MARKHAM

Report to: Development Services Committee Report Date: November 19, 2018

SUBJECT: Future Urban Area Conceptual Master Plan – Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study (Phases 1 and 2) Wards 2 & 6

PREPARED BY: Nhat-Anh Nguyen, P. Eng., Ext. 2849
Senior Manager, Development & Environmental Engineering

RECOMMENDATION:

1) That the report dated November 19, 2018 entitled "Future Urban Area Conceptual Master Plan – Transportation Water and Wastewater Master Plan Class Environmental Assessment Study (Phases 1 and 2) be received for information.

PURPOSE:

This purpose of this report is to advise Council of the completion of the Future Urban Area Conceptual Master Plan – Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study (Phases 1 and 2).

BACKGROUND:

Conceptual Master Plan for Future Urban Area adopted by Council in October 2017

At its October 17, 2017 meeting, Council adopted the Conceptual Master Plan (CMP) for the Future Urban Area (FUA). The CMP laid out a high level community structure plan along with policy direction for the development of the FUA lands. The FUA lands and the CMP are shown on **Figures 1 and 2,** respectively. A number of technical studies were initiated to identify the transportation, water and wastewater networks to inform the CMP.

DISCUSSION:

Municipal Class EA is an approved process that allows municipal infrastructure to be planned in a manner designed to protect the environment

The Municipal Class EA process provides a framework for planning municipal infrastructure projects in a manner designed to protect the environment and meet the requirements of the Environmental Assessment Act. The process categorizes the different municipal projects according to their environmental significance and potential impacts on the environment; and provides guidance on the consultation requirements and approvals process. The municipal project categories (described as project schedules) outlines the different planning methodologies (described as Phases) for the different projects. The current Class EA identifies four (4) project schedules and five (5) phases for the planning and documentation of a planned municipal project. The four project schedules are:

Schedules A and A+ projects: These projects are pre-approved and can proceed to implementation without following any procedures set out in the Class EA. Schedule A+ projects are also pre-approved but require the public to be notified prior to their implementation. Schedule A and A+ projects typically have very little to no impact on the environment.

Schedule B projects: These projects can potentially have minor impacts the environment and members of the public, and must follow a screening process as identified in Phases 1 and 2 of the Class EA before they can proceed to implementation.

Schedule C projects: These projects can potentially have significant impacts on the public and the environment and must follow the full five phases of the Class EA process.

The five phases of the Class EA process and their respective planning and design steps are shown in **Figure 3**.

In addition to providing a framework for the planning of a municipal project, the Class EA recognizes the benefits of planning and documenting groups of related projects such as water, wastewater or transportation networks, prior to their implementation on a project-specific basis, and provides guidance on completing the planning of those groups of related projects. This type of planning under the Class EA is known as a master planning process. These *Master Plans*, as defined in the Class EA, are long range plans that integrate infrastructure requirements for existing and proposed land uses with environmental assessment principles, and are required to address the first two phases of the Class EA process.

Technical studies prepared to inform CMP were undertaken in a manner consistent with the Class EA Process for *Master Plans*

As indicated above, transportation, water, and wastewater studies were undertaken to inform the CMP. Those studies identified and evaluated the different transportation, water, and wastewater infrastructure options. The work completed for those studies, along with the consultation that took place with the stakeholders and members of the public, was done in a manner consistent with Class EA process for *Master Plans.*

The *Future Urban Area Conceptual Master Plan – Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study* consolidates the transportation, water, and wastewater studies into one *Master Plan* document.

The *Future Urban Area Conceptual Master Plan – Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study* (Master Plan Class EA), appended to this report as **Attachment 1**, documents the work, the consultation, and the decision-making process in identifying and evaluating the different transportation, water, and wastewater strategies, concepts, and recommending the networks to support the CMP. The Master Plan Class EA also identifies and categorizes the different municipal transportation, water and wastewater projects that require Phases 3 and 4 of the Class EA process be completed before they can be implemented (Phase 5).

NEXT STEPS:

Projects identified in the Master Plan Class EA as Schedule B or C projects will require completion of Phases 3 and 4 of the Class EA prior to their implementation
The completion of the Master Plan Class EA brings the master planning process to the end of Step 6 of Phase 2 of the Class EA (i.e., selection of the preferred transportation, water, and wastewater solutions). Specific transportation, water, and wastewater projects categorized as Schedules B or C projects in the Master Plan Class EA will require the proponent to complete the remaining Phases 3 and 4 of the Class EA prior to their respective implementation.

The municipal projects identified in the Master Plan Class EA can be carried out by a landowner in the FUA or by the City. In the event a landowner constructs the project(s) to support his respective development(s), the landowner would only be subject to Schedule C projects and be required to complete Phases 3 and 4 of the Class EA. Examples of these types of projects would include roads and bridge crossings that are estimated to exceed the cost limits identified in the Class EA. In the event the City wishes to construct certain projects, it would be subject to undertaking the balance of the Class EA process for Schedule B and C projects. Examples of these types of projects would include roads and bridge crossings, water booster station.

Phases 3 and 4 of Class EA for Schedule C projects will further refine the preferred solutions identified in Phases 1 and 2 and will be required to be completed prior to the registration of the impacted draft plan of subdivision
Phases 3 and 4 of Class EA includes developing alternative designs and mitigation measures at the project-specific level to avoid or mitigate impacts on the environment. Accordingly, the preferred alignments and designs for the individual roads, water and wastewater infrastructure may result in some minor changes from the preferred solution identified in Phases 1 and 2. The completion and filing of the Environmental Study Report (Phase 4 of the Class EA) will be required prior to the registration of the impacted draft plan of subdivision(s).

ALIGNMENT WITH STRATEGIC PRIORITIES:

The Future Urban Area Conceptual Master Plan – Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study was completed to support the development of the FUA Conceptual Master Plan to accommodate a portion of Markham's growth to 2031 as identified in the Markham Official Plan 2014 and York Regions Official Plan 2010.

BUSINESS UNITS CONSULTED AND AFFECTED:

The City's Planning Department has been consulted with and concurs with the recommendation of this report.

RECOMMENDED BY:

Brian Lee, P. Eng.
Director, Engineering

Arvin Prasad, MCIP, RPP
Commissioner, Development Services

ATTACHMENTS:

Figure 1: Future Urban Area Lands
Figure 2: FUA Community Structure Plan
Figure 3: Municipal Class EA Planning and Design Process

Appendix 'A': *Future Urban Area Conceptual Master Plan – Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study*

FUTURE URBAN AREA - LOCATION MAP

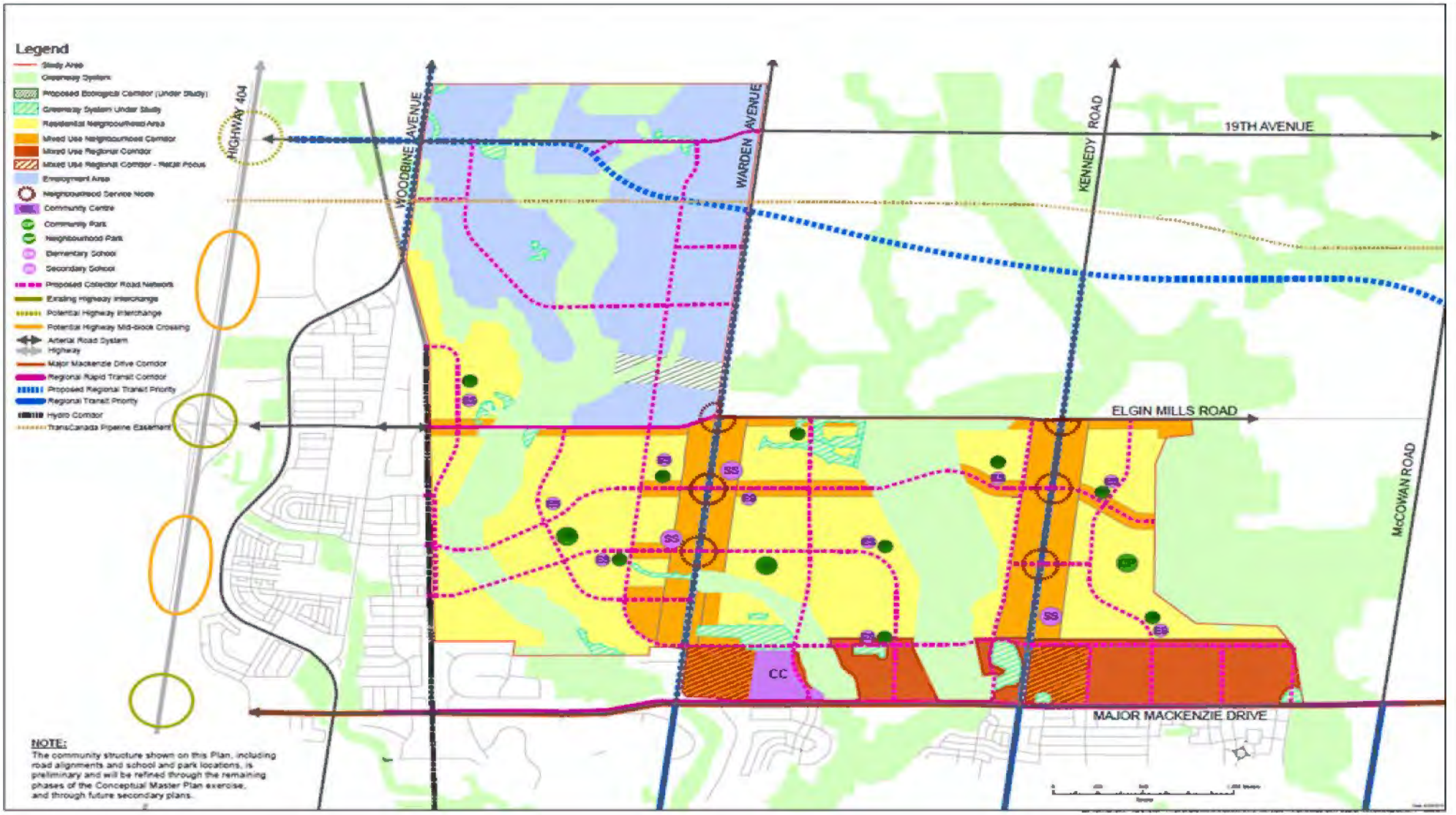
FUTURE URBAN AREA

MARKHAM

Drawn By: CPW

Checked By: SK

FIGURE No.1

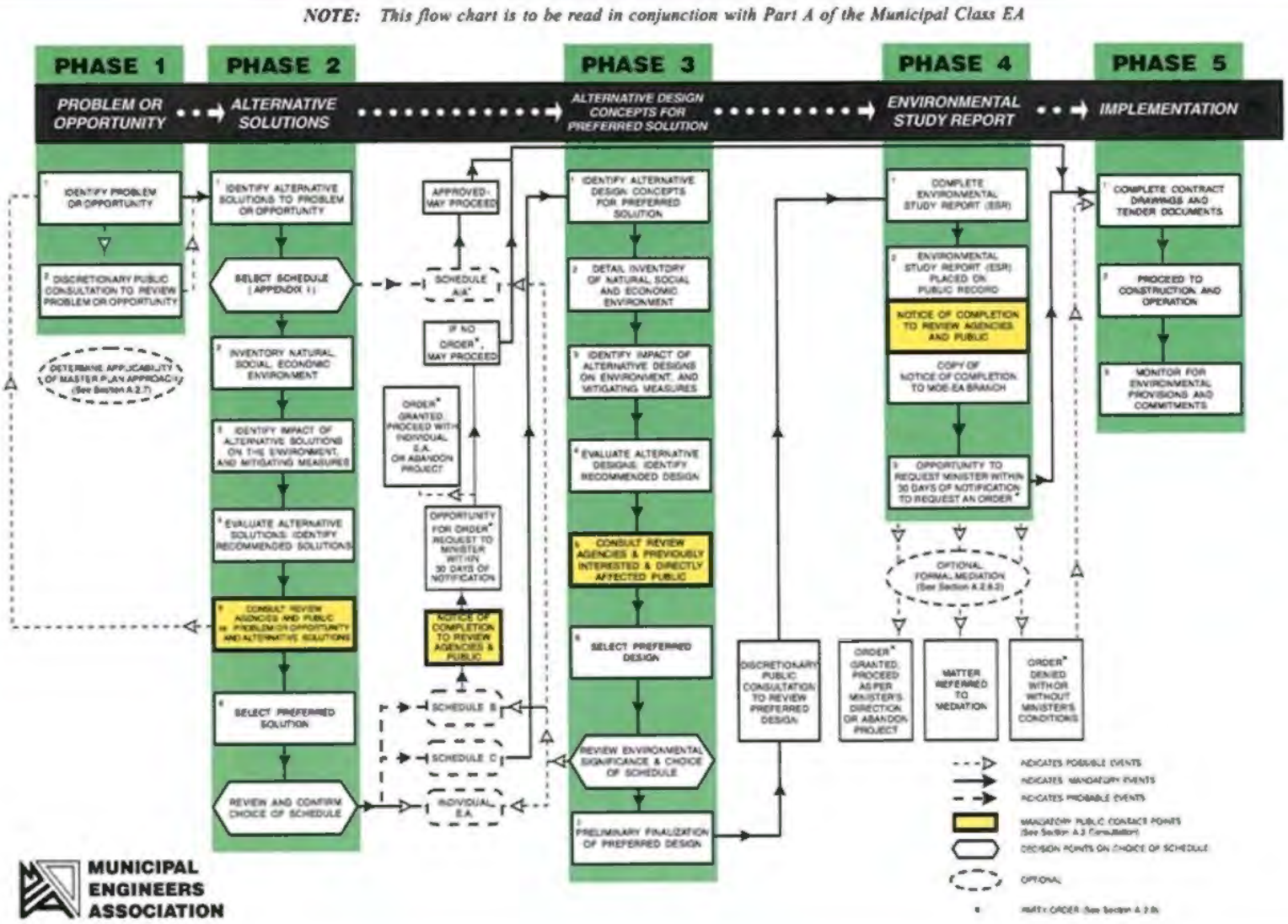


COMMUNITY STRUCTURE PLAN

DEVELOPMENT SERVICES COMMISSION

MARKHAM

FIGURE No.2



MUNICIPAL CLASS EA PLANNING AND DESIGN PROCESS

Appendix 'A'

City of Markham
Future Urban Area Conceptual Master Plan

Volume 2 – Transportation, Water and Wastewater Master Plan
Class Environmental Assessment Study (Phases 1 and 2)

Issues and Revisions Registry

Identification	Date	Description of issued and/or revision
Draft Report	April 30, 2018	For internal review FUA EA Report - v007.docx
Draft Report		For client review
Draft Report	July 30, 2018	Updated by NN to reflect comments received
Final Report	October 23, 2018	Updated by NN and PG to address final comments received

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Appendix A2 Joint Technical Advisory Committee meetings

1. June 19, 2015
2. April 13, 2017
3. July 28, 2017

Technical Advisory Committee meeting minutes[1]

1. January 10, 2014
2. February 21, 2014
3. March 27, 2014
4. April 25, 2014
5. May 29, 2014
6. July 18, 2014
7. July 29, 2014
8. September 18, 2014
9. September 19, 2014
10. September 24, 2014
11. October 23, 2014
12. October 24, 2014
13. November 21, 2014
14. December 19, 2014
15. February 20, 2015
16. March 13, 2015
17. March 27, 2015
18. April 13, 2015
19. May 22, 2015
20. June 2, 2015
21. June 19, 2015
22. August 21, 2015
23. October 23, 2015
24. January 22, 2016
25. February 26, 2016
26. April 7, 2016
27. June 17, 2016
28. September 23, 2016
29. September 28, 2016
30. November 4, 2016
31. December 8, 2016
32. February 24, 2017
33. April 13, 2017
34. July 28, 2017

[1] TAC meetings are summarized in Appendix A0. Paper copies are available for review by contacting the City of Markham.

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Appendix A3 Steering Committee minutes[2]

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2. September 6, 2013
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8. April 11, 2014
9. June 13, 2014
10. July 4, 2014
11. September 5, 2014
12. October 3, 2014
13. November 14, 2014
14. January 9, 2015
15. February 6, 2015
16. March 6, 2015
17. May 8, 2015
18. June 5, 2015
19. August 7, 2015
20. October 2, 2015
21. November 19, 2015
22. February 5, 2016
23. April 1, 2016
24. June 3, 2016
25. August 5, 2016
26. September 9, 2016
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Appendix A4 PIC #1 Materials January 15, 2015

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1. Notice
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[2] Steering Committee meeting are summarized in Appendix A0. Paper copies are available for review by contacting the City of Markham.

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UNDER SEPARATE COVER

Conceptual Master Plan - Volume 1: Community Structure Plan and Key Policy Direction, September 2017

Conceptual Master Plan - Volume 3: North Markham Future Urban Area Subwatershed Study (Berczy, Bruce, Eckardt and Robinson Creeks)

Topics	Project Team Members
Project Manager Class EA Advisor	Nhat-Anh Nguyen, P. Eng., City of Markham Janet Amos, RPP, Amos Environment + Planning Loren Polonsky, GM Blue Plan Philip Gray, Cole Engineering Group Ltd.
Water Resources Geomorphology Geotechnical Hydrology Natural Heritage (terrestrial and aquatic)	Ron Scheckenberger, P.Eng., AMEC Foster Wheeler (Wood Group) Aaron Farrell, AMEC Foster Wheeler (Wood Group)
Land Use Planning Archaeological Assessment Cultural Heritage First Nations and Métis Engagement	Marg Wouters, RPP, City of Markham Catherine Jay, City of Markham George Duncan, RPP, City of Markham Stephen Kitagawa, City of Markham Lilli Duoba, RPP, City of Markham
Transportation	Joseph Palmisano, P.Eng., City of Markham Yannis Stogios, P. Eng., Parsons Andrew Evraire, Parsons
Water Servicing	Marija Ilic, P. Eng., City of Markham Jean-Luc Daviau, M.A.Sc., P.Eng., WSP
Wastewater Servicing	Marija Ilic, P. Eng., City of Markham Philip Gray, P. Eng., Cole Engineering Group Ltd.

Executive Summary

Markham's Official Plan provides for new neighbourhood and employment lands in north Markham. The identification of these lands for inclusion within the City's urban area is one of the components of Markham's strategy to accommodate assigned population and employment growth to 2031. The neighbourhood and employment lands encompass approximately 1,300 hectares (3,200 acres), north of Major Mackenzie Drive and east of the Hydro Corridor and Woodbine Avenue.

The Official Plan identifies these lands as 'Future Urban Area' and outlines a comprehensive process to be undertaken prior to development occurring on the lands. A key component of the planning process is the development of a Conceptual Master Plan (CMP). The CMP is intended to provide a high level comprehensive Community Structure Plan for the entire Future Urban Area (FUA) lands to form the basis of more detailed secondary plans for smaller areas (concession blocks).

The CMP was informed by the findings of a number of City-led concurrent background studies, including a subwatershed study, transportation, water and wastewater studies and planning and urban design studies. The studies were undertaken in a coordinated integrated manner, each following an integrated three-phase process. The CMP also followed a Municipal Class Environmental Assessment (Class EA) process for the proposed transportation, water and wastewater projects required to serve the new FUA. The CMP process was designed to satisfy the first two phases of the Municipal Class EA process to the conclusion of Phase 2. In this document, the CMP phases of study and the Class EA phases are distinguished by referring to the latter as CMP phases.

After intensive analysis and consultation with agencies, landowners the public and First Nations and Métis over the course of four years, the CMP was endorsed by City of Markham Council on October 17, 2017.

CMP documentation is organized within three separate volumes under separate covers as follows:

- **Volume 1: Community Structure Plan and Key Policy Direction** - provides an overview of the CMP process and a summary of the work undertaken to date, including identification of a Community Structure Plan and key policy direction for secondary plans;
- **Volume 2: Transportation, Water and Wastewater Master Plan (Class EA)** – documents the transportation, water and wastewater servicing studies (this document);
- **Volume 3: Subwatershed Study** - documents all phases of the Subwatershed Study.

The vision for the new communities to be developed in the FUA reflects the vision of sustainable growth outlined in the Markham Official Plan 2014 and York Region Official Plan 2010. The Official Plan requirements were distilled into a set of guiding principles that provide collectively for the development of sustainable, healthy, compact and complete new communities. The principles, are organized under the broad headings of: protection and enhancement of the natural environment; building complete, compact communities; increasing travel options; maintaining a vibrant and competitive economy and adopting 'green' infrastructure and development standards.

The recommended Community Structure Plan identified in **Figure ES.1** provides a high level community structure across all of the FUA lands consistent with the guiding principles.

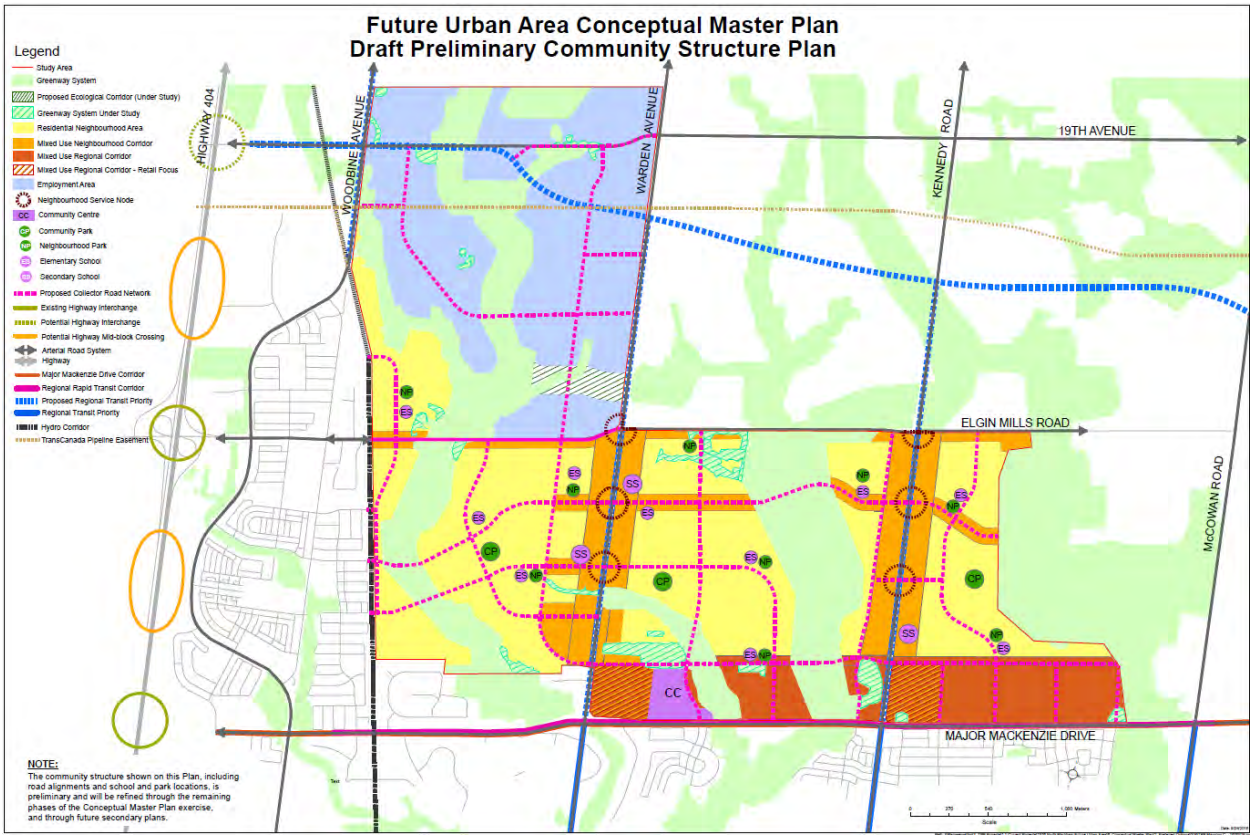


Figure ES.1 Recommended Community Structure Plan

The Community Structure Plan identifies a protected Greenway System, a transportation network, an open space network and broad land use categories which together deliver the structural elements of the new communities and employment area to be developed in the FUA.

The Community Structure Plan represents a balance between the Official Plan objectives of protecting and enhancing the natural environment and developing compact, complete new communities to accommodate growth. This balance was derived from intensive, integrated analysis which weighed the findings of the supporting subwatershed, transportation, water and wastewater servicing and planning studies, as well as consideration of existing land uses and public, stakeholders and agencies input. The key findings and strategies of each of the supporting studies are provided in Volume 1, the CMP which was endorsed by City of Markham Council on October 17, 2017.

The broad land use components (Residential Neighbourhood Area, Mixed Use Neighbourhood Corridor and Mixed Use Regional Corridor) in the Community Structure Plan provide for a range of housing types (from ground oriented units to apartments), schools, parks and open space, as well as appropriate locations for retail and service uses, all at transit-supportive densities. These lands are being planned to support an overall density of 70 residents and jobs per hectare and 20 units per hectare consistent with the York Region Official Plan 2010, accommodating a population of approximately 45,000 residents.

Approximately 16,000-18,000 jobs are anticipated within the Community Structure Plan, consisting of approximately 5,000 jobs within the Residential Neighbourhood Area and Mixed Use Corridors and 11,000-13,000 jobs being accommodated within the Employment Area north of Elgin Mills Road.

The Employment Area is intended to accommodate primarily general employment uses with opportunities for business park uses and ancillary retail and service at appropriate locations.

Building on the Community Structure Plan and the findings of each of the supporting studies, the transportation, water and wastewater servicing networks required to support the development of the FUA are outlined in this document. The documentation of the transportation, water and wastewater projects has been completed in a manner consistent with the requirements of the Municipal Class Environmental Assessment, 2007, as amended 2015 (Class EA) for Phases 1 and 2 of the Class EA process. This document is a Master Plan within the meaning of the Class EA and will be used as the basis for future consideration of transportation, water and wastewater projects which are subject to Schedule B or C of the Class EA.

CMP Volume 2 documents the Class EA Study process including the development and screening of transportation, water and wastewater strategies (i.e., do nothing, or build new transportation system), the development of network concepts used to test various servicing arrangements and public, stakeholders and agencies consultation and First Nations and Métis engagement. Two public meetings, one public event, over twenty Technical Advisory Committee meetings, First Nations and Métis meeting, numerous opportunities for public review at the City of Markham Development Services Committee and Council were provided over the course of this study.

CMP Volume 2 documents the recommendations for the implementation of a series of new City of Markham collector roads that will also form the basis of the future active transportation and transit systems as well as servicing networks of mains and facilities to provide water and wastewater services to the FUA. The recommended projects are listed and described in **Section 8**, Master Plan Recommendations.

Next Steps

With the completion of CMP Volume 2 – Transportation, Water and Wastewater Class EA Study (Phases 1 - 2), the City of Markham will embark on a series of next steps in the detailed planning for the FUA. The next steps for land use planning are the submission, review and approval of secondary plans, including supporting Master Environmental Servicing Plans (MESP) and community design plans in accordance with requirements of the Planning Act. The next steps in the provision of the transportation, water and wastewater for the new community is to carry out Class EA requirements according to the Municipal Class EA designation of each project. For example, major collector roads are subject to Schedule C of the Class EA and are required to comply with Phases 3 and 4 of the Class EA process. Both the planning and servicing require additional study and public, stakeholders and agencies input prior to approval and construction.

As the community planning and Class EA Studies are completed, it is recommended that phasing plans will also be established for each secondary plan area. At minimum, phasing plans are expected to have regard for development occurring in an orderly progression, with regard for delivery of key infrastructure and providing for elements of a complete community in each phase.

Urban design guidelines to guide community design plans, a Community Energy Plan to identify means of reducing energy demand in the new communities and associated financial analysis are also underway to further inform MESPs, Class EA studies and secondary plans.

1 Introduction

A Conceptual Master Plan has been prepared by the City of Markham as a guidance document for the planning and development of urban expansion lands in north Markham. These lands are referred to collectively as the Future Urban Area (FUA). The Conceptual Master Plan (CMP) was informed by a number of supporting studies following a Master Plan process of a Municipal Class Environmental Assessment (EA). The supporting studies addressed planning and urban design, natural heritage and water resources, transportation, water and wastewater.

The documentation for the CMP is organized within three volumes, each under separate cover, as follows:

- Volume 1: Community Structure Plan and Key Policy Direction, September 2017
- Volume 2: Transportation, Water and Wastewater Master Plan (Class EA Phases 1-2)
- Volume 3: Subwatershed Study (Berczy, Bruce, Eckardt and Robinson Creeks)

Volume 1 identifies a Community Structure Plan and key policy direction for the FUA lands, and is referred to as the Conceptual Master Plan. Volume 1 was endorsed by Markham Council on October 17, 2017 as the basis for the preparation of more detailed secondary plans and supporting Master Environmental Servicing Plans (MESPs) and community design plans. The Volume 1 report also includes a summary of the process and findings of each of the supporting studies undertaken.

Volume 3 documents the Subwatershed Study undertaken for the Berczy, Bruce, Eckardt and Robinson Creeks which traverse the FUA lands.

Volume 2 (this report) documents the transportation, water and wastewater servicing studies undertaken to support the development of the new communities in the FUA, in a manner that satisfies the requirements for Phases 1 and 2 of the Class EA for the future infrastructure projects (water, wastewater, roads) within and servicing the FUA. The report provides an overview of the CMP as well as detailed documentation regarding the evaluation process undertaken, public consultation and reports/memoranda prepared throughout the process for each of the studies.

Volume 2 consists of eight sections as follows:

Section 1 – Introduction

Section 2 – Conceptual Master Plan, Environmental Assessment and Policy Context

Section 3 – Public Consultation

Section 4 – Study Area Context

Section 5 – Transportation for Growth

Section 6 – Water Services for Growth

Section 7 – Wastewater Services for Growth

Section 8 – Master Plan Recommendations

A number of appendices provide more detailed information related to the section contents.

2 Conceptual Master Plan, Environmental Assessment and Policy Context

2.1 Conceptual Master Plan 2017

Markham's Official Plan 2014 provides for new neighbourhood and employment lands in north Markham. The identification of these lands for inclusion within the City's urban area is one component of Markham's strategy to accommodate assigned population and employment growth to 2031. The neighbourhood and employment lands encompass approximately 1,300 hectares (3,200 acres), generally bounded by Major Mackenzie Drive East to the south, the Hydro Corridor and Woodbine Avenue to the west, the northern City limits and Elgin Mills Road to the north and Warden Avenue and Robinson Creek to the east (see **Figure 2.1 – North Markham Future Urban Area Location Map**).

The Official Plan identifies these lands as 'Future Urban Area' and outlines a comprehensive planning process to be undertaken prior to development occurring on the lands (see **Figure 2.2 - Planning Process for the FUA**). A key component of the comprehensive planning process is the development of a Conceptual Master Plan (CMP) over the entirety of the FUA lands in order to ensure consistent, coordinated planning and development within individual secondary plan areas.

Underlying the CMP, among other things, is Official Plan policy direction to deliver compact communities within the FUA, which could accommodate the identified population and employment growth at specified minimum densities. The CMP endorsed by Markham Council in October 2017 represents a balance between Official Plan objectives of protecting and enhancing the natural environment, and developing compact, complete new communities to accommodate growth. This balance is derived from intensive, integrated analysis which weighed the findings of the supporting subwatershed, transportation, servicing and planning studies, as well as consideration of existing land uses and public input.

The CMP identifies a high level Community Structure Plan along with associated policy direction for subsequent secondary plans and development applications (see **Figure 2.3 – Community Structure Plan**). The Community Structure Plan identifies broad structural land use categories, a high level transportation and servicing system, an integrated open space system and major community facility requirements. The policy direction addresses the requirements for sustainable community development as identified in the York Region and Markham Official Plans, as well as provincial and regulatory agency requirements. The land use planning policy context underlying the CMP is further detailed in **Section 2.3**. Further details are available in the CMP Volume 1 report.

The CMP is a Council endorsed non-statutory document that is not subject to appeal to the Ontario Municipal Board. Throughout the CMP exercise, it was anticipated that individual secondary plans and accompanying MESPs and community design plans (CDPs) would be prepared to guide the development of each of the concession blocks within the FUA. For the purposes of the CMP, the individual concession blocks are referred to as the 'Employment Block', 'Berczy Glen Block', 'Angus Glen Block' and 'Robinson Glen Block', as shown in **Figure 2.4 – Anticipated Secondary Plan Blocks**. The approval of these secondary plans, to be adopted as statutory amendments to the Markham's Official Plan 2014, will be followed by approval of plans of subdivision and site plans prior to building permit issuance.

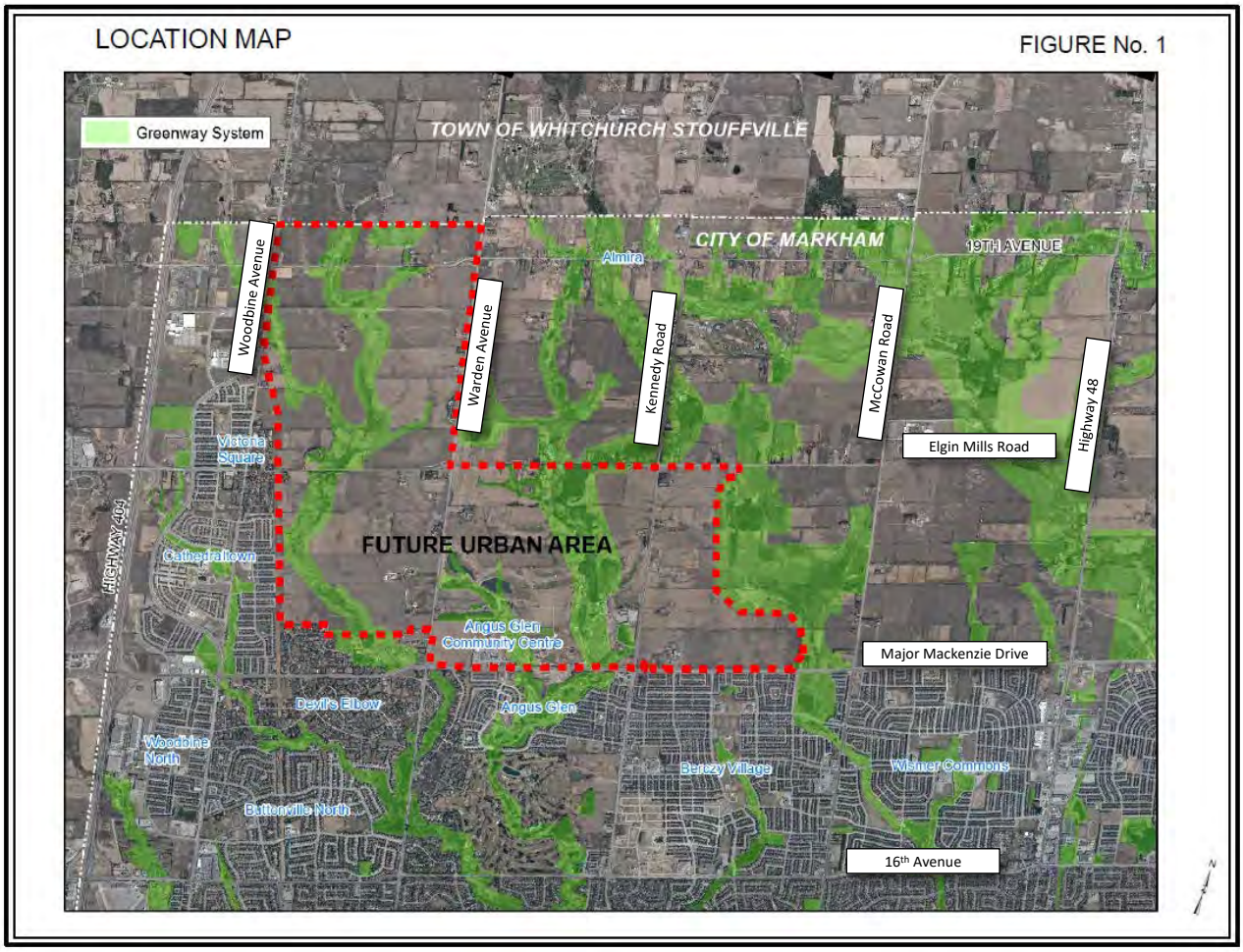


Figure 2.1 North Markham Future Urban Area Location Map

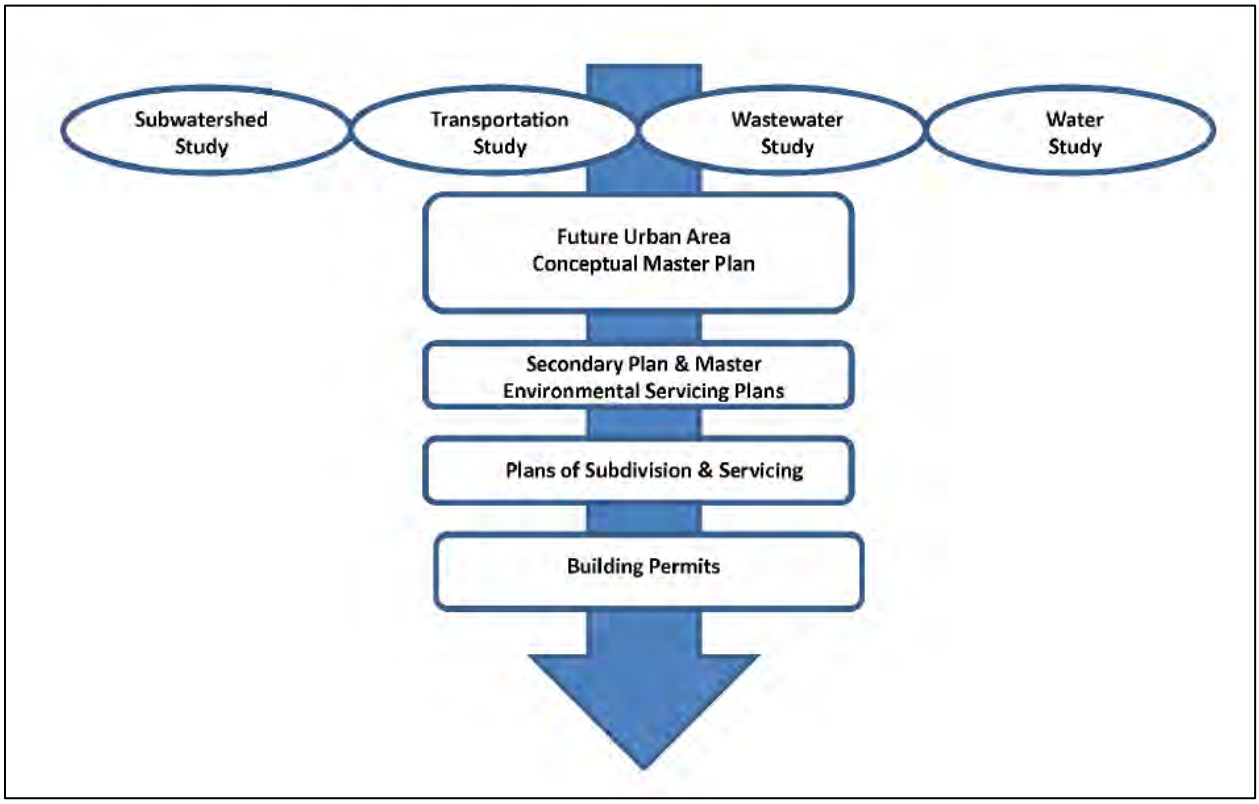


Figure 2.2 Planning Process for the FUA

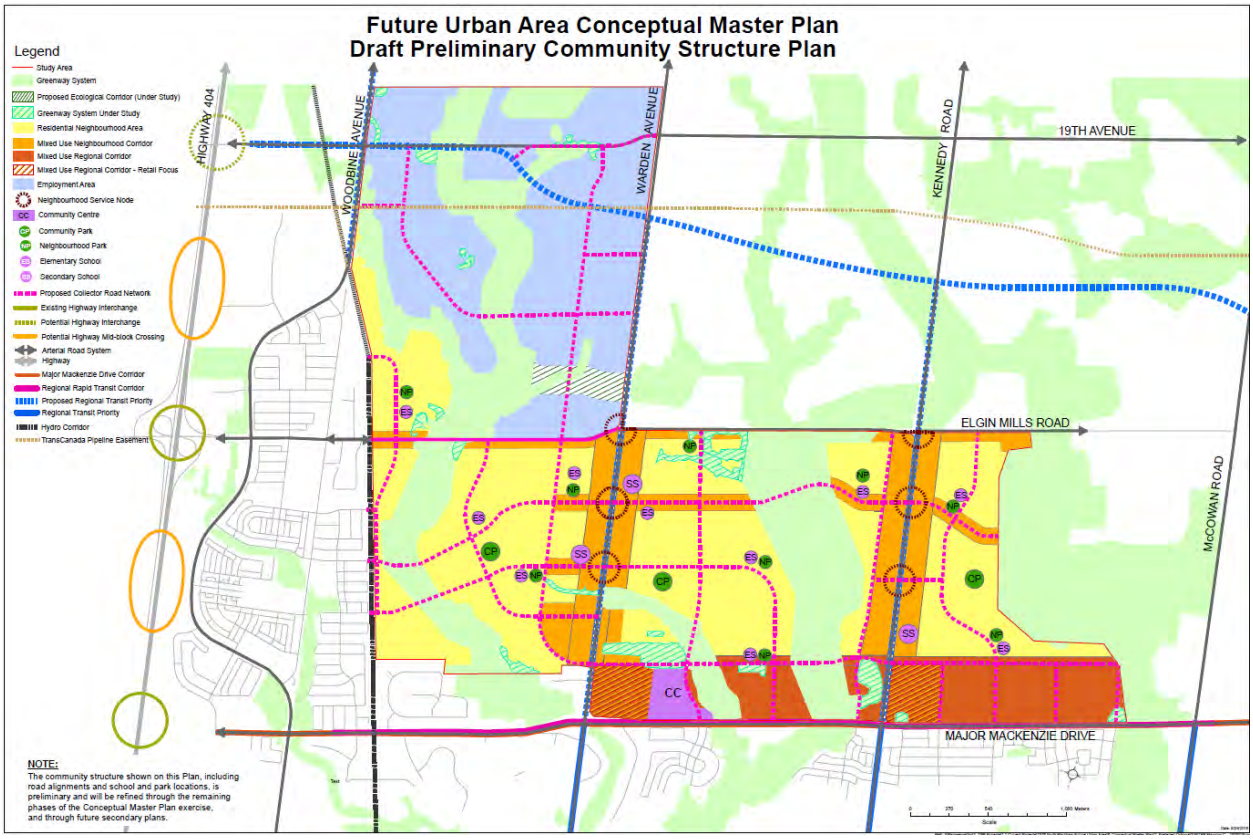


Figure 2.3 Community Structure Plan

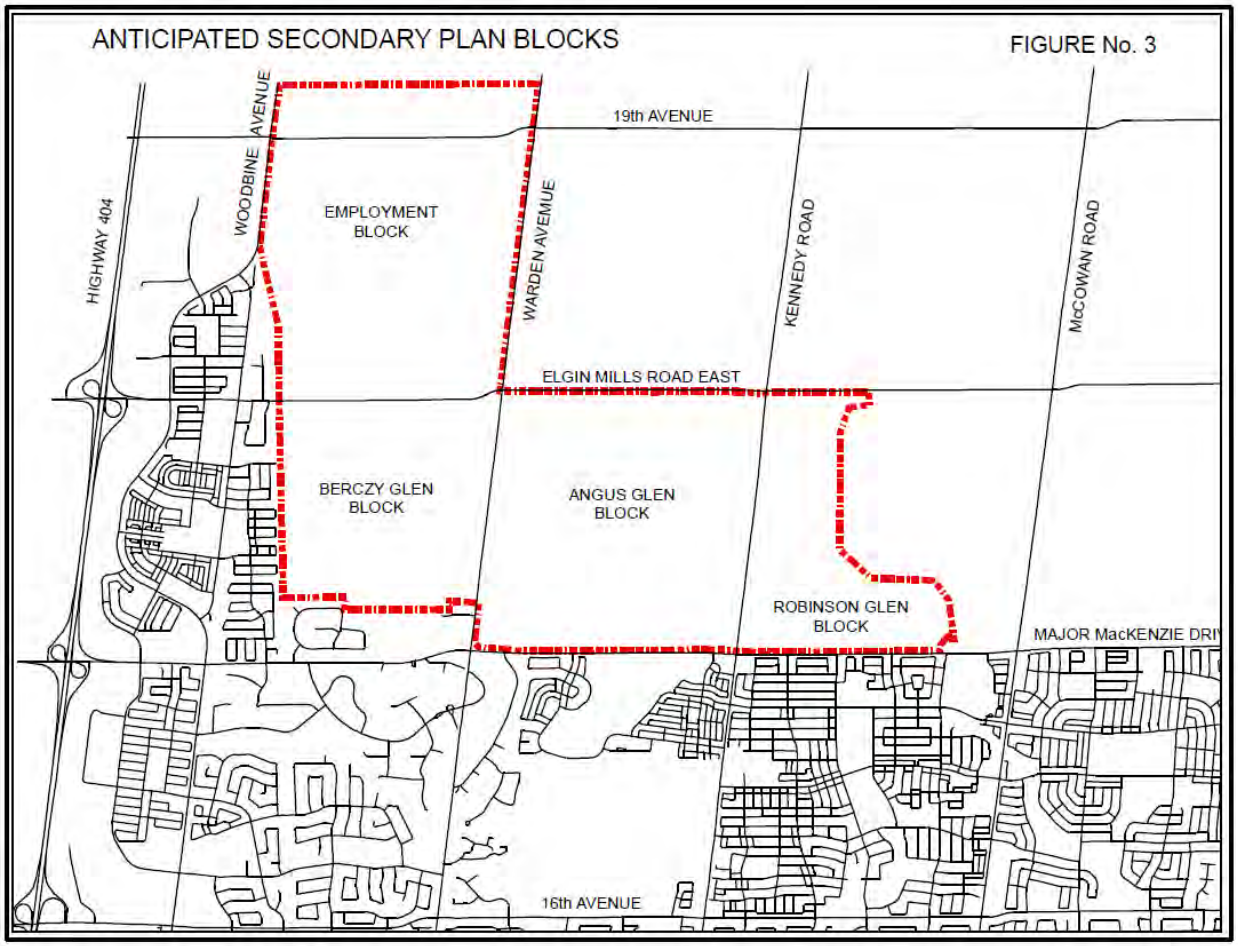


Figure 2.4 Anticipated Secondary Plan Blocks

2.2 Conceptual Master Plan Process

The Conceptual Master Plan (CMP) was informed by the findings of concurrent technical studies, including a subwatershed study, a transportation study and water and wastewater servicing studies. The coordinated studies followed the Master Plan process of the Municipal Class EA. This Volume 2 report documents the transportation, water and wastewater studies to satisfy the Phase 1 and 2 requirements of a Municipal Class EA, as outlined in **Section 2.4**. Each of the supporting studies followed a similar three-phase process, which is referenced throughout this report, as follows:

- Phase 1 of the CMP - consisted of background, characterization and model development for each of the disciplines, and the initiation of the Municipal Class EA process.
- Phase 2 of the CMP - consisted of developing and testing preliminary land use concepts against the findings and evaluation criteria established in Phase 1 to arrive at a preferred Community Structure Plan. This phase involved assessing the potential impact of planned land use changes on area resources both with and without contemporary management practices in place.
- Phase 3 of the CMP – identified implementation and management strategies for the preferred Community Structure Plan pertaining to water and wastewater servicing.

The Subwatershed Study also includes a Phase 4 consisting of long term monitoring to evaluate the effectiveness of the management and implementation strategies. This work will continue beyond the completion of the CMP exercise.

2.3 Planning Policy Context

Land use planning for the FUA is directly influenced by senior levels of government, including the Province of Ontario and York Region. The requirements of senior levels of government are reflected in Markham's Official Plan.

2.3.1 Provincial Policy

Provincial policies and legislation directly influencing the planning of the FUA include the Planning Act, Provincial Policy Statement, Growth Plan for the Greater Golden Horseshoe (Growth Plan) and Greenbelt Plan. The Planning Act defines municipal authority in land use planning matters, working in concert with other Provincial legislation such as the Environmental Assessment Act. The Provincial Policy Statement 2014, issued under the Planning Act, provides principles and policy direction on matters of provincial interest relating to land use planning and development. These matters include building strong communities with an emphasis on efficient development and land use patterns, wise use and management of resources and protecting public health and safety. The Planning Act requires that any decisions relating to planning matters shall be consistent with policy statements under the Act.

The Provincial Growth Plan 2006 provides a framework for implementing the Province's vision for building strong, prosperous communities within the Greater Golden Horseshoe to 2031. The Growth Plan provides guidance on a wide range of issues related to growth management, including land use planning, urban form, transportation, infrastructure planning, housing and natural heritage and resource protection. The Growth Plan is premised on the principles of building compact, vibrant and complete communities, developing a strong and competitive economy, protection and wise use of natural resources and optimizing the use of existing and new infrastructure to support growth in a compact, efficient form.

A new Growth Plan 2017, with a 2041 planning horizon, came into effect on July 1, 2017. Although all planning decisions after July 1, 2017 must conform to this Plan, the Growth Plan provides transitional policies that enable planning for the FUA to continue under the policy context of the York Region Official Plan 2010, in conformance with the Growth Plan 2006.

The Greenbelt Plan 2017 identifies natural heritage an agricultural lands for protection from urban development. Within the FUA, the Greenbelt Plan applies to the valleylands/corridors associated with the main tributaries of the Berczy, Bruce and Robinson Creeks.

2.3.2 York Region Official Plan 2010 and Markham Official Plan 2014

The York Region Official Plan 2010 (YROP) implements the Growth Plan and Greenbelt Plan, ensuring that the requirements for the development of compact, complete, communities are addressed. The FUA lands were included with the Region's urban boundary through Regional Official Plan Amendment #3 in 2010 and are subject to policies for new communities outlined in Section 5.6 of the Regional Official Plan. These policies provide direction on, among other things, achieving minimum density targets, providing for a full range of housing types and services, providing for active transportation and an integrated open space network, protection of natural and cultural heritage and consideration of renewable energy sources and water conservation measures.

The Markham Official Plan 2014 more specifically designates the FUA lands as follows:

- Of the total 1,300 hectares within the FUA, approximately 975 hectares are developable. The remaining 325 hectares consist primarily of natural heritage lands. These natural heritage lands are protected from development as part of the 'Greenway System', a structural element in the Official Plan, with a corresponding 'Greenway' land use designation (see **Figure 2.5 - Official Plan Land Use Designations**).
- Approximately 700 hectares of the developable lands are designated 'Future Neighbourhood Area'. These lands, located primarily between Major Mackenzie Drive East and Elgin Mills Road, were identified in Markham's 2010 growth strategy to accommodate a population of approximately 38,000.
- Approximately 275 hectares of developable lands north of Elgin Mills Road, are designated 'Future Employment Area'. The growth strategy anticipated approximately 19,000 jobs within the FUA, with the majority of the jobs located within these lands.

The community planning requirements for the FUA, as identified in the YROP and Markham Official Plan, have been encapsulated in a set of guiding principles and parameters for the CMP as identified in **Section 2.3.3**.

2.3.3 Planning Vision for the FUA - Healthy and Resilient New Communities

The new neighbourhoods and employment lands in the FUA are being planned in accordance with the vision of sustainable growth outlined in Markham's Official Plan 2014 and the York Region Official Plan 2010. This vision is articulated under four main themes in the Markham Official Plan: protecting the natural environment, building compact and complete communities, providing sustainable travel choices, and maintaining a vibrant and competitive economy. A fifth theme is the adoption of green practices including the conservation of energy and water, waste reduction and the development of resilient stormwater management practices.

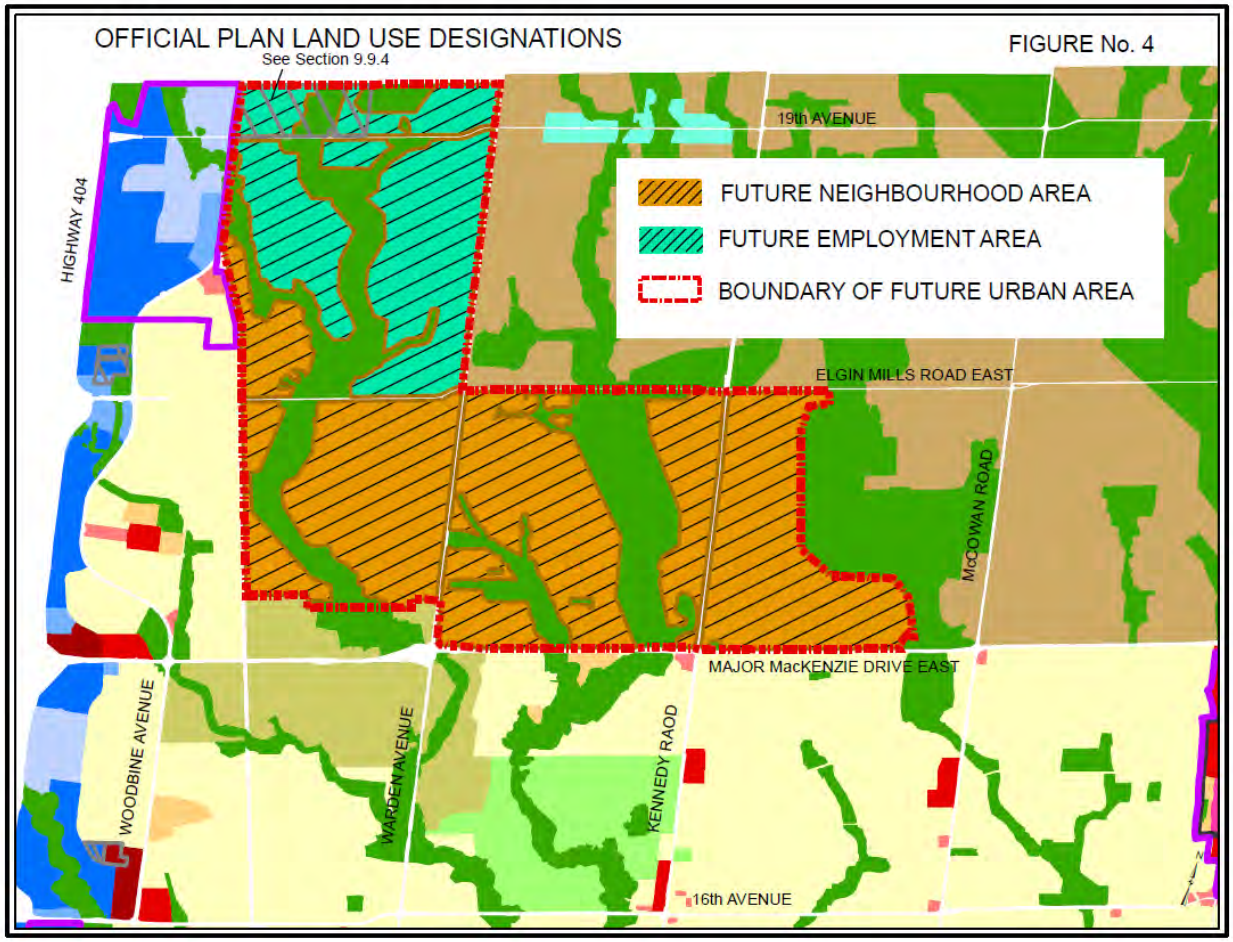


Figure 2.5 Official Plan Land Use Designation

Sustainable growth translates into healthy and resilient communities. There has been increasing evidence in recent years of the linkage between public health and community design. Studies have identified a number of health outcomes of low density, car dependent communities, including increasing rates of obesity and diabetes and health issues related to traffic-related air pollution. Communities built around the automobile eliminate regular physical activity from daily life, such as walking to school, to the corner store, or to a transit stop. Designing neighbourhoods around pedestrian activity with a high number of destinations within walking distance can create better health outcomes, as well as reducing the dependence on automobiles.

A number of built environment elements are associated with active living, including:

- Availability of a range of housing types and densities that meet the needs of a diverse population;
- Proximity to a variety of land uses including shops and services, institutional, employment, accessible by walking, cycling or transit;
- An interconnected street network that supports all forms of mobility options;
- Human scale streetscapes that encourage walking and cycling and provide a safe environment for these activities; and,
- Accessible public open spaces that offer a variety of passive and active activities.

Community design should also have regard for increasing levels of resiliency, anticipating increased risks to community infrastructure due to increases in temperature and extreme weather events.

A consolidated set of principles and parameters for how the FUA should be developed consistent with the Markham Official Plan and York Region Official Plan was identified in the CMP (Volume 1) and provided in **Table 2.1 – Principles and Parameters for Planning the FUA**. The Community Structure Plan and key policy direction identified in the CMP address these principles.

Table 2.1 Principles and Parameters for Planning the FUA

PROTECTING AND ENHANCING THE NATURAL ENVIRONMENT	
PP1	Confirm and refine the Greenway System to ensure protection and enhancement of natural heritage features and functions and water resources
PP2	Design with regard for nature heritage and enhance the urban forest – ensure development minimizes impacts to natural features, topography and soils and enhances the urban forest
BUILDING COMPACT, COMPLETE COMMUNITIES	
PP3	Provide for the daily needs of residents through the organization of residential neighbourhoods, mixed use centres and corridors and an integrated open space network, all integrated with a transportation network that includes transit and active transportation
PP4	Identify a housing mix that provides for a range of housing types and tenure, including affordable housing
PP5	Identify appropriate locations for mixed use Community Cores that provide a focus of retail and community services within reasonable walking distance from the majority of the population and accessible by transit

Table 2.1 Principles and Parameters for Planning the FUA

PP6	Identify an integrated open space network as one of the main organizing elements of the community (including natural areas, parkland and other open space); and ensure the open space network is well connected to the active transportation network
PP7	Identify the community infrastructure (public facility and service) needs of the community through a community infrastructure plan, as well as opportunities for places of worship
PP8	Plan to achieve a minimum density of 70 residents and jobs per developable hectare and 20 units per developable hectare across the 'Future Neighbourhood Area' lands
PP9	Recognize, conserve, promote and integrate cultural heritage resources in community design
PP10	Create community identity through establishment of a high quality public realm, place-making and a high standard of urban design (distinctive built form, streetscapes, parks and open space, landmarks and views, public art, etc); ensure communities are designed to be accessible by all, regardless of age or physical ability
PP11	Ensure access to local food through opportunities for urban agriculture
MAINTAINING A VIBRANT AND COMPETITIVE ECONOMY	
PP12	Plan for the range of jobs in the 'Future Employment Area' lands anticipated required to achieve the City's employment forecasts to 2031, at an overall density of 50-60 jobs per hectare; ensure employment uses are accessible by transit and active transportation networks
INCREASING TRAVEL OPTIONS (MOBILITY)	
PP13	Identify a comprehensive transportation system that emphasizes walking and cycling and transit as increasingly viable and attractive alternatives to the automobile
PP14	Plan for a grid pattern of streets and blocks that provides for a hierarchy of street types that provide appropriate and integrated facilities for walking and cycling; and facilitates an urban form that supports transit use and also increases opportunities for people to walk and cycle
ADOPTING GREEN INFRASTRUCTURE AND DEVELOPMENT STANDARDS	
PP15	Identify best management practices and approaches to stormwater management systems/facilities, water and wastewater systems and the transportation network to maximize water and energy conservation and resilience at the community level
PP16	Identify best management practices for green buildings to reduce demands on energy, water and waste systems
IMPLEMENTATION	
PP17	Public Engagement – encourage involvement of all stakeholders
PP18	Phasing and Sequencing/Financial Impact – identify general phasing, sequencing and cost of development
Source: Conceptual Master Plan for the Future Urban Area, Volume 1: Community Structure Plan and Key Policy Direction, September 2017, City of Markham	

2.4 Municipal Class Environmental Assessment Process

2.4.1 Overview of the Municipal Class EA Process

The Ontario *Environmental Assessment Act (EA Act)* establishes the basis and foundation for individual and Class EAs undertaken within the province. **Figure 2.6** shows the Municipal Class EA Planning and Design Process.

Once approved by the Ministry of Environment and Climate Change (MOECC), Class EAs such as the Municipal Class Environmental Assessment, 2007, as amended 2015, allow specific classes of undertakings to follow a planning and decision-making process that is more streamlined than that of an individual EA. Projects complying with an approved Class EA process have obtained approval under the EA Act and can proceed to implementation.

