Region of Peel - PN 2011 – 197P

West Brampton Watermain (Zone 5 Subtransmission Main)

Schedule C Class Environmental Assessment

Environmental Study Report

November 2013 ▪ File 11139

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Executive Summary

The Regional Municipality of Peel has completed a Municipal Class Environmental Assessment Study (Class EA) for the construction of the **West Brampton Watermain**, a 900 mm diameter watermain within Pressure Zone 5 in the City of Brampton. The new watermain will help meet the long term water supply needs for future approved growth and provide security, and flexibility in delivering water supply between the east and west Brampton water supply systems.

The study area limits for the Class Environmental Assessment study are Mississauga Road to the west, Dixie Road to the east, Steeles Avenue to the south, and Bovaird Drive to the north as shown below.

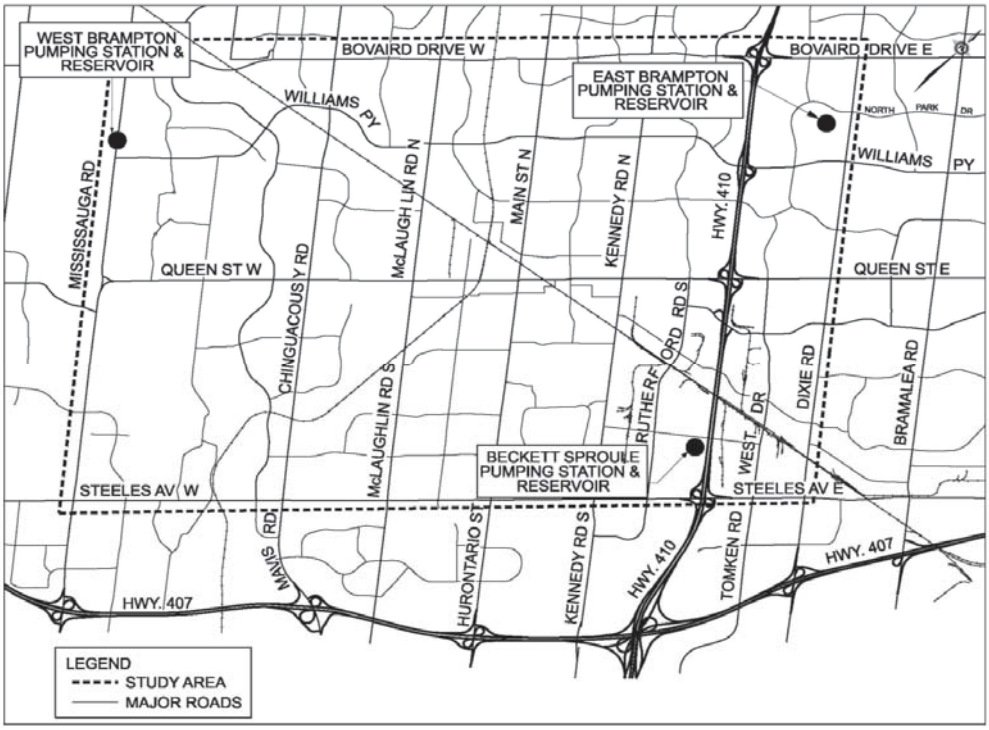

Figure 1: Study Area

Based on previous studies and a review of the existing water supply infrastructure, the West Brampton Watermain is required to convey the required water supply and ensure the following:

- Maximize the overall transfer between the east and west water trunk systems
- Optimize the sub-transmission size
- Provide security of supply within Zone 5
- Provide enhanced flows and pressure to the projected areas of intensification in Brampton within Zone 5
- Optimize the existing infrastructure
- Optimize the location for interconnections to the existing Zone 5 distribution system to existing mains 150mm diameter and larger where hydraulically beneficial.

Under the Class EA process and based on the Municipal Class EA list of Water and Wastewater Activities, the West Brampton Watermain project would typically follow a

Schedule B activity, however, the Region of Peel decided to undertake a higher level of investigation and consultation during the Environmental Assessment Study and followed a Schedule 'C' activity in accordance with the Municipal Class EA schedules.

The Region of Peel retained The Municipal Infrastructure Group Ltd. to undertake the Schedule C Class Environmental Assessment to identify solutions to the above statements.

During the initial stages of the project, the project team identified alternative planning solutions, including Do Nothing, Limit Community Growth, Reduce Water Demand, and Expand Existing Water System. Expanding the existing Water System addressed the problem statement with only minor potential effects on the Natural, Social, or Cultural Environments, therefore this planning solution was carried forward for additional evaluation. As a result, the project team identified alternative a short-list of watermain alignments based on the following criteria:

- Ease of connectivity to Pressure Zone 5
- Locate alternatives within existing rights-of-ways or existing public lands wherever practical. Preferred rights-of-way include major arterial, minor arterial, or collector roads. Avoid local residential roads where practical.
- Minimize length of alternative
- Maximize length of open-cut, thereby minimizing trenchless sections
- Maximize security of supply
- Enhance operational pressure range and east/west/east flow transfer
- Locate alternatives within or in close proximity to Pressure Zone 5
- Minimize impact to existing utilities and other infrastructure
- Avoid significant or sensitive areas, where practical
- Minimize number of watercourse crossings
- Consideration for impact on current and future residents, businesses, and public, including emergency services
- Minimize impact to traffic and transit where practical
- Minimize impact to community by coordinating work with other construction projects

The short list alternative alignments shown below (Figure 2) were comparatively and qualitatively evaluated based on criteria developed within the main categories, which represent the broad definition of the environment in the EA Act, including Technical, Natural Environment, Social, Cultural, and Financial. Based on the evaluation, Alternative 2 Williams Parkway (Figure 3) addressed the problem statement and ranked as well or better than the other short-listed alternatives, and was identified as the recommended solution.

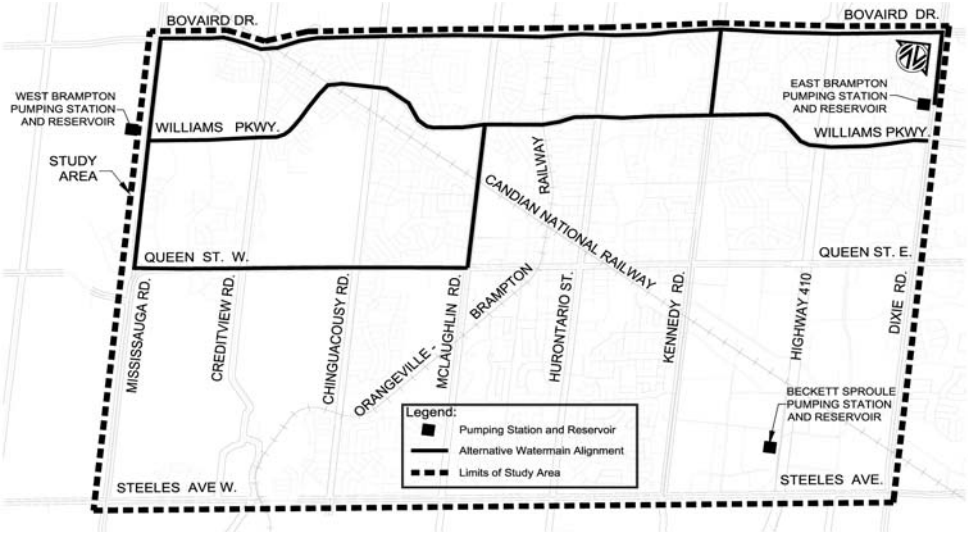

Figure 2: Alternative Alignments

The recommended alignment for the 900mm diameter West Brampton watermain will be located along the Mississauga Road and Williams Parkway corridors. It will connect to the existing water supply system to the west within the site of the West Brampton Pumping Station and to the east at Dixie Road to the proposed East Brampton Watermain (Zone 5).

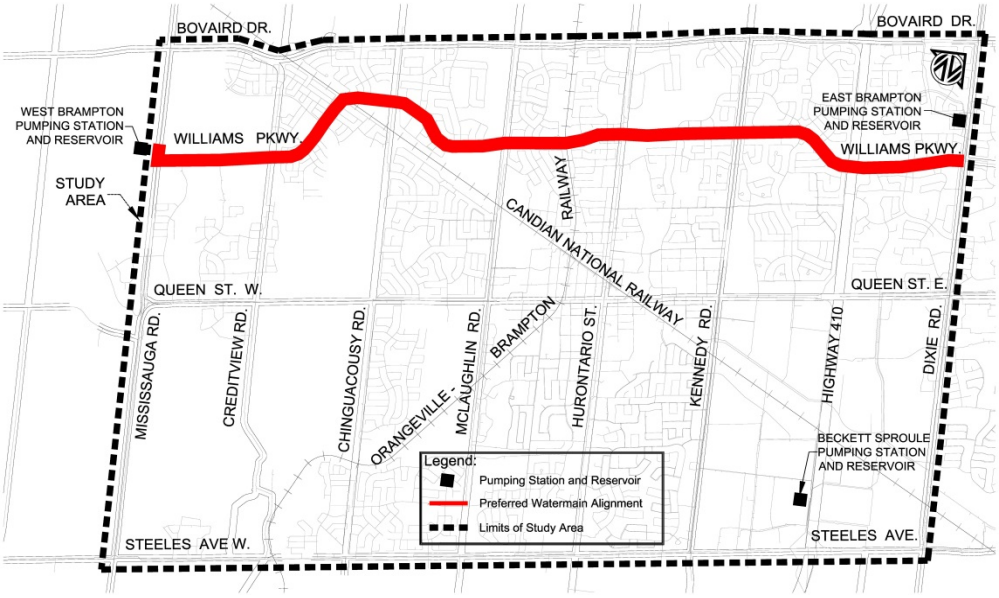

Figure 3: Preferred Watermain Alignment along Williams Parkway

The preferred West Brampton Watermain alignment was divided into the following segments and shown in Figure 4 below:

Segment 1 – East of McLaughlin Road to east of Kennedy Road

Segment 2 – East of Kennedy Road to Dixie Road

Segment 3 – East of Chinguacousy Road to West of McLaughlin Road

Segment 4 – West Brampton Pumping Station to east of Chinguacousy Road.

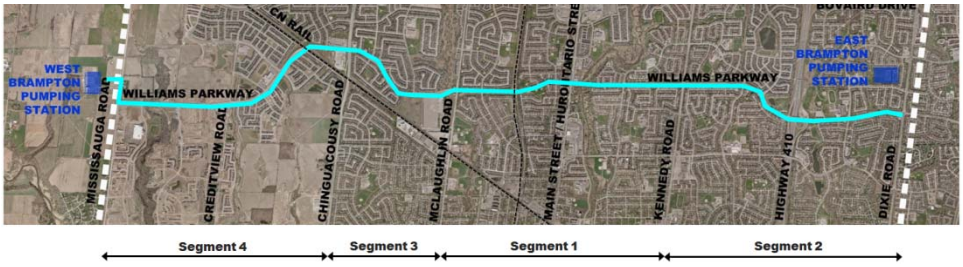

Figure 4: Preferred Alignment and Segments

It is anticipated that the West Brampton Watermain will be constructed in phases. The City of Brampton is undertaking the detailed design of Williams Parkway from McLaughlin Road to North Park Road which also will be constructed in phases. To allow for the coordination of the Williams Parkway road reconstruction and the West Brampton Watermain installation, two of the proposed West Brampton Watermain segments (Segment 1 and 2) are along the same lengths as the Williams Parkway Road reconstruction phases.

Watermains can be installed using various methods of construction, including open cut, conventional man-entry tunnel, Earth Pressure Balance Tunnel Boring Machine (EPBTBM), microtunnelling (also sometimes referred to as jack and bore), pipe ramming, horizontal directional drilling etc. Based on design criteria that were established through consultation with the key stakeholders, the project team developed alternative design concepts for the West Brampton Watermain. These design concepts were comparatively and qualitatively evaluated based on criteria developed within the main categories, which represent the broad definition of the environment in the EA Act, including Technical, Natural Environment, Social, Cultural, and Financial. A brief description of the preferred design concept for each segment follows below.

Within Segment 1 from McLaughlin to Kennedy Road, the watermain will be located on the south side from McLaughlin Road to Kennedy Road. The majority of the alignment will be open cut with the exception of the Mains Creek and Brampton Orangeville Rail Line crossing, Main Street and Etobicoke Creek crossing, and Kennedy Road crossing which will be crossed using trenchless technologies.

Figure 5: Segment 1 Design Concept and Connections

Within Segment 2 from Kennedy Road to Dixie Road, the watermain will be located on the south side from Kennedy Road to Major Oaks Park and on the north side from Major Oaks Park to Dixie Road. The majority of the alignment will be open cut with the exception of Highway 410 and Springbrook Tributary crossing, which will be crossed using trenchless technologies.

Figure 6: Segment 2 Design Concept and Connections

Within Segment 3 from Chinguacousy Road to McLaughlin Road, the watermain will be located on the south side. The majority of the alignment will be open cut with the exception of Fletcher's Creek and McLaughlin Road, which will be crossed using trenchless technologies.

Figure 7: Segment 3 Design Concept and Connections

Within Segment 4 from the West Brampton Reservoir to Chinguacousy Road, the watermain will be located on the west side of Mississauga Road and the south side of Williams Parkway. The majority of the alignment will be open cut with the exception of Huttonville Creek, Springbrook Creek, and Tributary 8B, James Potter, Canadian National Railway, and Chinguacousy Road which will be crossed using trenchless technologies.

Figure 8: Segment 4 Design Concept and Connections

The potential environmental effects of the preferred design alternative were identified and mitigation measures were developed. Monitoring and maintenance will be conducted during construction to ensure the effectiveness of these mitigation measures.

The estimated project costs area summarized in the following table.

Segment 1 – Construction	$16.2 Million
Segment 2 – Construction	$15.5 Million
Segment 3 – Construction	$8.5 Million
Segment 4 – Construction	$26.8 Million
Construction Contingency (20%)	$13.4 Million
Total Construction Cost	$80.3 Million
Engineering Cost (10% of Construction)	$8.0 Million
Unrecoverable HST (2.0%)	$1.8 Million
Total Project Cost	**$90.1 Million**

As previously discussed, it is anticipated that the project will be phased to coordinate the installation of the West Brampton Watermain with the Williams Parkway Road reconstruction. Based on the information available, the following construction schedule is anticipated:

Detailed Design and property acquisition	2014-2016
Segment 1 Construction	2017/2018
Segment 2 Construction	2018/2019
Segment 3 Construction	2020
Segment 4 Construction	2021

The project information and recommended alternatives were presented at a Public Open House held on October 18, 2012, between 6:30 p.m. and 8:30 p.m. and at a Public Open House held on June 4, 2013 between 6:30 p.m. and 8:30 p.m. The Open Houses provided an opportunity for attendees to review the information, present their comments and discuss them directly with the Region of Peel and its consultants. The public, agencies, and stakeholders were notified of the Open Houses through direct mailing, postal code mailings, notices posted on the Region of Peel Website, and notices published in the local paper, the Brampton Guardian.

During the first Public Open house, the preferred route was selected (Williams Parkway) and this was further evaluated to arrive at a preferred design alternative presented at the second Public Open House (combination of Open Cut and trenchless construction methods).

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Note: *A full size copy of the figures are provided at the back of the report*

Tables

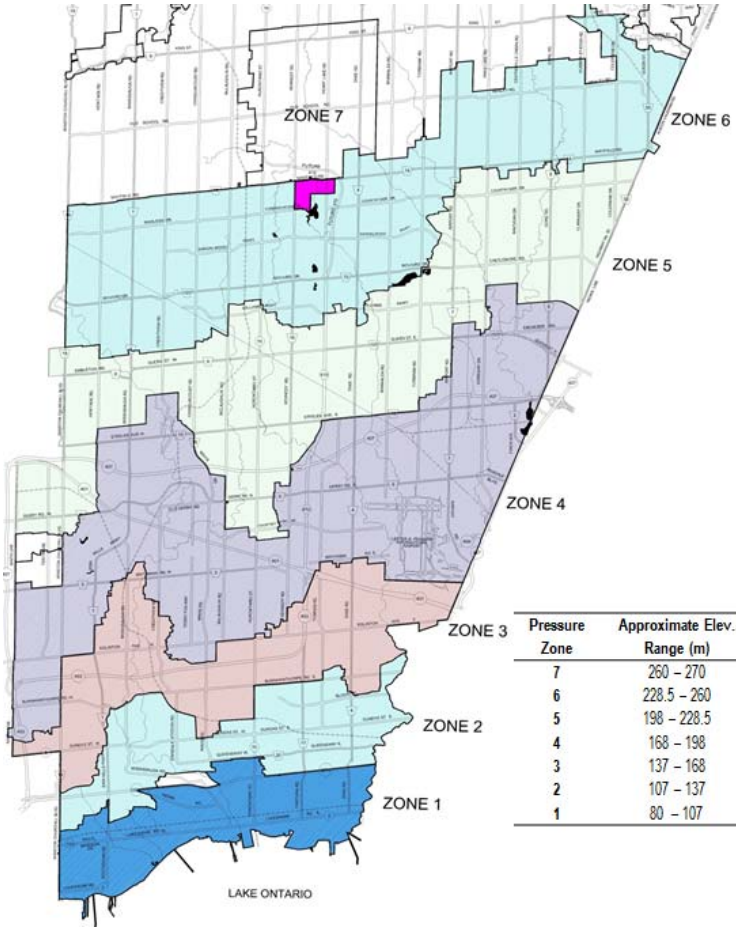
1 Introduction and Background

The Regional Municipality of Peel has completed a Schedule C Municipal Class Environmental Assessment Study (Class EA) for the construction of a watermain in the City of Brampton. The new 900mm diameter watermain will help meet the long term water supply needs for future approved growth. As an added benefit, it will also provide security, and flexibility in delivering water supply between the east and west Brampton water supply systems.

1.1 Water Supply Infrastructure

The South Peel water system, which includes the City of Mississauga and the City of Brampton, is supplied with water from Lake Ontario via parallel east trunk and west trunk systems. The east and west trunk parallel systems are connected through the distribution systems and two major existing east - west transmission mains along The Queensway and Steeles Avenue.

The elevations within the South Peel service area range from 80m to 270m. The service area is divided into seven main pressure zones. Each zone has an elevation range of approximately 30 metres. The main pressure zones are summarized in Figure 1-1.



Pressure Zone	Approximate Elev. Range (m)	TWL (m)
7	260 – 270	
6	228.5 – 260	
5	198 – 228.5	266.7
4	168 – 198	263.2
3	137 – 168	205.7
2	107 – 137	175.2
1	80 – 107	143.6

Figure 1-1 South Peel Pressure Zones

The Zone 5 pressure district is supplied with water from several facilities:

- Meadowvale North Pumping Station high lift pumps
- West Brampton Pumping Station low lift pumps from the west trunk
- Beckett Sproule Pumping Station high lift pumps
- East Brampton Pumping Station low lift pumps
- Airport Road Reservoir and Pumping Station high lift pumps, and
- Tullamore Pumping Station and Reservoir low lift pumps (Under Construction)

1.2 Region of Peel Water and Wastewater Master Plan Update

The Regional Municipality of Peel Master Plan was originally approved in May 1999. It was amended in 2002 based on the York-Peel Servicing Agreement, and then again in 2004 based on the York Peel Servicing Analysis, and the Northwest Brampton Servicing Analysis. The most recent update was completed in September 2007. It concluded that the general servicing concept from the previous Master Plan was valid.

The overall goals of the Master Plan are summarized in the following list:

- Provide a high level of service to existing users and approved growth
- Ensure security of supply
- Mitigate impacts to the environment
- Meet policy statements
- Ensure servicing meets technical criteria
- Optimize existing infrastructure.

The Master Plan update reviewed the servicing strategy based on the best available Provincial, Regional, and Local planning information. The projected 2031 Brampton population and employment considered in the Master Plan was 737,000 and 271,000 respectively. The population is higher and the jobs are lower than the official plan projected. The 2031 water demand projections were based on the population forecasts and the following Peel Design Criteria:

- Residential flows - 280 L/cap/day with a max day factor of 2.0
- I/C/I flows – 300 L/employee/day with a max day factor of 1.4
- Fire flows 303L/s for 4 hours at each facility

A summary of the water demand projections for Zone 5 as presented in the Water/Wastewater are included in Table 1-1.

Table 1-1 Master Plan Maximum Day Demands in Zone 5

Service Area	2011 (ML/d)	2021 (ML/d)	2031 (ML/d)
Zone 5	220.58	260.18	291.62

The Master Plan recommended a servicing strategy focused on the capacity of the trunk facilities. The recommended upgrades to the existing Zone 5 pumping capacity is summarized the table below:

Table 1-2 Region of Peel Master Plan 2031 Flows to Zone 5

West Trunk	Master Plan 2031 Capacity	East Trunk	Master Plan 2031 Capacity
Meadowvale North Zone 5 HL	90 ML/d	Beckett Sproule Zone 5 HL	193 ML/d
West Brampton Zone 5 LL	99 ML/d	East Brampton Zone 5 LL	71 ML/d
		Airport Road Zone 5 HL	89ML/d
		Tullamore Zone 5 LL	45 ML/d

The Plan recommended the following upgrades within the Zone 5 system:

That the east and west systems be connected via the distribution system and two existing east-west sub-trunks. The criteria for reviewing the existing capacity of the distribution system were based on the following:

- Maximum pressure of 690kPa (100 psi)
- Reasonable headloss 1.5m/km
- Maximum velocity of 2.0m/s

In addition, the Master Plan considered the East-West Water Transmission Capacity. For security and operational flexibility, the master plan recommended that additional capacity should be evaluated for the east-west connections in Zones 3 and 4 and potentially a second Zone 2 and/or Zone 5 interconnection.

1.3 Feasibility Assessment of Zone 5 Sub-transmission Main and East Brampton (Zone 4) Transmission Main Twinning

As noted in Table 1-2, the largest single source of the future Zone 5 flows is from the Beckett Sproule HL pumps. The Region of Peel undertook a feasibility study (June 2011), to review the existing 600 mm, 750 mm and 900 mm diameter Zone 5 watermains from Beckett Sproule, to determine whether the existing mains had capacity to convey the future 2031 flows. The report considered headlosses of 1.0, 1.5, 2.0, and even 2.5 m/km. When a headloss of 2.5m / km was considered, the feasibility study noted that the existing conveyance capacity to Zone 5 from Beckett Sproule would be 181 ML/d, which is less than the required 193 ML/d.

Therefore, the feasibility study recommended two Zone 5 projects to provide additional capacity from Beckett Sproule:

1 – Zone 5 north/south transmission main north of Beckett Sproule to the East Brampton PS. For the purpose of this study, this will be referred to as the East Brampton Watermain.

2 – New 750 mm diameter or 900 mm diameter sub-transmission main to convey flows up to 26 ML/d and connect West Brampton Reservoir to the new Zone 5 transmission main from Beckett Sproule (east-west watermain). For the purpose of this study, this will be referred to as the West Brampton Watermain.

This environmental assessment focuses on the West Brampton Watermain.

1.4 Study Area

The feasibility study recommended that the east-west watermain (sub-transmission main) be located within Pressure Zone 5 and connect between the West and East water supply systems. Therefore, the study area is predominantly within the Zone 5 pressure district.

The proposed study area limits for the West Brampton Watermain Class Environmental Assessment study are Mississauga Road to the west, Dixie Road to the east, Steeles Avenue to the south, and Bovaird Drive to the north. The study area is shown in Figure 1-2.

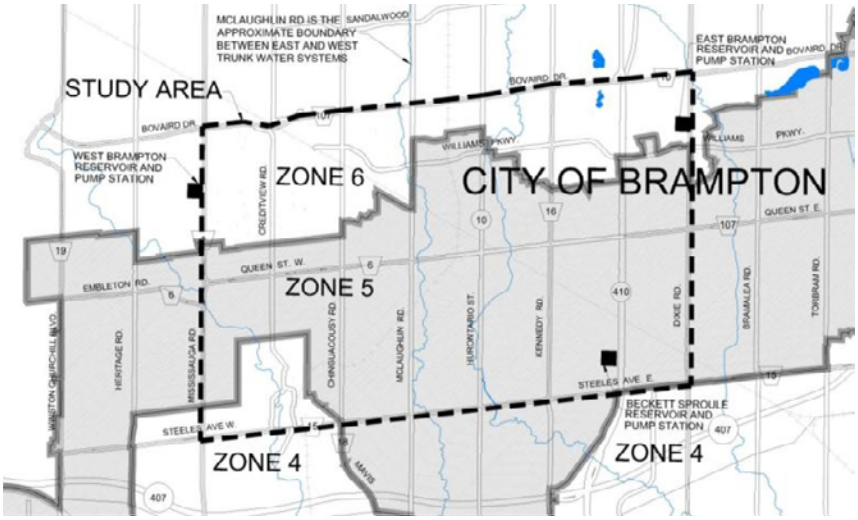


Figure 1-2: Study Area (Source: Peel Region)

1.5 Problem/Opportunity Statement

As identified in the Provincial Growth Plan, Regional Official Plan, and City of Brampton Official Plan, the City of Brampton is projected to grow to approximately 727,000 people and 314,000 jobs by 2031. The Region of Peel's Water and Wastewater Master Plan identified upgrades to the existing east and west water conveyance trunk facilities within Pressure Zone 5 to provide adequate supply to this zone. The existing watermains, and existing east-west transfer mains do not have the capacity to convey the flows from the east and west trunk facilities within the allowable pressure range.

