

VAUGHAN METROPOLITAN CENTRE
BLACK CREEK RENEWAL CLASS EA

ENVIRONMENTAL STUDY REPORT

FINAL REPORT • AUGUST 2018

REPORT PREPARED FOR



CITY OF VAUGHAN
2141 Major Mackenzie Drive
Vaughan, ON L6A 1T1

REPORT PREPARED BY



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TMIG PROJECT NUMBER 12122

REPORT PREPARED IN ASSOCIATION WITH



**PALMER ENVIRONMENTAL CONSULTING
GROUP INC.**



ARCHEOWORKS INC.



EXECUTIVE SUMMARY

Introduction

The Municipal Infrastructure Group Limited (TMIG), along with team members Palmer Environmental Consulting Group Limited (PECG) and Archeoworks Inc., were retained by the City of Vaughan (the City) to complete the Vaughan Metropolitan Centre (VMC) – Black Creek Renewal Class Environmental Assessment (Black Creek Renewal EA or EA). The EA builds upon the Black Creek Storm Water Optimization Study Master Plan Class Environmental Assessment (BCSWOS) (AECOM, 2012) that was completed by the City.

The BCSWOS identified a range of alternative solutions to reduce flooding and flood damages, improve water quality and limit stream bank erosion in Black Creek within the City. The preferred solution to address flooding was determined to be the reconstruction and renewal of Black Creek between the Edgeley Pond (north of Highway 7) and Highway 407 (referred to herein as the 'Black Creek Renewal' or 'new channel corridor').

The EA's purpose is to develop and evaluate potential channel alignments and physical forms for the Black Creek Renewal between Highway 7 and Highway 407. It considers the requirement to mitigate the current flooding and erosion problems in Black Creek as well as potential enhancements to the natural heritage system and public realm associated with the Black Creek corridor. The EA was carried out as a Schedule C project.

The study area is primarily located east of Jane Street, from Highway 7 to Highway 407 as highlighted in **Figure 1-1**. The existing urban context is generally characterized as discontinuous development with a mix of built form and vacant lots. The majority of Black Creek through the study area has been realigned and confined to a relatively narrow corridor and does not have adequate capacity to convey storm runoff from large storm events. Multiple driveway and road crossings currently exist along this reach of the creek that also contribute to the flooding issues.

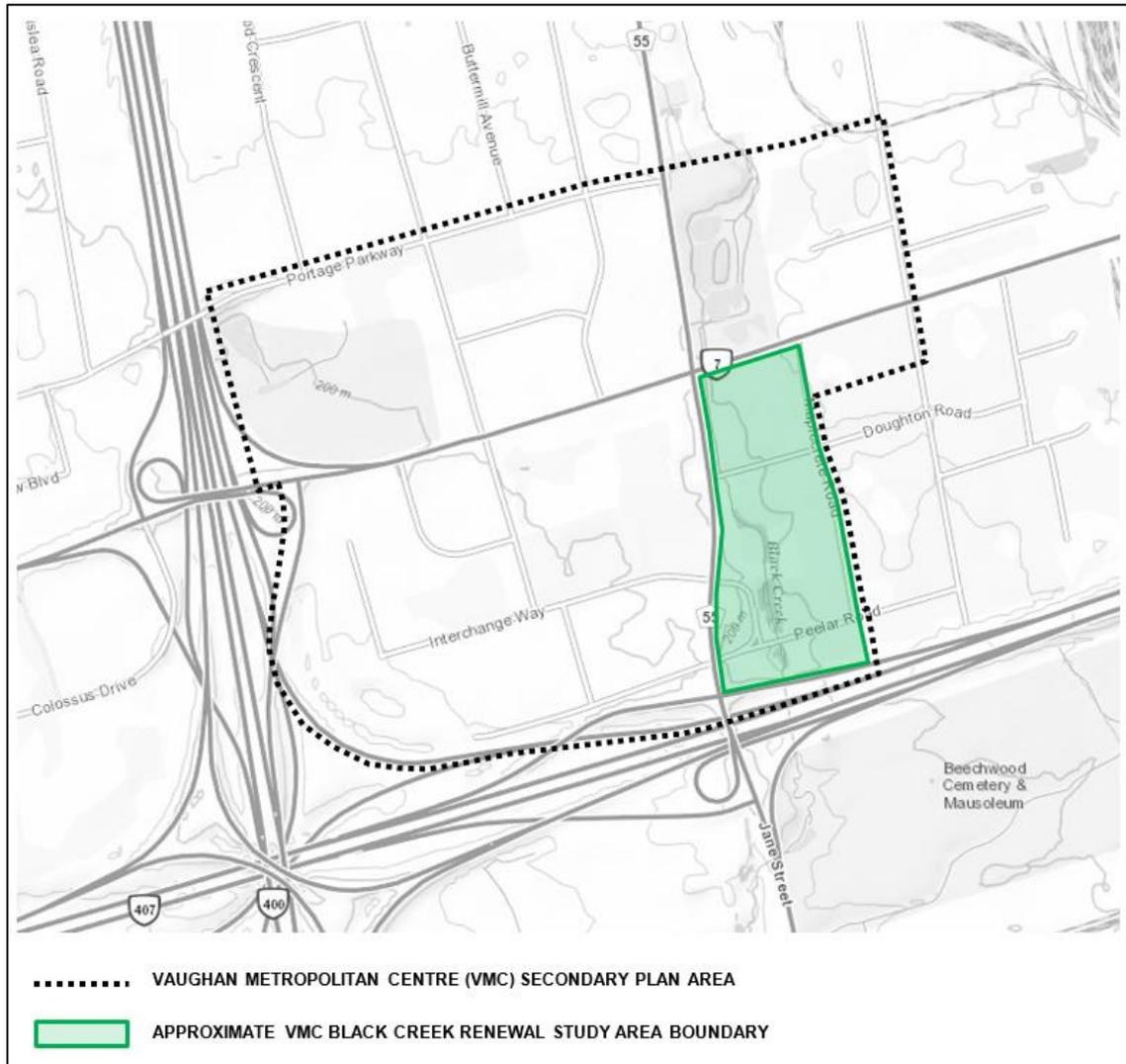
Problem and Opportunity Statement

The problem/opportunity statement was originally defined in the Black Creek Storm Water Optimization Study Master Plan Class Environmental Assessment (BCSWOS), and is provided below:

An opportunity exists to develop a comprehensive strategy that will establish measures to improve the water quality within Black Creek, as well as appropriate flood control and erosion protection works for the existing properties and future/planned development within the Subwatershed. Further, there is also an opportunity to protect and enhance the natural habitat along Black Creek. In order to prepare and implement a comprehensive strategy, a subwatershed-based approach is most appropriate to ensure that the full range of concerns, objectives and potential solutions are recognized and reconciled.

The VMC Black Creek Renewal Class EA study has confirmed that there is an opportunity to implement effective flood controls works, enhance the natural heritage system and enhance the public realm through the reconstruction and renewal of the Black Creek valley corridor between Highway 7 and Highway 407.