The Municipal Engineers Association (MEA) Municipal Class EA, as amended to 2015, allows common municipal infrastructure projects to be carried out using a pre-approved process. The Municipal Class EA lays out the applicable projects, the approval process, consultation requirements and additional directions to conduct Municipal Class EAs. The types of projects covered include municipal road, water and wastewater and transit. Specific project types relevant to the FUA include:

- New stormwater management retention/detention ponds or infiltration systems;
- Modifications to existing water crossings for purpose of flood control;
- Stormwater infiltration systems for groundwater recharge;
- Expanded water or wastewater servicing;
- New pumping stations or booster stations;
- Road widenings or improvements; and,
- New arterial and collector roads.

Under the Municipal Class EA, municipal projects are categorized according to their environmental significance and potential effects they may impose on the environment. These categories, described by specific Class EA "schedules", prescribe planning methodologies for each category. At present, there are four schedule classification types as described in Section A.1.2.2 in the Municipal Class EA: Schedule 'A', 'A+', 'B' and 'C'. The primary difference between the schedules is the degree to which each project may adversely affect the existing environment. For example, Schedule 'A' covers projects with few/minimal impacts while Schedule 'C' covers projects with significant impacts.

Each of the schedules follows a different process, which is comprised of a combination of the five phases that make up the Municipal Class EA process. For instance, a Schedule 'A' project requires the completion of only the first and last phase, while Schedule 'C' projects require that all five phases are conducted. The phases and schedules are summarized in **Table 2.2 – Municipal Class EA Schedule**.

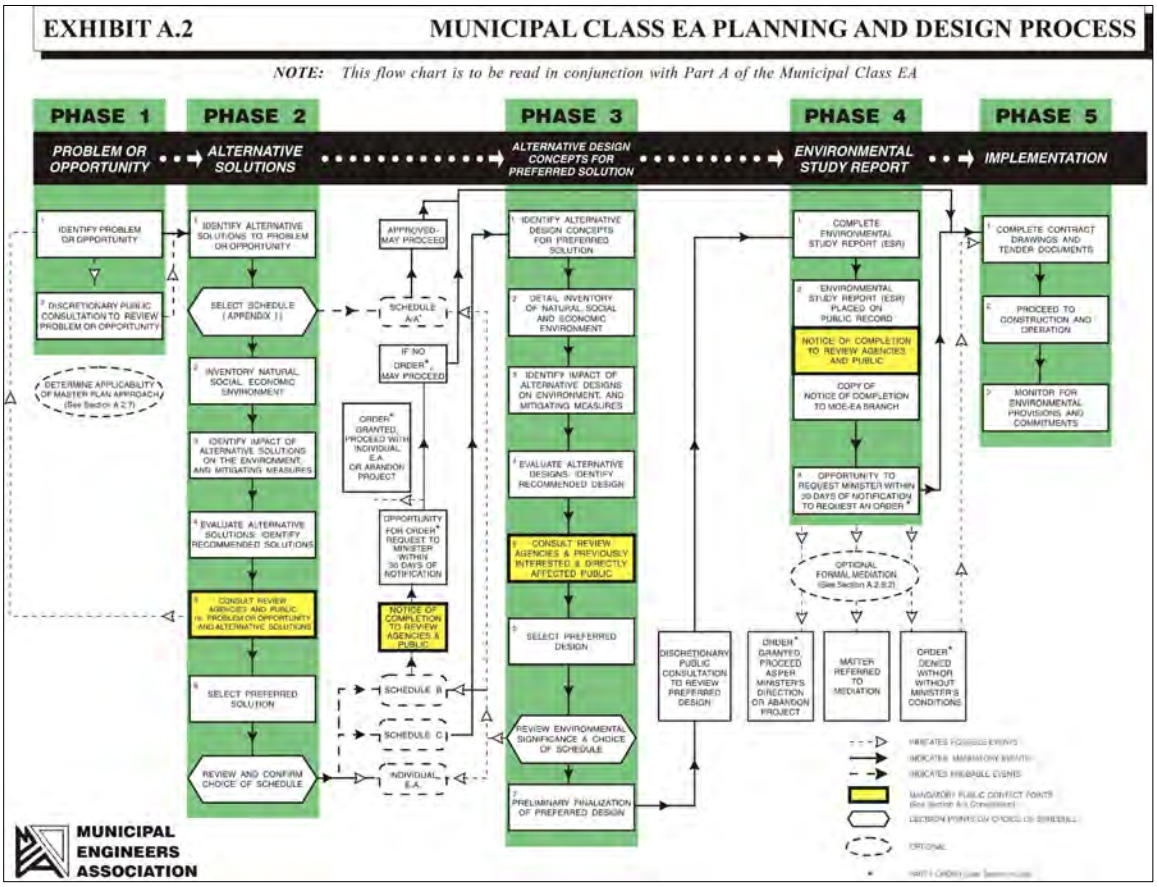


Figure 2.6 Municipal Class EA Planning and Design Process

Table 2.2 Municipal Class EA Schedules

Class EA Phases	Basic Description	Schedule			
		A	A+	B	C
Phase 1: Problem or Opportunity	Identify and describe the problem(s) and/or opportunity(ies).	X	X	X	X
Phase 2: Alternative Solutions	Identify, evaluate and select alternative solutions to the problem, prepare a general inventory of the environment and consultation.			X	X
Phase 2: Project File	Project file to document Phases 1 and 2 of the Class EA process; file to the public record for 30 days, Notice of Study Completion for Schedule B projects and respond to any Part II Order requests.			X	
Phase 3: Alternative Design Concepts for Preferred Solution	Identify, evaluate and select alternative designs for the preferred solution, identify potential impacts of the designs on the environment and consultation.				X
Phase 4: Environmental Study Report	Complete the Environmental Study Report (ESR), file to the public record for 30 days, Notice of Study Completion for Schedule C projects and respond to any Part II Order requests.				X
Phase 5: Implementation	Implement preferred design.	X	X	X	X

2.4.2 FUA Class EA / Master Planning Process

The Municipal Class EA described above details a process for planning and decision-making occurring on a project by project basis. However, it may be beneficial to study a group of related projects or an overall system of projects that share some common elements. This process allows the proponent to establish the need and justification of individual projects within a broader scope and context.

A Master Plan is a long range plan which lays out the infrastructure needs for existing and future land use across a broad area, which can range from a local area (i.e., the North Markham FUA) to an entire municipality like Markham. The Master Plan provides a framework and direction for subsequent projects that are to occur.

The Markham CMP lays out the vision, key concerns and supporting policies on which the infrastructure needs are based. Long range comprehensive planning and infrastructure studies are complementary to the Class EAs; thus, the City of Markham determined that the CMP would be integrated with the Class EA Master Planning process. This process is described in detail in Section A.2.7 in the Municipal Class EA.

Master Plans recommend both projects and strategies within a study area that are to be implemented over the life of the Plan. The Municipal Class EA process provides a pathway for the proponent to satisfy the requirements of Phases 1 and 2 (at a minimum) by incorporating that work into the production of the Master Plan. Subsequent stages of the Class EA process may, where required, include the completion of Phases 3, 4 and 5 of the Municipal Class EA over a smaller planning or development area.

The North Markham FUA CMP establishes the long-term transportation, water and wastewater visions or “blueprints” for the study area. The Master Plan also includes policies, programs and implementation plans, which collectively create a framework for future transportation, water and wastewater planning and decisions.

The City of Markham used Master Plan Approach # 1, more fully described in Appendix 4 of the Municipal Class EA, for this study. Each of the concurrent studies, in coordination with the CMP, served as the basis for the evaluation of the infrastructure project alternatives and for future investigations (see **Figure 2.6**).

This report documents the Municipal Class EA Master Plan process sufficiently to address Phases 1 and 2 of the Class EA process. Using this Master Plan approach, the City has completed the Class EA documentation to serve as the basis for specific future Class EA undertakings where Schedule ’B’ and ‘C’ projects are identified. The North Markham FUA CMP concludes with a set of recommended transportation, water and wastewater projects, resulting in the completion of Phase 2 (Alternative Solutions) of the Class EA process.

The City of Markham has chosen to conduct concurrent and fully collaborative land use, environmental and infrastructure studies to meet the provisions of the EA Act. The overall process, underpinned by the land use considerations in the CMP highlighted:

- Joint notifications and presentations to public, stakeholders and agencies;
- Concurrent assessment/analysis of land use, environmental and infrastructure issues;
- Concurrent decisions/recommendations;
- Collaborative approach to problem solving; and,
- Coordinated approach to documentation.

The work completed in the concurrent studies and reflected in the CMP was completed in sufficient detail to satisfy Phase 2, Step 6 of the Municipal Class EA process.

In conjunction with the secondary plan process, Phases 3 and 4 of the Municipal Class EA are expected to be undertaken by the City or landowners or landowner groups who will be preparing secondary plans. Work in the secondary plans will continue from the Class EA planning processes documented here and in the CMP and concurrent studies and it is important the studies are structured in an appropriate manner so that this objective can be achieved. Any required Notices of Study Completion for Schedule 'B' or 'C' projects will be issued following completion of the applicable study.

2.4.3 Problem or Opportunity Statement

In Step 1, Phase 1 of the Class EA process, the proponent identifies the problem or opportunity that is required to be addressed by a proposed project. Following discussions with stakeholders, the following Opportunity Statement was developed and presented to the public:

> *The City of Markham Official Plan 2014 designates lands for the development of new communities in the north Markham Future Urban Area that will comprise approximately 40,000 residents, 13,000 dwelling units and 16,000 to 19,000 jobs. In order to support the development of the North Markham Future Urban Area, the Conceptual Master Plan and the EA process will address the transportation, water and wastewater infrastructure and policies needed to accommodate residential and employment growth in a responsible and sustainable manner.*
>
> *(Note: Analysis undertaken during the CMP exercise suggests that in achieving the minimum 20 units per developable hectare and 70 residents and jobs per hectare density thresholds required in the Markham and York Region Official Plans, and to achieve an appropriate mix of housing types, a population of approximately 45,000 is expected in approximately 14,000 units.)*

No comments or feedback was received specific to the opportunity statement.

2.4.4 Evaluation of Alternatives and Options leading to the Preliminary Community Structure Plan

Transportation, water, and wastewater servicing options followed the consideration of the CMP phases and the development of land use planning options. As a preliminary step, four servicing strategies were considered including: do nothing, expand existing servicing, construct new servicing, and a combination of the expanded and new services. This approach was used for transportation, water, and wastewater projects.

Following an initial screening process, four preliminary conceptual planning options were developed (referred to as Concept Options A, B, C and D), based on the land use and transportation infrastructure required to address City population and employment forecasts as well as the vision for the FUA lands based on York Region and Markham community development policies. These preliminary concept options were evaluated for natural, social and environmental impacts for water, wastewater and roads.

Preliminary Concept Option A was selected as preferred and was further refined resulting in the development of preliminary Concept Option E. An additional Concept Option F was introduced by landowner groups. Options E and F were subsequently reviewed and evaluated resulting in Option G. As a result of additional discussion and review with landowner and agency stakeholders through the CMP process a variation on Concept Option G known as G-1 resulted.

Concept Option G-1 was tested in the first iteration of impact assessment in Phase 2 of the CMP. Based on the results of the 1st iteration of testing, refinements were made to Concept Option G-1, which resulted in the Preliminary Community Structure Plan identified in the October 2016 Conceptual Master Plan Interim Report.

2.4.5 Canadian Environmental Assessment Act (CEAA) Consideration

No CEAA projects were identified in this study. In the future, where potential for CEAA projects is identified, consultation will be required with CEAA or other federal authorities over the course of the study.

3 Public, Agency and Stakeholder Consultation

3.1 Overview

This chapter provides an overview of the consultation activities undertaken throughout the four year CMP exercise. The CMP's public consultation plan was based on Section A.3 of the Municipal Class EA.

Each of the CMP study phases provided the opportunity for FUA landowners, agencies, City departments, Markham Council, the general public (residents and businesses) and other stakeholders, including non-government organizations and First Nations and Metis communities, to participate in the planning process through one or more of the following:

- Technical Advisory Committee (TAC) meetings and workshops;
- Steering Committee meetings;
- Public Information Centres (PICs) or events;
- Reports and presentations to City of Markham Development Services Committee;
- Internal department meetings;
- External agency meetings;
- Area resident consultations; and,
- Indigenous community meetings.

An overview of the consultation activities is provided below, with summaries and detailed descriptions and records provided in **Appendix A**. All reports, notices, presentations, display panels and other public consultation materials can also be found on the City of Markham website.

Opportunities for public consultation for the planning of the FUA lands will continue during the review and approval of individual secondary plans, and subsequent plan of subdivision and zoning amendment applications pursuant to the Planning Act, including statutory public meetings.

3.2 Notice

3.2.1 Class EA Notice of Commencement

The Notice of Study Commencement was published in the Markham Economist and Sun and Thornhill Liberal on October 3, 2014, and circulated to local residents, agencies, landowners and other individuals and organizations recognized as having a potential interest in the study. The Notice of Study Commencement and the summary of comments regarding the Notice are documented in **Appendix A, Table 1**.

3.2.2 Notice for Public Information Centres (PICs) and Meetings

Notification methods included e-mail and regular mail invitations for the PICs and public events and workshops, newspaper ads for the PICs, use of a project website at **www.markham.ca** with dedicated FUA e-mail link; and a dedicated FUA e-mail account.

3.3 Technical Advisory Committee and Steering Committee Meetings

The FUA CMP exercise was led by a City of Markham Project Team consisting of Planning, Urban Design, Engineering and Community Services staff and their consultants. Project Team members are listed on the inside cover of this report.

At the outset of the CMP exercise, a Technical Advisory Committee (TAC) was formed to work through technical issues related to the supporting subwatershed, transportation, water and wastewater studies. The Technical Advisory Committee included the City Project Team as well as landowner representatives/consultants, and various discipline-specific staff from the Toronto and Region Conservation Authority (TRCA), and the Ministry of Natural Resources and Forestry (MNRF). The TAC reviewed, advised and made recommendations on the evolving technical studies (subwatershed, transportation, water and wastewater) and assisted with developing implementation strategies. TAC meetings were led by the City Project Team and were held on a monthly or bi-monthly basis.

During the course of the CMP exercise, the TAC meetings were differentiated into those that dealt primarily with land use issues, and those of a more technical nature (referred to as Joint TAC meetings) related to the subwatershed, transportation, water and wastewater studies, at which a number of landowner consultants were also present.

In addition to the TAC, a Steering Committee made up of City of Markham senior management (including the Chief Administrative Officer, Commissioner of Development Services, Director of Planning and Urban Design, Director of Engineering, among others), landowners and their representatives, and senior staff from York Region, TRCA and MNRF was established. The Steering Committee's mandate was to oversee the completion of the CMP and act as a decision-making body for technical issues that were not resolved through the Technical Advisory Committee. The Steering Committee met on a regular basis, either monthly or as needed, between August 2013 and July 2017.

The TAC and Steering Committee allowed for regular and ongoing dialogue between the City Project Team and key stakeholders throughout the CMP exercise. A summary of the TAC and Steering Committee meetings is provided in **Appendix A, Table 2 and Table 3**.

3.3.1 Technical Advisory Committee Workshops

In addition to the regular TAC meetings, a number of TAC Workshops were held. The nature of the workshops ranged from focused discussion of specific technical issues to broader stakeholder input at key milestones in the development of the CMP. A summary of each of the Workshops is provided chronologically below.

1) **Headwater Drainage Features Classification Technical Workshop – February 18 and 25, 2014**
   The purpose of this Workshop, held over the course of two days, was to develop consensus on a protocol for evaluating Headwater Drainage Features in the FUA lands (confirm). Attendees included members of the City Project Team, TRCA, MNRF, and landowner representatives. The workshop included presentations on the new Headwater Drainage Features guidelines, as well as on the potential screening process for drainage lines.

2) **Managing Growth Technical Workshop - May 8, 2014**
The purpose of this Workshop was to gain input from representatives of all City departments on their ideas and requirements for the new communities to be developed in the FUA. Note: this Workshop was led by the City Project Team and did not include other members of the Technical Advisory Committee.

3) **TAC Stakeholder Workshop #1 – June 11, 2014**
A full day TAC Workshop was held on June 11, 2014 to discuss the Preliminary Community Structure Plan Options in preparation for the iterative testing and validation process anticipated for Phase 2 of the CMP. In addition to the regular members of the Technical Advisory Committee, the Workshops included participation from York Region, local school boards, utilities (e.g., Hydro One), and local stakeholders groups, including non-government organizations

4) **Natural Heritage System Planning Technical Workshop – April 23, 2015**
TAC working group members were invited to the Natural Heritage System Planning Workshop to discuss the preparation for the Phase 2 Impact Assessment (first iteration), provide a summary of the Phase 1 characterization and integration, discuss the Natural Heritage System Planning and Design Logic and create plans for the Preliminary Natural Heritage System and complementary land uses.

5) **TAC Stakeholder Workshop #2 – May 5, 2015**
The purpose of this full day Workshop was to finalize the Preliminary Community Structure Plan Option(s) for testing and validation in Phase 2 of the FUA CMP. Members of the TAC working group and a broad range of participants, including several agencies, York Region and other interested parties were invited to attend.

6) **TAC Stakeholder Workshop #3 – May 3, 2016**
The purpose of this full day Workshop was to discuss the findings of the first iteration Impact Assessment, which included the presentation of Options A and B. Members of the TAC working group and a broad range of participants, including several agencies, York Region and other interested parties were invited to attend. The workshop included a break-out session which provided an opportunity for TAC members to provide comments on the options.

3.4 City of Markham Departments and External Agencies

Project Team members consulted extensively with City departments and external agencies throughout the studies. TRCA and MNRF staff were consulted on an ongoing basis through regular TAC and Steering Committee meetings. Other agencies consulted included neighbouring municipalities, school boards, utilities and Hydro One. A summary of agency meetings are provided in **Appendix A, Table 4**. Input provided by City staff as well as the Project Team's responses are summarized in **Table 5** in **Appendix A**.

3.5 Engagement with Markham Council and the Public

Markham Council and the general public were provided opportunity for input throughout the CMP exercise through several meetings of Markham Council's Development Services Committee, formal Public Information Centres (PICs), and one-on-one meetings with the City Project Team.

3.5.1 Development Services Committee

City Project Team staff presented reports to the Markham Development Services Committee of Council (DSC) on October 1, 2013, March 18, 2014, December 9, 2014, October 3, 2016, September 11, 2017 and September 25, 2017. The purpose of the staff reports was to update and obtain comments from Council on the CMP study progress in a public forum.

1) **Reports of October 2013, March 2014 and December 2014**
   The three staff reports in 2013 and 2014 provided an update of the status of the CMP exercise, and requested authorization to retain consultants and to enter into a funding agreement.

2) **Conceptual Master Plan Interim Report, October 3, 2016**
   The October 3, 2016 staff report provided an Interim Report on the CMP work to date and sought direction on holding a second PIC to obtain public input on the Preliminary Community Structure Plan identified in the Interim Report. A presentation on the Interim Report was also provided to Committee.

   The October 3, 2016 Development Services staff report, presentation and CMP Interim Report were posted on the City's website and circulated to City departments and external agencies for comment. **Appendix A, Table 6** provides a summary of comments received.

3) **Conceptual Master Plan Final Report, September 2017**
   On September 11, 2017, a City staff report containing the completed CMP Volume 1: Community Structure Plan and Key Policy Direction was considered by Development Services Committee and deferred to the next DSC meeting. At the September 25, 2017 DSC meeting, Committee "endorsed [the CMP Volume 1] as the basis for the review and approval of statutory secondary plans for the Future Urban Area lands; with the exception of the core linkage section (proposed ecological corridor), until such time as a workshop is held and a resolution is achieved on this issue".

   On October 17, 2017, Council ratified the Development Services Committee's endorsement of the CMP, including minor base mapping revisions to a number of figures in the Volume 1 report. The staff reports, presentations and resolutions of the September 11, 2017 and September 25, 2017 Development Services Committee, and October 17, 2017 Council meeting are available on the City of Markham website.

3.5.2 Public Information Centres (PICs)

Two formal public information centres were held during the CMP exercise. As well, a third opportunity for public comment was provided through a static display event.

PIC #1 – January 15, 2015

The first PIC was held in the evening of January 15, 2015 at the Markham Civic Centre. Two notices for PIC #1 were provided pursuant to the Municipal Class EA process. Both were published in the Markham Economist and Sun and Thornhill Liberal on December 18, 2014 and January 8, 2015. As well, invitations to the event were extended to local residents, landowners, review agencies and Indigenous communities by e-mail and regular mail.

The purpose of PIC #1 was to provide background material on the CMP and Municipal Class EA process while providing an opportunity to review and comment on the early stages of the study. Attendees were invited to review display materials and engage City staff and the consulting team in an open house setting. A detailed presentation was also provided by City Staff followed by a question and answer period.

A brochure describing the planning for the FUA was available for the public and comment sheets were made available.

An estimated 118 persons attended PIC #1. The questions and comments centred mainly on matters dealing with land use planning and the origins of the FUA. **Appendix A, Table 7** provides an overview of comments or questions received.

PIC #2 – November 3, 2016

The second PIC was held during the evening of November 3, 2016 in the Markham Civic Centre. Notices for PIC #2 were published in the Markham Economist and Sun and Thornhill Liberal on October 20 and 27, 2016. As was the case for PIC #1, invitations to the event were extended to local residents, landowners, review agencies and Indigenous communities by e-mail and regular mail.

The purpose of PIC #2 was to gain input on the information included in the October 2016 Interim Report, including a Preliminary Community Structure Plan. Attendees were invited to review display materials and engage City staff and the consulting team in an open house setting. Comment sheets were made available.

An estimated 65 persons attended PIC #2. The questions and comments centred mainly on matters dealing with land use planning. An overview of the comments received are provided in **Appendix A, Table 8**.

PIC #3 – September 7-11, 2017

A third opportunity for public input was provided towards the end of the CMP process. Display boards outlining the completed CMP, including the preferred Community Structure Plan and key policy direction scheduled to be considered by Markham Development Services Committee in late September 2017 were provided in the Angus Glen Community Centre from September 7 to 11, 2017. Notice for this event and the September 11, 2017 Development Services Committee meeting were provided by email to attend the public display event and also to attend the September 11, 2017 Development Services Committee.

3.5.3 City of Markham Website and Direct Contact

Throughout the CMP exercise, City staff elicited input from residents throughout the community through e-mail and telephone enquiries, and through the FUA web page on the City of Markham website.

Approximately 24 comments or questions were received in this manner between January 2015 and February 2017. The comments dealt primarily with information requests and background information. These comments are summarized in **Appendix A, Table 9**.

3.6 Indigenous Communities

The following Indigenous communities were engaged during the study:

- Alderville First Nation
- Beausoleil First Nation (Christian Island)
- Chippewas of Georgina Island
- Chippewas of Mnjikaing First Nation (Rama)
- Conseil de la Nation Huron-Wendat
- Curve Lake First Nation

- Hiawatha First Nation
- Kawartha-Nishnawbe First Nation of Burleigh Falls
- Métis Nation of Ontario
- Mississaugas of Scugog Island First Nation
- Mississaugas of the New Credit First Nation
- Six Nations of the Grand River Territory
- Wasauksing First Nation

The Indigenous groups identified above were provided with the Notice of Commencement, invitations to all public information events and individual letters of invitation to a joint meeting with the York Region and the City of Markham FUA team held on June 18 and 19, 2015 to discuss the study in more detail. Representatives from the Hiawatha First Nation, Mississauga of Scugog Island and the Wasauksing Indigenous communities attended the meeting with City of Markham. A summary of the June 18 meeting is provided in **Appendix A, Table 10**. Additional comments and responses are provided in **Appendix A, Table 11**.

4 Study Area Background and Context

4.1 Land Use

4.1.1 Existing Land Use

Existing land uses within the FUA are comprised of primarily agricultural, rural residential and recreational and open space uses, including a golf course and community centre.

Natural heritage features, discussed in more detail in **Section 4.3**, include a number of watercourses associated with the Berczy Creek, Bruce Creek, Eckardt Creek and Robinson Creek, which traverse the FUA lands in a north-south direction. Several small drainage features are also present on the landscape. Other natural heritage features include wetlands and woodlands not directly associated with the watercourses. The natural features provide habitat for various animals, birds and fish, including a number of endangered species.

Built features in the FUA, include:

- **Angus Glen Golf Course** – this golf course currently operates within a large portion of the Angus Glen Block. Twenty-nine fairways are currently configured on both tableland and Greenway System lands within the Block (an additional seven fairways are located outside of the FUA south of Major Mackenzie Drive East in the existing Angus Glen community). Ultimate build-out within the Angus Glen Block assumes the reconfiguration of the northerly fairways to allow for the continued operation of an 18-hole course (11 holes north of Major Mackenzie Drive East plus the existing seven holes south of Major Mackenzie Drive East) while allowing for development of tablelands for neighbourhood uses. An interim condition of a 27-hole course incorporating the existing fairways along the north side of Major Mackenzie Drive East is also contemplated. The ultimate layout of the golf course and the phasing of redevelopment of the course, has implications for infrastructure improvements (particularly the collector road network) and phasing of development.
- **Angus Glen Community Centre** - the existing Angus Glen Community Centre complex, located within the Angus Glen Block, will be integrated into the new community through new road and pedestrian connections and will form part of the integrated parks and open space network being planned to provide connectivity throughout the entire FUA.
- **Hydro Corridor** - a 30-40 metre wide Hydro One transmission corridor runs in a north-south direction at the west limit of the neighbourhood lands in the FUA. The corridor is part of a hydro distribution system extending from the City of Toronto to northern York Region.
- **Natural Gas Pipeline** - an underground pipeline for the transmission and distribution of natural gas traverses the northern portion of the Employment Block, just south of 19th Avenue. These lands may be owned, or subject to easements, in favour of TransCanada Pipelines Limited or local distributors. The lands are intended to be incorporated in the planned land use structure (i.e., employment uses) with appropriate setbacks from the easements.

4.1.2 Surrounding Land Use

The FUA lands are located north of the existing Angus Glen and Berczy communities which are south of Major Mackenzie Drive East, and the Jennings Gate/Heritage Hill residential estate communities west of Warden Avenue, and east of the existing Cathedral and Victoria Square communities beyond the hydro corridor. To the north, the lands designated for employment in the FUA extend to the northern City limit, north of 19th Avenue. The FUA lands are also adjacent to agricultural lands (designated 'Countryside') north of Elgin Mills Road.

The Community Structure Plan and associated policy direction in the CMP acknowledges the need for appropriate interface conditions with the adjacent urban and agricultural communities. For the Berczy Glen Block, key considerations include the estate residential communities immediately to the south (Jennings Gate Estates/Heritage Hills Drive) and the Victoria Square and Cathedral communities to the west across the Hydro Corridor. Consideration will be given to providing appropriate transition between these communities and the more compact neighbourhoods anticipated in the Berczy Glen Block.

Primarily ground-oriented residential development characterizes the communities on the south side of Major Mackenzie Drive East opposite the Angus Glen and Robinson Glen Blocks. Appropriate transition will be considered given the need to plan for higher transit-supportive densities on the north side of the planned Major Mackenzie Drive East rapid transit corridor.

The lands north of Elgin Mills Road and east of Warden Avenue are expected to continue in agricultural use to 2031, as reflected in the 'Countryside' designation in the Official Plan. Appropriate interface conditions between land uses within the 'Countryside' lands and the proposed urban development south of Elgin Mills Road and west of Warden Avenue will be considered, including provincial requirements for the interface between agricultural and urban land uses.

4.2 Cultural Heritage and Archaeological Resources

Markham's *Register of Property of Cultural Heritage Value or Interest* identifies 28 buildings of cultural heritage interest within the FUA lands (see **Appendix B**). Of the 28 properties, seven are designated for protection under the Ontario Heritage Act.

The remaining 21 properties of cultural value or interest have been given a preliminary evaluation rating by Markham Heritage staff, based on examination of existing photographs and documentation contained in the *Register* and property files, as well as examination of historic maps, deed abstracts and census data. The preliminary evaluation assigned a Group '1' or Group '2' rating to most of the remaining 21 properties. A Group '1' rating, assigned to five properties, indicates buildings of major significance to the City and is worthy of designation under the Ontario Heritage Act. A Group '2' rating, assigned to 11 properties, indicates buildings of significance and worthy preservation. A Group '3' rating, indicating buildings considered noteworthy, was assigned to one property, and three have been assigned a combination Group '2' / '3' rating. One property has not yet been assigned a Group rating. The majority of the 21 non-designated properties will require in-depth research before a final evaluation using Markham's heritage building evaluation system can be undertaken.

Potential archaeological resources within the FUA lands were also evaluated based on mapping provided by York Region. The mapping indicates that although the majority of the FUA lands have potential for archaeological resources given their proximity to watercourses, there are no known archaeological sites within the FUA lands that need to be considered in the CMP. Further archaeological assessments will be undertaken at the secondary plan or plan of subdivision stages.

4.3 Natural Environment in the Study Area

A stand-alone Subwatershed Study (Volume 3, "Berczy, Bruce, Eckardt and Robinson Creeks North Markham Future Urban Area Subwatershed Study", AMEC Foster Wheeler team) is being completed as part of the City of Markham's CMP.

The Subwatershed Study is intended to assess and characterize the location, extent, sensitivity and significance of natural heritage and water-based features and functions within the FUA, assess potential impacts of future development and recommend strategies to manage and mitigate their predicted impacts. The Subwatershed Study represents an integral component of the CMP, as it provides input to the land use plan by refining the City's current Greenway system while identifying strategies to protect, enhance and restore its ecological functions. The Subwatershed Study is being completed under a phased approach as follows:

- Phase 1: Subwatershed Characterization and Integration
- Phase 2: Subwatershed Impact Assessment
- Phase 3: Management Strategies and Implementation
- Phase 4: Long-Term Monitoring Plan (by others)

The Subwatershed Study findings were documented based upon the following key technical disciplines:

- Hydrogeology
- Hydrology and Hydraulics
- Fluvial Geomorphology
- Surface Water Quality
- Fisheries
- Terrestrial

The following sections summarize the key findings from each technical discipline of the Subwatershed Study, to provide context for the Class EA for the transportation, water and wastewater servicing required to support the FUA. Full details are provided in the CMP Volume 3, Subwatershed Study and in the following background studies:

- Phase 1: Characterization and Integration, North Markham Future Urban Area Berczy, Bruce, Eckardt and Robinson Creeks;
- North Markham Future Urban Area Berczy, Bruce, Eckardt and Robinson Creeks Phase 2 Subwatershed Impact Assessment (First Iteration);
- North Markham Future Urban Area Berczy, Bruce, Eckardt and Robinson Creeks Phase 2 Subwatershed Impact Assessment (Second Iteration); and,
- North Markham Future Urban Area Berczy, Bruce, Eckardt and Robinson Creeks Subwatershed Impact Assessment.

These documents (with the exception of the draft Phase 3 report) are available under separate cover in CMP Volume 3 entitled North Markham Future Urban Area CMP Subwatershed Study. The following sections summarize the finding of the subwatershed study and identify areas of potential impact for CMP Infrastructure Projects.

4.3.1 Hydrogeology

4.3.1.1 Existing Conditions

The FUA lies just south of the Oak Ridges Moraine (ORM) in the physiographic region known as the South Slope. The ORM is a 160-kilometre long, east-west oriented ridge of sand, silt and gravel deposits that forms a divide between the Lake Ontario and Lake Simcoe watersheds.

The FUA groundwater characterization was prepared by developing a conceptual hydrogeologic model based on historical groundwater investigations incorporating both regional (e.g., Rouge Watershed Report and York Tier 3 Water Budget) and local scale (RJ Burnside, 2013) data and analyses. This conceptual groundwater model was then incorporated into a fully integrated three-dimensional groundwater/surface water transient numerical model (MIKE SHE) to represent existing conditions and to use in assessing potential impacts and mitigation related to future land use change. The conceptual model characterization includes:

- The surficial geology of the FUA is dominated by sand and gravel deposits and sandy silt to silty sand till with local areas of glaciolacustrine silts and clay. The overburden thickness is on the order of 50 to 100 metres and is underlain by shale bedrock.
- The shallower sediments include the Halton silt clay till with inclusions of more permeable sand as well as localized areas of more permeable ORM sediments. The underlying sediments include the Newmarket Till (aquitard), the Thorncliffe Formation (aquifer), the Sunnybrook Drift (aquitard) and the Scarborough Formation (aquifer).

The major findings from the groundwater field program included:

- A refinement of the surficial geology map.
- Minimal seasonal variations of groundwater levels (less than 1.5 metres)
- Hydraulic gradients and observations indicating groundwater discharge throughout reaches of Berczy Creek (particularly in the vicinity of Elgin Mills Road), Bruce Creek north of Elgin Mills Road and in the vicinity of Warden Avenue, areas at 19th Avenue and Woodbine Avenue, south of Elgin Mills Road between Warden Avenue and Woodbine Avenue and the Robinson Swamp.

The groundwater assessment for the baseline characterization involved building the MIKE SHE model utilizing existing models and subsequently refining the model within the FUA. Input and calibration data to simulate the current groundwater flow conditions included climate data, topography, land use, streamflow, soil and hydrostratigraphic parameters, groundwater levels and groundwater discharge observations. The model was then used to establish the following simulated baseline/current conditions:

- Average groundwater recharge – the average within the FUA was 226 mm/year. Within the more permeable sandy areas, recharge is on the order of 400-500 mm/year in wetter years and 300-400 mm/year under long term conditions. Simulated recharge for lower permeability units (e.g., tills) can vary and be as much as 100 mm/yr lower than the base case and still be consistent with available data on input parameters.
- Average depth to water – the depth to water within the FUA is generally less than three metres and is closer to the ground surface along the majority of the stream reaches and Robinson Swamp. It is greater than 10 metres in areas coinciding with topographic highs. **Figure 4.1** illustrates the FUA's simulated average depth to water table.

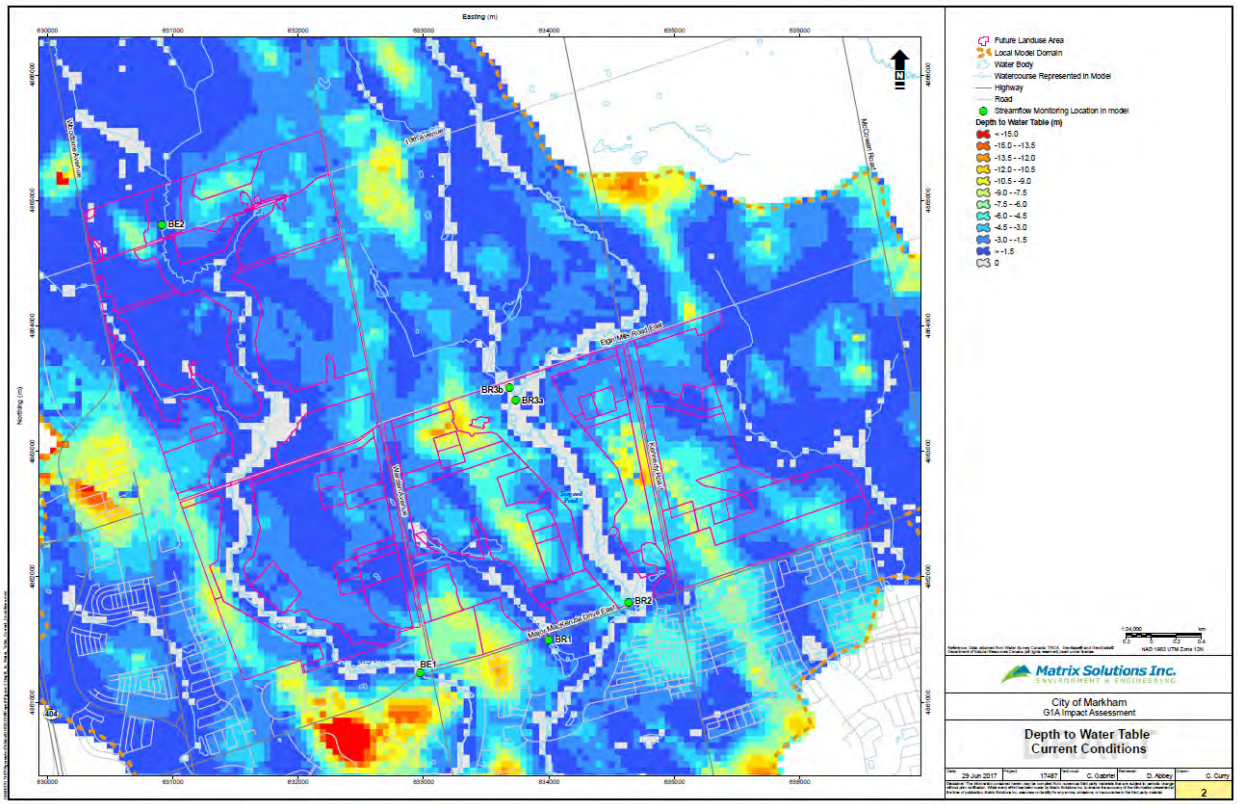


Figure 4.1 FUA Depth to Water Table

- Average groundwater discharge - discharge occurs as either baseflow to streams through the streambeds or seepage to ground surface where it can evapotranspire or flow to overland to the stream. The simulated discharge locations correlated well with mapped discharge areas (described above) and measured baseflow. **Figure 4.2** depicts the FUA's simulated average groundwater discharge.
- Robinson Swamp water budget:
  - The evapotranspiration balances the precipitation, which is higher in the swamp than the average within the study area.
  - Groundwater discharge to the Robinson Swamp and the subsequent overland flow accounts for 60% of the average outflow of Robinson Creek.

Discharge Contribution Area mapping (**Figure 4.3**) was carried out to highlight the connection between recharge areas and groundwater discharge locations within and outside of the FUA. The water budget analysis indicates that the majority of recharge supporting the discharge locations occurs within the FUA and medium recharge areas contribute the largest volume to the discharge areas. High recharge areas provide the second largest portion of recharge to the groundwater discharge areas in Bruce Creek and Upper Berczy Creek within the FUA. Low recharge areas provide the second largest portion of recharge to the groundwater discharge areas in Lower Berczy Creek.

4.3.1.2 Identification of Areas of Potential Impact for CMP Infrastructure Projects

As part of the Subwatershed Study and in coordination with the development of the CMP, the baseline/current conditions MIKE SHE model was modified to represent potential future land use conditions and evaluate impacts to the groundwater system with traditional end of main stormwater management and with different levels of infiltration management options (LID Best Management Practices). These management strategy simulations provided a preliminary understanding of the level of impact mitigation provided by different capture volumes (e.g., 4-10 mm per impervious area) for different land use types and physiographic conditions (e.g., topography and surficial materials) within the FUA. The insight from the first land use impact assessment iteration was used to refine the Preliminary Community Structure Plan (Option G-1).

Impacts and effectiveness of infiltration mitigation using LID Best Management Practices (BMPs) were evaluated for areas within the FUA by comparing existing and future simulation conditions for:

- Groundwater recharge;
- Discharge to streams and wetlands;
- Streamflow at existing gauge locations (flow duration frequency, annual, monthly, hourly);
- Discharge Contribution Areas to streams; and
- Water budgets for the FUA, subwatersheds and Robinson Swamp.

Without infiltration mitigation measures, increased imperviousness will reduce recharge, groundwater levels and subsequent discharge to the local stream reaches. The extent of impact was shown to be both spatially and temporally variable. Although most of the impacts were confined to the FUA, reductions in groundwater levels were also noted outside of the study area.

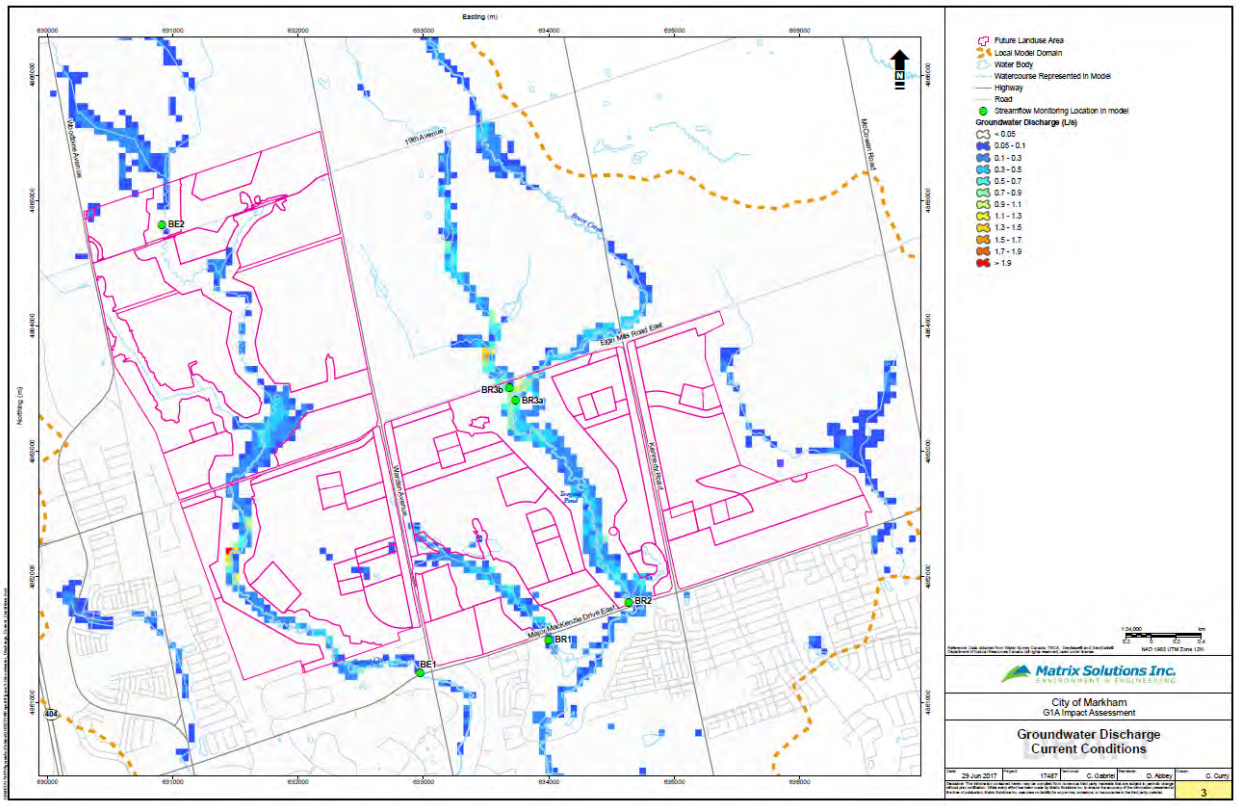


Figure 4.2 FUA Groundwater Discharge

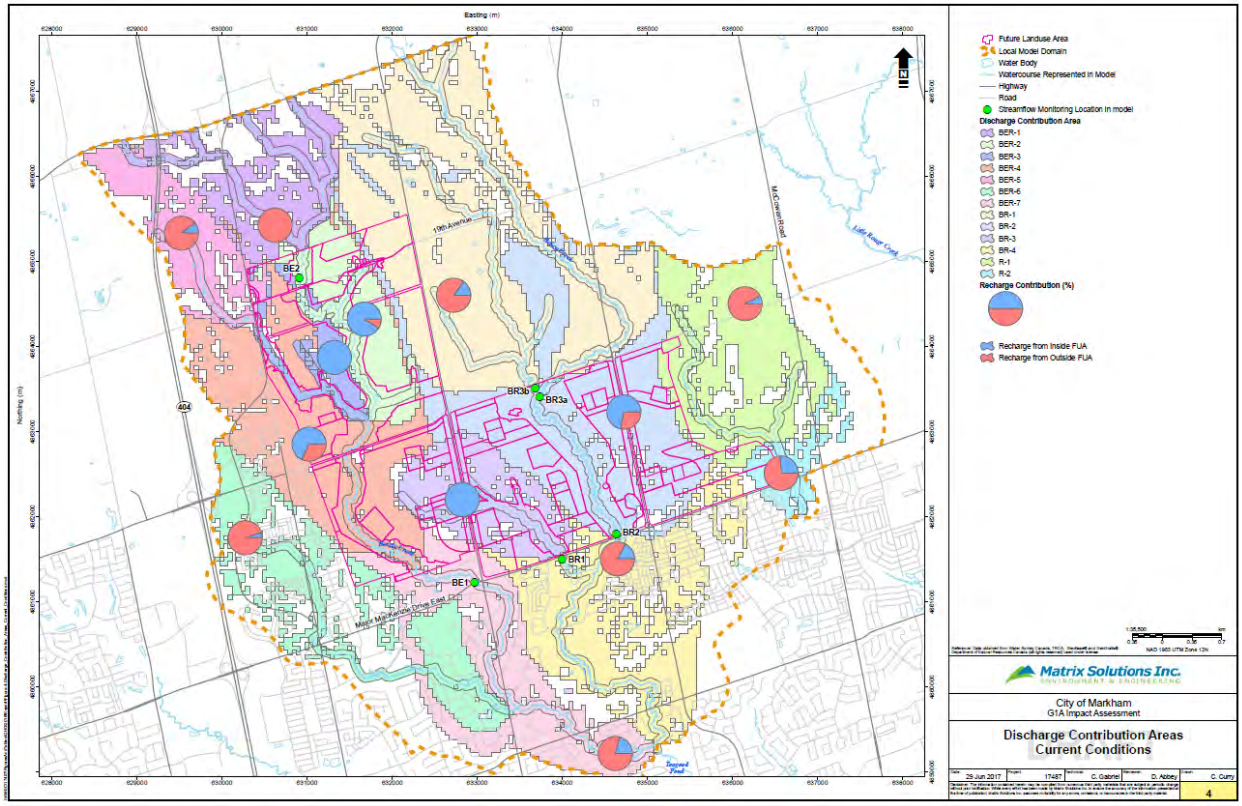


Figure 4.3 Discharge Contribution Area

Uniform capture rates ranging from 2 to 10 mm per impervious area were applied across the FUA. The 4 mm capture generally maintained groundwater levels and the associated Discharge Contribution Areas. The 10 mm capture was more efficient at maintaining groundwater discharge but areas of higher groundwater levels were observed and minor decreases to groundwater discharge were observed in Berczy Creek below Elgin Mills Road.

Spatially variable capture areas were utilized for the second land use iteration assessment. Six scenarios were run taking into account the results of the uniform capture results and the Discharge Contribution Areas. Overall Improvements were observed with the spatially variable capture approach.

The York Region Tier 3 Water Quantity Local Area Risk Assessment delineated a Local Area which defines the area within which any existing groundwater uses, future groundwater uses or recharge reductions have the potential to impact the sustainability of municipal well supplies or negatively impact other users (e.g., wetlands). The Moderate Risk Level requires that any activity within the Local Area that reduces aquifer recharge, or that removes water from an aquifer without returning it to the same aquifer (demand) is considered a drinking water quantity threat. The Local Area itself does not influence the characterization, but does highlight the connections and potential to impact municipal supplies and other users resulting from unmitigated land use development in the Local Area. However, its policies are consistent with many of the approaches and principles being considered, which include Best Management Practices for developments and Low Impact Development strategies (LIDs).

The northern half of the FUA lies within the York Region Local Area for its municipal groundwater supply. The changes in infiltration and recharge are identified as having a negligible impact on the York Region Local Area and sustainability of the wells supplies for the following reasons:

- Water supplying wells is derived from confined deep aquifers below the Newmarket Till;
- Future conditions simulations demonstrate a negligible change in the upward or downward vertical flux across the Newmarket Till; and,
- Levels of mitigation being evaluated will maintain existing vertical flux across the Newmarket Till.

4.3.1.3 Summary

The depths and design of infrastructure related to roads, road crossings, wastewater and storm mains and municipal watermains have the ability to intercept the shallow and intermediate groundwater flow associated with groundwater discharge to stream reaches and wetlands.

Site specific studies should be carried out throughout the FUA to refine the groundwater conditions and potential linkages where roads, water and wastewater infrastructure are being considered. Furthermore, any dewatering for infrastructure construction adds another factor for potential impacts to the groundwater flow and supply systems. Further assessments shall be carried out during subsequent studies (e.g., MESPs, Class EA Phases 3 and 4, etc.) to identify potential impacts on the groundwater regime, sensitive features in the area (e.g., wetlands and woodlots), and nearby supply wells and establish proper mitigation measures. Due consideration for the potential for localized strong upward hydraulic gradients should be included in the design of future site specific groundwater studies.

4.3.2 Hydrology and Hydraulics

4.3.2.1 Existing Conditions

The FUA lies within the middle section of the Rouge River Watershed. Its climatic conditions are characteristic elsewhere in southern Ontario, exhibiting mild winters and hot summers, with precipitation patterns exhibiting a seasonal variation.

The soils and land use conditions within the FUA contribute toward moderate infiltration rates and low runoff potential during storm events. Soils within the area are generally sand, with some areas of silt particularly within areas of the Berczy Creek Subwatershed.

Hydrologic analyses for the Subwatershed Study were completed using the TRCA-approved PCSWMM hydrologic model for the Rouge River Watershed. The PCSWMM hydrologic model for the Rouge River Watershed was refined within the limits of the FUA based on the refined watercourses information and LiDAR mapping assembled as part of the Subwatershed Study.

The reaches of the Bruce and Berczy Creeks which traverse the FUA are regulated watercourses within well-defined riverine systems with Regulatory floodplains. The Robinson Creek at the east boundary of the FUA is also a regulated watercourse within a regulated floodplain. The portion of the FUA within the Eckardt Creek Subwatershed discharges to an urban minor system (storm sewer network) south of Major MacKenzie Drive East and has no defined or regulated watercourses within the contributing drainage area in the FUA.

Hydraulic characterization of the regulated watercourses within the FUA was completed using the HEC-RAS hydraulic model. Hydraulic analyses for the Berczy, Bruce and Robinson Creeks were completed most recently by Clarifica Consulting Inc. as part of the 2006 Flood Plain Mapping Program. The hydraulic analyses applied the HEC-RAS hydraulic model. Field reconnaissance was conducted in order to obtain the geometry and dimensions of the hydraulic structures spanning the regulated watercourses within the FUA. A photographic inventory of the culverts was prepared and a Total Station Survey was completed at the structures in order to establish the inverts and dimensions, as well as cross-sections of the open watercourses upstream and downstream of the structure.

The hydraulic structure inventory was supplemented by information provided by the City of Markham and the area landowners for various structures (bridges and culverts) in the area, which was incorporated into the HEC-RAS hydraulic model accordingly. The Regional Storm peak flows generated by the approved PCSWMM hydrologic model were incorporated into the HEC-RAS hydraulic model in order to generate the Regional Storm floodplain through the FUA. Consistent with current practices at TRCA, the Regional Storm (Regulatory) floodplain was delineated for all watercourses with contributing drainage areas greater than 50 ha. The resulting floodplain and corresponding HEC-RAS cross-section location plans are illustrated in **Figure 4.4**. The floodline mapping indicates that the Regional Storm Floodplain is largely contained within the currently defined Greenway, with the exception of portions of the northwest tributary within the FUA and the Berczy Creek Subwatershed.

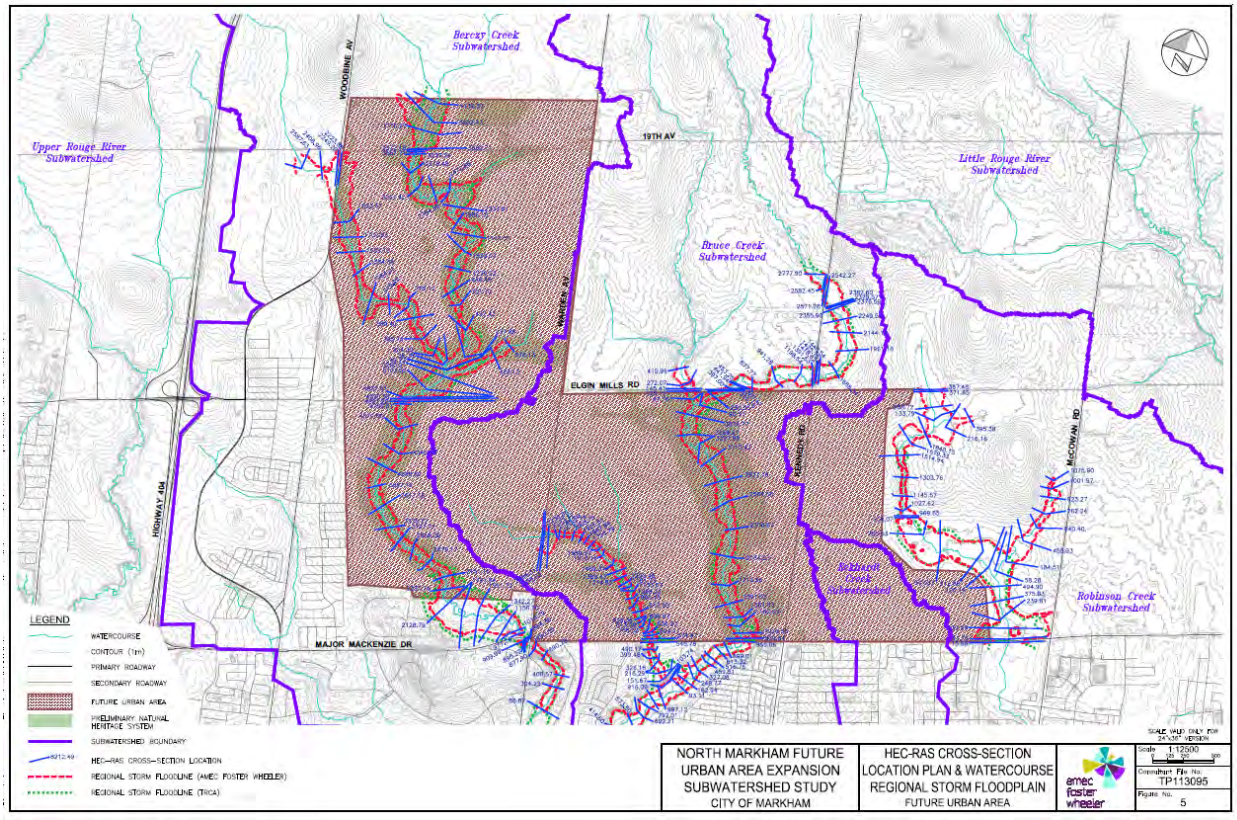


Figure 4.4 FUA Floodplain Data

4.3.2.2 Identification of Areas of Potential Impact for CMP Infrastructure Projects

As part of the Subwatershed Study and in coordination with the development of the CMP, hydrologic analyses were completed to determine the potential impacts of proposed future development within the FUA relative to flooding and erosion. The TRCA-approved PCSWMM hydrologic model for the Rouge River Watershed, refined within the limits of the FUA, was revised to represent the future land use conditions within the area as per the CMP, including future roads and roadway crossings at watercourses.

The results of the hydrologic analyses demonstrated that, in the absence of stormwater quantity controls, the increased peak flows and runoff volumes generated by the future urban land use would increase the erosion potential along the Berczy, Bruce and Robinson Creeks. Peak flows would be anticipated to increase along all watercourses for the more frequent events (i.e., 20 year frequency or less), due to the additional volume of runoff generated by the future land use, with reductions in peak flows at various locations along the Berczy and Bruce Creeks, as well as along the Robinson Creek and through the Unionville Special Policy Area (SPA) for the less frequent events (i.e., 50 year and 100 year), due to timing influences in runoff. Peak flows for the Regional Storm event, would increase along Robinson Creek and along Berczy Creek with increased flows through the Unionville SPA Damage Centre, representing potentially higher floodwaters in these areas during the Regional Storm event under future uncontrolled land use conditions.

End-of-pipe facilities and LID BMPs will be implemented throughout the FUA to mitigate impacts from urbanization. These facilities and BMPs will be designed and sized to capture and control/treat runoff from each catchment area including roads. Hydrologic model refinements will be required during the

preparation of the MESPs to ensure that the SWM facilities, LID Best Management Practices (BMPs), erosion control criteria are refined and updated in accordance with the results of the refined mode. Reliance on end-of-pipe facilities for erosion protection with drawdown times of five days (+/-) would largely mitigate increased erosion potential along the receiving watercourses, although residual increases above acceptable levels (i.e., 5% greater than existing) would be anticipated along the Bruce and Berczy Creeks, based on the erosion criteria and thresholds developed through the fluvial geomorphologic assessment. In addition, stream crossing structures will have to adhere to the TRCA *Crossings Guideline for Valley and Stream Corridors.* Strategic quantity controls to the 100 year level within the Bruce, Eckardt and Robinson Creeks and without 100 year controls within the Berczy would largely mitigate increased flood potential downstream, including most areas within the Unionville SPA.

4.3.2.3 Summary

The provision of LID infiltration-based best management practices, in combination with the end-of-pipe stormwater management facilities, would mitigate the impacts from land developments and capital projects. These facilities would minimize erosion potential along the receiving watercourses to within acceptable tolerances, provide flood protection to the 100 year flow condition at key locations downstream, and provide infiltration and groundwater recharge as per the established targets in the FUA Subwatershed Study.

The future development within the FUA would also result in increased peak flows during the Regional Storm event, particularly within the limits of the Unionville SPA Damage Centre. Regional Storm impacts through the Unionville SPA can be mitigated through the provision of local strategically-sited Regional Storm control facilities within the portions of the FUA and the Robinson Creek Subwatershed, as well as the employment lands in the Berczy Creek Subwatershed. These opportunities will be further explored and refined as part of subsequent studies (i.e., Secondary Plans and Master Environmental Servicing Plans).

4.3.3 Fluvial Geomorphology

4.3.3.1 Existing Conditions

Within the FUA Subwatershed Study area, there are three major watercourses: Berczy Creek, Bruce Creek and Robinson Creek. The area covers a substantial length of Berczy Creek (15 reaches) as compared to the other watercourses. Prior to undertaking the FUA Subwatershed Study, a number of studies was initiated by landowners which provided extensive coverage for the stream morphology component. To avoid duplication of efforts, the Subwatershed Study focused on:

- Desktop review and field verification of landowner studies; and,
- Supplementary characterization to address information gaps.

The three watercourses and their associated tributaries were assessed using both desktop and field-based methods. The desktop assessment reviewed local geology, physiography and watershed conditions to determine and verify reach delineation for the watercourses. A historic assessment was also completed reviewing morphologic change over time as well as historic changes within the watershed which may have influenced the channel morphology.

The final component of the desktop assessment was delineation of the meander belt width, which is a designated corridor that is intended to contain all of the natural meander and migration tendencies of a channel based on historic and future alignments. This permits channel adjustment to occur without risking damage to surrounding infrastructure and property. Preliminary meander belt widths are shown on **Figure 4.5**.

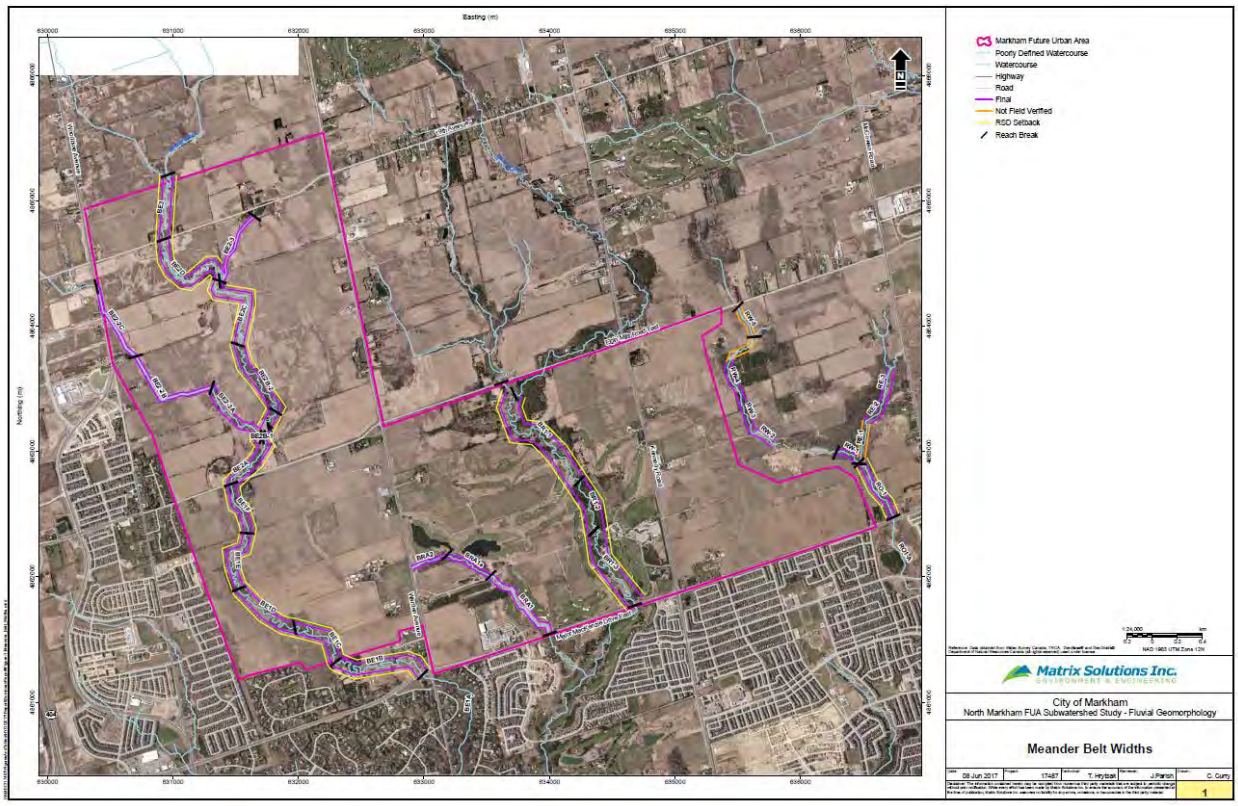


Figure 4.5 Meander Belt Widths

The field program employed both rapid and detailed assessments to characterize the watercourses. The rapid assessments used the RGA and RSAT protocols to document active channel processes and stability. The detailed assessment complements this work by providing additional quantitative information on channel geometry, substrates and hydraulics. A monitoring program was also completed which overlapped with previously established TRCA Regional Watershed Monitoring Network (RWMN) sites. Based on the field program, erosion thresholds were established for the FUA and refined in consultation with the Subwatershed Study TAC.

