Standards	Source
Sidewalk Width	N/A	1.5 m [2] 1.5 m Adjacent to Boulevard and Curb 1.2 m minimum from face of curb	1.8m Sidewalk 0.2m hard surface buffer between Cycle Track and Sidewalk *(as per City's AT group email dated August 9, 2021)*	Vaughan Pedestrian and Bicycle Master Plan Study, Pg. 4-5 City of Vaughan, STD. DWG. R - 128 City of Vaughan, Design Criteria, Pg. 15
Active Transportation Maximum Grade	N/A	5.0 % Maximum. Or match adjacent roadway grade when >5% 10% (9m max. distance)	Match proposed road grade	York Region Pedestrian and Cycling Planning and Design Guidelines, Pg. 46 York Region Trail Guidelines
Active Transportation Cross Slope	Varies	2.0 % Recommended 5.0 % Maximum	2.0 – 5.0%	York Region Pedestrian and Cycling Planning and Design Guidelines, Pg. 47

Notes:

1. The Vaughan Pedestrian and Bicycle Master Plan, Recommended Pedestrian and Bicycle Network provided in Map 4, designates Teston Road as Community Paved Shoulder Bikeway – Signed as bike route (CSB).
2. Sidewalks are required on both sides of collector and arterial roads (Vaughan Pedestrian and Bicycle Mater Plan – City of Vaughan Sidewalk Policy, Pg. 5-3 & 5-4)

Entrance Design Parameters

Entrance Design Parameters	Present Conditions	Design Standards	Proposed Standards	Source
Minimum Width	Varies - Rural (6 m – 25m)	3.0 m minimum (5.0m desirable) residential 5.0 m minimum (9.0 m desirable) commercial	Match existing entrance widths	York Region Road Design Guidelines, Pg. 62 & 634
Minimum Radius	Varies	3.0 m minimum (5.0m desirable) residential 5.0 m minimum (9.0 m desirable) commercial	5.0 m	York Region Road Design Guidelines, Pg. 63
Maximum Grade	Varies (1.5%-10%)	10%	10%	DS-200 & DS-214
Max. Algebraic Grade Change (4% Max)	14%	4%	Match or improve over existing conditions	DS-200 & DS-214
Sight Triangles	N/A	Major intersections: 20m x 20m Other intersections: 15m x 15m	15m x 15m	YR Sight Triangle Manual Pg. 21

7.3 Road Geometry

7.3.1 Horizontal Alignment

The horizontal alignment for the preferred design (with a 50km/h design speed) generally follows the existing centreline of Teston Road, with the exception where it is proposed to be shifted north about a central alignment from station 1+800 to 2+030 to avoid the existing watercourse that abuts closely to the proposed roadway platform. In addition, there are locations along the Teston Road corridor where the centreline is shifted slightly to the north or south of the existing alignment to provide a best fit for Teston Road within the existing and proposed right-of-way and minimize impacts to adjacent properties and features. Minor adjustments in the horizontal alignment are proposed at some locations in order to address geometric deficiencies and ensure that minimum design standards are met. The proposed horizontal alignment is illustrated on the preliminary design drawings in **Appendix M**.

7.3.2 Vertical Alignment

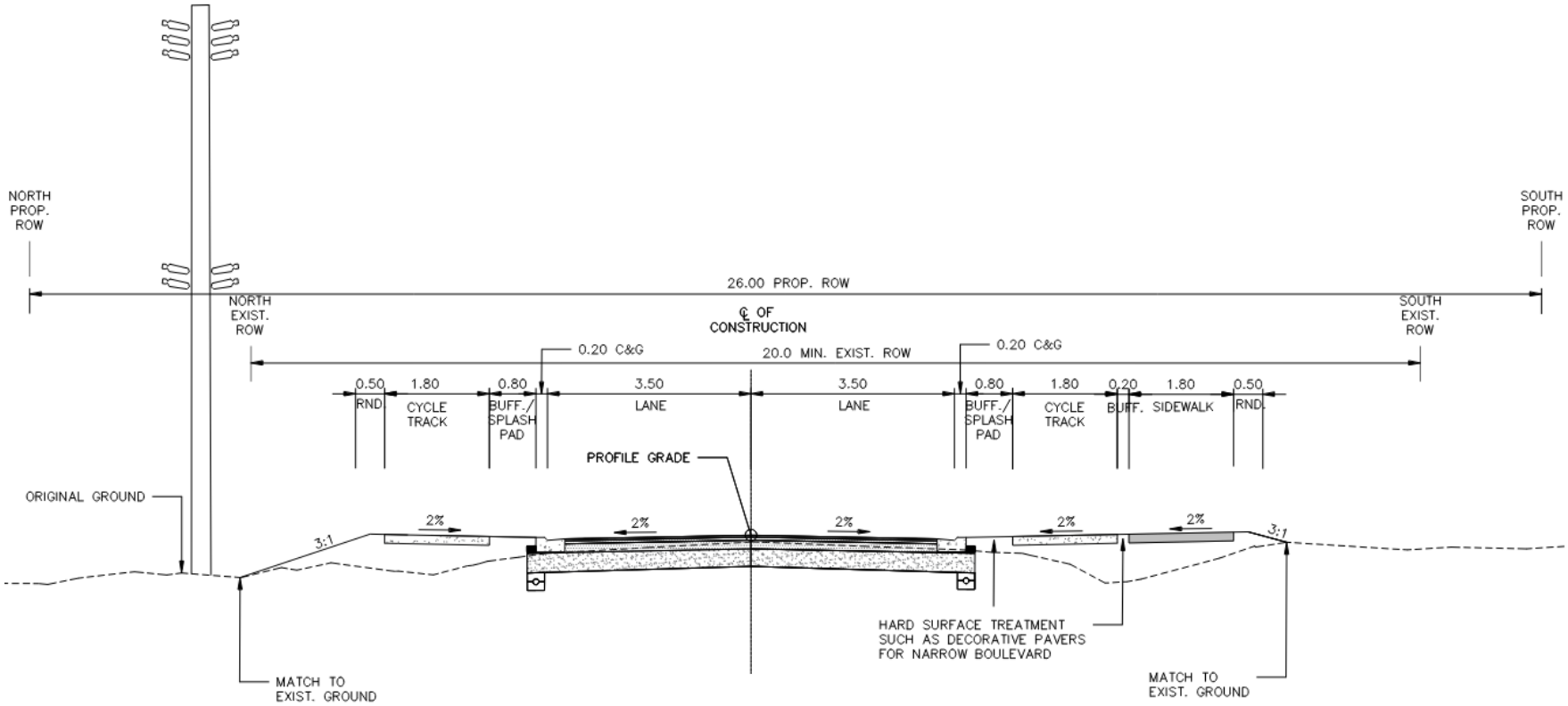
The proposed vertical alignment accommodates a 50 km/h design speed. This vertical alignment was chosen to match the existing road profile where possible, with minor adjustments proposed at some locations to address geometric deficiencies and meet the geometric standards required for the class of the road, as per the design criteria identified in Section 7.2. There are locations along the proposed vertical alignment that maintained existing sub-standard grades to match existing driveway profiles. The proposed vertical alignment matches back to the proposed vertical alignment designed by the development located southwest of Teston Road and Pine Valley Drive.

7.4 Typical Cross-Section

The typical cross-section for Teston Road between 250 m west of Pine Valley Drive and Kleinburg Summit Way is illustrated in **Figure 7-1** and generally consists of the following:

- Two general purpose lanes (one in each direction);
- 1.8m boulevard cycle tracks (traveling in the same direction as the road);
- 1.80m sidewalk on the south side only;
- 0.50m curb and gutter with 0.80m buffer/splash pad; and,
- 0.50m rounding buffer.