In the feasibility study, it was identified that these deficiencies could be addressed with the construction of three watermains within pressure zone 5. Two of the watermains are subject to the separate East Brampton Watermain EA. This project focuses on the east-west transfer sub-transmission main to convey the required water supply between the West Brampton Reservoir and Pumping Station and the planned East Brampton Watermain and acheive the following:

- Maximize the overall transfer between the east and west water trunk systems
- Optimize the sub-transmission size
- Provide security of supply within Zone 5
- Provide enhanced flows and pressure to the projected areas of intensification in Brampton within Zone 5
- Optimize the existing infrastructure
- Optimize the location for interconnections to the existing Zone 5 distribution system to existing mains 150mm diameter and larger where hydraulically beneficial.

2 Class Environmental Assessment Process

2.1 Class Environmental Process Overview

The planning of major municipal projects or activities is subject to the Ontario Environmental Assessment (EA) Act, R.S.O. 1990, and requires the proponent to complete an Environmental Assessment, including an inventory and description of the existing environment in the area affected by the proposed activity.

The Class EA process was developed by the Municipal Engineers Association, in consultation with the Ministry of the Environment (MOE), as an alternative method to Individual Environmental Assessments for recurring municipal projects that were similar in nature, usually limited in scale and with predictable range of environmental effects which were responsive to mitigating measures.

The Class EA provides for the four following designations of the project depending upon potential impacts:

Schedule A - Projects are limited in scale, have minimal adverse environmental effects and include a number of municipal maintenance and operational activities. These projects are pre-approved. Schedule A projects generally include normal or emergency operational and maintenance activities.

Schedule A + - Projects are within existing buildings, utility corridors, rights-of-way, and have minimal adverse environmental effects. These projects are pre-approved; however, the public is to be notified prior to project implementation.

Schedule B - Projects have the potential for some adverse environmental effects. The proponent is required to undertake a screening process, involving mandatory contact with directly affected public and relevant review agencies, to ensure they are aware of the project and that their concerns are addressed. If there are no outstanding concerns, then the proponent may proceed to implementation.

Schedule C - Projects have the potential for significant environmental effects and must proceed under the full planning and documentation procedures specified in the Class EA document. Schedule C projects require that an Environmental Study Report be prepared and filed for review by the public and review agencies.

Based on the Municipal Class EA list of Water and Wastewater Activities, the installation of a watermain "to connect to an existing system where such facility are not in either an existing road allowance or an existing utility corridor" would trigger a Schedule B project. Given the length of the watermain, and the potential impact to the natural environmental environment, and the social environment, The Region of Peel decided to undertake a higher level of investigation and consultation during the Environmental Assessment Study. As a result, the West Brampton Watermain followed a Schedule 'C' activity in accordance with the Municipal Class EA schedules. The following Class EA planning phases apply:

Phase 1 - Identify the problem (deficiency) or opportunity.

Phase 2 - Identify and evaluate alternative solutions to address the problem or opportunity by taking into consideration the existing environment, and establish the preferred solution taking into account public and review agency input.

Phase 3 - Identify Alternative Design Concepts for the preferred solution implementation by taking into consideration the existing environment, and establish the preferred design concept by taking into account public and review agency input.

Phase 4 - Document Environmental Assessment process that includes the design and consultation process in Environmental Study Report for public review.

Phase 5 - Complete contract drawings and documents, and proceed to construction and operation; monitor construction for adherence to environmental provisions and commitments. Where special conditions dictate, also monitor the operation of the completed facility.

The Class EA process also provides an appeal process to change the project status. Under the provisions of subsection 16 of the amended EA Act, there is an opportunity under the Class EA planning process for the Minister to review the status of a project. Members of the public, interest groups and review agencies may request the Minister to require a proponent to comply with Part II of the EA Act, before proceeding with a proposed undertaking. This is known as a "Part II Order" (formerly called "Bump-Up Request"). The Minister determines whether this is necessary with the Minister's decision being final. The procedure for dealing with concerns which may result in the Minister, by order, requiring the proponent to comply with Part II of the Act is outlined in the Municipal Class Environmental Assessment document.

Following the end of the 30 day public review period, if there are no outstanding Part II Order Requests, the project may proceed to Phase 5 of the Class EA process to complete design and the contract drawings and tender documents, and then move on to construction.

A flow chart describing the Class EA planning and design process is shown in Figure 2-1.

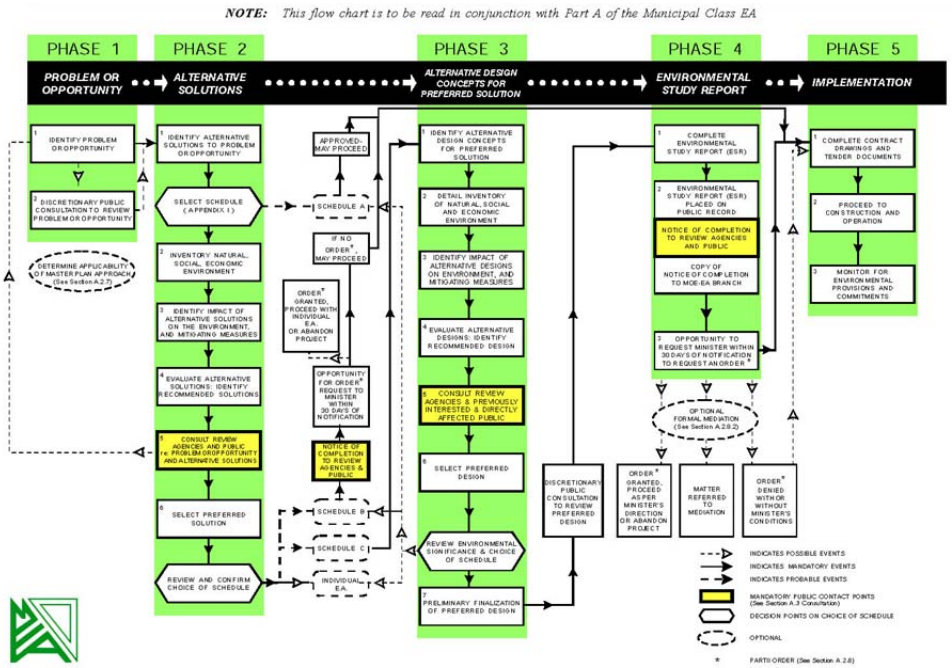


Figure 2-1 Class EA Planning Flow Chart (MEA 2000, update 2007)

2.2 Project Team

The Regional Municipality of Peel retained The Municipal Infrastructure Group Ltd. to undertake the Schedule C Class Environmental Assessment. The key members of the project team are listed in Table 2-1.

Table 2-1 Key Project Team Members

The Regional Municipality of Peel	
Italia Ponce, P.Eng.	Project Manager
Imran Motala, P.Eng.,	Program Manager
Anthony Parente, P.Eng.	Manager, Capital Works
The Municipal Infrastructure Group Ltd.	
Arbinder Hundal, P.Eng.,	Project Manager
Stephen O'Brien, P.Eng.	Project Advisor
Mark Tarras, P.Eng.	Project Director
Angela Carley,P.Eng.	Project Engineer
Savanta,	Natural Environmental Consultants
SPL Consultants Ltd.,	Environmental, Geotechnical, and Hydrogeological Consultants
BA Group Ltd.,	Traffic Consultants
Untermann McPhail	Built Heritage and Cultural Landscapes
Archeoworks	Archaeological Assessment
GHD Ltd.	Geomorphological Study
Hardy Stevenson	Public Consultation Consultants

2.3 Public Consultation Program

The communication and public consultation plan was prepared to ensure that the public has the opportunity to become engaged with the project over the course of the EA in a way that is important to them. The comments provided by the public were considered throughout the project.

The objectives of communications and public consultation were as follows:

- Inform the public and stakeholders about the project;
- Provide a meaningful way for the public to provide the project team with their comments;
- Build and maintain respectful, professional relationships with the City of Brampton, the Region and other stakeholders;
- Respect the comments provided by the public and stakeholders;
- Help members of the public learn about the EA process;
- Meet the First Nations 'duty to consult' requirements and ensure First Nations are notified of the project activities and are given an opportunity to provide comments;
- Balance the advice of various stakeholders and understand their decision-making process;
- Complete communications and public consultation that will contribute to MOE approval;

2.4 Phase 1 Public Consultation

2.4.1 Mandatory Contact List

A mandatory contact list was prepared during the initial stages and was updated during the study. A copy of this list has been included in **Appendix A**.

2.4.2 Notice of Study Commencement

The Notice of Study Commencement which describes the Environmental Assessment process and the objective of the project was issued on March 2, 2011 and March 7, 2011 and distributed within the study area. The Notice of Study Commencement was distributed by the following means:

- Posted on the Region of Peel Website
- Letter mailed directly to Mandatory Contact List, and;
- Newspaper advertisement in the Brampton Guardian on March 2, 2012 and March 7, 2012

A copy of the notice is included in **Appendix A.**

The Notice of Study Commencement notified the public of the study, set out to involve interested parties to provide concerns and comments and provided contact information for the project.

2.4.3 Comments Received

The project team received a number of comments in response to the Notice of Commencement. Table 2-2 summarizes the comments received:

Table 2-2 Summary of Comments Received during Phase One

Stakeholder	Summary of Comments	Project Team Action
Two residents	Wished to be notified of public information sessions	Added to mailing list
Hydro One Brampton	Provided contact information for potential utility relocation requirements	Added to mailing list. Will contact during Phase 3.
Ministry of Transportation	Interested on impacts on provincial highways.	Kept on mailing list. Schedule meeting with MTO to discuss the project.
Ministry of Natural Resources	Records indicate the area contains species at risk.	Undertaking Environmental Study along route and will keep Ministry involved.
CN Rail	Interested in rail crossings.	Will contact CN during Phase 3.
Peel School Board	Wishes to be kept informed.	Will keep on mailing list
Toronto and Region Conservation Authority	Letter summarizing area of interest.	Set up meeting with TRCA during Phase 2 to discuss further.
Credit Valley Conservation Authority	Meeting minute summarize comments	Set up meeting with TRCA during Phase 2 to discuss further.

2.5 Phase 2 Public Consultation

2.5.1 Stakeholder Meetings

Several meetings were held with key stakeholders in response to the Notice of Commencement. Table 2-3 summarizes the meetings with key stakeholders during Phase 2. A copy of the meeting minutes is included in **Appendix A.**

Table 2-3 Summary of Phase 2 Meetings

Meeting Date	Attendees	Primary Purpose	Comments Received
February 3, 2012	Region of Peel TMIG	Review Alternative Routes	
May 10, 2012	City of Brampton Region of Peel TMIG	Present Project Study Area and Alternative Alignments, and obtain the City`s preliminary comments.	Consider impacts to traffic/transit Consider impacts to parks Consider City of Brampton planned projects
May 29, 2012	TRCA Region of Peel TMIG	Present Project Study Area and Alternative Alignments, and obtain the TRCA`s preliminary comments.	Consider impacts to the natural environment
May 31, 2012	MTO Region of Peel TMIG	Present Project Study Area and Alternative Alignments, and obtain the MTO`s preliminary comments.	Consider subsurface conditions at crossings Keep shaft areas outside of the right-of-way Maintain minimum 10m offset from the overpasses
May 31, 2012	CVC Region of Peel TMIG	Present Project Study Area and Alternative Alignments, and obtain the CVC`s preliminary comments.	Watercourses are Redside dace habitat Watercourses to be crossed using trenchless technologies

2.5.2 Notice of Public Open House No. 1

In accordance with the Municipal Class EA, public consultation during Phase Two of the Class EA is mandatory. During Phase 2, the project team held a Public Open House. The Notice of the Public Open House was issued on October 3 and 10, 2012 and was provided through the following methods:

- Notice was published in the Brampton Guardian,
- Letter mailed to those on the stakeholder mailing list, and distributed through the postal code mailing within the study area.
- Region of Peel Website

See **Appendix A** for a copy of the Notice of Public Open House #1.

2.5.1 Comments Received

In response to the Notice of Public Open House No.1, the project team received comments that are summarized in Table 2-4:

Table 2-4 Summary of Comments Prior to the Public Open House

Stakeholder	Summary of Comments	Project Team Action
Resident near Williams Parkway and Kennedy Road.	Concerned about shortage of water. Requires constant supply of water for health care reasons.	Region of Peel advised that the construction is scheduled for 2015 Name is added to the stakeholder list Resident will be notified well in advanced in the future of any water shut off in the area. Will be are communicated to our capital works group at the time of construction

2.5.2 Public Open House No. 1

The Public Open House was held on October 18, 2012 from 6:30 p.m. to 8:30 p.m. at James Potter Public School, located at 9775 Creditview Road, Brampton, Ontario. Information presented at the POH was in the form of display boards arranged around the room.

At the first open house, the problem statement, alternative routes, evaluation criteria, and recommended route were presented. 12 people attended the Open House. No major concerns were identified at the end of the Open house #1 feedback period and it was confirmed that the Williams Parkways alternative was the preferred route for the watermain.

See **Appendix A** for a copy of the Summary Report.

2.6 Phase 3 Public Consultation

2.6.1 Stakeholder Meetings

An information package dated February 22, 2013 summarizing the results of the Public Open House No. 1, and the Phase 3 field investigations was issued to the City of Brampton, Ministry of Transportation, Orangeville Brampton Rail, CN Rail, TRCA, and CVC. In response to the information package, several meetings were held. Table 2-5 summarizes the meetings with key stakeholders during Phase 3.

Table 2-5 Summary of Phase 3 Meetings

Meeting Date	Attendees	Primary Purpose	Comments Received
February 14, 2013	Region of Peel TMIG	Review Alternative CN Rail Crossing location.	
March 20, 2013	CN Rail Region of Peel TMIG	Review CN Crossing	Permit and Crossing requirements
April 11, 2013	CVC Region of Peel TMIG	Review Watercourse Crossings within CVC jurisdiction.	Shafts to be located above the top-of-bank. Desk-top geomorphological study to be completed.
April 12, 2013	City of Brampton Region of Peel TMIG	Review Preferred Alignment with City of Brampton	Comments on the watermain locations within the right-of-way.

Meeting Date	Attendees	Primary Purpose	Comments Received
April 16, 2013	TRCA Region of Peel TMIG	Review Watercourse Crossings within TRCA jurisdiction.	Shafts to be located above the top-of-bank, minimize impact to existing natural features.
April 30, 2013	MTO Region of Peel TMIG	Review Highway 410 Crossing	Maintain clearances from existing structures. Encroachment Permit is required.

2.6.2 Notice of Public Open House No. 2

In accordance with the Municipal Class EA, public consultation during Phase 3 of the Class EA is mandatory. During Phase 3, the project team held a Public Open House. The Notice of Public Open House was issued on May 22, 29, and 31, 2013. The notice was provided through the following methods:

- Notice was published in the Brampton Guardian,
- Region of Peel Website
- Mass mailing by Postal Code along the preferred alignment

See **Appendix A** for a copy of the Notice of Public Open House #2.

In addition, a councillors briefing was held prior to the Open House on May 23, 2013. At the briefing, a copy of the information presented at the Open House was displayed; the councillors in attendance did not have any major concerns with respect to the preferred alignment, except with the schedule of the project. They would like to see coordination between the Region of Peel Project and the City of Brampton's project along Williams Parkway so that impact to residents is minimized.

2.6.3 Public Open House No. 2

The Public Open House was held on June 4, 2013 from 6:30 p.m. to 8:30 p.m. at Arnott Charlton Public School, located at 140 Winterfold Drive, Brampton, Ontario. Information presented at the POH was in the form of display boards arranged around the room.

At the second open house a summary of the material presented at the first open house, alternative design concepts, and recommended design concept was presented. Eight people attended the Open House. Some of the concerns identified by residents who attended the Open house were related to the schedule of the project, traffic impact and traffic signal cycles during construction.

See **Appendix A** for a copy of the Summary Report.

2.6.4 Comments Received

The project team received a number of comments during Phase 3. Table 2-6 summarizes the comments received outside of the meetings and Public Open House, and not specifically noted in the design criteria table:

Table 2-6 Summary of Comments Prior to the Public Open House

Stakeholder	Summary of Comments	Project Team Action/Response
Bell	Impact to existing easement near Fletchers Creek	Modified horizontal alignment to minimize property requirements from

Stakeholder	Summary of Comments	Project Team Action/Response
		Bell.
Hydro One	Minimize impact to existing vacant land near existing substation.	Modified horizontal and vertical alignment to minimize property requirements.
Resident	June 12, 2013 – Concern regarding the length, ambient noise, dirt, road closures, and impact on the neighbourhood.	June 28, 2013 – Responded with link to the display boards, planned schedule of construction, overview of the design alternative evaluation process, installation with the City of Brampton Williams Parkway Road widening, construction methods, and potential mitigation measures.
Resident	June 28, 2013 – Concern regarding traffic impacts and asked whether the watermain could be located away from the travelled road.	July 5, 2013 – Responded with link to the display boards, background on the EA process, history of the project, plans to coordinate some of the watermain installation with the City of Brampton Williams Parkway Road widening, construction methods, and potential mitigation measures.

2.7 Agencies Review of Draft Environmental Study Report (ESR)

On August 20, 2013, the draft ESR was provided to Credit Valley Conservation Authority, City of Brampton, Toronto and Region Conservation Authority, Ministry of Transportation, CN Rail, Orangeville Brampton Railway, and Ministry of the Environment for review and comments. A copy of the comments received is included in **Appendix A** and a summary is provided below:

Stakeholder	Summary of Comments	Project Team Action/Response
City of Brampton	▪ All existing infrastructure along the proposed route shall be considered within the detailed design. Infrastructure includes storm sewer, sanitary sewer, catch basins, watermains, hydro (above and below ground), buried communication networks, traffic lights, telephone poles etc. ▪ Any planned disruptions to public spaces (i.e. parks) shall be reviewed with City of Brampton park staff during the detailed design phase prior to works.	To be carried forward to detailed design
Ministry of the Environment	▪ Highlighted potential for TRCA, MNR permits at watercourse crossings ▪ If dewatering rates exceed 50,000 L/day, a Permit to Take Water (PTTW) is required, Follow Construction Dewatering Guidelines prepared by MOE Central Region.	Noted in the ESR To be carried forward to detailed design

Stakeholder	Summary of Comments	Project Team Action/Response
	▪ Confirmation on follow-ups regarding Aboriginal Consultation	
Credit Valley Conservation	▪ No comments/concerns at this time. ▪ Carry forward the criteria established in the ESR to Detailed Design	ESR will be provided for the Detailed Design.
TRCA	▪ Comments related to future studies in support of PTTW and TRCA permits ▪ Refer to TRCA Post-Construction Restoration Guidelines ▪ Refer to Erosion and Sediment Control Guidelines for Urban Construction, December 2006	Noted in the ESR To be carried forward to detailed design
Orangeville Brampton Railway	▪ Confirmed receipt of the ESR. ▪ No comments received	No action
CN Rail	▪ Required P.O. for $10,000, copy of the geotechnical report, and drawings for final sign-off during the design phase.	To be carried forward to detailed design.
MTO	▪ Require encroachment permit	To be carried forward to detailed design.

2.8 Notice of Completion

The Notice of Completion was issued on November 20, 2013 and was distributed by the following means:

- Posted on the Region of Peel Website
- Letter issued directly to Mandatory Contact List, and;
- Newspaper advertisement in the Brampton Guardian.

A copy of the notice is included in **Appendix A.**

A Notice of Completion is issued once the Environmental Study Report has been finalized and it marks the finalization of the study. . The notice provides the following information:

- A brief description of the project that outlines the problem or opportunity and the need for a solution;
- Reference to the project following the Municipal Class Environmental Assessment;
- Dates and outcomes of the PICs
- Recommended route and alternative design
- Location where the Environmental Study Report (ESR) can be reviewed
- Dates marking the start and end of the 30-day Public Review Period of the ESR

- Public Comment Options, including the right to submit a Part II Order to the Minister of the Environment
- Name and title of Agency contact person to whom comments should be directed;
- Name and address of the municipality;

2.9 First Nations Consultation

First Nation groups that potentially have an interest or stake specifically for this project have been identified to get their input and to address their comments/concerns.

First Nation and Métis Liaison

During the Municipal Class EA, the project team initiated contact with twenty First Nations and Métis groups and organizations, including the following:

- Alderville First Nation
- Beausoleil First Nation
- Chippewas First Nation of Georgina Island First Nation
- Chippewas of Rama First Nation
- Mohawks of the Bay of Quinte
- Moose Deer Point First Nation
- Six Nations of the Grand River
- Curve Lake First Nation
- Hiawatha First Nation
- Mississaugas of the New Credit First Nation
- Huron□Wendat First Nation
- Haudenosaunee Confederacy Chiefs Council
- Kawartha Nishnawbeg First Nation
- Anishinabek Nation □ Union of Ontario Indians
- Association of Iroquois and Allied Indians
- Métis Nation of Ontario
- Credit River Métis Council
- Chiefs of Ontario

A Project Initiation letter was mailed on April 3, 2012 to the above noted and Ontario Ministry of Aboriginal Affairs, Department of Indian and Northern Affairs Canada, Professional Corporation Litigation Lawyers, Mackenzie Lake Lawyers LLP, Donnelly Law. A copy of the letter is provided in **Appendix A**. Follow-up calls were completed to confirm receipt.

A response letter dated July 23, 2012 was received from Haudenosaunee Development Institute and was received for information.

An information package has been provided at project completion for their information.

3 Project Study Area – Existing Conditions

The study area limits for the West Brampton Watermain Class Environmental Assessment study are Mississauga Road to the west, Dixie Road to the east, Steeles Avenue to the south, and Bovaird Drive to the north. The area is preliminary residential, and the natural environmental features are located primarily at the seven watercourse crossings. The following section provides an overview of the existing and planned land use, natural environmental features, geotechnical and hydrogeological conditions, archaeological assessment, cultural heritage features, utilities, hydraulics overview, and traffic overview.

Some of the investigations described in the following sections discuss the different alternative alignments for the watermain route. Refer to section 4 for further detail.

3.1 Land Use (Existing and future)

Within the study area, the existing land use is primarily residential.

The south east corner of the study area is primarily industrial, and the south west corner is primarily open space with existing watercourses and valley lands.

Based on the approved planning information, the majority of the study area will remain primarily residential. The area along Queen Street between McLaughlin and Highway 410 has been identified as the Urban Growth Centre within the Places to Grow Act, the Region of Peel Official Plan, and Brampton's Official Plan. This area will be mixed-use and high density areas.

3.1.1 Policies affecting the study area

This section presents the different provincial, regional, and local municipal planning policies that pertain to the study area, its land use, and population growth targets.

3.1.1.1 Greenbelt Plan

The Greenbelt Plan was established in 2005 under the Greenbelt Act to protect identified agricultural environmental lands and provide linkages between the protected lands, while addressing the needs of developing communities in the Golden Horseshoe. Lands that fall within the Greenbelt are designated as Protected Countryside and may be further designated as Towns and Villages, Agricultural System, and Natural Heritage System.

Although, the Region of Peel includes lands that are part of the Greenbelt, the study area for West Brampton Watermain is identified as existing settlement area outside the Greenbelt.

3.1.1.2 Places to Grow

The 2006 Growth Plan for the Greater Golden Horse was prepared under the Ontario Provincial Government 2005 Places to Grow Act. The Growth Plan projects population and employment forecasts up to 2031 as well as general intensification requirements, prime agricultural protection policies, and identifies potential future transportation corridors and priorities.

The Provincial 2006 Growth Plan forecasts that the population within the Region of Peel will grow to 1,640,000 by 2031 and that the number of jobs will increase to 870,000. It also identifies Downtown Brampton as an urban growth centre with a minimum gross density target of 200 residents and jobs combined per hectare by 2031. The area is highlighted in the Downtown Brampton Urban Growth Centre Figure from Places to Grow.