The majority of the reaches on Berczy Creek and its associated tributary were classified as “in transition” or “in adjustment’. Dominant processes of adjustment were widening with planform adjustment and aggradation as a secondary process. These processes manifested differently in the reaches depending on the dominant surrounding vegetation. Reaches dominated by mixed meadow vegetation exhibited scouring and undercutting leading to frequent bank slumping. Outflanking of the failed bank material resulted in secondary flow paths. Additional inputs of scoured bank material resulted in aggradation. Reaches flowing through forested areas, were characterized by fallen and leaning trees resulting in woody debris jams. Backwatering from the jams led to large deposits of unconsolidated silt and sand. Beaver activity was also noted in a number of the reaches as a dominant impact on channel morphology.

Of particular consideration was the TRCA RWMN station located downstream of the FUA (GR-12). Based on the results from a nine-year monitoring period, the channel cross-section at this location appeared to be enlarging. This suggests that Berczy Creek is susceptible to development impacts and that downstream sections are already responding to these impacts. The Phase 1 - Characterization of Berczy Creek indicated that the channel is relatively active through channel processes of erosion and deposition under existing land use conditions resulting in variable channel characteristics throughout the FUA. It was important to consider this active nature as part of the Phase 2 Impact Assessment, particularly the potential for downstream impacts.

Bruce Creek and the western tributary were similarly active within the FUA, but characterized by different dominant processes. The western tributary was adjusting through degradation and planform alterations. The main branch has been historically active through planform adjustment; meander cutoffs were noted both at the upstream and downstream end of the FUA. There is also potential for future cut-offs, specifically within a series of meanders where adjustment was noted on historic aerial photographs. The Bruce Creek's history of meander cut-offs was an important consideration for the Phase 2 Impact Assessment particularly with respect to proposed crossing locations.

Robinson Creek was highly variable through the study area due to a number of wetland complexes, online ponds and historical channel alteration. The majority of the eastern branch was either poorly-defined or non-existent. Due to a lack of gradient, the area was dominated by wetlands and marshes. There were isolated sections where flow and gradient were sufficient to establish a defined channel over a short distance. In these sections, the substrates were very fine, consisting primarily of clay and organic material with a small percentage of fine sand. Robinson Creek is a relatively stable system which is frequently undefined due to various natural features (wetlands, ponds). The sensitivity due to this lack of definition was a consideration for the impact assessment, particularly in terms of any stormwater that is to be directed to the area.

4.3.3.2 Identification of Areas of Potential Impact for CMP Infrastructure Projects

As part of the Subwatershed Study and in coordination with the development of the CMP, it was determined that the primary impacts to watercourses from urbanization include changes to the hydrologic regime, as a result of increased impervious cover. Increased surface runoff can be largely mitigated through integrated stormwater management. Various targets are employed to ensure key elements of the fluvial system are maintained and protected to help absorb any potential impacts which may arise. For the impact assessment, three critical elements were assessed:

- the meander belt width corridor;
- potential loss of stream length and realignment; and
- proposed road crossing locations.

An additional consideration for the FUA is the presence of Redside Dace in the main branches of the Berczy, Bruce and Robinson Creeks. Under Ontario Regulation 176/13 of the Endangered Species Act (2007), the occupied or recovery Redside Dace habitat requires the application of a 30 metre setback to development from the meander belt width. This is applied to both sides, thereby increasing the overall meander constraint by an additional 60 metres.

4.3.3.3 Summary

Implementation of the meander belt width corridor can reduce and control negative impacts which may occur as a result of urbanization. It is also used to evaluate risk for potential road crossings. Within the meander belt width, development should be strictly limited to specific low impact and localized uses, such as trails or properly planned road crossings. This management strategy also limits disturbance to riparian vegetation which ensures resiliency of the fluvial system by reducing bank erosion and widening.

Recommendations regarding the management of these headwater drainage features in the FUA Subwatershed Study, which was established in consultation with all stakeholders including the TRCA and MNRF, should be addressed during the subsequent stages of studies (refer to **Section 4.3.5.3** and **Figure 4.6**) and in consultation with the TRCA and the MNRF. Future assessments of these features must address the TRCA *Stream Crossing Guidelines* to avoid unnecessary impacts to the watercourses and infrastructure. Additional geomorphologic assessments will be required for each stream crossing at the site-specific level to better understand impacts and properly design associated mitigation measures.

Road crossings are an integral part of urbanization and an important consideration in terms of impacts to watercourses. A poorly sited road crossing can result in negative impacts to the channel and higher risk to the crossing structure itself. In addition to the fact that transportation including stream crossings are required as part of urbanization, there are a number of environmental factors which should be considered when identifying the most appropriate location for a stream crossing. Ideally, for a large development area such as the FUA, it is important to minimize the number of times the proposed road network crosses the watercourse valley to the extent feasible. This will help reduce impacts to the watercourse as well as the surrounding natural heritage features. Ideally, road crossings should not be located within close succession. Providing an adequate distance between crossings allows for an area of potential adjustment, if there are negative impacts to the watercourse as a result of the crossing structure. This will minimize the risk of compromising any additional structures located downstream. The transportation assessment completed for the FUA has identified the need for two (2) crossings of the Bruce Creek that are within close proximity to each other (refer to **Section 5.6** and **Figure 5.14**). Additional environmental assessments including detailed fluvial geomorphological assessment shall be completed during subsequent studies (e.g., Secondary Plans, MESPs, Class EA Phases 3 & 4, etc.) in consultation with the TRCA and MNRF to further refine the location and alignment of all of the crossings, identify cut/fill requirements within the valley system, identify potential impacts, assess alternative mitigation options, and established the preferred mitigation option.

4.3.4 Surface Water Quality

4.3.4.1 Existing Conditions

A surface water monitoring program was conducted within the FUA to characterize the surface water quality within the area. The locations for conducting the water quality monitoring were established consultatively with members of the Subwatershed Study TAC and field reconnaissance was conducted to confirm the suitability of the locations for conducting the water quality monitoring. The water quality monitoring program was initiated in the fall of 2013. Grab sampling was completed at each monitoring location during 2013 and 2014 to characterize the surface water chemistry. The grab sampling distinguished between wet weather and dry weather conditions, to characterize the surface water chemistry during storm events, as well as during inter-event periods. All grab samples were analyzed by ALS Environmental for the following parameters:

- Oil and Grease

- Total Phosphorus
- Anions (Nitrate, Nitrite, Phosphate, Chloride)
- Ammonia
- Total Kjeldahl Nitrogen (TKN)
- Conductivity
- Total Solids (TS)
- Total Suspended Solids (TSS)
- BOD5
- Dissolved Oxygen
- pH/alkalinity
- Salinity
- Total Coliforms/Fecal Coliforms/E. Coli
- PAH
- Metals (Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Se, Si, Ag, Na, Sr, Tl, Sn, Ti, W, U, V, Zn, Zr)
- Hardness as CaCO3
- Turbidity

The results of the statistical analyses for the grab samples were compared to values reported in literature for similar land use conditions. The water quality monitoring program also included continuous water quality monitoring for turbidity, conductivity, temperature and dissolved oxygen. The continuous water quality monitoring was completed using EXO2 sondes. The continuous water quality gauges obtained and recorded water quality data at 15 minute timesteps. In order to inform the water quality impact assessment and development of the water quality management strategy for the FUA, the continuous water quality data were analyzed to characterize the instream surface water quality under existing conditions, relative to the water quality requirements for stormwater management in Redside Dace habitat. Duration analyses were completed for the continuous temperature data at each monitoring location, to determine the period of time during which the instream water temperature exceeded 24 C, as well as the period of time during which the dissolved oxygen levels were below 7 mg/L.

The water quality monitoring indicates that the existing surface water quality within the FUA is generally of higher quality, with lower concentrations of nutrients, microorganisms, TSS and most metals compared to literature and reported values for similar land use conditions. Similarly, with the exception of E. Coli, the existing surface water quality demonstrated few Provincial Water Quality Objective (PWQO) exceedances during wet weather conditions. Very few PWQO exceedances were noted for all parameters monitored under dry weather conditions.

The instream water temperature is generally below the 24 C objective for stormwater discharge in Redside Dace supporting habitat, based upon the continuous monitoring conducted in 2014. The dissolved oxygen levels were frequently below the 7 mg/L objective for stormwater discharge during the 2014 monitoring season at various monitoring locations. The statistical analyses of the calculated continuous TSS

concentrations provide a framework for establishing background concentrations for reference against the stormwater management effluent objective for Redside Dace supporting habitat.

4.3.4.2 Identification of Areas of Potential Impact for CMP Infrastructure Projects

As part of the Subwatershed Study and in coordination with the development of the CMP, it was determined that without mitigation measures, increased mass loadings of various water quality contaminants, including heavy metals, nutrients and thermal enrichment are expected. The stormwater management system within the FUA is required to address provincial standards for stormwater quality control to an enhanced standard of treatment, as well as requirements for protection of Redside Dace habitat as per the guidelines issued by the MNRF.

4.3.4.3 Summary

The stormwater management system within the employment lands is required to incorporate source controls for all individual sites while the balance of the FUA offers the opportunity to implement more centralized stormwater management facilities to provide stormwater quality, erosion and quantity control for multiple land ownerships. Low Impact Development infiltration best management practices are anticipated to form part of the overall stormwater management system, to satisfy requirements for erosion protection, maintaining baseflow in the receiving watercourses and enhancing aquatic habitat within the receiving systems. These facilities should form part of a treatment train approach toward stormwater management, specifically to enhance water quality, and would thus be integrated into the future development at source.

4.3.5 Fisheries

4.3.5.1 Rouge River Watershed Context

The FUA is located in the Rouge River watershed. The Rouge River drains an area of 336 km^2 to Lake Ontario and the watershed extends from Lake Ontario north to the drainage divide that separates the Lake Ontario and Lake Simcoe drainage, at the height of land along the ORM. The Rouge River has two primary branches: the more easterly Little Rouge River and the Rouge River, which joins approximately two kilometres upstream from Lake Ontario, just north of Highway 401. The FUA is located within the Rouge River drainage area.

The Berczy Creek and Bruce Creek subwatersheds both extend from their sources near the height of land on the ORM south to where they join, which is just south of 16th Avenue at the upper end of Toogood Pond. Only the northern-most portion of the Eckhardt Creek drainage basin lies within the FUA. The drainage from the portion of Eckhardt Creek that is within the FUA is conveyed in a storm main from Major Mackenzie Drive East south to a stormwater management facility that is effectively the source of the creek. The main branch of Robinson Creek originates north of Elgin Mills Road and is joined by a second, more eastern branch approximately 600 metres north of Major Mackenzie Drive East. South of Major Mackenzie Drive East, Robinson Creek flows southeasterly through the existing Markham urban area.

The draft Rouge River Watershed Fisheries Management Plan (TRCA and OMNRF, 2011) provides guidance for the management of fish and fish habitat in the Rouge tributaries that drain the FUA. The broad recommendations of the draft Rouge River Watershed Fisheries Management Plan are:

- Integrate water management with aquatic ecosystem health at early stages of the land use planning process;
- Protect Redside Dace and its habitat;
- Maintain the flow regime of streams pre- to post-development;
- Increase the connectivity within the watershed to support native biodiversity and healthy fish communities;
- Prevent the further establishment and expansion of aquatic invasive species in the Rouge watershed and undertake to reverse the abundance of established invasives;
- Identify and undertake priority riparian planting opportunities to address and improve aquatic habitat quality and quantity;
- Support ongoing assessment of Rainbow Trout stocking and potential naturalization; and,
- Provide examples of implementation projects that could address the priority recommendations within the fisheries management plan and provide a means to measure the fisheries management plan's success.

The fisheries management plan identifies the target fish species for Berczy Creek as Redside Dace, American Brook Lamprey, Rainbow Darter, Brassy Minnow and Rainbow Trout. The target fish species for Bruce Creek are Brook Trout, Redside Dace, American Brook Lamprey, Mottled Sculpin, Rainbow Darter and Rainbow Trout. The target fish species for Robinson Creek are Redside Dace, Pearl Dace, Rainbow Darter and Rainbow Trout.

4.3.5.2 Fish Habitat and Community

The FUA is located in the middle to lower portions of the Berczy Creek and Bruce Creek subwatersheds. Both of these creeks are perennially flowing streams where they enter the FUA, as is the west branch of Bruce Creek. In contrast, the headwaters of Robinson Creek are adjacent to the FUA which appears to transition from intermittent flow to perennial flow between Elgin Mills Road and Major MacKenzie Drive East as a consequence of groundwater discharge within that reach.

Water quality is generally very good within the FUA (see **Section 4.3.4**), as indicated by the presence of fish species considered to be sensitive to water quality (i.e., Rainbow Darter) that are present in all three creeks.

Table 4.1 identifies the fish species that have been captured within or in proximity to the FUA. Berczy, Bruce and Robinson Creeks each support diverse communities of resident fishes. Berczy and Bruce Creeks support several coolwater fish species. Brook trout, a coldwater species, occurs in Bruce Creek upstream from the FUA and Mottled Sculpin, another coldwater species, occurs within and upstream from the FUA. Neither of these coldwater species have been reported from Berczy Creek. The Robinson Creek fish community has fewer coolwater species than Berczy or Bruce and is dominated by common warmwater species within the FUA. Berczy, Bruce and Robinson Creeks also provide spawning and nursery habitat for Rainbow Trout, which migrate upstream from Lake Ontario to spawn.

The main branches of the Berczy, Bruce and Robinson Creeks support Redside Dace, an endangered fish species in Ontario and Canada. The Rouge River Watershed Fisheries Management Plan (TRCA and MNR, 2011) refers to the watershed as a "habitat stronghold" for Redside Dace. The area occupied by this species has declined in nearly every watershed where it occurs or has occurred in Ontario (Redside Dace Recovery Team, 2010). In Ontario, based on the length of watercourse occupied, the amount of Redside Dace habitat in the Rouge River watershed is second only to that in the Humber River watershed (Poos et al, 2012). Consequently, protection or enhancement of Redside Dace and their habitat in the Rouge River watershed is considered to be of paramount importance by MNRF and TRCA, although the protection of other species and their habitats are also priorities.

Water temperature monitoring in 2014 and 2015 as part of the FUA Subwatershed Study indicated that the main branches of Bruce and Berczy Creeks are in the cool-warmwater thermal regime, which is consistent with the fish communities. Groundwater discharge contributes to this thermal regime. Field investigations identified areas of groundwater discharge along Berczy Creek immediately downstream from 19th Avenue, immediately upstream and downstream of Elgin Mills Road and approximately mid-way between Elgin Mills Road and the downstream boundary of the FUA. An area of groundwater discharge was also identified in tributary BE3 and a spring is located on tributary BE2 near its confluence with the main branch of Berczy Creek. On Bruce Creek, areas of groundwater discharge have been identified just downstream from Elgin Mills Road and at two locations between Elgin Mills Road and Major Mackenzie Drive East. On Bruce Creek tributary BR2, water emanating from tiles is thought to be of groundwater origin. Small ice-free areas were observed at the outlets from two ponds on the golf course downstream from Warden Avenue. One area of groundwater discharge was observed along the west branch of Robinson Creek.

Fish sampling at a number of locations along tributaries to Berczy Creek and Bruce Creek have captured common warmwater species including Brook Stickleback, Creek Chub, Blacknose Dace and Bluegill. The latter is presumed to have originated from golf course ponds. The few locations where Brook Stickleback have been captured in headwater drainage features are in close proximity to the main branches of the creeks or their major tributaries.

Most of the headwater drainage features have been classified in accordance with the Evaluation, Classification and Management of Headwater Drainage Feature Guidelines (TRCA/CVC 2014 Update) during the Subwatershed Study, although the classification of a few is not finalized. Due to the high infiltration rates on the table lands, the majority of the headwater drainage features are ephemeral. The current (July 31, 2018) classifications are shown in **Figure 4.6**.

Table 4.1 Captured Fish Species in each Principal Watercourse Within or in Proximity to the FUA

Common Name	Scientific Name	Berczy Creek	Bruce Creek	Robinson Creek
American Brook Lamprey	*Lethenteron appendix*	P	P	
Blacknose Dace	*Rhinichthys atratulus*	P	P	P
Bluntnose Minnow	*Pimephales notatus*	P	P	
Brassy Minnow	*Hybognathus hankinsoni*	P	P	
Brook Stickleback	*Culaea inconstans*	P	P	P
Brown Bullhead	*Ameiurus nebulosus*		P	
Brown Trout	*Salmo trutta*	P	P	
Central Mudminnow	*Umbra limi*	P		
Common Shiner	*Luxilus cornutus*	P	P	
Creek Chub	*Semotilus atromaculatus*	P	P	P
Emerald Shiner	*Notropis atherinoides*	P	P	
Fathead Minnow	*Pimephales promelas*	P	P	
Finescale Dace	*Chrosomus neogaeus*	P	P	
Golden Shiner	*Notemigonus crysoleucas*		P	
Hornyhead Chub	*Nocomis biguttatus*	P		
Iowa Darter	*Etheostoma exile*		P	
Johnny Darter	*Etheostoma nigrum*	P	P	
Largemouth Bass	*Micropterus salmoides*		P	
Longnose Dace	*Rhinichthys cataractae*	P	P	P
Mimic Shiner	*Notropis volucellus*		P	
Mottled Sculpin	*Cottus bairdii*		P	
Northern Redbelly Dace	*Chrosomus eos*	P	P	
Pearl Dace	*Margariscus margarita*			P
Pumpkinseed	*Lepomis gibbosus*	P	P	P
Rainbow Darter	*Etheostoma caeruleum*	P	P	
Rainbow Trout	*Oncorhynchus mykiss*	P	P	
Redside Dace	*Clinostomus elongatus*	P	P	
Stonecat	*Noturus flavus*	P	P	
White Sucker	*Catostomus commersonii*	P	P	P
Number of species		**22**	**26**	**7**

Notes:

(Proximity indicated by the letter “P”)

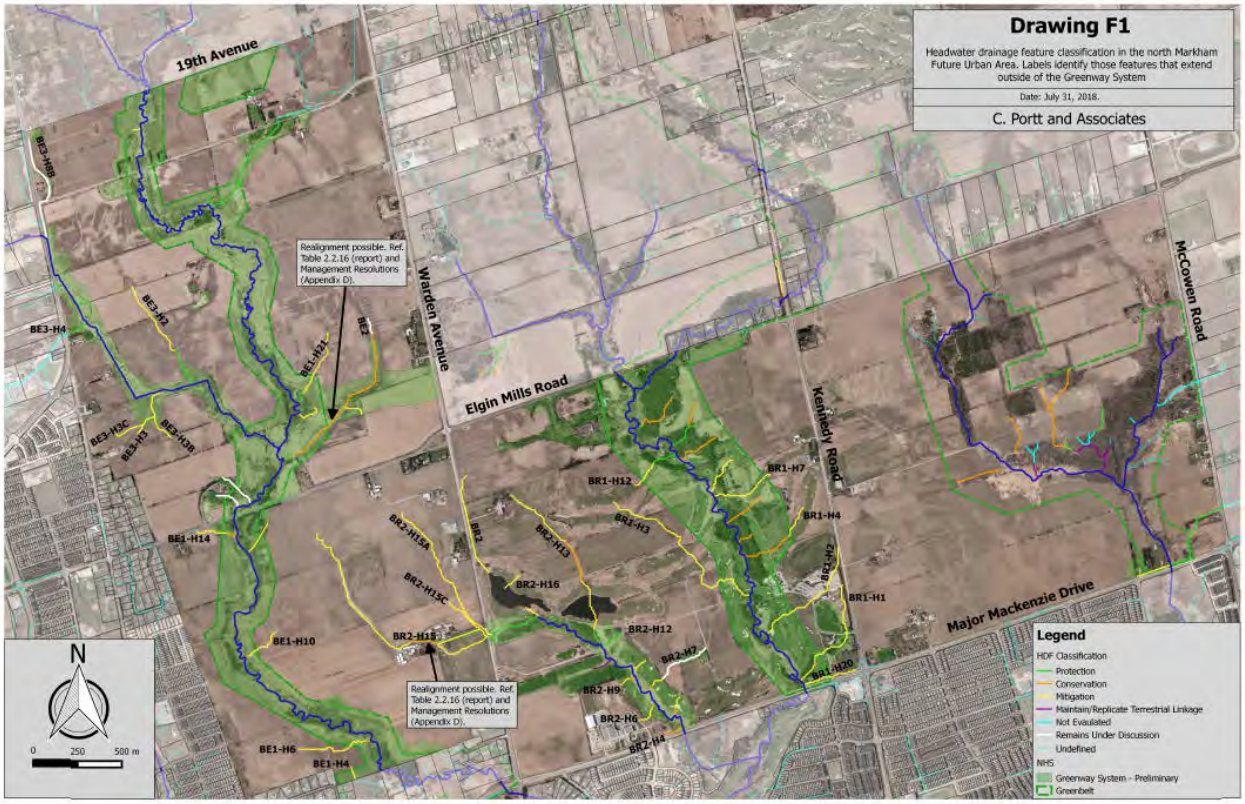


Figure 4.6 Current Headwater Drainage Features Classifications for the FUA (May 2017)

4.3.5.3 Identification of Areas of Potential Impact

Generally, in the absence of mitigation measures, urbanization, including infrastructure projects, may have direct impacts on fish habitat and indirect impacts on fish communities. Through the Subwatershed Study, the assessment of impacts on and protection of Redside Dace, due to its endangered status, was determined to be sufficient to address these potential impacts and result in the protection of the subject fish community in the north Markham FUA. The assessment of impacts and mitigation measures for several water-based and environmental disciplines, including hydrology, hydrogeology, fluvial geomorphology, water quality, and terrestrial ecology has been generally discussed in their respective sections in this document.

4.3.5.4 Summary

The management of land use changes will be required to prevent potential harmful effects to fish communities. Stormwater management and infiltration-based Low Impact Development Best Management Practices (LID BMPs) will be required to mitigate these impacts and maintain healthy aquatic habitat. Through further environmental assessment for infrastructure projects required to support the FUA, mitigation measures, such as erosion control, thermal cooling, maintaining adequate riparian buffers and setbacks for sensitive areas and fish habitat, including Redside Dace, will be explored and discussed with the applicable agencies. Additional geomorphologic assessments will be required for each stream crossing at the site-specific level to better understand impacts and properly design associated mitigation measures.

4.3.6 Terrestrial System

The FUA is contained in the Peel Plain physiographic region and is located in the middle of the Rouge Watershed. A major portion of this region is urban and agricultural, however it also contains high quality features including Robinson Swamp (Provincially Significant Wetland), a locally significant wetland at Milne Pond and the Bruce's Mill Conservation Area. The areas of the Berczy, Bruce, Eckardt and Robinson Creek subwatersheds that make up the FUA Subwatershed Study area are located within the Middle Tributaries as identified in the Rouge River State of the Watershed Report. Natural features within the Middle Tributaries are generally considered as being in poor condition, primarily resulting from low amounts of natural cover, urbanization within the southern sections of the subwatersheds and the agricultural matrix influences throughout the north sections. Despite the overall poor condition of the Middle Tributaries area, key natural features and functions include forest patches within the Robinson Creek headwater complex, occurrence of locally rare/sensitive flora species and locally rare/sensitive fauna species in the Robinson Creek headwater complex.

The terrestrial ecology component of the FUA Subwatershed Study focused on updating and refining the existing understanding of the form and function of terrestrial natural features within and neighbouring the north Markham FUA. This included documenting the extent and composition of plant communities, plant species, amphibians, birds and incidental observations of other wildlife. Data for the terrestrial ecology characterization were compiled from multiple sources including historical records (e.g., Natural Heritage Information Centre element occurrences, Breeding Bird Atlas data, TRCA element occurrences), various landowner groups (data collected between 2008 and 2013) and fieldwork conducted by landowner group consultants and the Subwatershed Study Team (conducted between 2013 and 2016).

A detailed account of the vegetation and wildlife resources within the FUA and neighbouring Robinson Creek Subwatershed is provided in the terrestrial sections of the Phase 1 and 2 reports of the FUA Subwatershed Study. A summary is provided below which outlines key findings for vegetation communities, plant species, amphibians, breeding birds and other wildlife observations.

Vegetation Communities

Natural features represent approximately 253 ha or 19% of the total area within the FUA (see **Table 4.2**). Cultural vegetation community types - including meadows, plantations, savannahs, thickets, woodlands and hedgerows - were the most abundant by area. This was followed by wetland communities and aquatic, swamp community types and upland forests. Each general vegetation community class included a range of more specific vegetation community types represented by ELC Community Series, Ecosites and/or vegetation types. Site-specific evaluation of wooded features are ongoing and follow the City of Markham's Terms of Reference for Woodlands Evaluations for the FUA which is found in the Subwatershed Study.

Botanical Species

A total of 686 vascular plant species were recorded for the initial Characterization Report for the study area, comprised of 394 (57%) native species, 223 (32%) introduced species and 65 (9%) genus level only. Of the species reported within the FUA, 16 are provincially rare and 141 are locally significant. **Table 4.3** documents the provincially significant species identified within the FUA.

An updated list of vascular plant species was compiled as part of the Phase 2, First Iteration Impact Assessment, primarily for lands located within the Bruce Creek system north and south of Elgin Mills Road and for lands in the Berczy Creek system north of Elgin Mills Road. A total of 334 vascular plant species was observed across the three Romandale properties alone, including 211 (63%) native species, 122 (37%) non-native species and one unknown Hawthorn species (*Crataegus sp*).

Amphibian Species

Within the FUA and neighbouring lands in the Robinson Creek subwatershed, seven anuran species were documented. Species detected include:

- American Toad (Anaxyrus americanus)
- Gray Treefrog (Hyla versicolor)
- Spring Peeper (Pseudacris crucifer)
- American Bullfrog (Lithobates catesbeianus)
- Green Frog (Lithobates clamitans)
- Northern Leopard Frog (Lithobates pipiens)
- Wood Frog (Lithobates sylvaticus)

All of these species have a provincial conservation rarity rank of S5 (“secure”) or S4 (“apparently secure”). At the local scale, Gray Treefrog, Spring Peeper, American Bullfrog, Northern Leopard Frog and Wood Frog are considered significant within the jurisdiction of the TRCA (TRCA, 2013).

Based on background information and surveys within the FUA, the overall distribution and abundance of calling frogs and toads within the FUA and adjacent lands appeared to be low. Wetland habitats occupy only 14% of the entire FUA land base and only a few of these had pond habitat suitable for breeding amphibians.

Preferred breeding habitats (i.e., shallow marsh and aquatic vegetation communities) only account for 2% of the FUA. This total increases to about 7% if shallow marsh communities are included. The latter are seasonal in formation and tend to be ephemeral; therefore, they may not always result in suitable breeding habitat.

Table 4.2 Natural Area within the FUA (summarized by ELC Community Series & Subwatershed)

Vegetation Community		Berczy Subwatershed			Bruce Subwatershed			Robinson Subwatershed			Total Natural Area in FUA		
Dscription	ELC Code	# of Features	Area (ha)		# of Features	Area (ha)		# of Features	Area (ha)		# of Features	Total Area (ha)	
Cultural													
Cultural Meadow	CUM	79	32.74	12.93%	79	68.87	27.20%	2	0.90	0.35%	**160**	**102.51**	**40.5%**
Plantation	CUP	6	0.78	0.31%	18	7.46	2.95%				**24**	**8.24**	**3.3%**
Cultural Thicket	CUT	11	4.02	1.59%	1	0.99	0.39%				**12**	**5.02**	**2.0%**
Cultural Woodland	CUW	19	6.98	2.76%	17	10.68	4.22%	1	0.47	0.18%	**37**	**18.13**	**7.2%**
Hedgerow	HR	43	5.89	2.33%	24	3.85	1.52%	1	0.18	0.07%	**68**	**9.92**	**3.9%**
Forest													
Coniferous Forest	FOC	1	0.41	0.16%	15	7.11	2.81%				**16**	**7.52**	**3.0%**
Deciduous Forest	FOD	14	3.55	1.40%	12	6.72	2.65%				**26**	**10.26**	**4.0%**
Mixed Forest	FOM				5	3.29	1.30%				**5**	**3.29**	**1.3%**
Wetland													
Meadow Marsh	MAM	54	31.26	12.35%	21	9.67	3.82%	2	0.10	0.04%	**77**	**41.03**	**16.2%**
Shallow Marsh	MAS	26	4.64	1.83%	9	0.66	0.26%				**35**	**5.29**	**2.1%**
Coniferous Swamp	SWC	3	0.40	0.16%	1	1.92	0.76%				**4**	**2.32**	**0.9%**
Deciduous Swamp	SWD	21	13.96	5.51%	11	7.70	3.04%				**32**	**21.66**	**8.6%**
Mixed Swamp	SWM				9	8.17	3.23%				**9**	**8.17**	**3.2%**
Thicket Swamp	SWT	7	1.46	0.58%	2	0.14	0.06%				**9**	**1.60**	**0.6%**
Aquatic													
Open Aquatic	OAO				6	6.83	2.70%				**6**	**6.83**	**2.7%**
Floating-leaved Shallow Aquatic	SAF				1	0.10	0.04%				**1**	**0.10**	**0.04%**
Mixed Shallow Aquatic	SAS				4	1.29	0.51%				**4**	**1.29**	**0.5%**
Total(Percent of Total Natural Area in FUA)		**284**	**106.1**	**41.9%**	**235**	**145.5**	**57.5%**	**6**	**1.6**	**0.7%**	**525**	**253.2**	**100%**

Table 4.3 Nationally and Provincially Significant Plant Species Documented in the FUA

Species	Current Common Name	SRANK	COSEWIC	MNR	Subwatersheds
Gleditsia triacanthos	Honey-locust	S2			Bruce, Robinson
Gymnocladus dioicus	Kentucky Coffee-tree	S2	THR	THR	Bruce
Juglans cinerea	Butternut	S3?	END	END	Berczy, Bruce, Robinson
Ligusticum scoticum ssp. scoticum	Scotch Lovage	S3			Berczy
Oxypolis rigidior	Stiff Cowbane	S2			Berczy
Picea rubens	Red Spruce	S3			Berczy
Prunus pumila var. pumila	Sand Cherry	S3			Berczy
Smilax ecirrata	Upright Carrion Flower	S3?			Bruce
Symphyotrichum dumosum	Bushy Aster	S2			Little Rouge
Symphyotrichum ericoides var. pansum	Prairie White Heath Aster	S2			Little Rouge
Symphyotrichum praealtum	Willowleaf Aster	S2		THR	Berczy
Tripleurospermum maritime	False Chamomile	S3?			Robinson
Uvularia perfoliata	Perfoliate Bellwort	S1			Little Rouge
Valeriana uliginosa	Mountain Valerian	S2			Robinson
Verbesina alternifolia	Wingstem	S3			Robinson
Vitis labrusca	Fox Grape	S1			Bruce

Bird Species

Based on the background information and field studies conducted within the FUA and neighbouring Robinson Creek subwatershed, 117 species of breeding birds were documented; of these, 90 could be confirmed specifically from the FUA. Woodland habitats supported the highest diversity of birds, followed by early successional/agricultural habitats, wetland habitats and urbanized/residential areas.

Other Key Wildlife Species Observations

Reptile observations were generally based on incidental records within the FUA and adjacent lands. Species that have been observed within the FUA and adjacent lands include:

- Eastern Gartersnake (Thamnophis sirtalis sirtalis)
- Eastern Milksnake (Lampropeltis Triangulum), listed as 'Special Concern' federally
- Midland Painted Turtle (Chrysemys picta marginata)
- Snapping Turtle (Chelydra serpentina); listed as 'Special Concern' federally and provincially
- Pond Slider (Trachemys scripta); introduced turtle species

Further information about the snake communities present within the study area should be ascertained through additional targeted studies. Hibernacula, which are significant wildlife habitat, may be present within the FUA and adjacent lands and targeted hibernacula searches should continue to be undertaken where appropriate habitat is present. Targeted studies would be required to understand the full extent of suitable turtle habitat within the FUA and adjacent lands.

4.3.6.1 Significant Features

Wetlands

Nearly a third of the natural area within the FUA is composed of wetland features. The majority of which occur within the floodplains of the watercourse systems and/or are associated with groundwater discharge areas/shallow water tables. Functional characteristics of wetland hydrology have been characterized based on field observations (e.g., occurrence of seeps and discharge area), association with flood plain areas of the main watercourses and associated with headwater drainage features. Additionally groundwater modeling results have been used to determine the expected depth to groundwater for wetland patch areas. From a policy perspective, the majority of wetland features were identified as provincially significant wetlands within the Bruce Creek or Berczy Creek wetland complex. Some isolated wetland features on the tablelands remain under review.

Woodlands

The woodland and forest feature areas within the FUA are represented by cultural woodlands, plantations, coniferous forest and deciduous forest types. The range of naturally occurring and cultural woodland types within and adjacent to the FUA is relatively high including a cross-section of deciduous and coniferous woodland and forest types. Almost all of the woodland and forest features exist within the Greenway system (e.g., of the woodland and forest community series, approximately 94% are within the Greenway). Of particular importance are the forests and woodlands that are relatively rare on the landscape (e.g., the coniferous forests) and those that contain 100 metre interior forested areas. All wooded features are expected to meet the City's size criteria for woodlands (i.e., 0.2 ha); however, stem counts and other characteristics were not available for this study and should be refined at the site scale to determine if wooded areas meet the City's woodland definition.

Where woodlands are located outside of the Greenway system, feature-specific woodland evaluations will be conducted to determine whether the features meet the criteria to be incorporated into the Greenway System.

Significant Wildlife Habitat (SWH)

A range of potential SWH types exist within the FUA and neighbouring areas of the Robinson Creek subwatershed. Based on the vegetation community types present and the occurrence of key wildlife species, 25 SWH types were flagged as potentially occurring. These types include:

- Deer winter congregation areas
- Colonially nesting bird breeding habitat (trees/shrubs)
- Wild Turkey winter range
- Turtle wintering areas
- Bat maternity colonies
- Bullfrog concentration areas
- Marsh bird breeding habitat
- Woodland area-sensitive bird breeding habitat
- Open country bird breeding habitat
- Shrub/early successional bird breeding habitat
- Forests providing a high diversity of habitats
- Foraging areas with abundant mast
- Amphibian breeding habitat (woodlands)
- Amphibian breeding habitat (wetlands)
- Turtle nesting areas
- Woodland raptor nesting habitat
- Seeps and springs
- Terrestrial crayfish
- Species identified as nationally endangered or threatened by COSEWIC which are not protected in regulation under Ontario's Endangered Species Act.
- Special Concern and rare wildlife species
- Species that are listed as rare (S1–S3) or historical in Ontario based on records kept by the Natural Heritage Information Centre in Peterborough.
- Species whose populations appear to be experiencing substantial declines in Ontario.
- Species that have a high percentage of their global population in Ontario and are rare or uncommon in the planning area
- Species that are rare within the planning area, even though they may not be provincially rare.

Animal Movement Corridors

The range of candidate SWH identified occurs mostly within the Greenway system; therefore, the form and function of the areas that have been flagged should be protected. Management recommendations as part of Phase 3 of the Subwatershed Study (draft, December 2017) direct potential enhancements that reinforce SWH that is within the Greenway system and/or identify opportunities to create areas that are consistent with SWH criteria.

Endangered and Threatened Species

Sixteen Species at Risk (SAR) were recorded in background studies and field investigations in the FUA and neighbouring lands (see **Table 4.4**). Of these, 12 are designated as Endangered or Threatened within Ontario; the remaining four are designated as Special Concern in Ontario.

Of those SAR documented, occurrences of species that prefer woodland habitats such as Wood Thrush and Eastern Wood-Pewee were found primarily within the Greenway System. Those that prefer open country habitat, such Bobolink, Eastern Meadowlark and Barn Swallow were found in some areas outside of the Greenway System and within the tableland areas. Some occurrences of these species within the Greenway System indicate that there is currently suitable habitat that will be protected. Their presence in these areas, however, will be intimately linked to the quality of habitat, the openness of adjacent areas outside of the Greenway System and the amount of suitable habitat that occurs within the surrounding landscape.

4.3.6.2 Identification of Areas of Potential Impact for CMP Infrastructure Projects

To facilitate the integration and impact assessment of the land characteristics with underlying physical processes present within the FUA, a series of landscape patches was delineated within the FUA and adjacent Robinson Creek subwatershed (see **Figure 4.7**). The objective of delineating patches was to create spatial units that were composed of land use types and/or natural heritage features that are similar in composition, structure and function. This resulted in four characteristics patch types: anthropogenic, meadow/early successional, shrub/mid-successional and/or wooded/late successional.

A detailed summary of key terrestrial characteristics, supporting hydrologic functions (e.g., shallow ground water, association with floodplains and association with headwater drainage features), key species and potential policy implications were outlined for each patch within the FUA and neighbouring Robinson Creek Subwatershed. The proposed land use concepts were then used to identify potential impacts (direct and indirect) for each patch and recommendations were provided for impact avoidance and/or management strategies to mitigation impacts. Specific management recommendations will be developed as part of the on-going Subwatershed Study during Phase 3 of the CMP process.

Additionally, a detailed assessment was completed to evaluate the impacts associated with locations where road crossings are proposed to cross the Greenway System. Generally, all road crossings will result in some degree of impact to natural heritage features within the FUA. Recommendations to avoid impacts to key areas have been provided and where unavoidable, management recommendation to mitigate potential impacts have been provided. Detailed mitigation strategies to address Greenway System road crossing were developed as part of Phase 3 of the CMP process.

Table 4.4 Species at Risk Observed

#	Common Name	Scientific Name		Subwatershed				
			Status	Berczy	Bruce	Eckardt	Robinson	Little Rouge
1	Chimney Swift	*Chaetura pelagica*	THR		✓			
2	Eastern Wood-Pewee	*Contopus virens*	SC	✓	✓		✓	✓
3	Bank Swallow	*Riparia*	THR	✓	✓			
4	Barn Swallow	*Hirundo rustica*	THR	✓	✓	✓	✓	✓
5	Wood Thrush	*Hylocichla mustelina*	SC				✓	✓
6	Bobolink	*Dolichonyx oryzivorus*	THR	✓	✓		✓	✓
7	Eastern Meadowlark	*Sturnella magna*	THR		✓			✓
8	Canada Warbler	*canadensis*	THR	Cardellina	✓			
9	Golden-winged Warbler	*Vermivora chrysoptera*	THR		✓			
10	Grasshopper Sparrow	*Ammodramus savannarum*	SC		✓			
11	Western Chorus Frog[1]	*Pseudacris crucifer aetura pelagica*	THR					
12	Snapping Turtle	*Chelydra serpentina*	SC	✓				
13	Little Brown Bat[2]	*Myotis lucifugis*	END	?	?	?	?	?
14	Butternut	*Juglans cinerea*	END	✓	✓		✓	
15	Kentucky Coffee-tree	Gymnocladus dioicus	THR		✓			
16	Willowleaf Aster	Symphyotrichum praealtum	THR	✓				

Notes:

1. Western Chorus Frog (Pseudacris crucifer) - No observations of Western Chorus Frog occurred within the FUA or the surrounding lands surveyed. However, two TRCA records occurred within at the north ends of the Berczy and Bruce Creek subwatersheds more than four kilometres from the North boundary of the FUA, and one record more than seven kilometres southeast of the FUA within the Robinson Creek subwatershed. There were no records of Western Chorus Frog in the MNRF data set.
2. Little Brown Bat (Myotis lucifugis) - No information about the observation(s) was provided in the report as it was not a Species at Risk at the time. The MNRF has requested additional information, and the issue is under review.

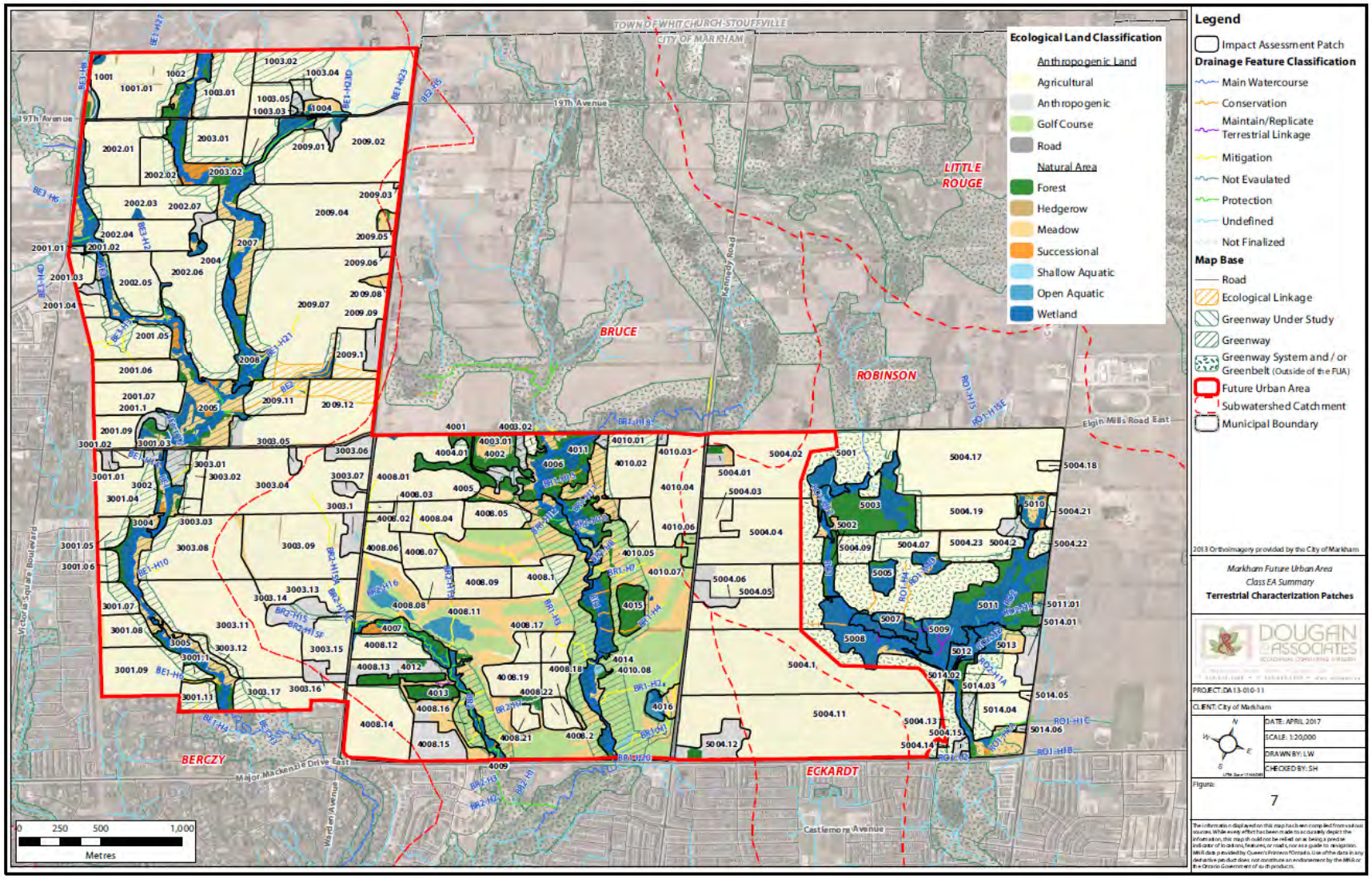


Figure 4.7 Terrestrial Characterization

4.3.6.3 Summary

Natural heritage features and functions are largely designated within the Greenway System and will be protected from development. Where direct impacts associated with removal of features occurs, best management practices will be required to reduce impacts to natural features and functions in the surrounding areas. Details concerning key sensitivities are outlined in the Subwatershed Study, CMP Volume 3.

Broad-scale opportunities for ecosystem enhancement within the FUA to direct ecological management strategies to specific patches have been identified in the Subwatershed Study. The goal is to create new habitat areas that will reinforce ecological functions that are currently present within the Greenway System (e.g., open habitats to support meadow and early successional species; woodland restoration to create larger woodland and forested patches) and/or create complementary habitat functions that may provide habitat for species that have more complex life histories and depend on a range of habitat types (e.g., woodland restoration near pond areas to create amphibian foraging habitat). Phase 3 of the Subwatershed Study process will provide specific management recommendations and will incorporates direction from agencies and stakeholders.

Where features are proposed for removal outside of the Greenway System (e.g., woodland areas, wetlands and/or individual trees), restoration and/compensation guidelines will be followed to ensure associated features and functions can be replicated within protected features, buffers and/or enhancement areas within the Greenway System. Additional details will be provided as part of the finalized Subwatershed Study.

4.4 Air Quality

The Markham Official Plan (Section 3.4.2) acknowledges that direct and indirect air pollution impacts human and ecosystem health, with the most significant sources of air pollution being related to the burning of fossil fuels and emissions of greenhouse gases. Among the policies in the Official Plan concerning air quality are:

- To work in consultation with public health agencies and other stakeholders to develop outreach and programs that raise awareness of air quality issues and encourage behavioural change in order to reduce air pollution and improve air quality;
- That certain sensitive land uses such as day care centres, private schools and public schools not be located near significant known air emission sources including the provincial 400 series highways; and,
- To require air quality impact studies be undertaken for development approvals where potential or known air quality emission levels can potentially impact certain sensitive land uses.

Based on the MOECC guide entitled Consideration of Climate Change in Environmental Assessment in Ontario (December 2017), it is the recommendation of the MOECC that an air quality assessment for the anticipated vehicle emissions related to the propose road improvement projects in the FUA should be considered

The MOECC guide should be consulted for additional information.

4.5 Transportation – Existing and Planned Conditions

4.5.1 Provincial Highways – Existing and Planned

The FUA is located east of Provincial Highway 404 which connects Markham to several communities in the Greater Toronto Area and Highways 401 and 407. The closest existing Highway 404 interchanges are located at Major Mackenzie Drive East and Elgin Mills Road, with a new interchange planned at 19th Avenue.

4.5.2 Arterial Roads – Existing and Planned

The components of the arterial road network include Major Mackenzie Drive East, Woodbine Avenue, Warden Avenue, Kennedy Road, 19th Avenue and the proposed Donald Cousens Parkway (DCP) from Markham Road to Highway 404 at 19th Avenue. Elgin Mills Road, east of Victoria Square Boulevard, is designated a major collector road under the City's jurisdiction. In a staff report dated May 14, 2018, the City of Markham Council requested that the Region of York be requested to assume Elgin Mills Road, between Victoria Square Boulevard and the York-Durham Line into the Region's road system. The arterial road network is primarily under the jurisdiction of York Region, with the exception of 19th Avenue east of Woodbine Avenue, which is a City arterial road. Existing Regional roads in the FUA typically consist of a two-lane rural cross section. An example of a typical cross section is shown in **Figure 4.8** on Warden Avenue, south of Elgin Mills Road. The southern limits of the FUA is bound by Major Mackenzie Drive East, which is a four lane arterial road with sections of urban and rural or partially rural cross-sections (i.e., some area retain ditches and are lacking sidewalks).

Figure 4.8 Warden Avenue Existing Rural Cross Section

The York Region 2016 Transportation Master Plan (TMP), established the Region's road network of arterial roads to 2041. The TMP's goal is to create a more robust, efficient, flexible, responsive and safe transportation system. The Regional roads will continue to play a foundational role in providing an interconnected system of mobility and enable the provision of YRT/Viva's transit services.

Figure 4.9 shows the projected Regional road network improvements for the year 2031, as reflected in York Region's Travel Demand Model and adapted from the York Region 2016 Transportation Master Plan. Generally, the regional roads adjacent to and within the FUA are all expected to be widened to four lanes. Sections of Major Mackenzie Drive East, Woodbine Avenue, and Kennedy Road are expected to be six lanes including two High Occupancy Vehicle (HOV) lanes south of Major Mackenzie Drive East. The segments of the future Donald Cousens Parkway (DCP) between Major Mackenzie Drive East and Markham Road, and between Warden Avenue and 19th Avenue, are anticipated to be in place by 2031. The alignment of the DCP is conceptual, as shown in the Region's TMP, to be confirmed through a Class EA process at a later date. In addition to proposed widening of Regional roads, Highway 404 mid-block crossings between 19th Avenue and Elgin Mills Road, and between Elgin Mills Road and Major Mackenzie Drive East are also proposed. For a complete description of the existing road network in the FUA and modelling results of the levels of service available see **Appendix C2**.

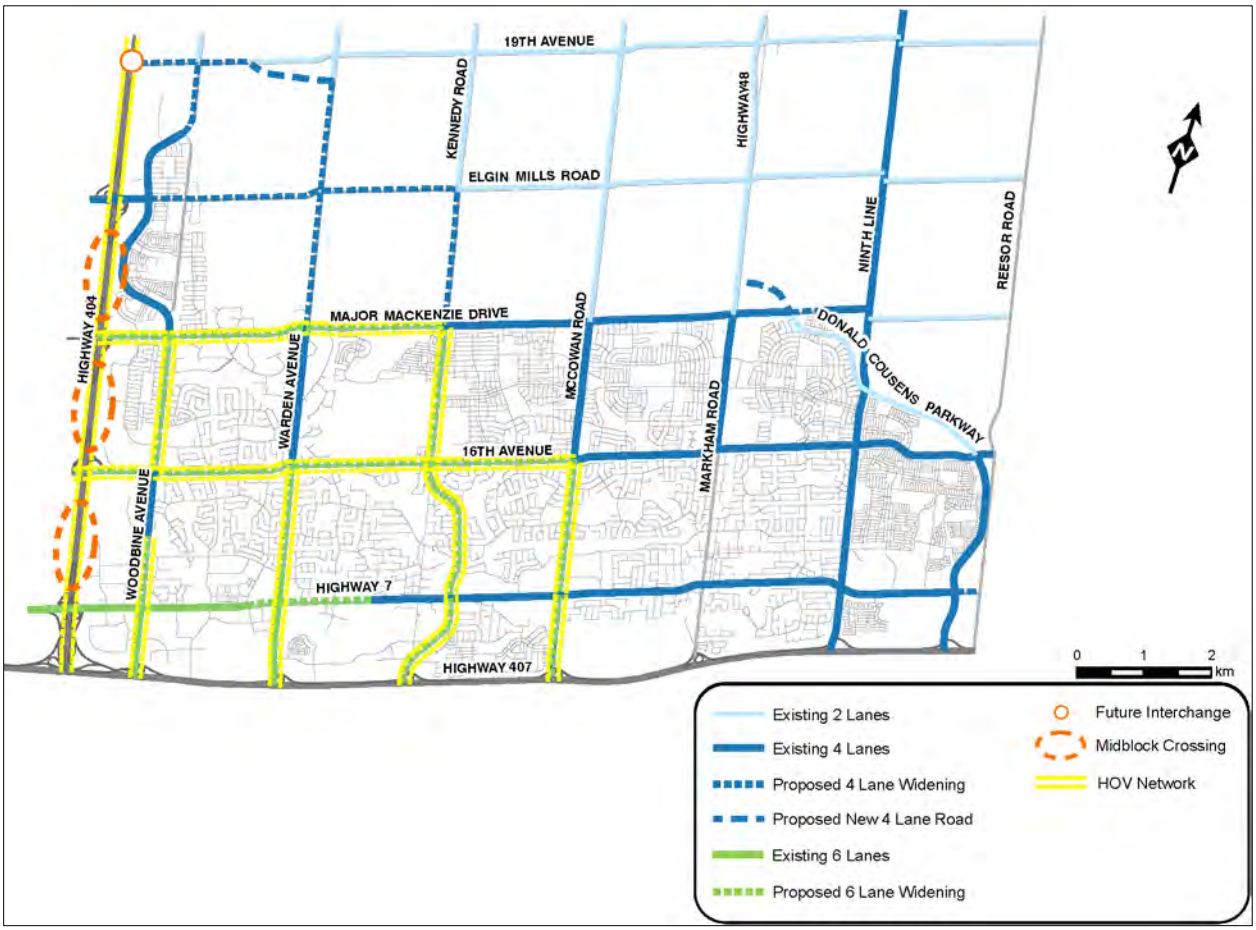


Figure 4.9 Study Area Regional Road Network Horizon Year 2031 (adapted from York Region Master Transportation Plan, 2016)

4.5.3 Collector Roads – Existing and Planned

City of Markham roads generally include collectors and local roads. Existing land uses within the FUA do not require a network of collector roads; however, there are several unpaved private roads in the area which access agricultural land uses and services to the Angus Glen Golf Club. At the western edge of the study area is the Cathedraltown community which features several collector and local roads providing access to the existing community. Stoney Hill Boulevard, Vine Cliff Boulevard and Rinas Avenue currently terminate at the edge of the FUA boundary at the Hydro Corridor and were constructed to facilitate the extension of these roads easterly into the FUA.

4.5.4 Transit Network - Existing and Planned

As is shown in **Figure 4.10**, existing transit service is limited within the FUA due to the lack of residents. York Region Transit (YRT) routes which operate in close proximity to the FUA include:

- Route 25 which runs east-west along Major Mackenzie Drive East;
- Route 18 which provides service to the Angus Glen Community Centre; and,
- Routes 24 and 80 which operate service to the Cathedraltown community on Woodbine Avenue.

In addition, Toronto Transit Commission (TTC) operate Route 68B Warden, Route 8 Kennedy and Route 42 Berczy terminate at Major Mackenzie Drive East at the southern border of the FUA.

The nearest GO Train stations relative to the FUA include Mount Joy, Markham, Unionville, Gormley and Richmond Hill stations.

While the Region's long term transportation network calls for rapid transit service along Major Mackenzie Drive and also along Woodbine Avenue, south of Major Mackenzie Drive East (subject to further study) by 2041, the level of transit infrastructure and service anticipated by 2031 will consist primarily of frequent transit service along almost all arterial road corridors. The Frequent Transit Network (FTN) will ultimately offer service frequencies of 15 minutes or less. The FTN will be supported by transit priority measures (reserved bus lanes, HOV lanes, and transit signal priority) to improve reliability and service. Providing Viva Curbside service on future Rapid Transit corridors will help transition the network to full rapid transit service. The inclusion of HOV lanes on major arterials will also support and improve transit by removing it from mixed traffic. It is expected that by 2031, rapid transit on Major Mackenzie Drive will extend from Jane Street to Leslie Street and HOV lanes will continue easterly into Markham. As well, HOV lanes on Woodbine Avenue by 2031 will precede the longer term development of rapid transit in that corridor. GO Rail service is also expected to expand with new Richmond Hill GO Rail Line stations at Stouffville Road and Bloomington Road by 2031.

Figure 4.11 shows Regional transit improvements that can be expected to be in place by the year 2031.

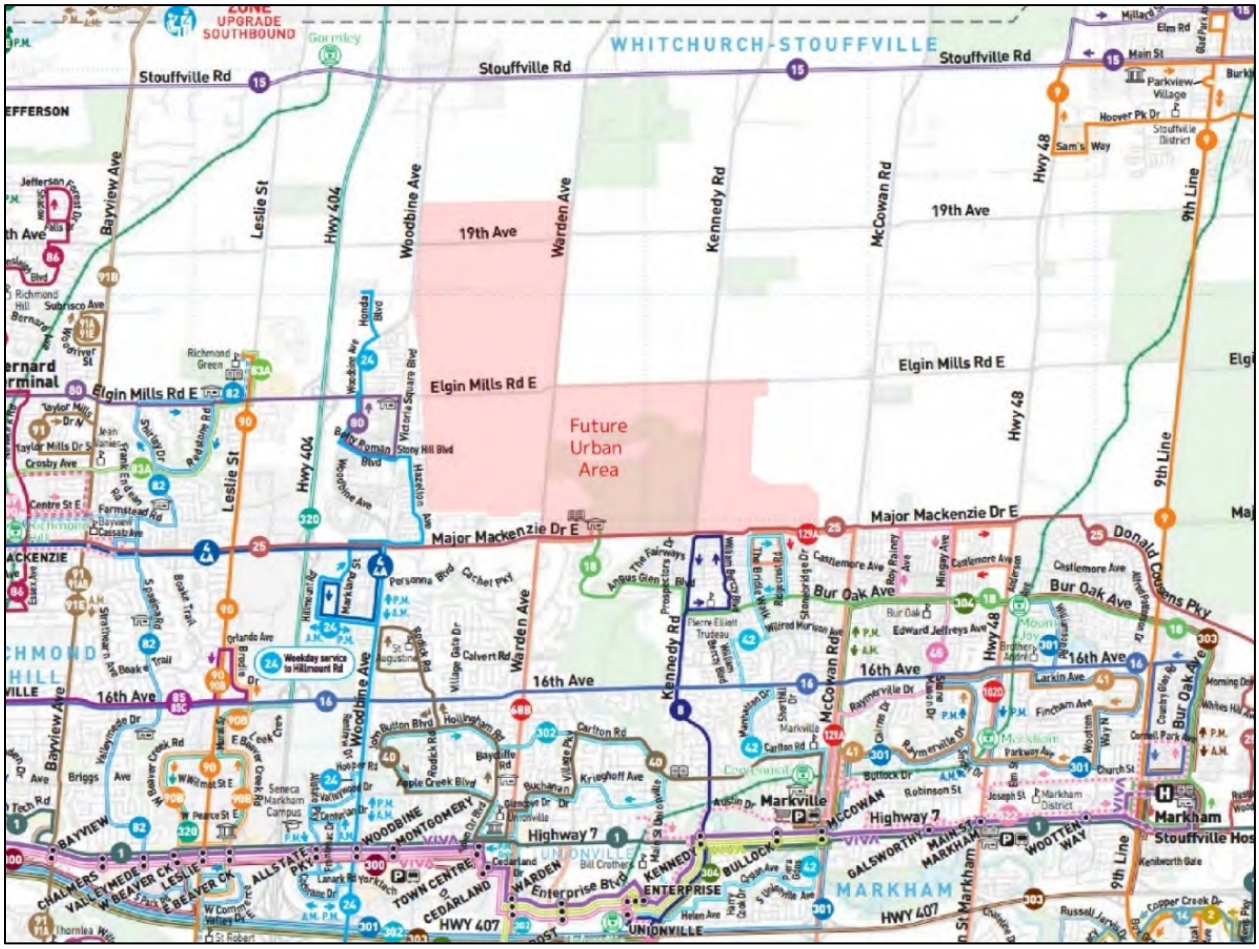


Figure 4.10 Existing Transit Routing

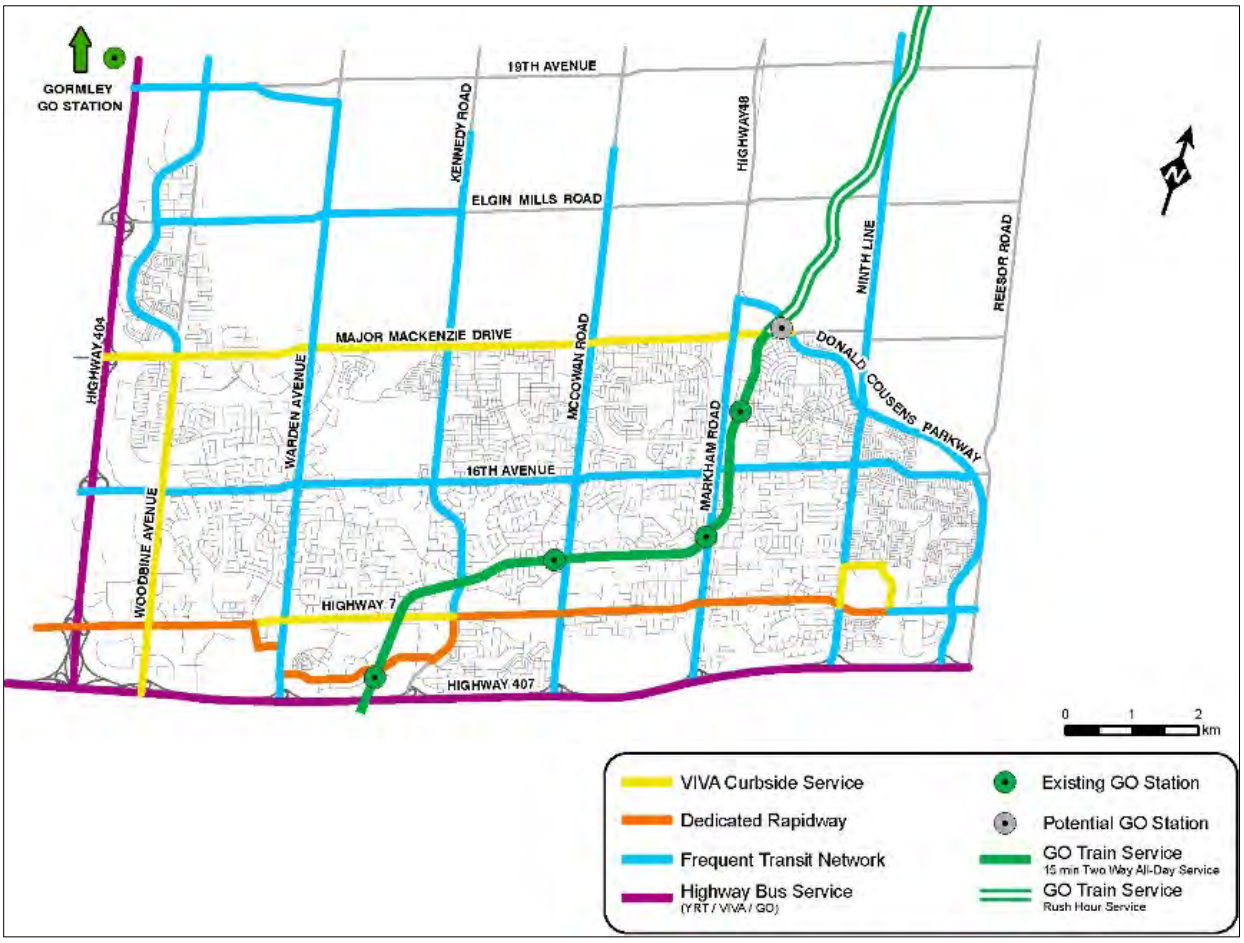


Figure 4.11 Regional Transit Improvements for 2031

4.5.5 Active Transportation - Existing and Planned

Existing cycling facilities in the study area are limited to paved shoulders on Warden Avenue and Kennedy Road. A shared multi-use path exists on the south side of Major Mackenzie Drive East at the southern edge of the study area. At the western edge of the FUA, the Cathedraltown community includes a multi-use path on Woodbine Avenue and on-road cycling lanes on:

- Betty Roman Boulevard;
- Russel Dawson Road;
- Pope John Paull II Square / Donald Buttress Boulevard East;
- Prince Regent Street;
- Murison Drive; and,
- Prince of Wales Drive.