Figure ES-1 VMC Black Creek Renewal EA Study Area



Public Consultation

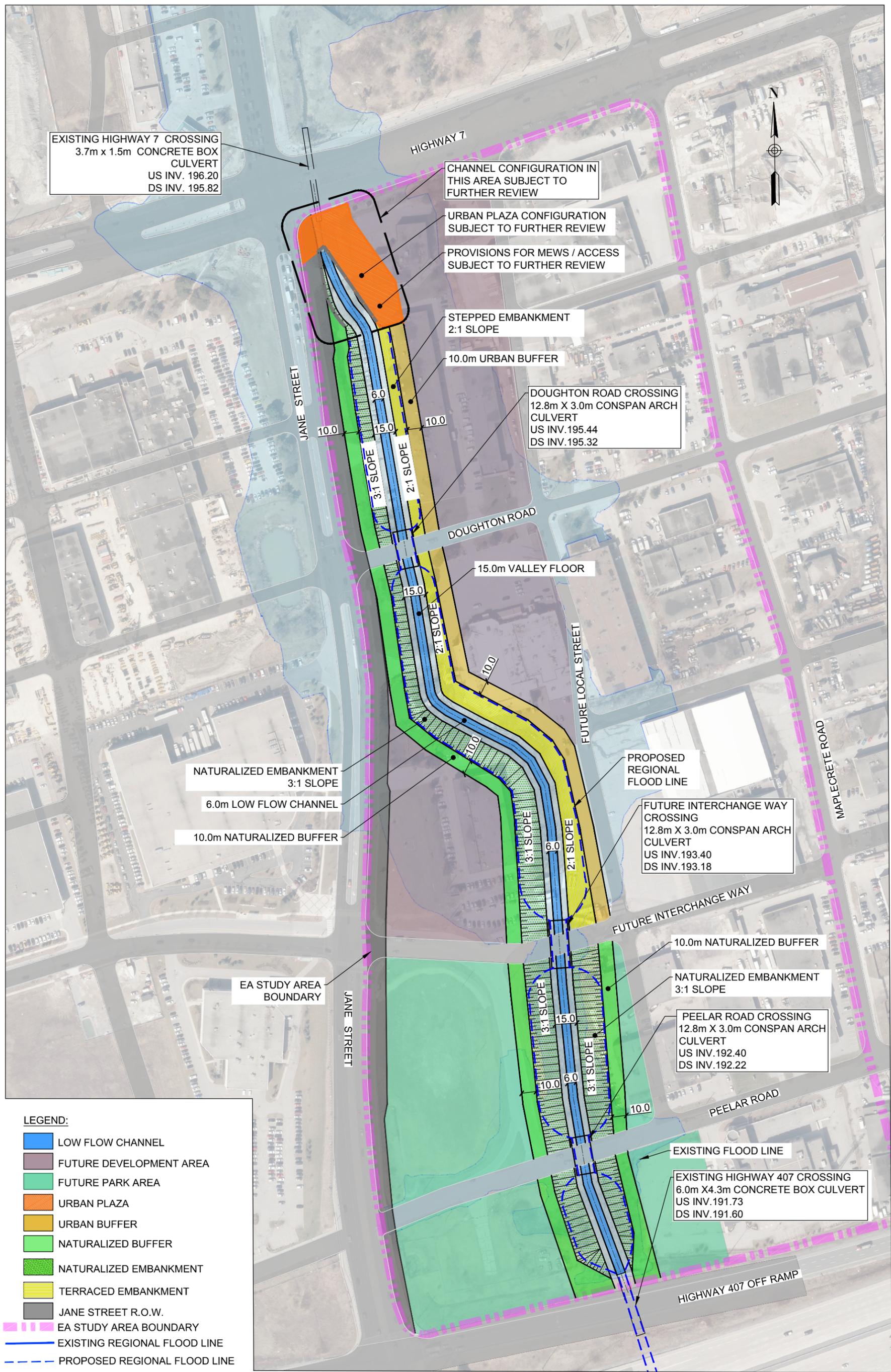
A Notice of Study Commencement was prepared and circulated on July 5, 2012 to the stakeholders, which included regulatory agencies, Aboriginal Communities, utilities, and local business and property owners. A Project Status Update was circulated on January 16, 2017, after a period of consultation and facilitation from 2013 to 2016 that was undertaken to resolve a number of land use planning issues affecting the study area. The outcome of the consultation and facilitation process was a land use framework to develop alternative alignments for the Black Creek Renewal. As part of the process, preliminary hydraulic analyses were completed to establish key design elements such as the required channel size and general configuration of the channel embankments and buffer areas, which were carried forward into the Black Creek Renewal EA.

The Public Information Centre (PIC) was held on May 10, 2017. The purpose of the PIC was to present the alternative designs, the evaluation methodology and the preferred design. During the PIC, members of the public and agency representatives were invited to provide comments for consideration in the EA, which were documented and followed up with a response. A Notice of Study Completion was issued on August 9, 2018.

Alternative Designs

The alternatives for this EA focused on the potential alignment configurations for the Black Creek Renewal. The following outlines the alternative alignments, where Alternative #2 to #4 are presented in **Figures ES-2 to ES-4**, respectively.

- Alternative #1 – Do Nothing
- Alternative #2 – New Valley over Existing Alignment
This alignment alternative generally follows the alignment of the existing creek valley, which runs adjacent to Jane Street from Highway 7 to Doughton Road and meanders east before the future Interchange Way crossing and continues straight in a southerly direction to the existing Highway 407 crossing.
- Alternative #3 – Jane Street Alignment
This alignment alternative will be adjacent to Jane Street for most of the new channel corridor and meander sharply east on the downstream side of Peelar Road to meet the existing Highway 407 culvert.
- Alternative #4 – Meander North of Peelar Road
This alternative alignment follows the valley alignment from Alternatives #2 and #3 for the upstream section up to Doughton Road, but features a meander east between future Interchange Way and Peelar Road before continuing to Highway 407.



EXISTING HIGHWAY 7 CROSSING
3.7m x 1.5m CONCRETE BOX
CULVERT
US INV. 196.20
DS INV. 195.82

CHANNEL CONFIGURATION IN
THIS AREA SUBJECT TO
FURTHER REVIEW

URBAN PLAZA CONFIGURATION
SUBJECT TO FURTHER REVIEW

PROVISIONS FOR MEWS / ACCESS
SUBJECT TO FURTHER REVIEW

STEPPED EMBANKMENT
2:1 SLOPE

10.0m URBAN BUFFER

DOUGHTON ROAD CROSSING
12.8m X 3.0m CONSPAN ARCH
CULVERT
US INV. 195.44
DS INV. 195.32

15.0m VALLEY FLOOR

NATURALIZED EMBANKMENT
3:1 SLOPE

6.0m LOW FLOW CHANNEL

10.0m NATURALIZED BUFFER

PROPOSED
REGIONAL
FLOOD LINE

FUTURE INTERCHANGE WAY
CROSSING
12.8m X 3.0m CONSPAN ARCH
CULVERT
US INV. 193.40
DS INV. 193.18

EA STUDY AREA
BOUNDARY

10.0m NATURALIZED BUFFER

NATURALIZED EMBANKMENT
3:1 SLOPE

PEELAR ROAD CROSSING
12.8m X 3.0m CONSPAN ARCH
CULVERT
US INV. 192.40
DS INV. 192.22

EXISTING FLOOD LINE

EXISTING HIGHWAY 407 CROSSING
6.0m X 4.3m CONCRETE BOX
CULVERT
US INV. 191.73
DS INV. 191.60

LEGEND:

- LOW FLOW CHANNEL
- FUTURE DEVELOPMENT AREA
- FUTURE PARK AREA
- URBAN PLAZA
- URBAN BUFFER
- NATURALIZED BUFFER
- NATURALIZED EMBANKMENT
- TERRACED EMBANKMENT
- JANE STREET R.O.W.
- EA STUDY AREA BOUNDARY
- EXISTING REGIONAL FLOOD LINE
- PROPOSED REGIONAL FLOOD LINE

VAUGHAN VMC BLACK CREEK RENEWAL CLASS EA
ALTERNATIVE #2
NEW VALLEY OVER EXISTING ALIGNMENT

SCALE: 1:2500	
DATE: AUGUST 2018	
DESIGNED BY: T.D.	DRAWN BY: M.M.
CHECKED BY: S.H.	CHECKED BY:

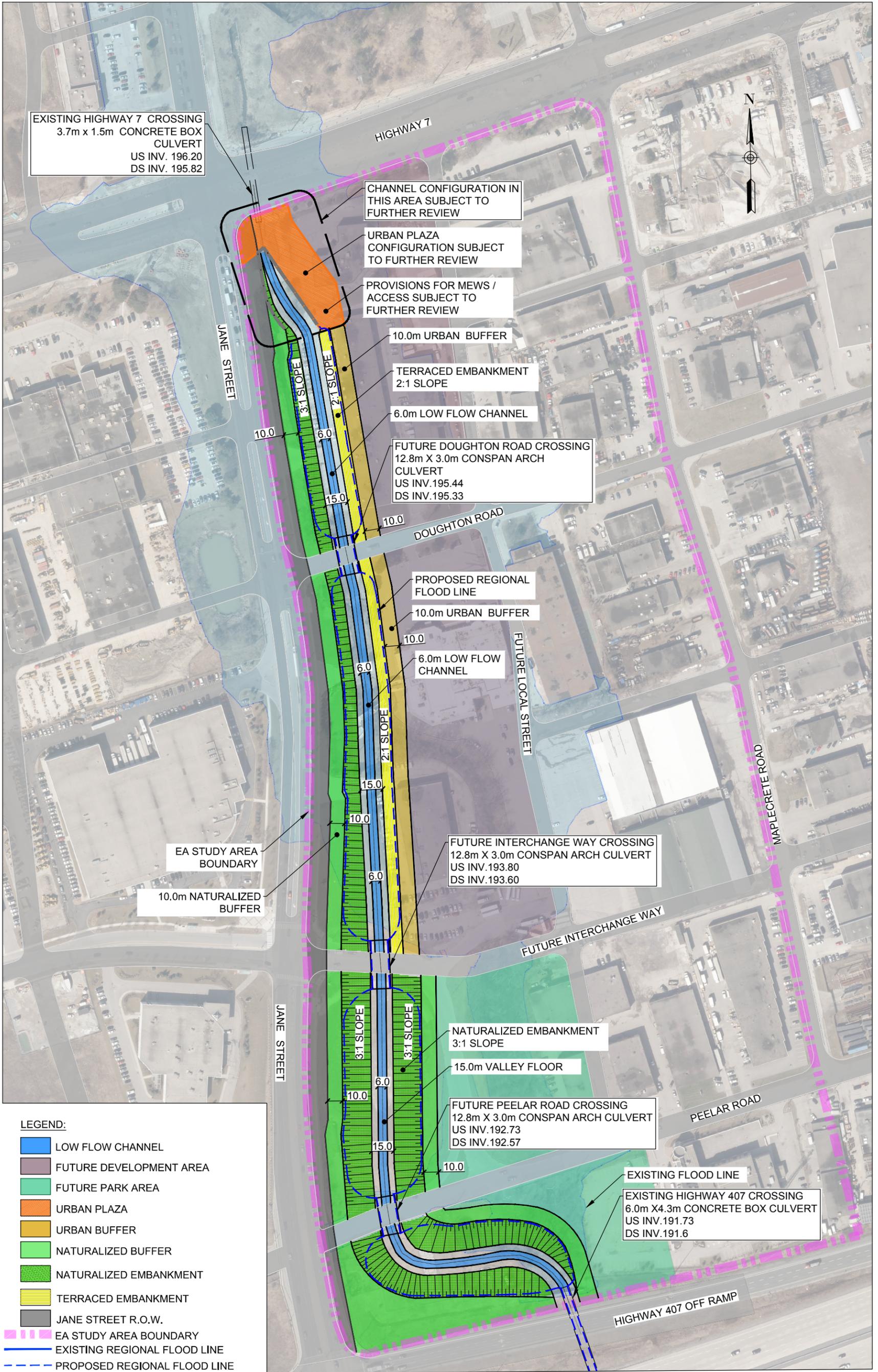
PROJECT No.	12122
FIGURE No.	ES-2

TMIG
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File: G:\Projects\2012\12122 - Vaughan VMC Black Creek Renewal Class EA's Drawings\Figures\ES-2 Alternative #2 - 11x17.dwg Date: Jul 20, 2018 - 11:00am. Edit By: mmoyakina Layout: ES-2

File: G:\Projects\20121222 - Vaughan VMC Black Creek Renewal Class EA's Drawings\Figures\Fig ES-3 Alternative #3 - 11x17.dwg Date: Jul 20, 2018 - 11:02am. Layout: ES-3



EXISTING HIGHWAY 7 CROSSING
3.7m x 1.5m CONCRETE BOX
CULVERT
US INV. 196.20
DS INV. 195.82

CHANNEL CONFIGURATION IN
THIS AREA SUBJECT TO
FURTHER REVIEW

URBAN PLAZA
CONFIGURATION SUBJECT
TO FURTHER REVIEW

PROVISIONS FOR MEWS /
ACCESS SUBJECT TO
FURTHER REVIEW

10.0m URBAN BUFFER

TERRACED EMBANKMENT
2:1 SLOPE

6.0m LOW FLOW CHANNEL

FUTURE DOUGHTON ROAD CROSSING
12.8m X 3.0m CONSPAN ARCH
CULVERT
US INV. 195.44
DS INV. 195.33

10.0m URBAN BUFFER

PROPOSED REGIONAL
FLOOD LINE

10.0m URBAN BUFFER

6.0m LOW FLOW
CHANNEL

FUTURE INTERCHANGE WAY CROSSING
12.8m X 3.0m CONSPAN ARCH
CULVERT
US INV. 193.80
DS INV. 193.60

EA STUDY AREA
BOUNDARY

10.0m NATURALIZED
BUFFER

NATURALIZED EMBANKMENT
3:1 SLOPE

15.0m VALLEY FLOOR

FUTURE PEELAR ROAD CROSSING
12.8m X 3.0m CONSPAN ARCH
CULVERT
US INV. 192.73
DS INV. 192.57

EXISTING FLOOD LINE

EXISTING HIGHWAY 407 CROSSING
6.0m X 4.3m CONCRETE BOX
CULVERT
US INV. 191.73
DS INV. 191.6

LEGEND:

- LOW FLOW CHANNEL
- FUTURE DEVELOPMENT AREA
- FUTURE PARK AREA
- URBAN PLAZA
- URBAN BUFFER
- NATURALIZED BUFFER
- NATURALIZED EMBANKMENT
- TERRACED EMBANKMENT
- JANE STREET R.O.W.
- EA STUDY AREA BOUNDARY
- EXISTING REGIONAL FLOOD LINE
- PROPOSED REGIONAL FLOOD LINE



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VAUGHAN VMC BLACK CREEK RENEWAL CLASS EA
ALTERNATIVE #3
JANE STREET ALIGNMENT

SCALE: 1:2500

DATE: AUGUST 2018

DESIGNED BY: T.D.

CHECKED BY: S.H.

DRAWN BY: M.M.

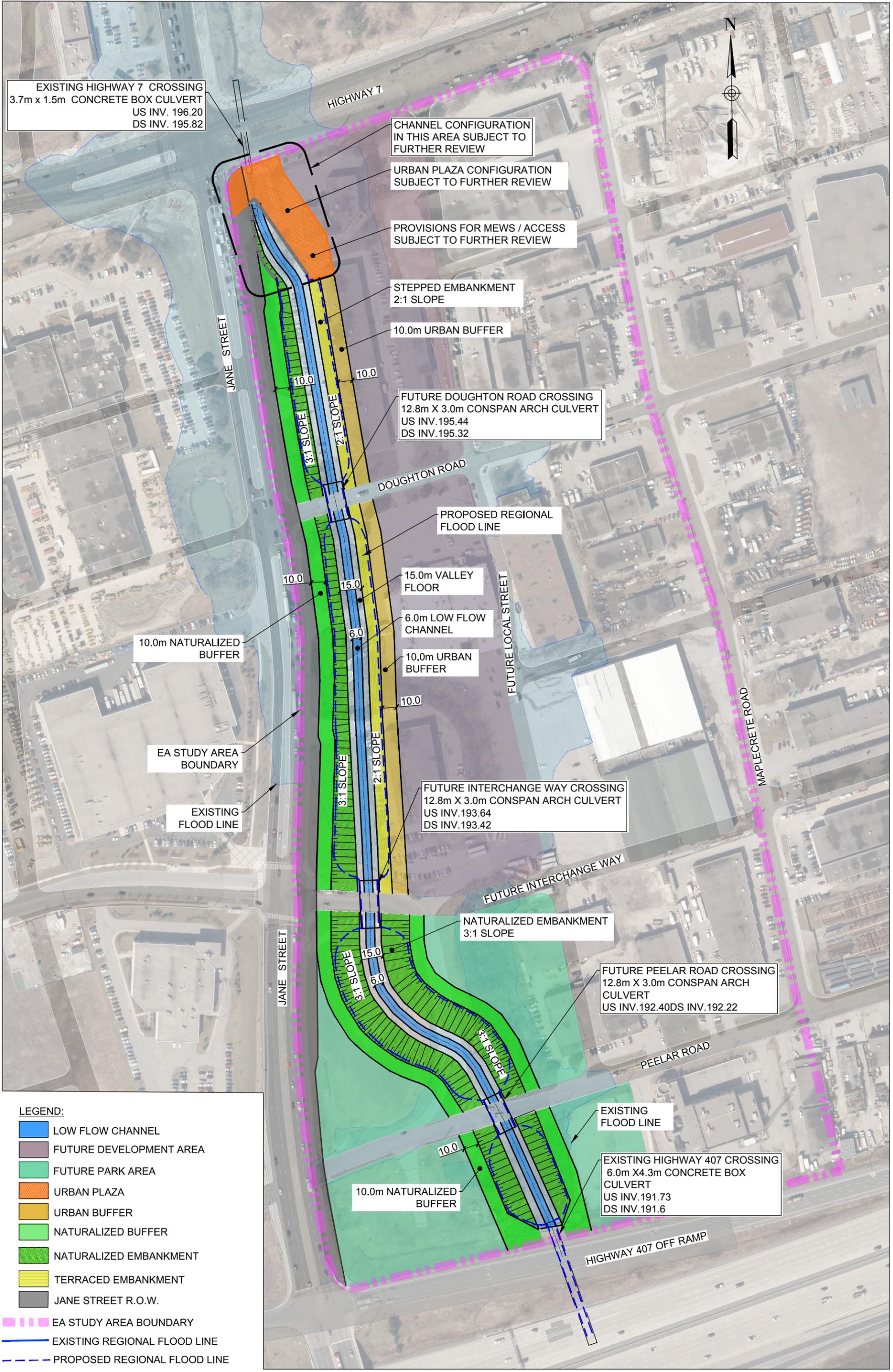
CHECKED BY:

PROJECT No.

12122

FIGURE No.

ES-3



EXISTING HIGHWAY 7 CROSSING
3.7m x 1.5m CONCRETE BOX CULVERT
US INV. 196.20
DS INV. 195.82

CHANNEL CONFIGURATION
IN THIS AREA SUBJECT TO
FURTHER REVIEW

URBAN PLAZA CONFIGURATION
SUBJECT TO FURTHER REVIEW

PROVISIONS FOR MEWS / ACCESS
SUBJECT TO FURTHER REVIEW

STEPPED EMBANKMENT
2:1 SLOPE

10.0m URBAN BUFFER

FUTURE DOUGHTON ROAD CROSSING
12.8m X 3.0m CONSPAN ARCH CULVERT
US INV. 195.44
DS INV. 195.32

PROPOSED REGIONAL
FLOOD LINE

15.0m VALLEY
FLOOR

6.0m LOW FLOW
CHANNEL

10.0m URBAN
BUFFER

10.0m NATURALIZED
BUFFER

EA STUDY AREA
BOUNDARY

EXISTING
FLOOD LINE

FUTURE INTERCHANGE WAY CROSSING
12.8m X 3.0m CONSPAN ARCH CULVERT
US INV. 193.64
DS INV. 193.42

NATURALIZED EMBANKMENT
3:1 SLOPE

FUTURE PEELAR ROAD CROSSING
12.8m X 3.0m CONSPAN ARCH
CULVERT
US INV. 192.40 DS INV. 192.22

EXISTING
FLOOD LINE

EXISTING HIGHWAY 407 CROSSING
6.0m X 4.3m CONCRETE BOX
CULVERT
US INV. 191.73
DS INV. 191.6

10.0m NATURALIZED
BUFFER

HIGHWAY 407 OFF RAMP

LEGEND:

- LOW FLOW CHANNEL
- FUTURE DEVELOPMENT AREA
- FUTURE PARK AREA
- URBAN PLAZA
- URBAN BUFFER
- NATURALIZED BUFFER
- NATURALIZED EMBANKMENT
- TERRACED EMBANKMENT
- JANE STREET R.O.W.
- EA STUDY AREA BOUNDARY
- EXISTING REGIONAL FLOOD LINE
- PROPOSED REGIONAL FLOOD LINE

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VAUGHAN VMC BLACK CREEK RENEWAL CLASS EA
MEANDER NORTH OF PEELAR ROAD ALIGNMENT

SCALE: 1:2500		PROJECT No.
DATE: AUGUST 2018		12122
DESIGNED BY: T.D.	DRAWN BY: M.M.	FIGURE No.
CHECKED BY: S.H.	CHECKED BY:	ES-4

Preferred Alternative Design

The alternative designs were comparatively and qualitatively evaluated based on criteria developed within five main categories (technical, natural environment, social, cultural, and financial considerations), which represent the broad definition of the environment in the EA Act. Alternative #4 (Meander North of Peelar Road) was selected as the preferred alignment due to a number of advantages compared to the other alternatives. A summary of the key impacts and benefits of Alternative #4 is provided below:

- **Technical Environment** – Alternative #4 will be able to convey the Regional Storm Event peak flow rate within the valley to provide flood protection for the area to satisfy the key objective of the Black Creek Renewal. Some construction challenges are expected because sections of the new channel corridor are located away from the existing alignment and will require long tie-in sections if constructed separately from other sections. Conversely, the lower reach of the new channel corridor is located on public lands, which will allow a large portion of the channel to be constructed without private land development, disturbing existing buildings, and in dry conditions, away from the existing watercourse. Some utilities are potentially in conflict with the new channel corridor and will require relocation, including the hydro pole corridor, natural gas line (NPS 12) and 300 mm watermain; however, the 900 mm sanitary trunk sewer appears to be avoided.
- **Natural Environment** – This alternative is expected to improve fish habitat and aquatic ecosystems by removing physical barriers to connectivity, improving substrate quality, and providing a wider, continuous low flow channel. The terrestrial ecosystem will also benefit by having an overall wider and longer valley corridor that is better vegetated compared to existing conditions. There will be a temporary disturbance of the existing aquatic and terrestrial habitat system during the construction; however, the study area does not contain any significant natural and environmentally sensitive areas and appropriate mitigation measures will be implemented.
- **Social / Cultural Environment** – There are no expected impacts to the cultural heritage with the new channel corridor; however, a Stage 2 Archaeological Assessment (AA) has been recommended for these lands prior to the construction. The land acquisition requirement for this alternative is the lowest amongst the alternatives. In addition, future development blocks adjacent to the new channel in this alternative will be more contiguous with the neighbourhood and aligned with policies in the VMC Secondary Plan.
- **Financial Environment** – The capital costs associated with Alternative #4 are estimated at \$39.7 million, which is within the costs for a new channel corridor that was outlined in the Black Creek Financial Strategy completed in 2016 for directly comparable items. Some maintenance costs will be incurred for the new channel corridor, but is roughly equal to the other alternatives. Finally, there will be no damage costs to adjacent properties and businesses for up to the Regional Storm Event.

A preliminary design was prepared for the proposed Black Creek Renewal based on the preferred alternative design (Meander North of Peelar Road), which refined the design based on surrounding grading constraints.

Conceptual construction staging was also considered for the Black Creek Renewal. Staging scenarios were developed with an aim to construct the new channel corridor in individual sections on both private and public land, concurrent with the re-development of individual parcels of land adjacent to Black Creek. This will allow for maximum flexibility and benefit to reduce flooding because sections of the new channel corridor can be constructed as soon as adjacent properties are ready for redevelopment. In general, the new channel corridor construction was divided into four major sections, each of which can be constructed individually and integrated together as other sections are completed. From downstream to upstream, the sections are (1) Highway 407 to upstream of Peelar Road, (2) North of Peelar Road to immediately downstream of Doughton Road, (3) Doughton Road and 7683 to 7695 Jane Street, and (4) 7725 Jane Street to Highway 7.