Figure 7-1: Typical Cross-Section



7.5 Cycling and Pedestrian Facilities

Continuous cycling facilities, consisting of 1.8m cycle track, are proposed along both sides of Teston Road and a continuous pedestrian sidewalk is proposed along the south side between 250 m west of Pine Valley Drive and Kleinburg Summit Way. A proposed hard-surfaced buffer/splash pad is proposed between the back-of-curb to the proposed cycle track.

The material type, treatment and pavement markings/signage for the sidewalk and cycle track will be confirmed during Detailed Design. The material type and treatment style will consider the interface between the respective active transportation facilities. Steel beam guiderail is proposed adjacent to steep slopes. The design and extent of guiderail will be confirmed during Detailed Design.

7.6 Traffic Calming Measures

There were various traffic calming measure considered in the study to reduce vehicular speeds and improve safety for pedestrians and cyclists along Teston Road. In addition to reducing the posted speed from 60 km/h to 50 km/h, the following are traffic calming measures to be considered and implemented, in consultation with the City, during the detailed design phase:

- **Speed Message Boards** – a speed message board is equipped with a radar unit that monitors the speed of oncoming traffic and displays it on a message board. Signs are placed on the same street, facing opposite directions, to monitor oncoming traffic in both directions. The signs do not take photos of cars. All traffic data collected from the speed board is analyzed, and study results are shared with York Regional Police for their information, driver education and any associated enforcement efforts;
- **Speed Reduction Pavement Markings** – Marking lines along the edge of the roadway can potentially make the road appear narrower, which slows down vehicular speeds; and
- **Warning Signage** – Installing warning signs along the road would have a psychological effect on motors to reduce traffic speeds.

7.7 Streetscaping and Landscaping

Landscaping opportunities exist between the proposed edge of boulevard and the proposed right-of-way on both sides of Teston Road where space is available. An arborist report identifying Tree Protection Zones is provided in **Appendix H**. Details regarding the type of plant species, as well as their planting spacing, is to be confirmed during the detailed design phase.

Where existing streetscape features (e.g. entry walls, pillars, decorative fencing, planting beds, planter curbs/edges, plaza paving, site furnishing, etc.) are impacted as a result of the proposed improvements, features are to be restored or relocated, where feasible.

7.8 Pavement Design

The preliminary pavement investigation recommendations are detailed in **Appendix I** and are provided for both rehabilitation and widening designs.

Pavement design recommendations need to be confirmed during detailed design by a geotechnical engineer.

7.8.1 Pavement Structure (Widening Areas)

The pavement structure for widening areas was designed based on pavement design parameters in Section 12.2 of **Appendix I**, while taking into consideration that the pavement thickness shall not be less than the minimum pavement requirements stipulated by the City of Vaughan for Industrial, Collector & Arterial Road. The City of Vaughan minimum pavement requirements were applied and the recommended conventional flexible pavement structure for Teston Road is presented in **Table 7-1**.

Table 7-1: Recommended Pavement Structure

Pavement Component/Parameter	Thickness (mm)
HL3 Surface Course	50
HL8 Binder Course	75
20mm CRL Base Course	125
50mm CRL Subbase Course	350*
Total Pavement Thickness	600

(*) Additional 40mm of 50mm CRL Subbase Course required between Sta. 2+720 and Sta. 3+175 to provide lateral drainage across the pavement platform.

7.8.2 Pavement Structure (Rehabilitation)

The preliminary design profiles indicate that significant grade adjustments ranging from up to 2.2m of grade lowering to 2.0m of grade raises are required for most of the alignment between Sta. 1+000 and Sta. 2+720. Since the grade adjustments occur over relatively short distances, implementing different rehabilitation strategies over short sections are not practical. It would also be most beneficial to have one pavement structure to ensure uniform pavement performance. Therefore, between Sta. 1+000 and Sta. 2+720, the recommended pavement structure should be the same as the pavement structure recommended in Section 7.8.1. Based on visual pavement condition evaluation and data collected from field investigations, it is noted that Teston Road's pavement has been recently rehabilitated towards the east project limit (between Sta. 2+720 and Sta. 3+175). Thus, along this section, a 50mm partial depth mill and repaving with a 50mm thick HL3 surface course is recommended. The existing pavement structure for this section is adequate for the 2031 Horizon Year and no rehabilitation is warranted.

7.9 Drainage/Stormwater Management Plan

7.9.1 Roadway Drainage System

The roadway profile is modified in the proposed conditions to address vertical alignment geometric deficiencies and accommodate larger culvert crossings. The roadway profile will be raised at the sag near Crossing C-1 and raised over Crossing C-2, and the high

point in the profile 100 m east of Crossing C-2 will be removed. Overall, the existing drainage patterns and discharge locations will not be altered as per the proposed roadway improvements, with the exception of the removed high point 100 m east of Crossing C-2, where major flows in the roadway will flow in an easterly direction towards the low point at Station 1+900.

7.9.2 Transverse Culvert Crossings

There are four (4) watercourse crossings within the study corridor. The proposed size, structure, and locations of each crossing was determined based on the existing condition assessment, natural heritage considerations, fluvial geomorphologic assessments, proposed roadway geometry, grading impacts, and hydraulic performance, with the objective of improving the drainage condition at each crossing, accommodating wildlife crossings, and addressing any existing deficiencies. A summary of the recommended approach for upgrades at each watercourse crossing is provided in **Table 7-2**.

Table 7-2: Transverse Culvert Crossing Recommendations

Crossing ID	Watercourse Crossing	Location	Recommendations for Watercourse Crossing Upgrades
C-1	Tributary of East Humber River	180 m west of Kipling Avenue	Replace existing 0.9 m diameter CSP culvert with a 4.267 m span x 1.525 m rise concrete open footing culvert
C-2	Purpleville Creek	360 m east of Kipling Avenue	Replace existing 3.0 m span x 1.0 m rise concrete box culvert with a 12.192 m span x 1.525 m rise concrete open footing culvert
C-3	Tributary of Purpleville Creek	790 m east of Kipling Avenue	Replace existing 2.4 m diameter CSP culvert with a 4.877 m span x 1.830 m rise concrete open footing culvert
C-4	Tributary of Purpleville Creek	670 m west of Pine Valley Drive	Extend existing 0.75 m diameter CSP culvert

7.9.3 Hydraulic Assessment of Proposed Transverse Crossings

Under proposed conditions, the drainage boundary and design peak flow values for the transverse crossings are considered to remain unchanged compared to the existing conditions. The increase in the pavement area as a result of the Teston Road improvements is negligible in comparison to the large external drainage areas contributing to each watercourse crossing location. Therefore, the design peak flows based on the current land use conditions were used to assess the hydraulic performance of the proposed crossings.

The hydraulic assessment for the proposed crossings is based on the preliminary proposed horizontal road design and vertical centerline profile design. Note that the proposed inverts of the crossing culverts are to be confirmed during detailed design to accommodate the road design and the roadside ditch grading. Hydraulic analysis results for proposed conditions are provided in **Table 7-3**.

Table 7-3: Hydraulic Analysis Results for Transverse Culverts (Proposed Condition)

Crossing ID	U/S Invert (m)	D/S Invert (m)	Length (m)	Road Elev. (m)	Water Surface Elev. (m)			Free-board (m)	Clearance (m) / HW/D	Remarks
					25-yr	50-yr	Reg./Check			
C-1	204.15	203.42	28.9	206.74	204.42	204.46	204.53[1]	2.32	0.53	Meets MTO criteria.
C-2	202.31	202.25	26.0	203.80	202.72	202.75	203.38	1.05	1.03	Meets MTO criteria.
C-3	199.74	199.67	17.2	202.65	199.94	199.96	200.30	2.71	1.56	Meets MTO criteria.
C-4	215.817	215.23	20.57	217.88	216.25	216.31	216.43[1]	1.63	0.58[2]	Meets MTO criteria.