Proposed Regional cycling facilities within the FUA as recommended by York Region's Transportation Master Plan are shown in **Figure 4.12**. Relevant to the FUA, the Transportation Master Plan states:

"Assigned facility type represents the minimum desirable facility class. A higher order facility would also be acceptable. Instances where the decision may be made to provide a higher order cycling facility along a corridor include routes which serve school-aged children, routes that provide access to an important community destination such as a school, hospital, community centre or major retail centre or where the roadway design changes significantly from what was originally envisioned."

Figure 4.12 Planned Active Transportation Network to 2041 (source: York Region 2016 Transportation Master Plan)

4.6 Water - Existing and Planned Conditions

Today residents in the FUA rely primarily on private groundwater wells for their water service. **Figure 4.13** shows the context of the existing water distribution system in the FUA area. Within the FUA boundary there are several areas where homes are serviced by individual wells; however the amount of water supplied by private wells is not significant.

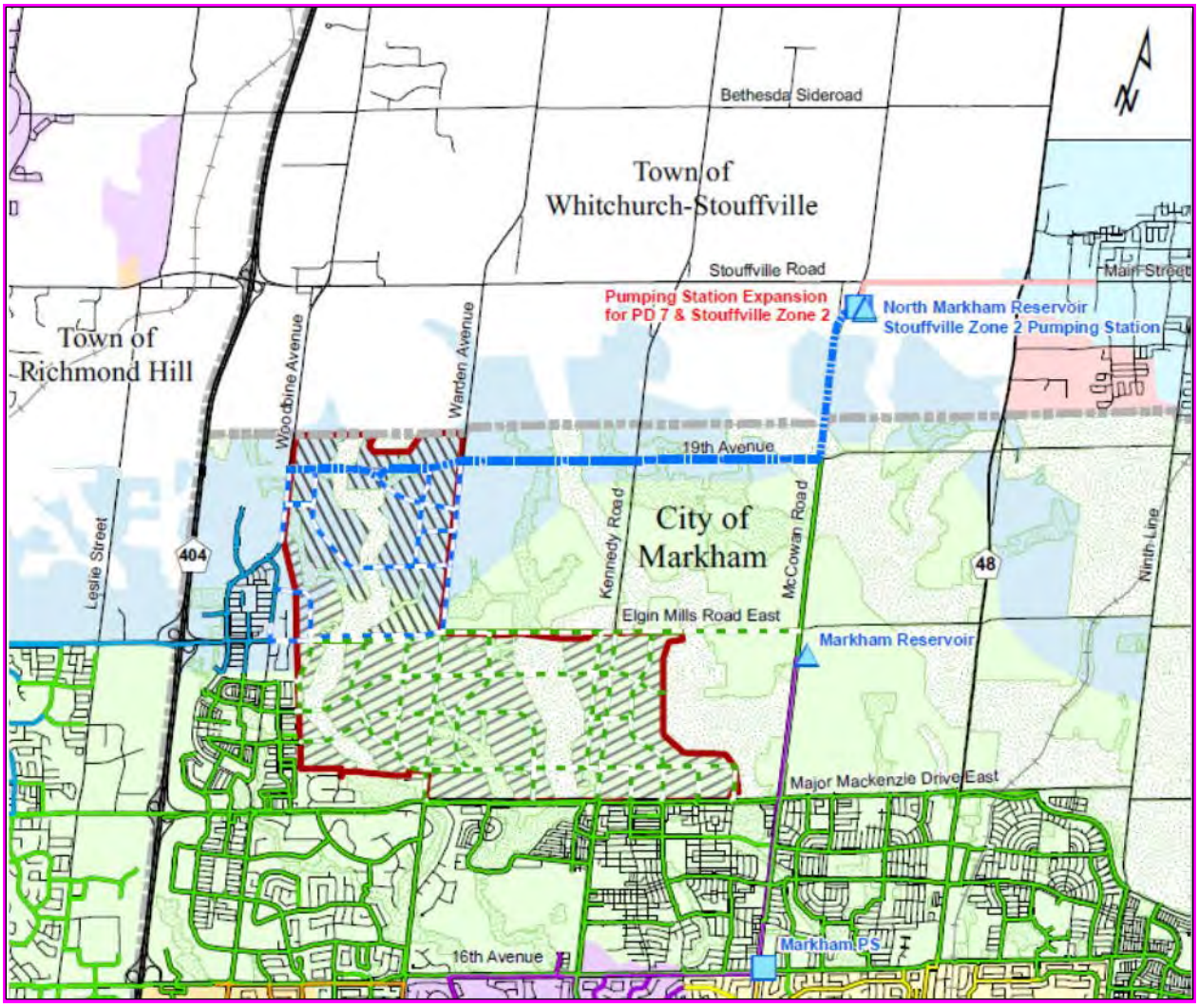


Figure 4.13 Water Service Area Impacted by FUA

4.6.1 Water Treatment and Primary Supply

Markham drinking water is sourced from Lake Ontario and purified at City of Toronto treatment plants, then pumped into large-diameter transmission pipelines up to York Region's reservoirs and booster pumping stations. The City of Markham purchases its treated water from York Region at several points to supply its distribution system, each is equipped with pressure control (via pressure relief valves or pumps) and flow measurement.

4.6.2 Existing Pressure Districts

Within the FUA service area presented in **Figure 4.13**, the existing ground elevations have resulted in specific pressure district boundaries to ensure water can be delivered within an acceptable range of pressures year-round, regardless of variations in water demand and/or unusual events such as fires. Each pressure district is supplied by at least two sources of water, such as pump stations and/or storage facilities. The FUA falls into Pressure District 6 (PD #6) where the existing service elevations range from 195 metres to 229 metres and Pressure District (PD #7) which includes part of Whitchurch-Stouffville and the existing service elevations range from 227 metres to 256 metres.

4.6.3 Water Storage Tanks and Reservoirs

Associated with the FUA service area, are the following existing water storage facilities:

- Pressure District 6: The main storage facility for PD #6 is the North Markham Reservoir located on McCowan Road just south of Stouffville Road.
- Pressure District 7: PD #7 storage is approximated to be 34.1 ML in 2031 and includes:
- North Richmond Hill Reservoir on Bathurst Street south of Gamble Road with storage of 22.7 ML; and,
- North Maple Reservoir on Keele Street south of Kirby Road with storage of 11.4 ML.

4.6.4 Water Distribution Network

Today there are no FUA water distribution watermains or water servicing facilities within the FUA. The existing system is well-gridded with larger regional mains along major arterial roadways. Watermains built within the Region of York grid can be used to connect developments and further improve the system's overall water distribution capacity by offering more pathways for flow and reducing flow velocity and frictional losses across the system.

4.6.5 Active Development in the Area

City of Markham is planning for development in the York Downs area immediately south of the FUA and Angus Glen Boulevard. The York Downs MESP provided servicing information that was considered in the development of water servicing for the FUA; however, the water demands in this area are expected to have limited impact on water distribution in the FUA. Intensification, as proposed for the York Downs area, tends to be associated with improvements to existing trunk and distribution water mains that maintain the local level of service and help sustain supply to the developing areas.

4.6.6 Basis of Design

FUA water servicing must occur within the regulatory framework prescribed by the province, Region and City. The infrastructure to be constructed will comply with a number Provincial Acts and regulations including the Safe Drinking Water Act, the EA Act and the Ontario Water Resources Act. For the design of drinking water infrastructure, municipalities must abide by the Ministry of Environment and Climate Change's (MOECC) Design Guidelines for Drinking Water Systems 2008. These guidelines provide strict rules regarding hydraulic design such as minimum and maximum service pressures. The Guidelines also provide suggested values that affect the design of water distribution networks including main roughness (C-factor) and transient pressure allowances. Servicing must result in a reliable, efficient and safe water system that population and industry can rely on. The MOECC provides the basis for drinking water infrastructure design and for wastewater infrastructure design; however, municipalities within the province are able to develop stricter guidelines in the design of infrastructure.

As the City is part of a two-tiered municipality with York Region, both municipalities have their respective design guidelines. In addition to provincial oversight, the City of Markham has a set of criteria and standards that are used to guide the design of new wastewater and watermains. The City's criteria, outlined in Section C (Water) and Section D (Wastewater) of the City's Design Criteria-Guidelines, cover all aspects of new main design within the FUA.

For the purpose of supplying water to the FUA, all water infrastructure will be property of the City and their designs will be subject to the City's criteria and guidelines. The only exception is the infrastructure to be owned and operated by the York Region (i.e., North Markham PD #7 Pumping Station).

4.7 Wastewater - Existing and Planned Conditions

Today residents in the FUA rely primarily on private septic systems for their wastewater treatment. **Figure 4.14** shows the context of the existing wastewater collection system in the FUA area.

4.7.1 Wastewater Treatment

York Region is responsible for treating wastewater for serviced areas in Markham, including the FUA once serviced. Based on York Region's 2016 Water and Wastewater Master Plan Update, the City's wastewater flows are conveyed to the dually-owned (York Region and Durham Region) Duffins Creek Water Pollution Control Plant. The City's wastewater flows are conveyed to the plant through the York Region's York-Durham Sewage System (YDSS) 16th Avenue trunk main and the Southeast Collector trunk main to the Duffins Creek Water Pollution Control Plant in Durham Region. The York Region Wastewater Master Plan, identified that all wastewater from the FUA will ultimately be discharged into the YDSS 16th Avenue trunk main, which runs along 16th Avenue just south of the FUA.

4.7.2 Collection System Features

In general, the wastewater flows in existing systems bordering the FUA are conveyed from north to south and ultimately discharged into the YDSS 16th Avenue trunk main. Wastewater mains were oversized in existing neighbourhoods to accommodate flows originating from the FUA (north of Major Mackenzie Drive East). **Figure 4.14** illustrates the location of connections in the existing wastewater service area designed to accept flows from the FUA.

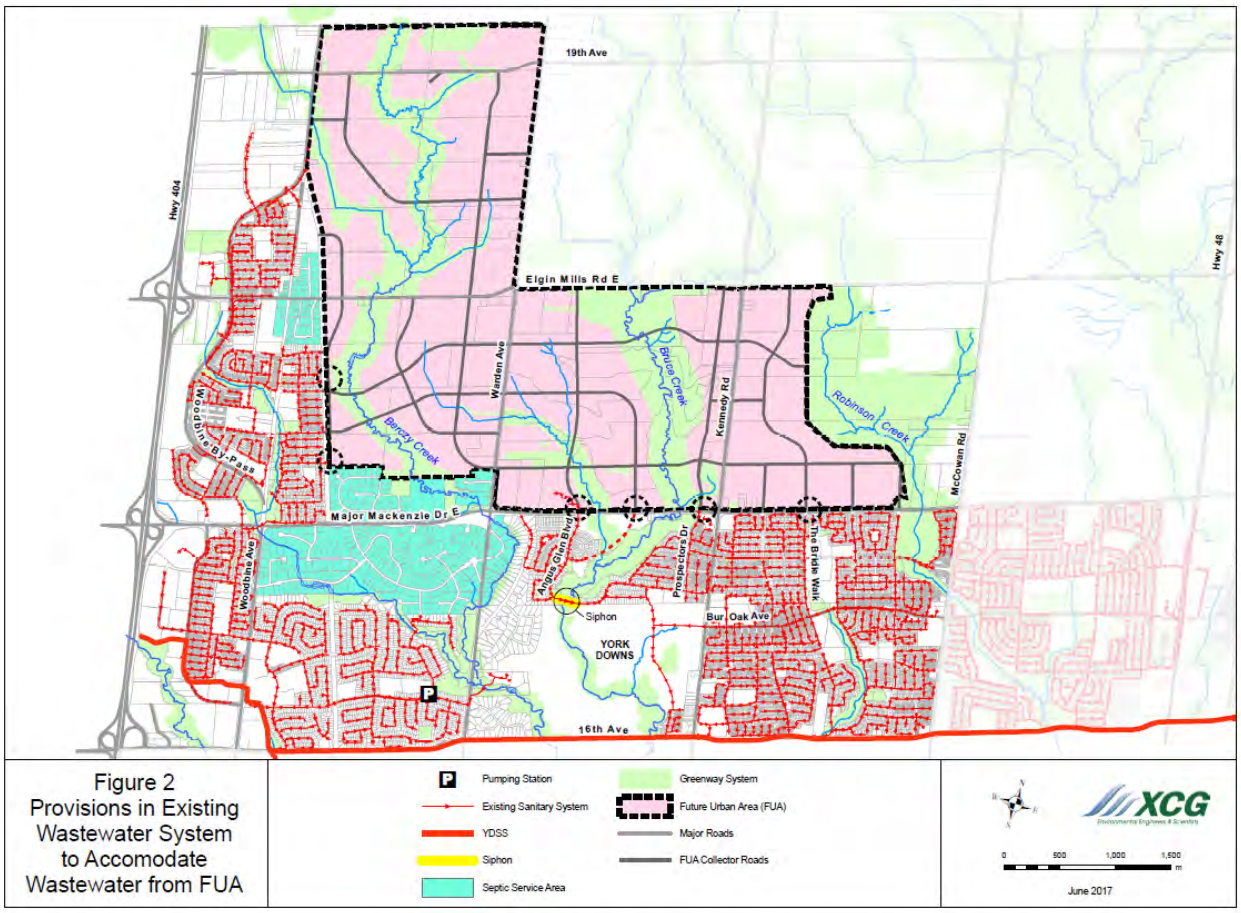


Figure 4.14 Existing Wastewater System Impacted by FUA

Background documents demonstrate that the areas north of Major Mackenzie Drive East and south of Elgin Mills Road were planned to be accommodated by existing wastewater mains[3]. The inherent capacity in existing systems is to be maximized.

The following locations have wastewater mains sufficient to accommodate some level of future servicing:

- The two connections on the east side of the existing service area and the western FUA boundary (just east of Victoria Square Boulevard) include two 300 mm diameter mains designed to accept future flows generally originating from west of Berczy Creek;
- Two connections at Major Mackenzie Drive East, one at Angus Glen Boulevard and the other at an ongoing development east of Stollery Pond Crescent, were designed to accept flows from growth areas north of Major Mackenzie Drive East originating between Berczy Creek and Bruce Creek. The existing Angus Glen Boulevard wastewater main was sized as a 675 mm wastewater main south of Stollery Pond Crescent and was constructed at a depth of 9.5 metres to ensure

[3] Source: York Region Official Plan Amendment 3, Wastewater Servicing Strategy Technical memorandum, York Region, June, 2012; and, Land Needs and a Recommended 2031 Urban Boundary Expansion for North Markham, the North Markham Landowners Group, April, 2010

flows originating from the development north of Major Mackenzie Drive East could be accepted without supplementary pumping;

- The most upstream main on Prospectors Drive was designed with a diameter of 450 mm to accept flows originating between Bruce Creek and Kennedy Road; and,
- The most upstream main on The Bridle Walk was designed with a diameter of 375 mm to accept flows originating between Kennedy Road and Robinson Creek.

Also, in the existing wastewater service area, which will receive FUA flows, is the Cachet Woods Sewage Lift Station. With three of four pumps in operation, this wastewater pumping station has a capacity of 270 L/s and services an area of approximately 126 ha with a population close to 3,800 persons.

4.7.3 Active Development in the Area

City of Markham is planning for development in the York Downs area immediately south of the FUA and Angus Glen Boulevard. The York Downs MESP provided servicing information that was considered in the development of wastewater servicing for the FUA. The York Downs development presents a timely opportunity to coordinate wastewater services in the area.

4.7.4 Basis of Design

In addition to servicing the anticipated wastewater flows generated from the FUA population, the City must also ensure its existing residents are provided a high level of wastewater servicing and are not placed at increased risk of basement flooding. As well, in areas surrounding the FUA, there continues to be growth and intensification that needs to be accommodated in concert with the FUA wastewater servicing plan. Consequently, an analysis of the City's existing wastewater infrastructure surrounding the FUA was undertaken to provide a comprehensive servicing strategy. This included assessing the existing wastewater infrastructure, taking into consideration wastewater infrastructure purposely constructed for servicing wastewater flows originating from the FUA and the need for expanded services.

Within the existing urban boundary are several areas where homes are serviced by individual septic systems. Provisions to provide wastewater services to these homes are made in the existing wastewater infrastructure. Therefore, any wastewater servicing solutions within the FUA should maintain the reserve capacity within the existing wastewater system to service the homes currently on septic systems.

For the design of wastewater infrastructure, municipalities must abide by the MOECC's Design Guidelines for Sewage Works 2008. These guidelines provide strict rules regarding minimum main slopes and sizing as well as flow-based rules including minimum depths and velocities. The Guidelines also provide suggested calculations and values that affect the design of wastewater mains including design flow calculations and minimum ground cover. The Provincial Design Guidelines are the basis for the City of Markham's Design Criteria-Guidelines.

In addition to provincial oversight, the City is one of two tiers of municipality authority along with York Region. Both municipalities have their respective design guidelines. For the purpose of conveying wastewater flows from the FUA to the Regional trunk main, all wastewater infrastructure will be property of the City and their designs will be subject to the City's criteria and guidelines.

The City of Markham's criteria and standards are used to guide the design of new City wastewater and watermains. The City's criteria, outlined in Section C (Water) and Section D (Wastewater) of the City's Design Criteria-Guidelines, cover all aspects of new main design including the initial stages of flow generation to minimum main sizing and cover. This set of criteria-guidelines must be followed for the design of all new mains within the FUA.

The City also has a different set of guidelines used to evaluate existing performance of wastewater infrastructure. This evaluation is required to be undertaken using the City's dynamic hydraulic model as it provides a more realistic approach to evaluating capacity in existing systems. The guidelines for evaluating existing wastewater systems involve simulating peak dry weather conditions and comparing the modelled dry weather flows with existing wastewater main capacity. The second part is to evaluate the hydraulic performance under design rainfall events (25-year and 100-year design storms) to evaluate system surcharge and freeboard conditions.

5 Transportation for Growth

5.1 Transportation Strategy Overview

This study identifies the FUA's transportation strategy consisting of the transportation infrastructure projects, programs and policies required to support the planned residential and employment areas growth in the FUA. The transportation strategy includes a road network on which to develop transit services and future pedestrian and cycling infrastructure, while balancing the need to respect environmental considerations related to watercourse crossings and impacts on other natural heritage features. A key consideration is the provision of more travel choices, while facilitating the interconnection between the various networks of roads, transit routes, sidewalks, cycling facilities and pathways and trails. This transportation strategy also addresses the need to pursue initiatives that reduce auto dependency by requiring appropriate transportation demand management (TDM) measures.

The transportation strategy and recommended road network will also help drive the potential location of new water and wastewater features given the overlap of the infrastructure improvements.

5.2 Future Travel Demand

The York Region Travel Demand Model, updated in 2016 to reflect the FUA land use development, is shown in **Table 5.1**. Travel demand was then extracted from the Regional model for the horizon year 2031 AM peak period. It is noted that approximately 19% and 36% of Markham's employment and population growth by 2031, respectively, is projected to be generated by the FUA.

Table 5.1 Population and Employment Growth from 2011 to 2031

Area	Population		Employment	
	2011	2031	2011	2031
Markham	301,700	424,400	154,800	239,800
FUA	-	44,000	-	15,800

Table 5.2 summarizes the total travel demand growth for Markham and the FUA between 2011 and 2031. It is expected that approximately 210,000 total person trips will originate from Markham and approximately 200,000 will be destined to Markham during the AM peak period by 2031. The travel demand identified in this table includes both trips originating from Markham and destined to Markham less Markham's internal trips (i.e., 210,000 +200,000 – 98,100).

Table 5.2 Travel Demand Growth from 2011 to 2031

Area	Total person trips in the 3-hour AM peak period	
	2011	2031
Markham	222,700	311,900
FUA	-	33,500

In this analysis, the Regional Travel Demand Model included five traffic zones that comprised the FUA area. **Figure 5.1** shows how these five traffic zones were disaggregated to the FUA zoning system comprising 17 finer zones as represented in the City's land use quantification data as shown in **Appendix C**. Thereafter, a traversal matrix for the subarea model was generated and utilized as input into the FUA traffic simulation model. An iterative process was then followed to update the model connectors that facilitate the loading of traffic demand onto the road network of the FUA simulation model in a way that adheres to the traffic patterns in the Regional model. Several outputs including travel demand growth, trip distribution and transit modal share were extracted from the Regional model and assessed for purposes of the overall travel demand analysis for the FUA.

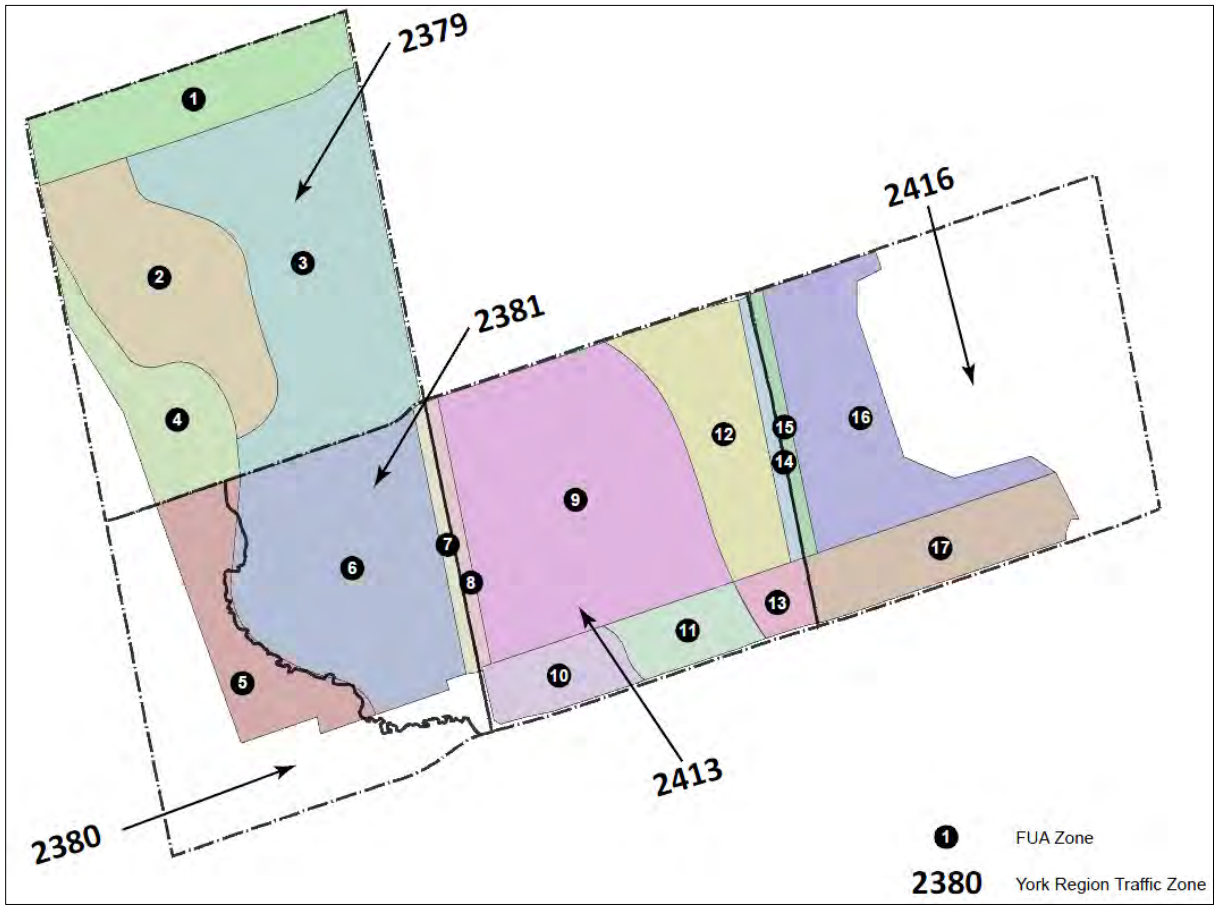


Figure 5.1 York Region Traffic Zones Disaggregated to FUA Traffic Zones

After a detailed zone system for the FUA was established in the Regional model and the base auto traffic demand for the study area was extracted, a number of traffic demand and network adjustments were performed in the FUA simulation model. These were intended to:

- Account for the High Occupancy Vehicle (HOV) and truck traffic components that were not explicitly considered in the Regional model; and,
- Provide the proper connections for the loading of traffic demand onto the road network.

Traffic analyses were then performed through a series of static and dynamic traffic assignments that captured the actual traffic demand and expressed it in the form of conventional volume-to-capacity (v/c) ratios, delay, mean queue, etc. for the various sections of the road network. This helped to identify whether there was sufficient capacity to accommodate the projected traffic demand and to depict the traffic performance of the proposed road network.

Figure 5.2 and **Figure 5.3** show that approximately 47% of Markham trips originating in Markham end in Markham. This is a strong indication of the maturation of land use and travel patterns in the City as more people are expected to live and work in Markham by 2031.

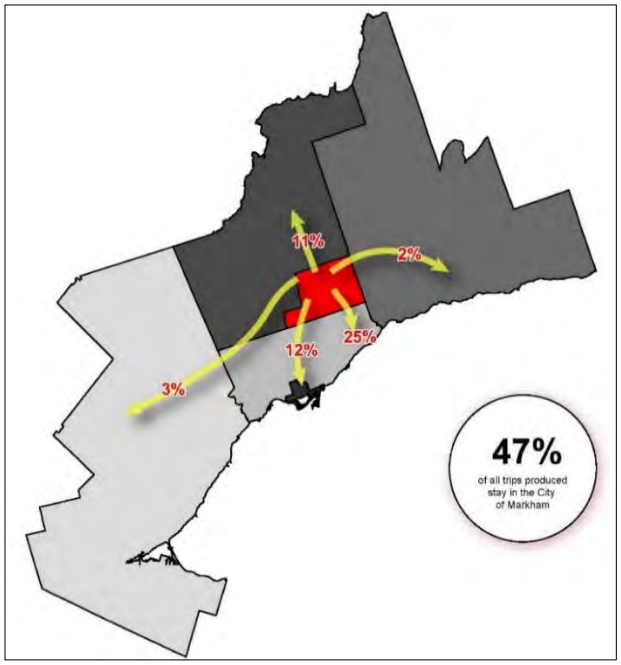


Figure 5.2 Distribution of Trips FROM Markham in the 2031 AM Peak Periods

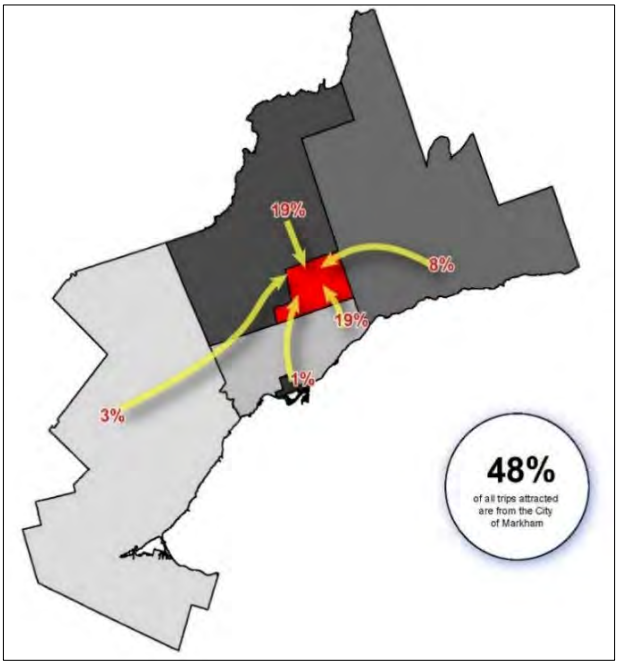


Figure 5.3 Distribution of Trips TO Markham in the 2031 AM Peak Periods

For the FUA in particular, it is expected that that 20,880 trips will originate from the area and that 13,360 trips will be destined to it during the morning peak period. As shown in **Figure 5.4** and **Figure 5.5**, a high level of self-containment is expected with approximately 42% of all trips originating from the FUA remaining in the City of Markham and 42% of all trips destined to the FUA originating from the City of Markham. Other major areas of attraction for FUA trips are the City of Toronto with a share of 35% (including 12% to downtown Toronto) and the remainder of York Region (excluding the City of Markham) accounting for 15%. York Region is the main generator for trips destined to the FUA, with a share of 27% of total AM peak period trips, excluding the City of Markham. This points to a south-westerly trip pattern for travel generated by the FUA, which is consistent with existing trends in travel demand patterns and the type and density of land uses in the respective areas.

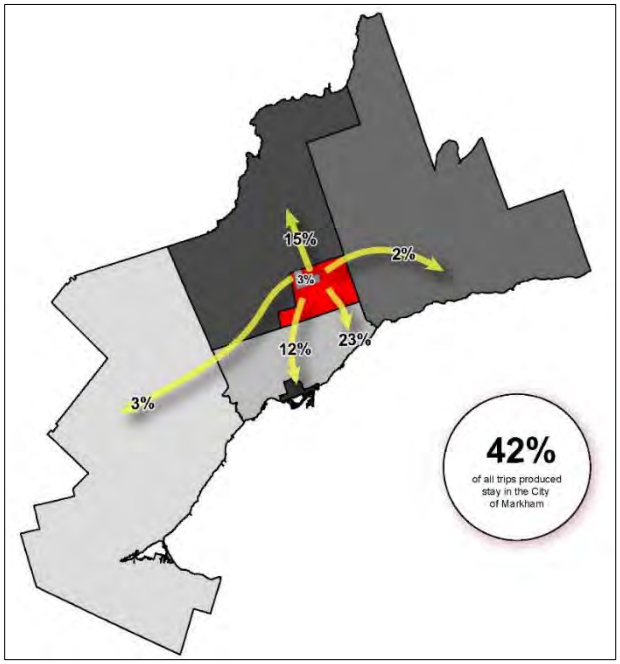


Figure 5.4 Distribution of Trips FROM the FUA in the 2031 AM Peak Periods

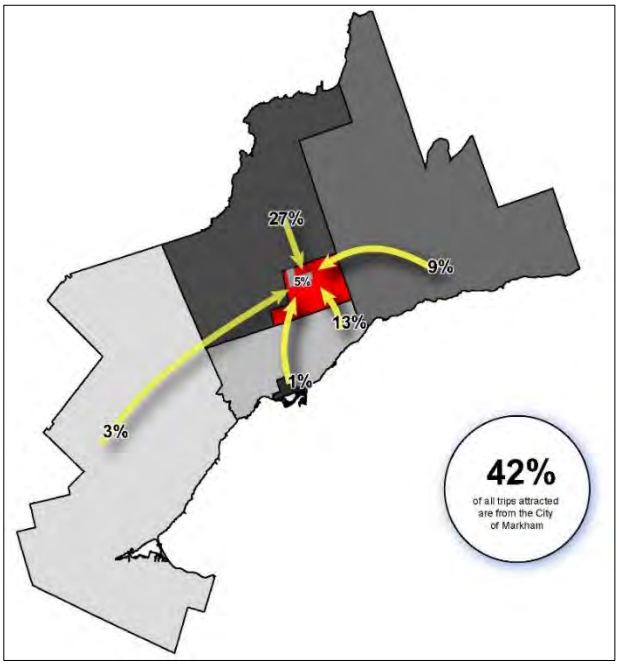


Figure 5.5 Distribution of Trips TO the FUA in the 2031 AM Peak Periods

5.2.1 Transit Demands

Information about transit usage in York Region, in Markham and in the FUA in particular was extracted from the York Region Travel Demand Model. As shown in **Table 5.3**, it is expected that 14% of all travel from York Region by the year 2031 will be served by transit. The corresponding transit share for Markham is 17%. For the FUA specifically, the Region's travel demand forecasts suggest that 18% of the trips generated from the newly developed area and 3% of the trips attracted to the area in the AM peak period will be using transit as the mode of travel.

Table 5.3 AM Peak Period Transit Mode Share

Area	From		To	
	2011	2031	2011	2031
York Region	11%	14%	5%	5%
Markham	14%	17%	7%	6%
FUA	-	18%	-	3%

These shares translate into approximately 4,200 trips to/from the FUA using some form of transit. The distribution of the outbound transit trips from the FUA is summarized in **Table 5.4**. The table also depicts the proportion of transit trips that are projected to be made via local/regional transit (bus/subway) or by GO Transit.

Table 5.4 Trips by Bus/Subway and GO Transit from the FUA in the 2031 AM Peak Period

	Downtown Toronto	Rest of Toronto	Markham	York Region	GTHA West	Durham Region	FUA
Bus/ Subway Trips	890	630	530	180	50	20	28
GO Transit Trips	1280	160	10	0	30	0	0
Total Transit Trips	2,170	790	540	180	80	20	28

This is a substantial amount of travel by transit that can only be realized through the proper combination of land use and transit service initiatives. Specifically, this level of transit usage will require transit supportive development with an appropriate allocation of land use mixes and densities along corridors with efficient transit service and high levels of convenience and accessibility throughout the area. Proposed new GO Rail stations, an expanded HOV network that would also facilitate faster transit service by bus, and Regional Express Rail (RER) are expected to contribute to accommodating the anticipated transit travel demand. GO trips are expected to utilize mainly the Unionville, Gormley, Mount Joy and Richmond Hill stations.

The base assumptions for major transit infrastructure and service in the area for the 2031 horizon year, are based on the Region's TMP. It is anticipated that, as part of future works (i.e. Secondary Plan), further discussions among the Region, the City, and the development proponents, will yield a feasible strategy for phasing in land development and transit initiatives (infrastructure, service and technologies) that would allow the realization of the anticipated levels of transit usage.

5.2.2 Active Transportation

Walking and cycling are important components of a local transportation system. Demand for walking and cycling is often dependent on land use patterns which facilitate convenient connections between destinations. Demand is often higher in areas where there is a system of integrated, connected and safe routes which are suitable for users of all ages and abilities. By designing a cycling and pedestrian system within the FUA that links local and regional routes, the number of vehicular trips may be reduced.

5.2.3 Summary of Travel Demand Findings

In summary, considerations from the traffic demand analyses for the horizon year 2031 morning peak hour for the FUA and surrounding areas were as follows:

- Traffic modelling based on the arterial and collector road network and transit modal share assumptions outlined above indicates that, as expected, southbound and westbound trip volumes are significantly higher than northbound and eastbound in both existing and 2031 conditions during the morning peak period.

- As expected, Major Mackenzie Drive East and 16th Avenue, with high westbound traffic which is the predominant travel pattern during the morning peak period, are expected to be congested. As well, major north-south arterials south of Major Mackenzie Drive East would also be expected to be congested at least during the morning peak period. Highway 404 is expected to be congested due to significant traffic volumes in the southbound direction during the morning peak period.
- This highlights the need for a highly efficient transit system which is frequent and accessible. Such a system should be combined with transit oriented development of appropriate land use mix and density to generate the desired levels of transit ridership. As well, travel demand management initiatives and emerging technologies will be also required. The traffic conditions of the FUA and the broader study area were analyzed assuming that a large extent of trips (i.e., 18% or over 3,800 trips from the FUA in the AM peak period) are expected to be moving by transit.
- The definition of frequent transit service in the Region's Transportation Master Plan for the year 2031 (in anticipation of rapid transit expansion closer to the FUA in the longer term) may not by itself be sufficient to support the desired levels of transit usage. An earlier extension of the Major Mackenzie Drive rapid transit system easterly from its planned terminus at Leslie Street by 2031 will better support the goal of building transit ridership. This will go hand-in-hand with the principle of developing the FUA as a compact, complete community with full retail and service employment, as well as community facilities and services that would make it more supportive of transit and active transportation modes of travel (walking, cycling, etc.).
- Auto trips from the FUA destined to Richmond Hill and employment areas east and west of Highway 404 and near Highway 404 / Highway 7 represent opportunities with the greatest potential for conversion from auto to transit travel mode and must strongly influence the transit routing recommendations.
- Arterial road improvements (including HOV network), transit improvements, the new interchange of Highway 404 at 19th Avenue, other planned interchange improvements (e.g., ramp extensions), and the Highway 404 mid-block collector road crossings in the broader study area are all essential requirements.
- There will be a need for at least two north-south and two east-west collector roads to traverse the full length of the FUA neighbourhood lands to provide enough capacity for traffic to move efficiently in and out of the FUA and access the arterial road system, provide good access and connectivity to the surrounding communities, circulation flexibility and active transportation opportunities.
- There will be a need for at least two collector road crossings of Berczy Creek within this Block for capacity purposes, as well as for good connectivity, internal flow balancing, route options, and active transportation opportunities.
- An active transportation network consisting of pedestrian facilities on both sides of all local and collector roads and in-boulevard cycling facilities (multi-use pathways) along all collector roads is recommended. This continuous, connected and low stress network will make walking and cycling within the FUA an attractive trip choice for residents of all ages and abilities.

- Transportation Demand Management (TDM) strategies for the FUA will be supported by a road network and land use pattern which allow for a more efficient use of the transportation system by providing a built environment which supports alternative modes of transportation such as walking and cycling for everyday trips. It will be a requirement of each subdivision and site plan to implement TDM measures that reduce auto dependency by encouraging a greater proportion of trips to be made by walking, cycling and transit.

5.3 Development and Screening of Transportation Strategies

Four transportation strategies were examined and screened for the FUA CMP. **Table 5.5** presents a summary of the four transportation strategies screened.

Table 5.5 Description of Transportation Strategies

Transportation Strategy	Description
1. Do Nothing	No new transportation improvements
2. Increase Transportation System Capacity	Increase the capacity of the existing transportation system with no new transportation system provided within the FUA
3. Build new Transportation System	Build a new transportation system within the FUA with no increase in capacity of the existing transportation system
4. Combination of Strategies 2 and 3	Increase the capacity of the existing transportation system and build a new transportation system within the FUA

Four transportation strategies were screened. **Table 5.6** identifies the screening criteria and the results of the screening process. The transportation strategies were evaluated based on the following screening criteria:

1. Is the strategy consistent with the goals and objectives of Markham's Official Plan?
2. Does the strategy provide travel mode choices?
3. Does the strategy provide network connectivity?
4. Does the strategy provide access to local and rapid transit service?
5. Does the strategy meet projected travel demand (2031)?
6. Will the strategy support population and employment growth by 2031?
7. Would the strategy encourage a more compact and sustainable urban form?

Table 5.6 presents the screening assessment that showed the combination strategy approach was recommended to best address the needs of projected population and employment growth as well as increased travel demand resulting from the development of the FUA. As well, the combination approach supported the development of a pedestrian, cycling and local transit network, while also providing direct access to future rapid transit services along Major Mackenzie Drive. The combination approach is also reflective of comments received at the first PIC in January 2015 which included the need to address future traffic, accommodate transit and transit supportive land uses and provide a parkland and connected Greenway System for the FUA. This combination approach also reflects the goals and objectives established by Markham's Official Plan.

Table 5.6 Screening of Transportation Strategies

Screening Criteria	Results				
	1. Do Nothing	2. Increase Capacity	3. New Transportation System	4. Combination	Key Conclusions **Legend:** **X The Strategy does not satisfy the screening criteria** **√ The Strategy satisfies the screening criteria** **√+ The Strategy satisfies the screening criteria and provides additional benefits as compared to the other strategies**
1. Is the strategy consistent with the goals and objectives of Markham's Official Plan?	**X**	**X**	**X**	**√**	• Strategy 1 is not consistent with the goals and objectives of Markham's Official Plan. • Strategy 2 would modestly support the goal of "Building Complete Communities" by providing more efficient infrastructure and additional travel choices through road widenings. However, Strategy 2 would not support the north Markham Future Urban Area's need for new collector roads that would "allow connectivity between neighbourhoods for all modes of transportation"[1] In addition, Strategy 2 would not "create an integrated transportation system that supports urban growth by improving network connectivity, including the timely completion of missing mid-blocks along major collector roads and by providing convenient inter-modal transfer points to widen the range of travel choices."[2] • Strategy 3 would satisfy some goals and objectives of Markham's Official Plan, through the development of new roads that would enhance connectivity between neighbourhoods for transit, cycling and walking. However, Strategy 3 would not widen existing arterial and collector roads to support all modes of travel which runs counter to the Official Plan's requirements for a more balanced and integrated transportation system. • Strategy 4 would satisfy the goals and objectives of Markham's Official Plan, through the development of new roads – and the expansion of existing infrastructure - that would enhance connectivity between neighbourhoods, provide more efficient infrastructure and support all modes of travel.
2. Does the strategy provide travel mode choices?	**X**	**√**	**√**	**√+**	• Strategy 1 will not support more sustainable modes of travel. • Strategies 2, 3 and 4 would promote more sustainable modes of travel through infrastructure improvements, although the combination of increased capacity and new roads (Strategy 4) will result in better and more frequent transit service, as well as accommodate more cycling and pedestrian facilities.

Table 5.6 Screening of Transportation Strategies

Screening Criteria	Results				
	1. Do Nothing	2. Increase Capacity	3. New Transportation System	4. Combination	Key Conclusions **Legend:** **X The Strategy does not satisfy the screening criteria** **√ The Strategy satisfies the screening criteria** **√+ The Strategy satisfies the screening criteria and provides additional benefits as compared to the other strategies**
3. Does the strategy provide network connectivity?	**X**	**X**	**√**	**√**	• Strategy 1 would not provide additional connectivity beyond what already exists. • Strategy 2 may improve regional mobility, but not overall connectivity. • Strategies 3 and 4 will improve connectivity by developing new roads between neighbourhoods and existing road network.
4. Does the strategy provide access to local and rapid transit service?	**√**	**√**	**√+**	**√+**	• Strategies 1 and 2 would provide access to proposed local and rapid transit service on Major Mackenzie Drive through existing (Regional) roads. • Strategies 3 and 4 would provide additional access to both local transit service and rapid transit service on Major Mackenzie Drive.
5. Does the strategy address the projected travel demand (2031)?	**X**	**X**	**X**	**√**	• Strategy 1 will not address the projected travel demand as it assumes no road improvements and new roads within the north Markham Future Urban Area. • Strategies 2 and 3 will not, by themselves, address the travel demand projected for the north Markham Future Urban Area by 2031. • Through building new roads and increasing the capacity on existing roads, Strategy 4 will best address projected travel demand in 2031.
6. Will the strategy support population and employment growth by 2031?	**X**	**X**	**X**	**√**	• Strategy 1 will not support projected population and employment growth as it assumes no new roads or road widenings in the north Markham Future Urban Area. • Strategies 2 and 3 will only minimally support the infrastructure needs of the 45,000 new residents and 19,000 employees projected by 2031 in the north Markham Future Urban Area.

Table 5.6 Screening of Transportation Strategies

Screening Criteria	Results				
	1. Do Nothing	2. Increase Capacity	3. New Transportation System	4. Combination	Key Conclusions **Legend:** **X The Strategy does not satisfy the screening criteria** **√ The Strategy satisfies the screening criteria** **√+ The Strategy satisfies the screening criteria and provides additional benefits as compared to the other strategies**
					• Strategy 4 will best meet the needs of the north Markham Future Urban Area's projected population and employment growth through infrastructure improvements designed to provide direct access to residential and commercial areas.
7. Would the strategy encourage a more compact and sustainable urban form?	**X**	**√**	**√**	**√**	• Strategy 1 would not encourage more compact and sustainable urban form, although it is possible that the evolution of some existing roads would occur over time, resulting in designs that promote more compact urban form. • Strategies 2, 3 and 4 would encourage more compact and sustainable urban form, by including elements that would promote cycling, walking and transit use.
Summary	**X**	**X**	**X**	**√**	• As a result of this assessment, the City of Markham recommended Strategy 4 (combination of increasing capacity of the existing transportation system and a building a new transportation system within the north Markham Future Urban Area) since it best addressed the needs of projected population and employment growth as well as increased travel demand in the north Markham Future Urban Area. As well, Strategy 4 will support the development of a pedestrian, cycling and local transit network, while also providing direct access to future rapid transit services along Major Mackenzie Drive. Strategy 4 is also consistent with the goals and objectives established by Markham's Official Plan.

Notes:

1. Official Plan, Transportation Services and Utilities, page 7-10
2. Markham Official Plan, Transportation Services and Utilities, page 7-4

5.4 Development of Transportation Network Concepts (Options A-D)

Following the initial screening process outlined in **Section 5.3**, four conceptual transportation network concepts were developed (known as Options A, B, C, and D) that are consistent with the combination strategy. Concept Options A - D were based on the land use and transportation infrastructure required to address the population, employment and unit projections and the vision for the north Markham Future Urban Area community contained.

In order to serve the transportation needs of the FUA, transportation network concepts (analogous to Concept Options A - D) comprised new roads, road widenings or transportation infrastructure and improvements that would accommodate the multi-modal vision and land use plan for the community based on Regional and Markham community development policies.

The first group of transportation network concepts presented at the TAC workshop including public, stakeholders and agencies on May 5, 2015 included:

Concept Option A (Figure 5.6): Characterized by a continuous grid pattern with north-south and east-west collectors and several connections to the boundary road network to maximize network connectivity and flexibility, and provide opportunities for local transit and on-street active transportation.

Concept Option B (Figure 5.7): Characterized by a partial grid to minimize environmental feature crossings with trade-offs in east-west versus north-south connectivity between adjacent neighbourhoods and to mid-block crossings and has the potential for circuitous routing and increased travel on arterial roads due to discontinuous roads and limited access to employment areas in the north due to the lack of a second crossing in the Angus Glen Block.

Concept Option C (Figure 5.8): Characterized by a partial grid to minimize environmental feature crossings with trade-offs in east-west versus north-south connectivity between adjacent neighbourhoods and to mid-block crossings, limited east-west access to and through employment areas and less east-west connectivity to the south of Elgin Mills Road, which places additional travel demand on Major Mackenzie Drive East and Elgin Mills Road and has the potential for circuitous routing.

Concept Option D (Figure 5.9): Characterized by a partial grid to minimize environmental feature crossings with trade-offs in east-west versus north-south connectivity between adjacent neighbourhoods and to mid-block crossings, providing several east-west and north-south collector roads, with limited connectivity to employment areas in the north; and reduced access to residential lands in the Angus Glen block (east of Warden Avenue) the potential for circuitous routing and increased travel on arterial roads.

The above network concepts options were evaluated for natural, social and environmental impacts based on the evaluation criteria described in **Section 5.5.1**. The evaluation criteria were the result of modifications over time by the Project Team, reflecting the input provided by staff, stakeholders and TAC members.

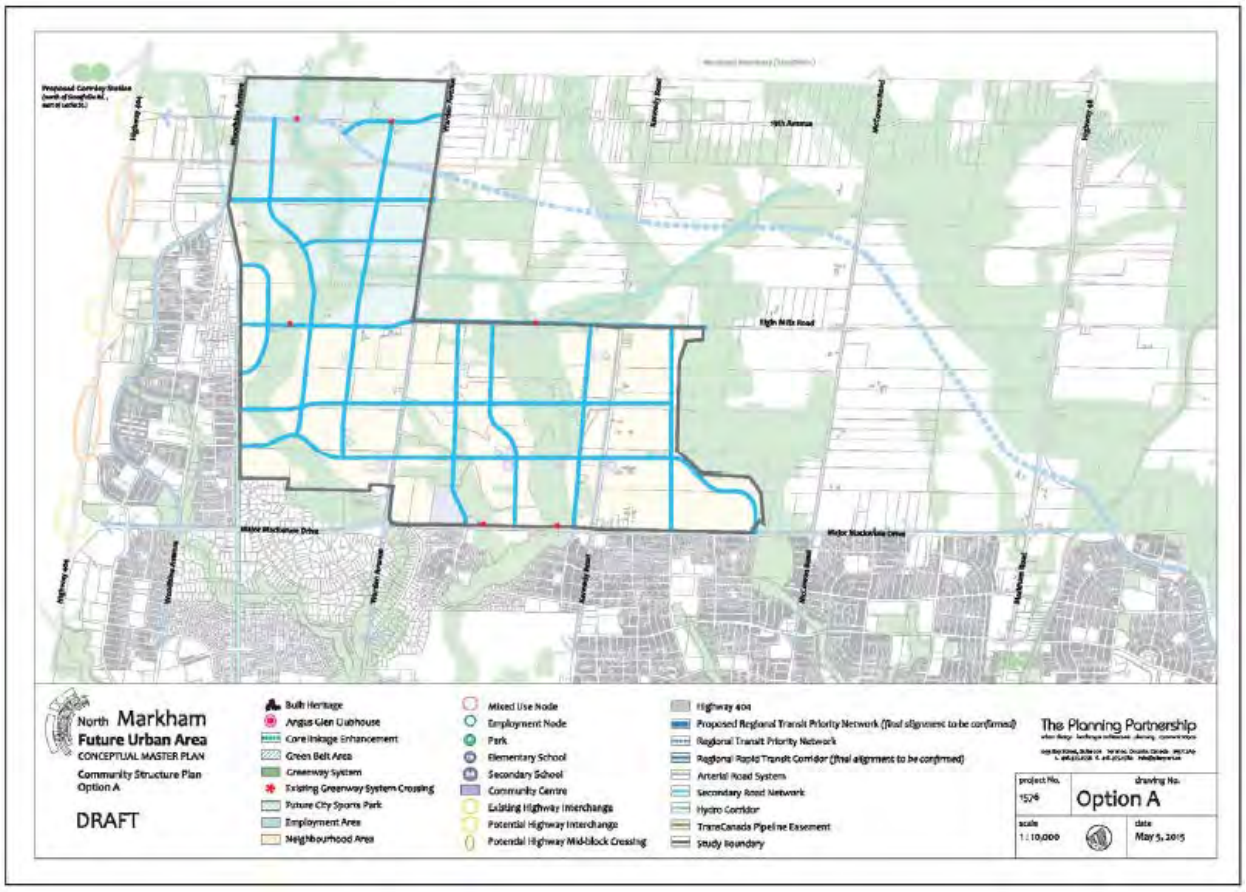


Figure 5.6 Transportation Network Concept Option A

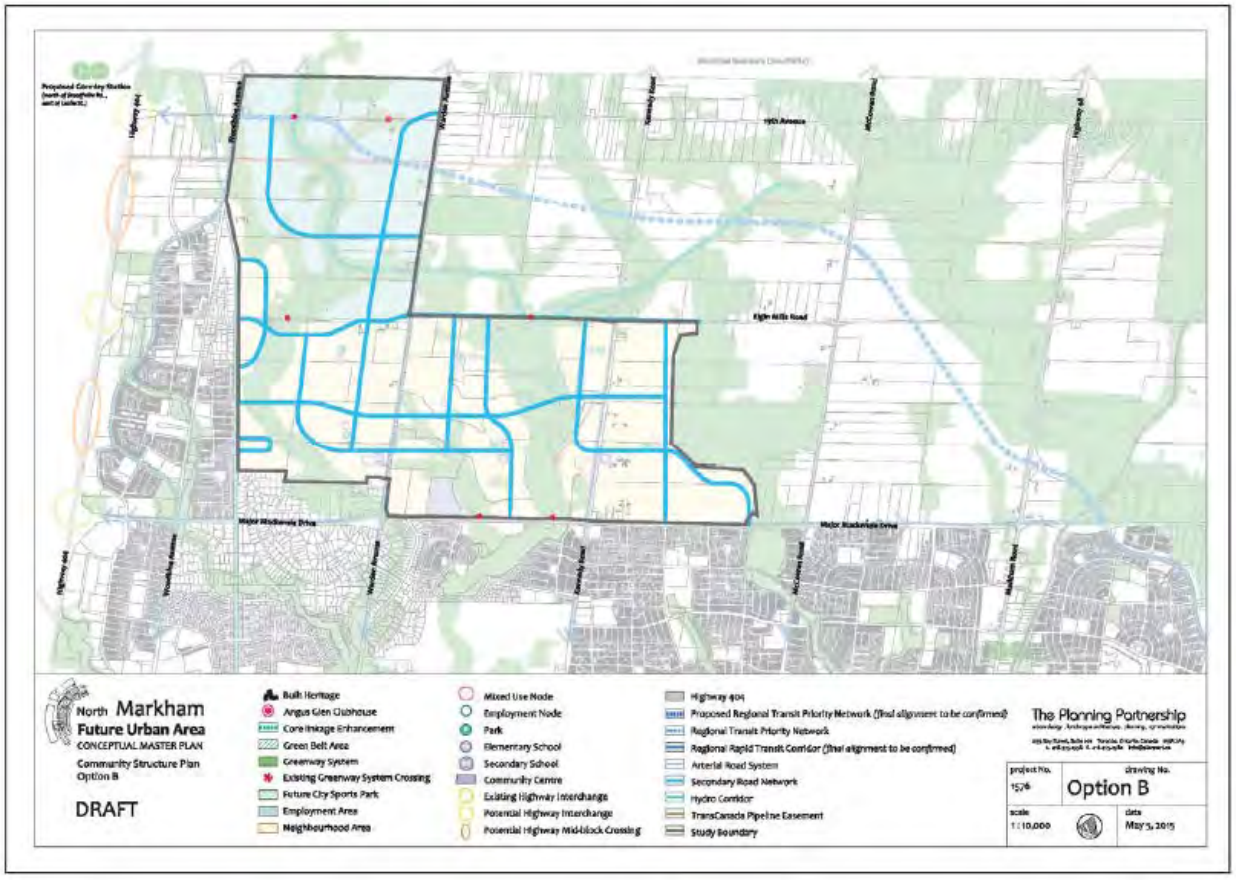


Figure 5.7 Transportation Network Concept Option B

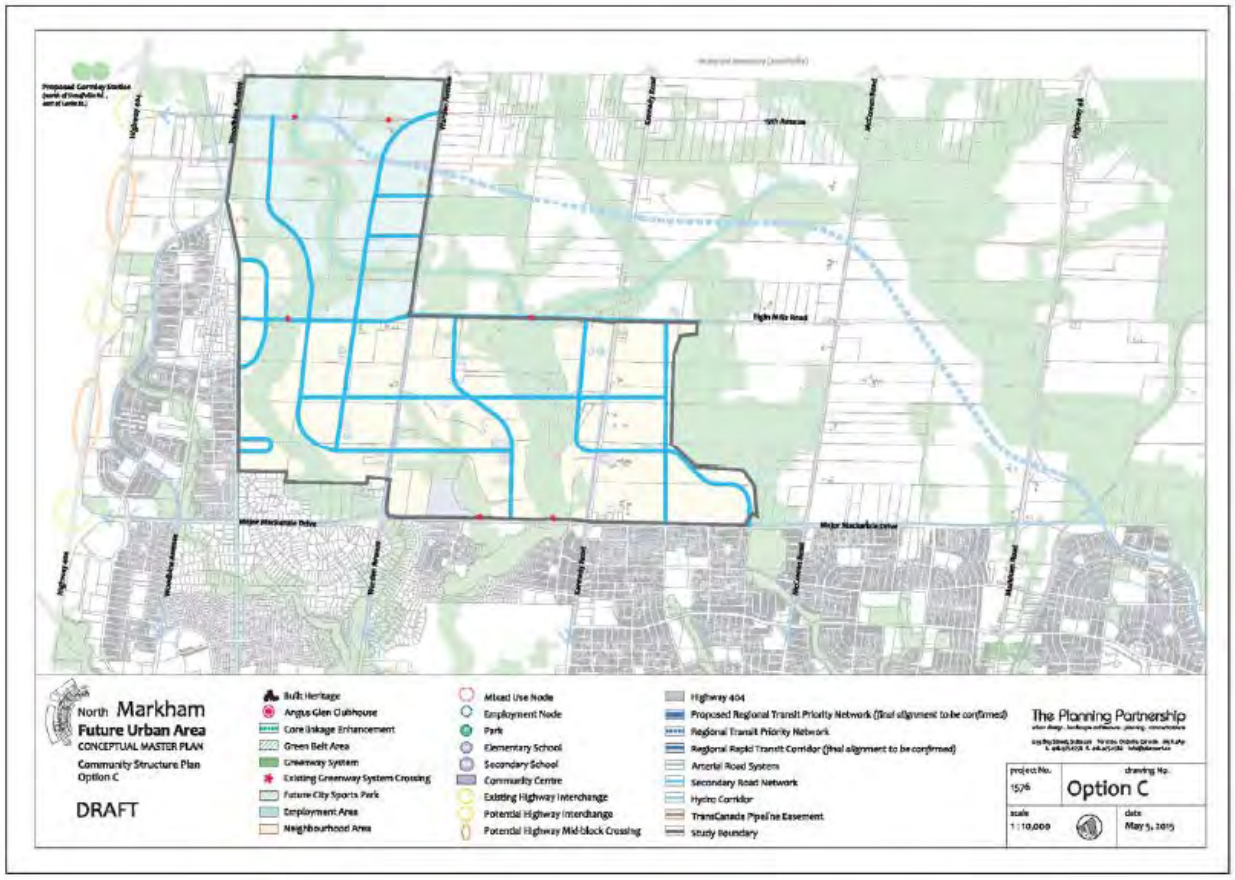


Figure 5.8 Transportation Network Concept Option C

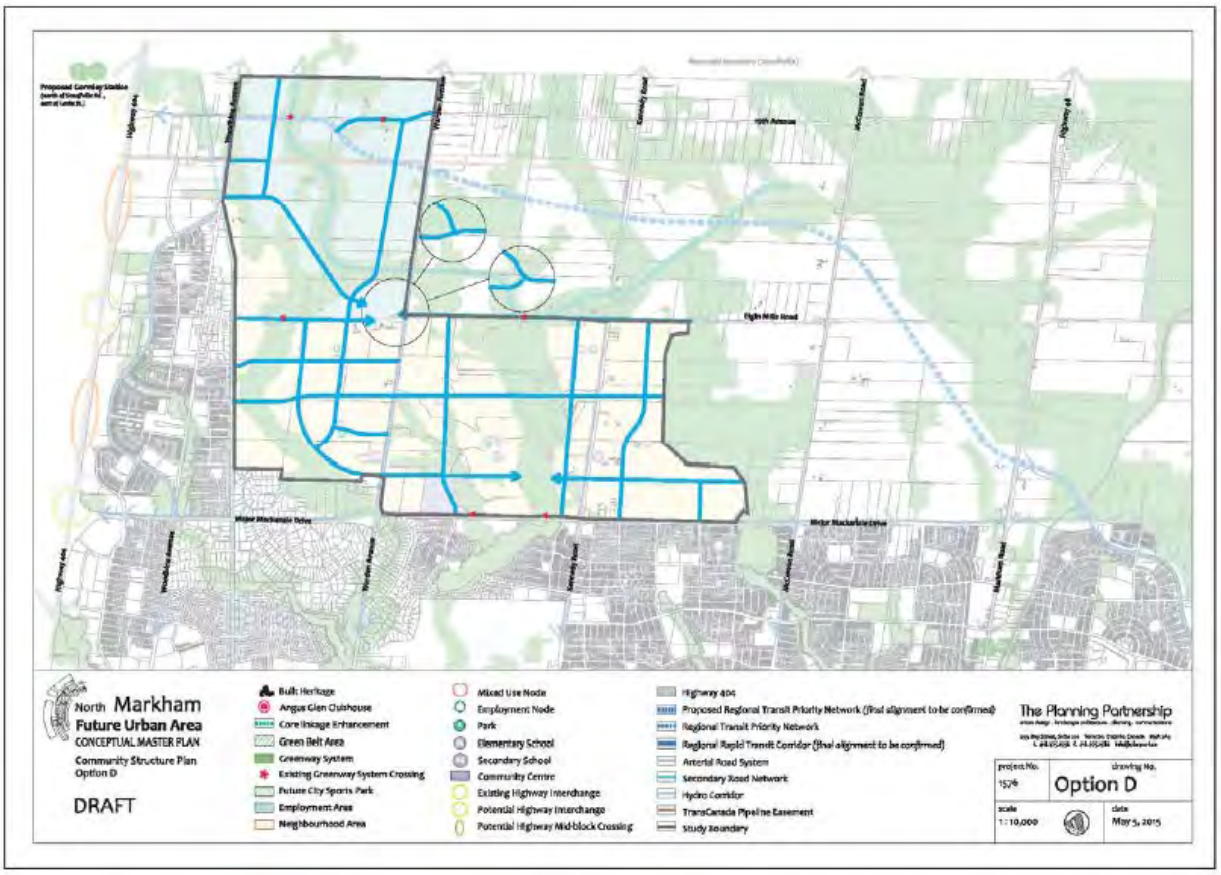


Figure 5.9 Transportation Network Concept Option D

5.5 Evaluation of Transportation Network Concepts

5.5.1 Evaluation Criteria

As identified in the previous section, each of the transportation network concept options were evaluated using the evaluation criteria shown in **Table 5.7** which reflect the natural, social and economic environments whose broad impacts needed to be addressed.