Figure 3-1 Places to Grow Downtown Brampton Urban Growth Centre (Places to Grow)

The Places to Grow Act and the Growth Plan provides the basis for the updates to the municipalities Official Plan.

3.1.1.3 Region of Peel Official Plan

The Region of Peel Official Plan was adopted by Regional Council in July 1996. The 2008 Office Consolidation includes the official plan amendments made during the 2007 review and the 2012 Office Consolidation includes the official plan amendment made after November

2008. The Official plan is currently under review and the 2011 Draft Office Consolidation is available on the Region`s website. In accordance with Places to Grow, the Regional Official Plan forecasts that the population within the Region of Peel will grow to 1,640,000 by 2031 and that the number of jobs will increase to 870,000. Within the City of Brampton, the population will grow to 727,000 and the number of jobs will increase to 314,000.

The Official Plan outlines policies regarding water supply and distribution of water, including a water efficient strategy to reduce per capita consumptions by 10-15% over the next 20 years.

The 2012 Office Consolidation identifies a Regional Urban Node along Queen Street from the CN Railway to Dixie Road. Official Plan Figure 16 identifies a Regional Growth Centre with similar boundaries and is consistent with Places to Grow. The density target for the growth centre is 200 residents and jobs per hectare by 2031 or earlier. (ROPA 24)

3.1.1.4 City of Brampton Official Plan

The 2006 Official Plan, approved in part by the Ontario Municipal Board by Order dated October 7, 2008, forecasts that by 2031 the population of Brampton will grow to 725,000 people and the number of jobs will increase to 310,000.

The province`s Places to Grow and 2011 Draft Region of Peel Office Consolidation identified downtown Brampton as an urban growth centre with a minimum gross density target of 200 residents and jobs combined per hectare by 2031. The City is currently undertaking the Queen Street West Land Use Study to establish a long term land use and urban design vision and establish a policy and regulatory framework to guide development.

3.2 Natural Environment

During the initial stages of the project, Savanta Inc. completed a technical memorandum of the existing natural environmental conditions within the Study Area based on secondary source information. A copy of the report is located in **Appendix B.** The following section highlights some of the findings.

3.2.1 Aquatic Resources

Each of these various routing options will cross at least one of the following watercourses, proceeding from west to east across the study area:

- Credit River
- Huttonville Creek; (Tributary 7)
- Springbrook Creek; (Tributary 8a)
- Tributary 8b;
- Fletcher's Creek;
- Mains Creek (Tributary to Fletcher's Creek)
- Etobicoke Creek
- Spring Creek

For the majority of the existing watercourses, the aquatic conditions improve towards the south of the study area. All these watercourses have been identified as providing habitat for Redside Dace. Redside Dace is protected under the Endangered Species Act (2007) and each of these watercourses are considered to comprise "regulated habitat" for this species. The MNR will assess the scope of works and will make a determination as to whether the proposed works have the potential to create any impacts, either directly or indirectly, to this species. Although concerns around the potential for direct or indirect impacts to Redside Dace are a key issue, there is also a general concern for the cool/warm water fish community that exists within each of these creeks.

Given the generally north/south orientation of the watercourses that bisect the whole of the study area, and the requirement to align the watermains in a west/east orientation, it will not be possible to avoid watercourse crossings.

The use of trenchless technologies will provide the ability to minimize or avoid direct impacts to these watercourses, however, the potential for dewatering in the open cut sections, at shafts and tunnel sections during the construction phases and the requirement to discharge this water must also be addressed. The use of trenchless watercourse crossings, along with a detailed and robust mitigation plan, will likely result in the ability to work with the MNR in approving these works under a Letter of Advice (LOA).

3.2.1.1 Terrestrial Resources

The study area contains various identified natural heritage features such as wetlands (including Provincially Significant Wetlands (PSWs), Environmentally Significant Areas (ESAs), woodlands, and valleylands as shown in Figure 3-2.

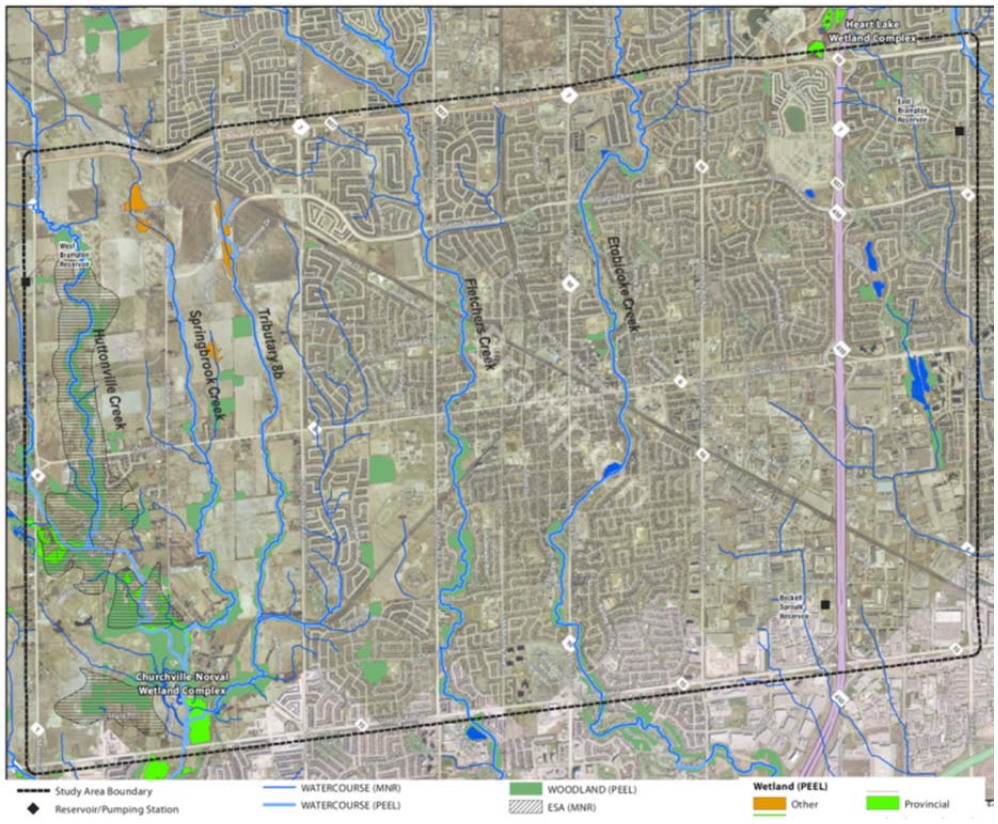


Figure 3-2 Existing Natural Heritage Features

The extent of designated natural heritage features is limited across the study area. Similar to the assessment of aquatic resources, the crossings of valley corridors associated with these key watercourses cannot be avoided, although all routing options will follow existing road right-of-ways (ROW).

No ANSIs are located on the Subject Lands. Small scattered woodlands are present.

3.2.2 Rare and Endangered Species

A search of the Natural Heritage Information Centre (NHIC) database revealed 10 records of the occurrence of rare and endangered species, eight of which are over 20 years old and are considered historical and not addressed in this reporting. The remaining two records are for Redside Dace (Endangered) which is addressed in the above Aquatic Resources Section.

3.2.3 Provincially Significant Wetlands (PSW)

Based on the NHIC, the Heart Lake Wetland Complex is located in the north east section of the study area.

The 35 wetlands of the Heart Lake Wetland Complex cover a total of 87 hectares. It is noteworthy for its high concentration of significant plants and its kettle lakes and kettle bogs. Many of the wetlands contribute spring flows to headwater tributaries and they occur in the midst of a recharge area for an aquifer (OMNR - Aurora District, 2000).

Adjacent uplands are important for many wetland species at the Heart Lake Wetlands Complex and are critical for the maintenance of its wetland functions. Waterfowl such as Mallard nest in fields around the wetlands. The population of woodland frogs such as Spring Peeper and Wood Frog rely on the wetlands for breeding, but forage and hibernate in upland forests and plantations. Leopard Frogs forage in fields a considerable distance from their wetlands. They also move between wetlands, hibernating in the bottom of deeper permanent ponds or lakes and breeding in more shallow wetlands. The resident Midland Painted Turtles and Snapping Turtles live year-round in the kettle lakes, but lay their eggs in surrounding uplands (OMNR - Aurora District, 2000). The wetlands contribute base flows to eight headwater tributaries of Mimico Creek and one headwater tributary of Etobicoke Creek. These wetlands contribute to flood attenuation, water quality improvement and the long term trapping of nutrients. The wetlands also occur in the midst of a recharge area for the Brampton Esker Overburden Aquifer (OMNR - Aurora District, 2000).

Therefore, it is important to acknowledge that Snapping Turtle (Special Concern) may occur in the general areas surrounding the Heart Lake PSW identified on Route 1. As well, frogs and other wildlife associated with wetlands likely occur in this area. There is also potential for rare plant species to occur here.

The NHIC website did not have information for the Churchville-Norval Wetland Complex located in the western portion of the study area, however it's also clear that avoidance of the feature is preferable.

3.3 Phase One Environmental Site Assessment

SPL Consultants Limited (SPL) completed a Phase One Environmental Site Assessment (ESA) Screening Assessment along the alternative watermain alignments. The investigation was undertaken to identify the presence or absence of areas of potential environmental concern. A copy of the report is located in **Appendix C**.

The Phase 1 report was based on federal, provincial, and private databases listed with EcoLog Environmental Risk Information Services Ltd. (EcoLog ERIS) and did not include physical sampling or testing. In summary, the southern portion of the study area is primarily industrial and commercial while the north portion of the study area is primarily residential. In addition, the majority of Spills, Private and Retail Fuel Storage Tanks, PCB Inventory and Waste Generators were listed in the southern portion of the study area.

Based on the findings of this Phase One ESA Screening Assessment, a Phase Two Environmental Site Assessment is recommended for selected industrial or commercially developed areas along the preferred alternative to confirm environmental concerns.

3.4 Hydrogeological/Geotechnical

SPL Consultants Limited (SPL) completed a Hydrogeological/Geotechnical Assessment of the Study Area based on secondary source information. A copy of the report is located in **Appendix D.**

The study area is located within the Etobicoke Creek Watershed and the Credit River and its subwatersheds (Fletcher`s Creek, Churchill Creek, Spingbrook Creek, and Huttonville Creek) as shown in Figure 3-3.

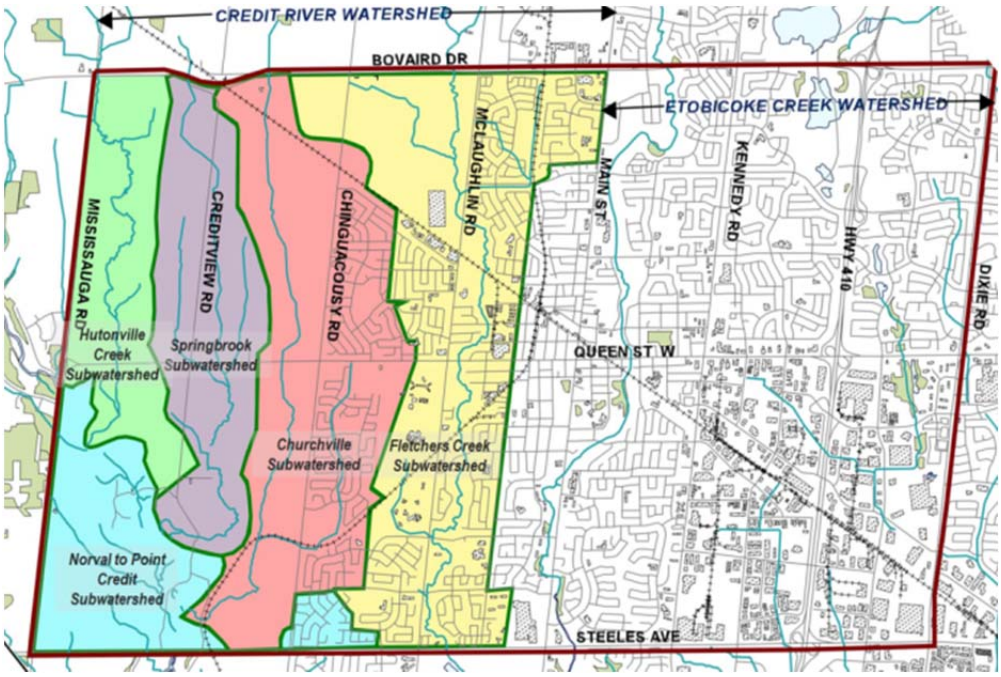


Figure 3-3 Watersheds within Study Area
(SPL Beatty, May 2012; Golden Horseshoe GIS Database 2002)

The subsurface geology within the study area is shown in Figure 3-4. In general, the surficial soil in the study area is the Halton glacial till which is generally a competent clayey silt glacial till of low permeability with the potential to encounter cobbles and the occasional boulders. There are a few pockets of fine textured glaciolacustrine deposits of silts, clays, silty sand the overly the till. Coarse textured glaciolacustrine deposits are in the southwest corner of the study area. Modern alluvial deposits of clay, silt, sand, gravel and organics are found within the stream valleys.

The most significant geologic feature in the area is the Brampton Esker. The approximate limits of the Brampton Esker are shown at the northeast portion of the Study Area. The Brampton Esker is a sand and gravel permeable ridge that can be up to 35 m thick in places. Historically, there has been aggregate extraction and associated dewatering. The water levels have been rebounding. Along the flacks and crest of the esker, there are areas of deep peat deposits. All alternatives routes described in Section 4 are affected in different degrees by the Esker conditions.

Within the study area, the depth to bedrock ranges from less than 5m within the stream valleys to over 50m. The area is underlain by the Queenston Formation Bedrock and Georgian Formation bedrock, which is shale. The upper few meters of the shale is weathered and fractures, beyond the weathered section, the shale has low permeability.

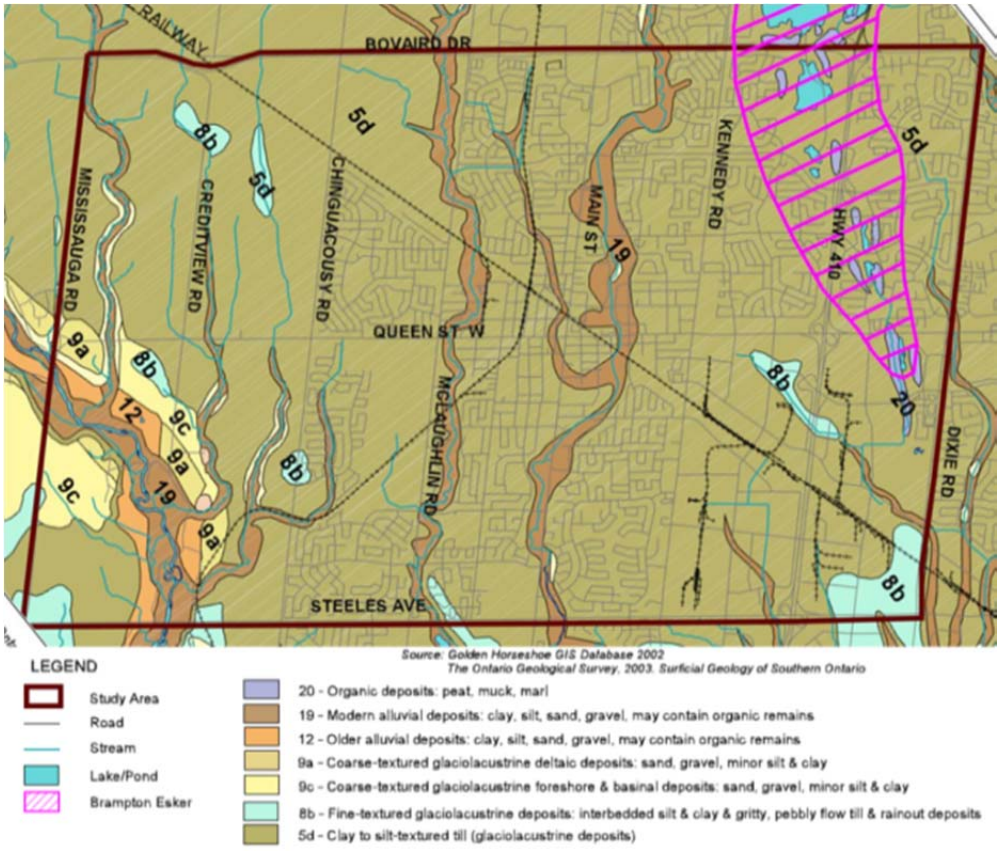


Figure 3-4 Surficial Geology
(SPL Beatty, May 2012)

The general direction of the existing groundwater flow is also from Bovaird Drive to Steeles Avenue. Based on available well records, 658 wells were identified; however 285 were reported as "not in use" or "usage not known." The water levels varied between 0.3 to 24.4 m below ground surface, with an average depth of 5.6m in the overburden wells and between 0.6 to 41.4 m in with an average depth of 5.2 m in bedrock wells.

3.5 Archaeological

Archeoworks Inc. completed a Stage 1 Archaeological Assessment of the Study Area. A copy of the report is located in **Appendix E**. In summary a total of 70 archaeological sites have been registered within and in close proximity to the study area. Three heritage cemeteries were identified within the study areas. The Stage 1 identified potential for the recovery of historic Euro-Canadian and Aboriginal remains within ***undisturbed*** portions of the study area. The majority of the proposed alternatives are located within ***disturbed*** areas. However, the report recommended that a Stage 2 archaeological assessment be conducted along the preferred alignment on any lands to be impacted by construction related activities that are not within previously within disturbed limits. It was further recommended that the watermain alternatives maintain a 10m construction buffer at the cemeteries and that a licensed archaeologist be on-site during construction to monitor any excavation/construction activities adjacent to the existing cemeteries.

3.6 Cultural Heritage

Unterman McPhail Associated completed a cultural heritage resource assessment for cultural heritage landscapes and built heritage resources for the Study Area. A copy of the report is

located in **Appendix F.** The Study area includes Lots 1 through 10, from Concession 4 WHS to the 3rd Concession 3HS in the former Township of Chinguacousy, County of Peel.

A review of resources and a preliminary field study was undertaken in May and June 2012 to review built heritage resources. Based on the findings, each alternative is adjacent to designated built heritage and cultural heritage landmarks. The highest number of landmarks was identified along Queen Street, and the fewest were identified along Williams Parkway. However, it is not anticipated that any of the alternatives would directly impact the existing landscapes.

3.7 Existing Utilities and Municipal Infrastructure

The project team contacted the local utility authorities to obtain existing information within the Study Area. The following section summarizes the information. Drawings submitted by each of the utilities will be included as part of the preliminary design report.

3.7.1 Rogers Cable Communications

On April 9, 2012, Rogers Cable Communications provided their existing utility information within the Study Area along the alternative watermain alignments. The existing plant includes Buried Coaxial TV Plant, Buried Fiber TV Plant, Aerial Coaxial TV Plant, and/or Aerial Fiber TV Plant.

3.7.2 Enbridge Gas Distribution

On April 30, 2012, Enbridge Gas Distribution provided their existing utility information within the Study Area along the alternative watermain alignments.

3.7.3 Hydro One Brampton

On May 11, 2012, Hydro One Brampton provided their existing utility information within the Study Area along the alternative watermain alignments. In general, there is existing hydro plant along each of the alternative watermain alignments. The most significant existing hydro is located at the existing Mount Pleasant Transformer Station at the southwest corner of Williams Parkway and Chinguacousy Road, and the existing north-south hydro corridor east of Chinguacousy Road and south of the transformer station.

The minimum clearance to the overhead hydro line as per the Ontario Health and Safety Act (OHSA) approved in 2005, would need to be maintained, otherwise it would identified as a conflict.

3.7.4 Bell

On May 18, 2012, Bell provided their existing utility information within the Study Area along the alternative watermain alignments. The existing plant includes buried conduit, existing buried bell, and aerial Bell.

Bell recommended that a minimum of 0.6m clearance should be maintained.

3.7.5 Railways

There are two rail lines that are within the study area – Orangeville Brampton Rail and the CN Rail.

The Orangeville Brampton Rail

The Orangeville Brampton Rail is a single track owned by The Orangeville Railway Development Corporation, maintained by Orangeville-Brampton Rail Access Group (OBRAG),

and operated by Cando Contracting Ltd. The rail track is 55-km long and a section of the Owen Sound Subdivision that connects Orangeville to the Canadian Pacific Railway (CPR) in Streetsville/Mississauga. The rail is normally operated 2 days per week (Tuesdays and Thursdays). In addition, seasonal tourist trains also use the tracks.

The Orangeville Brampton Rail is an at-grade crossing. Rail service will need to be maintained at all times.

The CNR

The CN Rail is a three track system through the study area. The tracks are used by the CN Rail and the GO Trains during morning and evening peak hour times. The majority of the CN Rail and road crossings within the study area are separated grade crossings. Rail service will need to be maintained at all times.

Any watermain crossing of the CN Rail will need to satisfy the rails crossing criteria and specifications.

3.7.6 400 series Highways

Highway 410 is a north/south provincial highway operated by the Ministry of The Transportation (MTO) and located within the eastern portion of the study area. There are full interchanges at Bovaird Drive, Williams Parkway, Queen Street, and Steeles Avenue. At the meeting of May 31, 2012 the MTO indicated that they had construction challenges due to the subsurface conditions at Queen Street and Williams Parkway. At Queen Street, a high water level was encountered. At Williams Parkway, the existing soils needed to be sub-excavated and replaced with granular.

The Ministry of Transportation has completed an environmental assessment and is currently at the Design stage for the widening of Highway 410 from Highway 401 to just south of Queen Street. Within the study area, the widening will be from 6 lanes to 10 lanes and occur within the middle of the road. The grass median storm drainage system will be replaced with a piped system. In addition, the grassed area within the Steeles Avenue interchange is planned to be used for stormwater management facilities. Construction timing is not yet known and funding has not been approved for this phase.

MTO would prefer that the shafts be located outside the MTO Right-of-Way (ROW) however during detailed design the shaft locations will be finalized and these criteria will be incorporated when siting the shafts. The tunnel horizontal alignment will be a minimum 10m clearance from the bridge footings. Any watermain crossing should be sufficiently deep to avoid conflicts with the proposed or future storm sewers. MTO requires a continuously welded steel primary liner. Concrete reinforced pipe will not be an accepted alternative. The strength of the tunnel liner should be equal to or greater than the water carrier pipe.

Watermain construction access will not be from the Highway 410 on or off ramps. The watermain location, shaft location, and chamber location should consider future flexibility/construction at the interchange.

3.7.7 Watermains

The Regional Municipality of Peel owns and operates the existing water conveyance and distribution system within the Region of Peel.

The Region provided a copy of their existing watermains within the Study Area. In general, there are existing transmission mains and watermains along each of the alternative alignments. Within the study area, the larger diameter watermains are located along Mississauga Road, Steeles Ave, along an existing easement west of Highway 410, West Drive, Dixie Road, and Bovaird Drive.

3.7.8 Sanitary

The Regional Municipality of Peel owns and operates the existing sanitary (wastewater) system within the Region of Peel. The Region provided a copy of their existing sewers within the Study Area. In general, there are existing sewers along each of the alternative watermain alignments. A minimum 2.5 m horizontal clearance and a minimum 0.5m vertical clearance in accordance with the Ministry of Environment guidelines will be provided.

3.7.9 Storm

The City of Brampton and the Regional Municipality of Peel own and operate the existing storm infrastructure within the Study Area. In general, there are existing sewers along the majority of the alternative watermain alignments. A minimum 2.5 m horizontal clearance and a minimum 0.5m vertical clearance in accordance with the Ministry of Environment guidelines will be provided.

3.7.10 Hydraulics

The InfoWater hydraulic model for the South Peel Water System was received in June 2012 from the Region, and the model included several system and demand scenarios. For the purposes of this project, the following two scenarios were considered:

The SS_2016_PHD (Steady State 2016 Peak Hour Demand) scenario is representative of the initial system and operating conditions following the anticipated commissioning of the sub-transmission main.

The SS_2051_PHD (Steady State 2051 Peak Hour Demand) This scenario is representative of the future system and worst case operating conditions.

The model was run under 2016 peak hour demand conditions, when the proposed sub-transmission main is not in service (Do Nothing). Between Hurontario Street and McLaughlin Road and north of Williams Parkway there is an area of low pressure (30-40 psi). Typically, the area near the northern boundary of Zone 5 is within this low pressure range of 30-40 psi. Further south and just north of Queen Street, the pressure is in the 40-50 psi range. South of Queen Street, there are pockets of 40-50 psi pressures but the majority is between 50-70 psi. The lowest pressures are typically located north of Queen Street in Zone 5 indicating that any proposed sub-transmission main would be best with an east-west alignment north of Queen Street.