1 Check Flow equal to 115% of the 100-yr storm, according to WC-1 of the MTO Highway Drainage Design Standards (2008)
2 HW/D

7.9.4 Stormwater Management Plan

The stormwater management plan for the study area within the Humber River watershed shall be developed to comply with the Toronto and Region Conservation Authority (TRCA) Stormwater Management Criteria, MECP Stormwater Management Guidelines, Humber River Hydrology Update Final Report (TRCA, 2018), York Region Road Design Guidelines, and City of Vaughan Engineering Design Criteria.

The proposed stormwater management plan for the project has been developed by examining the opportunities and constraints within the entire study corridor. Runoff from the paved roadway area will be conveyed to the proposed exfiltration and roadway storm sewer systems and discharge to the existing watercourses within the study limits. The pavement area will increase by 1.40 ha due to the additional cycle tracks and sidewalk. Enhanced level water quality, water balance, and erosion control treatment will be provided for 2.01 ha of pavement area, exceeding the MECP requirement of providing treatment to the increased pavement area. Drainage Areas A-6 and A-7 have been accounted for in the stormwater management strategy by the adjacent subdivision developer. Accordingly, no additional stormwater controls are proposed for these areas.

The stormwater management plan for this project is presented on the Drainage Plans in **Appendix K**. **Table 7-4** provides a summary of the water quality treatment and quantity control strategies proposed to mitigate the increase in impervious surface within the project limits from the cycle tracks and sidewalk.

Table 7-4: Summary of Stormwater Management Plan

Drainage Area ID	Existing Pavement Area (ha)	Additional Pavement Area (ha)	Pavement Area Receiving Quality Treatment (ha)	Quality Storage Volume Provided (m^3)	Quantity Control Storage Required[2] (m^3)
A-1	0.55	0.34	0.34	31	64
A-2[1]	0.26	0.24	0.50	41	46
A-3[1]	0.14	0.13	0.28	27	25
A-4[1]	0.39	0.40	0.79	76	75
A-5[1]	0.11	0.11	0.11	18	21
A-6[3]	0.39	0.12	0.00	0	0
A-7[3]	0.19	0.06	0.00	0	0
Total	**2.02**	**1.40**	**2.01**	**194**	**230**

[1] Total pavement area is treated to meet MECP requirements of treating the overall increased pavement area in the corridor
[2] Based on controlling up to 100-year storm
[3] Quality and Quantity control provided by Zzen-Lindvest Residential Subdivision stormwater management facility

7.10 Structures

As recommended in Section 7.9.2, existing culverts at crossings C-1, C-2, and C-3 require replacement due to poor physical condition of existing culvert at C-2 and poor hydraulic performance for all three crossing culverts. Additionally, openness ratios analysis was undertaken to improve wildlife passage from existing crossing conditions. The wildlife passage analysis for each crossing structure is presented in **Appendix G**.

The recommended structural culverts' type and sizing are presented in **Table 7-5** below.

Table 7-5: Recommended Structural Culverts

Crossing ID	Type	Span (m)	Rise (m)	Length (m)
C-1	Concrete Open Footing	4.267	1.525	28.93
C-2	Concrete Open Footing	12.192	1.525	26.01
C-3	Concrete Open Footing	4.877	1.830	17.20

Additional boreholes and proposed footing dimensions are to be determined during the detailed design phase to confirm founding soil conditions to accommodate for the crossing replacements.

7.11 Noise

A noise impact assessment was undertaken to determine potential noise impacts resulting from the proposed road improvements to Teston Road. The objectives of the study included the following:

- To 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);
- To use these predictions to assess potential impacts according to the applicable guidelines;
- To specify mitigation measures where required; and,
- To assess the potential for construction noise and provide a Code of Practice to minimize potential impacts.

The potential environmental noise impacts of the proposed undertaking were assessed. Both operational and construction noise impacts were 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 minor and all the homes will experience a slight decrease in noise levels due to the proposed change in posted speed on Teston Road from 60 km/h to 50 km/h;
- There are no adverse noise impacts and changes do not exceed the 5 dBA impact criteria in the Noise Protocol. No additional noise mitigation is recommended; and

- Construction noise impacts are temporary in nature but may be noticeable at times in nearby residential NSAs. Methods to minimize construction noise impacts should be included in the Construction Code of Practice, as outlined in **Appendix N**.

Additional details from the noise impact assessment are included in **Appendix N**

7.12 Air Quality

An air quality impact assessment was conducted by SLR Consulting Ltd. to determine potential impacts of the proposed road improvements to Teston Road on local air quality in the vicinity of the study area. Under the direction of MECP, a quantitative assessment is not required for this project. Therefore, a qualitative assessment was completed based on the following tasks:

- Identification and mapping of all sensitive receptor locations within 500 m of the project;
- Identification of proposed project activities and locations relative to identified sensitive receptors;
- Providing a summary of Best Management Practices (BMPs) to reduce construction related impacts. The BMPs will focus on mitigating diesel and dust related emissions from construction equipment; and
- Providing recommendations for documentation of inspection procedures and any air quality complaints received.

From an air quality perspective, the main concerns relating to construction activities include fugitive dust and diesel exhaust emissions. In addition, worst-case meteorological conditions included dry and/or windy days. Meteorological data from Pearson International Airport is provided in **Appendix O** and should be considered when planning construction staging and storage areas relative to air-sensitive receptors. The project study area was reviewed, and air-sensitive receptors were identified. Consideration should be given to limiting or postponing construction operations that may create fugitive dust emissions resulting in downwind impacts at nearby sensitive receptor locations. Examples of common Best Management Practices (BMPs) and controls are provided in **Appendix O**.

From an operational perspective, the project involves no alterations to the number of traffics lanes, lane positioning or lane widths, and there will be minimal increase in future traffic volumes. Based on these factors, the overall air quality impact from a day-to-day operational standpoint is expected to be insignificant between a build versus no build scenario.

7.13 Agriculture

Based on the future travel demand forecast in Section 4.7, the preferred design of Teston Road does not require roadway widening to accommodate for future traffic volumes. However, boulevard widening is required to accommodate for active transportation facilities on both the north and south side of Teston Road. The preferred design, presented in **Appendix M**, does not encroach, impact, or remove lands for cultivation.

7.14 Fluvial Geomorphology

The preliminary design of the preferred option was evaluated to provide guidance on how to mitigate erosion risks for the proposed crossings and to identify opportunities for improvements. The proposed crossings were reviewed with reference to the three geomorphic span options and recommended crossing skew. Existing and proposed hydraulic information was also reviewed to develop recommendations on the need for bed or bank erosion protection or scour pool construction. Peak flows and velocities for existing and proposed conditions were reviewed. The length and location of the proposed structures were also reviewed with respect to their configuration to the surrounding topography and channel alignments.

7.14.1 Crossing 1

The existing 900mm CSP culvert is proposed to be replaced with an open footing culvert with a span of 4.27 m. This will be a moderate improvement over the existing culvert, as the span will increase by 3.37 m. The proposed span is roughly equivalent to the Moderate Risk span option of 4.0 m (three times the bankfull width of 1.3 m), which is considered the minimum geomorphic span. The open footing structure will provide the opportunity to install natural substrate and create a low flow channel through the crossing.

The proposed alignment provides an opportunity to naturalize a portion of the upstream reach by realigning the creek away from the road. This will provide additional space to create a channel corridor in which for channel processes, such as meandering, may occur without risk to the road embankment. A 15 m wide corridor is recommended based on valley floor widths upstream of the proposed realignment.