Recommendations for Future Study

A number of studies are required for the detailed design of the Black Creek Renewal:

- Several utility conflicts were identified in this EA and a detailed utility investigation is necessary to determine which utilities need to be relocated and the options of relocation.
- A detailed topographic survey is required to support final grading design for the new channel corridor and identify existing features.
- The archaeological assessments (AA) will continue to a Stage 2 AA, as recommended by the Stage 1 AA completed as part of this EA. If necessary, a Stage 3 AA will be completed.
- A geotechnical investigation is required to determine subsurface soil conditions, groundwater levels, and design recommendations for culvert footings, retaining walls, and slope stability.
- A final grading assessment is required to confirm the minimum freeboard from the Regional Storm Event water surface elevation and overland flow routes into the new channel corridor. Coordination is also required with the detailed design of future road construction surrounding the new channel corridor.
- Natural channel design for the low flow channel is necessary in detailed design to incorporate recommendations from fluvial geomorphological and aquatic habitat studies for long-term erosion protection and to provide fish habitat and passage in the new channel corridor. The TRCA's Crossing Guideline for Valley and Stream Corridors will also need to be incorporated at detailed design.
- Landscape and urban design will be completed for the park areas and other public amenities adjacent to the new channel corridor. In particular, the VMC Consultation and Facilitation process established the urban design vision which will need to be incorporated in detailed design. A Tree Inventory, Preservation Plan and Restoration Plan will be required in detailed design. The southeast corner of the intersection between Highway 7 and Jane Street will also require future study and stakeholder consultation during detailed design.

Construction Impacts and Mitigation

The construction of the new channel corridor will have impacts on the surrounding area including terrestrial features; breeding birds, threatened and endangered bat species; surface water and aquatic habitat; local groundwater; soils; adjacent private and public properties; air quality, noise and vibration; utilities; and traffic and transportation. Best management practices are required to mitigate these impacts and will be detailed specifically for the site in an Environmental Management Plan (EMP), construction staging plans, and Erosion and Sediment Control (ESC) Plans.

A number of permits and approvals are also required with the Toronto and Region Conservation Authority, York Region, Ministry of the Environment, Conservation and Parks, Ministry of Natural Resources and Forestry, Fisheries and Oceans Canada, and local utility owners.

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1 INTRODUCTION AND BACKGROUND

1.1 Study Overview and Purpose

The Municipal Infrastructure Group Limited (TMIG), along with team members Palmer Environmental Consulting Group Limited (PECG) and Archeoworks Inc., were retained by the City of Vaughan (the City) to complete the Vaughan Metropolitan Centre (VMC) – Black Creek Renewal Class Environmental Assessment (Black Creek Renewal EA or EA). The EA builds upon the Black Creek Storm Water Optimization Study Master Plan Class Environmental Assessment (BCSWOS) (AECOM, 2012) that was completed by the City.

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The Black Creek Renewal EA's purpose is to develop and evaluate potential channel alignments and physical forms for the Black Creek Renewal between Highway 7 and Highway 407. It considers the requirement to mitigate the current flooding and erosion problems in Black Creek as well as potential enhancements to the natural heritage system and public realm associated with the Black Creek corridor.

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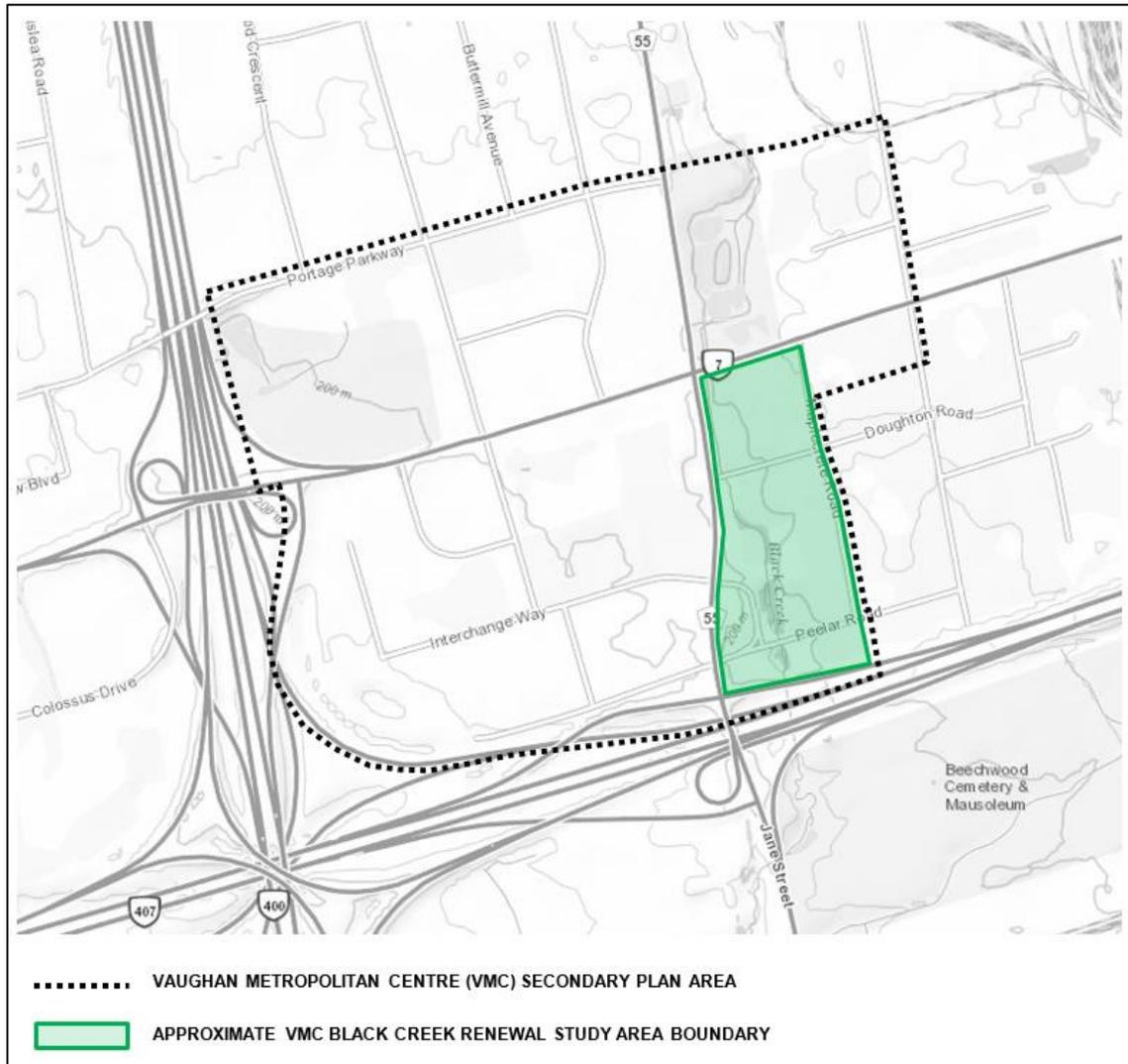
This Environmental Study Report documents the development and evaluation of potential alternative alignments for the recommended Black Creek Renewal through the VMC, including the preliminary design of the preferred alternative. It also outlines the cost, approvals and future studies needed for implementation of the recommended works.

1.2 Project Background

The Black Creek subwatershed is located within the cities of Vaughan and Toronto, and is a tributary of the Humber River. The main channel of Black Creek is approximately 36 km in length with headwaters near Weston Road and Major Mackenzie Drive in Vaughan and outlet at the Humber River near Royal York Road and Dundas Street West in Toronto. Black Creek has historically experienced a high level of anthropogenic alteration as a result of changing land use in the watershed, from agricultural uses to residential, commercial and industrial development more recently. The channel alterations include straightening, re-alignments and various sections of engineered channel.

With respect to hydrology and flooding, the largest storm on record to affect the area was Hurricane Hazel on October 15, 1954, which generated 214 mm of rainfall. In recent history, a severe storm on August 19, 2005 exceeded the 100-year storm event for the study area with up to 123 mm of rainfall recorded at nearby rain gauges (AECOM, 2012) and caused flooding in the study area. The BCSWOS determined that this reach of Black Creek can only accommodate flows generated by a 5-year storm event; therefore, adjacent properties and portions of Jane Street, Peelar Road and Highway 7 are susceptible to flooding during moderate rainfall events.