Using the Do Nothing as the baseline, the model was run again with the West Brampton Watermain along the alternative alignments (refer to section 4.3) , and the watermain alignments along Williams Parkway and Queen Street were hydraulically better.

Additional hydraulic transient analysis is required for the preferred alternative route. This will be reviewed during the preliminary design phase of this project.

3.7.11 Transportation

BA Group Ltd. reviewed the existing transportation conditions within the study area along the alternative alignments. A copy of the technical memorandum is located in **Appendix G**, and an overview of the main east-west corridors is provided below.

Bovaird Drive is a major regional arterial road with a 4-lane and 6-lane cross section. The 6-lanes provide flexibility for managing traffic during construction. There are a limited number of driveways off of Bovaird Drive. Most of the adjoining residential land uses have alternative access points onto other collector and arterial roads. Key transportation issues include access to the Mount Pleasant GO station, access to the large commercial properties, potential impacts at the Main Street intersection, and a higher number of transit routes.

Williams Parkway is a minor city arterial road with a 4-lane cross section and grassed boulevards. There are a limited number of driveways off of Williams Parkway. Most adjoining

residential landuses have alternative access points onto other collector and arterial roads. Traffic volumes are comparatively lower than the other east-west arterials.

Queen Street is a major arterial road with a 2-lane, 4-lane, and 6-lane cross-section under regional control except the portion between McMurchy Avenue and Highway 410, which is under City of Brampton control. Key transportation issues associated with the route is the limited right-of-way width through the downtown corridor, high levels of pedestrian activity, high number of intersections and driveways, and impacts to the local and GO Bus services.

Steeles Avenue is a major regional arterial road with a 6-lane cross section. There are a limited number of driveways off of Steeles Avenue. Key transportation issues include impact to the high volume of traffic, and impact to the transit.

4 Alternative Solutions

4.1 Planning Alternatives

In response to the Problem Statement in Section 1.5, the following alternative water servicing solutions were identified:

Do Nothing: No changes or improvements to the existing water system would be undertaken. Even though the "Do Nothing" alternative does not address the Problem Statement, the Class EA requires its consideration in all Class EAs as a means of providing a benchmark for evaluating the other alternatives.

With this planning solution, there would be no potential costs or effects on the Natural, Social, or Cultural Environments, however, the future approved water demand service area would not be met and the security of the water supply system would remain unchanged.

Limit Community Growth: Future development, which has been approved under the official plan, but has not yet received draft plan approval, would be limited to reduce the requirements for additional storage.

With this planning solution, there would be no potential costs or effects on the Natural, Social, or Cultural Environments, however, the future approved water demand would not be met and the security of the water supply system would remain unchanged.

Reduce Water Demand: The Region of Peel's Water Smart Peel program provides education on water efficiency and incentives for upgrades. Although there would be no effects on the Natural or Cultural Environments and relatively low costs, this solution alone, does not address the problem statement.

Expand Existing Water System: The existing South Peel water system would be expanded to include a connection between the east and west system within Zone 5. This solution addresses the problem statement with only minor potential effects on the Natural, Social, or Cultural Environments.

The preferred servicing solution chosen to address the Problem Statement in Section 1.5 was determined to be the Expand Existing Water System.

4.2 Alternative Watermain Alignments (Long-list)

4.2.1 Identification of the Long-list Alternative Watermain Alignments

A long list of alternative watermain alignments was identified to address the problem statement. The criteria that were used to determine the long list of alternative alignments are summarized as follows:

- Connectivity to Pressure Zone 5
- Locate alternatives within an existing right-of-way or existing public lands wherever practical. Preferred rights-of-way include major arterial, minor arterial, or collector roads. Avoid local residential roads where practical.
- Minimize length of sub-transmission main for all alternatives
- Maximize security of supply
- Optimize flow and operational pressure range
- Locate alternatives within or in close proximity to Pressure Zone 5

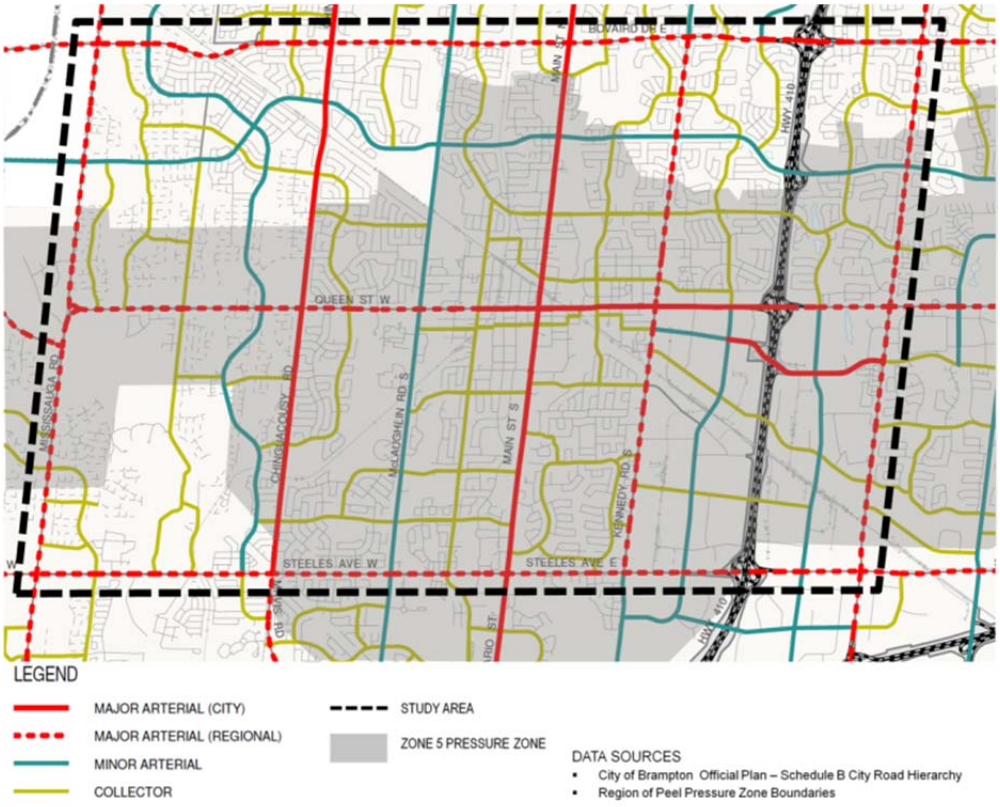


Figure 4-1 Road Classifications and Zone 5 Pressure Boundary

For the purposes of the long-list of alternative alignments, it is assumed that the future north-south watermain (East Brampton watermain) is located along Dixie Road. The long-list of alternative watermain alignments are described below and shown in Figure 4-2.

Alternative 1

The watermain would connect at the West Brampton Pumping Station, be located along Mississauga Road to Bovaird, along Bovaird to Dixie Road, and along Dixie Road to Williams Parkway Boulevard.

Alternative 1B

Given the potential utility constraints along Bovaird Drive near Dixie, and the potential traffic impacts along Dixie Road, an alternative route was identified south along Kennedy Road from Bovaird Drive and then east along Williams Parkway.

Alternative 2

The watermain would connect at the West Brampton Pumping Station, be located along Mississauga Road to Williams Parkway Boulevard, and along Williams Parkway Boulevard to Dixie Road.

Alternative 3

The watermain would connect at the West Brampton Pumping Station, be located along Mississauga Road to Queen Street, and along Queen Street to Dixie Road.

Alternative 3B

Given the potential utility and services constraints and traffic impacts along Queen Street through the downtown area, an alternative route was identified north along McLaughlin Road, and east along Williams Parkway.

Alternative 4

The watermain would connect at the West Brampton Pumping Station, be located along Mississauga Road to Steeles Avenue, and along Steeles Avenue to Dixie Road

Alternative 4B

Given that Alternative 4 includes two crossings of the Credit River, an alternative route was identified along Queen Street, south along Chinguacousy Road, east along Steeles Avenue, Rutherford Road, and Glidden Street.

Sub-alternatives

Additional sub-alternatives include other potential connectors from one alternative to another.

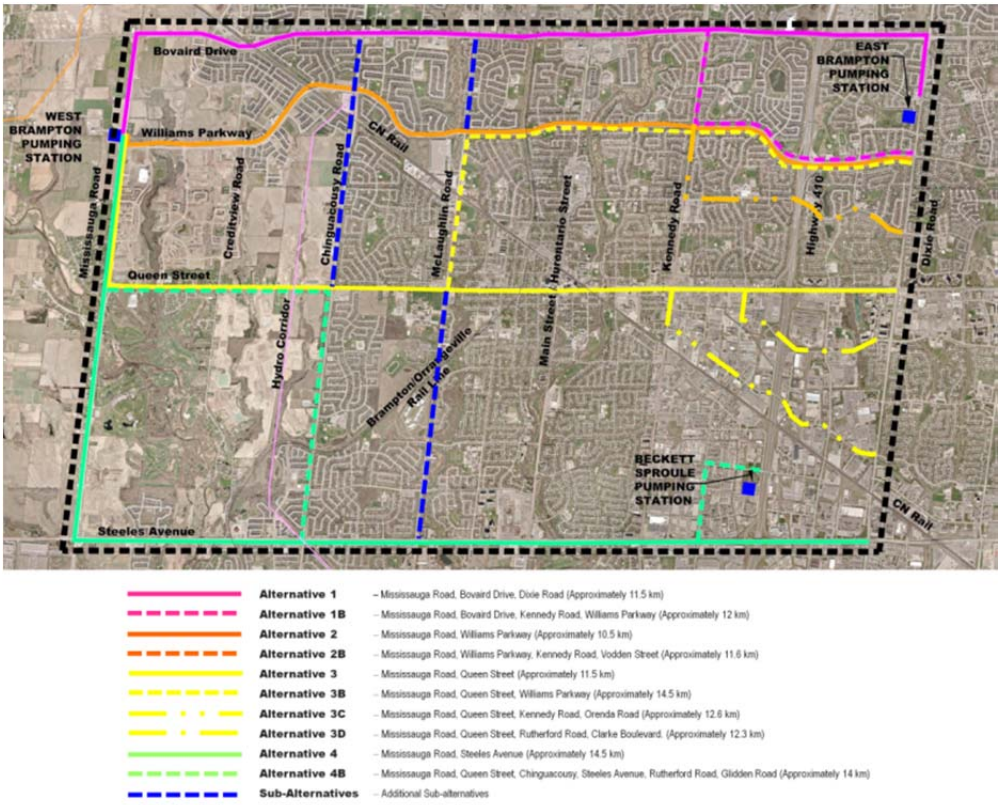


Figure 4-2 Alternative Watermain Alignments

4.2.2 Identification of the Short-list of Alternative Watermain Alignments

The project team reviewed the long-list of alignments. The review process concluded with a short list of alternative sub-transmission main alignments. The short list alternative alignments were identified based on the following criteria:

- Ease of connectivity to Pressure Zone 5
- Locate alternatives within existing rights-of-ways or existing public lands wherever practical. Preferred rights-of-way include major arterial, minor arterial, or collector roads. Avoid local residential roads where practical.
- Minimize length of alternative

- Maximize length of open-cut, thereby minimizing trenchless sections
- Maximize security of supply
- Enhance operational pressure range and east/west/east flow transfer
- Locate alternatives within or in close proximity to Pressure Zone 5
- Minimize impact to existing utilities and other infrastructure
- Avoid significant or sensitive areas, where practical
- Minimize number of watercourse crossings
- Consideration for impact on current and future residents, businesses, and public, including emergency services
- Minimize impact to traffic and transit where practical
- Minimize impact to community by coordinating work with other construction projects

4.3 Alternative Watermain Alignments (Short-List)

Based on the above criteria, the project team identified a short-list which are summarized below and shown in Figure 4-3.

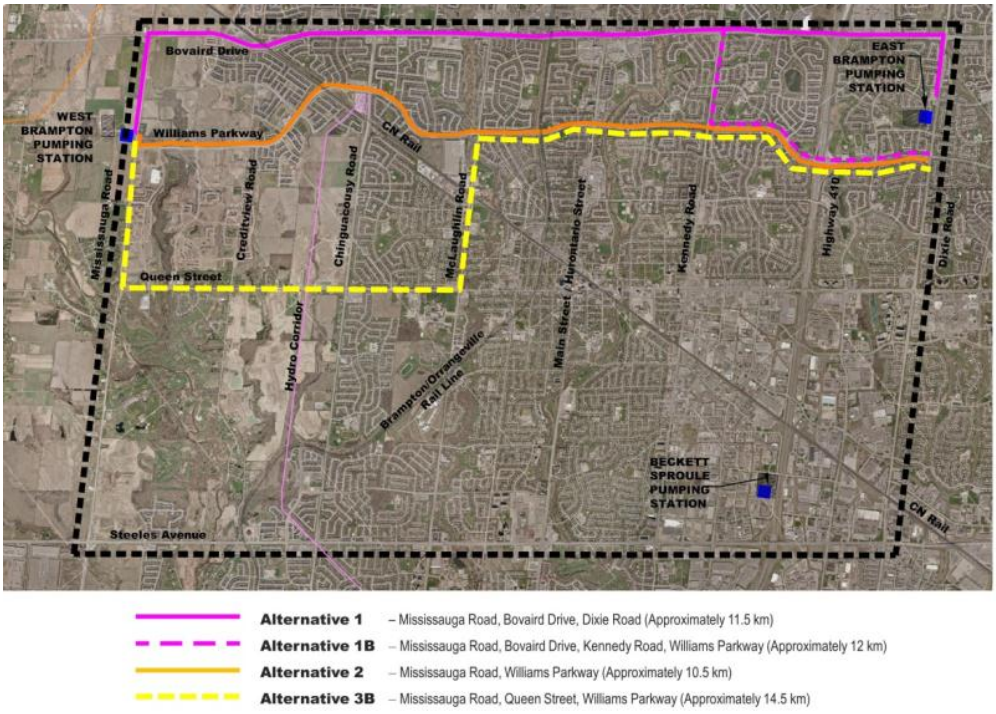


Figure 4-3 Short-list Alternative Alignments

4.3.1 Description of the Evaluation Criteria

All alternative watermain alignments will be comparatively and qualitatively evaluated based on criteria developed within the following main categories, which represent the broad definition of the environment in the EA Act:

- **Technical** which relates to the technical feasibility, constructability, ease of access, operation and maintenance, and other engineering aspects of the alternative solution;

- **Natural Environment** which relates to potential impacts to the natural and physical components of the environment (*i.e.*, air, land, water and biota) including natural and/or environmentally sensitive areas;
- **Social** which relates to potential impacts to residents, neighbourhoods, businesses, community character, social cohesion and community features;
- **Cultural** which relates to potential impacts to historical/archaeological remains, and heritage features; and
- **Financial** which relates to the capital costs of the alternative solution.

Within each main category, project-specific evaluation criteria have been developed based on a review of the Municipal Class EA, the existing conditions of the project area, the alternative watermain alignments being considered, and the problem statement. The project-specific evaluation criteria are listed in Table 4-1.

Table 4-1 West Brampton Watermain – Evaluation Criteria

Category	Evaluation Criteria	Indicator
Technical	Hydraulics (solves problem/opportunity)	Operating pressure, head loss, transient pressures, isolation valve sizes and number of chambers required, ,
	Geology, Hydrogeology -Consideration for approvals/permits requirements, schedule implications, construction duration	Subsurface soils and rock characteristics, Groundwater levels – water table levels
	Overall efficiency of system	Subtransmission pipe size, appurtenances sizes and overall length and alignment changes, zonal interconnections lengths and sizes
	Potential effects on security of supply within the water distribution system	Proximity of the new system to existing watermains, feedermains, utilities, including sewers and culverts.
	Operational considerations / future maintenance	Access to maintenance chambers – open cut vs deep tunnel, access for repair under critical highway crossings, possible larger pipe size for man entry under Hwy. 410.
	CONSTRUCTABILITY: Potential constructability - consideration for watercourse, rail, major road crossings, Subsurface conditions, accessibility, and safety, Relative length of sub-transmission main	Width of ROW Maintenance and repair access Length and depth of route Tunnel/open cut complexity (soil conditions), restricted construction areas (at critical crossings i.e. shaft work areas) Interconnections, lengths and sizes
	Construction Method	Open cut or trenchless
	Potential impacts to existing utilities	Proximity /conflicts with existing utilities and infrastructure
	Conflict with past/future infrastructure improvements	Ability to coordinate with planned infrastructure improvements
	Construction traffic management	Permissible haul routes Permissible construction traffic movements into and out of shafts for trenchless sections Rolling lane closures
Natural Environment	Potential effects on natural features	Proximity to ESAs and ANSIs and presence of CVC and TRCA regulated areas
	Potential effects on aquatic habitat	Number and type of stream crossings Groundwater management - Potential water taking (PTTW) Groundwater discharge (sewers and / or waterbodies). Impact to surface drainage
	Potential effects on terrestrial features	Number of trees removed and/or disturbed, loss of vegetation, proximity to woodlands and treescape, parks
	Potential effects on species of concern	Number of species at risk affected or proximity to habitat

Category	Evaluation Criteria	Indicator
		Loss or disruption to species of concern habitat,
Social/ Cultural Environment	Area Requirements	Amount of permanent easements and shapes required Amount of temporary easements and shapes required
	Community Impact or Land use considerations	Number of adjacent community facilities affected by construction (i.e churches, parks, sporting areas) Number of households and businesses along route Number of Schools Loss of land resulting from temporary and permanent easements
	Works within a disturbed area	
	Potential impact to traffic (vehicular, pedestrian) and Temporary disruption during construction (traffic considerations)	Traffic volumes Pedestrian and vehicular safety during construction Rolling lane closures and traffic flow disruption during construction Reduction in level of service Duration Dust, noise, safe street parking and vibration Number of intersections affected Construction vehicles impact on public traffic and vice versa. Emergency response vehicles.
	Transit considerations	Impact on public transport systems (i.e GO, buses etc.)
	Potential impact on archaeological resources	Effects on archaeological potential and ability to mitigate
	Potential impact on built heritage and cultural landscapes	Effects on cultural heritage resources and ability to mitigate
	Safety	Public safety procedures (i.e. temporary side walk closures, alternate temporary road crossing locations etc.) Schools, hospitals and other public places.
	Compliance with Planning policies	Potential conflict with Official plan policies including secondary plans and Master Servicing plan , MTO policies
Cost	Potential capital costs associated with the alternative	Capital cost Property acquisition cost (temporary and permanent easements) Restoration cost

Based on the evaluation criteria, a qualitative "net effects analysis" will be undertaken to identify the potential effects on the environment, apply reasonable mitigative measures, identify the relative advantages and disadvantages, and propose the recommended alternative.

4.3.2 Comparative Evaluation of Alternative Watermain Alignments

The evaluation criteria were used to comparatively evaluate the alternative solutions and identify a recommended solution. A copy of the evaluation matrix is found in **Appendix H.**

4.3.3 Identification of the Recommended Solution

Based on the evaluation of all alternative watermain alignments, Alternative 2 Williams Parkway addressed the problem statement and ranks as well or better than the other three short-listed alternatives.

- Technical Criteria – Comparatively, Williams Parkway was the best hydraulically, had the fewest hydrogeological constraints, was the shortest alternative, had a high security of supply, few conflicts with utilities, and had a greater potential to coordinate with other construction projects.
- Natural Environmental Criteria – Comparatively Williams Parkway had minimal natural environmental impacts
- Social Criteria – Comparatively, Williams Parkway had fewer traffic impacts, fewer transit impacts, least number of adjacent built heritage features.

A new sub-transmission main along Williams Parkway was identified as the recommended solution.

4.4 Description of the Preferred Watermain Alternative

After comments received by residents, stakeholders, agencies during Public Open House #1, the project team confirmed that the preferred alternative route for the watermain was Williams Parkway. The proposed 900mm diameter watermain will be connected to the existing watermain within the site of the West Brampton Pumping Station to the west and to the proposed East Brampton Watermain (Zone 5) to the east. The watermain will be located within the Mississauga Road and Williams Parkway corridors as shown in Figure 4-4.

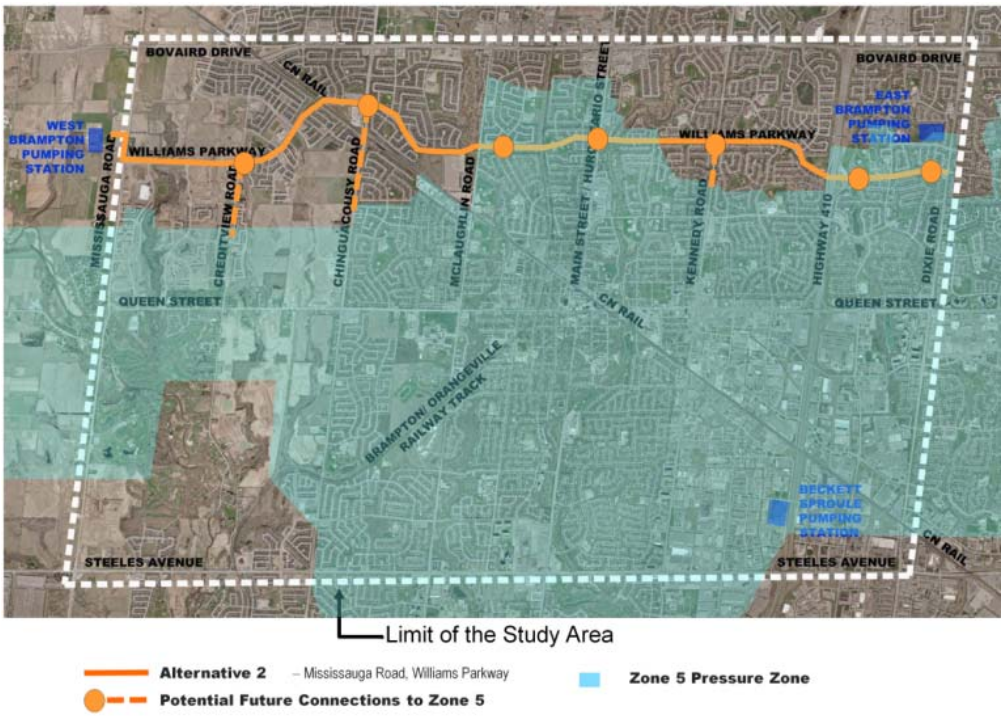


Figure 4-4 Preferred Watermain Alternative

5 Alternative Designs

This section presents the design alternatives for the preferred 900mm diameter Zone 5 West Brampton Watermain alignment. It presents the existing conditions along the preferred alignment, and identifies potential installation methods along the alignment and at critical crossings. The design alternative considers the natural environment, cultural environment, social environment, and technical factors.

The installation methods evaluated were open cut and trenchless. The trenchless methods considered included pipe ramming, horizontal directional drilling, conventional and microtunnelling and earth pressure balance tunnel boring methods (EPBTBM) and are described in detail in Section 5.1. Based on the Region policy regarding watermain size, the acceptable materials, including the prevailing geology and the hydrogeology, the construction suitability, the conventional and the EPBTBM tunnelling and microtunnelling methods of installation would best satisfy these requirements.

The West Brampton Watermain was divided into the following segments as shown in *Figure 5-1*. Segment descriptions are provided below.

- Segment 1 – East of McLaughlin Road to east of Kennedy Road
- Segment 2 – East of Kennedy Road to Dixie Road
- Segment 3 – East of Chinguacousy Road to West of McLaughlin Road
- Segment 4 – West Brampton Pumping Station to east of Chinguacousy Road.

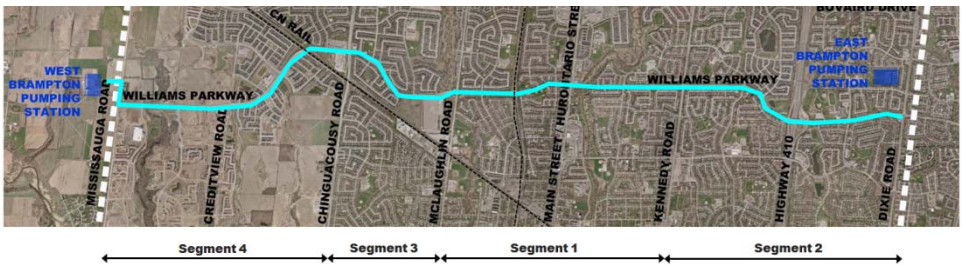


Figure 5-1 Preferred Alignment and Segments

It is anticipated that the West Brampton Watermain will be constructed in phases. The City of Brampton is undertaking the detailed design of Williams Parkway from McLaughlin Road to North Park Road. The Williams Parkway road reconstruction will also be constructed in phases. To allow for the coordination of the Williams Parkway road reconstruction and the West Brampton Watermain installation, two of the proposed West Brampton watermain segments can be installed at the same time the Williams Parkway road reconstruction phases.