Conceptual corridor limits and a conceptual channel centerline for the upstream realignment are presented in **Appendix J**. The realignment introduces a sinuous planform which extends beyond the proposed right-of-way. **Table 9** in **Appendix J** provides the channel length, slope, and sinuosity for the conceptual planform. The tie-in elevations and planform and corridor parameters should be revisited and confirmed in later design stages.

7.14.2 Crossing 2

Teston Road in the vicinity of Crossing 2 will be widened by approximately 2.9 m to the north and 4.6 m to the south (measured from edge of pavement to edge of proposed sidewalk). Crossing 2 is proposed to be replaced with an open footing culvert with a span of 12.19 m. This will be a considerable improvement over the existing 3.3 m concrete box culvert as the span will increase by 8.89 m. The proposed span falls between the Moderate Risk span option of 7.5 m and the Low Risk span options of 20 m (based on three times the bankfull width of 2.5 m and the upstream meander amplitude of 20 m, respectively). The proposed crossing will provide the opportunity to re-establish natural substrate and create a low-flow channel through the crossing.

The proposed crossing will have a slightly greater skew to the southeast compared to the existing crossing to better align with the channel downstream, to mitigate encroachment of the structure into the southwest creek embankment and to direct flow away from that

embankment, where toe erosion was observed. This is in line with the geomorphic recommendations for Crossing 2. The recommended skew is approximately 28 degrees from perpendicular to Teston Road. The culvert length will increase to 26.01 m from the existing 8.22 m. The preliminary slope through the crossing will be 0.26%. Slopes will be refined at detailed design.

Channel velocities under proposed conditions will be similar to existing at the inlet under all but the Regional flow, which will increase due to reduced flow restriction. At the culvert outlet, velocities will increase at the 5-year to Regional flows by 10% to 26%. Bed and bank protection and the creation of a scour pool at the culvert outlet may be required to provide stability and dissipate flows (as identified for residual erosion hazards for proposed span between Moderate and Low risk). Further downstream, the southwest creek embankment may also require bank protection to prevent further erosion along the toe of slope. "Soft" treatments such as plantings and live brush mattresses are recommended to be used where possible. Downstream tie-in works should also be considered at detailed design to shift the channel and direct flow away from the west embankment.

7.14.3 Crossing 3

The crossing is proposed to be replaced with an open footing culvert with a span of 4.88 m. This will be an improvement over the existing 2.30 m embedded CSP culvert, as the span will increase by 2.58 m. The proposed span is roughly equivalent to the Moderate Risk span option of 4.5 m (three times the bankfull width of 1.5 m), which is considered the minimum geomorphic span. The proposed open footing culvert will provide the opportunity to install natural substrate and create a low-flow channel through the crossing.

The proposed crossing maintains the existing crossing skew, which is in line with the geomorphic recommendation. The preliminary slope through the upstream tie-in, the proposed crossing and the downstream tie-in are 0.72%, 0.51%, and 1.42%, respectively. Slopes will be refined during the detailed design phase.

Channel velocities under proposed conditions will be similar to existing at the inlet under all flows. However, stabilization works should be considered at the inlet and outlet to reduce lateral and vertical erosion risks (as recommended for Moderate Risk option in Section 7). Erosion protection will be required at the culvert inlet on the west bank, which is currently protected by boulders. This bank is prone to erosion as it is the outer bank of a meander. Any future works at Crossing 3 should also consider the existing drop in channel elevation downstream of the future right-of-way. To ensure stability, the channel through the culvert and downstream tie-in should be composed of a graded substrate mixture with a stable core and buried stone protection should also be installed to act as a grade control. During and post-construction monitoring is recommended to ensure the channel profile is stable.

7.15 Hydrogeology

A hydrogeology assessment was conducted within the Study Area, including dewatering estimates and assessments of potential impacts. The findings are provided in **Appendix Q** are summarized as follows:

- Open cut excavations will be required for culvert replacements located at chainage 1+200, 1+740 and 2+175 and it is envisioned that active dewatering will be required to enable construction;
- Excavations requiring dewatering are expected mostly within relatively impermeable silty clay till soils;
- Shallow groundwater levels are expected at elevations ranging from 202.0± m near the central portions of the project falling to elevations of 199.7± m at the western extent and 200.3± m at the eastern extent of the project limits;
- It is anticipated that excavations will be completed within silty clay till deposits with an estimated hydraulic conductivity of 1.0×10^{-8} m/s;
- Based on the groundwater quality analysis completed, groundwater quality will meet the requirements for discharge overland, provided sediment control measures are in place. Groundwater quality exceedances with respect to limits for the PWQO were observed for total metals including copper, lead, iron, vanadium, and zinc in addition to total phosphorus. Concentrations within filtered samples (dissolved concentrations) were observed to meet the PWQO limits;
- Land use in the vicinity of the site consists of rural residential properties. Private supply wells were identified within a 500 m radius of the subject site. Private groundwater supply wells are completed within overburden deposits between 10 m to 27 m in depth, for domestic purposes with flow rates ranging between 15 L/min to 132 L/min (4 to 35 USG/min). Local groundwater is considered an adequate private supply source with flow rates reported more than typical residential demand of 11 to 19 L/min (3 to 5 USG/min). Issues regarding private supply of groundwater are not expected in the vicinity of the project area;
- Dewatering estimates were calculated given the observed site conditions and construction requirements and includes removal of precipitation (32 mm rainfall event) in excavated areas. Construction dewatering for culvert replacements is expected to average 20,200 L/day for locations at chainage 1+740 and 2+175. The culvert replacement at chainage 1+200 is expected to be completed above the groundwater table;
- Dewatering for the purposes of construction dewatering is not expected to require permitting from the Ministry of the Environment and Climate Change (MECP) (i.e. dewatering less than 50,000 L/day). Discharge can be carried out overland to allow for infiltration into the underlying soils;
- The radius of influence associated with the groundwater control activities is estimated at approximately 5± m. Significant structures are not expected to be situated within the predicted radius of influence for construction dewatering;
- A program of monitoring during construction is recommended. The monitoring should include frequent inspection of the excavation and discharge water. Detailed records should be maintained regarding excavation progress and pumping rates and volumes; and
- Further investigation is recommended under detailed design to evaluate and refine preliminary conditions noted in this report. Further investigation includes but should

not be limited completion of a private well survey, and additional groundwater measurement and testing based on the selected final design.

7.16 Illumination

Full illumination is proposed along Teston Road. The existing hydro poles located on the north side of Teston Road (between Kipling Avenue and Ballantyne Boulevard) can potentially be used to connect tapered elliptical aluminum arms with a Standard Cobrahead or LED Cobrahead type of streetlight (to be confirmed during the detailed design phase). Minor relocation will be required for some existing hydro poles due to conflicts with the proposed boulevard. Existing streetlight-mounted hydro poles may require to be adjusted on the north side of Teston Road between Kleinburg Summit Way and Kipling Avenue.

A Photometric analysis is required during detailed design to determine streetlight spacing to meet City of Vaughan's requirements as per City of Vaughan's Engineering Design Criteria and Standard Drawing (Dec 2020). Illumination will consider the roadway profile, the urban cross-section, and active transportation requirements.

7.17 Property Requirements

Based on City of Vaughan's Official Plan (2010) Schedule 9 Future Transportation Network, the City may acquire up to 26m right-of-way for Teston Road between Kipling Avenue and Pine Valley Drive, and 24m right-of-way between Kleinburg Summit Way and Kipling Avenue. Additional land may be acquired to accommodate intersection requirements, culvert crossings, etc. The proposed design attempts to minimize property requirements. In general, grading will be contained within the existing right-of-way where feasible. In areas where grading extends beyond the proposed right-of-way, grading easements will be required. Grading easements will be confirmed during detailed design.