Figure 1-1 VMC Black Creek Renewal EA Study Area



A number of key stormwater management (SWM) issues, constraints and opportunities were previously identified in the Black Creek Subwatershed by the City and Toronto and Region Conservation Authority (TRCA), as a result of hydrologic and hydraulic modelling, as well as field observations following major rainfall events (AECOM, 2012). Considerations identified by the TRCA within the study area include:

- A number of structures and municipal infrastructure is located within the Regulatory Floodplain;
- The Black Creek channel and associated hydraulic structures do not provide sufficient capacity, leading to flooding under the Regulatory Storm Event;
- Little to no water quality treatment for the older industrial areas contributing runoff to Black Creek;
- The proximity of existing structures and municipal infrastructure to Black Creek poses a significant constraint to increasing the hydraulic capacity of the channel;
- Geotechnical issues were identified along the slopes of the channel; and
- New development initiatives in the study area provide an opportunity to implement appropriate quality and quantity controls.

The BCSWOS was a Municipal Class EA (Phases 1 and 2) completed in 2012 to consider solutions to the SWM issues in the study area and broader Black Creek watershed within the City. With respect to the study area of this EA, the preferred solutions included the construction of a new naturalized channel to replace the existing Black Creek channel between the Edgeley Pond and Highway 407, sized to safely convey the Regulatory Flood. This solution necessitated the current Black Creek Renewal EA to determine the preferred alignment for the new channel corridor.

1.3 Municipal Class Environmental Assessment Process

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 EA, 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, Conservation and Parks (MECP), as an alternative method to Individual Environmental Assessments for recurring municipal projects that were similar in nature, usually limited in scale and with predictable ranges of environmental effects which were responsive to mitigating measures. The latest Municipal Class EA document (October 2000, as amended 2007, 2011 & 2015) has been used for this study.

The Class EA provides for the following designations of projects 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 (Phases 3 and 4).

The five phase Class EA planning process is described below:

- 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 and evaluate the design alternatives for implementing the preferred solution by considering the net positive and negative effects of each alternative design concept including mitigation measures.
- Phase 4:** Prepare the Environmental Study Report (ESR) for review by agencies and the public.
- 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 for the ESR, if there are no outstanding Part II Order Requests, the project may proceed to Phase 5 of the Class EA process to complete design, contract drawings and tender documents, and move on to construction.

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

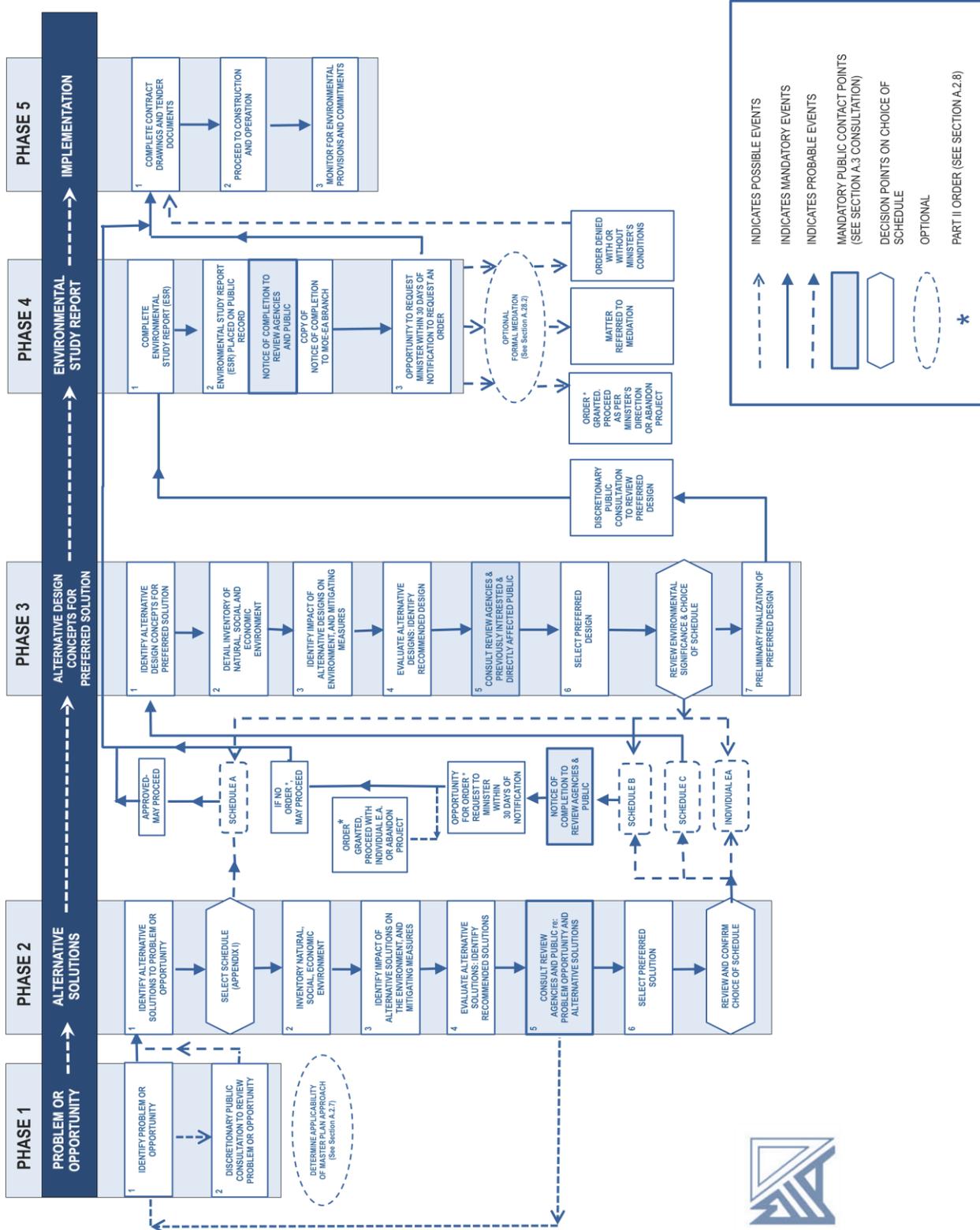
1.4 Confirmation of EA Schedule

The BCSWOS outlined the requirement for a Schedule C Class EA for the Black Creek Renewal based on the construction of three water crossings at estimated costs of over \$2.4 million each (as the cost limit for Schedule C) according to the Municipal Class EA document (October 2000, as amended 2007, 2011 & 2015). However, the \$2.4 Million limit referenced in the BCSWOS falls under the ‘Municipal Road Projects’ schedules.

As this is primarily a flood reduction project, it may be more appropriate to reference the schedules for ‘Municipal Water and Wastewater Projects’. Under this category, activities including ‘Modify existing watercourse crossings for the purpose of flood control’ and ‘Works undertaken in a watercourse for the purposes of flood control or erosion control’ are considered Schedule B activities.

Regardless, the VMC Black Creek Renewal EA has been conservatively completed as a Schedule C project. The BCSWOS satisfied Phases 1 and 2 of the Municipal Class EA process, and the VMC Black Creek Renewal EA encompasses Phases 3 and 4 in the Class EA process which identifies and evaluates the design alternatives for the new channel corridor.

Figure 1-2 Municipal Class EA Planning Flow Chart



1.5 Co-ordination with Other Infrastructure Studies

The following studies were underway or completed for infrastructure planning in the VMC area during the Black Creek Renewal EA. These studies had direct and indirect impacts on the design and evaluation of the new channel corridor, and vice versa. Information related to land use planning is summarized in **Section 4.1**.

1.5.1 Vaughan Metropolitan Centre Streetscape and Open Space Plan

The Vaughan Metropolitan Centre Streetscape and Open Space Plan (EDA, 2015) was completed by the City in November 2015 to build upon on the planning and urban design framework outlined in the VMC Secondary Plan (described in **Section 4.1.6**). The proposed Black Creek Renewal was identified as the most prominent natural heritage feature within the VMC and represents a significant open space area. It can potentially provide social and recreational spaces as well as a strong landscape identity for the VMC.

The key design guidelines and typical elements for the Black Creek open space with particular relevance to the Black Creek Renewal includes pedestrian and cycling linkages in the form of walkways and paths.

1.5.2 VMC Municipal Servicing Master Plan

The VMC Municipal Servicing Master Plan (TMIG, 2012), completed in 2012, found that the existing water, wastewater and stormwater management infrastructure could not accommodate the planned growth in the VMC Secondary Plan Area. The study developed and evaluated alternatives for the provision of municipal servicing to support the redevelopment objectives established by the VMC Secondary Plan and presented a preferred comprehensive servicing plan.