5.1 Watermain Installation Methods

There are several methods that can be employed for the installation of the 900mm diameter concrete pressure pipe (CPP) sub-transmission main. These methods include open cut, conventional man-entry tunnel, Earth Pressure Balance Tunnel Boring Machine (EPBTBM), microtunnelling (also sometimes referred to as jack and bore), pipe ramming, horizontal directional drilling etc. The type of trenchless method used will depend very much on the detailed geotechnical and hydrogeological field investigation findings.

The subsurface studies have indicated that the rock is closer to the surface at the west portion of the preferred alignment and generally drops as the sub-transmission main alignment progresses eastwards. Also the alignment will need to negotiate a way through the Brampton Esker that consists primarily of gravel sized stone, including cobbles and boulders with a high water table. At this stage it appears that conventional tunneling, EPBTBM, microtunnelling and pipe ramming offer good possibilities for the installation of the trenchless sections of the sub-transmission main depending on length of drive and geology.

The following provides an overview of the 900mm diameter CPP concrete pressure pipe watermain installation methods.

Open Cut / Open Trench / Trench Box

Open Cut / Open Trench / Trench Box method is generally more economically and results in a higher watermain installation rate when the watermain depth is less than 7 m below the surface. This method requires an excavator to remove the existing soil from the surface to the depth of the watermain, install the watermain, cover the watermain with suitable soil or granular material, and temporarily restore the surface. Near the completion of the watermain installation, the surface will be fully restored to existing conditions or better.

The required width for the installation of the watermain is dependent upon the depth of the watermain and the existing conditions. In general, the construction zone width will include approximately 4.0m for the excavator centred at the watermain and an additional 4.0m for construction vehicles to bring and remove material from site.

Conventional Tunnelling

This method requires a minimum tunnel bore size of 1800mm to allow for man-entry, including support equipment and services required to complete the bore. The tunnel may be bored in overburden soils or rock. If in overburden then the tunnel will include a primary liner. This will likely consist of metal ribs and timber lagging, bolted segmental metal plates can also be used. The outside of the timber lagging may require enclosure in a geotextile fabric to reduce the infiltration of fine soils into the tunnel. If in rock, and depending on the rock quality only the tunnel roof may require support. If the rock is of a poor quality then the tunnel support may extend to the spring line or further down to the invert of the tunnel. Although not required, some contractor's will install a primary liner even in good quality rock. This allows for cleaner working conditions inside the tunnel and may help to increase production rate. Tunnelling in rock can result in a potential for rock 'flour' that may impact any pumps and groundwater treatment prior to discharge.

Cobbles and boulder sizes may drive up the tunnel size. The TBM will need to be sized such that the cutters can break through the larger boulders. If the boulders are larger than can be broken by the TBM then a manual breaking of the boulders may be required. Depending on the subsurface conditions, there may be a need to use an earth pressure balance type TBM.

This method will require the construction of entry and exit shafts, including the siting of tunnel work areas. The work areas including the shafts will be enclosed from a safety and security perspective. The work area enclosure will contain the contractor's trailers, transformer(s), spare muck rails, ventilation, water supply piping and electrical supply conduits, tunnel support system members, muck storage site, etc.

Earth Pressure Balance Tunnel Boring Machine (EPBTBM)

The smaller sized EPBTBM suitable for this size of watermain installation range in size between 1800mm and 2100mm tunnel bore size. The size of machine selected by the contractor will to a large extent depend on what size of TBM is available at the time of construction. This method allows man-entry into the tunnel, including support equipment and services required to complete the bore in the shielded machine. EPBTBM are designed to operate in soft or hard ground conditions that contain water under pressure. These machines are designed to pressurize the cutterhead chamber and balance the external pressure by monitoring and adjusting the pressure inside the cutterhead chamber and achieve a balance with the pressure in front of the cutterhead. These machines can deal with cobbles and boulders and a high water table. EPBTBM have an articulated shield for maneuverability that is sealed against external hydraulic pressure of water to 10 Bar (about 100kPa = 14psi).

The tunnel may be bored in overburden soils or rock. The primary liner can be precast segmental reinforced concrete panels with adjacent panels being bolted to each other. Waste

and muck removal is carried out in a similar manner to that in a conventional tunnel i.e. using muck carts etc.

This method will require the construction of entry and exit shafts, including the siting of tunnel work areas. The work areas including the shafts will be enclosed from a safety and security perspective. The work area enclosure will contain the contractor's trailers, crane, transformer(s), spare muck carts and rails, ventilation system piping, water supply piping and electrical supply conduits, tunnel support system members, muck storage site, etc.

Microtunnelling

This method involves non man-entry tunnel boring techniques. The bore alignment and progress is controlled by remote means from the surface. The control centre will normally be located near the entry shaft. For the 900mm diameter watermain, the tunnel bore size being considered is 1500mm. The primary liner material can be either reinforced concrete jacking pipe (RCP) or steel pipe that is continuously welded or with permalok joints. The 1500mm internal diameter primary liner will allow the CPP watermain pipe to be moved through during installation along straight sections and the large radii bends. This method will face similar challenges as the conventional tunneling in terms of cobbles and boulders etc. The effective breaking up of the cobble and boulders may force an increase in the size of the tunnel.

As with conventional man-entry this method will require the construction of entry and exit shafts, including the siting of tunnel work areas. The work areas including the shafts will be enclosed from a safety and security perspective. The work area enclosure will contain the contractor's trailers, transformer(s), power supply, cuttings transport system, sludge tanks, pipe lubrication materials, water supply piping and electrical supply conduits, tunnel support primary liner system members, muck storage site, etc.

Pipe Ramming

Pipe ramming involves jacking a primary liner by hammering from an entry shaft. The primary liner will cut through the overburden and retains the plug of soil as it progresses forward. The soil plug can be periodically removed or left in the liner until it reaches the exit shaft depending on drive length. This method will not work in rock but is effective in overburden. The jacking process is length-limited to drives of up to 60m that have been successfully completed depending on the jacking capacity. This method may be effective under the smaller sensitive crossings such as creeks, buried utilities etc. Again as with tunneling this method also requires shafts and work areas.

Horizontal Directional Drilling

This method requires plastic or steel pipe, but is most effective by the use of a plastic pipe that is pulled into place following the pilot hole drilling and reaming process. The Region of Peel's policy is that at 400mm and larger watermain size only CPP can be used. Therefore since the limiting size where plastic pipe cannot be used is 400mm this method was not investigated further.

5.2 Watermain Design Criteria

The design alternatives were developed based on the following design criteria that were established through consultation with the Region of Peel, City of Brampton, CVC, TRCA, MTO, CN and The Orangeville Brampton Rail.

Table 5-1 Watermain Design Criteria

Region of Peel	Watermain to be located within arterial and collector roads

	where possible Minimum watermain depth is 2.1 m below grade. Minimize watermain depth, minimize trenchless sections. Line valves every 600m Watermain permanent easement is a minimum 8.4m Watermains 400mm and larger will be concrete pressure pipe.
City of Brampton	Provide minimum 1.0m clearance to catchbasins Preferred location within road is the boulevard, multi-use pathway, or curblane. Minimize impact to traffic Maintain existing transit routes Maintain access and parking areas at parks Consider trenchless crossing of subgrade pedestrian walkways Consider trenchless crossing of intersections.
CVC (CVC jurisdiction is west of the Orangeville Brampton Railway)	CVC instructed that watercourses within their jurisdiction shall be crossed using trenchless technologies unless trenchless is not an option. Shaft locations and staging areas should not encroach on the naturalized areas, and be located above the top-of-bank. Depth of the watermain below the creek should be below the long term potential scour depth
TRCA (TRCA jurisdiction is east of the Orangeville Brampton Railway)	Shaft locations and staging areas should not encroach on the naturalized areas, and be located above the top-of-bank. All water courses shall be crossed using trenchless technologies Protect existing rain gauges. Provide a 2.0m clearance between the watermain and the existing elliptical stormwater culvert just west Dixie Road.
MTO	The MTO Hwy. 410 crossing must be trenchless Watermain should be offset from the existing bridge footings Watermain should be located within a solid/steel liner Depth of the watermain should allow for future storm sewer improvements
CN	CN crossing must be trenchless Watermain should be located within a liner under the tracks
OBRY	OBRY crossing must be trenchless Watermain should be located within a primary liner under the tracks

Other Project Design Criteria	Provide sound technical and cost economical solutions Avoid mixed face with tunnelling techniques Provide achievable tunnel radii Provide adequate sized staging areas for Contractor's temporary and permanent installation requirements Restrict permissible construction traffic movements where possible Easy construction traffic movement where possible by allowing construction vehicle movements only in certain directions. Easy construction traffic access to and from site, especially trenchless sections work areas Site works to minimize construction related noise, vibration, lighting (if night time work allowed) and dust impacts Minimize impacts to residents affected by construction activity Minimize utility relocations and traffic impacts Provide adequate clearance from existing hydro station Minimize property requirements Strict compliance with the groundwater and precipitation runoff discharge criteria. Consider safety to public, operations personnel, and construction crews.

The following section describes the existing conditions along the route and evaluates the design alternatives.

5.3 Description of the Evaluation Criteria

The design alternatives will be comparatively and qualitatively evaluated based on criteria developed within the following main categories, which represent the broad definition of the environment in the EA Act:

- **Natural Environment** which relates to potential impacts to the natural and physical components of the environment (*i.e.*, air, land, water and biota) including natural and/or environmentally sensitive areas;
- **Cultural** which relates to potential impacts to historical/archaeological remains, and heritage features; and
- **Social** which relates to potential impacts to residents, neighbourhoods, businesses, community character, social cohesion and community features;
- **Technical** which relates to the technical feasibility, constructability, ease of access, operation and maintenance, and other engineering aspects of the alternative solution;

5.4 Segment 1 – East of McLaughlin to Kennedy Road

5.4.1 Natural Environment

Natural environment considered aquatic, terrestrial, and geomorphological conditions. The following section highlights some of the findings.

5.4.1.1 Aquatic and Terrestrial

Natural Environmental site investigations were carried out by Savanta on June 17, October 12, and November 9, 2012. The summary of the findings along Segment 1 is provided in Table 5-2. For additional detail, a copy of the Natural Environmental Report is found in **Appendix I.**

Table 5-2 Summary of Aquatic and Terrestrial Environment within Segment 1

Vegetation Community	Vegetation Communities are located at the watercourses crosses. Watercourse 5 (Mains Creek) and Watercourse 6 (Etobicoke Creek).
Flora	No nationally or provincially rare or endangered plant species were recorded from the Subject Lands
Aquatic Habitat	At Etobicoke Creek (TRCA jurisdiction) there is less vegetation north of the road compared to the south side. Approximately 30 small minnows were observed, and no barriers to fish movement were found. At Mains Creek (CVC jurisdiction) there is a high density of cattails. Additional riparian vegetation is limited. No fish were observed. Dense cattails could serve as a barrier to fish movement, although at periods of high water levels, this is likely not an issue.
Breeding Birds	The segment was lined with residential housing and was found to be unfit for ground nesting birds.
Reptiles	No reptiles were observed.
Wildlife Habitat	At Etobicoke Creek, the adjacent woodland has potential to provide wildlife habitat.

The existing aquatic and terrestrial features are located primarily at the watercourse crossings. The alternative design concepts at the watercourse crossings consider the impact to the aquatic and terrestrial features.

5.4.1.2 Species at Risk

The Ministry of Natural Resources (MNR) Species at Risk (SAR) screening letter (April 11, 2012; noted a potential SAR for the Subject Lands. Targeted searches were conducted for the species. The summary of the findings is provided in Table 5-3. For additional detail, a copy of the Natural Environmental Report is found in **Appendix I.**

Table 5-3 Summary of Species at Risk within Segment 1

Species	MNR Comment	Results of Targeted Surveys
Butternut	Potential SAR for the Subject Lands	Targeted searches for Butternut were conducted but the species was not found

Redside Dace	All of the watercourses in CVC jurisdiction have been identified as providing habitat for Redside Dace	Mains Creek is a contributing Redside Dace habitat. For the purposes of this report, Etobicoke Creek is also considered Redside Dace habitat.
Bobolink, Chimney Swift , Eastern Meadowlark	Threatened, might also occur in the vicinity of the study area.	Were not observed during surveys
Cerulean Warbler, Red-headed woodpecker	Special Concern, Historical Records	Were not observed during surveys
American Kestrel	May be a candidate for a federal Species at Risk designation	Were not observed within this segment.
Milksnake, Snapping Turtle	(Threatened) might also occur in the vicinity of the study	No reptiles were observed

Based on the field surveys, Redside Dace was the only species at risk found to be within the Segment. The alternative design concepts at the watercourse crossings will consider the presence of Reside Dace.

5.4.1.3 Geomorphology

A desktop geomorphological review has being undertaken by GHD for the watercourse crossings and is found in **Appendix J.** As noted in the report, the trenchless crossing of the watercourses avoids the requirements for instream work and channel restoration requirements and the proposed depth is conservative given the local watercourse conditions.

5.4.2 Cultural

There were no cultural heritage landscapes (CHL) or built heritage resources (BHR) identified along this segment, and, therefore the alternative design concepts will not be affected.

5.4.3 Social

Landuse

Williams Parkway is an existing 4-lane road with a centre landscaped median. The City of Brampton completed an Environmental Assessment to widen it to 6-lanes. From McLaughlin to the Orangeville-Brampton Rail there is a concrete channel south of Williams Parkway, and residential rear-lots on the north side of Williams Parkway. East of Orangeville-Brampton Rail, Ambro Park is located north of Williams Parkway, and Burton Park is located south of Williams Parkway. Between the parks and Main Street, there are residential lots on both sides of Williams Parkway. From Main Street to Kennedy Road, there are residential lots on both sides, Tara Park located at Etobicoke Creek crossing, and an underground pedestrian crossing connecting Claypine Park, and Hollowtree Park.

Transit

Based on the current transit system, there are transit routes along Williams Parkway, and transit routes cross this segment at Royal Orchard/Vodden, Main Street, Centre Street, and

Kenney Road. As discussed with the City of Brampton, the transit route that crosses Williams Parkway will need to be maintained.

Traffic

BA Group undertook an evaluation of the existing traffic conditions and identified four construction options at intersections: These options are 1. Bored tunnel under the intersecting road; 2. Open trench construction across the (north-south); intersecting road, while maintaining two way (north/south) traffic flow; 3. Open trench construction across the intersecting road, while maintaining one way (north or south) traffic flow; 4. Full closure of the intersecting road. Within Segment 1, the watermain crosses Vodden Street, Murray Street, Main Street, Baronwood Court, Centre Street, and Kennedy Road.

Street	**Option 1** Bored Tunnel	**Option 2** Trenched maintaining 2 way traffic	**Option 3** Trenched with one-way peak direction flow	**Option 4** Full Closure	**Rationale**
Vodden	1	X	X	**2**	Can be scheduled during off-peak, alternative access are available.
Murray Street	2	X	X	**1**	Low traffic volume, alternative routes available.
Main Street	**1**	X	X	X	High traffic volume, part of longer tunnel section.
Baronwood Court	X	X	X	**1**	Low traffic volume, alternative routes available.
Centre Street	2	X	X	**1**	Low traffic volume, alternative routes available.
Kennedy Road	1	X	X	X	High traffic volume.

1 – Most Preferred, 4 – Least Preferred, Grey – Selected, X – Not considered

A copy of technical memo can be found in **Appendix K**.

5.4.4 Technical

To minimize the depth of the watermain and minimize the length of the trenchless sections, the majority of the watermain along this segment was considered to be constructed using open cut methods, with the exception of the Mains Creek and Orangeville Brampton Railway crossing and the Main Street and Etobicoke Creek crossing and the Kennedy Road crossing. At these locations trenchless technologies were considered. The remaining roadway crossings within this segment were considered as a staged, open-cut crossing rather than a trenchless crossing given the limited room available for staging areas, the likely encroachment of the work areas onto Williams Parkway, the additional challenges that trenchless methods involve, the slower rate of installation, and the additional costs.

The following section summarizes the existing geotechnical and hydrogeological conditions, identifies and evaluates the open cut sections and the trenchless crossings, and identifies the

connections between the West Brampton Watermain and the Zone 5 water distribution system.

5.4.4.1 Geotechnical and Hydrogeological

SPL Consultants Limited undertook a geotechnical and preliminary hydrogeological investigation along the proposed route. A copy of the report is found in **Appendix L.** The investigations included a review of the existing information and supplementary field investigations, including exploratory boreholes and monitoring wells.

In general the existing topsoil/road base is underlain by glacial tills of slity clay to silty sand texture over residual soils or till/shale complex. In some areas, the glacial tills are overlain by or imbedded with silty clay to clayey silt and cohesionless silt, sandy silt, sand, and gravelly sand. The glacial tills are underlain by bedrock.

Within Segment 1, the existing bedrock was found between 3.1m to 8.3 m below grade. From McLaughlin to Etobicoke Creek, the existing bedrock was the Queenston Formation and from Etobicoke Creek to Kennedy Road, the existing bedrock was the Georgian Bay Formation. Some of the open cut sections will be within the bedrock, however, it is anticipated that the top weaker portion of the bedrock can generally be removed with an excavator equipped with required rock removal accessories. However, the underlying stronger rock will be more time consuming, and may require the use of impact breakers and line-drilling.

Within Segment 1, the existing groundwater table was observed between 0.9m to 5.4 m below grade. Based on the permeability tests, a PTTW is required. Increased dewatering efforts are required where the excavation reaches gravelly sand to silt (till), which was found in the boreholes near the Mains Creek and Orangeville Brampton Crossing.

Additional geotechnical and hydrogeological site investigations are recommended during the detailed design phase.

5.4.5 Comparative Evaluation of Alternative Open-Cut Watermain Designs for Segment 1

During the evaluation of alternative design concepts, the horizontal location of the watermain within the right-of-way was also considered. For the open cut section, two main design alternatives were considered. Design Alternative 1 was located on the north side of Williams Parkway and Design Alternative 2 was located on the south side of the right-of-way. The centre median was also considered, however, the existing trunk sanitary and storm sewers, including the catchbasins connections are located within the median for the majority of the segment. The summary of the evaluation is provided in the following section.

Table 5-4 Open-Cut Alternative Design Comparative (Segment 1)

Segment	Design Alternative 1	Design Alternative 2	Preferred Alternative
1 –McLaughlin Road to Kennedy Road	North Side of Williams Parkway	South Side of Williams Parkway	
McLaughlin Road to Orangeville-Brampton Rail	Existing Street Trees Residential Rear Lots Ex. 400mm WM, Ex. Phone and TV, Ex. Streetlights Crosses Royal Orchard Drive.	Existing Street Trees Residential rear lots. Concrete Channel south of Williams Parkway Ex. Hydro, Ex. Streetlights, wider boulevard Crosses Vodden Street	Alignment on South Side: Similar environmental and landuse on both sides, however, there is less impact to existing utilities on south side. Potential traffic impacts at Vodden intersection during week days.

Segment	Design Alternative 1	Design Alternative 2	Preferred Alternative
Orangeville-Brampton Rail to Main Street and Etobicoke Creek Crossing	Existing Street Trees Ambro Park and Residential Rear Lots Ex. 400mm WM, EX. Storm and WTC, Ex. 150mm Gas, Ex. Phone, Ex. Streetlights Crosses Hardine Road and Murray Street	Existing Street Trees Burton Park and Residential Lots Ex. Sanitary Sewer, Ex. Hydro, , Ex. Phone, Ex. Streetlights Crosses Murray Street	Alignment on South Side Similar environmental and landuse on both sides, however, there is less impact to existing utilities on south side, and the watermain crosses one less intersection. There is alternative access to Murray Street available.
Main Street and Etobicoke Creek Crossing to Centre	Street Trees Residential Rear Lots Ex. 200mm Gas, Ex. Hydro, Ex Phone Crosses Baronwood Court and Centre Street	Street Trees Residential Rear Lots Ex. 300mm WM, Ex. Hydro. Crosses Elderwood Place and Centre Street	Alignment on South Side Similar environmental and landuse on both sides, however, to minimize Williams Parkwaycrossings, alignment remains on south side.
Centre to Kennedy Road	Park and path to EE Carrefour des Jeunes School Ex. 200mm WM, Ex. Hydro, Ex Phone Crosses Pedestrian Crossing Kennedy Road	Park and path to EE Carrefour des Jeunes School Ex. Hydro. Crosses Pedestrian Crossings and Kennedy Road	Alignment on South Side Similar environmental and landuse on both sides, however, there is less impact to existing utilities on south side. Pedestrian crossing is recommended to be crossed using open-cut methods. Kennedy Road is not recommended to be crossed using open-cut methods.

5.4.6 Comparative Evaluation of Trenchless Watermain Designs for Segment 1

Within Segment 1, the four locations where trenchless installation was considered include Mains Creek and Orangeville Brampton Rail, Etobicoke Creek and Main Street, Kennedy Road and the Pedestrian crossing between Claypine Park and Hollowtree Park.

Mains Creek and Brampton Orangeville Rail Line

The watermain is on the south side at this location, so the crossing of Mains Creek and Brampton Orangeville Rail Line was also considered on the south side. Mains Creek crossing and the rail crossing are approximately 35 m apart and were considered as a single crossing.

South of Williams Parkway and west of Mains Creek, there is an existing boulevard to site a long and narrow staging area and shaft location. The limits of the staging area are constrained by the existing Mains Creek channel south of the boulevard, and should be located above the top of bank.

South of Williams Parkway and east of the Orangeville Brampton Rail is Burton Park. There are a number of existing utilities within the park, including an existing 150mm diameter watermain, a 600mm storm sewer, and a 675mm sanitary sewer, however there is room to locate a shaft within this area. The limits of staging area are constrained by the swale east of the rail, the pathway south of the Williams Parkway right-of-way, the parking lot to the west, and Williams Parkway to the north.

At the proposed vertical alignment, the liner and the watermain would be within silty sand /sand and silt till/shale complex. The water table was observed 2.9m below grade. As noted in the geotechnical report, anticipated ground behaviour would be "bouldery" and "slow to fast ravelling". The presence of cobbles and boulders should be expected, and the rate of excavation is anticipated to be slow. At this crossing, jack and bore method with a 1200mm diameter liner for personnel-entry could be considered. Micro-tunnelling and tunnelling can also be considered.

Etobicoke Creek and Main Street

The watermain is on the south side at this location, so the crossing of Main Street and Etobicoke Creek was also considered on the south side. Main Street and Etobicoke Creek are approximately 125 m apart and were considered as a single crossing. The City of Brampton noted that there are improvements planned to Etobicoke Creek and the bridge at this location as part of the Williams Parkway road reconstruction. The watermain horizontal alignment has been fixed at approximately 8m distance from the south limit of the Etobicoke Creek bridge deck. Main Street carries approximately 2200 to 2300 two way vehicles during the peak hours under existing conditions.

A staging area can be located in the southwest corner of Williams Parkway and Main Street. This staging area occupies some of Slater Circle. There are no driveways off this section of Slater Circle. The limits of the staging need to allow pedestrian movements between Slater Circle and Williams Parkway.

South of Williams Parkway and east of the Etobicoke Creek, there is a park area in which there is room to locate a shaft and smaller staging areas. The limits of staging area are constrained by the woodlot south of Williams Parkway.

At the proposed vertical alignment, the liner and the watermain would be within Queenston shale with limestone/siltstone. Additional boreholes are required during the design phase to characterize the rock quality and strength properties. The water table was observed 4.6 to 5.4m below grade. Groundwater infiltration into the tunnel should be manageable using conventional sumps and pumps within the shaft.

Claypine Park and Hollowtree Park

A pedestrian underpass across Williams Parkway connects Hollowtree Park to Claypine Park. The watermain is on the south side of Williams Parkway at this location, so the crossing was also considered on the south side.

The pedestrian pathway was considered as an open cut crossing and a trenchless crossing.

The open cut crossing would require the watermain alignment to shift from the Williams Parkway right-of-way to the Hollowtree Park, cross the existing pathway, and shift back to Williams Parkway right-of-way. The alignment would temporarily impact the existing walkway, and the park area would be disturbed and require full restoration. The walkway can be temporarily realigned to provide uninterrupted pedestrian access as the watermain is installed. There would be less impact to the traffic along Williams Parkway. The City of Brampton indicated that there is a planned storm sewer installation within the park in 2013, and their preference would be to minimize the disruption to the park and the walkway.