7.18 Utilities

Existing utilities along the corridor were identified based on available information provided by the utility companies at the time of the EA study. Existing utilities along the Teston Road corridor, will be relocated as necessary to accommodate the preferred design. The existing utilities and the identified conflicts of the proposed improvements are documented on the Utility Composite and Conflict Plan provided in **Appendix P**.

The location and alignment of existing municipal services including storm sewers, sanitary sewers, and watermain, as well as any private utility infrastructure, are to be confirmed during detailed design, which may result in changes to the identified utility impacts. All utility information should be updated prior to construction to ensure that the data is accurate and to finalize relocation requirement as necessary. During the next phase of design, meetings will be held with utility companies as required where potential impacts to existing or future services are identified.

7.19 Preliminary Cost Estimate

Based on preliminary cost estimates, the cost of the recommended improvements is estimated at $18.5 million. This preliminary cost estimate includes costs for road work and retaining wall construction, addition of streetlights, culvert replacement, landscaping, traffic control, and engineering services; however, property acquisition costs are not included in the estimate. More details on the preliminary cost estimate are provided in **Appendix R**. These preliminary cost estimates are to be reviewed and confirmed during detailed design.

7.20 Constructability, Staging and Detour Considerations

The proposed improvements to Teston Road are expected to have significant impacts to pedestrian and vehicular movements. The critical component of the construction will be the culvert replacements at each of the three watercourse crossings. Due to the anticipated environmental impacts associated with maintaining traffic at these locations by way of a temporary roadway detour, a full closure of Teston Road to vehicular and pedestrian traffic is proposed. The key benefit of a roadway closure is that construction of these culverts can take place over a single construction season, which is preferred by MECP and TRCA since it reduces the risk of potential environmental exposure to flooding, erosion and sedimentation. A temporary roadway detour would require realignment of Teston Road, resulting in significant impacts to adjacent properties and natural environmental resources. In addition, a separate temporary crossing of watercourse crossings C-2 and C-3 would be required, which would increase the risk of flooding and further loss of Redside Dace habitat.

For the remainder of the Teston Road corridor, access to all properties during construction is to be maintained at all times. During detailed design, a traffic detouring strategy should be developed to provide motorists with alternate routes around the construction zone. The plan should also address how access to all properties along Teston Road will be maintained at all times.

7.21 Construction Monitoring and Maintenance Considerations

The improvements of Teston Road should be staged to maintain both local and through traffic within the Study Area to the extent possible and minimize disruptions. Any necessary interruptions to traffic, including the need for road closures for culvert replacements at each of the three watercourse crossings, should be minimized as feasible.

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

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

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 normally allowed hours. If construction activities are required outside of these hours, the Contractor should minimize the amount of noise being generated to not be clearly audible in any noise sensitive areas;
- There should be explicit indication that the Contractor is expected to comply with all applicable requirements of the contract; and,
- All equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order. This is also a requirement of the Vaughan noise control by-law.

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

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

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

8 Potential Environmental Impacts and Mitigation

8.1 Potential Environmental Impacts and Mitigation

The proposed cross-section, horizontal and vertical alignment designs aim to minimize impacts to adjacent lands and features, including sensitive natural areas, vegetation, culturally significant features, buildings, and properties outside the road right-of-way. However, although the benefits outweigh the negative effects, there will be some impacts that will need to be mitigated. A summary of the potential impacts to natural, social/economic and cultural environments, together with recommended mitigation measures, is provided in **Table 8-1**.

Table 8-1: Anticipated Impacts and Proposed Mitigation Measures

Factor	Details/Anticipated Impact	Proposed Mitigation
a) Land Use and Socio-Economic Impacts	a) Impacts on residents during construction, including increased travel time or possible detours. b) Impacts to commercial driveway access during construction. c) Some driveways will need to be re-graded	i. Prior to construction, specific notices and contact information will be delivered to area residents and property owners informing them of construction details, including temporary impacts to driveway access prior to construction and in advance of work related to their access. ii. Maintain access to individual driveways during construction.
b) Archaeology	a) Stage 1 background study determined that 65 previously registered archaeological sites are located within one kilometre of the Study Area. The property inspection determined that parts of the Study Area exhibits archaeological potential and will require Stage 2 assessment. b) The Damiani (AlGv-231) site is an ancestral Huron-Wendat village site within 100 metres of the Study Area. An associated ossuary has not yet been identified for the site. c) The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance, low and wet conditions, or being previously assessed. These lands do not require further archaeological assessment	i. To minimize the risk of impacting an ossuary within the project limits, a licensed archaeologist should be engaged to conduct a program of archaeological monitoring during the removal of topsoil for all parts of the Study Area that are within both 1000 metres of the Damiani site and 300 metres of water (see Supplementary Documentation) ii. 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. iii. Should any archaeological resources be unexpectedly encountered during construction, all activities impacting archaeological resources will cease immediately. MCM will be notified, and a licensed archaeologist is required to carry out an archaeological assessment in accordance with the Ontario Heritage Act and the Standards and Guidelines for Consultant Archaeologists. iv. If human remains are encountered, all activities will cease immediately and the local police or corner as well as the Registrar of Cemeteries at the Ministry of Consumer Services will be contacted. In situations where human remains are associated with archaeological resources, MCM will also be notified to ensure that the site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act. v. Further stages of archaeological assessment to be considered during Detailed Design.
c) Built Heritage Resources and	a) Direct impacts to CHL 2 are anticipated as proposed work occurring along Teston Road which is carried over the cultural heritage landscape. However, impacts	i. During construction establish no-go zones with fencing and instruct construction crews to avoid CHR and unintended impacts.

Factor	Details/Anticipated Impact	Proposed Mitigation
Cultural Heritage Landscapes	are anticipated to be temporary in direction and are not anticipated to negatively impact the Cultural Heritage Value of the watercourse. b) Direct impacts to CHL 3, CHL 4 are anticipated, however, encroachment and construction activities are not anticipated to have direct or indirect impacts to the potential CHVI of the property or identified potential heritage attributes.	ii. Post-Construction consider planting with sympathetic plant species and replacement of any impacted landscape features with potential cultural heritage value. iii. Consider planning construction and staging to avoid any unintended impacts, limiting tree and vegetation removal where feasible, and employing post-construction rehabilitation and landscaping. iv. The proposed property acquisition and encroachment should be minimized, where technically feasible.
d) Noise	a) The results show that changes in sound levels resulting from the proposed project are expected to be minor. b) Construction noise impacts are temporary in nature but may be noticeable at times in nearby residential NSAs.	i. Methods to minimize construction noise impacts should be included in the contract documents: a. Construction hours should abide by City of Vaughan noise control by-law 062-2018. If construction activities are required outside of these hours, the Contractor should minimize the amount of noise being generated to not be clearly audible in any noise sensitive areas. b. All equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order.
e) Property Requirements	a) Potential property acquisition and construction easements are anticipated at some locations as a result of the proposed design. b) Impacts to trees located outside of the existing right-of-way.	i. Formal definition of property requirements to be confirmed during Detailed Design. ii. Temporary or permanent easements, modifications to grading slopes (in accordance with geotechnical recommendations) to reduce the amount of area required, or in some cases considering a retaining wall or other type of soil retention feature to minimize grading footprint iii. Where impacts to trees cannot be avoided, compensation will be provided as per a compensation strategy developed during Detailed Design. This will consist of a plan to either replant trees at these locations or provide compensation to the property owner.