Table 5.7 Evaluation Criteria for Transportation Concepts

Factor	Evaluation Criteria
Transportation	
Travel Demand	• Ability to address total travel demand
Traffic	• Network connectivity and flexibility • Consistency between road function and traffic demand • Sufficient number of road crossings • Potential to impact roadway safety
Transit	• Ability to address projected transit demand • Potential to incorporate transit improvements for riders • Provides access to future Major Mackenzie Drive rapid transit service
Pedestrians and Cyclists	• Connects and integrates new pedestrian and cycling facilities with the surrounding community • Provides pedestrian and bicycle-friendly streets
Natural Environment	
Aquatic and Terrestrial Environment	• Degree of impact to aquatic habitat and species • Degree of impact to vegetation (linear extent of woodlands, wetlands impacts; key areas impacted) • Degree of impact to flora Species-at-Risk and conformity to the Endangered Species Act, 2007 • Degree of impact to wildlife and habitat • Degree of impact to fauna Species-at- Risk and conformity to the Endangered Species Act, 2007
Policies and Governance	
Municipal and Regional Policies	• Consistent with the intent of the Markham Official Plan (2014), York Region Official Plan (2010) and the York Region Transportation Master Plan (2009) • Supports the new community vision, principles and strategies of the FUA
Social and Cultural Environment	
Land Use	• Supports existing and future developments • Supports appropriate transit systems through density and land use locations • Supports sustainability initiatives
Streetscaping / Urban Design	• Accommodates opportunities to provide streetscaping and urban design elements • Supports active transportation and public health initiatives
Air Quality	• Degree of impact on air quality and/or greenhouse gas emissions
Noise Effects	• Degree of noise impacts on the adjacent community

Table 5.7 Evaluation Criteria for Transportation Concepts

Factor	Evaluation Criteria
Stormwater	• Supports opportunities to reduce runoff and improve recharge
Groundwater	• Degree of impact on groundwater quality and quantity
Construction Impacts	• Degree of impact resulting from construction related effects such as noise, dust and odours on area residents, businesses and roadway users
Built and Cultural Heritage	• Degree of impact on built heritage resources and/or cultural heritage landscapes
Archaeology	• Degree of impact on archaeological resources
First Nations Lands	• Degree of impact on First Nation lands and resources
Financial	
Capital Costs	• Potential capital cost of implementation

5.5.2 Evaluation of Transportation Network Concepts (Options A-D)

During the evaluation of the transportation network concept options, input was received through several TAC meetings as well as with several stakeholders including the TRCA, MNRF, participating landowners and local school boards. All materials prepared in support of the transportation components of the evaluation are found in **Appendix C**.

The evaluation of the network concept options was undertaken using a Reasoned Argument Approach. The Reasoned Argument Approach aims to use a clear and thorough rationale of the trade-offs between the various evaluation factors and criteria and the reasons why one option is technically preferred over another.

This first evaluation resulted in the selection of **Concept Option A** as the best network concept to accommodate future population and employment growth through strong investments in all modes of transportation and meets the Future Urban Area's transportation principles and strategies. It was recognized that suitable adjustments and mitigation that avoid or minimize impacts would be required.

Table 5.8 summarizes the results of the evaluation of transportation network concepts of Options A - D.

Table 5.8 Evaluation of Transportation Network Concept Options A- D - Summary

Evaluation Criteria	A	B	C	D
Transportation				
• Travel Demand • Traffic • Transit • Pedestrians and Cyclists	• The best overall transportation network to meet the needs of the North Markham Future Urban Area, by providing greater access, connectivity and more balanced flows while facilitating other modes of travel.	• Generally supports alternative modes of travel; however, lacks in accommodating projected travel demand, access to employment lands and providing balanced traffic flows.	• Generally supports other modes of travel; however, lacks in accommodating projected travel demand, access to employment lands and providing balanced traffic flows. The lack of a second crossing in the Angus Glen block and discontinuities on the west side of the study area will make it more challenging to accommodate peak hour peak direction demand along Major Mackenzie Drive and Elgin Mills Road.	• Generally provides a balanced transportation network while accommodating future travel demand; however the proposed transportation network provides limited access to employment lands.
Natural Environment				
• Aquatic and Terrestrial Environment	• The road network would impose significant impacts on the natural environment; however, these impacts can be minimized through mitigation measures or avoidance during detailed design.	• The road network would impose some significant impacts on the natural environment, though relatively less than the other options. These impacts can be minimized through mitigation measures or avoidance during detailed design.	• The road network would impose significant impacts on the natural environment; however, these impacts can be minimized through mitigation measures or avoidance during detailed design.	• The road network would impose significant impacts on the natural environment; however, these impacts can be minimized through mitigation measures or avoidance during detailed design.
Policies and Governance				
• Municipal and Regional Policies	• Consistent with local and regional plans and the vision and principles of the North Markham Future Urban Area.	• Partially consistent with local and regional plans and the vision and principles of the North Markham Future Urban Area.	• Partially consistent with local and regional plans and the vision and principles of the North Markham Future Urban Area.	• Partially consistent with local and regional plans and the vision and principles of the North Markham Future Urban Area.
Social and Cultural Environment				
• Land Use • Streetscaping / Urban Design • Air Quality • Noise Effects • Stormwater • Groundwater • Construction Impacts	• Supportive of surrounding land uses and urban design, though there may be potential impacts on air quality, noise, built/cultural heritage features, etc. These impacts would be minimized through mitigation	• Supportive of surrounding land uses and urban design, though there may be potential impacts on air quality, noise, built/cultural heritage features, etc. These impacts would be minimized through mitigation	• Supportive of surrounding land uses and urban design, though there may be potential impacts on air quality, noise, built/cultural heritage features, etc. These impacts would be minimized through mitigation	• Supportive of surrounding land uses and urban design, though there may be potential impacts on air quality, noise, built/cultural heritage features, etc. These impacts would be minimized through mitigation

Evaluation Criteria	A	B	C	D
• Built and Cultural Heritage • Archaeology • First Nations Lands	measures and avoidance during detailed design.	measures and avoidance during detailed design.	measures and avoidance during detailed design.	measures and avoidance during detailed design.
Financial				
• Capital Cost	• As the study is at a conceptual stage, costs will be further defined as the study moves forward, though Concept Option A will likely result in high costs.	• As the study is at a conceptual stage, costs will be further defined as the study moves forward, though Concept Option B will likely result in moderate to high costs.	• As the study is at a conceptual stage, costs will be further defined as the study moves forward, though Concept Option C will likely result in moderate to high costs.	• As the study is at a conceptual stage, costs will be further defined as the study moves forward, though Concept Option D will likely result in moderate to high costs.
Recommended for Further Evaluation?				
Recommendation for Further Evaluation	**Yes**: Concept Option A provides the best transportation system to accommodate future population and employment growth through strong investments in all modes of transportation and meets the Future Urban Area's transportation principles and strategies. It is recognized that suitable adjustments and mitigation that avoid or minimize impacts will be required.	**No**: Partially consistent with local and regional plans and policies and the Future Urban Area's Transportation principles and strategies. Concept Option B falls short in accommodating future travel by providing limited north-south and east-west parallel road options and limited access to employment areas.	**No**: Partially consistent with local and regional plans and policies and the Future Urban Area's Transportation principles and strategies, as it lacks east-west parallel routes which limits mobility and accessibility for all modes of transportation.	**No**: Partially consistent with local and regional plans and policies and the Future Urban Area's Transportation principles and strategies, as it lacks east-west parallel routes which limits mobility and accessibility for all modes of transportation.

Legend:

No Impacts / Mostly Positive Results	
Few Impacts / Generally Positive Results	
Potential impacts that generally can be managed through mitigation	
Potentially significant impacts that can be managed through mitigation / Generally Negative Results	
Potential impacts that cannot be mitigated / Mostly Negative Results	

5.5.3 Development and Evaluation of Transportation Network Concept Options E, F and Major Mackenzie Drive East Collector Road Connection, Preliminary Community Structure Plan

As a result of additional input provided at the May 5, 2015 TAC Workshop, Concept Option A was refined, resulting in the development of Concept Option E. The refinement of land uses and the transportation network occurred in tandem (refer to **Section 2.4.4**). An additional Concept Option F was introduced by landowner groups. The two additional concepts, Concept Options E and F, were similar to Option A, with some variations between them found mostly in the northern portions of the FUA where the road network was adjusted slightly. Options E and F are shown in **Figure 5.10** and **Figure 5.11** respectively.

The Project Team applied similar evaluation criteria as used previously in the evaluation of Concept Options A to D to evaluate Concept Options E and F. The evaluation of Concept Options E and F is summarized in **Table 5.9**. Based on the evaluation Concept Options E and F and as a result of additional discussion and review with landowner and agency stakeholders through the CMP process, another Concept Option variation identified as G-1 resulted.

Concept Option G-1 was tested in the first iteration of impact assessment Phase of the CMP. Based on the results of the first iteration of testing, refinements were made to Concept Option G-1, which resulted in the **Preliminary Community Structure Plan** (see **Figure 5.12**). It should be noted that from a transportation perspective, there are no noticeable differences between Option G-1 and the Preliminary Community Structure Plan. Additional testing of the Preliminary Community Structure Plan is presented in **Appendix C6**. In particular, **Appendix C6** considers the implication of eliminating proposed creek crossings. The outcome of the assessment recommended two creek crossings within the Berczy Glen and Angus Glen Blocks. These connections offer continuous collector roads that address the total travel demand with reasonable levels of connectivity and flexibility. Furthermore, they will provide relief to the overall transportation network which will also allow for a better and more attractive transit system. The elimination of any of these crossings or reduction in the number of lanes would create issues with connectivity for active transportation modes, transit routing flexibility and out-of-the-way travel to access adjacent arterials such as Elgin Mills Road.

Further to discussions with the landowners and stakeholders, another **Concept Option** (see **Figure 5.13**) which included only one east-west crossing and the introduction of a north-south Major Mackenzie Drive East Collector Road connection within the Berczy block was evaluated. **Table 5.10** presents a summary of the evaluation of the previous Preliminary Community Structure Plan and Major Mackenzie Drive East Collector Road Connection Concept Options. The detailed evaluation of all the Concept Options are provide in **Appendix C8**.

The outcome of the evaluation process ultimately determined the **Preliminary Community Structure Plan** (see **Figure 5.12**) represent the preferred transportation network that best meets the needs of the FUA balancing impacts to the natural and social environment, while also having regard for implementation cost.

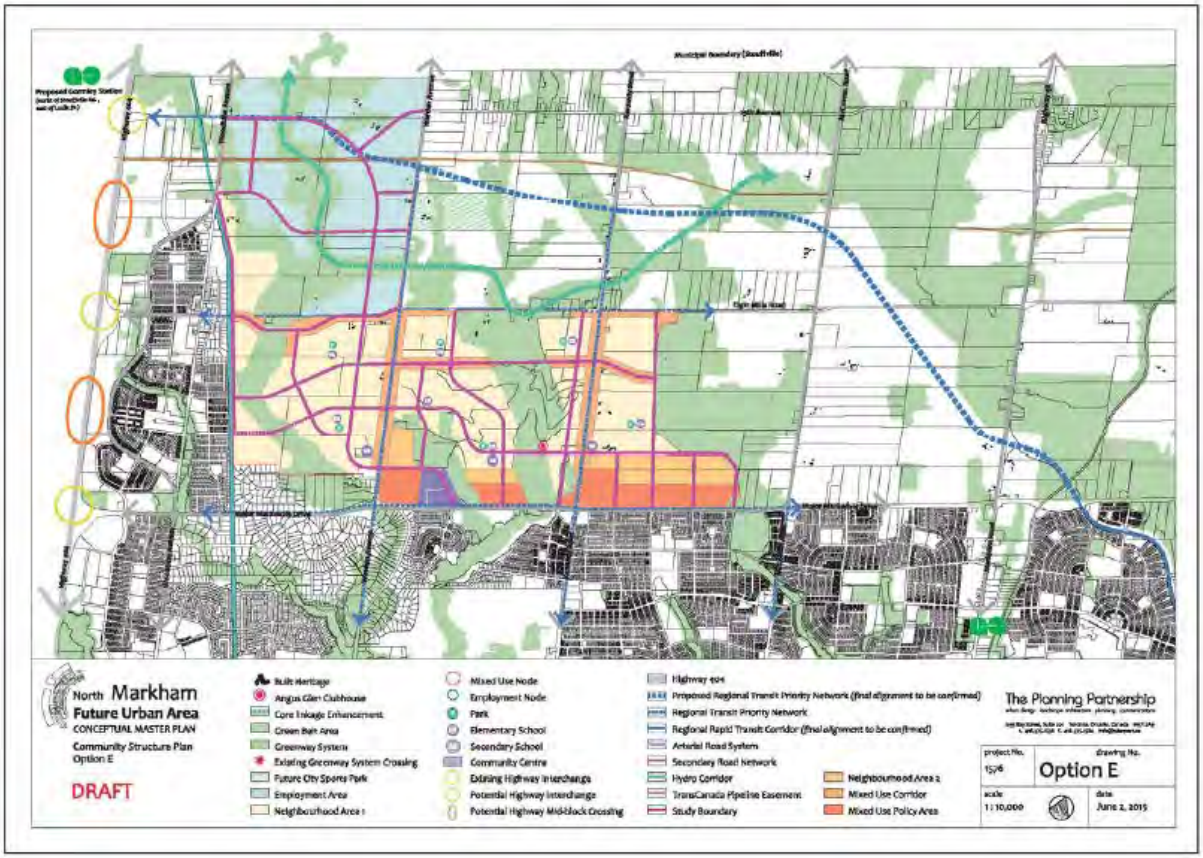


Figure 5.10 Transportation Network Concept Option E

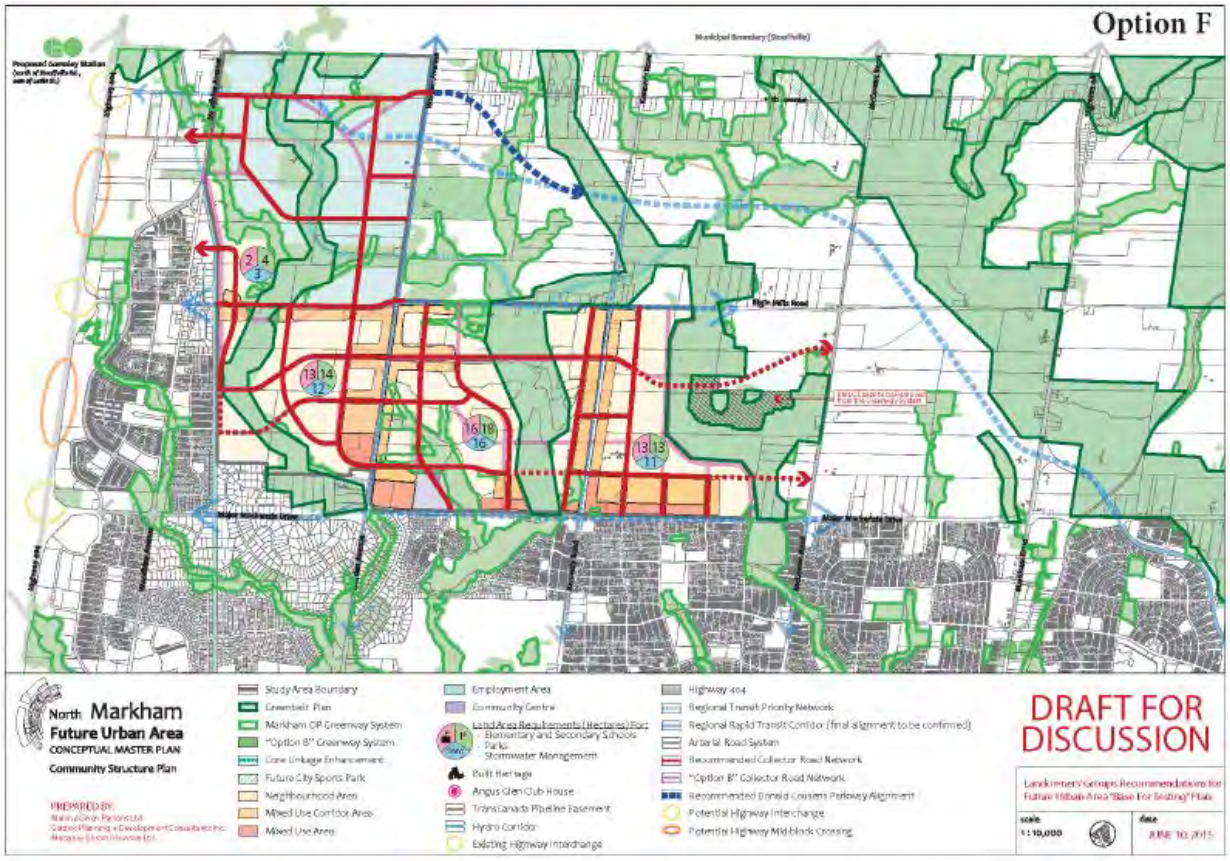


Figure 5.11 Transportation Network Concept Option F

Table 5.9 Evaluation of Transportation Network Concept Options E and F

	Transportation System	Natural Environment	Policies & Governance	Social & Cultural	Financial
E	• Would meet the needs of the North Markham Future Urban Area by accommodating future traffic volumes, providing greater connectivity and balanced traffic flows while facilitating other modes of travel. However, there is limited access to employment areas.	• The road network would impose significant impacts on the natural environment, though slightly less than Concept Option F; however, these impacts can be minimized through mitigation measures or avoidance during detailed design.	• Consistent with local and regional plans and the vision and principles of the North Markham Future Urban Area.	• Supportive of surrounding land uses and urban design, though there may be potential impacts on air quality, noise, built/cultural heritage features, etc. These impacts would be minimized through mitigation measures and avoidance during detailed design.	• As the study is at a conceptual stage, costs will be further defined as the study moves forward, though Concept Option E will likely result in moderate to high costs.
F	• Would generally meet the needs of the North Markham Future Urban Area by accommodating future traffic volumes, providing greater connectivity and balanced traffic flows while facilitating other modes of travel. However, there is limited access to employment areas, and the lack of a second crossing in the Angus Glen block would place additional pressure on other east-west corridors.	• The road network would impose significant impacts on the natural environment - slightly more than Concept Option E; however, these impacts can be minimized through mitigation measures or avoidance during detailed design.	• Partially consistent with local and regional plans and the vision and principles of the North Markham Future Urban Area, except in the following areas: • realignment of Donald Cousens Parkway which varies from local and regional policies; and, • lack of a second mid-block crossing in the Angus Glen block.	• Supportive of surrounding land uses and urban design, though there may be potential impacts on air quality, noise, built/cultural heritage features, etc. These impacts would be minimized through mitigation measures and avoidance during detailed design.	• As the study is at a conceptual stage, costs will be further defined as the study moves forward, though Concept Option F will likely result in moderate to high costs.
Recommended for Further Evaluation?	**Recognizing the pros and cons of both options, a "hybrid" of Concept Options E and F (known as Concept Option G-1), is recommended for further evaluation, which would balance the benefits of the proposed transportation system while avoiding or minimizing impacts to the natural and social environment.**				

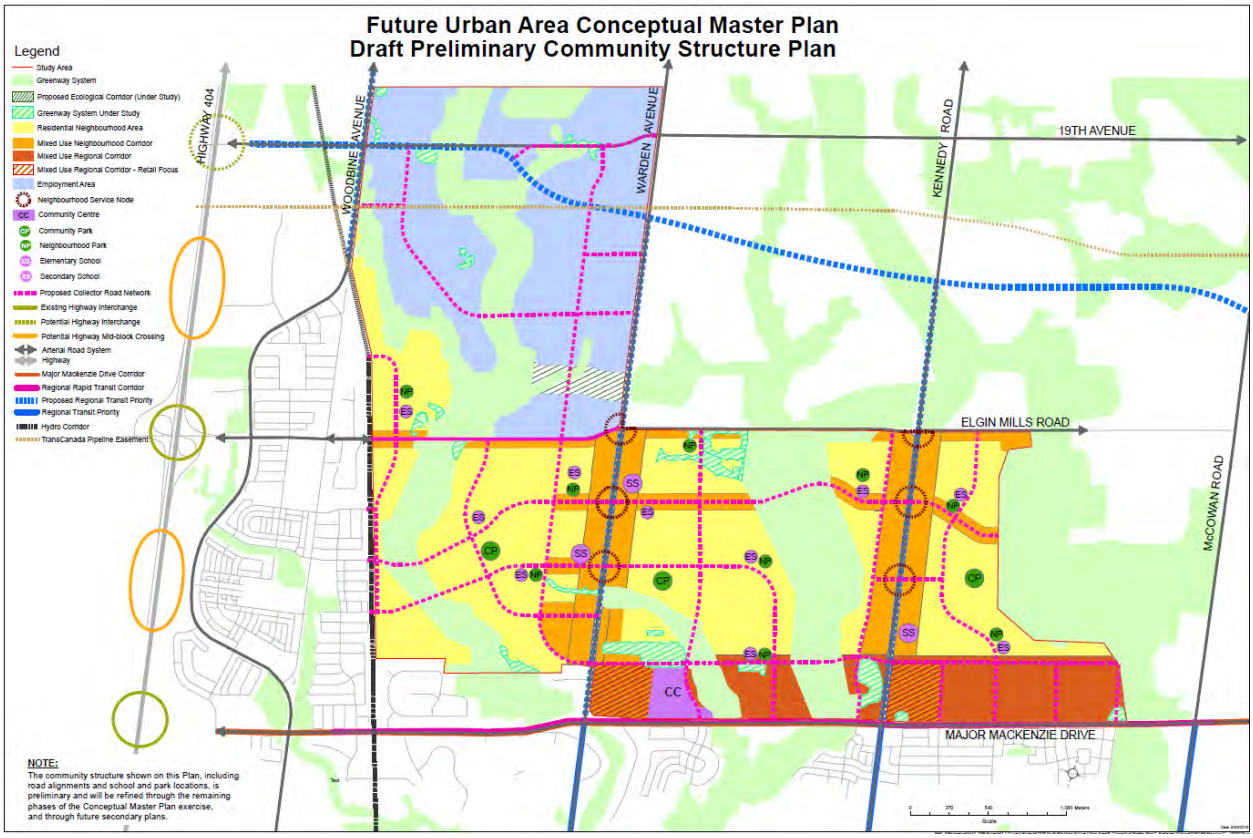


Figure 5.12 Transportation - Preliminary Community Structure Plan

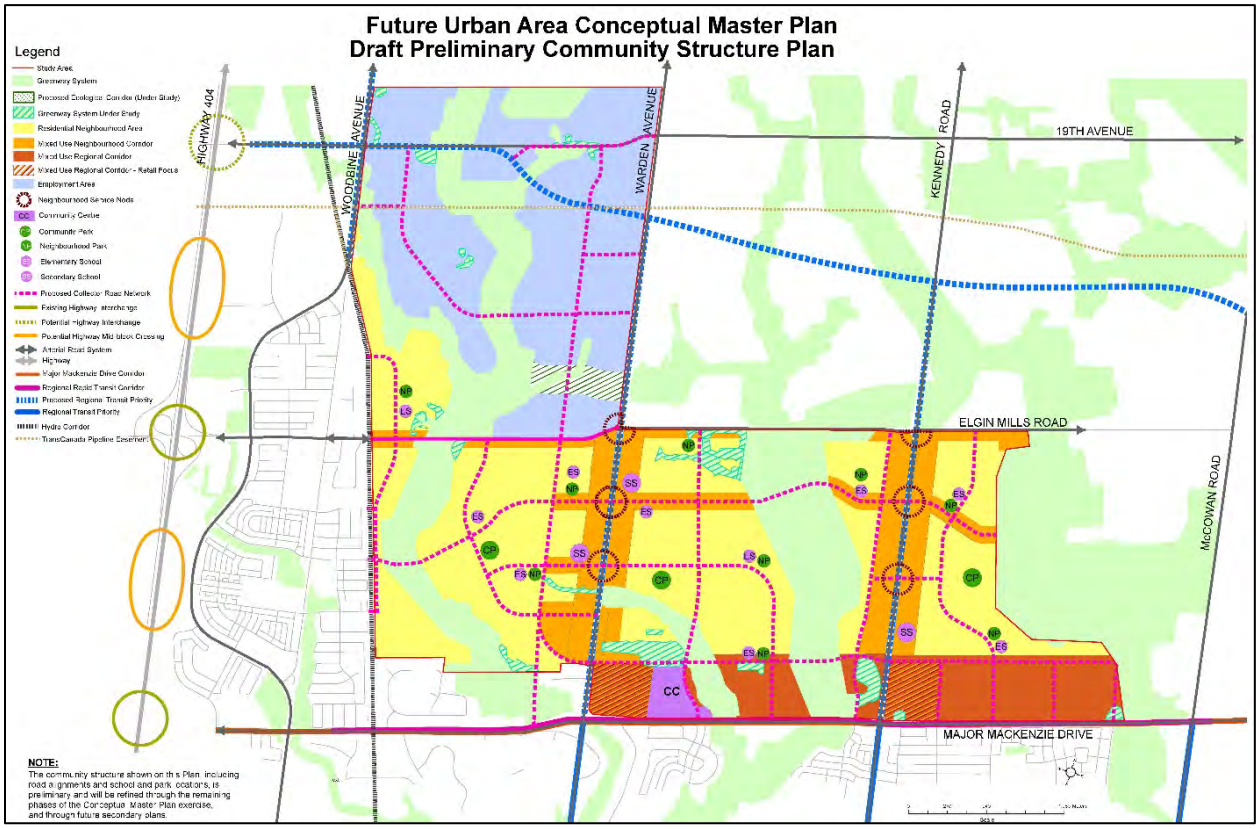


Figure 5.13 Concept Option Major Mackenzie Drive East Collector Road Connection

Table 5.10 Evaluation of Transportation Network Concept Options: Preliminary Community Structure Plan and Major Mackenzie Drive East Collector Road Connection

	Transportation	Natural Environment	Policies & Governance	Social & Cultural Environment	Financial	Recommended for Further Evaluation?
Preliminary Community Structure Plan (Option G)	• Would meet the needs of the North Markham Future Urban Area by accommodating projected traffic volumes and providing good connectivity and mid-block collectors throughout. Adequate connections to employment lands in the north are provided.	• Impacts to terrestrial and aquatic resources are expected for all proposed crossings. In some cases, proposed realignments will help to avoid impacts. In other cases, impacts can be managed through following best management practices to avoid or mitigate impacts; site-specific strategies can be developed throughout the conceptual and detailed design of crossings.	• Consistent with local and regional plans and the vision and principles of the North Markham Future Urban Area.	• Supportive of surrounding land uses and urban design, particularly the mixed use corridors. There may be potential impacts on air quality, noise, built/cultural heritage features, etc., though these impacts would be minimized through mitigation measures and avoidance during detailed design.	• Implementation of the road infrastructure will result in moderate to high costs.	The Preliminary Community Structure Plan is recommended subject to detailed evaluation and refinements of elements such as creek crossings as it meets the needs of the FUA balancing impacts to the natural and social environment while also having regard for implementation cost.

Table 5.10 Evaluation of Transportation Network Concept Options: Preliminary Community Structure Plan and Major Mackenzie Drive East Collector Road Connection

	Transportation	Natural Environment	Policies & Governance	Social & Cultural Environment	Financial	Recommended for Further Evaluation?
Concept Option with Major Mackenzie Drive East Collector Road Connection	• Would meet the needs of the North Markham Future Urban Area by accommodating projected traffic volumes by providing more access to Major Mackenzie Drive. Adequate connections to employment lands in the north are provided. However, east-west connectivity is limited to one major mid-block crossing.	• Slightly greater impacts to terrestrial and aquatic resources are expected for all proposed crossings. In some cases, proposed realignments will help to avoid impacts. In other cases, impacts can be managed through following best management practices to avoid or mitigate impacts; site-specific strategies can be developed throughout the conceptual and detailed design of crossings.	• Consistent with local and regional plans and the vision and principles of the North Markham Future Urban Area	• Supportive of surrounding land uses and urban design, particularly the mixed use corridors. There may be potential impacts on air quality, noise, built/cultural heritage features, etc., though these impacts would be minimized through mitigation measures and avoidance during detailed design.	• Implementation of the road infrastructure will result in high costs.	The Concept Option with Major Mackenzie Drive Collector Road Connection is not recommended for further evaluation. Generally both networks had similar advantages and disadvantages. However, the Conception Option with Major Mackenzie Drive Collector Road connection would have had more adverse natural environment impacts, and also be costlier to implement.

5.6 Recommended Transportation Network

The recommended Transportation Network Concept for the FUA is based on the Preliminary Community Structure Plan for the FUA, as shown on **Figure 5.14** (same as **Figure 5.12**). To facilitate discussion of the FUA road network, a collector roads "naming system" was developed, as shown below in **Figure 5.15**.

With the selection of a recommended transportation network concept, further testing was undertaken to assess the recommended transportation network to further refine and define transportation system features. The Phase 2 impact assessment was undertaken in two iterations of testing. In the first iteration, a land use option based on the road network shown in a preliminary Community Structure Plan was tested. The analysis in the first iteration was focused on the traffic demand aspects of the FUA, aimed at identifying constraints and opportunities with regard to the arterial road access points and the collector crossings and number of lanes. In the second iteration of testing (**Appendix C7**), the first iteration analysis was rerun using updated information including the York Region Travel Demand Model based on the completed York Region TMP and refined land use information for the FUA.

The findings outlined below are based on this updated information. The FUA collector road network was further defined in terms of the number of lanes, the anticipated intersection traffic control and potential need for turn lanes. Also, a comprehensive active transportation network was established. The Phase 2 second iteration confirmed that all the collector roads will provide for two travel lanes except for EW-1, which will be a major collector road with four travel lanes. The number of lanes for all roads in the study area are summarized in **Figure 5.16**.

A key concern about EW-1 is that the four lanes cannot be carried throughout the entire corridor. The section of EW-1 west of NS-2 will be limited to two lanes to match the collector road to the west of the FUA, which is a two-lane road. However, EW-1 was the most feasible choice for the four-lane east-west connection based on travel demand figures and given its continuity across the FUA lands.

5.6.1 Intersection Configuration and Traffic Control

Based on the projected traffic volumes and operational performance, the type of intersection traffic control and potential need for auxiliary lanes (left/right turn bays) were identified at a preliminary level. The proposed traffic signal locations in the FUA are shown in **Figure 5.17**. Where no signals are shown, the intersection is expected to be all-way or two-way stop controlled. Generally, traffic signals are proposed where collector roads intersect with major arterials or at key locations within the FUA transportation network.

Figure 5.17 also identifies intersections where auxiliary lane(s) may be needed on at least one of the intersection approaches. Generally, auxiliary lanes are proposed at signalized intersections with major arterial roads. Where an intersection with an arterial road is stop controlled, turn lanes were assessed on a case by case basis and added as required.

A more detailed traffic signal warrant analysis and operational analysis should be completed to confirm these findings as part of secondary plan and subdivision applications.

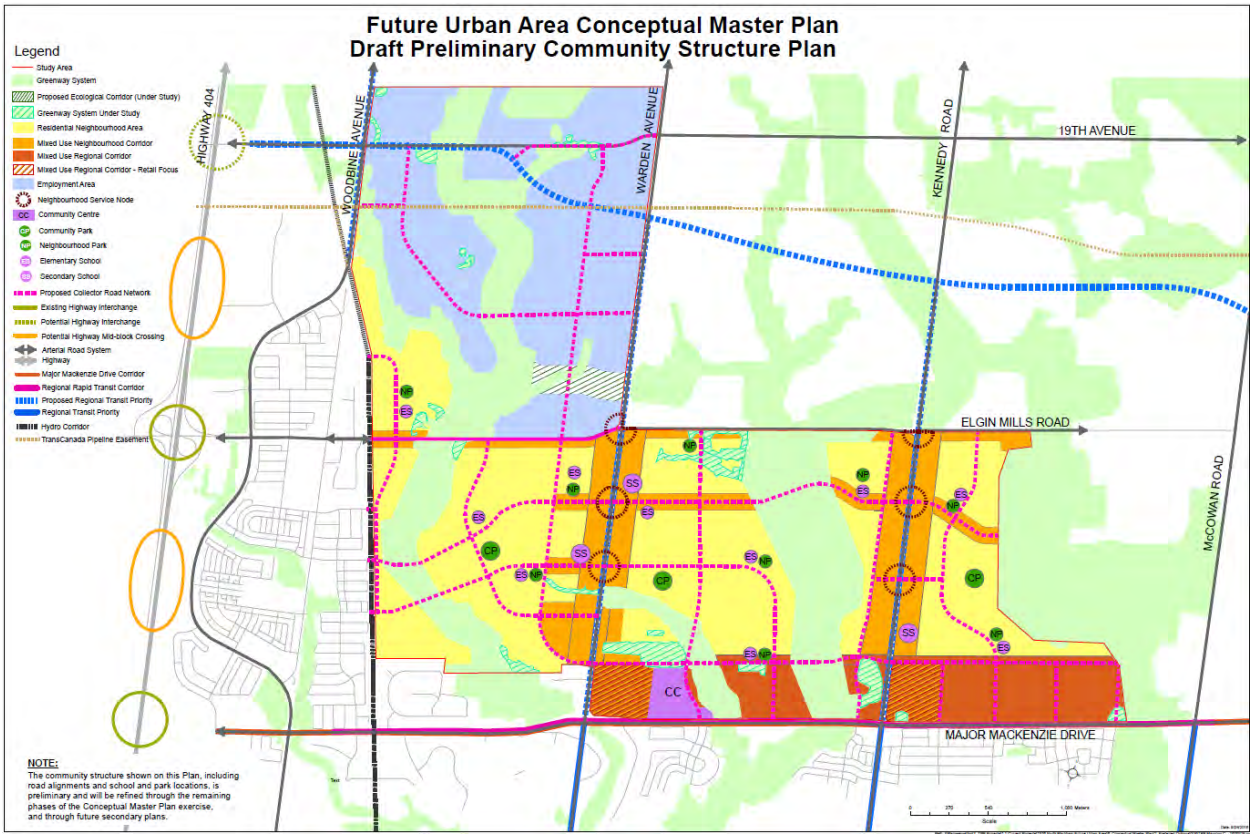


Figure 5.14 Recommended Transportation Network Concept for FUA

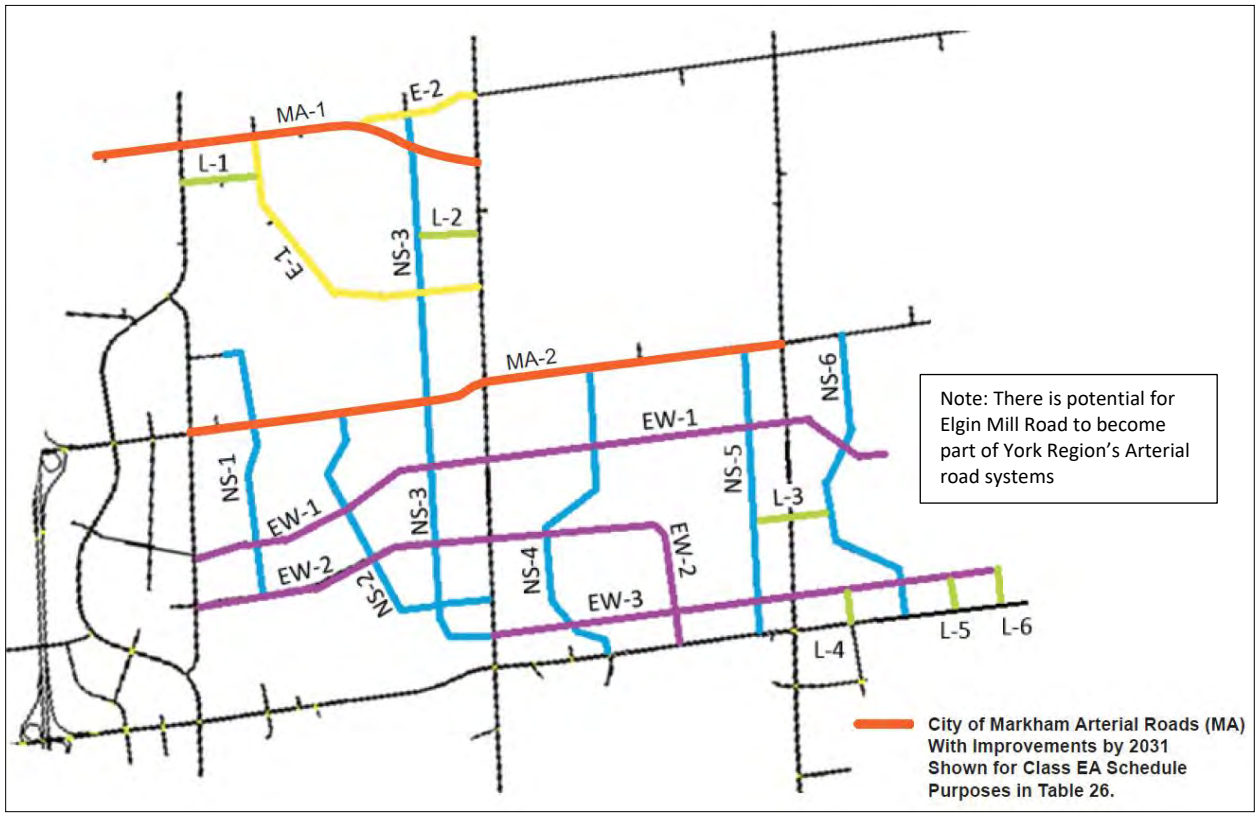


Figure 5.15 FUA Collector Road Naming Convention

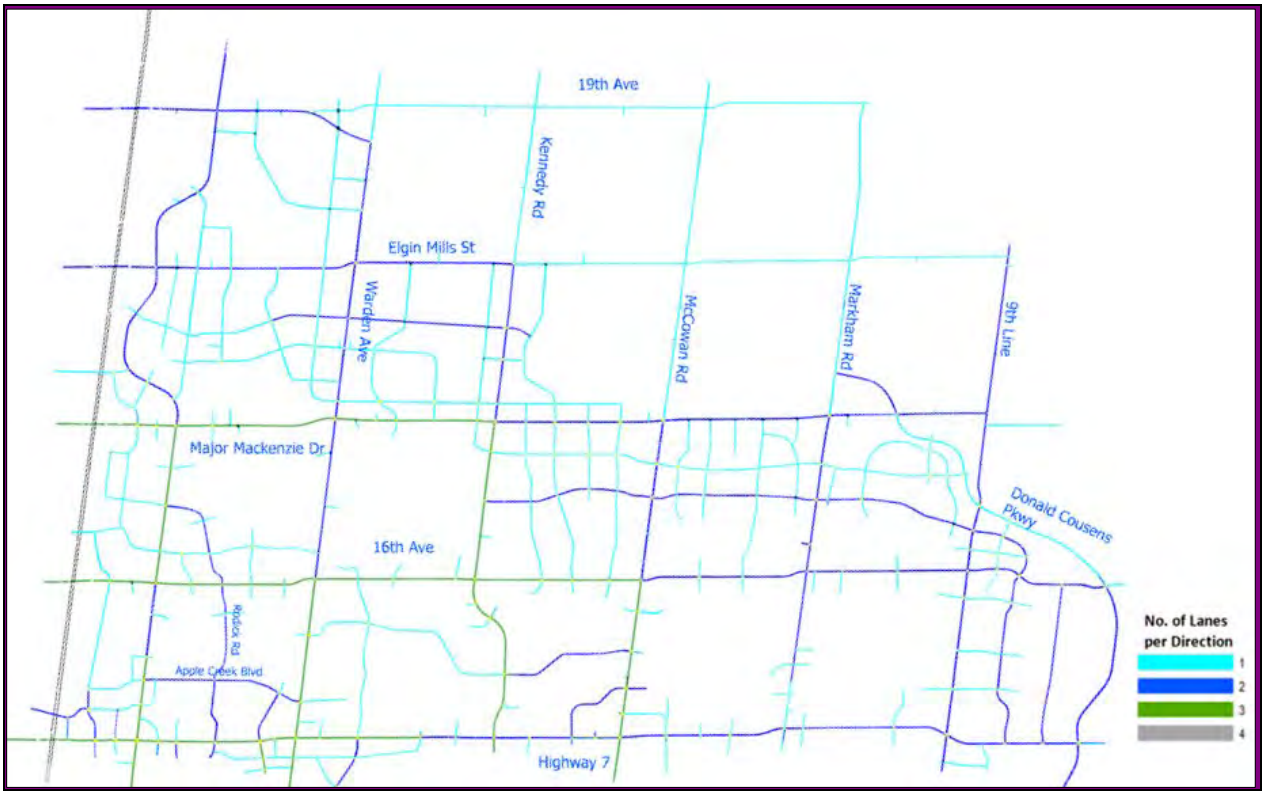


Figure 5.16 FUA Proposed 2031 Road Network Configuration

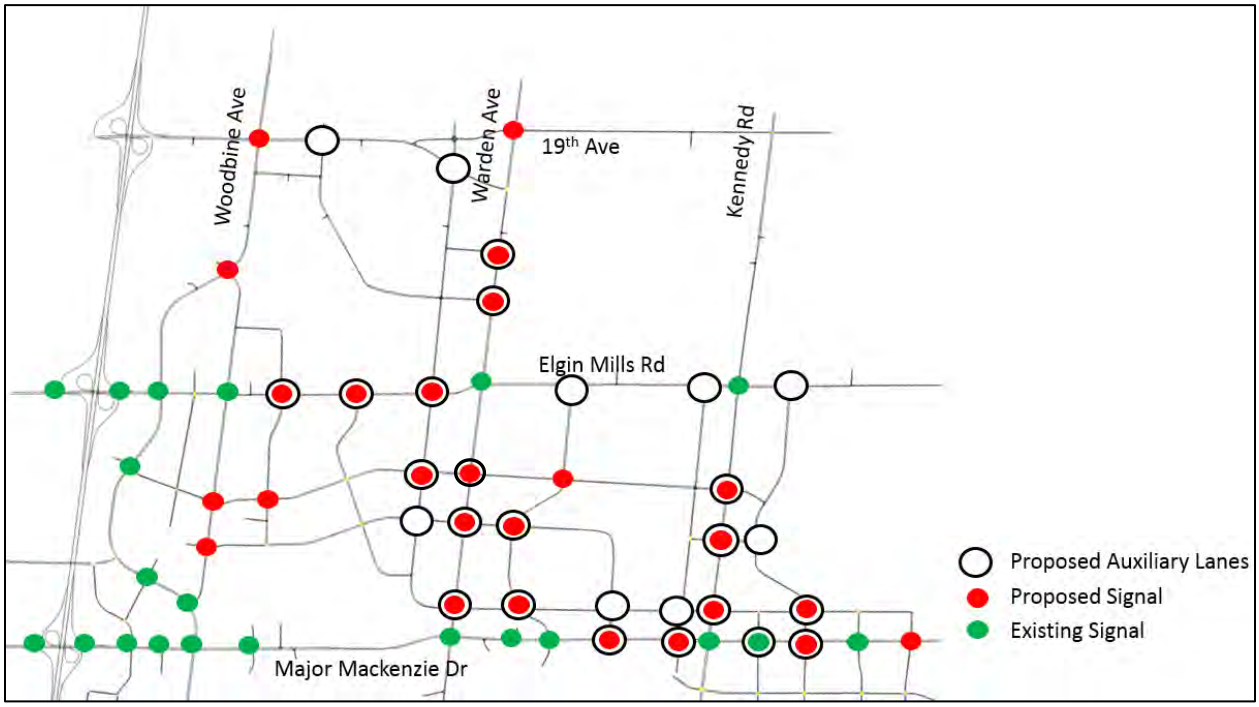


Figure 5.17 FUA Proposed Signal and Intersection Configuration

5.6.2 Conceptual Transit Network Plan

With significant growth in residential and employment land uses within the FUA, there is a strong need to expand the transit network to provide additional transit service to serve these new areas. The primary goals of expanding the transit network within the FUA are:

- To provide enhanced transit services with reasonable headways, convenient routing, good connectivity and accessibility (e.g., less than 400 metre walking distance) to increase transit modal share; and
- To connect residents to key employment and commercial areas within Markham, Richmond Hill and more broadly, the GTHA.

An analysis of additional transit potential was completed as part of the Supplemental Transportation Analysis Memorandum from September 15, 2016 (**Appendix C6**). This analysis focused on identifying FUA auto travel demand patterns with a high potential for conversion to transit. The findings showed that the majority of auto trips from the FUA were destined to Richmond Hill and employment areas east and west of Highway 404 and near Highway 404 and Highway 7. These travel patterns and their potential for diversion from auto to transit trips strongly influenced the conceptual transit network shown in **Figure 5.18**.

The strategy for developing the conceptual transit network for enhancing transit services within the FUA is to provide direct services between residential and employment/commercial areas and convenient transfer opportunities to those routes. It is important to note that future transit expansion in the FUA will be contingent upon further evaluation and service planning by appropriate transit authorities. Potential route extensions into the FUA will also be dependent on the phasing of development, as the ultimate collector road network is expected to be completed in multiple phases.

5.6.3 Active Transportation Strategy

A major goal of the FUA active transportation policy relates to the need to connect residential and employment land uses with a continuous network of walking and cycling facilities. Recognizing the importance of this requirement, an integrated network of multi-use trails, in-boulevard cycling facilities and cycling lanes are proposed for the FUA. This continuous, safe and low stress network will make cycling within the community an attractive and healthy transportation alternative. This is in keeping with the City of Markham Official Plan policies in Section 7.1.4.2.

5.6.3.1 Cycling Facilities

Cycling facilities are proposed on collector roads which directly connect residents to higher density land uses, employment areas and community facilities such as retail uses on the north side of Major Mackenzie Drive East. These facilities will allow residents to cycle to their destinations using a direct route.

On major arterial roadways it is recognized that traffic volumes and speeds could be perceived as a deterrent to cycling if these routes were to include traditional painted cycling lanes. Separated facilities on major roads, such as Warden Avenue and Kennedy Road, should be considered at the Secondary Plan stage to provide a high level of safety for cyclists while seamlessly connecting residents to other areas of Markham.

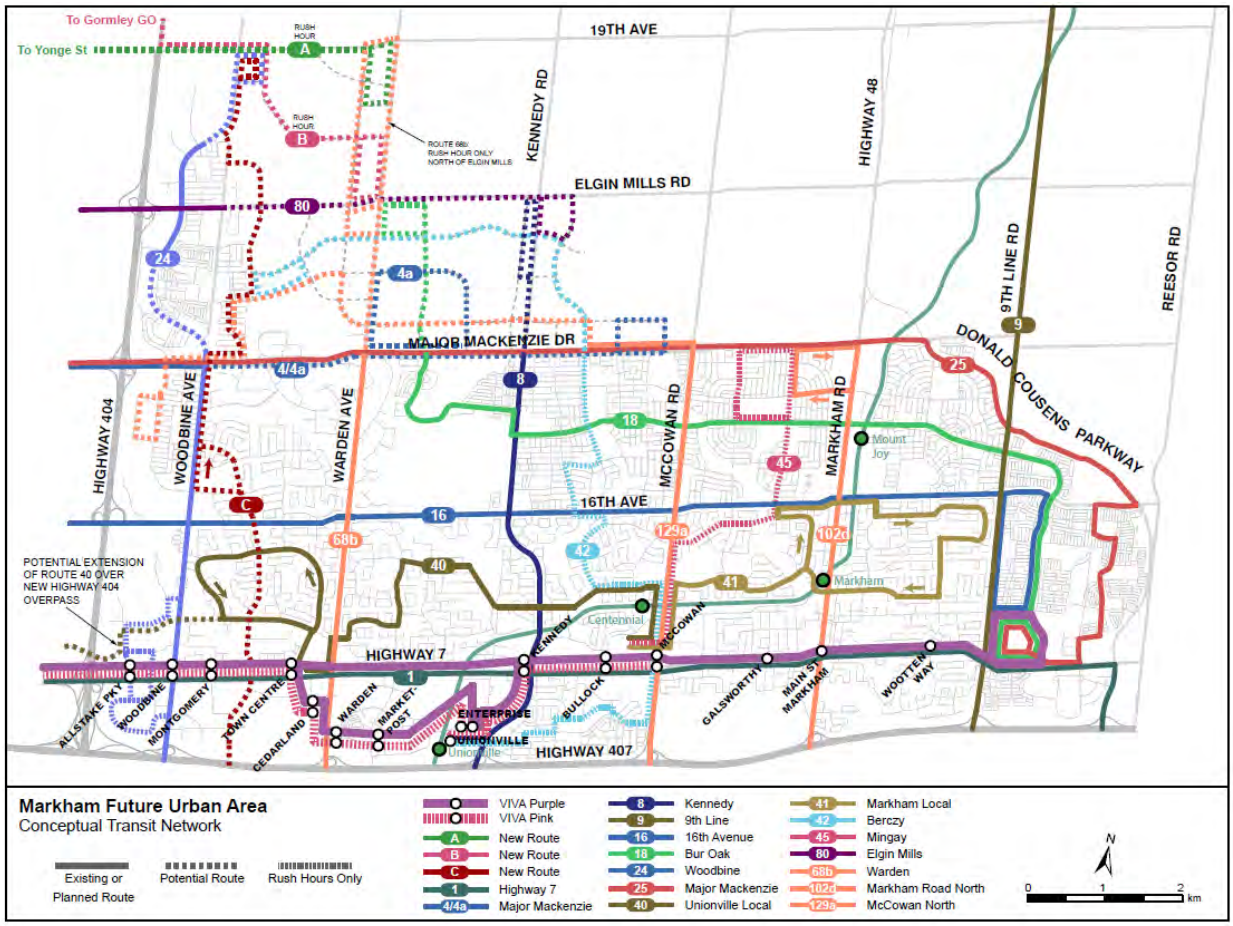


Figure 5.18 FUA Conceptual Transit Routing

As the FUA develops, it is anticipated that major arterial roads will be widened to accommodate the projected population growth. As these roads are widened and rebuilt, opportunities will exist to incorporate best practices for cycling facility design into these corridors.

The introduction of cycling facilities are supported by policies of the 2014 City of Markham Official Plan and their construction is subject to Schedule A+ of the Municipal Class EA. It is anticipated that cycling facilities will be addressed as part of the preparation of the FUA secondary plans and future York Region road widening Class EA Studies.

Figure 5.19 shows the proposed FUA Draft Conceptual Active Transportation Network. As a result of this study, in-boulevard cycling facilities were recommended for the FUA collector roads as shown on **Figure 5.19**. It should be noted that further study via Phases 3 and 4 of the Class EA Studies, secondary plans, of subdivision or detailed design will determine the final design for in boulevard cycling facility. This consideration is highlighted in Section 6, Master Plan

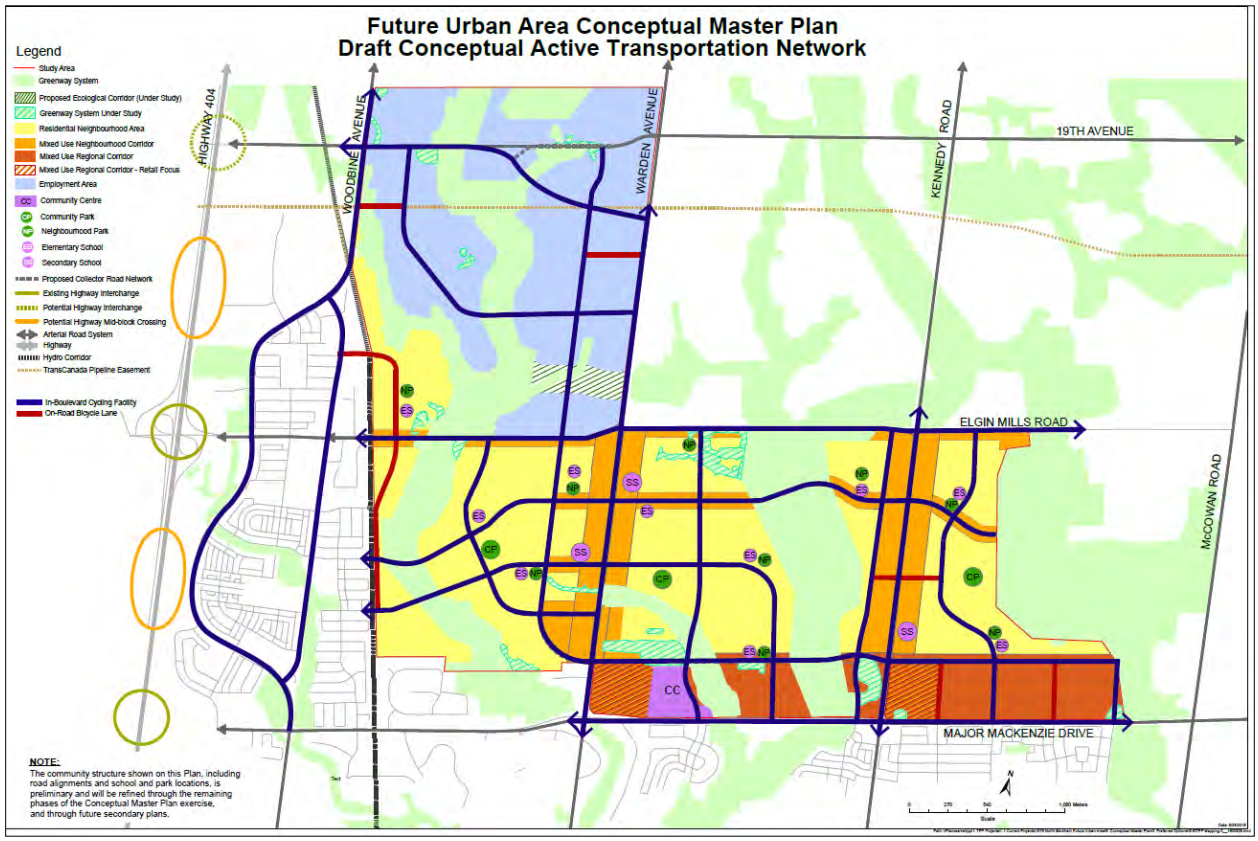
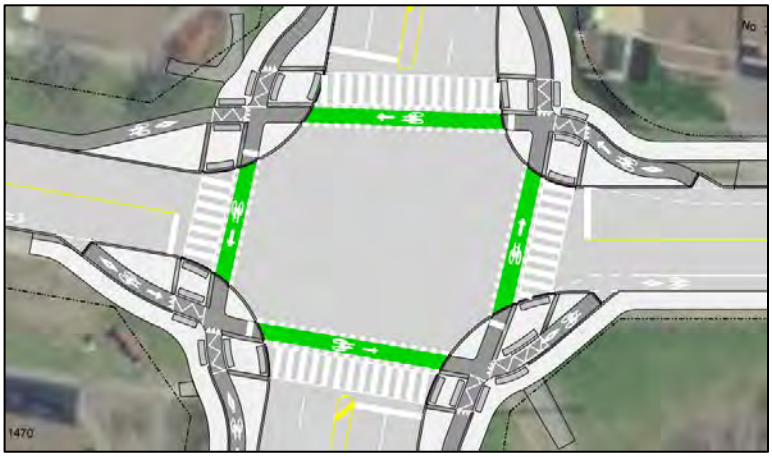


Figure 5.19 FUA Draft Conceptual Active Transportation Network

When fully built, the FUA will feature several new signalized intersections as shown previously in **Figure 5.17**. While the proposed road network includes in-boulevard cycling facilities and cycling lanes on major arterial and collector roadways, it is important for these facilities to be maintained at major new signalized intersections.

The protected intersection concept (shown in **Figure 5.20**) is a common design feature in many communities and has recently been recommended for use in the City of Ottawa. The protected intersection:

- Allows for cyclists to be separated from traffic during most of the time spent at an intersection;
- Reduces crossing distance;
- Improves sight lines for turning vehicles; and,
- Provides a continuous cycling facility for right turning cyclists.



Source: City of Ottawa Dynes Road and Prince of Wales Drive Reconstruction Project

Figure 5.20 Protected Intersection Application in the City of Ottawa

The protected intersection concept can be adapted for all road sizes and is not constrained by lane-widths or on-street parking. The protected intersection concept within the FUA should be explored further during detailed design.