The trenchless crossing would involve a shaft within the boulevard on either side of the pedestrian crossing. One of the shafts would include a drain chamber. The staging area will encroach on the Williams Parkway curb-lane, resulting in its loss for road users. *It* will also impact the existing sidewalk. In addition, the existing utilities within the boulevard will need to be temporarily supported or relocated. The construction duration of the trenchless method would be approximately six to eight weeks. The work would include set up of the work area enclosure, setting up all support equipment and services, obtaining temporary power source

for the TBM, construction of the shafts, tunnelling with a primary liner system, installation and grouting of the pipe, installation of a drain chamber at the low spot. The drain chamber will contain an in-line vale and will therefore be cast in-place. The construction of the cast in-place drain chamber will add another four weeks to the schedule at this location. The open cut installation could be completed in approximately one week at a lower cost and much reduced traffic and environmental impacts.

Both the trenchless method and the open cut method will cause some disturbance to the existing park, however, the open cut method will result in a shorter construction duration resulting in a shallower watermain that will be visible during construction, and a shallower drain chamber, minimized environmental impact (noise, dust etc.) at a significantly lower cost, therefore, the open cut method is recommended.

Kennedy Road

The watermain is on the south side at this location, so the crossing of Kennedy Road is also considered on the south side. Kennedy Road carries approximately 2000 two way vehicles during the peak hours under existing conditions.

South of Williams Parkway, there are existing rear lots east and west of Kennedy Road. To minimize the impacts to the existing turning movements from and onto Williams Parkway, the trenchless crossing shafts and staging areas are located approximately 50 m from the intersection.

At the proposed vertical alignment, the liner and the watermain would be within Clayey silt till/shale complex and possible bedrock. Additional boreholes are required during the detailed design phase to verify the bedrock conditions and considerations may be given to lower the tunnel sections completely into bedrock. The water table was observed 0.9 m below grade. As noted in the geotechnical report, anticipated ground behaviour would be "bedrock" "bouldery" and "hard". The presence of cobbles and boulders should be expected, and the rate of excavation is anticipated to be slow. Micro-tunnelling and tunnelling can be considered.

5.4.7 Identification of the Connections to the existing water distribution system in Segment 1

The Region of Peel`s InfoWater water model was used to identify and evaluate the interconnection locations from the West Brampton Watermain (Zone 5 sub-transmission main) to various points within the Zone 5 pressure district. Within Segment 1, the West Brampton watermain crosses three watermains that are 400mm diameter or greater. The locations and sizes within Segment 1 are provided in the following table:

Table 5-5 Segment 1 Connections

Road	Diameter (mm)	Length of Watermain to connect to Zone 5 watermain (m)
Vodden Street	400	0
Main Street	400	0
Kennedy Road	400	890

The 2016 and 2051 peak hour demand scenarios were simulated, and all three connections are recommended.

5.5 Segment 2 –Kennedy Road to Dixie Road

5.5.1 Natural Environment

Natural environment considered aquatic, terrestrial, and geomorphological conditions. The following section highlights some of the findings.

5.5.1.1 Aquatic and Terrestrial

Natural Environmental site investigations were carried out by Savanta on June 17, October 12, and November 9, 2012. The summary of the findings is provided in Table 5-6. For additional detail, a copy of the Natural Environmental Report is found in **Appendix I.**

Table 5-6 Summary of Aquatic and Terrestrial Environment within Segment 2

2	Vegetation Community	Vegetation Communities are located at the watercourse crossings. Watercourse 7 (Spring Creek)
	Flora	No nationally or provincially rare or endangered plant species were recorded from the Subject Lands
	Aquatic Habitat	Vegetation is limited, lower potential for habitat.
	Breeding Birds	Lined with residential housing and was found to be unfit for ground nesting birds.
	Reptiles	No reptiles were observed.
	Wildlife Habitat	Some linkage capacity

The existing aquatic and terrestrial features are located primarily at the watercourse crossing. The alternative design concepts at the watercourse crossing consider the impact to the aquatic and terrestrial features.

5.5.1.2 Species at Risk

The Ministry of Natural Resources (MNR) Species at Risk (SAR) screening letter (April 11, 2012; noted a potential SAR for the Subject Lands. Targeted searches were conducted for the species. The summary of the findings is provided in Table 5-7. For additional detail, a copy of the Natural Environmental Report is found in **Appendix I.**

Table 5-7 Summary of Species at Risk within Segment 2

Species	MNR Comment	Results of Targeted Surveys
Butternut	Potential SAR for the Subject Lands	Targeted searches for Butternut were conducted but the species was not found
Redside Dace	All of the watercourses in CVC jurisdiction have been identified as providing habitat for Redside Dace	Spring Creek is within the TRCA jurisdiction. For the purposes of this report, it is assumed that it is regulated habitat for Redside Dace.

Bobolink, Chimney Swift, Eastern Meadowlark	Threatened, might also occur in the vicinity of the study area.	Were not observed during surveys
Cerulean Warbler, Red-headed woodpecker	Special Concern, Historical Records	Were not observed during surveys
American Kestrel	May be a candidate for a federal Species at Risk designation	Was not observed during surveys
Milksnake, Snapping Turtle	(Threatened) might also occur in the vicinity of the study area.	No reptiles were observed

Based on the field surveys, Redside Dace was the only species at risk found to be within the Segment. The alternative design concepts at the watercourse crossings will consider the presence of Reside Dace.

5.5.1.3 Geomorphology

A desktop geomorphological review has being undertaken by GHD for the watercourse crossings and is found in **Appendix J.** As noted in the report, the trenchless crossing of the watercourses avoids the requirements for instream work and channel restoration requirements and the proposed depth is conservative given the local watercourse conditions.

5.5.2 Cultural

There were no cultural heritage landscapes (CHL) or built heritage resources (BHR) identified along this segment.

5.5.3 Social

Landuse

Williams Parkway is an existing 4-lane road with a centre landscaped median. The City of Brampton completed an Environmental Assessment to widen it to 6-lanes up to North Lake Road. From Kennedy Road to South Lake Boulevard, there are residential rear lots on both sides of the road. There is an underground pedestrian walkway to Weybridge Park. From South Lake Road to Highway 410, Major Oaks Park is located on the north side of Williams Parkway, and rear residential lots are located on the south side and a pedestrian walkway connects the two areas. From Highway 410 to North Park Drive, there is an existing GO Carpool lot, Bramalea Limited Community park, and North Park Secondary School north of Williams Parkway, and Lafrance Park, and residential development south of Williams Parkway. From North Lake Road to Dixie Road, there are residential rear lots and a Spring Creek on the north side, and residential rear lots on the south side.

Transit

Based on the current transit system, there are transit routes along Williams Parkway, and transit routes cross this segment at Rutherford Road, Southlake Boulevard, North Park Road, and Dixie Road. As discussed with the City of Brampton, the transit routes that cross Williams Parkway will need to be maintained.

Traffic

BA Group undertook an evaluation of the existing traffic conditions and identified four construction options at intersection crossings are considered: These options are 1. Bored tunnel under the intersecting road; 2. Open trench construction across the (north-south); intersecting road, while maintaining two way (north south) traffic flow; 3. Open trench construction across the intersecting road, while maintaining one way (north or south) traffic flow; 4. Full closure of the intersecting road. Within Segment 2, the watermain crosses Rutherford Road, Southlake Blvd, and North Park Drive.

Street	**Option 1** Bored Tunnel	**Option 2** Trenched maintaining 2 way traffic	**Option 3** Trenched with one-way peak direction flow	**Option 4** Full Closure	**Rationale**
Rutherford Road	2	X	**1**	3	Maintain peak volume,
North Park Drive	3	**1**	2	4	Minor lane reductions to maintain two way traffic.

1 – Most Preferred, 4 – Least Preferred, Grey – Selected, X – Not considered

A copy of technical memo can be found in **Appendix K**.

5.5.4 Technical

To minimize the depth of the watermain and minimize the length of the trenchless sections, the majority of the watermain along this segment was considered to be constructed using open cut methods, with the exception of the pedestrian walkways (between Weybridge Parkette and Hansen Parkette and another at Major Oaks Park), Hwy 410 crossing, and Spring Creek crossing. At these locations trenchless technologies were considered. The remaining roadway crossings within this segment were considered as a staged, open-cut crossing rather than a trenchless crossing given the limited room available for staging areas, the likely encroachment onto Williams Parkway, the slower rate of installation, and the additional costs.

The following section summarizes the existing geotechnical and hydrogeological conditions, identifies and evaluates the open cut sections and the trenchless crossings, and identifies the connections between the West Brampton Watermain and the Zone 5 water distribution system.

5.5.4.1 Geotechnical and Hydrogeological

SPL Consultants Limited undertook a geotechnical and preliminary hydrogegological investigation along the proposed route. A copy of the report is found in **Appendix L.** The investigations included a review of the existing information and supplementary field investigations, including exploratory boreholes and monitoring wells.

In general the existing topsoil/road base is underlain by glacial tills of silty clay to silty sand texture over residual soils or till/shale complex. In some areas, the glacial tills are overlain by or imbedded with silty clay to clayey silt and cohesionless silt, sandy silt, sand, and gravelly sand. The glacial tills are underlain by bedrock. Near Highway 410, the Brampton Esker deposits of silty sand to sandy gravel containing cobbles and boulders from the predominant formation below the fill and above the bedrock surface.

Within Segment 2, only the boreholes at Highway 410 were extended down to Bedrock. At these boreholes, the existing bedrock was found between 21.6m to 25.3 m below grade. The

existing bedrock was the Georgian Bay Formation. It is anticipated that the open cut sections within the dense fill materials may lead to slower installation progress rates.

Within Segment 2, the existing groundwater was observed between 1.4 m to 12.6 m below grade. Based on the permeability tests, a PTTW is required. Increased dewatering efforts are required where the excavation reaches gravelly sand to silt (till), which was found in the boreholes near the Dixie Road. Increased dewatering efforts are also required within the Brampton Esker.

Additional geotechnical and hydrogeological field investigation will be required during the detailed design phase.

Crossing of Hwy 410

For the design horizontal alignment two vertical alignments were evaluated. The horizontal alignment crosses Hwy. 410 through the 'Brampton Esker'. The Brampton Esker trends in a southeasterly direction, beginning just south of Heart Lake, extending over a distance of some 5km to south of Queen Street and having a maximum width of about 500m The Esker deposits consist of coarse grained cohesionless sands, gravel, cobbles and boulders. The preliminary design for the watermain shows the alignment about 30m north of the Williams Parkway bridge over Hwy. 410.

At the Hwy. 410/Williams Parkway interchange, six (6) borings were advanced. Four of the six borings were drilled to bedrock and then diamond cored 2 to 5m into shale to prove bedrock.

The Hwy. 410/Williams Parkway is underlain by Fill, Halton Till, Brampton Esker Deposits, and Georgian Bay Formation shale bedrock.

SPL's groundwater level measurements in their boreholes at the interchange (readings taken in the fall of 2012) ranged from elevation 225.0m to 226.2m (~10□12m below grade at the shafts). A water table aquifer exists within the Brampton Esker deposits.

This crossing will present challenging work conditions because of the gravels, cobbles and boulders. The Hwy. 10 crossing methodology will allow for both tunnelling and microtunnelling. The tunnel boring machines for both methods will need to be able to control and manage the groundwater head, including the breaking and crushing of boulders of various sizes. The tunnelling method may involve the use of a conventional TBM or an Earth Pressure Balance TBM.

The two vertical options follow:

Option 1. As noted above is aligned through the Brampton Esker. This alignment will require the tunnelling process to take place in cohesionless soils such as gravels, cobbles and boulders. The size and frequency of the occurrence of the cobbles and boulders cannot be assessed with accuracy.

Option 2. The vertical alignment was lowered across the Hwy. 410. This places the tunnelling process below the Esker and into the shale bedrock hence removing the risk of encountering cobbles and boulders. However the deeper tunnelling in rock below the Esker will make the shafts deeper and therefore this option is the more expensive of the two evaluated.

The evaluation allows the Region to adopt either of the two vertical alignment options during the detailed design stage.

5.5.5 Comparative Evaluation of Alternative Open-Cut Watermain Designs for Segment 2

During the evaluation of alternative design concepts, the horizontal location of the watermian within the right-of-way was also considered. For the open cut section, two main design alternatives were considered. Design Alternative 1 was located on the north side of Williams Parkway and Design Alternative 2 was located on the south side of the right-of-way. The centre median was also considered, however, the existing trunk sanitary and storm sewers were located within the median for the majority of the segment. The summary of the evaluation is provided in the following section.

Table 5-8 Open-Cut Alternative Design Comparative (Segment 2)

Segment	Design Alternative 1	Design Alternative 2	Preferred Alternative
2 – Kennedy Road to Dixie Road or East Brampton PS	North Side of Williams Parkway	South Side of Williams Parkway	
Kennedy Road to Rutherford Road	Some street Trees Residential Rear Lots, Weybridge Park and St. Joachim Elementary School, Ex. 300mm WM, Ex. Phone and Cable, Ex. Streetlights Crosses Pedestrian Walkway and Rutherford Road.	Very few Street Trees Residential Rear Lots Ex. Hydro, Ex. Streetlights Crosses Pedestrian Walkway and Rutherford Road.	Alignment on South Side Similar environmental and landuse on both sides, however, there is less impact to existing utilities on south side. Pedestrian Crossway is recommended to be open cut south of Williams Parkway, and Rutherford staged crossing maintaining one-way flow in peak direction.
Rutherford Road to Major Oak Park	Existing Street Trees Wide Boulevard and Park Ex. 300mm WM, Ex. Phone and Cable, Ex. 150mm Gas, Ex. Streetlights Crosses Southlake Road	Very few Street Trees Residential Rear Lots Ex. Hydro, Ex. Streetlights No road crossings	Alignment on South Side Similar environmental and landuse on both sides, however, there is less impact to existing utilities on south side.
Bramalea Limited Community Park to Dixie Road	Street Trees North Park Secondary School, Residential Rear lots, Etobicoke Tributary Ex. 150mm gas, Ex. Hydro. Crosses North Park Road	Lafrance Park, Residential Rear lots Ex. 600mm WM, Ex. Hydro Crosses Howden Boulevard	Alignment on North Side Similar environmental and landuse on both sides, however, there is less impact to existing utilities on north side. North Park Road crossing is recommended to be staged to maintain two-way traffic.

5.5.6 Comparative Evaluation of Trenchless Watermain Designs for Segment 2

Within Segment 2, the four locations where trenchless installation was considered include pedestrian crossing between Weybridge Parkette and Hansen Parkette, the pedestrian crossing to Major Oaks Park, Highway 410, and the Spring Creek.

Weybridge Parkette to Hansen Parkette

A pedestrian underpass is located from Weybridge Parkette to Hansen Parkette. The watermain is on the south side at this location, so the crossing was also considered on the south side.

The pedestrian pathway was considered as an open cut crossing and a trenchless crossing.

The open cut crossing would require the watermain alignment to shift from the Williams Parkway right-of-way to the Hansen Parkette, cross the existing pathway, and shift back to Williams Parkway right-of-way. The alignment would temporarily impact the existing walkway, and the park area would be disturbed and require full restoration. However, there would be less impact to the traffic along Williams Parkway. This pathway does connect to St. Joachim Elementary School.

The trenchless crossing would involve a shaft within the boulevard on either side of the pedestrian crossing. One of the shafts would include a drain chamber. The staging area will likely encroach on the Williams Parkway curb-lane, and will impact the existing sidewalk. In addition, the existing utilities within the boulevard will need to be temporarily supported or relocated.

The construction duration of the trenchless method would be approximately six to eight weeks. The work would include set up of the work area enclosure, setting up all support equipment and services, obtaining temporary power source for the TBM, construction of the shafts, tunnelling with a primary liner system, installation and grouting of the pipe, installation of a drain chamber at the low spot. The open cut installation could be completed in approximately one week at a lower cost and much reduced traffic impact.

The open cut method will likely result in a shorter construction duration, a shallower watermain, and a shallower drain chamber, therefore, the open cut method is recommended.

Pedestrian Crossing - Major Oaks Park

A pedestrian underpass connects the path from Major Oaks Drive and Royal Salisbury to Major Oaks Park. The watermain is on the south side west of this location and on the north side east of this locations, so both sides were considered.

The pedestrian pathway was considered as an open cut crossing and a trenchless crossing.

The open cut crossing is proposed on the north side, and through the park. The pathway is twinned through this section, so construction could be staged to minimize the impact to the pathways. The alignment through the park will require full restoration, however it minimizes the impacts to Williams Parkway right-of-way close to Highway 410.

The trenchless crossing would involve a shaft within the boulevard on either side of the pedestrian crossing. One of the shafts would include a drain chamber. The drain chamber will contain an in-line valve and will therefore be cast in-place. The construction of the cast in-place drain chamber will add another four weeks to the schedule at this location. The staging area will likely encroach on the Williams Parkway curb-lane, and will impact the existing sidewalk. In addition, the existing utilities within the boulevard will need to be temporarily supported or relocated.

Given the space constraints with the trenchless method, the open cut method north of the park is recommended.

Highway 410 Crossing

At the Highway 410 crossing, there are parks located at the northwest and northeast corners, and there are existing residential areas located at the southwest and southeast corners. Given the space constraints on the south side, the Highway 410 crossing is considered on the north side. The City of Brampton noted that there are planned improvements and widening to the Williams Parkway Bridge, however, the design is conceptual at this time. The design provides adequate clearance from the bridge in the event that it is widened in the future.

On the west side, the construction access would be shared with the existing Major Oaks Park pedestrian access. The pedestrian access will require temporary diversion to facilitate construction. Based on discussions with the City, this access would need to be maintained at all times. The planned staging area and shaft would be located such that the existing parking

area is not impacted. The construction vehicles will share the existing vehicular access with the public. A pedestrian path will need to be maintained for access to the soccer field. Alternatively, this work could be completed in the winter.

On the east side, the construction access would be shared with the existing park access located approximately 350m east of Highway 410. The shaft locations and staging areas considered are located in the parking lot. The leash free area would remain accessible during the construction phase. Upon completion, the construction impacted area would need to be fully restored to existing conditions. The existing parking lot minimizes the impact to the leash free park and minimizes required temporary access roads and work areas. However, it does occupy a part of the existing parking spaces. Upon completion, the parking lot area would be restored to existing conditions. To minimize the disturbance to the park, the parking lot is the proposed location for the shaft and staging area.

A clearance in excess of 5 tunnel diameter below the Highway 410 lanes is provided for the higher vertical alignment. Based on borehole at this location, the higher option vertical alignment would be within the Brampton Esker overburden through saturated sandy to sandy gravel with possible boulders and cobbles. As noted in the geotechnical report, anticipated ground behaviour for the shallower vertical alignment would be "flowing" and "bouldery."

For the deeper options, the tunnel would be through the Georgian Bay Formation of fissile shale with interbeds of calcareous siltstone and limestone layers. Additional boreholes are required to characterize the rock quality and strength properties. Groundwater infiltration into the tunnel should be manageable using conventional sumps and pumps within the shaft and the use of an earth pressure balance TBM. There may be potential for rock 'flour' that may impact any potential pumps and groundwater treatment.

Spring Creek

The watermain is on the north side at this location, so the crossing of Spring Creek was also considered on the north side. The watercourse is conveyed by an existing 2.87m (rise) x 4.37m (span) segmentally bolted CSP. The separation provided between the CSP and the watermain below is 2m. This is in line with the instructions from the TRCA.

North of Williams Parkway, there is an existing boulevard to site a narrow staging area. The existing CSP will be supported, and the watermain will be installed using open trench methods.

5.5.7 Identification of the Connections to the existing water distribution system in Segment 2

The Region of Peel`s InfoWater water model was used to identify and evaluate the interconnection locations from the West Brampton Watermain (Zone 5 sub-transmission main) to various points within the Zone 5 pressure district. Within Segment 2, the West Brampton watermain crosses three watermains that are 400mm diameter or greater. The 600mm diameter watermain west of Highway 410 is located within an existing easement and located on the south side of Williams Parkway. The same 600mm diameter crosses Highway 410. It is considered to connect to the 600mm diameter on the east side of Highway 410. The locations and sizes within Segment 2 are provided in the following table:

Table 5-9 Segment 2 Connections

Road	Diameter (mm)	Length of Watermain (m)
East of 410	600	0
North Park Drive	600	0

The 2016 and 2051 peak hour demand scenarios were simulated. Both these connections are recommended.

The main connection within Segment 2 is to the East Brampton watermain near Dixie Road. There is a chamber planned on the East Brampton Watermain at the north west corner of Dixie Road and Williams Parkway complete with a stub. The West Brampton watermain will connect to the stub provided.

5.6 Segment 3 –Chinguacousy Road to McLaughlin Road

5.6.1 Natural Environment

Natural environment considered aquatic, terrestrial, and geomorphological conditions. These are described in the following sections.

5.6.1.1 Aquatic and Terrestrial

Natural Environmental site investigations were carried out by Savanta on June 17, October 12, and November 9, 2012. The summary of the findings is provided in Table 5-10. For additional detail, a copy of the Natural Environmental Report is found in **Appendix I.**

Table 5-10 Summary of Aquatic and Terrestrial Environment within Segment 3

3	Vegetation Community	Vegetation Communities are located at the watercourse crossings. Watercourse 4 (Fletcher's Creek)
	Flora	No nationally or provincially rare or endangered plant species were recorded from the Subject Lands
	Aquatic Habitat	Main Branch of Fletcher's Creek - The creek bottom is sand and silts covered with scattered gravel and stones. Dense riparian vegetation. No fish were observed, and no barriers to fish movement were found.
	Breeding Birds	Lined with residential housing and was found to be unfit for ground nesting birds.
	Reptiles	No reptiles were observed.
	Wildlife Habitat	Some linkage capacity

The existing aquatic and terrestrial features are located primarily at the watercourse crossings. The alternative design concepts at the watercourse crossings consider the impact to the aquatic and terrestrial features.

5.6.1.2 Species at Risk

The Ministry of Natural Resources (MNR) Species at Risk (SAR) screening letter (April 11, 2012; noted a potential SAR for the Subject Lands. Targeted searches for were conducted for the species. The summary of the findings is provided in Table 5-11. For additional detail, a copy of the Natural Environmental Report is found in **Appendix I.**

Table 5-11 Summary of Species at Risk within Segment 3

Species	MNR Comment	Results of Targeted Surveys
Butternut	Potential SAR for the Subject Lands	Targeted searches for Butternut were conducted but the species was not found

Redside Dace	All of the watercourses in CVC jurisdiction (Huttonville Creek, Springbrook Creek, Tributary 8b, and Fletcher's Creek) have been identified as providing habitat for Redside Dace	All of the watercourses in CVC jurisdiction have been identified as providing habitat for Redside Dace. Redside Dace is protected under the Endangered Species Act (2007) and each of these watercourses is considered to comprise "regulated habitat" for this species.
Bobolink, Chimney Swift , Eastern Meadowlark	Threatened, might also occur in the vicinity of the study area.	Were not observed during surveys
Cerulean Warbler, Red-headed woodpecker	Special Concern, Historical Records	Were not observed during surveys
American Kestrel	May be a candidate for a federal Species at Risk designation	Was observed during Savanta's bird survey at in the large old field meadow just west of Chinguacousy Road. The bird was not displaying breeding behaviour, but was a visitor in the field, likely foraging. American Kestrel nests in tree cavities and would not use the old-field as nesting habitat. The species is often found perching on power lines along side roads to hunt, and any extra noise from the watermain installation will not likely prove a major disturbance
Milksnake, Snapping Turtle	(Threatened) might also occur in the vicinity of the study	No reptiles were observed

Based on the field surveys, Redside Dace was the only species at risk found to be within the Segment. American Kestrel was observed west of the Segment. The alternative design concepts at the watercourse crossings will consider the presence of Reside Dace, and the alternative design concepts adjacent to the substation will consider the presence of the American Kestrel.

5.6.1.3 Geomorphology

A desktop geomorphological review has being undertaken by GHD for the watercourse crossings and is found in **Appendix J.** As noted in the report, the trenchless crossing of the watercourses avoids the requirements for instream work and channel restoration requirements and the proposed depth is conservative given the local watercourse conditions.

5.6.2 Cultural

There were no cultural heritage landscapes (CHL) or built heritage resources (BHR) identified along this segment.

5.6.3 Social

Landuse

Williams Parkway is an existing 4-lane road with a centre landscaped median. From Chinguacousy Road to McLaughlin Road, there are residential rear lots on both sides of the road, and an industrial area south of Williams Parkway and west of McLaughlin. There is an open-space park area near Fletcher`s creek.

Transit

Based on the current transit system, there are transit routes along Williams Parkway, and transit routes cross this segment at Fletcher`s Creek Blvd. As discussed with the City of Brampton, the transit route that cross Williams Parkway will need to be maintained.