Factor	Details/Anticipated Impact	Proposed Mitigation
f) Air Quality	a) Based on the project involving no alterations to the number of traffics lanes, lane positioning or lane widths, and no associated increase in future traffic volumes, the overall air quality impact from a day-to-day operational standpoint is expected to be insignificant.	i. During the construction phase of the project, it is recommended that precautionary and mitigation approaches be considered for activities in closest proximity to the identified sensitive receptor locations. ii. Best Management Practices should be followed during construction to reduce any air quality impacts such as material wetting or use of non-chloride dust suppressants to reduce dust, use of wind barriers, and limiting exposed areas which may be a source of dust, and equipment washing.
g) Fluvial Geomorphology	a) The proposed retaining wall is located within the theoretical meander belt width. At a local scale, the flood hydraulics coming through the 5011 Teston Road driveway crossing just upstream might exacerbate erosion risk to the retaining wall. b) Due to the proximity of the retaining wall to the creek at Sta. 1+940, construction will directly impact the bankfull channel. Assuming that the retaining wall may be constructed from the roadway, excavation and ground disturbance may extend at least 15 m (estimated) from the road centreline, extending into the creek. Excavation would be required for the retaining wall footing. a) Temporary impacts related to erosion and sediment control (ESC) are anticipated.	i. Local realignment of the creek is recommended to relocate the channel outside of the work area and provide horizontal separation between the bankfull channel and the retaining wall. ii. Should construction from the roadway be infeasible, a larger construction footprint and greater impacts to the creek, riparian vegetation and floodplain would be required due to valley access by heavy equipment. As such, construction from the roadway is preferred. iii. To isolate the work area from the watercourse, an earth berm or temporary coffer dam should be constructed between the excavation area and the channel. A comprehensive ESC plan should be developed and implemented during construction under the supervision of a qualified ESC inspector. iv. Wedge of slope material may be replaced following construction of retaining wall to mitigate potential erosion. Option to incorporate buried erosion protection. v. Opportunities to restore channel morphology adjacent to roadway near south of Sta. 1+940 with realignment should be explored during Detailed Design.
h) Source Water Protection	a) The Teston Road study corridor, based on the MECP Source Protection Information Atlas and correspondence with TRCA, is located in the Toronto and Region Source Protection Area and parts of the study area are located on lands designated as Highly Vulnerable Aquifers (HVA) as illustrated in **Section 5.11.**	i. The additional impervious surface associated with the roadway improvements would reduce the amount of groundwater infiltration from the surface. To offset these impacts and balance water quantity, the stormwater management strategy described in Section 7.9. addresses infiltration of stormwater runoff from the road right-of-way. In addition, the

Factor	Details/Anticipated Impact	Proposed Mitigation
	b) Potential threats associated with Teston Road improvements include: • The establishment, operation, or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage (limited to stormwater runoff) • The application of road salt • The storage of snow (limited to roadway clearing operations only)	implementation of Low Impact Development (LID) measures will be considered during Detailed Design. ii. Additional road salt associated with winter maintenance for the proposed roadway improvements may increase impacts to source water protection areas. The City of Vaughan has developed Salt Management Plans for effective winter maintenance while striving to minimize the amount of salt entering the environment and at the same time meeting Provincial legislation related to road maintenance standards for winter services. iii. Treatment of contaminants present in roadside snowbanks should be considered in detailed design.
i) Streetscaping	a) Impact to existing trees and landscaped features in the boulevard	i. Where impacts to trees cannot be avoided, compensation will be provided as per a compensation strategy developed during detailed design. ii. Impacted features will be restored or relocated, where feasible iii. Increased opportunity for aesthetics throughout the corridor with the provision of landscaped boulevards where feasible to be implemented within the right-of-way.
j) Utilities	a) Existing utilities in conflict with proposed improvements	i. A relocation plan will be developed during Detailed Design as necessary. ii. All utility information will be updated prior to construction to ensure that the data is accurate and to finalize relocation requirements as necessary, in consultation with utility providers.
k) Construction Detours/Temporary Lane Reductions	a) Inconvenience during construction	i. Impacts will be temporary in nature. The City will attempt to mitigate impacts where possible. ii. During Detailed Design, a traffic management plan will be developed to determine how traffic will be accommodated during construction and how access to properties adjacent to Teston Road will be maintained.
l) Vegetation And Vegetation Communities	a) Displacement and/or Disturbance to Vegetation Communities/Vegetation b) Displacement of Rare, Threatened or Endangered Vegetation and Vegetation Communities	i. Prepare Edge Management Plans and detailed Planting Plans by qualified professional to mitigate impacts during Detailed Design. ii. Employ efforts to control non-native and invasive plant species management through recommendations identified in the Natural Heritage

Factor	Details/Anticipated Impact	Proposed Mitigation
		Report provided in **Appendix G** and sanitation of construction equipment. iii. Follow Construction Best Management Practices as identified in the Natural Heritage Report provided in **Appendix G.**
m) Fisheries and Aquatic Habitat	a) Temporary disruption or permanent loss of site-specific habitat; b) Temporary Changes to water quality; c) Changes in water temperature; and, d) Restoration/Enhancement	i. Prepare Restoration / Enhancement Plan to provide overall benefit to the watercourse through restoration of riparian habitat. ii. Where in-water work and work within the riparian habitat at the watercourse crossings are required, they should be permitted from July 1 to September 15. iii. Isolate work areas behind cofferdams iv. Treat effluent from unwatering prior to its release back into the receiving watercourse v. Deploy and maintain erosion and sediment controls (silt fencing, flow checks, etc.) vi. During construction: a. Delineate work areas with construction fencing to minimize the area of disturbance b. Install appropriate sediment control structures prior to and maintain during construction to prevent entry of sediments into the watercourse c. Where cofferdams are to be employed, treat unwatering effluent prior to discharge to receiving watercourse d. Construct cofferdams using pea gravel bags or equivalent to isolate the work area and maintain flow e. Use fish screen where cofferdams are to be deployed, at the end of the dewatering pump to prevent fish impingement and/or entrainment f. Capture and safely release fish isolated by construction activities to the watercourse g. Implement good housekeeping practices related to material storage/stockpiling, equipment fueling/maintenance, etc. during construction

Factor	Details/Anticipated Impact	Proposed Mitigation
		h. Stabilize the banks and minimize the potential for erosion as quickly as possible with vegetation and/or ESC blanket for disturbed riparian areas vii. Restoration of disturbed riparian areas associated with culverts and retaining wall works will focus on the replacement and enhancement of the riparian vegetation that will be affected by the proposed works viii. Secure a permit from the TRCA, pursuant to O.Reg. 166/06
n) Wildlife and Wildlife Habitat	a) Displacement of wildlife and wildlife habitat; b) Barrier effects on wildlife passage; c) Wildlife/vehicle conflicts; d) Wildlife passage considerations for enhanced functionality; e) Disturbance to wildlife from noise, light and visual intrusion; f) Potential impacts to migratory birds; and g) displacement of rare, threatened or endangered wildlife and significant wildlife habitat.	i. Clearing or disruption of vegetation where birds may be nesting should be completed outside the window of April 1 to July 31 to avoid the breeding bird season for the majority of the bird species protected under the act. If clearing or disruptions are required in this period, a nest screening survey needs to be conducted by a qualified avian biologist. If an active nest is located, all activities will be halted until birds have fledged and/or a mitigation plan shall be developed and provided to Environment Canada – Ontario Region for review prior to implementation. ii. It is recommended that target surveys for Rapid Clubtail, and Rusty-patch Bumble Bee be carried out during the Detailed Design phase. iii. Construction duration and disturbance in the vicinity of the culverts will be minimized to the extent possible to reduce the potential for increase in road mortality caused by wildlife avoidance of these structures. iv. Suitable maternity roosting habitat for bats includes mature trees found within and adjacent to the right-of-way. It is recommended to review habitat conditions, using standardized protocols (i.e. MECP protocol), and development of mitigation to protect species/habitat should be considered during Detailed Design.
o) Surface Water	a) Impacts resulting from any clearing, excavating or cut and fill operations will be temporary in nature by may result in the erosion of or sedimentation to, sensitive receiving watercourses	i. During Detailed Design identify site-specific Erosion and Sediment Control Measures to be implemented prior to the construction phase in accordance with Ontario Provincial Standard Specification (OPSS) 805 – Construction Specification for Temporary Erosion and Sediment Control Measures (2010) to