The study recommended a number of improvements to water and wastewater infrastructure that is crossing or adjacent to the existing Black Creek channel. It also presented a preferred stormwater management strategy for VMC southeast quadrant, which encompasses the study area. The VMC Municipal Servicing Master Plan also recommended the retrofit of the existing Edgeley Pond to treat the quantity and quality of storm runoff from a large drainage area north of Highway 7, which discharges to Black Creek within the study area.

The VMC Black Creek Renewal Class EA considered the recommended improvements to water, wastewater and stormwater infrastructure in the development and evaluation of alternatives for the Black Creek Renewal.

1.5.3 York Region Highway 7 Bus Rapid Transit

York Region's Highway 7 Corridor and Vaughan North-South Link Public Transit Improvements EA (York Region, 2005) established the need for a Bus Rapidway extending along Highway 7 from Highway 50 in Vaughan to Reesor Road in Markham. The BRT provides connectivity between three designated urban centres along Highway 7, including the VMC, with stations located at Millway Avenue and Creditstone Road. The construction of the BRT segment at Jane Street was completed in late 2016.

As part of the improvements to Highway 7 to accommodate the BRT, the existing Black Creek culvert at Highway 7 was left in place, but a retaining wall at the downstream face of the culvert was added to contain the widened road platform. These works were reviewed as part of this EA.

1.5.4 Toronto-York Spadina Subway Extension

The Toronto-York Spadina Subway Extension provides a critical extension for the existing Toronto Transit Commission (TTC) subway system across the municipal boundary between the City of Toronto and York Region. The extension includes the addition of six new stations, terminating at the new Vaughan Metropolitan Centre Station within the VMC Secondary Plan area. Construction of the VMC Station and the subway line extension was completed at the end of 2017.

The designs for the VMC Station and the subway alignment were reviewed and considered in the development and evaluation of alternative designs for the Black Creek Renewal.

1.5.5 City of Vaughan Water and Wastewater Master Plan

The City completed a Water and Wastewater Master Plan Class EA (TMIG, 2014) in 2014 to identify the infrastructure requirements associated with the planned growth in the City established by the Official Plan. The Water and Wastewater Master Plan identified infrastructure planning and implementation strategies and selected the preferred alternative to meet the City's growth needs, premised upon a time horizon of 2031. The preferred alternative was to expand and enhance existing water and wastewater infrastructure; however, the EA did not recommend any projects within the VMC as servicing requirements for the area were covered in the VMC Municipal Servicing Master Plan described in **Section 1.5.2**.

1.5.6 City of Vaughan Storm Drainage and Stormwater Management Master Plan

Similar to the Water and Wastewater Master Plan, in 2014 the City completed a Storm Drainage and Stormwater Management Master Plan Class EA (Cole Engineering, 2014) to identify the stormwater related infrastructure requirements associated with fulfillment of the Official Plan projections for growth in the City. The EA did not recommend any projects within the VMC as servicing requirements for the area were covered in the VMC Municipal Servicing Master Plan described in **Section 1.5.2**.

1.5.7 Black Creek Financial Strategy

The *Allocation of Funding Sources Report and Development Charges Background Study – Black Creek Financial Strategy* (fp&p and Hemson, 2016) was completed in 2016 to identify appropriate funding sources for improvements to the Edgeley Pond (located to the north of the EA study area) and the Black Creek Renewal. The study assessed the functional benefits of the projects and the benefitting interest groups to support Area-Specific Development Charges by-law(s). The Black Creek Financial Strategy considered a concept design of the new channel corridor for the cost estimate and functional benefits of the project.

1.5.8 Edgeley Pond and Park

The Edgeley Pond is a stormwater management facility located immediately north of the EA study area, northeast of the intersection between Highway 7 and Jane Street. The City is currently completing detailed design for a new park and retrofits for the stormwater management facility to provide improved water quality, flood control, and ecological function. Similar to the Black Creek Renewal, the Edgeley Pond and Park will form a signature amenity for the VMC and is a key component of the stormwater management infrastructure in the VMC. The final design of the Edgeley Pond and Park will have potential effects on the flow rate in Black Creek and the configuration of the new channel corridor around Highway 7 requires consideration in the design of the new channel corridor.

Of particular relevance is the planned enclosure of Black Creek from the outlet of the retrofitted Edgeley Pond to and contiguous with the culvert under Highway 7. This EA has been co-ordinated with the Edgeley Pond retrofit project to ensure agreement with the alignment and configuration of the culverts under Highway 7 and leading upstream to the Edgeley Pond.

1.6 Project Team Organization

TMIG is the lead consultant for the Black Creek Renewal EA and is the technical lead for the channel design, hydraulic modelling and stormwater management aspects of the new channel corridor.

The project team consists of the following sub-consultants:

- **Palmer Environmental Consulting Group Ltd. (PECG)**, undertaking the natural heritage assessment and identifying any required measures to mitigate the impact on the natural environment; and
- **Archeoworks Inc.**, undertaking the archaeological investigation for the study area.

2 PROBLEM AND OPPORTUNITY STATEMENT

The problem/opportunity statement was originally defined in the Black Creek Storm Water Optimization Study Master Plan Class Environmental Assessment (BCSWOS), and is provided below:

An opportunity exists to develop a comprehensive strategy that will establish measures to improve the water quality within Black Creek, as well as appropriate flood control and erosion protection works for the existing properties and future/planned development within the Subwatershed. Further, there is also an opportunity to protect and enhance the natural habitat along Black Creek. In order to prepare and implement a comprehensive strategy, a subwatershed-based approach is most appropriate to ensure that the full range of concerns, objectives and potential solutions are recognized and reconciled.

The VMC Black Creek Renewal Class EA study has confirmed that there is an opportunity to implement effective flood controls works, enhance the natural heritage system and enhance the public realm through the reconstruction and renewal of the Black Creek valley corridor between Highway 7 and Highway 407.

3 PUBLIC CONSULTATION

3.1 Notice of Study Commencement

A Notice of Study Commencement was prepared and circulated on July 5, 2012, on behalf of the City. The Notice was mailed directly to review agencies, utilities, property owners, Aboriginal communities, and other stakeholders identified during the VMC Secondary Plan process. The Notice of Study Commencement was also posted within the Vaughan Citizen, the City website, and TMIG's website. The Notice summarized the purpose and scope of the study, and invited comment. A copy of the Notice along with comments received and corresponding actions are summarized in **Appendix A1**.

3.1.1 Project Status Update

A Project Status Update was circulated on January 16, 2017 to the stakeholders identified during the Notice of Study Commencement. The notice was sent after a period of consultation and facilitation from 2013 to 2016 that was undertaken to resolve a number of land use planning issues affecting the study area (further described in **Section 3.2.2**). A copy of the Project Status Update is provided in **Appendix A2** for reference.

3.2 Stakeholder Consultation

3.2.1 Project Consultation

Following the Notice of Study Commencement, a number of meetings were held in 2012 and 2013 involving various departments within the City, the TRCA and many landowners in the study area, including:

- A meeting with the TRCA was held on October 30, 2012 to review alignment concepts for the Black Creek Renewal;
- A November 5, 2012 meeting where landowners in the study area were presented alignment concepts and a summary of the factors influencing the extent of the channel corridor;
- A channel design workshop was held with the TRCA on December 11, 2012 to refine alignment concepts; and
- A project progress update meeting was held with the TRCA on March 3, 2013.

Documentation for agency meetings and correspondence is provided in **Appendix A3**, while public meetings and correspondence is provided in **Appendix A4**. During the above set of meetings, a number of conflicting interests among the stakeholders were identified that could not be readily resolved and a decision was made to provide a more extensive stakeholder consultation and facilitation process outside of the EA, as described in **Section 3.2.2**.

Following the stakeholder consultation and facilitation process, and after the Project Status Update, a meeting was held with the TRCA and York Region on February 15, 2017 to provide an update on the project and discuss the alternative alignments and preferred design for the Black Creek Renewal.