5.6.3.2 Multi Use Trails

A network of multi-use trails is recommended throughout the FUA to provide recreational opportunities while also providing a comfortable off-road Active Transportation system. An example of a multi-use trail is shown below in **Figure 5.21**. The use of existing greenways for multi-use trails is permitted in the Greenbelt Plan and 2014 City of Markham Official Plan. Considering the environmental sensitivity of greenways, as per section 3.1.1.9 of the 2014 City of Markham Official Plan: *"Nature-based recreational infrastructure such as trails, trailheads, foot bridges, parking, signage, picnic facilities, washrooms and interpretative facilities must be designed to maintain the ecological integrity of the Greenway System."*

Source: Fanno Creek Greenway Trail – Beaverton, OR; Source: Wikipedia User Finetooth

Figure 5.21 Example of Multi-use Trail in Natural Areas

Maintaining a continuous network of multi-use trails is of significant importance for the FUA in order for residents to increase their access to the Greenway System. Multi-use trails are supported by policies of the 2014 City of Markham Official Plan and their construction is subject to Schedule A+ of the Municipal Class EA. It is anticipated that trails will be addressed as part of the preparation of secondary plans.

5.6.4 Transportation Demand Management Strategies

Transportation Demand Management (TDM) involves using various strategies to influence, reduce or redistribute travel demand to make more efficient use of transportation infrastructure. This often manifests itself in impacting an individual's personal travel decisions, such as the time of travel (shift away from peak travel periods) or the mode of travel (such as carpooling or transit).

TDM is supported by York Region's Transportation Master Plan that states: *"The Region also recognizes that changes to the built environment must be accompanied by TDM initiatives that build individuals' awareness and understanding of their travel options, shape their preferences and encourage them to try new ways of travelling."*

The Region's TDM Implementation Strategy, developed in 2013, established policies and initiatives that included:

- Partnerships with Metrolinx, various local municipalities and other relevant associations;
- Workplace, school and residential TDM programs; and,
- Development approvals.

Some Regional examples include Smart Commute, a workplace TDM program and the York Region Active and Safe Routes to School Committee, a school TDM program that encourages active transportation.

The City of Markham is also engaged in TDM strategies, both in partnership with York Region and in its own local programs. Local examples include Smart Commute Markham Richmond Hill, Active & Safe Routes to School and Travel Smart Cornell. Integration of similar strategies will be encouraged or negotiated for the FUA. Employment and school TDM programs will be applicable for the employment lands and the new educational institutions proposed for the FUA.

TDM strategies for the FUA will be supported by a road network and land use pattern which enables a more efficient transportation system by supporting more sustainable modes of transportation. This approach is supported by the 2014 City of Markham Official Plan which advocates TDM measures that reduce auto dependency by encouraging a greater proportion of trips to be made by walking, cycling and transit.

Specific TDM approaches for the FUA could include:

- "Minimizing walking distance to planned and existing transit stops through measures such as the provision of walkways, sidewalks and more direct street patterns" (York Region Official Plan, 2010).
- "Connecting transit stops directly to sidewalks and adjacent buildings in urban areas" (York Region Official Plan, 2010).
- "Providing bus bays, transit shelters and bus loops with sufficient lighting and accessibility features" (York Region Official Plan, 2010).
- Encouraging home builders to work in partnership with York Region to consider providing new residents with PRESTO cards or transit information packages as a method of encouraging public transit use.
- Optimizing pedestrian and cycling connections to community destinations by considering elements such as illumination and continuity.
- Providing in-boulevard bicycle parking adjacent to significant destinations such as retail areas.
- Providing enhanced short-term and long-term bicycle parking facilities, including shower and change rooms.
- Implementing a cycling network wayfinding system throughout the community highlighting trip time and length to major destinations.
- Encouraging auto sharing companies to lease parking spaces at key destinations in the area.
- Encouraging employers to consider telecommuting as a viable work alternative.
- Providing passenger pick-up and drop-off facilities at major destinations.
- Ensuring sidewalks leading to major destinations address pedestrian desire lines from transit stops or existing sidewalks to reduce pedestrian travel time.

A detailed TDM strategy and implementation plan will be a key requirement of the subdivision and site plan application process.

5.6.5 Addressing Environmental Impacts of Road Crossings

The Preliminary Community Structure Plan was undertaken with the goal of reducing and eliminating creek crossings by collector roads wherever possible, there are five new and three upgraded creek crossings proposed as part of this CMP Class EA study. The creek crossings include:

- Three new crossings of Berczy Creek;
- Two upgraded crossings of Berczy Creek;
- Two new crossings of Bruce Creek; and
- One upgraded crossing of Bruce Creek.

The new creek crossings will span a total of approximately 2.5 kilometers of the Greenway System. Of this total, the types of land being crossed include the following:

- 580 metres - wetland
- 507 metres - woodland
- 531 metres - meadow
- 934 metres – anthropogenic (e.g., man-made environments such as farmland)

While potential impacts of the crossings on the natural environment will be assessed in more detail, including geomorphologic assessments will be required for each stream crossing at the site-specific level to better understand impacts and properly design associated mitigation measures, during Phases 3 and 4 of the Class EA process, as well as during preliminary and detailed design, several mitigation measures have been identified which will be taken into consideration during further studies in order to minimize or avoid impacts, including:

- Evaluation of structure design and locations to avoid long term impacts to watercourse and infrastructure;
- Refine the proposed routing of road alignments that cross the natural heritage network and natural system to avoid impacts;
- Design and construct crossings of the natural heritage network and natural system to mitigate the potential for negative impacts;
- Implement mitigation approaches, such as restoration/enhancement of areas within and adjacent to the valley as treed habitat, to reduce impacts to wildlife and habitat; and,
- Minimize or avoid impacts on observed Species at Risk (Barn Swallow, Bobolink and Eastern Meadowlark) through appropriate timing of construction and habitat replacement where required.

5.6.6 Recommended Transportation Network Summary and Next Steps

5.6.6.1 Summary

The following summarizes key observations and recommendations related to the recommended transportation network for the horizon year 2031:

- Further discussions with stakeholders are expected to better define the specific transit system that would make transit usage more attractive for those that choose to live and/or work in the FUA. Phasing and funding considerations should also be addressed as part of such next steps so that a realistic and feasible implementation plan can be identified.
- Auto trips from the FUA destined to Richmond Hill and employment areas east and west of Highway 404 and near Highway 404 / Highway 7 represent opportunities with the greatest potential for conversion from auto to transit travel mode and must strongly influence the transit routing recommendations.
- The collector road system for the FUA, as identified in the preferred Community Structure Plan, appears to be properly sized in terms of access points. There will be a need for at least two north-south and two east-west collector roads to traverse the full length of the FUA neighbourhood lands to provide enough capacity for traffic to move efficiently in and out of the FUA and access the arterial road system, provide good access and connectivity to the surrounding communities, circulation flexibility and active transportation opportunities.
- The Berczy Glen Block appears to be the most challenged with regard to access to/from the arterial road system. This is due to its limited westward connectivity through the Hydro Corridor and lack of connection opportunities southward to Major Mackenzie Drive East. As well, high levels of congestion on Warden Avenue and the desire to avoid out-of-the-way travel for access to/from Elgin Mills Road accentuate the access problem for this Block. There will be a need for at least two collector road crossings of Berczy Creek within this Block for capacity purposes, as well as for good connectivity, internal flow balancing, route options, and active transportation opportunities.
- Collector roads will generally provide for two lanes of travel except for the east-west collector road located just south of Elgin Mills Road which will be a major collector road with four travel lanes.
- An active transportation network consisting of pedestrian facilities on both sides of all local and collector roads and in-boulevard cycling facilities (multi-use pathways) along all collector roads is recommended. This continuous, connected and low stress network will make walking and cycling within the FUA an attractive trip choice for residents of all ages and abilities.
- Transportation Demand Management (TDM) strategies for the FUA will be supported by a road network and land use pattern which allow for a more efficient use of the transportation system by providing a built environment which supports alternative modes of transportation such as walking and cycling for everyday trips. It will be a requirement of each subdivision and site plan to implement TDM measures that reduce auto dependency by encouraging a greater proportion of trips to be made by walking, cycling and transit.

5.6.6.2 Next Steps

The next steps of the CMP planning process for transportation projects will include the following:

- For recommended Schedule C road projects, Phases 3 and 4 of the Class EA planning process will be carried out to identify, evaluate and select the preferred road design concepts. The Phases 3 and 4 studies may be carried out and documented in one or more Environmental Study Reports, depending on the anticipated project phasing by the landowners and City of Markham.

- Consideration of phasing of transportation improvements as part of the preparation of FUA Secondary Plans;
- Refinement of cost estimates of the FUA collector road network; and,
- Conformity with mitigation measures required to address potential social and environmental impacts as outlined in this study.

A discussion of transportation recommendations and next steps is provided in **Section 8**. The phasing of development within the FUA is key in ensuring the Community Structure Plan can be implemented in a safe and sustainable manner by providing the residents of this new community with access to adequate municipal services and facilities, including roads, trails, cycling, water and wastewater, fire stations, parks, and community facilities. To accomplish this goal, a master phasing plan will be required to accompany secondary plans and MESPs.

Completion of EA Process

Certain new roads identified in the CMP will require further Class EA undertakings before construction. Based on preliminary cost estimates these undertakings will generally follow the Municipal Class EA process for Schedule C projects. The Class EA Master Plan has been undertaken in a manner that fulfills Phases 1 and 2 of the Municipal Class Environmental Assessment (EA) process and provides a complete assessment of the need and justification for the identified projects. Phases 3 and 4 of the Municipal Class EA undertaking for Schedule C projects will need to be completed prior to construction. Phase 3 of the EA process will involve the development of alternative design concepts, which will finalize the location and configuration of the conceptual collector road alignments shown in the preferred Community Structure Plan, and Phase 4 will document the rationale, and the planning, design and consultation process of the project in an Environmental Study Report.

6 Water Service for Growth

6.1 Water Strategy Overview

To service the FUA growth, a water servicing concept will be identified along with the water infrastructure projects, programs and policies required to support the new residential and employment areas. To service the FUA a network of watermains and related facilities such as reservoirs, pumping stations will be required. For the most part, the recommended road network was used as the template for the water distribution system throughout the FUA. The selection of arterial and collector road locations, was selected as the preferred location for the water servicing facilities as it has been demonstrated to balance the need to respect environmental considerations related to watercourse crossings and impacts on other natural heritage features with the need for water servicing infrastructure.

6.2 Demands for Growth

To accommodate the FUA's land use plan and densities and ensure the FUA's water needs are met to 2031, the system must be expanded and updated to provide both:

- Maximum day demand (MDD) plus fire flow; or,
- Maximum hour demand (City of Markham minimum pressure of 300 kPa).

Using the City's InfoWater water model, the Maximum Day Demand (MDD) scenario was assessed based on a 24-hour simulation. It should be noted that the model currently contains diurnal patterns developed by the City for both Pressure Districts 6 and 7 (PD #6 and PD #7) and by extension includes the Peak hour demand condition.

Added to this model were the demands resulting from the 2031 projected population within the FUA boundary. To generate demands, the City's Design Standards (Section C – Watermain and Appurtenances) were followed. Design flows/demands are based on the following criteria:

- Population as per the Second Iteration and 2031 growth projections in existing areas;
- 365 L/capita/average day demand for both residential and employment;
- MDD peaking factors of 2.0 and 1.4 for residential and non-residential demands, respectively; and,
- Peaking factors of 2.25 and 1.79 for residential and non-residential demands respectively in addition to MDD.

Under fire flow conditions, pressures above 140 kPa (20 psi, minimum stipulated by MOECC) and must be maintained at an arterial watermain level (York Region) and at a City of Markham watermain level. The fire flow considerations included the following:

- Fire Flow will be less when developments are built out due to the friction losses in the mains delivering flow from the arterial mains to the developments; and,
- Fire Flow may vary based on actual elevations. Because points of higher elevation have lower static pressures under normal conditions, they may limit Available Fire Flow by their residual pressures under fire flow conditions.

According to City of Markham standards, Required Fire Flow is to be determined from first principles as per the Fire Underwriters Survey. Because the FUA development details are not available at this time, a minimum fire flow requirement of 117L/s (7,000 L/min) was used for residential areas and the Required Fire Flow was assumed to be 283L/s (17,000L/min) for non-residential areas.

6.3 Development and Screening of Water Strategies

Four water servicing strategies were developed to initially screen the best means to meet the FUA's demand and fire flow requirements to service future growth. These strategies comprised both existing planned infrastructure and new infrastructure projects. Descriptions of each servicing strategy are presented in **Table 6.1**.

Table 6.1 Description of Water Strategies

Water Strategy	Description
1. Do Nothing	There is no construction of new water distribution infrastructure other than the immediate local servicing within the FUA. The watermains will supply water from the existing distribution system to new developments as they are built.
2. Increase Existing Water Distribution System Capacity	Allow new developments within the FUA to be built gradually north and east from existing water distribution infrastructure, supplying new watermains through connections to existing infrastructure. Existing infrastructure upgrades to be made as needed.
3. Construct New Water Distribution Infrastructure	Provide new water distribution network within the FUA to provide water service throughout, allowing for developments to be built largely independent of one another. New distribution network will be supplied by connections to existing water distribution infrastructure where no upgrades are undertaken.
4. Combination of Strategy 2 and 3	Provide new water distribution network within the FUA to provide water service throughout, allowing for developments to be built largely independent of one another. New distribution network will be supplied by connections to existing water distribution infrastructure. Upgrades to existing infrastructure will be made as needed to ensure the level of service within the FUA satisfies the City's requirements.

The four water servicing strategies were screened using a set of criteria developed by the City for the purpose of evaluating all major infrastructure projects associated with the FUA. The water servicing strategies were screened based on the following screening criteria:

1. Is the strategy consistent with the goals and objectives of Markham's Official Plan?
2. Does the strategy meet projected water demand and pressure?

3. Does the strategy support population and employment growth to 2031?
4. Is the strategy consistent with the policy directions of the Markham Growth Management Strategy?
5. Is the strategy consistent with "Greenprint" - the Markham Community Sustainability Plan?
6. What is the Capital Cost
7. What are the Operation and Maintenance Costs

Table 6.2 identifies the screening criteria and the results of the screening process.

6.4 Development of Water Servicing Network Concepts

Following the initial screening process, two broad conceptual-level water servicing network concepts were developed based on the available infrastructure and proposed Regional services. The broad water servicing network concepts were for interim or ultimate water servicing; that is, with and without the development of post-2031 Regional improvements as noted in the York Region Water and Wastewater Master Plan, 2016.

Lands within the FUA are located in either PD #6 or PD #7 as shown in **Figure 6.1**. The FUA lands located south of Elgin Mills Road are supplied by PD #6 while PD #7 generally supplies FUA lands located north of Elgin Mills Road.

- **Pressure District 6**: Existing service elevations range from 195 m to 229 m. This PD will expand east from the existing area near Highway 404 and north from Major Mackenzie Drive East.
- **Pressure District 7**: This PD includes part of Stouffville. Existing service elevations range from 227 m to 256 m. This PD will expand east from the existing area near Highway 404 and north from Elgin Mills Road East.

The York Region Water and Wastewater Master Plan, 2016 identified water servicing infrastructure required to service the FUA, including a new PD #7 pump station and associated watermains; however, the proposed construction timeframe for the new PD #7 pumping station is post-2031.

Existing communities within PD #6 are serviced by an existing water system which is sufficiently sized and adequately supplied for servicing the FUA once it is developed with its own watermain network to connect it to the existing water infrastructure. New Regional infrastructure for servicing PD #6 is not required.

Existing communities within PD #7 are serviced by a single Regional watermain supply point from Richmond Hill, along Elgin Mills Road.

Table 6.2 Screening of Water Servicing Strategies

Screening Criteria	Results				
	1. Do Nothing	2. Increase Capacity	3. New Services	4. Combination of #2 and #3	Key Conclusions Legend: X The Strategy does not satisfy the screening criteria √ The Strategy satisfies the screening criteria √+ The Strategy satisfies the screening criteria and provides additional benefits as compared to the other strategies
1. Is the strategy consistent with the proposed vision and key principles of the FUA?	X	√	√	√	• Do Nothing is not consistent with the vision or principles defined for the FUA. • Strategies 2, 3 and 4 would satisfy most elements of the vision, with water services that supports a complete, compact, healthy and accessible community.
2. Does the strategy meet projected water demand and pressure?	X	X	√	√+	• The 'Do Nothing' strategy will not support increased demands of the FUA. • Strategy 2 will meet demands for areas close to existing serviced areas • Strategies 3 and 4 would meet the projected demands and pressure requirements of the FUA with Strategy 4 providing the requirements more efficiently.
3. Will the strategy support population and employment growth to 2031?	X	X	√	√+	• Strategies 1 and 2 will not meet the servicing needs for the FUA. • Strategy 3 will support growth to 2031. • By increasing capacity of existing services and building new services, Strategy 4 will best meet the population and employment growth in 2031.
4. Is the strategy consistent with the policy directions of the Markham Growth Management Strategy?	X	X	√	√+	• Strategies 1 and 2 are not consistent with the policies of the Markham Growth Management Strategy as they do not provide the needed water services to accommodate growth. • Strategy 3 is generally consistent with the policy directions of the Markham Growth Management Strategy as it would provide water services in coordination with Markham and other levels of government. • Strategy 4 would best meet the principles of Markham's Growth Management Strategy by providing water services in a coordinated and more sustainable fashion.
5. Is the strategy consistent with "Greenprint" - the Markham Community Sustainability Plan?	X	√	√	√+	• Strategy 1 is not consistent with the "Water Efficiency" objective of continual improvements to city systems and the "Energy and Climate" objective to protect water systems included in the "Greenprint" - Markham Community Sustainability Plan.

					• Strategies 2 and 3 are somewhat consistent with the "Water Efficiency" objective of continual improvements to city systems and the "Energy and Climate" objective to protect water systems included in the Markham Community Sustainability Plan. • Strategy 4 is consistent with the Water Efficiency" objective of continual improvements to city systems and the "Energy and Climate" objective to protect water systems.
6. Capital Cost	**X**	**X**	**√**	**√**	• There are no costs associated with 'Do Nothing' strategy; however, without investments, the water system will not meet City needs in the future. • Strategy 2 has a lower capital costs, but does not provide the services needed for the entire FUA. • Strategy 3 can meet the existing servicing needs of the FUA; however, it does not consider servicing future development areas. This approach may cause increased future costs as external lands are built out. • Strategy 4 has the second lowest capital costs and meets all of the FUA servicing requirements. Strategy 4 further reduces costs as it avoids upsizing supply watermains in the near future.
7. Operation and Maintenance Costs	**X**	**X**	**√**	**√+**	• Strategies 1 and 3 do not meet the FUA servicing needs. • Alterative 3 will have operational costs typical of new watermains. • Strategy 4 will have lower operational costs than Strategy 3 as it would be more efficient at meeting the supply requirements.
8. Summary	**X**	**X**	**X**	**√**	• As a result of the screening assessment, the City of Markham recommends Water Servicing Strategy 4. • Strategy 4 will provide water supply to the FUA that is consistent with the water efficiency objectives while comprising lower operational costs. The other concepts were not recommended because: • Strategy 1 does not meet the growth requirements; • Strategy 2 will not meet the FUA servicing needs; and • Strategy 3 does not consider future developments and may result in higher capital costs.

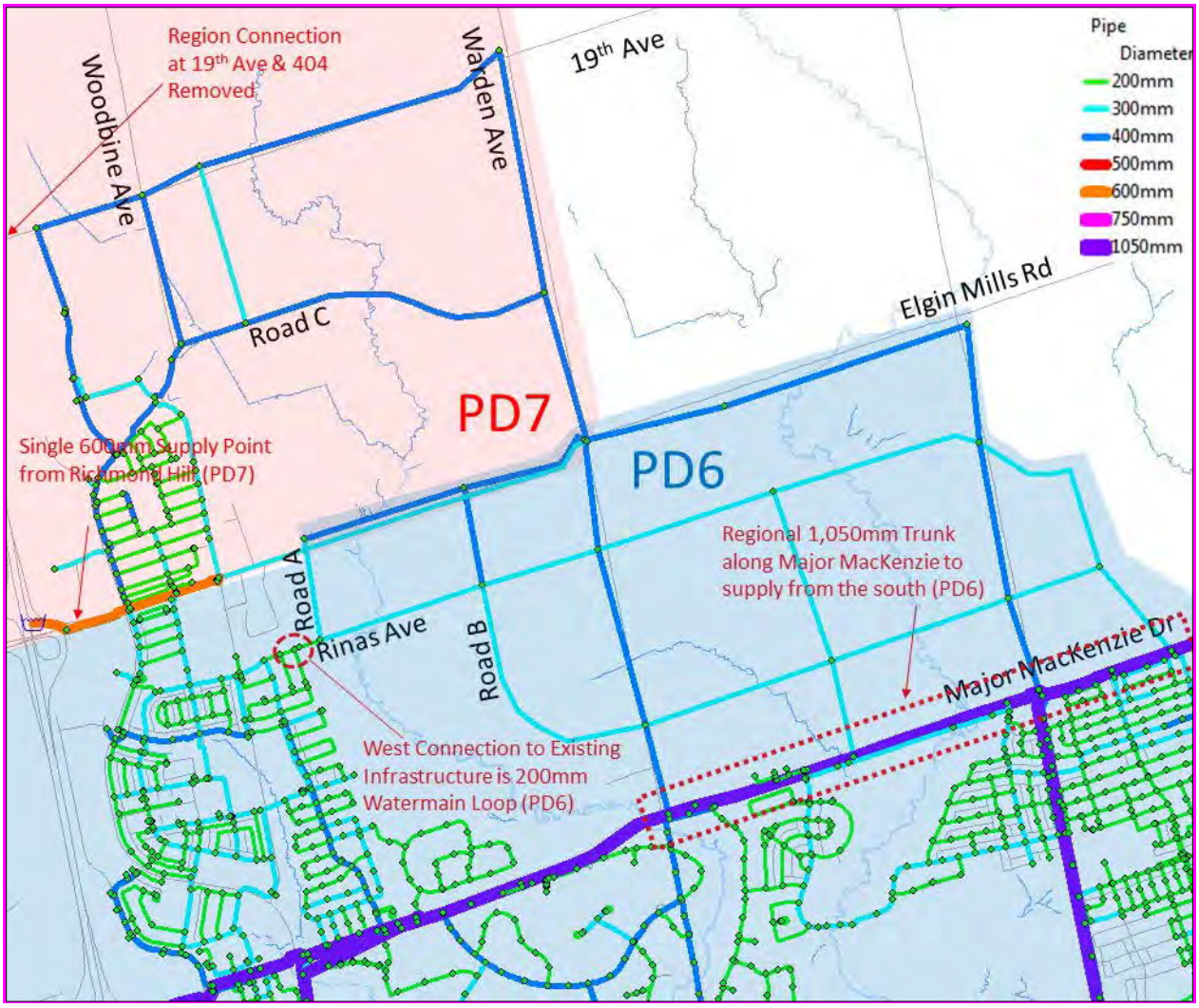


Figure 6.1 Pressure Districts and Constraints on FUA Water Supply

Constraints on the FUA water supply are shown in **Figure 6.1** and include:

- York Region Master Plan, 2016 deferred the proposed regional connection to the west in the area of 16th Avenue and Highway 404 to post 2031.
- Generally, elevation increases to the north which may results in pressure concerns within PD #6 in the area of Elgin Mills Road. System improvements or PD boundary relocation may be required to provide adequate level of service in this area.
- Built and natural boundaries including Highway 404 to the west and streams and green spaces may will require crossings by new projects and special mitigation measures.

The pressure boundary was further examined in the FUA study and redefined to elevation of 227.00masl, in order to meet criteria without further oversizing and looping of sub-trunks and feedermains.

The York Region Water and Wastewater Master Plan, 2016 stated the Region's preferred servicing strategy to supply water to the PD #7 includes a new PD #7 pumping station and watermains to provide a secondary feed. Timing of construction of the pump station and associated infrastructure is identified as 2031-2035 in the Regional Master Plan. The new PD #7 pumping station is proposed to be constructed adjacent to the existing North Markham Reservoir (located near McCowan Road and Stouffville Sideroad) as shown in **Figure 6.2**.

The Future North Markham PD #7 Pump Station and the alignment of the watermain are to be confirmed by the Region as part of future studies. The preferred water servicing main will connect to the existing Regional watermain on Elgin Mills Road East as shown in **Figure 6.2**.

The following is an excerpt from the York Region Water and Wastewater Master Plan, 2016: "*Construct a new 350L/s pumping station assumed to be located adjacent to the existing North Markham Reservoir and 10km of watermain from the new pumping station to the existing* PD #7 *watermain at the intersection of Woodbine Avenue and Elgin Mills Road. This project is required to support urban expansion north of Elgin Mills Road in Markham.*"

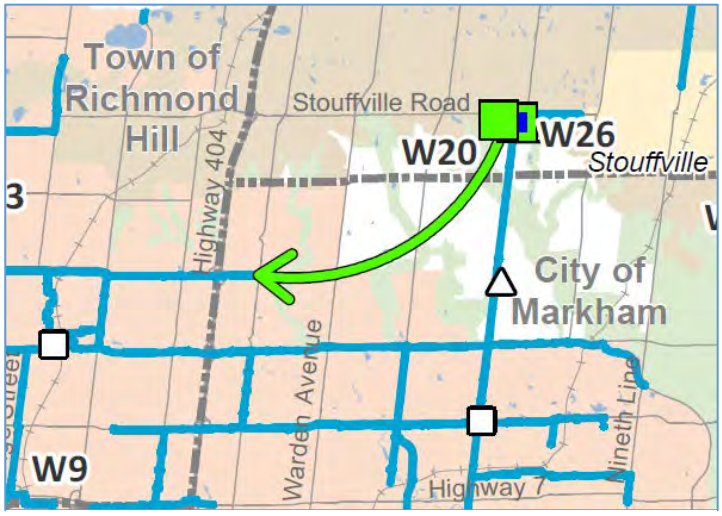


Figure 6.2 Future York Region PD#7 Pump Station and Watermain

Figure 6.3 and **Figure 6.4** show the Ultimate and Interim Water Servicing Network Concepts.

Typically, for system safety a second supply point is required. In the event of a watermain being temporarily out of service (e.g., due to breaks, reconstruction, etc), the area within PD #7 could be temporarily supplied with water from the PD #6. The Project Team concluded that water pressures and flows in the PD #7 area would not be able to meet the City's criteria and would leave the PD #7 area vulnerable to emergency situations while the Regional watermain is out of service.

The construction of the Regional water infrastructure (PD #7 pumping station and associated watermains) is not planned until after the 2031 build-out horizon of the FUA. Until the infrastructure under the ultimate servicing scenario is built, a secondary supply by means of a feedermain on 19th Avenue crossing Highway 404, or a temporary booster station would be required for the servicing of the Employment Block lands north of Elgin Mills Road to add security of supply for the PD #7 area. The preferred location for the temporary booster station is in the vicinity of Warden Avenue and Elgin Mills Road, due to its proximity to both PD #6 and PD #7.

As a result of the consideration of both interim and ultimate water servicing options, four water servicing network concepts were developed in order to provide water service to the FUA. The four water servicing network concepts were based on both the interim and ultimate water servicing concepts and on the road network shown in the Preliminary Community Structure Plan (see **Figure 5.12**), which is also the recommended transportation network concept for the FUA (**Figure 5.14**).

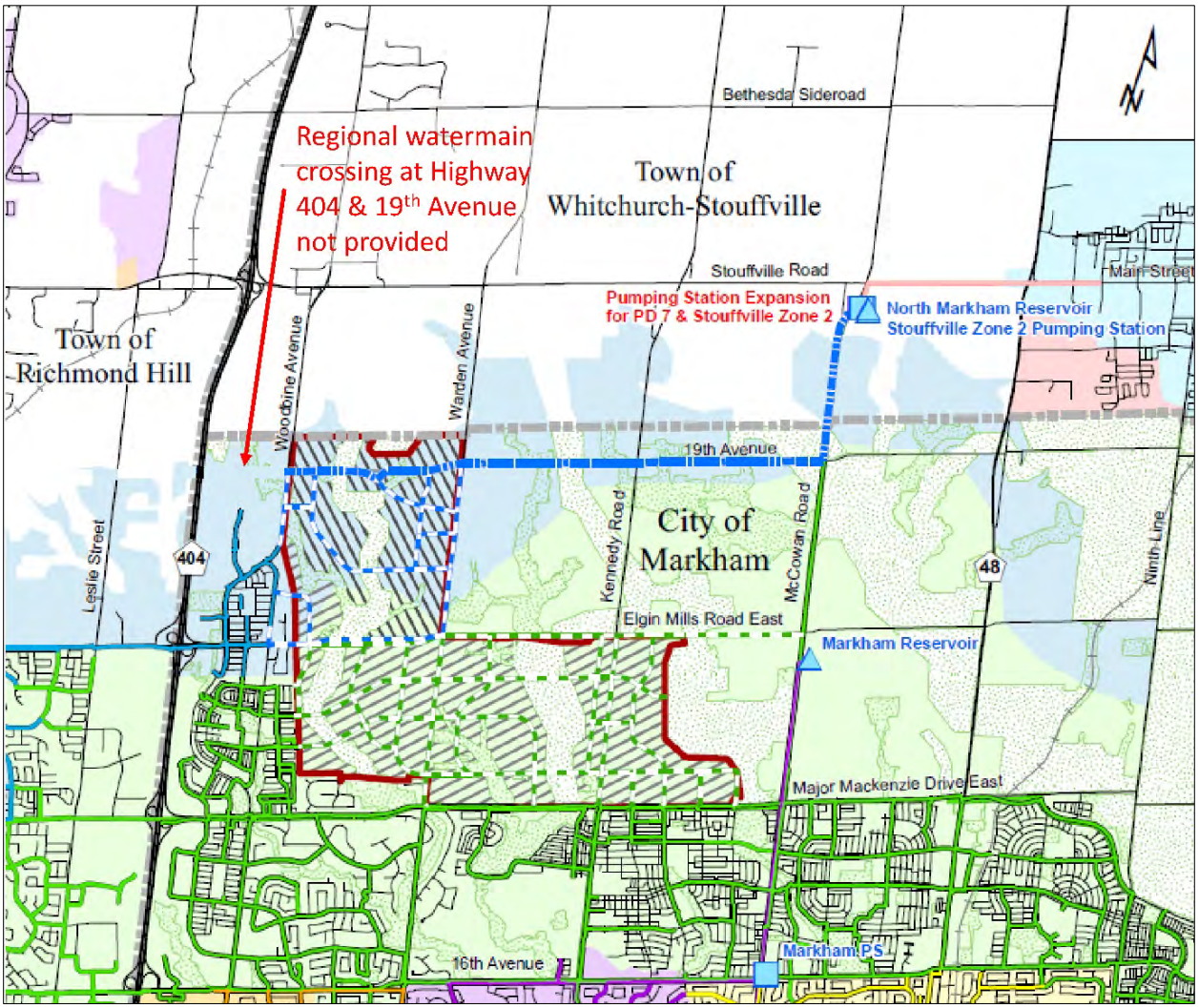


Figure 6.3 Ultimate Water Servicing Concept Option A and B

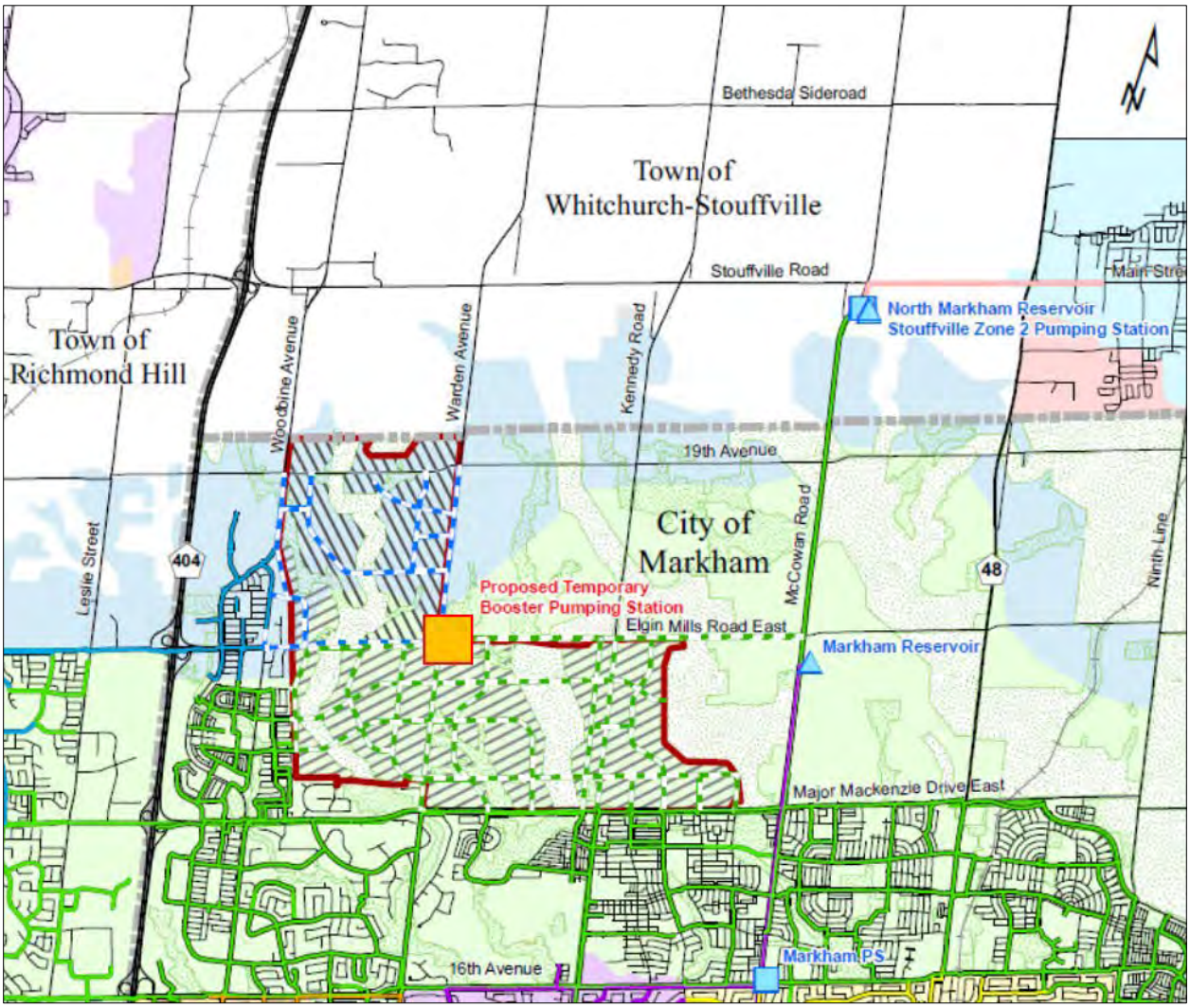


Figure 6.4 Interim Water Servicing Concept Option C and D

The water servicing network concepts options developed for inclusion in the water servicing modelling (see **Appendix D** for results of water servicing modelling) include:

Concept Option A: Three Supply Points for PD #7
This network concept provides three points of supply for PD #7:

- A watermain crossing at Highway 404 and Elgin Mills Road;
- A watermain crossing at Highway 404 & 19th Avenue; and,
- A Regional pumping station located at the North Markham Reservoir feeding PD #7 from the east.

Because the pumping station is scheduled for completion between 2031 and 2035, this network concept is not feasible within the FUA planning horizon, see **Figure 6.3**.

Concept Option B: Two Supply Points for PD #7
Without the PD #7 pumping station built at the North Markham Reservoir, the two watermain connections crossing Highway 404 (at Elgin Mills Road and 19th Avenue) could provide redundancy of supply for PD #7 within the FUA. The York Region Water and Wastewater Master Plan, 2016 does not recommend a watermain crossing at Highway 404 and 19th Avenue. Consequently, this network concept leaves only one point of supply, which is not feasible from a security of supply standpoint, see **Figure 6.3**.

Concept Option C: Booster Pumping Station with Large Arterial Watermains
This network concept provides a PD #6 to PD #7 booster pumping station as the second point of supply to PD #7 east of Highway 404 to supplement the watermain crossing Elgin Mills Road. This network concept would feature larger arterial watermains to distribute flow to the north end of PD #6 as well as throughout PD #7, see **Figure 6.4**.

Concept Option D: Booster Pumping Station with Smaller Watermains
This network concept features the same PD #7 supply points as network concept C and provides a parallel network of smaller watermains with an equivalent cross-sectional area as the larger arterial watermains to distribute water to the north end of PD #6 and throughout PD #7. **Table 6.3** illustrates this concept, see **Figure 6.4**.

Table 6.3 Characteristics of Network Concept "Water – D"

Larger Arterial Watermain		Watermain Network Alternative		% Equivalent Area
Diameter (mm)	Area (m^2)	Main Combination	Area (m^2)	
600	0.283	500mm & 300mm	0.267	94%
600	0.283	2 x 400mm	0.251	89%
500	0.196	400mm & 300mm	0.196	100%
400	0.126	2 x 300mm	0.141	113%

6.5 Evaluation of Water Strategy Network Concepts

The water servicing network concepts were evaluated using a common set of criteria to determine a preferred concept. The evaluation criteria included the following categories:

- Natural Environment;
- Social Environment;
- Technical Considerations; and,
- Cost Considerations.

For the natural environment, potential aquatic and terrestrial system impacts were addressed as a result of water infrastructure construction and more broadly, development of the FUA community. Factors affecting the degree to which water infrastructure could impact the natural environment include the number/amount of green space crossed, the location of environmentally sensitive areas (ESAs) and the number of watercourses crossed.

Social environmental considerations are also important both during and after construction of water infrastructure. They include avoiding impacts to archaeological and heritage resources (including Indigenous resources), as well as minimizing the effects on the community, urban green spaces, etc. The concepts must also address their potential impact post-construction, including how the community's air quality, traffic and noise will be impacted.

In addition to evaluating how the water infrastructure could impact the community and adjacent lands, the feasibility and estimated costs (capital and operations and maintenance) of infrastructure projects were evaluated. Another factor considered is whether the construction of infrastructure can be phased at a high level over a long period of time and developed only when needed.

6.5.1 Evaluation of Concepts A - D

Table 6.4 summarizes the evaluation of water servicing network concepts options A, B, C and D. The water servicing network concepts are based on specific water servicing infrastructure as shown on **Figures 6.3 and 6.4**. The four concept options (A, B, C, and D) were based on the Preliminary Community Structure Plan (see **Figure 5.12**), which is also the recommended transportation network concept for the FUA (**Figure 5.14**).

Table 6.4 Evaluation of Water Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Water Servicing Network Concepts			
		A	B	C	D
		Three Supply Points for PD #7	Two Supply Points for PD #7	Booster Pumping Station / Large Watermains	Booster Pumping Station / Smaller Watermains
Natural Environment					
Terrestrial System	• Degree of impact on terrestrial habitats or systems, including terrestrial features / functions (ANSIs, ESAs), unique vegetation species, mature trees, existing park / open space, linkages or wildlife.	4 crossings of Greenway Least crossing length Follows road alignment	5 crossings of Greenway Follows road alignment except for one area	5 crossings of Greenway 1 crossing more sensitive Follows road alignment except for one area	4 crossings of Greenway 1 crossing more sensitive Follows road alignment
Aquatic System	• Degree of impact aquatic habitats or systems including possible impacts on aquatic life, feature / functions and water quality.	2 watercourses crossed Follows road alignment	3 watercourses crossed Follows road alignment	3 watercourses crossed Follows road alignment	2 watercourses crossed Follows road alignment
Social Environment					
Urban Green Spaces	• Degree of impact to existing urban spaces including parks, ravines and open spaces during construction.	Short-term impact resulting from construction. Mitigation measures required.	Short-term impact resulting from construction. Mitigation measures required.	Short-term impact resulting from construction. Mitigation measures required	Short-term impact resulting from construction. Mitigation measures required
Community Impacts during Construction	• Degree of impact to the community in terms of access to the site, visibility, road access, possible noise / odour / light and other short term construction impacts.	Short-term impact to community associated with noise, dust, traffic and construction.	Short-term impact to community associated with noise, dust, traffic and construction.	Short-term impact to community associated with noise, dust, traffic and construction.	Short-term impact to community associated with noise, dust, traffic and construction.
Post Construction Community Impacts	• The extent to which the concept blends in with the existing land uses in terms of minimizing impacts related to visibility, noise, air emissions, traffic congestions and regulatory requirements.	Compatible with post-construction communities.	Compatible with post-construction communities	Compatible with post-construction communities.	Compatible with post-construction communities.

Table 6.4 Evaluation of Water Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Water Servicing Network Concepts			
		A	B	C	D
		Three Supply Points for PD #7	Two Supply Points for PD #7	Booster Pumping Station / Large Watermains	Booster Pumping Station / Smaller Watermains
Archaeological, Heritage Resources and First Nations	• Degree of impact on existing archaeological and heritage resources, including Indigenous archaeological resources.	Potential impact of lands with archaeological potential; mitigation measures sought for properties impacted.	Potential impact of lands with archaeological potential; mitigation measures sought for properties impacted.	Potential impact of lands with archaeological potential; mitigation measures sought for properties impacted.	Potential impact of lands with archaeological potential; mitigation measures sought for properties impacted.
Technical Considerations					
Feasibility	• Space Availability and Accessibility – Accessibility to the system associated with construction, long term maintenance and operation and future infrastructure works. • Complexity of System – What is the complexity of a system concept with respect to configuration, operation and maintenance and control?	System is accessible and will follow road rights-of-ways. Segments through green space may have access issues. Pump station slated for completion between 2031 and 2035, so not feasible for servicing in either 2016 or 2031.	System is accessible and will follow road rights-of-ways. Segments through green space may have access issues. Will only feature one supply point and will not be feasible from a security of supply perspective as a result removal of watermain crossing at Highway 404 and 19th Avenue.	System is accessible and will follow road rights-of-ways. Requires the construction, operation and maintenance of a temporary booster pumping station. Potential pressure issues at the north end of PD #6 may require system modifications.	System is accessible and will follow road rights-of-ways. Requires the construction, operation and maintenance of a temporary booster pumping station. Potential pressure issues at the north end of PD #6 may require system modifications.
Constructability	• Construction Constraints /Ease of Construction – The degree to which the concept is easy to construct with respect to conflicts, alignment and overall depth of system. • Construction of Projects that can be Coordinated with Road Improvements or Construction – A concept that can be coordinated with other infrastructure improvements now and in the future.	Generally will follow road-right-of-way. 2 creek crossings, which will have sufficient cover. 4 Greenway crossings.	Generally will follow road-right-of-way. 3 creek crossings, which will have sufficient cover. 5 Greenway crossings.	Generally will follow road-right-of-way. 3 creek crossings, which will have sufficient cover. 5 Greenway crossings.	Generally will follow road-right-of-way. 2 creek crossings, which will have sufficient cover. 4 Greenway crossings.

Table 6.4 Evaluation of Water Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Water Servicing Network Concepts			
		A	B	C	D
		Three Supply Points for PD #7	Two Supply Points for PD #7	Booster Pumping Station / Large Watermains	Booster Pumping Station / Smaller Watermains
Performance	• Effectiveness in Providing Required Level of Service for 2031 – Effectiveness of the concept to meet City performance requirements. • Impacts on Existing Service – The impact of the concept on areas of existing service associated with increased demand (i.e., potential decrease in service pressure and available fire flow).	Pumping station at North Markham Reservoir assumed to be effective in providing the level of service required. Provides security of supply with at least two supply points.	Concept will not provide security of supply.	Effective in providing service pressures for PD #7. Pressure issues exist in north end of PD #6 – will require larger mains and/or PD #6/7 boundary relocation. Provides security of supply with at least two supply points.	Effective in providing the level of service required for PD #7. Pressure issues exist in north end of PD #6 – will require larger mains and/or PD #6/7 boundary relocation. Provides security of supply with at least two supply points.
Reliability and Operation	• Ability to Maintain Existing Services During and Following Construction – Continuity of service to existing homes. • Compatible with the York Region's 2016 Water and Wastewater Master Plan Update Infrastructure – Is this concept complementary to York Region's 2016 Water and Wastewater Master Plan Update? • Potential Opportunities / Constraints to Service Build-Out Condition – Is there opportunity to expand the concept to provide service for build-out conditions. • The Degree to which the Concept will Increase Operational and Maintenance Requirements – Are the operation and maintenance needs more for a network concept? • Reliability of Service – Does the concept provide a greater degree of	Existing services can be maintained. This network concept is not consistent with York Region's 2016 Water and Wastewater Master Plan Update as there will be no PD #7 crossing at Highway 404 and 19th Avenue. However, the pump station is expected to be built between 2031 and 2035. There is an opportunity to expand the servicing beyond the current urban boundaries if sized appropriately. Operation and maintenance requirements minimal.	Existing services can be maintained This network concept is not consistent with York Region's 2016 Water and Wastewater Master Plan Update as there will be no PD #7 crossing at Highway 404 and 19th Avenue. There is an opportunity to expand the servicing beyond the current urban boundaries if sized appropriately. Operation and maintenance requirements minimal.	Existing services can be maintained This network concept is in line with the York Region's 2016 Water and Wastewater Master Plan Update. The temporary booster pump station will be owned and operated by the City and may be decommissioned once PD #7 pump station is online. There is an opportunity to expand the servicing beyond the current urban boundaries if sized appropriately. Additional operation and maintenance required for temporary booster pumping station.	Existing services can be maintained This network concept is in line with the York Region's 2016 Water and Wastewater Master Plan Update. The temporary booster pump station will be owned and operated by the City and may be decommissioned once PD #7 pump station is online. There is opportunity to expand the servicing beyond the current urban boundaries if sized appropriately. Additional operation and maintenance required for temporary booster pump station. Greater number of mains will require more maintenance and flushing effort.

Table 6.4 Evaluation of Water Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Water Servicing Network Concepts			
		A	B	C	D
		Three Supply Points for PD #7	Two Supply Points for PD #7	Booster Pumping Station / Large Watermains	Booster Pumping Station / Smaller Watermains
	reliability and minimize the impact of a main break?				Greatest reliability of service as impact of main breaks minimized by network of smaller mains.
Existing Infrastructure	• Utilization of Existing Infrastructure – Does the concept take advantage of existing infrastructure and maximize use? • Existing System Upgrade Requirements – Does the concept require upgrades to the existing system?	Maximizes use of existing infrastructure and delays the need for upgrading existing systems. Requires minimal existing system upgrades.	Maximizes use of existing infrastructure and delays the need for upgrading existing systems. Requires minimal existing system upgrades	Maximizes use of existing infrastructure and delays the need for upgrading existing systems PD #6 may require upgrades in order to improve pressures at north end of PD #6 as temporary booster pumping station will increase flow and friction loss.	Maximizes use of existing infrastructure and delays the need for upgrading existing systems PD #6 may require upgrades in order to improve pressures at north end of PD #6 as temporary booster pumping station will increase flow and friction loss.
Phasing	• Staged Growth and Maximizing Use of Existing or Planned Infrastructure – Does the concept delay the need for system expansion and / or upgrade? Incremental Extensions of Infrastructure as Growth Progresses – Can new infrastructure be phased as well?	PD #7 security of supply cannot be provided east of Highway 404 prior to construction of PD #7 pumping station.	PD #7 security of supply cannot be provided east of Highway 404.	Temporary booster pump station must be built prior to growth in PD #7 due to security of supply. Phasing of watermains may be possible from south to north; however, lower (phased) demands and larger mains may present water age concerns.	Temporary booster pump station must be built prior to growth in PD #7 due to security of supply. Phasing of watermains may be possible from south to north and would be more flexible with smaller mains.
Cost Considerations					

Table 6.4 Evaluation of Water Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Water Servicing Network Concepts			
		A	B	C	D
		Three Supply Points for PD #7	Two Supply Points for PD #7	Booster Pumping Station / Large Watermains	Booster Pumping Station / Smaller Watermains
Costs	• Capital Costs - The capital cost associated with the construction of the concept including labour, material and equipment and possibly property acquisition • Operation and Maintenance Cost - Post-construction operation and maintenance - Post-construction operation and maintenance activities associated with various mitigation measures including regulation inspection, grass cutting / weed control, performance monitoring, sediment / trash removal and energy requirements from pumping, lights, flushing and other operational requirements • Balanced Infrastructure Costs with Staged Level of Growth	Cost not considered as Concept A does not provide servicing for FUA growth to 2031.	Cost not considered as Concept B does not provide security of supply.	Concept C will cost less than Concept D as it will involve fewer mains and crossings. Concept C will likely have lower operation and maintenance costs than Concept D as there would be fewer mains to maintain and flush. Balanced infrastructure costs with staged level of growth to be evaluated in greater detail as the study moves forward.	Concept D will have the highest capital costs due to greater number of mains and crossings. Concept D will likely have higher operation and maintenance costs than Concept C as there would be more mains to maintain and flush. Balanced infrastructure costs with staged level of growth to be evaluated in greater detail as the study moves forward.
Summary of Key "Advantages"		Maximizes use of existing infrastructure while requiring minimal existing system upgrades.	Maximizes use of existing infrastructure while requiring minimal existing system upgrades.	Lower capital cost and operation and maintenance requirements than Concept D.	Greater reliability through distribution network. Greater flexibility in phasing with smaller mains.
Summary of Key "Disadvantages"		Security of supply not available until 2031 to 2035 when PD #7 pump station is complete.	Security of supply not provided as change to York Master Plan has removed PD #7 connection at Highway 404 and 19th Avenue.	Phased demands and larger mains may present water quality challenges.	Higher capital cost and operation and maintenance requirements than Concept C.

Table 6.4 Evaluation of Water Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Water Servicing Network Concepts			
		A	B	C	D
		Three Supply Points for PD #7	Two Supply Points for PD #7	Booster Pumping Station / Large Watermains	Booster Pumping Station / Smaller Watermains
Overall Summary		• **Concept A** is not feasible as it relies on the PD #7 pump station as a point of supply which will not be available until 2031 to 2035. • **Concept B** is not feasible as it does not provide security of supply due to the removal of the PD #7 crossing at Highway 404 and 19th Avenue. • **Concepts C and D** are similar in that they both rely on two points of supply (PD #6-to-PD #7 booster pump station and PD #7 crossing at Highway 404 and Elgin Mills Road). However, these concepts differ in their distribution philosophies: Concept C uses larger arterial mains while Concept D uses smaller networks of pipe. Concept D offers greater reliability when considering the impact of main breaks but has higher capital costs and operation and maintenance requirements. • Overall, **Concept C** is recommended as the preferred water network servicing concept because it has a few complexities (crossings, Greenway System). Network **Concept D** is another possibility. • Network **Concepts A** and **B** are not feasible resulting from the disadvantages noted above. • NOTE: If York Region re-instates the 19th Avenue feedermain **Concept B** should be reconsidered.		

Legend

No Impacts / Mostly Positive Results
Few Impacts / Generally Positive Results
Potential impacts that generally can be managed through mitigation
Potentially significant impacts that can be managed through mitigation / Generally Negative Results
Potential impacts that cannot be mitigated / Mostly Negative Results

As noted in **Table 6.4**, all servicing network concepts presented are similar in complexity, level of service and costs. Concept A and B are not feasible as they rely on the PD #7 pump station as a point of supply and it will not be constructed by the York Region until 2031 to 2035. Concept D offers greater reliability than Concept C, but with higher capital, operation and maintenance costs. Concept C has fewer complexities (e.g., crossings, Greenway System) which resulted in its preference. Water Servicing Network shown in Concept C is recommended as the preferred water network servicing concept.

Concept Option C features a new PD #6 to PD #7 booster pumping station near Warden Avenue and Elgin Mills Road East as shown in **Figure 6.4**. The station would be constructed and operated by the City and decommissioned if/when the Regional PD #7 pumping station is brought online. If York Region re-instates the 19th Avenue feedermain, Concept B should be reconsidered.

6.6 Recommended Water Servicing Network Summary and Next Steps

Based on FUA modelling results the Project Team recommends that the proposed FUA water servicing network concept should consist of trunk watermains and a temporary booster pumping station from PD #6 to PD #7. The principal reasons for the recommended water servicing network concepts are as follows:

- Simulations and coordination with the York Region have confirmed there is sufficient storage in PD #7; and,
- System security by providing a secondary feed from PD #6 to PD #7.

To ensure water supply security in the event of an interruption of the only supply from PD #7 across Highway 404 along Elgin Mills Road East, a new booster pumping station is required to be constructed on a suitable location along Elgin Mills between Woodbine and Warden Avenues. The exact location and configuration will be finalized in subsequent MESP and secondary plans.

The following are further recommendations to be addressed:

- Consider an upper limit to the non-residential Required Fire Flow (RFF) value within the FUA that may be lower than the 283L/s value in the York Region guidelines. In the absence of finalized calculations specific to the developments and building within FUA, these are not possible to calculate. Lowering the Required Fire Flow value would reduce the large main diameters required to provide the fire flow.
- When plans are sufficiently advanced to model smaller-diameter watermains, include enough nodes to represent high and low topography within PD #6 and PD #7 to ensure that adequate pressure is provided throughout.
- Finalize and refine the timing, capacity and cost estimates for the proposed booster pumping station.

Temporary Booster Pumping Station

- For security of supply as the FUA builds out, a temporary booster pumping station will be required until the Regional PD #7 pumping station and the transmission mains to the FUA area become available. Without this temporary booster pumping station, the only water supply to PD #7 within the FUA will be the existing Regional watermain connection crossing Highway 404 at Elgin Mills Road East.

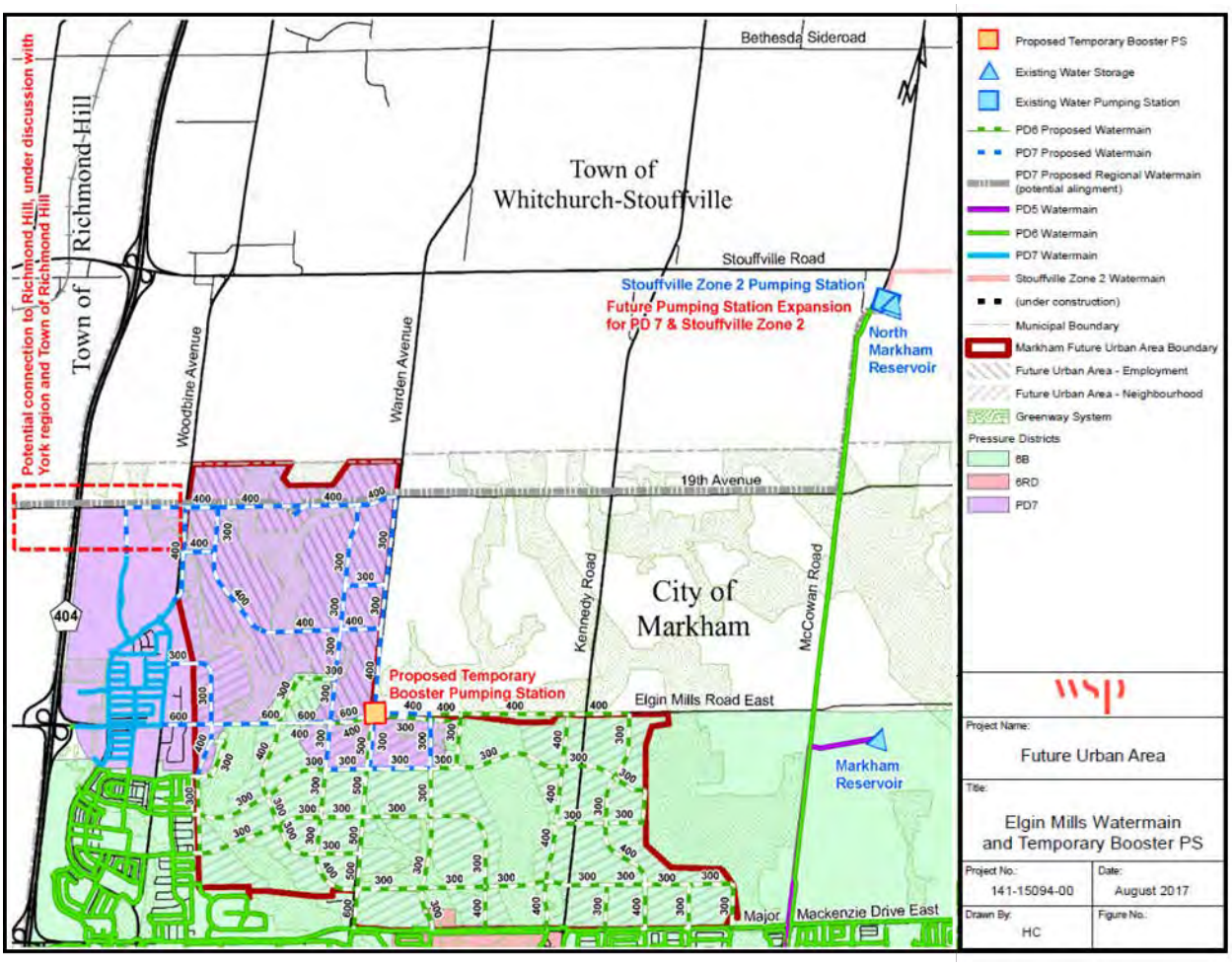


Figure 6.5 Recommended Community Structure Plan with Water Servicing

The exact location of the temporary PD #6 to PD #7 booster PS has not yet been determined. **Figure 6.6** shows potential locations for the proposed pumping station along Elgin Mills Road East. Site selection will be addressed in subsequent Class EA Schedule B.

At the April 13, 2017 TAC meeting, booster pumping station options were discussed and are summarized below:

- **Options A, B and C**: these locations offer the best source reliability as three PD #6 mains would intersect near the booster PS. As well, the supply length would be very short as the booster PS would be located at Warden Avenue and Elgin Mills Road East (essentially within PD #7).
- **Option D**: this location features good source reliability as it is located along a large main on Warden Avenue with ample looping. The supply length is relatively short as the booster PS would be located approximately 300m south of Elgin Mills Road East (PD #7 boundary).
- **Option E**: this location has the longest source length as it is located the furthest west along Elgin Mills Road East (PD #6 north boundary). From a supply perspective, the booster PS would be located mid-block so discharge flow would have to travel east to Warden Avenue or west to Woodbine Avenue in order to service the area to the north.

Next Steps

A discussion of water recommendations and next steps is provided in **Section 8**. Further consultation will be undertaken with York Region and the Town of Richmond Hill on the PD7 watermain on 19th Avenue, as a secondary supply point for Markham's PD7 existing and proposed development. The MESPs submitted in support of secondary plans will be required to include watermain analysis and confirm that phasing of development will meet City criteria for providing a secure water distribution system. MESPs will also be required to identify any water infrastructure required external to the secondary plan area.

Completion of EA Process

As indicated above, the alignments of the new watermains will generally follow the FUA road network and will be required to be constructed as a condition of approval of development. Accordingly, the watermains in the FUA will designated as Schedule A projects and are considered pre-approved and can proceed to implementation by a landowner without any further Municipal Class EA requirements. Watermain projects that cross a watercourse using trenchless technology and are required to be constructed as a condition of approval of a development, are designated as Schedule A/A+ pre-approved projects and can be implement by a landowner without any further Municipal Class EA requirements.