Factor	Details/Anticipated Impact	Proposed Mitigation
		minimize construction-related impacts on surface water quality and fish habitat ii. A preliminary drainage/stormwater management plan has been prepared to mitigate potential changes to the existing pavement area resulting from potential increase in quantity runoff. This plan will be reviewed and finalized in Detailed Design.
p) Soil Removal m And Contaminants	a) The study area contains 1 property with areas of potential environmental concern (APEC) which ranked medium risk. b) (#55) – Transformer Manufacturing, Processing and Use (northeast quadrant of Kleinburg Summit Way and Teston Road intersection) c) Residential driveway entrances along Teston Road were identified to have exceedances of salt related contaminants.	i. For medium risk APEC, the soil and/or grounder water may be investigated during future earthworks. ii. During future earthworks for the road improvement project, soil management activities may warrant chemical analysis of soil conditions for salt related contaminants to support re-use on-site and/or off-site disposal. No sample is required as per Ontario Regulation 153/04, as amended. iii. Activities related to management of excess soil through construction should be completed in accordance with MECP's new regulation released December 2019, titled "On-Site and Excess Soil Management" (O. Reg. 406/19). This document provides guidance on proper management of excess soils, ensuring valuable resources don't go to waste and to provide clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring strong protection of human health and the environment. iv. If, at any time, the management of excavated soil or excess soil causes an adverse effect, such as odour, litter, dust, noise, or other impacts to the natural environment or water quality, appropriate preventive and remedial actions will immediately be taken to alleviate the adverse effect or impact. Until these issues are addressed, all soil management activities may need to be suspended, including soil excavating, transporting or receiving. v. Proposed works adjacent to properties identified as having a medium risk ranking for contamination concern should be adequately assessed during Detailed Design. If subsurface work is to be conducted in the vicinity of any of the properties identified as having issues of potential environmental

Factor	Details/Anticipated Impact	Proposed Mitigation
		concern, further investigations including Phase I and Phase II ESAs may be required and will be undertaken during Detailed Design. If impact is encountered, it should be managed in consultation with a qualified professional. vi. Should there be discharge of a contaminate into the natural environment, notice of the discharge must be provided in accordance with the provisions of the Environmental Protection Act, R.S.O 1990, c. E. 19 (EPA)

9 Timing of Implementation and Future Commitments

9.1 Project Schedule

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

After the review period, provided that no Section 16 Orders are received, the City may proceed to Phase 5 of the Class EA process – design and construction. Property acquisition and utility relocation will then be scheduled, followed by construction.

9.2 Commitments to Future Work

1) Property Requirements
    a. Property requirements identified in this report and shown on the preliminary design drawings are preliminary and will be finalized during Detailed Design. Where feasible, review opportunities for easements instead of property acquisition.
    b. Review design opportunities to minimize property acquisition requirements at constrained locations.
    c. Obtain construction easements as required.
    d. Consult with property owners during the development of construction staging plans to maintain access to properties and minimize impacts (as feasible).
    e. Obtain Permission to Enter Agreements from landowners where access to their property is required.
2) Archaeology
    a. Should future work require an expansion of the study area, complete Stage 1 Archaeological Assessment (AA) to confirm presence/absence of archaeological potential.
    b. Complete Stage 2 AA for impacted lands as per recommendations of the Stage 1 AA as early as practicable during Detailed Design.
    c. Complete any additional stages of AA as per recommendations of the Stage 2 AA.
    d. Engage with Indigenous Communities that expressed interested in the Stage 2 Archaeological Assessments when they are conducted.
    e. Findings from subsequent archaeological assessments are to be filed with the MHTSCI to obtain clearance for archaeology.

f. Should any archaeological resources be unexpectedly encountered during construction, all activities impacting archaeological resources will cease immediately. MCM will be notified, and a licensed archaeologist is required to carry out an archaeological assessment in accordance with the Ontario Heritage Act and the Standards and Guidelines for Consultant Archaeologists.

g. If human remains are encountered, all activities will cease immediately and the local police or corner as well as the Registrar of Cemeteries at the Ministry of Consumer Services will be contacted. In situations where human remains are associated with archaeological resources, MCM will also be notified to ensure that the site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act.

3) Cultural Heritage

a. 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.

b. Construction activities and staging should be suitably planned and undertaken to avoid unintended negative impacts to identified CHLs. Avoidance measures may include, but are not limited to: erecting temporary fencing, establishing buffer zones, issuing instructions to construction crews to avoid identified CHLs, etc.

c. Post construction rehabilitation with sympathetic plantings can be implemented. Suitable mitigation measures may also include establishing no-go zones with fencing and issuing instructions to construction crews to avoid the CHLs.

4) Noise

a. Construction practices to abide by construction code of practice and City of Vaughan's Noise Control By-Law to minimize temporary construction noise impacts as outlined in the Noise Impact Assessment Report in **Appendix N**.

5) Air Quality

a. Consider additional vegetation planting to minimize particulate impacts to nearby sensitive receptors.

b. Best Management Practices should be followed during construction to reduce any air quality impacts such as material wetting or use of non-chloride dust suppressants to reduce dust, use of wind barriers, and limiting exposed areas which may be a source of dust, and equipment washing.

6) Fluvial Geomorphology

a. The tie-in elevations and planform and corridor parameters should be reviewed and confirmed during Detailed Design.

b. Bank protection and local channel modifications to be evaluated during Detailed Design.

c. Scour hazard assessment to be conducted by a qualified engineer and/or geoscientists during Detailed Design to identify the scour hazard limit at each watercourse crossing for which alterations to the crossing structure or watercourse are proposed, and where road embankment works adjacent to watercourses are proposed.

d. Scour hazard assessment to be conducted to confirm footing depth requirements and identify erosion control mitigation as needed during Detailed design near south of Sta. 1+940.

e. Channel realignment and slopes at Crossing 1 to be refined during Detailed Design.

f. Conceptual channel cross-section at Crossing 1 to be reviewed and refined during detailed design.

g. Opportunities to restore channel morphology adjacent to roadway near south of Sta. 1+940 with realignment should be explored during Detailed Design.

h. Distinct pool and run-type cross-sections be developed at detailed design, along with a channel profile with variation in slope corresponding to these morphological units.

i. Existing watercourse topography to be confirmed during Detailed Design.

7) Natural Heritage

a. A TRCA permit under Ontario Regulation 166/06 will be required for all works within regulated areas. Meet with TRCA early in the Detailed Design stage.

b. In-water work should only be conducted during the recommended construction timing window of July 1 to Sept 15. This will ensure that Redside Dace and their habitats downstream are protected during the sensitive spawning period, as well as ensuring that the stream has stabilized, and the riparian habitat is established before the winter months. Once construction is completed, the riparian habitat must be restored using native materials.

c. Construction should be undertaken during periods when the channel is dry or with minimal flow. Although flows may be absent, contingency plans should be established to address potential flows resulting from unanticipated storm events.

d. The length of time required for in-water work should be kept to a minimum.

e. Watercourses should not be blocked or flows impeded sufficiently to limit fish movement (i.e. pumping or diversion of flows around the work site can be used to avoid blocking flow during construction).

f. Appropriate sediment controls should be in place and measures taken to prevent sediment from exceeding 25 mg/L above background level during construction.

g. Exposed soil should be graded to a stable angle and revegetated in a manner that prevents erosion and slopes of culverts should mimic the natural stream bed.

h. Materials moved during construction activities should not be stockpiled where they can adversely affect drainage patterns and be a minimum of 30 m from the watercourse.