Traffic

BA Group undertook and evaluation of the existing traffic conditions and identified four construction options at intersection crossings are considered: 1. Bored tunnel under the intersecting road; 2. Open trench construction across the (north-south); intersecting road, while maintaining two way (northsouth) traffic flow; 3. Open trench construction across the intersecting road, while maintaining one way (north or south)traffic flow; 4. Full closure of the intersecting road. Within Segment 3, the watermain crosses Whitewash Way/Withers Way, Fletcher's Creek Blvd, and McLaughlin Road.

Street	**Option 1** Bored Tunnel	**Option 2** Trenched maintaining 2 way traffic	**Option 3** Trenched with one-way peak direction flow	**Option 4** Full Closure	**Rationale**
Withers Way	2	X	X	**1**	Low traffic volume, alternative routes available.
Oxtail Lane	2	X	X	**1**	Low traffic volume, alternative routes available.
McLaughlin Road	**1**	X	X	X	High traffic volume, part of longer tunnel section.

1 – Most Preferred, 4 – Least Preferred, Grey – Selected, X – Not considered

A copy of technical memo can be found in **Appendix K**.

5.6.4 Technical

To minimize the depth of the watermain and minimize the length of the trenchless sections, the majority of the watermain along this segment was considered to be constructed using open cut methods, with the exception of the Fletchers Creek and McLaughlin Road crossing. At this location trenchless technologies were considered. The remaining roadway crossings within this segment were considered as a staged, open-cut crossing rather than a trenchless crossing given the limited room available for staging areas, the likely encroachment onto Williams Parkway, the slower rate of installation, and the additional costs.

The following section summarizes the existing geotechnical and hydrogeological conditions, identifies and evaluates the open cut sections and the trenchless crossings, and identifies the connections between the West Brampton Watermain and the Zone 5 water distribution system.

5.6.4.1 Geotechnical and Hydrogeological

SPL Consultants Limited undertook a geotechnical and preliminary hydrogeological investigation along the proposed route. A copy of the report is found in **Appendix L.** The investigations included a review of the existing information and supplementary field investigations, including exploratory boreholes and monitoring wells.

In general the existing topsoil/road base is underlain by glacial tills of silty clay to silty sand texture over residual soils or till/shale complex. In some areas, the glacial tills are overlain by or interbedded with silty clay to clayey silt and cohesionless silt, sandy silt, sand, and gravelly sand. The glacial tills are underlain by bedrock.

Within Segment 3, the existing bedrock was found between 4.3m to 13.7m below grade. The existing bedrock was the Queenston Formation. Some of the open cut sections will be within the bedrock, however, it is anticipated that the top weaker portion of the bedrock can generally be removed with an excavator equipped with required rock removal accessories. However, the underlying stronger rock will be more time consuming, and may require the use of impact breakers and line-drilling.

Within Segment 3, the existing groundwater was observed between 2.9 to 7.0m below grade. Based on the permeability tests, a PTTW is required. Increased dewatering efforts are required where the excavation reaches gravelly sand to silt (till), which was found in the boreholes near White's Way and Fletchers Creek.

5.6.5 Comparative Evaluation of Alternative Open-Cut Watermain Designs for Segment 3

During the evaluation of alternative design concepts, the horizontal location of the watermain within the right-of-way was also considered. For the open cut section, two main design alternatives were considered. Design Alternative 1 was located on the north side of Williams Parkway and Design Alternative 2 was located on the south side of the right-of-way. The centre median was also considered, however, the existing trunk sanitary and storm sewers were located within the median for the majority of the segment. The summary of the evaluation is provided in the following section.

Table 5-12 Open-Cut Alternative Design Comparative (Segment 3)

Segment	Design Alternative 1	Design Alternative 2	Preferred Alternative
3 – Chinguacousy Road to McLaughlin Road	North Side of Williams Parkway	South Side of Williams Parkway	
Chinguacousy Road to Fletchers Creek Boulevard	Residential Rear Lots Ex. 300mm WM, Ex. Gas, Ex. Fibre Crosses Whitewash Way and Fletchers Creek Blvd.	Residential Rear Lots Ex. Phone, Ex. Fibre, Ex. Hydro Crosses Withers Way	Alignment on South Side Similar environmental and landuse on both sides, however, there is less impact to existing utilities on south side. There are alternative accesses to Withers Way available.
Fletchers Creek Boulevard to McLaughlin	Residential Rear Lots Ex. 300mm WM, Ex. Gas, Ex. Fibre Crosses McLaughlin Road.	Industrial Lands Ex. Phone, Ex. Fibre, Ex. Hydro Crosses McLaughlin Road.	Alignment on South Side Similar environmental and landuse on both sides, however, there is less impact to existing utilities on south side.

Segment	Design Alternative 1	Design Alternative 2	Preferred Alternative
			McLaughlin Road is not recommended to be crosses using open trench methods.

5.6.6 Comparative Evaluation of Trenchless Watermain Designs for Segment 3

Within Segment 3, the one location where trenchless installation was considered was at Fletchers Creek and McLaughlin Road.

Fletchers Creek and McLaughlin Road

The watermain is on the south side at this location, so the crossing of Fletchers Creek and McLaughlin Road was also considered on the south side. Fletchers Creek and McLaughlin Road are approximately 120 m apart and were considered as a single crossing.

South of Williams Parkway and west of Fletchers Creek, there is major infrastructure, large storm and sanitary sewers, and steep slopes that would have required major earth works to achieve an effective work area. Further west of Fletchers Creek, there is an existing boulevard fronting an industrial building to site a narrow staging area and shaft location. The limits of the staging area are constrained by the existing industrial building.

South of Williams Parkway and east of McLaughlin Road there is an existing boulevard area between Williams Parkway and Mains Creek for a shaft and staging areas.

At the proposed vertical alignment, the watermain would be within Queenston Formation of shale with limestone/siltstone and clayey silt till/shale complex. The water table was observed 2.9m - 7.0m below grade. As noted in the geotechnical report, anticipated ground behaviour would be "bouldery", "slow to fast ravelling", and "hard". The presence of cobbles and boulders should be expected, and the rate of excavation is anticipated to be slow. Micro-tunnelling and tunnelling can be considered.

5.6.7 Identification of the Connections to the existing water distribution system in Segment 3

The Region of Peel`s InfoWater water model was used to identify and evaluate the interconnection locations from the West Brampton Watermain (Zone 5 sub-transmission main) to various points within the Zone 5 pressure district. Within Segment 3, the West Brampton is primarily located within Zone 6, and a new watermain is required to reach the existing Zone 5 watermain. A watermain along Chinguacousy to connect to the existing Zone 5 system was considered.

Table 5-13 Segment 3 Connection

Road	Diameter (mm)	Length of Watermain (m)
Chinguacousy Road	300	1825

The distance is approximately 1.8km from the 900mm CPP West Brampton Watermain to a 300mm diameter Zone 5 watermain pressure district, and approximately 2.4km to the existing 600mm diameter at the intersection of Queen Street and Chinguacousy. The 2016 and 2051 peak hour demand scenarios were simulated both with and without the connections between the West Brampton watermain and the existing Zone 5 pressure district within Zone 5 to determine the impact/benefit/improvement these connections would have. Only minimal improvements were observed with respect to node pressures with the added connections in

Segment 3 and Segment 4. Therefore, it is recommended that the 1825m watermain along Chingucousy does not provide an observable improvement to Zone 5.

5.7 Segment 4 –West Brampton Pumping Station to Chinguacousy Road

More detailed field investigations were completed for the preferred alternative. The following section summarizes the findings of the detailed investigations.

5.7.1 Natural Environment

Natural environment considered aquatic, terrestrial, and geomorphological conditions. The following section highlights some of the findings.

5.7.1.1 Aquatic and Terrestrial

Natural Environmental site investigations were carried out by Savanta on June 17, October 12, and November 9, 2012. The summary of the findings is provided in Table 5-14. For additional detail, a copy of the Natural Environmental Report is found in **Appendix I.**

Table 5-14 Summary of Aquatic and Terrestrial Environment within Segment 4

4	Vegetation Community	Vegetation Communities are located at the watercourses and open fields, These include Watercourse 1 (Huttonville Creek), Watercouse 2 (Springbrook Creek), Watercourse 3 (Tributary 8b); and the field south of Williams Parkway, west of Chinguacousy Road.
	Flora	No nationally or provincially rare or endangered plant species were recorded from the Subject Lands
	Aquatic Habitat	Huttonville Creek - The creek bottom is covered with gravel, stones, and some sand. Dense riparian vegetation Approximately 20 small minnows were observed, and no barriers to fish movement were found. Springbrook Creek - The creek is a braided channel through dense cattails. The creek bottom is covered with muck. Dense riparian vegetation No fish were observed. The dense cattails could serve as a barrier to fish movement, although at periods of high water levels, this is likely not an issue Tributary 8B- The creek channel is dry bare soil, but is rock-lined at the culvert crossing. Dense riparian vegetation No fish or fish barriers were observed
	Breeding Birds	Migratory birds were observed. A nesting colony of Barn Swallows, with six active nests was observed underneath the Huttonville Creek bridge.
	Reptiles	No reptiles were observed.
	Wildlife Habitat	Huttonville Creek provides linkage capacity, and was the only watercourse crossing area to have mammal tracks recorded, which included white-tailed deer, northern raccoon, and coyote.

The existing aquatic and terrestrial features are located primarily at the watercourse crossings. The alternative design concepts at the watercourse crossings consider the impact to the aquatic and terrestrial features.

5.7.1.2 Species at Risk

. The Ministry of Natural Resources (MNR) Species at Risk (SAR) screening letter (April 11, 2012; noted a potential SAR for the Subject Lands. Targeted searches were conducted for the species. The summary of the findings is provided in Table 5-15. For additional detail, a copy of the Natural Environmental Report is found in **Appendix I.**

Table 5-15 Summary of Species at Risk within Segment 4

Species	MNR Comment	Results of Targeted Surveys
Butternut	Potential SAR for the Subject Lands	Targeted searches for Butternut were conducted but the species was not found
Redside Dace	All of the watercourses in CVC jurisdiction (Huttonville Creek, Springbrook Creek, Tributary 8b, and Fletcher's Creek) have been identified as providing habitat for Redside Dace	All of the watercourses in CVC jurisdiction have been identified as providing habitat for Redside Dace. Redside Dace is protected under the Endangered Species Act (2007) and each of these watercourses is considered to comprise "regulated habitat" for this species.
Bobolink, Chimney Swift , Eastern Meadowlark	Threatened, might also occur in the vicinity of the study area.	Were not observed during surveys
Cerulean Warbler, Red-headed woodpecker	Special Concern, Historical Records	Were not observed during surveys
American Kestrel	May be a candidate for a federal Species at Risk designation	Was observed during Savanta's bird survey at in the large old field meadow just west of Chinguacousy Road. The bird was not displaying breeding behaviour, but was a visitor in the field, likely foraging. American Kestrel nests in tree cavities and would not use the old-field as nesting habitat. The species is often found perching on power lines along side roads to hunt, and any extra noise from the watermain installation will not likely prove a major disturbance
Milksnake, Snapping Turtle	(Threatened) might also occur in the vicinity of the study	No reptiles were observed

Based on the field surveys, Redside Dace and American Kestrel were observed within the Segment. The alternative design concepts at the watercourse crossings will consider the presence of Reside Dace.

5.7.1.3 Geomorphology

A desktop geomorphological review has being undertaken by GHD for the watercourse crossings and is found in **Appendix J.** As noted in the report, the trenchless crossing of the

watercourses avoids the requirements for instream work and channel restoration requirements and the proposed depth is conservative given the local watercourse conditions.

5.7.2 Cultural

There were two sites located within this segment. Huttonville Cemetery is located on the east side of Mississauga Road (Part Lot 9, Con. 4 WHS, geographic township of Chinguacousy) The cemetery was turned over to the City of Brampton in 1983. There is a commemorative plaque from the Brampton Heritage Board on site. The site is municipally designated under the OHA. The LeFlar/McClure Farm is within Part Lot 9, Con. 4 WHS, geographic township of Chinguacousy.

The watermain alignment does not directly impact the heritage sites.

5.7.3 Social

Landuse

Mississauaga Road is a 4 lane road. The area on both sides is currently zoned agricultural. Williams Parkway is an existing 4-lane road with a centre landscaped median. From Mississauga Road to Williams Parkway, the area north of Williams Parkway is zoned institutional, parks, and residential. The area south of Williams Parkway is zoned commercial, floodplain, open space, and institutional, and residential. From Creditview to the James Potter, the area near Springbrook Creek is floodplain. There is residential development, and St. Roch`s Catholic School and the north side, and residential development, and a SWM pond on the south side. From James Potter to Chinguacousy, Tributary 8B is north of Williams Parkway up to the CN Rail, and residential areas and commercial area at the north west corner of Williams Parkway and Chinguacousy. On the south side there is a vacant parcel of land that is zoned commercial, residential areas, and an open space, and the Hydro Substation.

Transit

Based on the current transit system, there are transit routes along Williams Parkway, and transit routes cross this segment at Royal West Drive, James Potter Road, and Chinguacousy. As discussed with the City of Brampton, the transit routes that cross Williams Parkway will need to be maintained.

Traffic

BA Group undertook and evaluation of the existing traffic conditions and identified four construction options at intersection crossings are considered: 1. Bored tunnel under the intersecting road; 2. Open trench construction across the (north-south); intersecting road, while maintaining two way (northsouth) traffic flow; 3. Open trench construction across the intersecting road, while maintaining one way (north or south)traffic flow; 4. Full closure of the intersecting road. Within Segment 4, the watermain crosses Mississauga Road, Royal West Drive, Elbern Markell Drive, Abotsbury Drive, Valleyway Drive, James Potter Road Pertosa Drive, and Chinguacousy Road.

Street	**Option 1** Bored Tunnel	**Option 2** Trenched maintaining 2 way traffic	**Option 3** Trenched with one-way peak direction flow	**Option 4** Full Closure	**Rationale**
Mississauga Road	X	**1**	2	3	Temporary Lane reductions (4 to 2)
Royal West Drive	**1**	X	1	X	May be part of longer tunnel section.

Street	**Option 1** Bored Tunnel	**Option 2** Trenched maintaining 2 way traffic	**Option 3** Trenched with one-way peak direction flow	**Option 4** Full Closure	**Rationale**
Elbern Markell	3	X	**1**	2	Maintain peak flow, alternative accesses are available.
Abotsbury Drive	2	X	X	**1**	Low traffic volume, alternative routes available.
Valleyway Drive	2	X	X	**1**	Low traffic volume, alternative routes available.
James Potter Drive	**1**	X	X	X	Part of longer tunnel section.
Chinguacousy Drive	**1**	X	X	X	High traffic volume, part of longer tunnel section.

1 – Most Preferred, 4 – Least Preferred, Grey – Selected, X – Not considered

A copy of technical memo can be found in **Appendix K**.

5.7.4 Technical

. To minimize the depth of the watermain and minimize the length of the trenchless sections, the majority of the watermain along this segment was considered to be constructed using open cut methods, with the exception of the Huttonville Creek crossing, Springbrook Creek crossing, and Tributary 8B crossing. At these locations trenchless technologies were considered. The remaining roadway crossings within this segment were considered as a staged, open-cut crossing rather than a trenchless crossing given the limited room available for staging areas, the likely encroachment onto Williams Parkway, the slower rate of installation, and the additional costs.

The following section summarizes the existing geotechnical and hydrogeological conditions, identifies and evaluates the open cut sections and the trenchless crossings, and identifies the connections between the West Brampton Watermain and the Zone 5 water distribution system.

5.7.4.1 Geotechnical and Hydrogeological

SPL Consultants Limited undertook a geotechnical and preliminary hydrogeological investigation along the proposed route. A copy of the report is found in **Appendix L.** The investigations included a review of the existing information and supplementary field investigations, including exploratory boreholes and monitoring wells.

In general the existing topsoil/road base is underlain by glacial tills of silty clay to silty sand texture over residual soils or till/shale complex. In some areas, the glacial tills are overlain by or inbedded with silty clay to clayey silt and cohesionless silt, sandy silt, sand, and gravelly sand. The glacial tills are underlain by bedrock.

Within Segment 4, the existing bedrock was found between1.8m to 8.1 m below grade. From McLaughlin to Etobicoke Creek, the existing bedrock was the Queenston Formation and from

Etobicoke Creek to Kennedy Road, the existing bedrock was the Georgian Bay Formation. Some of the open cut sections will be within the bedrock, however, it is anticipated that the top weaker portion of the bedrock can generally be removed with an excavator equipped with required rock removal accessories. However, the underlying stronger rock will be more time consuming, and may require the use of impact breakers and line-drilling.

Within Segment 4, the existing groundwater was observed between 0.9m to 5.4 m below grade. Based on the permeability tests, a PTTW is required. Increased dewatering efforts are required where the excavation reaches gravelly sand to silt (till), which was found in the boreholes near the Mains Creek and Orangeville Brampton Crossing.

5.7.5 Comparative Evaluation of Alternative Open-Cut Watermain Designs for Segment 4

During the evaluation of alternative design concepts, the horizontal location of the watermain within the right-of-way was also considered. For the open cut section, two main design alternatives were considered. Design Alternative 1 was located on the north side of Williams Parkway or West side of Mississauga Road and Design Alternative 2 was located on the south or east side of the right-of-way. The centre median was also considered, however, the existing trunk sanitary and storm sewers were located within the median for the majority of the segment. The summary of the evaluation is provided in the following section.

Table 5-16 Open-Cut Alternative Design Comparative (Segment 4)

Segment	Design Alternative 1	Design Alternative 2	Preferred Alternative
4 – Mississauga Road to Chinguacousy Road	North Side (or West Side)	South Side (or East Side)	
West Brampton Reservoir to Williams Parkway	Agricultural Land Ex. 1200mm SAN, Bell, Streetlights	Agricultural Land Ex. 750mm WM, Overhead hydro, Bell, Ex. 150mm Gas east side.	Alignment on West Side Similar environmental and landuse on both sides, however, there is less impact to existing utilities on west side.
Mississauga Road to Creditview	Vacant land, Residential Ex. WM, Ex. Bell, Ex. Gas, Ex. Streetlights Crosses Mississauga Road.	Commercial, Stormwater Management, Residential Ex. Bell, Ex. Cable, Ex. Gas, Ex. Streetlights Crosses Mississauga Road, Royal West Drive, Elbern Markell Drive.\	Alignment on South Side There is less impact to existing utilities on south side. Mississauga Road crossing will be staged to maintain two-way traffic during peak hours. The remaining will be staged to maintain one-way traffic in the peak hour.

Segment	Design Alternative 1	Design Alternative 2	Preferred Alternative
Creditview to James Potter Parkway	Residential, St. Roch Catholic Secondary School Ex. WM, Ex. Bell, Ex. Streetlights Crosses Abbotsbury Drive, Valleyway Drive, James Potter Road	Residential, Stormwater Management Facilities Ex. Bell, Ex. Streetlights	Alignment on South Side More staging area available on the south side at the watercourse crossing. There is less impact to existing utilities on the south side.
James Potter Parkway to Chingacousy	Residential, Commercial	Residential, Hydro Transformer Station Ex. Fibre	. Considered trenchless.

5.7.6 Comparative Evaluation of Trenchless Watermain Designs for Segment 4

Within Segment 4, the four locations where trenchless installation was considered include Huttonville Creek, Springbrook Creek, Tributary 8B, and the CN Rail.

Huttonville Creek

The watermain is on the south side at this location, so the crossing of Huttonville Creek was also considered on the south side.

South of Williams Parkway and west of Huttonville Creek, there is a small open space parcel of land east of Royal West Drive, and a commercial area west of Royal West Drive. The shaft and staging areas will be located there to minimize the impact to the existing naturalized areas, and be located above the top-of-bank of Huttonville Creek.

South of Williams Parkway and east of the Huttonville Creek, there is an existing pathway and stormwater management pond block. The shaft and the work area will be located within this block. Two options were evaluated for the shaft location on the west side of the Huttonville Creek. For option 1 the shaft and staging areas will be located to minimize the impact to the existing naturalized areas, and be located above the top-of-bank of Huttonville Creek. For option 2, the shaft will be located west of Royal west Drive and south of Williams Parkway. This option eliminates the impact to the existing landscaped area immediately east of Royal West Drive. The evaluation of the alternative (Option 2) shaft location provides the Region with flexibility during the detailed design and construction stages.

At the proposed vertical alignment, the possible liner and the watermain would be within Queenston Formation of shale with limestone/siltstone and clayey silt till/shale complex. As noted in the geotechnical report, anticipated ground behaviour would be "bedrock". Additional boreholes with rock coring and testing are required to characterize the rock quality and strength properties. The water table was observed 3.6 to 4.8m below grade. Groundwater infiltration into the tunnel should be manageable using conventional sumps and pumps within the shaft. There may be potential for rock 'flour' that may impact any potential pumps and groundwater treatment. Micro-tunnelling and tunnelling can be considered.

Springbrook Creek

The watermain is on the south side at this location, so the crossing of Springbrook Creek was also considered on the south side.

South of Williams Parkway and west Main Street, there is an existing boulevard and Louisburg Crescent to site staging area and shaft location. There are no driveways off this section of Louisburg Crescent. The limits of the staging need to allow pedestrian movements between Louisburg Crescent and Williams Parkway.

South of Williams Parkway and east of the Springbrook Creek is a residential area. The shaft is considered in the right-of-way and the staging area will be located to minimize the impact to the existing naturalized areas and be located above the top-of-bank of Springbrook Creek.

At the proposed vertical alignment, the possible liner and the watermain would be within Queenston Formation of shale with limestone/siltstone and clayey silt till/shale complex. As noted in the geotechnical report, anticipated ground behaviour would be "bedrock". Additional boreholes with rock coring and testing are required to characterize the rock quality and strength properties. The water table was observed 4.4m below grade. Groundwater infiltration into the tunnel should be manageable using conventional sumps and pumps within the shaft. There may be potential for rock 'flour' that may impact any potential pumps and groundwater treatment. Micro-tunnelling and tunnelling can be considered.

Tributary 8B and James Potter, Canadian National Railway, and Chinguacousy

The watermain is on the south side at this location, so the crossing of Tributary 8B was also considered on the south side. The distance between Tributary 8B/James Potter crossing and the Canadian National Railway is approximately 450m, and the distance between the Canadian National Railway and Chinguacousy Road is approximately 550m. Initially, each of the crossings was considered independently, however, given the potential impacts to the residents on Crystal Glen, the access and property restrictions at the CN and James Potter and the required clearances to the hydro sub-station, the crossings were considered collectively.

South of Williams Parkway and west of Tributary 8B, there is an existing stormwater management pond. The shaft and staging area is proposed within the stormwater management block. The area will need to be fully restored.

South of Williams Parkway and east of the James Potter, there is an existing vacant property, however there is a site plan application in for this area. The area is anticipated to be developed prior to the installation of the West Brampton Watermain, and therefore the area will not be available for a staging area.

At the CN Rail, there is existing residential area on the west side and an open field area on the east side. The open field area is owned by the local hydro authority, and may be used for a future expansion of the existing plant, the shaft location and staging area would require property, and the open cut section would be required along the existing hydro property. To minimize impact to the traffic along Williams Parkway near James Potter, minimize impact to residents on Cyrstal Glen, minimize property requirements near the CN Rail, and minimize impact to the existing hydro station, the area from just west of James Potter to just east of Chinguacousy Road is considered to be installed using trenchless technologies. The staging area east of Chinguacousy would be east of the intersection within the existing boulevard.

At the proposed vertical alignment, the liner and the watermain would be within mixed face conditions ranging from Queenston Formation and clayey silt till shale complex of shale with limestone/siltstone and clayey silt till/shale complex with cobbles and boulders. As noted in the geotechnical report, anticipated ground behaviour would be "bedrock" and "bouldery". Additional boreholes with rock coring and testing are required to characterize the rock quality and strength properties. Based on the more detailed investigations the vertical alignment may be lowered to be entirely within the bedrock to eliminate mixed face conditions. The water table was observed 2.8m – 3.8m below grade. Groundwater infiltration into the tunnel should be manageable using conventional sumps and pumps within the shaft. There may be potential for rock 'flour' that may impact any potential pumps and groundwater treatment. Micro-tunnelling and tunnelling can be considered.

5.7.7 Identification of the Connections to the existing water distribution system in Segment 4

The Region of Peel`s InfoWater water model was used to identify and evaluate the interconnection locations from the West Brampton Watermain (Zone 5 sub-transmission main) to various points within the Zone 5 pressure district. Within Segment 4, the West Brampton is primarily located within Zone 6, and a new watermain is required to reach the existing Zone 5 watermain. A watermain was considered along Creditview Road and James Potter Road.