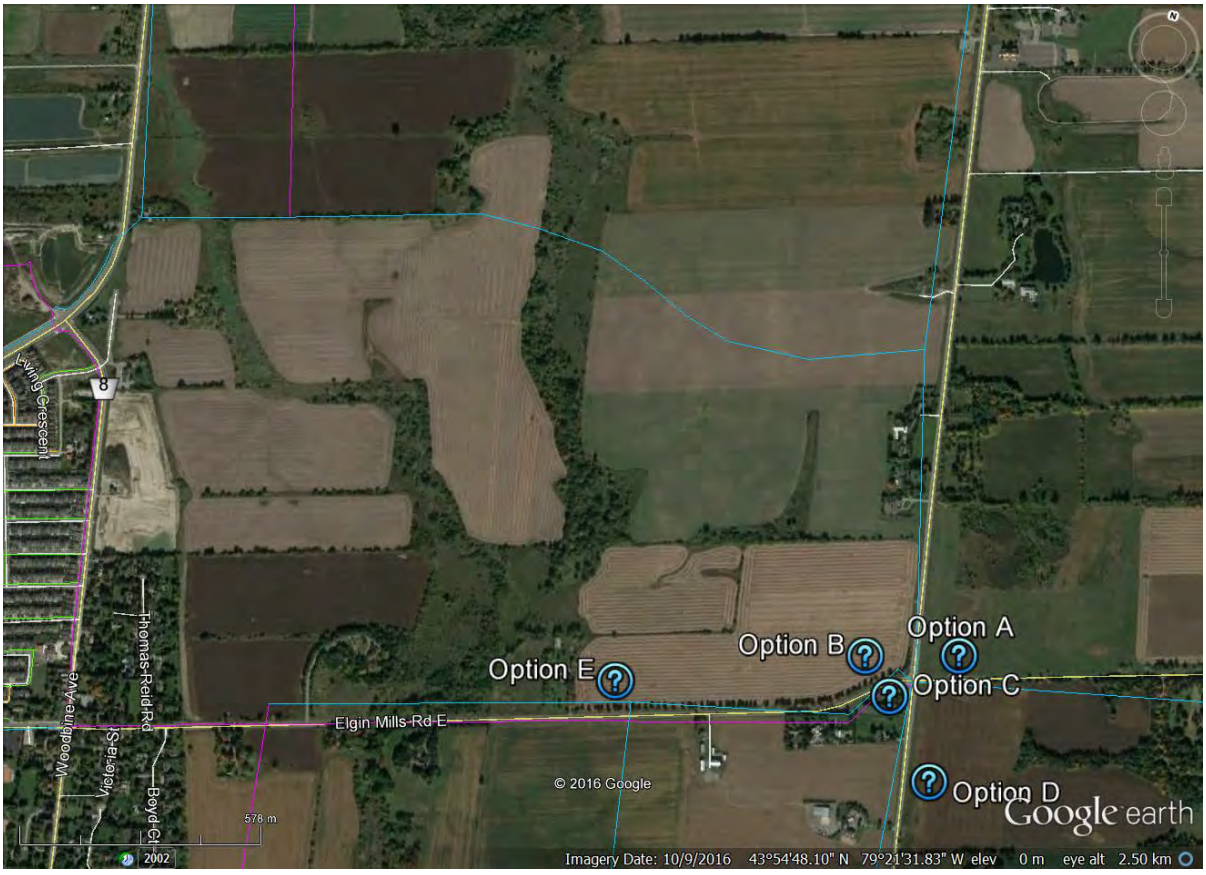


Figure 6.6 Potential Sites for Temporary Water Pumping Station (to 2031)

7 Wastewater Service for Growth

7.1 Wastewater Strategy Overview

The FUA's wastewater servicing strategy will identify the wastewater infrastructure projects, programs and policies required to support the wastewater needs of the new residential and employment areas. In developing and evaluating wastewater servicing strategies for the FUA a range of wastewater services were considered including gravity sewers, sewage pumping stations, new services, and improvements to existing wastewater services. For the most part, the recommended road network was used as the template for aligning the wastewater collection system and locating any wastewater facilities throughout the FUA. The recommended road network respects the environmental considerations related to watercourse crossings and impacts on other natural heritage features. The final alignment will be determined at the secondary plan stage. Consequently, the wastewater servicing strategy and recommended wastewater servicing network extensively overlap with the location of the arterial and collector roads projects.

7.2 Demands for Growth

To ensure the FUA's wastewater needs are serviced to 2031, consideration needs to be given to new systems that are required as well as existing systems that may need to be expanded and updated for growth within the FUA. Servicing the FUA must take into consideration not only the FUA development but ongoing development outside of the FUA that impact the wastewater servicing capacity available for servicing the FUA. There are identified developments in the surrounding wastewater service area (i.e., York Downs) that also require wastewater servicing. The proposed York Downs development (amongst others) will impact existing and future wastewater systems and thus, consideration must be given to these potential developments when looking at wastewater servicing options for the FUA and the surrounding area outside of the FUA. In addition, there are some areas serviced by private septic systems that will require municipal servicing in the future and they could be serviced by the existing systems downstream of the FUA before discharging into the 16th Avenue York-Durham Sewage System (YDSS).

The 2016 York Region Water and Wastewater Master Plan Update, identified that all wastewater from the FUA will ultimately be discharged into the YDSS 16th Avenue trunk main which runs along 16th Avenue just south of the FUA. As identified in 2016 Water and Wastewater Master Plan Update, the YDSS and Duffins Creek Water Pollution Control Plant have sufficient capacity for future growth in Markham, including the FUA.

In terms of conveyance, wastewater originating within the FUA will ultimately need to be conveyed to the YDSS, per the York Region's Master Plan. Servicing the FUA lands should also maximize the built-in existing system capacity identified in the existing wastewater systems outside of the FUA. There was built-in capacity to the south and west of the FUA designed to accommodate some level of development in the lands that are located within the FUA boundary.

The City Design Standards were used to determine the FUA wastewater demands. Design flows for the FUA were based on 2nd Iteration Zone Quantification and the following City's Design Criteria:

- 365 Litres per capita per day (Lpcd) for residential and employment wastewater generation;
- Harmon Peaking Factor; and,
- Extraneous flow allowance of 0.26 L/s/ha.

Outside of the FUA, design flows for growth in the surrounding area were developed using the same flow generation methodology. Where there were existing services, the calibrated hydraulic model was used to define existing flows. Development and analysis of wastewater servicing strategies for the FUA are outlined in the following sections.

7.3 Development and Screening of Wastewater Strategies

The development of wastewater strategies was first considered and documented in June 2012 by York Region and the Town of Markham (now City of Markham) as part of the Regional Official Plan Amendment 3 (ROPA 3) using a refined land budget analysis endorsed by Regional Council in March 2010. The ROPA 3 area became known as the City of Markham Future Urban Area (FUA). At the time, a high level assessment of wastewater servicing strategies was undertaken as part of the ROPA 3 process. The wastewater assessment recognized there was additional servicing capacity built into the existing wastewater systems south of Major Mackenzie Drive East at Angus Glen Boulevard, Prospectors Drive, The Bridle Walk, and in the Woodbine Avenue system west of Berczy Creek. The assessment also acknowledged the 2009 York Region Water and Wastewater Master Plan had identified a North Markham Collector Trunk Sewer. This regional sewer was conceptually shown on McCowan Avenue starting at the 16th Avenue YDSS and extending north of 19th Avenue (final location and route subject to an Environmental Assessment).

The wastewater strategy assessment in 2012 focused on two basic servicing strategies:

1. Convey wastewater from the FUA to the existing wastewater system, with upgrades to accommodate the additional flow, ultimately connecting to the 16th Avenue YDSS between Warden Avenue and Kennedy Road.

2. Convey flows from the Employment Block (north of Elgin Mills Road E between Woodbine Avenue and Warden Avenue) via an east-west new trunk sewer north of Elgin Mills Road to the York Region's proposed North Markham Collector conceptual on McCowan Road. Residential development within the Employment Block would connect to the existing system west of the FUA and Ultimately south to the YDSS on 16th Avenue east of Woodbine Avenue.

Figure 7.1 shows the 2012 servicing strategies considered. At the time, the evaluation identified the first strategy as preferred primarily because of capital costs and the opportunity to defer the North Markham Collector Trunk Sewer to beyond 2031.

The 2012 assessment of wastewater servicing strategies became the foundation of four wastewater strategies to provide for future growth and the expansion of the urban area boundary using information available as part of the Phase 1 assessment. The four strategies reflect the 2012 strategies and carries them through an updated screening process with FUA Phase 1 information to reaffirm the preferred servicing strategy.

These strategies comprised both existing infrastructure data and information reflecting planned infrastructure projects. Descriptions of each servicing strategy are presented in **Table 7.1**.

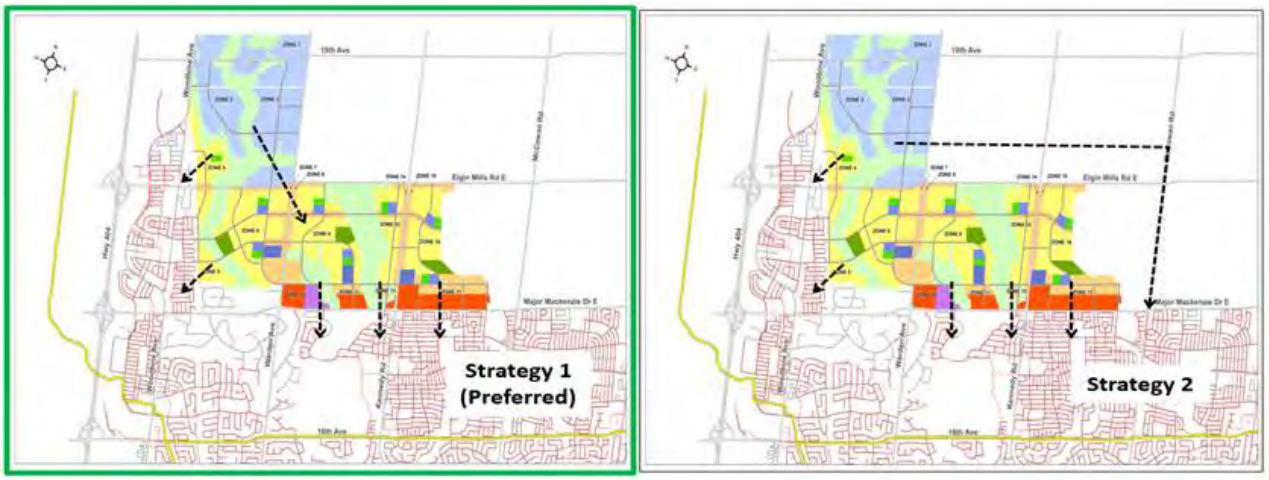


Figure 7.1 2012 ROPA/FUA Wastewater Servicing Strategies

Table 7.1 Description of Water Strategies

Water Strategy	Description
1. Do Nothing	There is no construction of new wastewater infrastructure other than the immediate local servicing within the FUA. The wastewater mains will convey wastewater flow to the existing wastewater system where the existing wastewater infrastructure will be left in place.
2. Increase Existing Wastewater System Capacity	Provide local wastewater servicing in the FUA and convey flows to the existing wastewater system. Infrastructure upgrades within the existing wastewater system are limited to increases in diameter to existing wastewater mains.
3. Construct New Wastewater System Infrastructure	Make use of York Region's proposed North Markham Collector Main (York Region Master Plan, 2009) on McCowan Road by constructing a new main on Elgin Mills Road East to convey wastewater flows from the employment lands. All wastewater flows in the FUA originating south of Elgin Mills Road East are conveyed through existing wastewater infrastructure where no upgrades are undertaken.
4. Combination of Strategy 2 and 3	Provide local servicing within the FUA and convey all flows south through the wastewater infrastructure in the existing urban boundary. Where required, upgrades to the existing wastewater infrastructure are made; however, the construction of new wastewater mains can be completed should it make the most sense.

Four wastewater servicing strategies were screened using a set of criteria developed by the City for the purpose of evaluating all major infrastructure projects associated with the FUA. The screening criteria were based on Markham's core vision and values and also reflected the potential effectiveness of each concept as well as taking into consideration costs at a qualitative level.

The water servicing strategies were screened based on the following screening criteria:

1. Is the strategy consistent with the proposed vision and key principles of the north Markham FUA?
2. Does the strategy meet projected wastewater capacity needs (2031)?
3. Will the strategy support population and employment growth by 2031?
4. Is the strategy consistent with the policy directions of the City of Markham's Official Plan (2014)?
5. Is the strategy consistent with the "Greenprint" – Markham's Community Sustainability Plan?
6. What is the Capital Cost?
7. What are the Operation and Maintenance Costs?

Table 7.2 identifies the screening criteria and the results of the screening process.

The outcome of screening the wastewater strategies clearly shows that Strategy 1 - "Do Nothing" will not provide the servicing necessary. Strategy 2 relies on providing local servicing and upgrading through existing services south of Major Mackenzie Drive East and the Woodbine Avenue systems following existing alignments. This strategy will provide the services needed, but is not necessarily the most cost effective solution and may be more disruptive to the community and environment. Strategy 3, is similar to Strategy 2; however, it involves new infrastructure including conveying the employment lands to a future York Region collector on McCowan Road (North Markham Collector). Other new infrastructure is also considered in Strategy 3 south of Major Mackenzie Drive East. The screening identifies cost as being a significant factor for not selecting Strategy 3 as the cost to service the employment lands is considerably higher than servicing these lands through existing services. However, new infrastructure south of Major Mackenzie Drive East was identified as an advantage over Strategy 2 where only existing alignments are followed. Strategy 4, represents the best of Strategy 2 and 3 where FUA servicing is accomplished through existing services east of Woodbine Avenue and south of Major Mackenzie Drive East where existing services are upgraded and/or new alignments are used to convey wastewater ultimately to the YDSS on 16th Avenue.

The outcome of the screening process identified Strategy 4 as the best wastewater servicing strategy to address the needs of the projected population and employment growth within the FUA while limiting the impact on existing communities. Strategy 4 is consistent with the 2012 ROPA 3 assessment of wastewater strategies of conveying all FUA wastewater through existing City of Markham sanitary systems using upgrades and/or new infrastructure to meet the servicing needs. Wastewater Strategy 4 is therefore carried forward into the next level of investigation to develop more specific servicing concepts and alternatives.

Table 7.2 Screening of Wastewater Servicing Strategies

Screening Criteria	Results				
	1. Do Nothing	2. Increase Capacity	3. New Services	4. Combination of #2 and #3	Key Conclusions Legend: X The Strategy does not satisfy the screening criteria √ The Strategy satisfies the screening criteria √+ The Strategy satisfies the screening criteria and provides additional benefits as compared to the other strategies
1. Is the strategy consistent with the proposed vision and key principles of the north Markham Future Urban Area?	X	✓	✓	✓	• Strategy 1 is not consistent with the vision or principles defined for the FUA. • Strategies 2, 3 and 4 would satisfy most elements of the vision, with wastewater services that support a complete, compact, healthy and accessible community.
2. Does the strategy meet projected wastewater capacity needs (2031)?	X	X	✓	✓+	• Strategy 1 will not meet the capacity needs. • Strategy 2 by itself will not provide the needed capacity to service all of the FUA by 2031. • Strategy 3 will provide the necessary wastewater services. • By increasing the capacity of existing services and building new services, Strategy 4 will best meet the wastewater capacity needs by 2031.
3. Will the strategy support population and employment growth by 2031?	X	X	✓	✓+	• Strategies 1 and 2 will not meet the needs of the FUA. • Strategy 3 will support projected growth by 2031. • By increasing the capacity of existing services and building new services, Strategy 4 will best meet the population and employment growth by 2031.
4. Is the strategy consistent with the policy directions of the City of Markham's Official Plan (2014)?	X	X	✓	✓+	• Strategies 1 and 2 are not consistent with the policies of Markham's Official Plan (2014) as they do not provide the needed wastewater services to accommodate growth. • Strategy 3 is generally consistent with the policy directions of Markham's Official Plan (2014) as it provides wastewater services in coordination with Markham and other levels of government. • Strategy 4 would best meet the principles of Markham's Official Plan (2014) by supporting and providing wastewater services in a coordinated and more sustainable fashion.

5. Is the strategy consistent with the "Greenprint" – Markham's Community Sustainability Plan?	X	✓	✓	✓+	• Strategy 1 is not consistent with the "Water Efficiency" objective of continual improvements to City systems and the "Energy and Climate" objective to protect wastewater system included in the "Greenprint" – Markham's Community Sustainability Master Plan. • Strategies 2 and 3 are somewhat consistent with the "Water Efficiency" objective of continual improvements to City system and the "Energy and Climate" objective to protect wastewater systems included in the "Greenprint" – Markham's Community Sustainability Plan. • Strategy 4 is consistent with the "Water Efficient" objective of continual improvements to City systems and the "Energy and Climate" objective to protect wastewater systems.
6. Capital Cost	X	X	X	✓+	• There are no costs associated with Strategy 1; however without investment, the wastewater system will not meet the City's needs in the future. • Strategy 2 has lower capital costs, but does not provide the services needed for the entire FUA. • Strategy 3 can meet the servicing needs of the FUA; however, the capital costs are substantially higher than Strategy 4 as the former requires deeper pipes, must be constructed upfront to service the employment lands and has more crossings through environmentally sensitive areas. • Strategy 4 has the lowest capital costs and meets all of the FUA's wastewater servicing.
7. Operation and Maintenance Cost	X	X	✓	✓+	• Strategies 1 and 2 do not meet the FUA's servicing needs. • Strategy 3 will have higher costs as it includes more pipe length. As well, there are more crossings that likely will include siphons which require routine maintenance not required by gravity systems. The costs will also be greater because the new services would comprise deeper wastewater mains and may have deposition issues because of low flow conditions. • Strategy 4 has the lowest operation and maintenance costs, as a gravity main system can be expanded to development areas given the initial existing system capacity available.
Summary	X	X	X	√	• As a result of the screening assessment, Strategy 4 was identified as the most feasible servicing strategy, which would be further investigated in future phases of study. • Strategy 4 was deemed the best wastewater servicing strategy to address the needs of the projected population and employment growth within the FUA while limiting the impact on existing communities. Strategy 4 was also the most consistent with key City policies, including the City of Markham Official Plan (2014) and "Greenprint" – Markham's Community Sustainability Plan.

7.4 Development of Wastewater Network Concepts

Building on the selected wastewater servicing strategy, four (4) wastewater servicing network concepts were developed. Each of the four concepts were based on servicing the FUA through existing City sanitary systems with a combination of maximizing existing infrastructure and constructing new wastewater infrastructure. These concept options reflect or mirror the four Preliminary Community Structure Plans (known as Options A, B, C and D) presented in the **Section 5.4**. The wastewater servicing network concepts maximized the use of existing wastewater infrastructure and proposed new wastewater infrastructure where required. The concepts also generally locate services within proposed collector roadways.

The FUA's large service area and its general topography provided the opportunity to develop and evaluate a number of high-level wastewater servicing network concepts based on the strategy of maximizing existing infrastructure and new infrastructure. Key factors in identifying and developing feasible wastewater servicing concepts started with the need to align with the vision and key principles of Markham and the FUA which includes providing wastewater servicing to all developable areas within the FUA, while ensuring existing services are not compromised.

Because the wastewater strategy involves having the FUA serviced through existing infrastructure, the City's hydraulic model (InfoWorks CS) of the existing wastewater system is used to assess the existing wastewater infrastructure and servicing options. The InfoWorks CS model was prepared and calibrated to 2014-2015 flow data representing the City's entire wastewater system. The wastewater model was used to determine the extent of wastewater infrastructure that could be impacted by flows originating in the FUA, as well as to determine preliminary sizing for infrastructure inside the FUA.

Previously, **Figure 4.14** presented the wastewater service area which may be impacted by the FUA. The affected downstream areas are north of 16th Avenue, west of McCowan Road and east of Highway 404. A more thorough assessment was subsequently undertaken to determine the potential impacts on the wastewater infrastructure within the wastewater service areas given the future development in the FUA.

- **Concept Option A** (**Figure 7.2**): Based on the Community Structure Plan Option A and provides a layout of collector wastewater mains and follows entirely the proposed road network, avoids placement of wastewater mains on Regional roads, discharges into the existing wastewater system at six locations and crosses green spaces at four locations. This network concept minimizes the number of connections with the existing wastewater system and reduces the number of possible replacement or new wastewater infrastructure in the existing urban area.
- **Concept Option B** (**Figure 7.3**): Based on the Community Structure Plan Option B and provides a layout of collector wastewater mains similar to Option A. Option B, however, requires construction of a wastewater main on Major Mackenzie Drive East. Other than the main on Major Mackenzie Drive East, Options A and B are largely the same with six wastewater connections between the FUA and the existing wastewater system and four green space crossings.
- **Concept Option C** (**Figure 7.4**): Based on the Community Structure Plan Option C and is similar to Option B in that there are the same wastewater connections between the existing system and the FUA and the construction of a wastewater main on Major Mackenzie Drive East. The two options differ in the location of the green space crossings which is the result of difference in the proposed road networks.

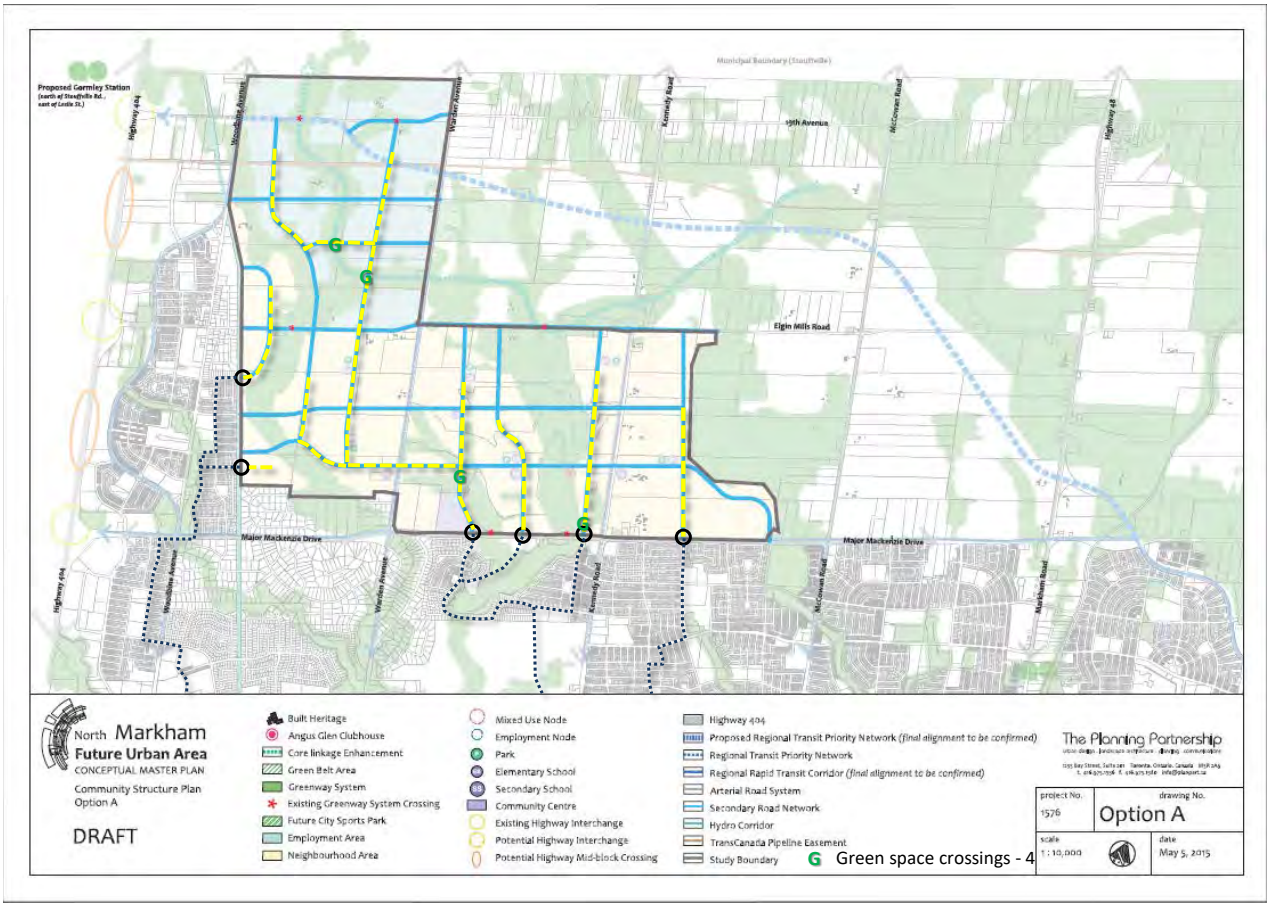


Figure 7.2 Wastewater Servicing Network Concept A

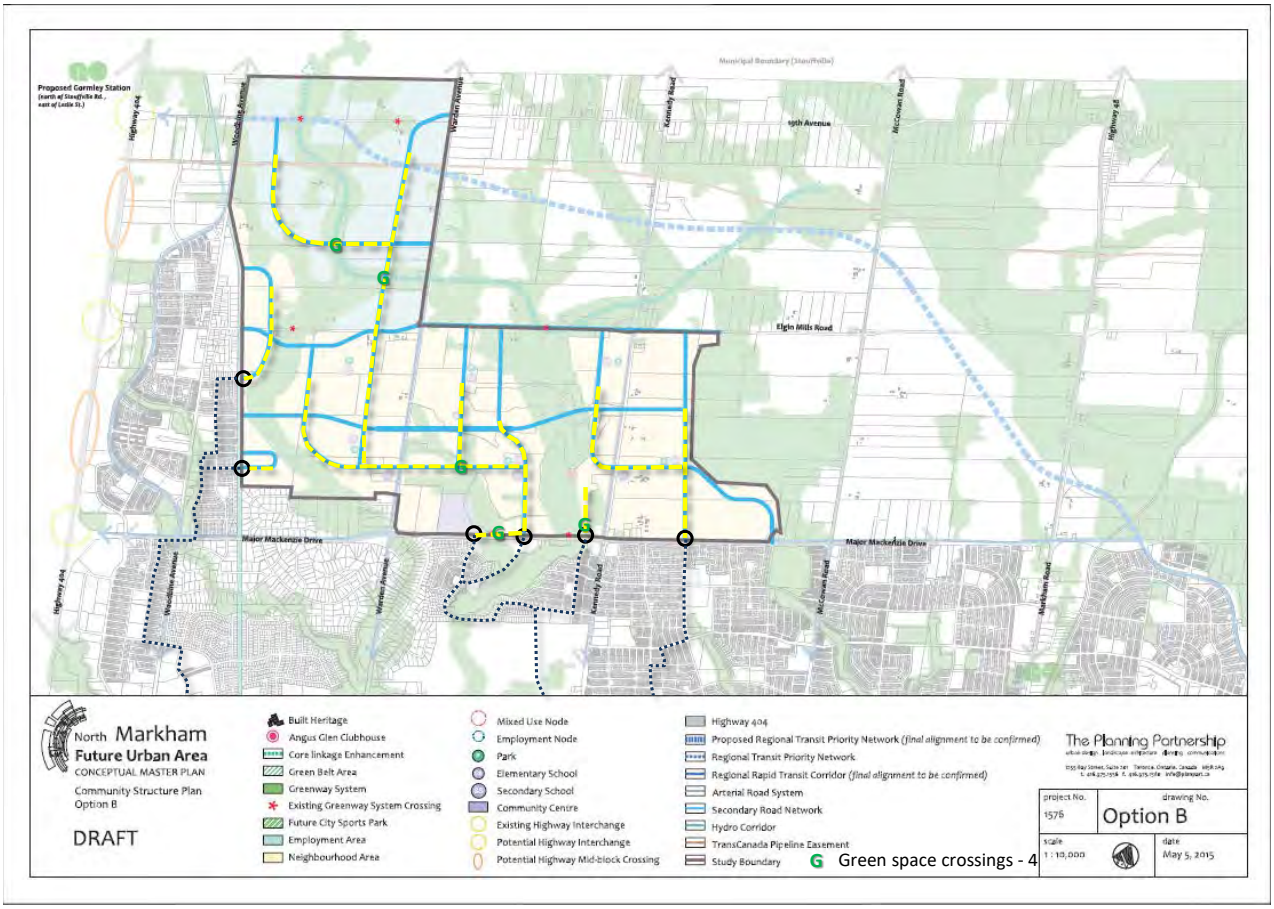


Figure 7.3 Wastewater Servicing Network Concept B

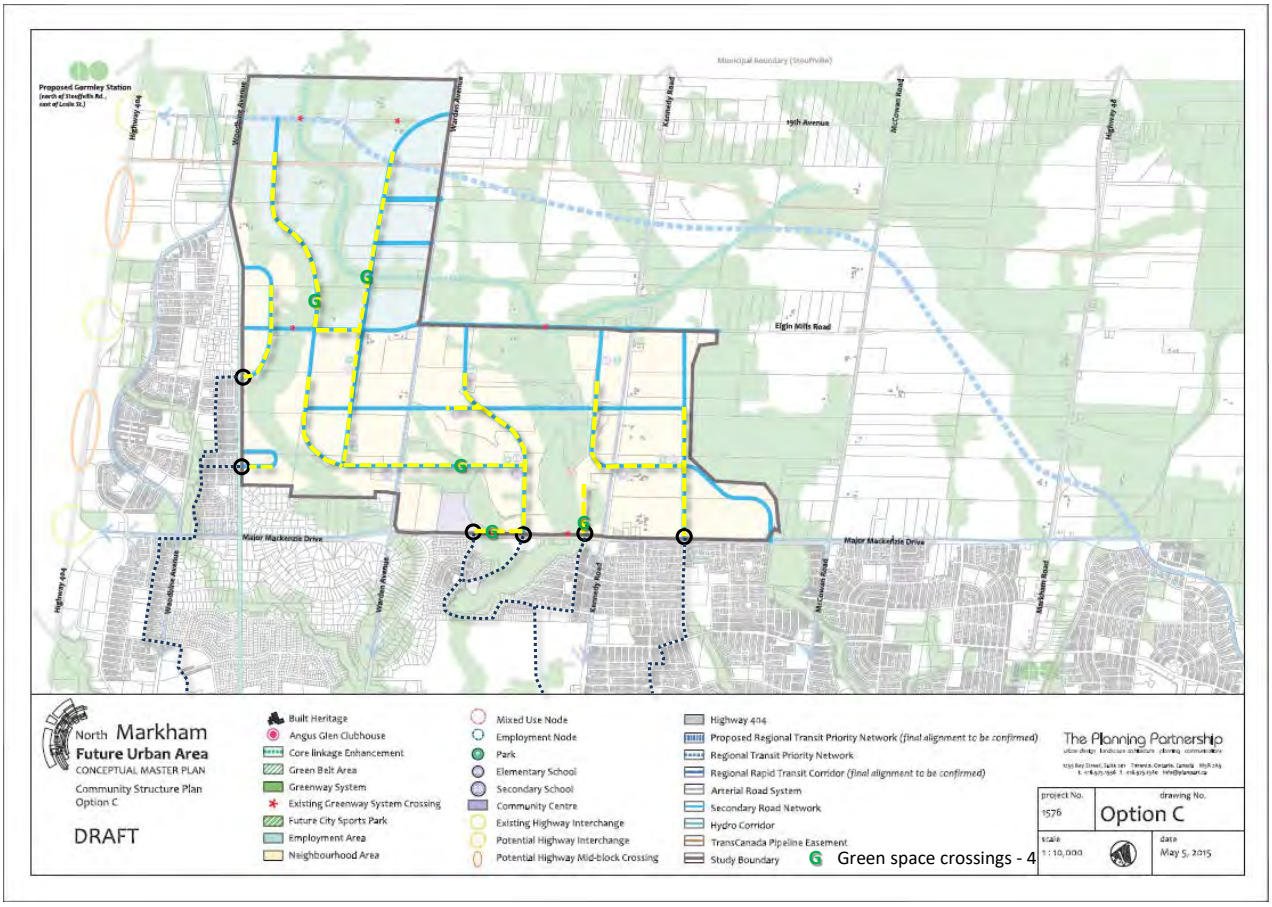


Figure 7.4 Wastewater Servicing Network Concept C

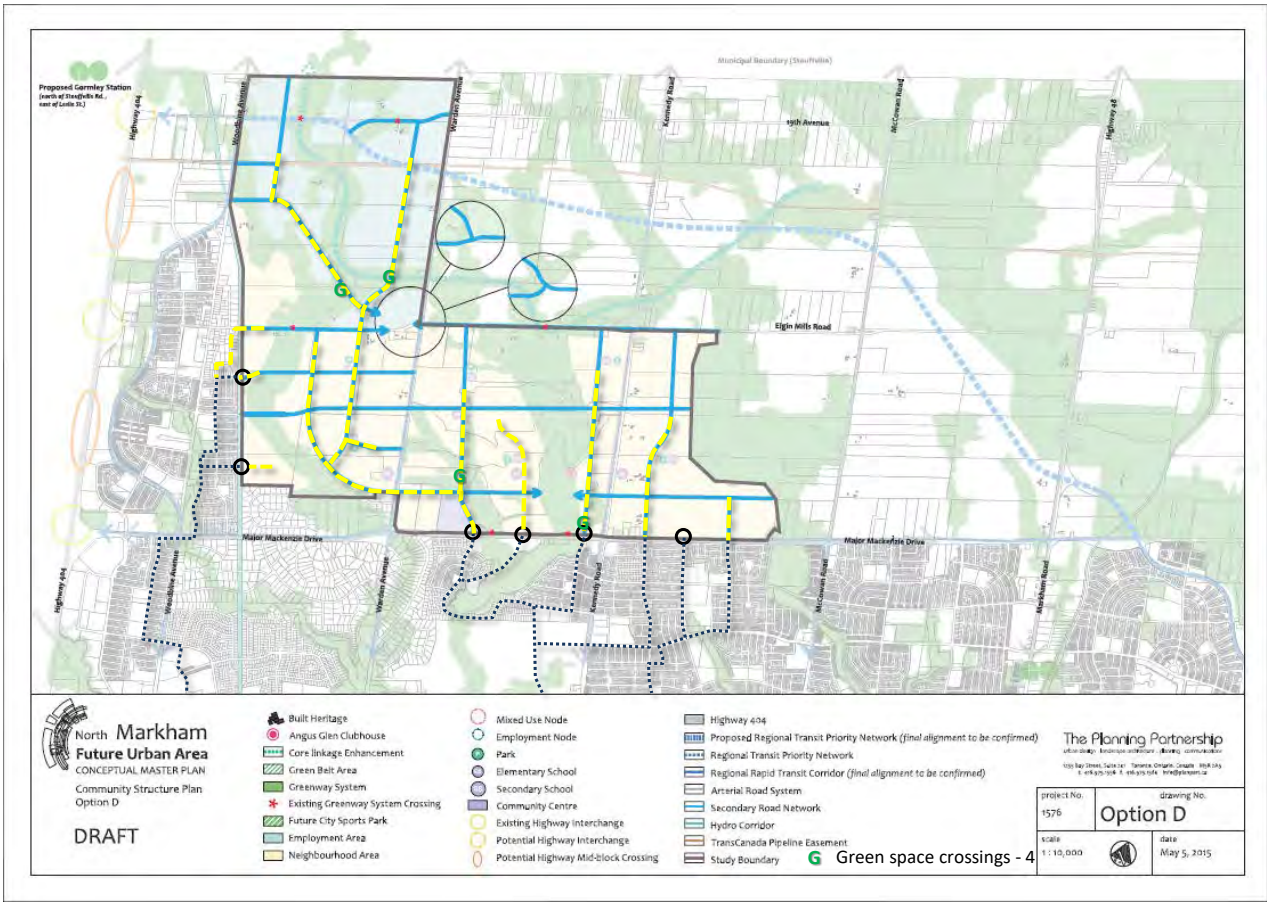


Figure 7.5 Wastewater Servicing Network Concept D

- **Concept Option D** (**Figure 7.5**): Based on the Community Structure Plan Option D. Option D contrasts sharply from the previous options, as it comprises a different road network, collector wastewater mains, the location of the four green space crossings and the number of wastewater connections between the FUA and the existing wastewater system. In Option D, there are eight connections which could result in an increased need to upgrade the existing system or new wastewater infrastructure.

Each of the four wastewater servicing network concepts were developed with the intention of keeping most of the wastewater mains within proposed collector roadways. As the Community Structure Plans were further refined beyond the initial concepts (A to D) to include modifications to land use classifications and some adjustments to road network alignments, only minor adjustments to the proposed wastewater collector mains were required. Although the wastewater system is an integral part of the community, the layout of the new collector wastewater mains may be readily adapted as the FUA is planned. The FUA wastewater servicing is largely defined by the existing system connection points as the FUA has a sloping topography from north to south that makes the area fully serviceable by gravity systems. Each servicing network concept was evaluated using a defined set of criteria to determine the optimal wastewater main layout.

7.5 Evaluation of Wastewater Network Concepts

The four wastewater servicing network concepts were evaluated using a common set of criteria to determine a preferred concept. The evaluation criteria included the following categories:

- Natural Environment;
- Social Environment;
- Technical Considerations; and,
- Cost Considerations.

For the natural environment, potential aquatic and terrestrial system impacts were addressed as a result of wastewater infrastructure construction and more broadly, development of the FUA community. Factors affecting the degree to which wastewater infrastructure could impact the natural environment include the number/amount of green space crossed, the location of environmentally sensitive areas (ESAs) and the number of watercourses crossed.

Social environmental considerations are also important both during and after construction of wastewater infrastructure. They include avoiding impacts to archaeological and heritage resources (including Indigenous resources), as well as minimizing the effects on the community, urban green spaces, etc. The concepts must also address their potential impact post-construction, including how the community's air quality, traffic and noise will be impacted.

In addition to evaluating how the wastewater infrastructure could impact the community and adjacent lands, the feasibility and estimated costs (capital and operations and maintenance) of infrastructure projects were evaluated. Another factor considered is whether the construction of infrastructure can be phased at a high level over a long period of time and developed only when needed.

7.5.1 Evaluation of Concepts A - D

Table 7.3 presents the results of the evaluation of wastewater servicing network Concept Options A through D.

Table 7.3 Evaluation of Wastewater Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Wastewater Servicing Network Concepts			
		A	B	C	D
Natural Environment					
Terrestrial System	• Degree of impact on terrestrial habitats or systems, including terrestrial features / functions (ANSIs, ESAs), unique vegetation species, mature trees, existing park / open space, linkages or wildlife.	• 4 crossings of Greenway • Least crossing length • Follows road alignment	• 5 crossings of Greenway • Follows road alignment except for one area	• 5 crossings of Greenway • 1 crossing more sensitive • Follows road alignment except for one area	• 4 crossings of Greenway • 1 crossing more sensitive • Follows road alignment
Aquatic System	• Degree of impact aquatic habitats or systems including possible impacts on aquatic life, feature / functions and water quality.	• 2 watercourses crossed • Follows road alignment	• 3 watercourses crossed • Follows road alignment	• 3 watercourses crossed • 1 crossing is more sensitive than Concepts A or B • Follows road alignment	• 2 watercourses crossed • 1 crossing is more sensitive than Concepts A or B • Follows road alignment
Social Environment					
Urban Green Spaces	• Degree of impact to existing urban spaces including parks, ravines and open spaces during construction.	• Short-term impact resulting from construction. Mitigation measures required.	• Short-term impact resulting from construction. Mitigation measures required.	• Short-term impact resulting from construction. Mitigation measures required.	• Short-term impact resulting from construction. Mitigation measures required.
Community Impacts during Construction	• Degree of impact to the community in terms of access to the site, visibility, road access, possible noise / odour / light and other short term construction impacts.	• Short-term impact to the community associated with noise, dust, traffic and construction activities. Mitigation measures will be required.	• Short-term impact to the community associated with noise, dust, traffic and construction activities. Mitigation measures will be required.	• Short-term impact to the community associated with noise, dust, traffic and construction activities. Mitigation measures will be required.	• Short-term impact to the community associated with noise, dust, traffic and construction activities. Mitigation measures will be required.
Post Construction Community Impacts	• The extent to which the concept blends in with the existing land uses in terms of minimizing impacts related to visibility, noise, air emissions, traffic congestions and regulatory requirements.	• Compatible with post-construction communities.	• Compatible with post-construction communities	• Compatible with post-construction communities.	• Compatible with post-construction communities.
Archaeological, Heritage Resources and First Nations	• Degree of impact on existing archaeological and heritage resources, including Indigenous archaeological resources.	• Potential impact of lands with archaeological potential; mitigation measures sought for properties impacted.	• Potential impact of lands with archaeological potential; mitigation measures sought for properties impacted.	• Potential impact of lands with archaeological potential; mitigation measures sought for properties impacted.	• Potential impact of lands with archaeological potential; mitigation measures sought for properties impacted.

Table 7.3 Evaluation of Wastewater Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Wastewater Servicing Network Concepts			
		A	B	C	D
Technical Considerations					
Feasibility	• Space Availability and Accessibility – Accessibility to the system associated with construction, long term maintenance and operation and future infrastructure works. • Complexity of System – What is the complexity of a system concept with respect to configuration, operation and maintenance and control?	• System is accessible and will follow road rights-of-way. • Segments through green space may have access issues. • Gravity system - no additional maintenance or controls required. • Downstream improvement likely required in Angus Glen system. Other downstream improvements may be required.	• System is accessible and will follow road rights-of-way. Proposed roadway does not provide servicing route to area between Warden Avenue and Kennedy Road. • Segments through green space may have access issues. • Pipe required on Major Mackenzie Drive to convey flow to Angus Glen system. • Gravity system - no additional maintenance or controls required. • Downstream improvement likely required in Angus Glen system. Other downstream improvement may be required.	• System is accessible and will follow road rights-of-way. Proposed roadway does not provide servicing route to area between Warden Avenue and Kennedy Road. • Segments through green space may have access issues. • Pipe required on Major Mackenzie Drive to convey flow to Angus Glen system. • Gravity system - no additional maintenance or controls required. • Downstream improvement likely required in Angus Glen system. Other downstream improvement may be required.	• System is accessible and will follow road rights-of-way. Proposed roadway does not provide servicing route to area between Warden Avenue and Kennedy Road. • Segments through green space may have access issues. • Gravity system - no additional maintenance or controls required. • Downstream improvement likely required in Angus Glen system. Other downstream improvement may be required. To be investigated further through study.
Constructability	• Construction Constraints /Ease of Construction – The degree to which the network concept is easy to construct with respect to conflicts, alignment and overall depth of system. • Need for Deep Pipe Construction – Creek / Highway / Railway Crossings, Alignment Changes and Potential Challenges During Construction – Construction methods and consideration for the complexity of construction methods associated with a concept.	• Generally will follow road right-of-way. • System depth is reasonable. Deeper than Concept C. • 2 creek crossings which have sufficient cover. • 4 Greenspace crossings.	• Generally will follow road right-of-way. Not all pipes in right-of-way. • System depth is reasonable. Deeper than Concepts A and C. • 3 creek crossings which have sufficient cover.	• Generally will follow road right-of-way. Not all pipes in right-of-way. • System depth is reasonable. Less than Concepts A and B. • 3 creek crossings which have sufficient cover.	• Generally will follow road right-of-way. Not all pipes in right-of-way. • System depth is reasonable. Less than Concepts A, B and C. • 2 creek crossings which appear to have sufficient cover.

Table 7.3 Evaluation of Wastewater Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Wastewater Servicing Network Concepts			
		A	B	C	D
	• Construction of Projects that can be Coordinated with Road Improvements or Construction – A concept that can be coordinated with other infrastructure improvements now and in the future.	• Downstream improvements on Angus Glen Boulevard likely to involve micro-tunneling. Potential to provide alternative outlet to 16th Trunk west side of Bruce Creek.	• 5 Greenspace crossings. • Downstream improvements on Angus Glen Boulevard. Likely to involve micro-tunneling. Potential to provide alternative outlet to 16th Trunk west side of Bruce Creek.	• 5 Greenspace crossings. • Downstream improvements on Angus Glen Boulevard. Likely to involve micro-tunneling. Potential to provide alternative outlet to 16th Trunk west side of Bruce Creek.	• 4 Greenspace crossings. • Downstream improvements on Angus Glen Boulevard likely to involve micro-tunneling. Potential to provide alternative outlet to 16th Trunk west side of Bruce Creek.
Performance	• Effectiveness in Providing Required Level of Service for 2031 – Effectiveness of the concept to meet City performance requirements for new and existing wastewater capacity (i.e., d/D < 85%). • Impacts on Downstream Infrastructure – Potential impact of the concept on downstream infrastructure associated with increased peak flow and volume (i.e., potential increase to risk of basement flooding, system capacity).	• Effective in providing the level of service required. • Downstream wastewater systems will require improvement, although not immediately. • Staging is possible.	• Effective in providing the level of service required. • Downstream wastewater systems will require improvement, although not immediately. • Will not fully utilize capacity built into downstream system. • Staging is possible.	• Effective in providing the level of service required. • Downstream wastewater systems will require improvement, although not immediately. • Will not fully utilize capacity built into downstream system. • Staging is possible.	• Effective in providing the level of service required. • Downstream wastewater systems will require improvement, although not immediately. • May require existing downstream system to be improved immediately. • Staging is possible.
Reliability and Operation	• Ability to Maintain Existing Services During and Following Construction – Continuity of service to existing homes.	• Existing services can be maintained.	• Existing services can be maintained. •	• Existing services can be maintained	• Existing services can be maintained. •
	• Is this concept complementary to York Region's 2016 Water and Wastewater Master Plan Update?	• Is compatible with the York Region's 2016 Water and Wastewater Master Plan Update	• Is compatible with the York Region's 2016 Water and Wastewater Master Plan Update	• Is compatible with the York Region's 2016 Water and Wastewater Master Plan Update	• Is compatible with the York Region's 2016 Water and Wastewater Master Plan Update
	• Is there an opportunity to expand the concept to provide service for build-out conditions?	• There is an opportunity to expand the servicing beyond the current urban boundaries if sized appropriately.	• There is an opportunity to expand the servicing beyond the current urban boundaries if sized appropriately.	• There is an opportunity to expand the servicing beyond the current urban boundaries if sized appropriately.	• There is an opportunity to expand the servicing beyond the current urban boundaries if sized appropriately.
	• The degree to which the network concept will increase operational and maintenance	• Gravity systems – operation and	• Gravity systems – operation and	• Gravity systems – operation and	• Gravity systems – operation and

Table 7.3 Evaluation of Wastewater Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Wastewater Servicing Network Concepts			
		A	B	C	D
	requirements – Are the operation and maintenance needs more for a concept?	maintenance comparable to servicing concepts.	maintenance comparable to servicing concepts.	maintenance comparable to servicing concepts.	maintenance comparable to servicing concepts.
Existing Infrastructure	• Utilization of Existing Infrastructure – Does the concept take advantage of existing infrastructure and maximize use? • Existing System Upgrade Requirements – Does the concept require upgrades to the existing system?	• Maximizes use of existing infrastructure and delays the need for upgrading existing systems. • Existing systems south of Major Mackenzie Drive will require improvements to accommodate full 2031 build out.	• Maximizes use of existing infrastructure and delays the need for upgrading existing systems. • Existing systems south of Major Mackenzie Drive will require improvement to accommodate full 2031 build out.	• Maximizes use of existing infrastructure and delays the need for upgrading existing systems. • Existing systems south of Major Mackenzie Drive will require improvement to accommodate full 2031 build out.	• Maximizes use of existing infrastructure and delays the need for upgrading existing systems. • Existing systems south of Major Mackenzie Drive will require improvement to accommodate full 2031 build out.
	• Impacts on the Sizing of Existing Infrastructure – Is the existing infrastructure adequately sized or will more capacity be required? • Trunk Infrastructure that Potentially Should be Oversized to Accommodate Future Growth – Is there opportunity to service a larger area with the concept beyond 2031?	• Potential alternative servicing with new connection to 16th trunk west of Bruce Creek. • Other local improvements may be required west of Woodbine Avenue in the existing system. • The system improvements can be enhanced to accommodate an expanded urban area beyond 2031.	• Potential alternative servicing with new connection to 16th trunk west of Bruce Creek. • Other local improvements may be required west of Woodbine Avenue in the existing system. • The system improvements can be enhanced to accommodate an expanded urban area beyond 2031.	• Potential alternative servicing with new connection to 16th trunk west of Bruce Creek. • Other local improvements may be required west of Woodbine Avenue in the existing system. • The system improvements can be enhanced to accommodate an expanded urban area beyond 2031.	• Potential alternative servicing with new connection to 16th trunk west of Bruce Creek. • Other local improvements may be required west of Woodbine Avenue in the existing system. • The system improvements can be enhanced to accommodate an expanded urban area beyond 2031.

Table 7.3 Evaluation of Wastewater Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Wastewater Servicing Network Concepts			
		A	B	C	D
Phasing	• Staged Growth and Maximizing Use of Existing or Planned Infrastructure – Does the concept delay the need for system expansion and / or upgrades? • Incremental Extensions of Infrastructure as Growth Progresses – Can new infrastructure be phased?	• The expansion of existing systems that need improvements can be delayed until required. • Incremental staging is not possible for the employment lands. Servicing to employment lands will also require servicing to residential areas between Major Mackenzie and Elgin Mills. • All other residential areas can be staged with servicing needs.	• The expansion of existing systems that need improvement can be delayed until required. • Incremental staging is not possible for employment lands. Servicing to employment lands will also require servicing to residential areas between Major Mackenzie and Elgin Mills. • All other residential areas can be staged with servicing needs.	• The expansion of existing systems that need improvement can be delayed until required. • Incremental staging is not possible for the employment lands. Servicing to employment lands will also require servicing to residential areas between Major Mackenzie and Elgin Mills. • All other residential areas can be staged with servicing needs.	• The expansion of existing systems that need improvement can be delayed until required. • Incremental staging is not possible for the employment lands. Servicing to employment lands will also require servicing to residential areas between Major Mackenzie and Elgin Mills. • All other residential areas can be staged with servicing needs.
Cost Considerations					
Costs	• Capital Costs - The capital cost associated with the construction of the concept including labour, material and equipment and possibly property acquisition • Operation and Maintenance Cost - Post-construction operation and maintenance - Post-construction operation and maintenance activities associated with various mitigation measures including regulation inspection, grass cutting / weed control, performance monitoring, sediment / trash removal and energy requirements from pumping, lights, flushing and other operational requirements • Balanced Infrastructure Costs with Staged Level of Growth	• Capital and operating costs for Concepts A and D are similar.	• Operating costs for Concepts A, B, C and D are similar. • Capital costs are likely greater because of system depth, length and crossings.	• Operating costs for Concepts A, B, C and D are similar. • Capital costs likely greater because of system depth, length and crossings.	• Operating costs for Concepts A, B, C and D are similar. • Capital costs likely greater than Concepts A, B and C because of additional local improvements and length of system.

Table 7.3 Evaluation of Wastewater Servicing Network Concepts A-D

Criteria Type	Evaluation Criteria	Wastewater Servicing Network Concepts			
		A	B	C	D
Summary of Key "Advantages"		• Staged implementation. • Optimizes the the use of existing infrastructure capacity in comparison to B, C and D. • Gravity system.	• Staged implementation. • Maximizes the use of some existing infrastructure. • Gravity system.	• Staged implementation. • Maximizes the use of some existing infrastructure. • Gravity system.	• Staged implementation. • Maximizes the use of some existing infrastructure. • Gravity system
Summary of Key "Disadvantages"		• Access to services in green space. • Deep system. • Local disturbance to expand existing services.	• Major Mackenzie Drive wastewater pipe likely required. • Deepest system (deeper than Concept A). • Additional creek crossing. • Local disturbance to expand existing services. • Pipes do not follow road right-of-way.	• Major Mackenzie Drive wastewater pipe likely required. • Additional creek crossing. • Local disturbance to expand existing services. • Pipes do not follow road right-of-way.	• Access to services in green space. • Local disturbance to expand existing services. • Pipes do not follow road right-of-way. • Additional downstream improvement required.
Summary		• All wastewater servicing network concepts (shown in Options A, B, C and D) are similar in complexity, service and costs. Overall, the wastewater servicing shown in Option A is identified as the preferred wastewater servicing network concept, because it has fewer complexities (i.e., watercourse or greenway crossings) while all pipes follow proposed City rights-of-way and take full advantage of downstream capacity.			

As noted in **Table 7.3**, all servicing network concept options presented are similar in complexity, level of service and costs. Wastewater Servicing Network shown in **Concept Option A** was identified as the preferred wastewater servicing network concept.

7.5.2 Development and Evaluation of Options E, F, G-1 and Preliminary Community Structure Plan

The refinement of land uses and the transportation network occurred in tandem to the assessment of the wastewater servicing network concepts. Additional land use and road concepts were developed, as referenced in **Sections 2.4.4** and **Section 5**. These options, which are described in more detail in **Section 5.5.3** of this study include:

- Option E (**Figure 5.10**) based on the revised City and TAC recommended road layout; and,
- Option F (**Figure 5.11**) based on the land owners group's suggested road and land use plan.
- Option G-1 (**Figure 5.12**) was developed as a hybrid of Option E and F based on further discussions with TAC and considered together with an updated preliminary Natural Heritage System (NHS). Option G-1 was found to optimally balance the benefits of the proposed transportation system while avoiding and minimizing impacts to the natural and social environment.
- Preliminary Community Structure Plan (**Figure 5.13**) was a further refinement of Option G-1.

Wastewater servicing concepts for Options E, F, G-1 and the Preliminary Community Structure Plan are effectively the same as Option A (**Figure 7.2**), particularly with respect to the wastewater connections between the FUA and the existing system. Consequently, the evaluation of E, F, G-1 and the Preliminary Community Structure Plan against the previous wastewater concepts B, C and D would still result in Option A, or E, F, G-1, or the Preliminary Community Structure Plan as being preferred.

From a wastewater servicing perspective, Concept Option A is comparable to the wastewater servicing requirements following the Preliminary Community Structure Plan. **Figure 7.6 - Recommended Community Structure Plan with Wastewater Servicing** shows the recommended wastewater services that are consistent with the Preliminary Community Structure Plan.

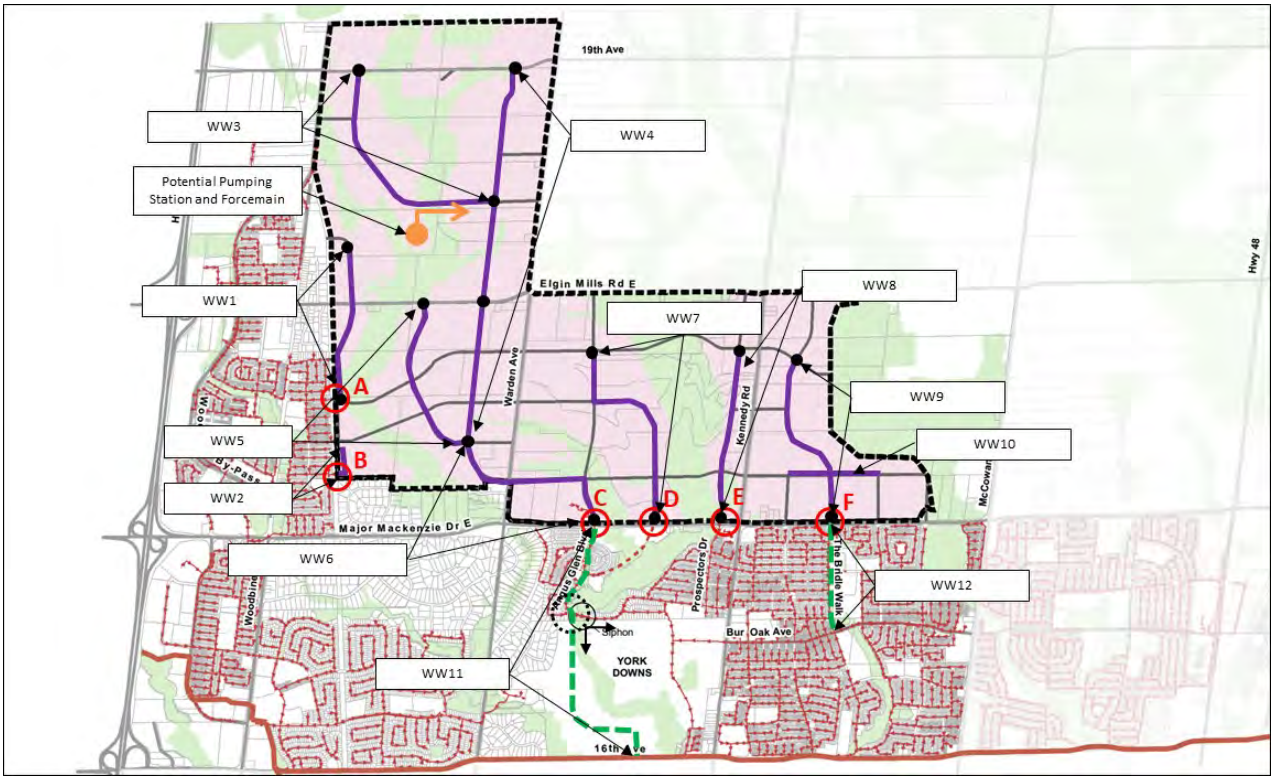


Figure 7.6 Recommended Community Structure Plan with Wastewater Servicing

7.5.3 Wastewater Servicing Alternatives

Using **Figure 7.6 - Recommended Community Structure Plan with Wastewater Servicing** as the basis for wastewater servicing, further investigations and preliminary testing were undertaken to look at additional wastewater servicing opportunities. From the wastewater concept presented in **Figure 7.6**, additional wastewater servicing variations were developed and evaluated based on opportunities to reduce the cost of servicing, facilitate staging of infrastructure, capitalize on other opportunities in the area, and to improve long term operation and maintenance. The variations considered are all consistent with the Community Structure Plan wastewater concept presented previously in **Section 7.5.2**.

7.5.3.1 Employment Block Servicing Alternatives (Zone 2)

Further testing was done to evaluate alternative servicing for the employment lands. **Figure 7.7** (Figure 10 in the Conceptual Master Plan, September 2017) shows four alternatives to service the Employment Block, they include:

Alternative 1	• Servicing follows FUA collector road layout using gravity sewers
Alternative 2	• Gravity sewers following FUA collector roads • Pumping station and forcemain to convey flow from west of Berczy Creek to the east side of Berczy Creek.
Alternative 3	• Gravity sewers following FUA collector roads • Alternative gravity crossing of Berczy Creek to Elgin Mills Road E.
Alternative 4	• Gravity sewers following FUA collector roads • Portion of the employment block flows diverted to the Woodbine Avenue systems.

Appendix E provides additional information for each of the above alternatives.

From a technical perspective, Employment Block Alternative 4 is least preferred as the existing Woodbine sanitary collection system is generally at capacity with the FUA service area contributions from the FUA lands west of Berczy Creek. Any additional flow to the Woodbine system, beyond the FUA area west of Berczy Creek, will trigger a system improvement through the existing network.

Employment Block Alternatives 1 and 2 are similar where wastewater is conveyed to the east and then south. The introduction of a sewage pumping station in the Employment Block (Alternative 2) will likely allow the sanitary sewers to be constructed at a shallower depth (less cost) and may improve flexibility in regards to the timing of infrastructure with development. However, the long term cost of a pumping station, versus a complete gravity systems, need to be considered. Alternative 1 will result in the wastewater system being the deepest of each alternative and lead to the need to have dual local sewers at shallow depths at a greater cost of implementation and add to future operation and maintenance costs.

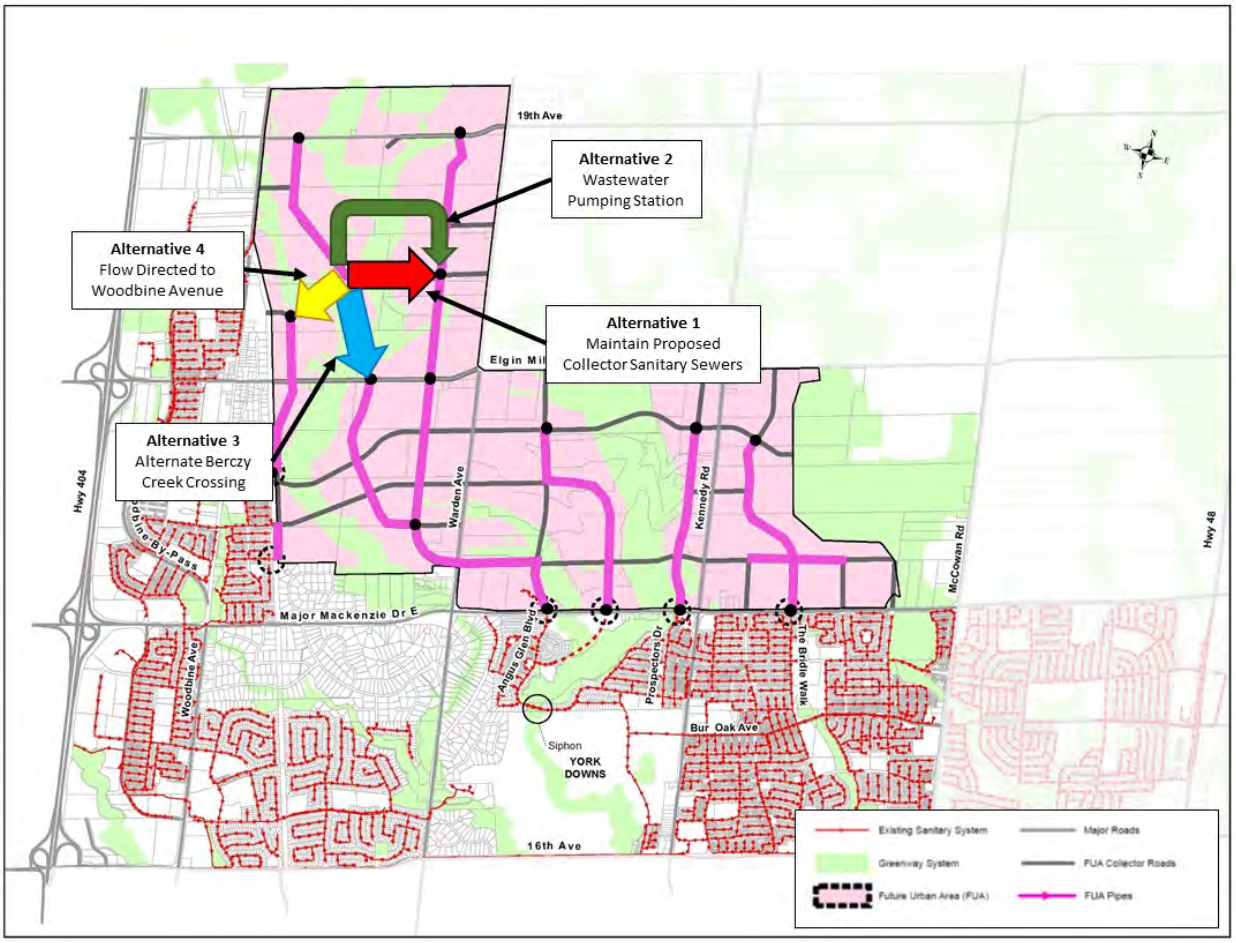


Figure 7.7 Employment Block Wastewater Alternatives

Alternative 3 follows a more natural drainage pattern by not conveying the Employment Block flows from the peninsula area east, but taking them in a more southerly direction crossing Berczy Creek to Elgin Mills Road. This alignment allows the wastewater servicing east of Berczy Creek and north of Elgin Mills Road to be constructed at a much shallow depth minimizing the need for dual local and collector sewers. It also results in the wastewater collection system in the Berczy Glen area to be constructed at a marginally shallower depth. The Alternative 3 Berczy Creek crossing is however not part of a road right of way and crosses Berczy Creek at a more sensitive environmental location.