8) Hydrogeology

a. Confirm and further refine the preliminary hydrogeological recommendations based on the selected design.

b. Carry out additional detail level hydrogeological investigations for final design. Investigations should include confirmation of rates of hydraulic conductivity and groundwater levels within areas proposed for culvert replacement and refinement of the predicted zone of influence of dewatering.

c. Complete a private well survey to refine locations of private wells and to determine operational histories and construction details for private wells and to complete baseline groundwater quality sampling and groundwater level measurements.

d. Refine recommendations for well monitoring and contingency plans for groundwater control activities.

e. Consult with the Region of York regarding Kleinberg Well No. 2 and the monitoring network in place to include these locations within the well monitoring plan for construction.

f. Carry out additional groundwater quality assessments to verify the level of groundwater treatment that would be required to meet regulatory discharge criteria.

9) Drainage and Stormwater Management

a. During detailed design, review and verify design flows based on any changes to the land-use and associated hydrologic information that may affect the peak flows presented in this Class EA study.

b. During detailed design, complete a spread analysis to ensure that the ponding at low points shall not exceed 100 mm on the crown of the road.

c. In-situ infiltration rate measurements will be completed at all proposed LID locations to inform the Detailed Design of LID facilities and ensure sufficient separation with the groundwater table.

d. During the detailed design, confirm the location and performance characteristics of bioretention facilities to ensure that all bioretention cell design criteria are met.

e. During the detailed design, confirm the location, pipe sizing, and orifice sizing of the online storage pipes to ensure that the water quantity control criteria are met.

f. During the detailed design, confirm the proposed inverts of the crossing culverts to accommodate the road design and the roadside ditch grading.

g. During Detailed Design investigate supplemental Best Management Practice Measures to mitigate water temperature impacts and to inform the treatment train approach to be considered as outlined in Drainage and Stormwater Management Report.

h. During Detailed Design, a review of the current practice on road salt management and an evaluation of the potential impacts on surface water from the increase salt load of the pre-development versus post-development roadway salt impacts will be included.

i. During Detailed Design, reconfirm culvert sizing in consultation with TRCA.

j. During Detailed Design complete a detailed assessment to ensure that the proposed works will not generate any negative impacts to the floodplain.

k. As stipulated by MECP and various other agencies, the project corridor requires “enhanced” level of protection (TSS removal of 80%).

l. During Detailed Design, storage volume calculations with a minute-by-minute time step will be provided for TRCA’s review.

m. During Detailed Design, further consideration will be provided towards providing water quality control and water balance for the entire paved area.

10) Roadway Design

a. Address design requirements through the preparation of contract drawings and specifications.

b. Consider retaining walls at constrained locations.

c. Confirm proposed re-grading at driveways during detailed design once each driveway design is developed.

d. Confirm signage and pavement markings during detailed design.

e. Implement traffic calming measures to reduce excessive speeding and enhance corridor safety.

f. At the time of Detailed Design, changes to design standards and/or industry best practices compared to those available at the time of the EA, can be considered.

11) Active Transportation Facilities

a. Confirm material type, pavement markings, signage, transitions and treatment for the recommended multi-use paths and sidewalks.

b. At the time of Detailed Design, any changes to design standards and/or industry best practices related to the accommodation of active transportation users, compared to those available at the time of the EA, can be considered. This includes consideration of the applicable standards for pedestrian and cyclist treatment across entrances and intersections.

12) Streetscaping and Landscaping

a. Confirm streetscaping opportunities as per the preliminary design. Develop streetscaping plan, including individual tree planting locations, during detailed design.

b. A gap analysis must be undertaken during the detail design phase prior to construction when permission to enter has been obtained for private property and should include all trees within 6 m of the proposed disturbance limits. The gap analysis will be undertaken in accordance with the City of Vaughan and TRCA requirements.

c. During the detail design phase, the Arborist Report will be updated to reflect any refinements to the detail design, such as revised grading limits, and to consider site-specific mitigation measures to reduce the impact to trees throughout the study area.

13) Illumination

a. Illumination along the study corridor will consider the roadway profile, the urban cross-section, and active transportation requirements.

b. Details will be based on City of Vaughan's illumination standards and will be confirmed during Detailed Design, at which time the type and location of poles and luminaires will be confirmed.

14) Geotechnical and Hydrogeological Investigation

a. Detailed geotechnical investigation will be required to confirm the subsurface conditions and recommendations.

b. Additional testing during detailed design to confirm preliminary recommendations for management of excess excavated soils in accordance with current regulations.

c. During construction, material testing, and inspection should include observations and inspection of sewer trench, culvert and pavement sub-grade conditions, compaction testing of backfill and pavement materials as well as concrete and asphalt testing.

15) Contamination

a. A subsurface investigation involving sampling and analysis of soil and groundwater within the excavation depths for the proposed construction works would be required to confirm or refute the potential for contamination from the identified PSCs.

b. If subsurface work is to be conducted in the vicinity of any of the properties identified with potential environmental concern, further

investigations including Phase I ESAs may be required and will be undertaken during Detailed Design. If impact is encountered, it will be managed in consultation with a qualified professional.

16) Agriculture

a. Consider the use or creation of vegetated features, signage (No Trespassing/Private Property) and/or fencing to reduce the potential for trespassing and potential vandalism on adjacent agricultural lands in Detailed Design.

b. Consider the use of plantings/vegetation as buffers to reduce visual impacts and sounds in Detailed Design.

c. Considering limiting the use of tall streetlights or use lighting that is directed down and away from agricultural lands detailed design.

17) Utilities

a. Update utility information prior to construction to ensure that the data is accurate. Confirm location and resulting impacts to existing utilities and future services.

b. Determine formal definition of impacts on utilities during detailed design, in consultation with individual utility companies. Finalize relocation requirements with utility companies as necessary.

18) Constructability, Staging and Detours

a. Develop traffic management plan and staging concept to determine how vehicular (maintain one lane in each direction) and pedestrian and cyclist traffic will be accommodated during construction and how access to properties adjacent to Teston Road will be maintained.

19) Additional Consultation and Coordination

a. Consult with affected property owners including those where property is required or where access to their property will be impacted.

b. Consult with regulatory agencies and individual municipalities as required.

c. Coordinate with developers as required to determine their status, timelines, and any impacts to the study corridor.

d. Continue to consult with Indigenous Communities (as required).

20) Summary of Anticipated Permits and Approvals

a. DFO Request for Review.

b. TRCA permit under Ontario Regulation 166/06.

c. Permit to Take Water (PTTW) or EASR registration for construction to be confirmed if required.

d. Environmental Compliance Approval (ECA) from MECP for stormwater management facilities and storm sewers.

e. MECP Species at Risk (SAR) permitting or registration requirements under the Endangered Species Act (ESA).

f. Permission to Enter Agreements.

g. Clearance for cultural heritage and archaeology from MHTCSI based on findings from subsequent cultural heritage assessments and archaeological assessments as required.

9.3 Timing of Implementation

Timing of improvements is to be confirmed during Detailed Design. Construction timing is anticipated for 2024 – 2025 and is subject to change.