Table 5-17 Segment 4 Connections

Road	Diameter (mm)	Length of Watermain (m)
Creditview Road	300	1215
James Potter Road	400	2203

The distance from the 900mm CPP West Brampton Watermain to the Zone 5 watermain and pressure district, ranges between 1.2 and 2.2km. The 2016 and 2051 peak hour demand scenarios were simulated both with and without these connections between the West Brampton watermain and the existing Zone 5 pressure district within Zone 5 to determine the impact/benefit/improvement these connections would have. Only minimal improvements were observed with respect to the node pressures with the added connections in Segment 3 and Segment 4. Therefore, it is recommended that the 1215m watermain along Creditview Road and the 2203m watermain along James Potter Road do not provide an observable improvement to Zone 5.

The main connection within Segment 4 is at the West Brampton Reservoir and Pumping Station. Various options were consider, including a connection directly within the pumping station, a connection to the existing 1200mm Zone 5 watermain along the access road, and a connection to the existing 750mm Zone 5 watermain on Mississauga Road. Based on the existing drawings, and a site visit, the connection the connection within the pumping station is constrained, and was not preferred. The Region indicated that their preference was to not connection to the existing 750mm Zone 5 watermain on Mississauga Road, therefore the preferred connection is to the existing 1200mm Zone 5 watermain along the access road. The connection point would be between the pumping station and the existing chamber. A meter chamber on the new 900mm diameter watermain would be required. The connection to the existing Zone 5 watermain at the isolation chamber will depend on the existing pipe condition.

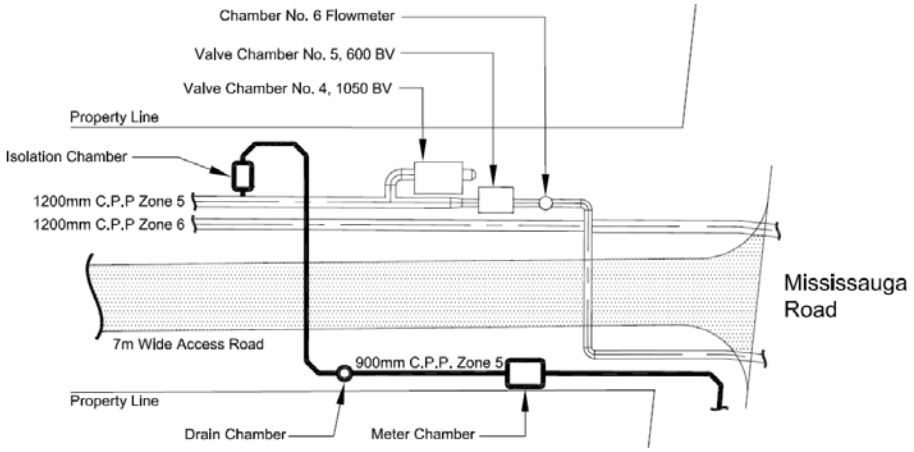


Figure 5-2 Schematic of Connection at West Brampton Reservoir and Pumping Station

5.8 Identification of the Preferred Design

The preferred 900mm diameter West Brampton watermain route is approximately 10.7 km. The watermain will connect to an existing Zone 5 watermain within the West Brampton Reservoir and Pumping Station site at the west end and connects to the distribution system in the east end at Dixie and Williams Parkway. The watermain will be primarily within existing road Rights-of-ways.

The horizontal and vertical alignment of the proposed watermain was based on design criteria presented in Section 5.1. The alignments will continue to be refined during detailed design as the design of the Williams Parkway Road Reconstruction is finalized, the topographic survey is completed, and existing utilities are field-verified.

Within Segment 1 from McLaughlin to Kennedy Road, the watermain will be located on the south side from McLaughlin Road to Kennedy Road. The majority of the alignment will be open cut with the exception of the Mains Creek and Brampton Orangeville Rail Line crossing, Main Street and Etobicoke Creek crossing, and Kennedy Road crossing which will be crossed using trenchless technologies.

Figure 5-3 Segment 1 Watermain Location and Connections

Within Segment 2 from Kennedy Road to Dixie Road, the watermain will be located on the south side from Kennedy Road to Major Oaks Park and on the north side from Major Oaks Park to Dixie Road. The majority of the alignment will be open cut with the exception of Highway 410, which will be crossed using trenchless technologies.

Figure 5-4 Segment 2 Watermain Location and Connections (ii)

Within Segment 3 from Chinguacousy Road to McLaughlin Road, the watermain will be located on the south side. The majority of the alignment will be open cut with the exception of Fletcher's Creek and McLaughlin Road, which will be crossed using trenchless technologies.

Figure 5-5 Segment 3 Watermain Location and Connections (iii)

Within Segment 4 from the West Brampton Reservoir to Chinguacousy Road, the watermain will be located on the west side of Mississauga Road and the south side of Williams Parkway. The majority of the alignment will be open cut with the exception of Huttonville Creek, Springbrook Creek, and Tributary 8B, James Potter, Canadian National Railway, and Chinguacousy Road which will be crossed using trenchless technologies.

Figure 5-6 Segment 4 Watermain Location and Connections

6 Property Requirements

The majority of the West Brampton Watermain is located within the existing right-of-way, however, at some locations, permanent and temporary easements property have been identified to provide area for construction access and staging.

As per the Region of Peel requirements the minimum permanent easement width for the watermain will be 8.3m wide. The watermain will be 3.0m clear of the edge of the permanent easement.

Easements will be sized to allow the contractor to complete the required works. Every effort has been made to optimize the easement areas within the site physical constraints. The easements may vary in size due to local constraints and available space within Williams Parkway right-of-way (ROW). The following table summarizes the location of the property requirements. A copy of the Property Requirement Plans is provided in **Appendix M.**

Table 6-1 Summary of Property Requirements

Location	Temporary Easement	Permanent Easement	Encroachment
Huttonville Creek	1 – Required for staging area south of Williams Parkway right of way and west of Royal West Drive. 2 – Required for staging Area south of Williams Parkway and east of Royal West Drive 3 – Required for staging Area south of Williams Parkway within SWM Block.	Required along watermain across Huttonville Creek from shaft to shaft.	N/A
Springbrook Creek	Not required - Staging areas are within rights-of-way.	Required along watermain across Springbrook Creek where outside of right-of-way.	N/A
Tributary 8B, James Potter	1 – Required for staging area south of Williams Parkway and west of James Potter within SMW Block.	Required along watermain from shaft to shaft where outside of right-of-way.	
CN Crossing		Permanent easement / agreement required at rail crossing.	
Chinguacousy Road	Not required. Staging area is within right-of-way.	Not required, within right-of-way.	N/A
Fletchers Creek	1 – Required for staging area west of Fletchers Creek and south of Williams Parkway.	Permanent easement along watermain across Fletchers Creek from shaft to shaft where outside of right-of-way.	
Main Street and Etobicoke Creek	1 – Required for staging area east of Etobicoke Creek and south of Williams Parkway	Required along watermain across Etobicoke Creek where outside of right-of-way.	
Mains Creek and	Not required. Staging area is	Permanent easement /	

Location	Temporary Easement	Permanent Easement	Encroachment
Orangeville Rail	within right-of-way	agreement required at rail crossing.	
Major Oaks Park	1 – Required for staging area and temporary access road.	Required along watermain through the park.	
Highway 410	N/A	N/A	Required for watermain crossing.
Bramalea Community Park	1 – Required for staging area within existing parking lot.	Required along watermain through the park.	

During the detailed design phase, the property requirements will be refined. The Region will commence the property negotiations, which will include a meeting with the property owners The City of Brampton has requested a meeting with Parks Staff to develop a plan and determine the space requirements and feasibility to maintain operations.

7 Mitigation Measures

7.1 Natural Environment

Based on the natural environmental surveys, the existing aquatic and terrestrial features are located primarily at the watercourse crossings. The proposed watermain will be constructed within the Mississauga Road and Williams Parkway Right-of-Way. Adverse effects to adjacent aquatic and terrestrial features from this project are not anticipated. The potential construction related impacts are discussed in the following section

Watercourses

West Brampton Watermain crosses five watercourses within CVC jurisdiction and two watercourses within TRCA jurisdiction. All the watercourses within the CVC jurisdiction are classified as Redside Dace habitat, with the exception of Mains Creek, which is contributing habitat. The watercourses within TRCA jurisdiction are also considered to be Redside Dace habitat. The proposed use of trenchless technologies for all watercourse crossings will avoid direct impacts to these watercourses; however, the potential for dewatering during the construction phases and the requirement to discharge this water must also be addressed during the detailed hydrogeological investigations and detailed design stage.

The use of trenchless technology at all watercourse crossings, along with a robust mitigation plan, will likely result in the ability to work with the MNR in approving these works under a Letter of Advice (LOA). An Information Gathering Form will be submitted to MNR so they can assess the scope of works and make a determination as to whether the proposed works have the potential to create any impacts, either directly or indirectly, to this species.

Construction will be restricted to the fisheries window, unless otherwise approved.

To prevent accidental introduction of debris into the water, the establishment and use of specific construction access routes is recommended, as well as the use of mitigation techniques that contain sediment and debris within the work site.

Best Management Practices (BMPs) for the protection of aquatic habitat, including the use of standard erosion and sediment control devices, will be reviewed at the detailed design stage and incorporated into the detailed design package and should adhere to the principles limiting soil mobilization and trapping sediment as close to the source as possible.

Temporary Construction Related Effects on Groundwater

The West Brampton Watermain will be installed are a relatively shallow depth, and it is not anticipated to have an adverse impact on the regional groundwater system. Any environmental impacts from the construction of the West Brampton Watermain, in terms of the hydrogeological aspects, are likely to be localized and temporary, it is anticipated that the zone of influence will be minimal. However, in the vicinity of the watercourse crossings, and the Highway 410 crossing, it will be important to re-assess the situation in the light of the results of the detailed geotechnical investigations and hydrogeological investigations. If a Permit to Take Water is required an additional mitigation program will be developed to mitigate migration of contaminants across property boundaries and potential adverse effects.

Breeding Birds

There is no expected impact on ground nesting birds along the right-of-way, or for birds that would use trees and shrubs for nesting, since better quality nesting habitat at these locations is situated well away from the right-of-way. As well, the trenchless crossing of the watercourse will result in minimal disturbance to the habitats surrounding the watercourses, and only minimal additional noise impacts compared to that created by current traffic and construction activities occurring in the general area.

A nesting colony of Barn Swallows, with six active nests was observed underneath the Huttonville Creek bridge. Huttonville Creek will be crossed using trenchless technologies. The associated construction equipment and machinery will be within the staging areas. The impact from the machinery noise should be considered when finalizing the shaft locations and staging areas during detailed design.

Social Environment

- Temporary Access to Private Property

The Contractor will minimize impacts on adjacent private properties by confining all construction activities to the working area and not entering upon or occupying any private property outside of the working area for any purpose unless written permission from the landowner has been obtained in advance. Should access to private property be granted, the property will be restored to its original condition or better following the completion of construction operations. Photographs are to be taken of the areas to be disturbed prior to construction operations. The Contract Administrator (CA) will be the sole judge of whether the disturbed areas are restored to a satisfactory condition.

- Temporary Construction Related Nuisance Effects (Noise, Vibration, Dust, Odours and Fumes)

The Contractor's activities, specifically the operation of construction equipment, will result in a temporary increase in noise, vibration, dust and odours in the project area during the construction period. While it is anticipated that these effects will be short in duration and limited to periods of construction machinery operation, the following mitigating measures have been recommended for implementation to minimize or eliminate the potential adverse effects:

- Temporary Modifications to Driveway Access and Boulevards

Other than minor, temporary restrictions, access to residences, businesses and community facilities will be maintained during and following construction. The use of temporary driveways for some entrances will be required during the construction period. However, the Contractor will be responsible for contacting property owners and notifying them of the temporary modifications to their driveways and any potential for temporary disruptions to their access well in advance of commencing such activities in order to allow for the development of alternative arrangements.

Any boulevards damaged by construction activities including settlements caused by the storage of material will be restored with topsoil and re-sodded.

- Temporary Disruption of Traffic on Roads

All disruptions should be identified early. All construction staging plans will be submitted for Region and City review. During the Work, the disruption should be communicated to the travelling traffic in advance of the proposed Work to allow traffic to plan an alternate route as required. All traffic signals and lighting must remain operational throughout the project or temporary works must be provided.

- Work Area Aesthetics

During construction, the Contractor will be required to maintain the work area in a tidy condition, free from the accumulation of debris, waste, rubble, etc. in order to minimize the visual impact of the work area. In addition, the Contractor's sheds, site offices, other temporary structures and storage areas for materials and equipment will be grouped in a compact manner and maintained in a neat and orderly condition at all times.

- Generation of Excess Materials

The proposed improvements will require excavation and filling. Various types of materials, including asphalt, rock, and soil will be generated during these project activities and will require the appropriate management.

Material identification and management options will be used both inside and outside the construction area during construction. All excess and unsuitable materials generated during construction will be managed appropriately. The materials may be reused as a construction material or managed as engineered fill. Materials may also be temporarily stockpiled in preparation for these uses or removed from the site if required. Where an excess material management option cannot meet environmental constraints, another option must be pursued or the material must be managed as waste.

All contaminated wastes must be taken to an appropriately approved waste disposal site and transported by an appropriately licensed waste disposal carrier as per the operational constraint for the management of contaminated materials. The Contractor will be required to manage all waste materials generated by construction activities in accordance with all provincial and federal regulations/approval requirements. The Contractor will be required to provide a copy of all approvals and agreements, including waste manifests to the Contract Administrator.

Cultural Environment

- Encountering of Deeply Buried Archaeology Remains

Prior to construction, a Stage 2 archaeological assessment will be completed to clear the area of archaeological concerns. Should deeply buried archaeological remains be encountered during construction, the Ministry of Tourism and Culture regulations under the Ontario Heritage Act require the Contractor to immediately cease activities in the affected area and contact the Ministry.

- Encountering of Human Remains

In the event that human remains are encountered during construction, both MCL and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Consumer and Business Services should be contacted immediately.

Table 7-1 Potential Negative Effects and Mitigation measures

Potential Negative Effects/ Concerns	Mitigative / Enhancement Measures
Disturbance to Vegetation	Include appropriate compensation plans for removal of existing vegetation in consultation with the Region and Conservation Authority..
Disturbance to Area Watercourses	Include appropriate Best Management Practices in accordance with Erosion and Sediment Control Guideline for Urban Construction, December 2006 for protecting aquatic habitat in the detailed design package for limiting soil mobilization and trapping sediment as close to the source as possible. These sedimentation and erosion protection measures are to reflect these principles: minimize the duration of soil exposure, retain existing vegetation where feasible, encourage re-vegetation, divert runoff away from exposed soil, and keep runoff velocities low. Maintain the integrity of all sediment trapping devices through regular monitoring. In the event that it is determined that that controls are unacceptable, the Contractor shall cease those operations, as identified, which are causing the entry of deleterious material to watercourses. Such operations shall remain suspended until otherwise directed in writing. Such structures should be removed only after the soils of the construction areas have been stabilized and then only after the trapped sediments have been removed. Environmental monitoring should include periodic site visits by the CA to confirm proper adherence to confirmed mitigation measures.
Temporary Construction Related Effects on Groundwater	Utilize appropriate construction techniques to minimize extent of required groundwater withdrawal Implement well monitoring program during construction within low-lying areas and at the watercourse crossings.
Temporary Access to Private Property	Minimize impacts on adjacent properties by confining all construction activities to the working area and not entering upon or occupying any private property outside of the working area for any purpose unless written permission from the land owner has been obtained in advance. Take photographs of areas to be disturbed prior to construction operations. Restore private property to its original condition or better following construction

Potential Negative Effects/ Concerns	Mitigative / Enhancement Measures
	operations. The Contract Administrator will be the sole judge of whether the disturbed areas are restored to a satisfactory condition.
Temporary Construction Related Nuisance Effects (i.e., Noise, Vibration, Dust, Odours and Fumes)	Comply with Noise control by-laws. Prevent unnecessary noise by maintaining equipment in proper operating condition, including but not limited to non-defective muffler systems, properly secured components, and the lubrication of moving parts. Environmental monitoring should include periodic site visits by the CA to confirm proper adherence to confirmed mitigation measures. Noise complaints will be addressed and additional mitigative measures implemented as feasible. Implement the following standard mitigation measures during construction to minimize dust: Undertake dust/debris control measures as necessary. Use low dust generating construction techniques/equipment Maintain equipment in proper working order and operate only as required (no excessive idling) to reduce engine emissions. Dust and odour complaints will be addressed and additional mitigative measures implemented as feasible. Environmental monitoring should include periodic site visits by the CA to confirm proper adherence to confirmed mitigation measures.
Temporary Modifications to Driveway Access and Boulevards	Contact property owners and notify them of the temporary modifications to their driveways and any potential for temporary disruptions to their access in advance of commencing such activities Restore with topsoil and re-sod any damaged boulevards
Temporary Disruption of Traffic on Roads	Utilize a traffic management plan and standard traffic control measures on the project to safely co-ordinate traffic flow.
Temporary Effects on Work Area Aesthetics	Maintain the work area in a tidy condition free from the accumulation of debris, waste, rubble, etc. in order to minimize the visual impact of the work area. Group sheds, site offices, other temporary structures and storage areas for materials and equipment in a compact manner and maintain in a neat and orderly condition at all times.
Generations of Excess Materials	Utilize material identification and management options both inside and outside the construction area during construction. Manage all excess and unsuitable materials generated during construction appropriately. The materials may be reused as a construction material or managed as engineered fill. Materials may also be temporarily stockpiled in preparation for these uses or removed from the site if required. Take all contaminated wastes that cannot be reused or meet constraints to an appropriately approved waste disposal site and transport by an appropriately licensed waste disposal carrier. The Contractor will be required to manage all waste materials generated by construction activities in accordance with all provincial and federal regulations/approval requirements. A copy of all approvals and agreements will be provided to the CA, including waste manifests.
Encountering Deeply Buried Archaeological Resources	Contact the office of the Regulatory & Operations Group, Ministry of Culture immediately in the event that deeply buried archaeological remains are encountered during construction activities.
Encountering Human	Contact both the Ministry of Culture, and the Registrar or Deputy Registrar of the

Potential Negative Effects/ Concerns	Mitigative / Enhancement Measures
Remains	Cemeteries Regulation Unit of the Ministry of Consumer and Business Services immediately in the event that human remains are encountered during construction.

8 Cost and Schedule

The project cost estimates have been prepared for each segment and are summarized in the table below. The trenchless construction estimates are based on the use of micro-tunnelling with a 1500mm liner with the exception of the trenchless section from James Potter to Chinguacousy and the trenchless section at MTO. For both these sections the trenchless construction estimates are based on the use of and Earth Pressure Balance tunnel boring machine with a 2100mm liner.

Table 8-1 Cost Estimate of each Segment

Segment 1 – Construction	$16.2 Million
Segment 2 – Construction	$15.5 Million
Segment 3 – Construction	$8.5 Million
Segment 4 – Construction	$26.8 Million
Construction Contingency (20%)	$13.4 Million
Total Construction Cost	$80.3 Million
Engineering Cost (10% of Construction)	$8.0 Million
HST (2% non-recoverable)	$1.8 Million
Total Project Cost	$90.1 Million

As previously discussed, it is anticipated that the project will be phased to coordinate the installation of the West Brampton Watermain with the Williams Parkway Road reconstruction. Based on the information available the following construction schedule is anticipated:

Detailed Design and property acquisition	2014-2016
Segment 1 Construction	2017/2018
Segment 2 Construction	2018/2019
Segment 3 Construction	2020
Segment 4 Construction	2021

9 Permits and Approvals

9.1 City of Brampton

Coordination with the City of Brampton will be required during the Preliminary and Detailed Design Process. Road Occupancy Permits will be required from the City during construction.

9.2 Utility Coordination

The proposed West Brampton Watermain alignment will be circulated to the utility companies along the Route during preliminary design and detailed design phases.

9.3 Toronto and Region Conservation Authority

The watercourse crossings within TRCA jurisdiction will require a Permit for the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Pursuant To Ontario Regulation 166/06). During the detailed design stage, TRCA should be kept informed.

9.4 Credit Valley Conservation Authority

The watercourse crossings within CVC jurisdiction will require a Permit for the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Pursuant To Ontario Regulation 160/06).

9.5 Ministry of Transportation

An encroachment permit will be required from the Ministry of Transportations Corridor Management Office for the proposed crossing under Highway 410. The encroachment permit will be subject to MTO's standard Encroachment Permit conditions as well as any site-specific conditions that may apply.

9.6 Ministry of the Environment

A Permit to Take Water will be required in the event that there will be groundwater taking of more than 50,000 L/d. If a permit is required a mitigation program will be need to be developed.

9.7 Ministry of Natural Resources

An Information Gathering Form will need to be submitted to MNR to assess the scope of works and make a determination as to whether the proposed works have the potential to create any impacts, either directly or indirectly.

9.8 Ministry of Tourism, Culture and Sport

Ministry of Tourism and Culture clearance will be required prior to construction of the proposed works.

9.9 Orangeville Brampton Railway

A crossing agreement will be required from Orangeville Brampton Railway.

9.10 Canadian National Railway

A crossing agreement will be required from CN Rail. Based on discussions with CN, the submission will include the following:

- Application Form
- Geotechnical Report
- Engineering Drawings and supporting information in accordance with CN checklist for Watermains under CN Right-of-Way
- $10,000 PO to cover Engineering review / Geotechnical Review.

9.11 Drinking Water Works Permit

The existing Drinking Water Works Permit will need to be reviewed during the detailed design to confirm whether the West Brampton Watermain meets the established design criteria. If so, a Form 1 is required.

10 Conclusions and Recommendations

10.1 Conclusions

The Region of Peel undertook a Schedule C Class Environmental Assessment (EA) to address the Problem Statement identified in **Section 1.5**. Throughout the EA, the project team consulted with the public and key stakeholders in accordance with the Municipal Class EA requirements. The public consultation program and the outcomes are summarized in **Section 2.**

During the initial stages, the project team identified the limit of the study area and prepared a description of the existing conditions as presented in **Section 3**. Through the comparative evaluation of alternative solutions, the project team identified Alternative 2 along Mississauga Road and Williams Parkway as the preferred route for West Brampton Watermain as described in **Section 4.** Alternative 2 comparatively ranked as well or better than the other three short-listed alternatives. The problem statement, comparative evaluation of the alternative routes, and recommended preferred alternative was presented to the public at the Public Open House held on October 18, 2012.

Based on the evaluation of alternative design concepts for Alternative 2, the West Brampton Watermain will be installed primarily by open cut, with trenchless crossings of the watercourses, railways, and Highway 410, and some of the arterial roads. The evaluation and description of the preferred design concept is provided in **Section 5.** The majority of the West Brampton watermain is located within and existing right-of-way, however some temporary easements and permanent easements will likely be required as described in **Section** 6. The project team has considered potential negative impacts to the environment and identified corresponding mitigative / enhancement measures to mitigate the impact as summarized in **Section 7**. The design concept, easement locations, and mitigation measures were presented to the public at the Public Open House held on June 4, 2013.

10.2 Recommendations

This Environmental Study Report documents the process and the outcomes of the Schedule C Class Environmental Assessment for the West Brampton Watermain. The Region may proceed with the following:

- 30 Day Public Review and Comment Period for the Environmental Study Report.
- Detailed design and additional field investigation to refine the design
- Development and implementation of the mitigation measures during detailed design and construction
- Acquisition of the required property
- Acquisition of the required Permits and Approvals
- Construction of the West Brampton Watermain

11 References

1 *Greenbelt Plan, Ministry of Municipal Affairs and Housing, February 2005*
2 *Places to Grow, Growth Plan for the Greater Golden Horseshoe, Ministry of Public Infrastructure Renewal, 2006*
3 *Region of Peel Official Plan, Office Consolidation 2008*
4 *Region of Peel Official Plan, DRAFT Office Consolidation 2011*
5 *City of Brampton Official Plan,2008*
6 *Region of Peel Water and Wastewater Master Plan Update,* KMK Consultants Limited, September 2007
7 *Feasibility Study Assessment of Zone 5 Sub-Transmission Main and East Brampton (Zone 4) Transmission Main Twinning,*
8 *Municipal Class Environmental Assessment, Municipal Engineers Association, October 2000, as amended in 2007*
9 *Design Guidelines for Drinking-Water Systems, Ministry of the Environment 2008*
10 *Public Works Design, Specifications, and Procedures Manual Linear Infrastructure Watermain Design Criteria, Region of Peel, Revised June 2010*
11 *Erosion and Sediment Control Guideline for Urban Construction, December 2006.*
12 *Williams Parkway from McLaughlin Road to North Park Drive Environmental Study Report, Chisholm Fleming and Associates, June 2011*