To identify the preferred alternative a more focused evaluation was undertaken to consider the merits of alternatives 1, 2 and 3. The assessment is focused on the servicing of the Employment lands, in particular the peninsula area north of Elgin Mills Road.

Table 7.4 presents a summary of the additional evaluation to determine the preferred servicing alternative for the peninsula area of the employment lands.

Table 7.4 Employment Block Wastewater Servicing Alternatives for Peninsula Area

Consideration	Alternative 1 Gravity Sewer Along the Collector Roads	Alternative 2 Pumping Station from Peninsula Area	Alternative 3 Gravity Sewer Under Berzy Creek Greenway
Environmental Impact	Creek Crossing within ROW	Creek Crossing within ROW	Separate Creek Crossing
Green Belt Crossing Width	Approximately 210m	Approximately 210m	Approximately 300m
System Depth	14.5m at Elgin Mills at top end of Berzy Glen connection. Up to 12m deep through Employment lands	5.9m at Elgin Mills and Berczy Glen. Nominal depth through Employment Lands	6.2m at Elgin Mills and Berczy Glen. Nominal depth through Employment land
Valley Crossing	Trenchless under Creek	Trenchless under Creek	Combination of open cut in Valley and trenchless under creek
Constructability	Extensive dewatering required due to depth below the water table. Extensive excavation width and associated disturbance with the adjacent lot areas due to depth.	Some de-watering required due to depth below the water table.	Some de-watering required due to depth below the water table.
Tableland Construction	More extensive potential for dual local/collector through Employment Lands and Berczy Glen due to depth.	Potential dual local/trunk through portions of Berczy Glen due to depth	Potential dual local/trunk through portions of Berczy Glen due to depth
Impact of Berczy Glen and downstream systems. *(Street B is internal to Berczy Glen and goes south and loops to the east from Elgin Mills Road to Warden Avenue)*	Approximately 1600m long, 14.5 to 9.0m deep sewer along Street B from Elgin Mills to Warden.	Approximately 1850m long, average 7.6m deep sewer along Street B from Elgin Mills to Warden.	Approximately 1850m long, average 7.6m deep sewer along Street B from Elgin Mills to Warden.
Connection at Angus Glen Boulevard at Major Mackenzie Drive.	Gravity to existing sewer at Angus Glen Boulevard and Major Mackenzie Drive.	Gravity to existing sewer at Angus Glen Boulevard and Major Mackenzie Drive.	Gravity to existing sewer at Angus Glen Boulevard and Major Mackenzie Drive.
Construction/Maintenance/Replacement Permits (TRCA/MNRF)	TRCA/MNRF permit to cross the creek (within ROW). Maintenance none anticipated, Replacement same as Construction	TRCA/MNRF permit to cross the creek (within ROW). Maintenance none anticipated, Replacement same as Construction	TRCA/MNRF permit to cross the creek (separate valley crossing). Maintenance none anticipated, Replacement same as Construction

Table 7.4 Employment Block Wastewater Servicing Alternatives for Peninsula Area

Consideration	Alternative 1 Gravity Sewer Along the Collector Roads	Alternative 2 Pumping Station from Peninsula Area	Alternative 3 Gravity Sewer Under Berzy Creek Greenway
Maintenance Access	Municipal ROW	Municipal ROW	Access roads/trails with turning areas provided to manholes within the valley, likely easement over employment land block on southeast side of the valley.
Long Term Maintenance and Operation	Deep access manholes, all within ROW. O&M for gravity system is typical for municipal operation.	Shallower access manholes, all within ROW, but long term PS maintenance and operation.	Shallower access manholes, some within valley and easements on private employment lands. O&M for gravity system is typical for municipal operation.
Implementation Schedule	Allows for Flexibility	Allows for Flexibility	Allows for Flexibility
Cost Comparison (Berczy Glen, crossing, additional sewers, Employment Lands)	~$9.3M	~$11.8	~$5.9M
Preferred - Rank	NO - 2	NO - 3	YES - 1

Legend

Highest ranked

Mid ranked

Lowest rank

In reviewing **Table 7.4**, the preferred servicing alternative when considering opportunities to reduce the cost of servicing, facilitate staging of infrastructure, capitalize on other opportunities in the area, and to improve long term operation and maintenance has identified Alternative 3, followed closely by Alternative 1. Alternative 2 is the least preferred because of the need for a sewage pumping station and the associated capital costs and subsequent operation and maintenance costs of a pumping station over time in comparison to gravity systems. Alternative 3 is preferred over Alternative 1 primarily because it will allow the wastewater system to be constructed at shallower depths, is more economical and will have lower long term maintenance issues. To accomplish this does require an additional crossing of Berczy Creek and the Greenbelt beyond that of the road right of ways. Alternative 3 also provides the opportunity to service a larger portion of the Employment Block lands including the peninsula area and the Employment Block adjacent to Warden Avenue with a connection along Elgin Mills Road.

7.5.3.2 South of Major Mackenzie Drive East

The preferred waterwater servicing alternative requires improvements to existing wastewater services south of Major Mackenzie Drive East. The improvements are associated with Angus Glen Boulevard and The Bridle Walk.

Angus Glen Boulevard
South of Mackenzie Drive and Angus Glen Boulevard additional servicing concepts were considered. These options were explored primarily because of the proposed development of the York Downs Golf Course.

Appendix E provides additional information on the options considered. For all the options, capacity improvements in existing systems or new capacity are required. In total, three concepts were considered:

- Alternative 1 - Upgrading all of the existing wastewater pipes on Angus Glen Boulevard through the existing connection point with the 16th Avenue YDSS.
- Alternative 2 - The development of the York Downs Golf Course west of Bruce Creek allows for a new wastewater pipe to be installed that would convey all of the flows south to a new 16th Avenue YDSS connection.
- Alternative 3 - Split the flows at Angus Glen Boulevard at the top end of the siphon, so a portion of the flow would continue in the existing system, while a portion of flow would be diverted through a new pipe through the York Downs development.

Figure 7.8 shows three alternatives. The three servicing alternatives south of Major Mackenzie Drive East were evaluated with City staff. For all three alternatives, the wastewater needs of FUA are met. Overall Alternative 2 and 3 were identified as being preferred over Alternative 1 because of the cost and construction feasibility of upgrading the existing system from Major Mackenzie Drive East and Angus Glen Boulevard south to the 16th Avenue YDSS connection. Alternative 2 and 3 were favoured because in Alternative 2, the siphon is eliminated and the existing pipe downstream of the siphon does not require upgrading. In Alternative 2 the size of the pipe through York Downs is larger than the pipe size required in Alternative 3. For Alternative 3 the siphon is maintained but flow in excess of the downstream pipe capacity would be diverted through the York Downs connection south to a new 16th Avenue YDSS connection. At this time, Alternative 2 and 3 for existing system improvements south of Major Mackenzie Drive East in association with Angus Glen Boulevard have been carried forward. Both alternatives require a new wastewater sewer through the York Downs lands.

Appendix E provides additional information on constructability of upgraded sanitary service on Angus Glen Boulevard immediately south of Major Mackenzie Drive East. Portions of the upgrades service can be micro-tunneled to minimize local disruption. The extent of the micro-tunnel versus open cut construction work will depend on the final alternative.

The Bridle Walk
There are no alternatives for upgrading the pipe segments on The Bridle Walk.

Figure 7.8 Angus Glen Boulevard Options

Woodbine System
The earlier wastewater system assessment (**Appendix E**) identified capacity issues in the Woodbine avenue sanitary systems to the west and south. Through the Phase 2 iteration process, and in discussions with the City of Markham Wastewater staff, the capacity was determined not to be an issue. Therefore, no new or upgraded wastewater services are planned for the Woodbine Avenue system in association with the FUA.

7.6 Recommended Wastewater Servicing Network Summary and Next Steps

The York Region Water and Wastewater Master Plan, identified that all wastewater from the FUA will ultimately be discharged into the YDSS 16th Avenue which runs along 16th Avenue just south of the FUA.

In general, the existing wastewater flows in the area surrounding the FUA are conveyed from north to south and ultimately discharged into the YDSS 16th Avenue. Wastewater services were previously installed to accommodate future flows originating from lands now inside the FUA, north of Major Mackenzie Drive East and south of Elgin Mills Road[4].

[4] Source: ROPA 3 Wastewater Servicing Strategy TM, York Region, June, 2012; and, Land Needs and a Recommended 2031 Urban Boundary Expansion for North Markham, the North Markham Landowners Group, April, 2010.

Figure 7.9 shows the recommended wastewater servicing network, as well as the various alternatives for the Employment Block and Angus Glen Boulevard. The recommended wastewater servicing to support the FUA and the CMP includes the following features:

- The sanitary system is based on a gravity servicing and utilizing existing system capacity south of Major Mackenzie on Angus Glen Blvd., Prospectors Drive, and The Bridle Walk. There are also several connections to the west to the Woodbine Avenue system (Rinas Avenue/James Joyce Drive., Haywood Drive and Stone Hill Blvd.). The final connection points will be determined through the MESP process.
- The majority of proposed sanitary collector sewers are to be constructed within the proposed City or York Region road right-of-ways with the exception of the greenbelt crossing from the Employment Block peninsula to Elgin Mills Road.
- The final alignment of wastewater systems through communities will be determined at through the MESP and secondary plan process. The final alignment may not follow the exact alignment identified in the EA process because detailed layout information and phasing is not available at this stage.
- The phasing or sequence of projects is dependent on how development emerges in the FUA. None of the improvements are immediately required because of the built-in capacity in the existing wastewater system.
- It will be necessary to coordinate the downstream improvements of the existing system with York Downs (located south of Major Mackenzie Drive East) to maximize and enhance the FUA servicing opportunities.
- Improvements to existing wastewater services will be required on Angus Glen Boulevard and The Bridle Walk.

Employment Block

Figure 7.9 shows a separate Berczy Creek crossing for the Employment land peninsula area. This alternative (Alternative 3) is identified as part of the recommended wastewater servicing strategy and is subject to further testing. This alternative is consistent with the recommended FUA wastewater servicing strategy. In the event the additional crossing (Berczy Creek) is not permitted, then the alternative gravity solution (Alternative 1) is to be considered. This alternative also presents the opportunity to intercept additional Employment Block lands adjacent to Warden Avenue.

Angus Glen Boulevard

Figure 7.9 shows the preferred alternatives for Angus Glen Boulevard. The proposed York Downs development as presented in the York Downs MESP presents an opportunity to service the FUA area through a new sanitary sewer through the York Downs lands, versus upgrading the existing services downstream of the Angus Glen Boulevard siphon. Three alternatives for servicing were investigated and previous Alternatives 2 and 3 are identified as preferred. In both cases, the existing sanitary services on Angus Glen Boulevard from Major Mackenzie Drive East, south to the siphon will be upgraded. As well, both options include a new sanitary collector through the York Downs lands that will intercept all or a portion of the FUA flows. If all the flows are conveyed through the York Downs the siphon can be abandoned. As the FUA area develops the siphon and downstream system will be used until the additional capacity is required. It is essential sanitary servicing needs are coordinated with the York Downs development. Option 2 and 3 are identified as part of the recommended wastewater servicing strategy and will be subject to further testing. The two options are consistent with the recommended FUA wastewater servicing strategy.

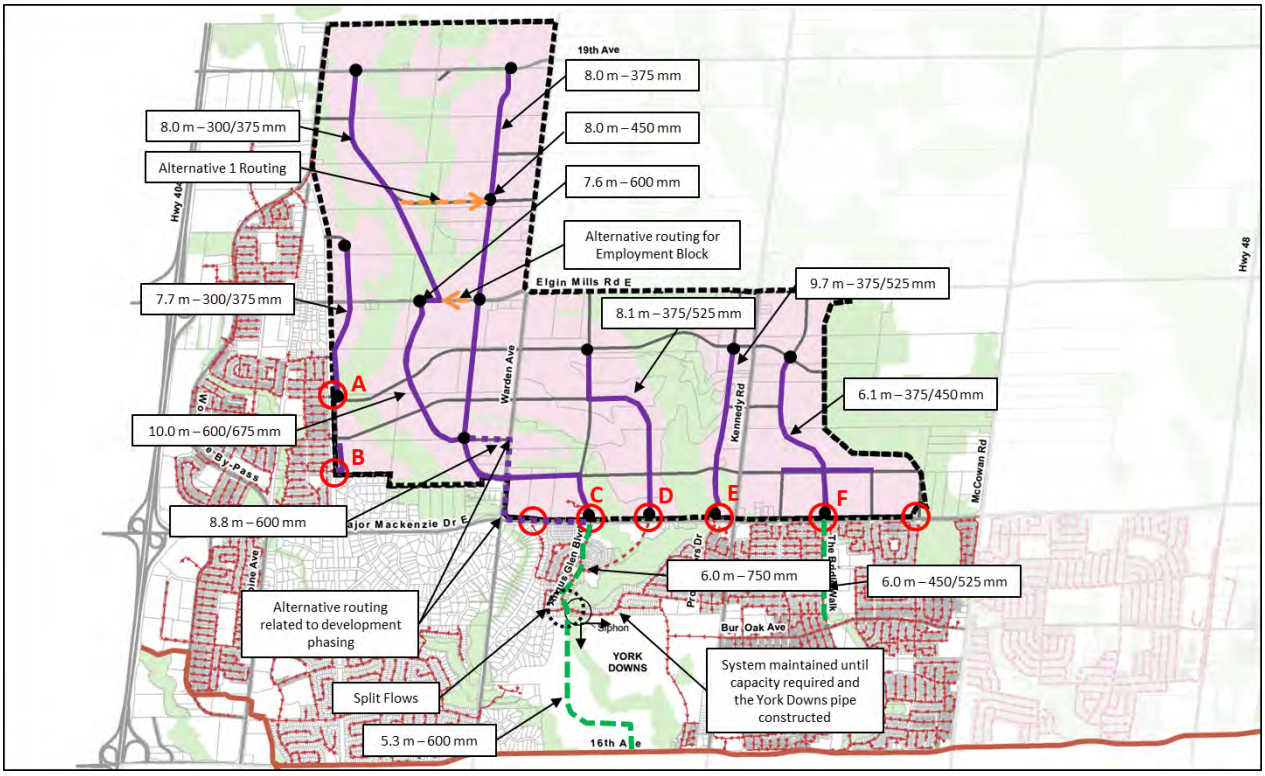


Figure 7.9 Recommended Community Structure Plan Wastewater Servicing

Next Steps

A discussion of wastewater recommendations and next steps is provided in **Section 8**. The preferred wastewater servicing concept will be further reviewed with alternatives for a gravity system throughout the FUA. MESPs will reflect the preferred servicing alternatives selected by the City and identify if variations to the alignment are required based on phasing within Blocks, as well as any infrastructure required external to the secondary plan areas. For wastewater servicing, internal roads may provide opportunity for optimal locations for sanitary mains and development phasing may require the location of the sanitary collectors to be relocated, potentially to Regional Roads (i.e. Warden Avenue and/or Major Mackenzie Drive East).

The MESPs submitted in support of secondary plans will be required to include wastewater analysis and confirm that phasing of development meets City criteria. MESPs will also be required to identify any wastewater infrastructure required external to the secondary plan area.

Completion of EA Process

The construction of wastewater servicing projects may require further EA undertakings. Wastewater mains that follow road allowances or which are required as a condition of draft plan approval of a subdivision are designated Schedule A projects. All sewers that cross a creek using trenchless technology are designated Schedule A+ projects. Schedule A/A+ projects are considered pre-approved and can proceed to implementation by a landowner without any further Municipal Class EA requirements.

In the event a sewage pumping station alternative is selected (Employment Block), the project would be considered a Schedule B project and can proceed to implementation by a landowner without any further Municipal Class EA requirements if its construction was a condition of approval of development.

The Class EA Master Plan has been undertaken in a manner that fulfills Phases 1 and 2 of the Municipal Class Environmental Assessment (EA) process. Phases 3 and 4 of the Municipal Class EA undertaking for any identified Schedule C projects will need to be completed prior to construction. Phase 3 of the EA process will involve the development of alternative design concepts, which will finalize the location and configuration of the wastewater infrastructure, and Phase 4 will document the rationale, and the planning, design and consultation process of the project in an Environmental Study Report.

The proposed wastewater servicing projects associated with the recommended FUA wastewater servicing network includes a list of proposed wastewater projects to service the FUA and their Class EA requirements (**Section 8.1.3**).

8 Master Plan Recommendations

8.1 Recommended Projects and Master Phasing Plan

The CMP process resulted in a set of transportation, water and wastewater servicing recommendations. These recommended projects reflect the key elements of the Plan and adhere to the Official Plan's principles and parameters guiding the development of the FUA.

As noted in CMP Volume 1, Section 5.2.4, the phasing of development within the FUA is key in ensuring the Community Structure Plan can be implemented in a safe and sustainable manner by providing the residents of this new community with access to adequate municipal services and facilities, including roads, trails, cycling, water and wastewater, fire stations, parks, and community facilities. To accomplish this goal, a master phasing plan will be required to accompany secondary plans and MESPs.

The recommended CMP was endorsed by City of Markham Council in October 2017. The Community Structure Plan is shown in **Figure 8.1 - Community Structure Plan, 2017**.

As discussed in **Section 2**, this CMP Volume 2 Master Plan will serve as the foundation for future investigations for specific recommended projects. Under the Municipal Class EA, municipal projects are categorized according to their environmental significance and potential effects they may impose on the environment. These categories, described by specific Class EA schedules, prescribe planning methodologies for each category. There are four schedule classification types as described in Section A.1.2.2 in the Municipal Class EA: Schedule 'A', 'A+', 'B' and 'C'. The main difference between the Schedules is the degree to which each project may affect the existing environment; for example, Schedule 'A' covers projects with few/minimal impacts and Schedule 'C' covers projects with potentially significant impacts.

Appendix 1 of the Municipal Class EA identifies specific types of projects subject to each of the four schedules. As described above, the types of projects and activities are categorized generally with reference to the magnitude of their anticipated environmental impact.

For details on the implementation of the recommended projects, see Next Steps.

8.1.1 Recommended Transportation Projects

Certain types of road projects are Schedule A or A+ and are pre-approved, regardless of their cost. Other projects are Schedule B or C projects dependent on initial construction cost estimates. The Municipal Class EA specifies that the selection of the most appropriate Class EA schedule should be based on a cost estimate prepared during Phase 2 of the Class EA process and that the cost limits are based on the 2012 Road Cost Limits published by the MEA for this purpose. As part of this Master Plan, a cost estimate for each of the recommended transportation projects was prepared and a determination of the project schedules is based on the cost estimate.

Table 8.1 and **Figure 8.2** (as shown previously in **Figure 5.15**) identifies the Class EA Schedule for the road projects recommended in this Master Plan.

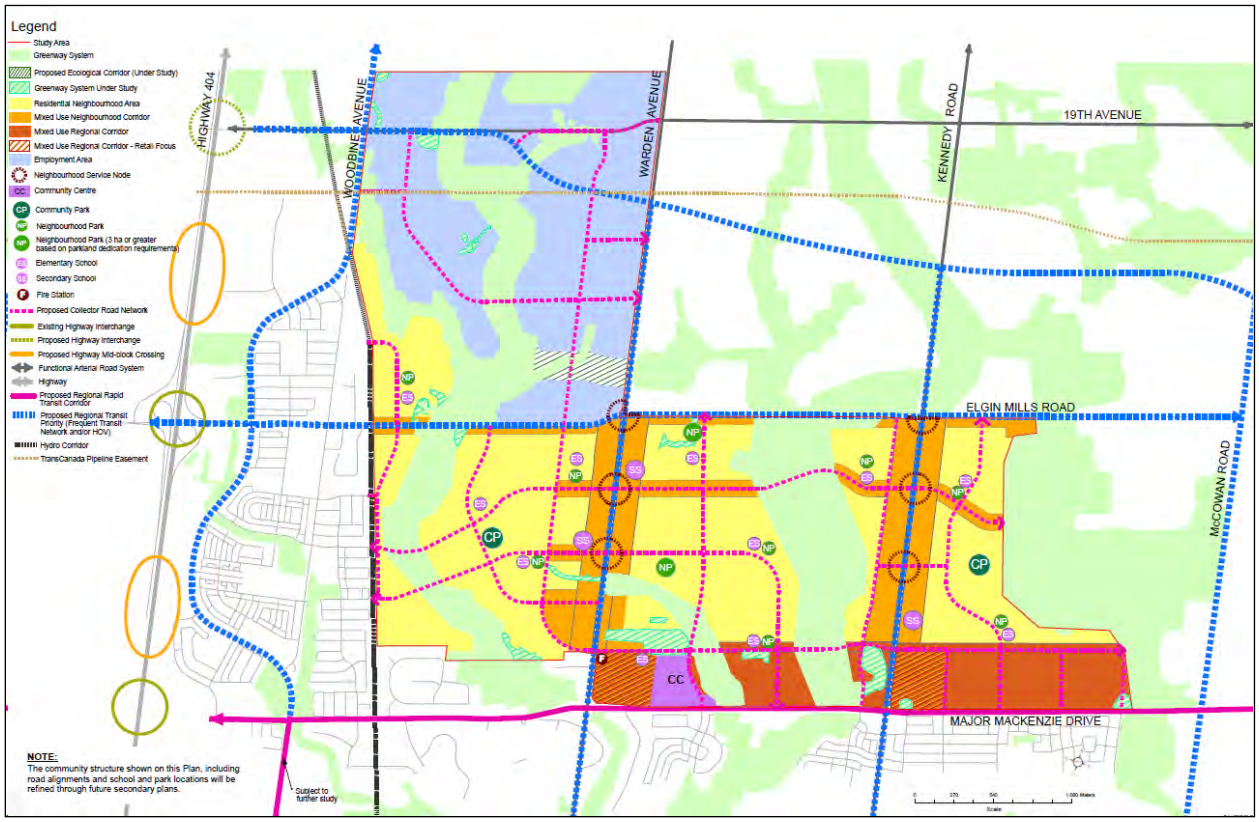


Figure 8.1 Community Structure Plan, 2017

Table 8.1 Recommended FUA Road Projects - Class EA Schedule[1,2]

Road Segment	From	To	Proposed Class EA Schedule[3]	Comments (if any)
EW-1	Victoria Square Blvd.	East of NS-6	Schedule C	Includes multiple watercourse crossings
EW-2	Victoria Square Blvd.	Major Mackenzie Drive	Schedule C	Includes watercourse crossing
EW-3	Warden Avenue	L-6	Schedule C	Includes multiple watercourse crossings
E-1	19th Avenue (MA-1)	Warden Avenue	Schedule C	Includes watercourse crossing

[1] *All proposed specifications are preliminary estimates and should be verified / refined through detailed design phases.*

[2] *In the FUA, Elgin Mills Road and 19th Avenue are under the jurisdiction of the City of Markham. These roads (labelled here as MA-1 and MA-2) are proposed to be widened.*

[1] *All proposed specifications are preliminary estimates and should be verified /refined through detailed design phases.*

[2] *In the FUA, Elgin Mills Road and 19th Avenue are under the jurisdiction of the City of Markham. These roads (labelled here as MA-1 and MA-2) are proposed to be widened.*

[3] *Class EA schedule determination based on initial capital / construction cost estimates as outlined in the Municipal Class EA, Appendix 1, Municipal Road Schedules and the 2012 (most recent) MEA Project Cost Limits.*

Table 8.1 Recommended FUA Road Projects - Class EA Schedule[1,2]

Road Segment	From	To	Proposed Class EA Schedule[3]	Comments (if any)
E-2	19th Avenue (MA-1)	Warden Avenue	Schedule C	Scope of project may impact watercourse crossing
NS-1	Victoria Square Blvd.	EW-2	Schedule C	No comments
NS-2	Elgin Mills Road (MA-2)	Warden Avenue	Schedule C	No comments
NS-3	E-2	Warden Avenue	Schedule C	Includes watercourse crossing
NS-4	Elgin Mills Road (MA-2)	Major Mackenzie Drive	Schedule C	Includes watercourse crossing
NS-5	Elgin Mills Road (MA-2)	Major Mackenzie Drive	Schedule C	No comments
NS-6	Elgin Mills Road (MA-2)	Major Mackenzie Drive	Schedule C	No comments
L-1	Woodbine Avenue	E-1	Schedule B	Road anticipated to cost less than $2.3million
L-2	Warden Avenue	NS-3	Schedule B	Road anticipated to cost less than $2.3million
L-3	NS-5	NS-6	Schedule B	Road anticipated to cost less than $2.3million
L-4	EW-3	Major Mackenzie Drive	Schedule B	Road anticipated to cost less than $2.3million
L-5	EW-3	Major Mackenzie Drive	Schedule B	Road anticipated to cost less than $2.3million
L-6	EW-3	Major Mackenzie Drive	Schedule B	Road anticipated to cost less than $2.3million
MA-1 (19th Avenue)	Highway 404	Warden Avenue	Schedule C	Road to be widened and realigned; includes multiple watercourse crossings
MA-2 (Elgin Mills)	Victoria Square Blvd.	Kennedy Road	Schedule C	Road to be widened; includes multiple watercourse crossings

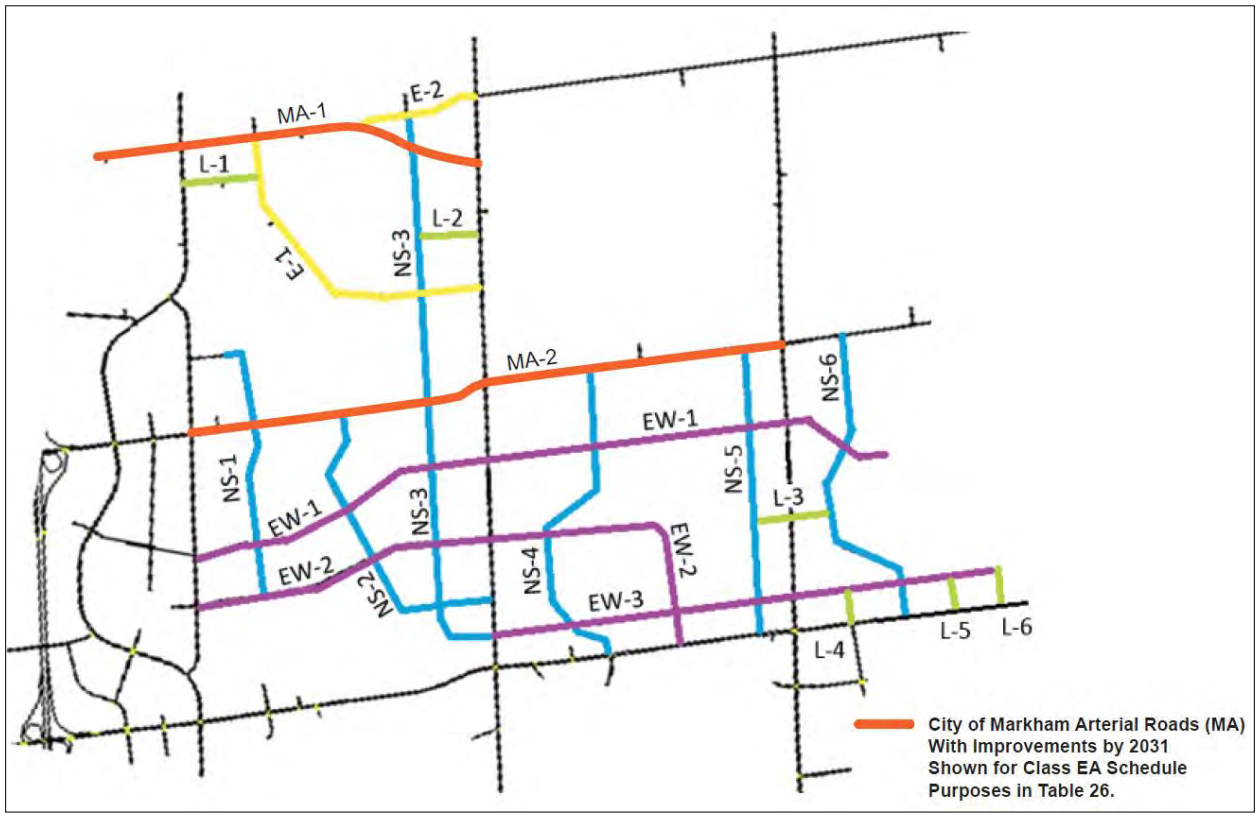


Figure 8.2 FUA Recommended Road Projects

8.1.1.1 Transportation Recommendations

The following are the recommendations of this report with regard to transportation projects. It is anticipated that these will be considered during the preparation of secondary plans and Class EA (Phases 3 and 4) Studies and detailed design as appropriate.

Cycling

- Cycling facilities are proposed on collector roads which directly connect residents to higher density land uses, employment areas and community facilities such as retail uses on the north side of Major Mackenzie Drive East. In boulevard cycling facilities on major roads, such as Warden Avenue and Kennedy Road, should be considered at the Secondary Plan stage to provide a high level of safety for cyclists while seamlessly connecting residents to other portions of Markham. The recommended cycling network shown in **Figure 5.19** proposes a network cycling facilities on all major arterial roads which will be subject to widening in order to promote the greatest level of cycling comfort and utility.
- As a result of this study and in particular **Section 5.6.3**, a combination of in-boulevard cycling facilities on key corridors and on-road bicycle lanes for minor roads were recommended for the FUA for some of the City roads as shown on **Figure 5.19**. It should be noted that further study via Phases 3 and 4 of the Class EA Studies, secondary plans, plans of subdivision or detailed design may result in the re-evaluation and revision of some or all of these proposed facilities, and proposed on-road bicycle lanes could be upgraded to in-boulevard facilities.

- The protected intersection concept to allow for continuous cycling facilities across major signalized intersections should be explored further in the secondary plans for its applicability as outlined in **Section 5.6.3**.

Air Quality

- As noted in **Section 4.4** of this report and in consideration of Section 3.4.2 of the Markham Official Plan, the assessment of air quality is a recommendation of the MOECC. As a result it is recommended that an air quality assessment be carried out for the anticipated vehicle emissions in the FUA.

Multi Use Trails

- Planning for Multi-use Trails, including their continuity across arterial and collector roads, should be incorporated in secondary plans as outlined in **Section 5.6.3**. Multi-use trails are supported by policies of the 2014 City of Markham Official Plan and their construction is subject to Schedule A+ of the Municipal Class EA. It is anticipated that trails will be addressed as part of the preparation of secondary plans.

Transportation Demand Management (TDM)

- A detailed TDM strategy and implementation plan will be a key requirement of the subdivision and site plan application process. TDM strategies should be incorporated into all future FUA planning (see **Section 5.6.4** of this report).

Intersections

- A more detailed traffic signal warrant analysis and operational analysis should be completed to confirm the preliminary findings documented in **Section 5.6.4** of this report as part of Secondary Plan and subdivision applications.

Transit and HOV

- Additional coordination among the Region, YRT, the City and the landowners will be required to develop a phasing strategy addressing both land development and transit initiatives. Future transit expansion in the FUA will be contingent upon further evaluation and service planning by appropriate transit authorities. In the short term, an extension of the Major Mackenzie Drive rapid transit system easterly from its planned terminus at Leslie Street by 2031. As the ultimate collector road network is expected to be completed in multiple phases, improvements could be phased in. Arterial road improvements (including HOV network), transit improvements, the new interchange of Highway 404 at 19th Avenue, other planned interchange improvements (e.g., ramp extensions) and the Highway 404 mid-block collector road crossings are all essential requirements.

Collector Road Improvements

- There is a need for at least two new north-south and two east-west collector roads to traverse the full length of the FUA neighbourhood lands. This is essential to provide enough capacity for traffic to move efficiently in and out of the FUA and access the arterial road system, provide good access and connectivity to the surrounding communities and enhance circulation flexibility and active transportation opportunities. The recommended CMP east-west collector road alignments in the Robinson Glen block are located in anticipation of these roads extending across the block to McCowan Road and beyond in the future, subject to additional study.

- The Berczy Glen Block may experience access issues to/from the arterial road system. This is due to its limited westward connectivity through the Hydro Corridor and lack of connectivity south to Major Mackenzie Drive East. As well, high levels of congestion on Warden Avenue and the desire to avoid out-of-the-way travel for access to/from Elgin Mills Road accentuate the access problem for the Berczy Glen Block. Two collector road crossings of Berczy Creek within the Berczy Glen Block are included in the Preliminary Community Structure Plan to improve road capacity, enhance connectivity and internal flow balancing and provide more route options and active transportation opportunities.
- Collector roads will generally provide for two lanes of travel except for the east-west collector road located just south of Elgin Mills Road which will be a major collector road with four travel lanes.
- An active transportation network consisting of pedestrian facilities on both sides of all local and collector roads and in-boulevard cycling facilities (multi-use pathways) along all collector roads is recommended. This continuous, connected and low stress network will make walking and cycling within the FUA an attractive trip choice for residents of all ages and abilities.
- Transportation Demand Management (TDM) strategies for the FUA will be supported by a road network and land use pattern which allow for a more efficient use of the transportation system by providing a built environment which supports alternative modes of transportation such as walking and cycling for everyday trips. It will be a requirement of each subdivision and site plan to implement TDM measures that reduce auto dependency by encouraging a greater proportion of trips to be made by walking, cycling and transit.

Road Crossings of the Natural Heritage System

- A series of mitigation measures will be developed and explored further based on the recommendations of the CMP Subwatershed Study, which are specific to the natural heritage system crossings to eliminate or minimize potential impacts. Proposed impact management measures should be considered for their applicability at each proposed crossing.
- Underground services and road construction should be coordinated to reduce the amount of time that construction occurs in areas of high sensitivity.
- Potential impacts of the road crossings of the natural environment will be assessed in more detail during Phases 3 and 4 of the Class EA process, as well as during preliminary and detailed design. The following mitigation measures will be taken into consideration during further studies in order to minimize or avoid impacts:
    - Refine road alignment that crosses the future linkage to the east to avoid impacts to a wetland;
    - Design and construct bridges that span the creek valley for some or all of the road crossings to mitigate the potential for negative impacts along Berczy Creek;
    - Implement mitigation approaches, such as restoration/enhancement of areas within and adjacent to the valley as treed habitat, to reduce impacts to wildlife and habitat; and,
    - Minimize or avoid impacts on observed Species at Risk (Barn Swallow, Bobolink and Eastern Meadowlark) through appropriate timing of construction and habitat replacement where required.

Master Phasing Plan

- As noted in Section 5.2.4 of CMP Volume 1, the phasing of development within the FUA is key in ensuring the Community Structure Plan can be implemented in a safe and sustainable manner by providing the residents of this new community with access to adequate municipal services and facilities, including roads, trails, cycling, water and wastewater, fire stations, parks, and community facilities. To accomplish this goal, a master phasing plan will be required to accompany secondary plans and MESPs.

8.1.2 Recommended Water Projects

Unlike road projects, which are categorized by their estimated construction cost, water projects under the Municipal Class EA process are categorized with reference to the type and location of projects which represent the potential magnitude of their anticipated environmental impact. Typical normal or emergency operational activities are pre-approved Schedule A or A+ projects. Schedule B and Schedule C projects usually involve water projects that could include potential major impacts to property or watercourses.

The recommended water projects resulting from this Master Plan can be characterized as follows:

- All new watermains constructed under City or Regional roadways will be Schedule A+.
- New watermains required as condition of a plan of subdivision will be Schedule A.
- All watermains, whether under roadways or not, which traverse water bodies (i.e., stream crossings) and which use trenchless technology will be Schedule A+.
- The booster pumping station would involve acquiring land at a future site (to be determined) and will be a Schedule B project.

Figure 8.3 identifies the water projects recommended in this Master Plan (as shown previously in **Figure 6.5**). As indicated above, the alignments of the new watermains will generally follow the FUA road network and will be required to be constructed as a condition of approval of development. Accordingly, the watermains in the FUA are designated as Schedule A projects and are considered pre-approved and can proceed to implementation by a landowner without any further Municipal Class EA requirements. Watermain projects that cross a watercourse using trenchless technology and are required to be constructed as a condition of approval of a development, are designated as Schedule A/A+ pre-approved projects and can be implement by a landowner without any further Municipal Class EA requirements.

For the FUA, the water projects all fall under a Schedule A/A+ with the exception of the booster pumping station which will be a Schedule B project. The final size and layout of watermains will be determined through the MESP and Secondary Plan process.

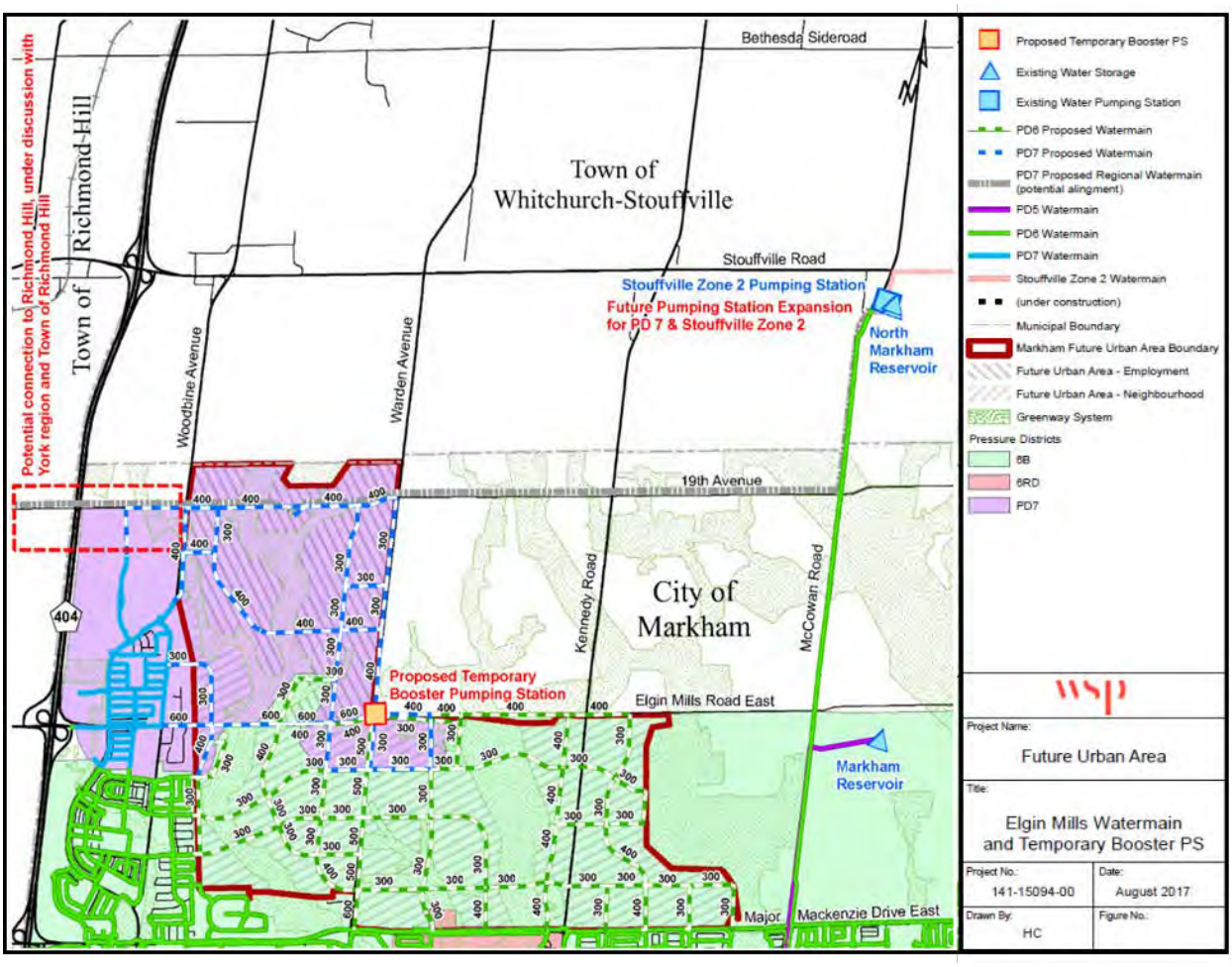


Figure 8.3 FUA Recommended Water Servicing

8.1.2.1 Water Servicing Recommendations

The following are the recommendations of this report with regard to water projects. It is recommended that these will be considered during the preparation of secondary plans and Class EA Studies and detailed design as appropriate.

- Very short sections of the existing PD #6 distribution network can be twinned to avoid conveyance bottlenecks at interfaces with the proposed FUA mains.
- To ensure water supply security in the event of an interruption of the only supply from PD #7 across Highway 404 along Elgin Mills Road East, a new booster pumping station is required along Elgin Mills. The exact location and configuration will be finalized in subsequent studies.
- Consider an upper limit to the non-residential Required Fire Flow (RFF) value within the FUA that may be lower than the 283L/s value in the York Region guidelines. In the absence of finalized calculations specific to the developments and building within FUA these are not possible to calculate. Lowering the Required Fire Flow value would reduce the large main diameters required to provide the fire flow.

- Examine PD #6 and PD #7 Regional mains crossing Highway 404 in greater detail, to ensure there is sufficient capacity to service the FUA.
- When plans are sufficiently advanced to model for smaller-diameter watermains in order to include enough nodes to represent high and low topography within PD #6 and PD #7 to ensure that adequate pressure is provided throughout.

Temporary Booster Pumping Station

- For security of supply, a temporary booster pumping station will be required. The exact location of the temporary PD #6 to PD #7 booster PS has not yet been determined. **Figure 6.6** shows potential locations for the proposed pumping station along Elgin Mills Road East. Site selection will be addressed in subsequent studies. The specific studies will be confirmed prior to implementation including the need to fulfill any Municipal Class EA process requirements, which are dependent upon the proponent.

Master Phasing Plan

- As noted in Section 5.2.4 of CMP Volume 1, the phasing of development within the FUA is key in ensuring the Community Structure Plan can be implemented in a safe and sustainable manner by providing the residents of this new community with access to adequate municipal services and facilities, including roads, trails, cycling, water and wastewater, fire stations, parks, and community facilities. To accomplish this goal, a master phasing plan will be required to accompany secondary plans and MESPs.
- The phasing or sequence of projects is dependent on how development emerges in the FUA. Beyond local watermains, none of the water servicing improvements are immediately required because of the built-in capacity in the existing water system. However, it will be necessary to coordinate the downstream improvements of the existing system with York Downs (located south of Major Mackenzie Drive East) in order to maximize and enhance the FUA servicing opportunities.

Crossings of the Natural Heritage System

- A series of mitigation measures will be developed and explored further in the Phases 3 and 4 Class EA Study, based on the recommendations of the CMP Subwatershed Study, which are specific to the natural heritage system crossings to eliminate or minimize potential impacts. State of the art measures should be considered for their applicability at each proposed crossing.
- Underground services and road construction should be coordinated to reduce the amount of time that construction occurs in areas of high sensitivity.
- Potential impacts of the road crossings of the natural environment will be assessed in more detail during Phases 3 and 4 of the Class EA process, as well as during preliminary and detailed design. The following mitigation measures will be taken into consideration during further studies in order to minimize or avoid impacts:
    - Refine servicing alignment that crosses the future linkage to the east to avoid impacts to a wetland;
    - Design and construct servicing mains in a manner that avoids the natural heritage features in the creek valley (e.g., trenchless technology) for some or all of the creek crossings to mitigate the potential for negative impacts along Berczy Creek;

- Implement mitigation approaches, such as restoration/enhancement of areas within and adjacent to the valley as treed habitat, to reduce impacts to wildlife and habitat; and,
- Minimize or avoid impacts on observed Species at Risk (Barn Swallow, Bobolink and Eastern Meadowlark) through appropriate timing of construction and habitat replacement where required.

8.1.3 Recommended Wastewater Projects

Unlike road projects, which are categorized by their estimated construction cost, wastewater projects under the Class EA process are categorized with reference to the type and location of projects which represent the potential magnitude of their anticipated environmental impact. Typical normal or emergency operational activities are pre-approved Schedule A or A+ projects. Schedule B and Schedule C projects usually involve wastewater projects that could include potential major impacts to property or watercourses.

The recommended wastewater projects resulting from this Master Plan can be characterized as follows:

- All new wastewater mains constructed under City or Regional roadways will be Schedule A+.
- All wastewater mains, whether under roadways or not, which traverse water bodies (i.e., stream crossings) and which use trenchless technology will be Schedule A+.
- New wastewater water mains required as a condition of a plan of subdivision for development will be Schedule A.

Figure 8.4 identifies the wastewater projects recommended in this Master Plan (as shown previously in **Figure 7.9**). As indicated above, the alignments of the new wastewater mains will generally follow the FUA road network and will be required to be constructed as a condition of approval of development. Accordingly, the wastewater mains in the FUA are designated as Schedule A projects and are considered pre-approved and can proceed to implementation by a landowner without any further Municipal Class EA requirements. Wastewater projects that cross a watercourse using trenchless technology and are required to be constructed as a condition of approval of a development, are designated as Schedule A/A+ pre-approved projects and can be implement by a landowner without any further Municipal Class EA requirements.

The final size and layout of wastewater mains will be determined through the MESPs and Secondary Plan process. No further Class EA study will be required for wastewater mains.

8.1.3.1 Wastewater Recommendations

The following are the recommendations of this report with regard to wastewater projects. It is recommended that these will be considered during the preparation of secondary plans, MESP and detailed design as appropriate.

- Servicing upgrades south of Major Mackenzie Drive East are not required immediately, there is available capacity in the existing systems for some level of FUA development.

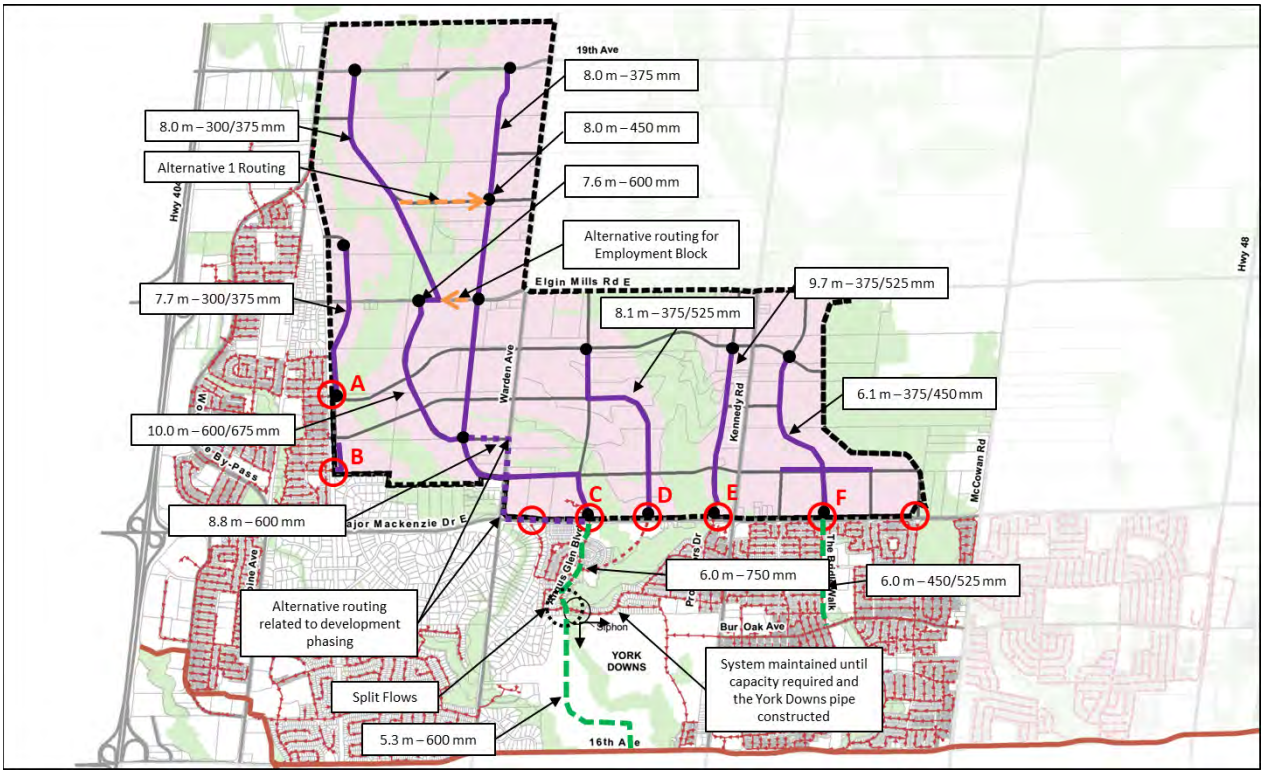


Figure **8**.4 FUA Recommended Wastewater Servicing

- The optimal wastewater main alignment is to follow the public right-of-way, with the exception of the wastewater main crossing under the Berczy Creek from the Employment Block peninsula lands. The final alignment will be subject to local MESP and secondary plans review and approval as well as development phasing.
- As noted in in **Section 7.5.3** and shown in **Figure 7.9**, there is an alternative gravity servicing option for the Employment Block peninsula if the Berczy Creek crossing in the south is not permitted.
- As noted in in **Section 7.5.3** and shown in **Figure 7.9**, there is an alternative to convey additional Employment Clock lands adjacent to Warden Avenue west along Elgin Mills Road. The final alignment will be subject to local MESP and secondary plans review and approval as well as development phasing.
- Alternative servicing routes may include wastewater mains on Warden Avenue and Major Mackenzie Drive (Regional Roads) because of development phasing. The final alignment will be subject to local MESP and secondary plans review and approval as well as development phasing
- As noted in in **Section 7.5.3** and shown in **Figure 8.4**, there are servicing options presented for Angus Glen Boulevard south of Major Mackenzie Drive East where a new wastewater main is constructed through the York Downs lands where all FUA flows will be diverted or a portion of FUA flows will be diverted.
- Factors to be considered for the design of the Angus Glen Boulevard improvements from Major Mackenzie Drive East to upstream of the siphon include micro-tunneling to minimize disruption. The amount of micro-tunneling possible will depend on the final servicing option. If all flow

upstream of the siphon are diverted through York Downs the entire length could be micro-tunneled below existing services. If there is a flow split at the siphon only the top portion can be micro-tunneled as the upgraded pipe must match inverts with the existing system upstream of the siphon.

Master Phasing Plan

- As noted in Section 5.2.4 of CMP Volume 1, the phasing of development within the FUA is key in ensuring the Community Structure Plan can be implemented in a safe and sustainable manner by providing the residents of this new community with access to adequate municipal services and facilities, including roads, trails, cycling, water and wastewater, fire stations, parks, and community facilities. To accomplish this goal, a master phasing plan will be required to accompany secondary plans and MESPs.
- Development phasing may require the location of the sanitary collectors to be relocated, potentially to Regional Roads (i.e. Warden Avenue and/or Major Mackenzie Drive East).
- The phasing or sequence of projects is dependent on how development emerges in the FUA. Beyond local wastewater mains, none of the wastewater servicing improvements are immediately required because of the built-in capacity in the existing wastewater system. However, it will be necessary to coordinate the downstream improvements of the existing system with York Downs (located south of Major Mackenzie Drive East) in order to maximize and enhance the FUA servicing opportunities.

Crossings of the Natural Heritage System

- A series of mitigation measures will be developed and explored further in the Class EA Study, based on the recommendations of the CMP Subwatershed Study, which are specific to the natural heritage system crossings to eliminate or minimize potential impacts. State of the art measures should be considered for their applicability at each proposed crossing.
- Underground services and road construction should be coordinated to reduce the amount of time that construction occurs in areas of high sensitivity.
- Potential impacts of the road crossings of the natural environment will be assessed in more detail during Phases 3 and 4 of the Class EA process, as well as during preliminary and detailed design. The following mitigation measures will be taken into consideration during further studies in order to minimize or avoid impacts:
  - Refine servicing alignment that crosses the future linkage to the east to avoid impacts to a wetland;
  - Design and construct servicing mains in a manner that avoids the natural heritage features in the creek valley (e.g., trenchless technology) for some or all of the creek crossings to mitigate the potential for negative impacts along Berczy Creek;
  - Implement mitigation approaches, such as restoration/enhancement of areas within and adjacent to the valley as treed habitat, to reduce impacts to wildlife and habitat; and,
  - Minimize or avoid impacts on observed Species at Risk (Barn Swallow, Bobolink and Eastern Meadowlark) through appropriate timing of construction and habitat replacement where required.

8.2 Next Steps

The Preferred Community Structure Plan comprises a set of recommendations for the preferred transportation, water and wastewater projects required to serve the North Markham Future Urban Area. This study has documented the completion of Phase 2, Step 6 (dealing with the identification of alternative solutions) of the Municipal Class EA environmental planning process. No Notice of Completion is being issued as part of this Phases 1 and 2 process however, a Notice of Completion will be issued in the future for Schedule B and C projects in accordance with the Municipal Class EA.

As outlined in the City's CMP process, the Preferred Community Structure Plan and Key Policy Directions was presented to, and endorsed by City of Markham Council in the Fall of 2017. This endorsement signals the completion of the Phases 1 and 2 Class EA process and serve as direction for the preparation of the FUA secondary plans. FUA secondary plans will be prepared, adopted and approved as amendments to the City's Official Plan and additional opportunities for public input on the proposed land uses will be provided in accordance with the Planning Act. The FUA secondary plans will provide a platform for the development of plans of subdivision, zoning by-law applications and ultimately building permits.

Prior to construction of the recommended Schedule C road projects, Phases 3 and 4 of the Class EA planning process will be carried out to identify, evaluate and select the preferred road design concepts. The Phases 3 and 4 studies may be carried out and documented in one or more Environmental Study Reports, depending on the anticipated project phasing by the landowners and City of Markham. For example, an Environmental Study Report for each Secondary Plan area or one Environmental Study Report for a related group of projects to be constructed at the same time. The goal of the Environmental Study Reports for the Schedule C road projects will be to build on the Phases 1 and 2 work completed in this study and to comply with Phases 3 and 4 of the Class EA planning process. The Environmental Study Report will establish the specific locations, crossing types and capacities of the recommended road projects to best address the future transportation needs of the FUA.

Prior to construction of the recommended Schedule A+ water and wastewater projects, a public notice will be issued in accordance with the Municipal Class EA. No additional public, stakeholders and agencies review will be required to comply with the Municipal Class EA.

Prior to construction of the recommended Schedule B booster station project, alternative sites will be identified and additional Phase 2 evaluation will be carried out. The proponent will determine what level of public, stakeholders and agencies consultation, if any, is required. The recommended booster station project will be subject to additional documentation supplementing that found in this study (possibly in the form of a Project File) and issuance of a Notice of Completion in accordance with the Municipal Class EA.

In accordance with Sections A.2.4 and A.2.5 of the Municipal Class EA, the Class EA Phases 3 and 4 Studies will consist of the following key steps:

1. **Alternative Design Concepts**
   - Identify reasonable and viable alternative design concepts to implement the preferred solution selected in the Master Plan (e.g., for road projects these could include number of interim and ultimate lanes, provisions for transit, walkability features, intersections, creek crossing locations and dimensions, separated bike lanes or multi-use paths, etc.).

- Confirm the Class EA Schedule of the subject projects. If a project is identified as a Schedule A or A+, they may be excluded from subsequent study. If a project is identified as a Schedule B project, only the Notice of Completion provisions will apply where it is confirmed that the Schedule B provisions were addressed in the CMP.

2. Existing Environmental Conditions

- Compile an inventory of natural, social and economic environments which will be potentially impacted by the alternative design concepts.
- Complete site specific technical studies (traffic modelling, geotechnical, hydrogeology, surface water/fisheries, endangered and threatened species) as necessary to complement existing studies and data found in the CMP. Note that studies need only provide the information required to select a preferred alternative design concept.

3. Net Effects of Each Alternative Design Concept

- Identify the mitigation measures which will be applied to the alternative design concepts (e.g., use of trenchless technology, large span creek crossings, noise abatement measures, use of best practices for construction, etc.).
- Assess the potential net impacts of the identified alternative design concepts.

4. Evaluation Criteria

- Establish evaluation criteria by which the alternative design concepts will be assessed noting that only areas of potential impact will be subject to evaluation.
- Evaluate alternative design concepts to determine a preferred design concept.
- Confirm the appropriate Class EA Schedule for the preliminary preferred design concept.

5. Public, stakeholders and Agency Consultation

- Notify public, stakeholders and agencies and provide one consultation opportunity for public, stakeholders and agencies (i.e., public meeting or PIC) to present and receive feedback on the preliminary preferred design concept.
- Ensure continued dialogue and consultation with Indigenous communities.

6. Prepare Environmental Study Report

- The Environmental Study Report will summarize this Study and document the alternative design concepts, mitigation measures and selection of the preferred alternative design concepts.
- The Environmental Study Report will include all relevant background information collected throughout the course of the study.
- The Environmental Study Report may be combined with other studies (i.e., Master Environmental Servicing Plan, Secondary Plan background studies, etc.) as long as the provisions of the Class EA are addressed.

7. Notice of Completion

- The notice, issued to all public, stakeholders and agencies and advertised in two issues of the local newspaper, signals the start of a minimum 30-day public review period during which the Environmental Study Report will be made available for review.

- If there are concerns raised with any project(s), they should be firstly discussed with the proponent and, if they cannot be resolved, any party may write to the MOECC requesting a Part II Order.
- Upon expiry of the 30-day review or resolution to any Part II Order requests, the proponent may design and implement the project(s).
- In accordance with the City's CMP approach, the management strategies and recommendations developed in the next phase of study will solidify key policy direction for the secondary plans and will also clearly identify the transportation, water and wastewater projects to be addressed. Examples of the City's preliminary policy directions which may affect the recommended infrastructure projects include:
- Protection and enhancement of natural features through a confirmed protected Greenway System and complementary land uses (e.g., locating parks in high infiltration areas).
- Distribution of land uses which support transit and provide appropriate transition to existing communities.
- Integration of cultural heritage resources into neighbourhood design.
- Identifying road and transit networks which provide required connectivity, while minimizing impacts of stream crossings.
- Establishing appropriate Low Impact Development (LID) best management practices to maintain water balance, enhance fish habitat and protect environmental features; and,
- Determining the need for temporary water pumping station near Warden Avenue and Elgin Mills Road.

The City of Markham's Key Directions document will provide guidance for objectives to be met with regard to land use planning and infrastructure projects in the new neighbourhoods and employment lands. These are outlined in the principles and parameters identified in **Table 2.1**. Examples of these directions include:

- Community design that focuses on walkability.
- 'Green' development practices, including the requirement for community energy plans.
- Phasing of development to ensure infrastructure is available to support development in a cost effective manner; and
- Other matters identified through the CMP process.