3.2.2 VMC Consultation and Facilitation Process

As described in **Section 3.2.1**, conflicting interests among stakeholders over the size, alignment and configuration of the Black Creek Renewal and Edgeley Pond required a consultation and facilitation process outside of the EA. Between 2013 and 2014, directly affected landowners and agencies met to better understand key issues, opportunities and constraints of this project and the Edgeley Pond project.

With respect to the Black Creek Renewal, the consultation and facilitation process resulted in a land use framework to develop alternative alignments. As part of the process, preliminary hydraulic analyses were completed to establish key design elements such as the required channel size and general configuration of

the channel embankments and buffer areas, which were carried forward into the Black Creek Renewal EA. The urban design vision was also established for this area through this process, which is illustrated by the demonstration plan developed at the time (enclosed in **Appendix A5**).

Subsequent to the consultation and facilitation process, a financial strategy was developed by the City to establish a framework for funding a number of projects involving Black Creek in the VMC. The *Allocation of Funding Sources Report and Development Charges Background Study – Black Creek Financial Strategy* (fp&p and Hemson, 2016) was approved by City Council in June 2016.

3.2.3 Aboriginal Communities Consultation

Aboriginal communities were contacted by letter through each of the consultation stages of the EA, which included the Notice of Study Commencement, Project Status Update, Notice of Public Information Centre, and Notice of Study Completion. The full list of communities and a record of communication and responses are summarized in **Appendix A6**.

As part of the MECP's response to the Project Status Update (February 2017), the MECP provided a list of communities that were identified as potentially affected by the proposed project, which included the following:

- Alderville First Nation;
- Curve Lake First Nation;
- Hiawatha First Nation;
- Mississaugas of the New Credit First Nation; and
- Mississaugas of Scugog Island First Nation.

The above communities were contacted since the initial Notice of Commencement (July 2012) and included in subsequent stakeholder communications. Several communities expressed interest related to the archaeological potential of the project and will be engaged should there be any relevant findings result from the recommended Stage 2 Archeological Assessment.

3.3 Public Information Centre

The Public Information Centre (PIC) was held on May 10, 2017, from 6 p.m. to 8 p.m. The purpose of the PIC was to present the alternative designs, the evaluation methodology and the preferred design. The PIC was advertised in the local newspapers: *Vaughan Citizen* and *Thornhill/Richmond Hill Liberal* on April 27, 2017 and May 4, 2017. Notices were also distributed to all landowners/businesses in the study area. Letters were also sent to all stakeholders who replied to the Notice of Study Commencement and Project Status Update and indicated interest in the study. During the PIC, members of the public and agency representatives were invited to provide comments for consideration in the EA, which were documented and followed up with a response.

A total of 21 people were recorded on the sign-in sheet for the PIC, and six comment forms were completed and submitted. Copies of the notice, display materials and comment forms are included in **Appendix A7**. The key issues raised by the attendees are summarized in **Table 3-1**, along with the response from the project team.

Table 3-1 Key Issues Raised from PIC

Issues and Suggestions	Project Team Response
Concern for access to properties adjacent to Jane Street	The implementation of the renewed channel corridor will coincide with the redevelopment of the properties adjacent to Jane Street. In most cases, new local streets are proposed under the VMC Secondary Plan to provide access to these properties. In exceptional cases, review of the access will need to be conducted outside of this EA during development applications.
Concern for the amount of land available for development after the Black Creek Renewal	The alternative designs were developed recognizing the land constraints in the area. The footprint of the renewed channel corridor was minimized to the extent practical for the conveyance of flood flows, slope stability and integration with surrounding grades. Opportunities to refine the final grades and dimensions of the renewed channel corridor can be examined at detailed design in consultation with property owners.
The design of the urban park has significant potential to become a destination for recreational purposes and an appropriate level of effort and imagination is required.	The VMC Secondary Plan and other VMC planning guidelines have recognized the importance of Black Creek and surrounding park lands for recreation and enhancing the public realm of the area. Opportunities to create appropriately designed amenity space will be explored in detailed design, as long as the flood protection objectives and overall configuration of the corridor established by the Black Creek Renewal EA are maintained.

3.4 Notice of Study Completion and Report Review

The Notice of Study Completion was issued on August 9, 2018. The notice was published in the local newspapers: *Vaughan Citizen* and *Thornhill/Richmond Hill Liberal* on August 9, 2018. Copies of the notice were distributed to all homes and businesses in the study area. Notices were also mailed to all stakeholders who indicated interest throughout the study process. Copies of the ESR were made available at Vaughan City Hall and the Vaughan Public Library for a period of 30 calendar days following the notice.

To note, as of July 1, 2018, a Part II Order Request Form must be used to request a Part II Order. The Part II Order Request Form is available online on the Forms Repository website (<http://www.forms.ssb.gov.on.ca/>) by searching “Part II Order” or “012-2206E” (the form ID number).

Copies of the Draft ESR were sent to both the MECP and TRCA on November 15, 2017 for review. Comments were received from MECP on December 7, 2017 and from TRCA on January 23, 2018. The response letters to both MECP and TRCA, documenting how their comments have been addressed, are included in **Appendix A8**. A copy of the Notice of Completion is included in **Appendix A9**.

4 EXISTING ENVIRONMENTS

4.1 Planning Environment

4.1.1 Existing Land Use

As described in the VMC Secondary Plan, the VMC is embedded in the heart of a major regional industrial area located within a multi-modal transportation network. The lands within the study area east of Jane are predominantly made up of small, individually owned properties with low-scale manufacturing and industrial service uses. Land uses immediately adjacent the existing Black Creek channel also include an office building, two retail plazas, an arena and a two banquet halls.

4.1.2 Provincial Policy Statement

The Provincial Policy Statement (PPS) (April 2014) provides broad land use planning and development policy direction, particularly as it relates to matters of provincial interest including but not limited to the natural environment and natural hazards. The Natural Hazard policies (Section 3.1 of the PPS) generally prohibit development in areas at risk of flooding from riverine systems as well as areas that cannot be safely accessed due to excessive flood depths and velocities during severe storm events. The PPS contains some exemptions to these policies, such as designated Special Policy Areas and flood fringe areas where separate policies apply. At this time, the Study Area is not designated as a Special Policy Area nor managed as a two-zone area where new development in the flood fringe could be permitted. Therefore, within the study area, re-development in areas east of Jane Street are restricted due to the current flooding issues and extent of the floodplain (see **Section 4.4.4**).

The PPS also includes policies to protect and preserve employment areas, particularly in proximity to major transportation corridors (Section 1.3 of the PPS), and policies generally promoting intensification and redevelopment in existing built-up area (Section 1.1 of the PPS).

4.1.3 Growth Plan for the Greater Golden Horseshoe

The Growth Plan for the Greater Golden Horseshoe (GPGGH) (May 2017) is another provincial policy document intended to guide future growth in the area. The latest GPGGH took effect on July 1, 2017 and is generally intended to direct future population and employment growth to existing urban areas. The plan identifies the VMC as an Urban Growth Centre. Given the location of Black Creek within the VMC, the renewal of the corridor has a significant role in achieving the population and employment growth targets for the City and York Region set out in the GPGGH.

The GPGGH also outlines policies for infrastructure to support growth, which includes policies around stormwater management, water resources systems and natural heritage systems. The Black Creek Renewal is a major green infrastructure need in the VMC to support this Urban Growth Centre and adheres to GPGGH policies to manage water quantity and enhance the natural heritage system.

4.1.4 York Region Official Plan

The York Region Official Plan is intended to guide growth at the regional scale and provide planning direction to local municipalities including the City of Vaughan. The Region's Official Plan was adopted in 2010 and was consolidated in April 2016 with all OMB decisions and amendments since adoption.

The Black Creek Renewal EA study area is designated 'Urban' in the Region's Official Plan, and the various maps included do not show any wetlands, woodlands, greenlands, or other significant natural features within the study area. Portions of the study area are designated 'Highly Vulnerable Aquifers' on Map 14 of the Region's Official Plan, though it is not close to any wellhead protection areas or significant groundwater recharge areas. The policies pertaining to Highly Vulnerable Aquifers in the Region's Official Plan (Section

2.3 of the Official Plan) state that ‘An application for major development within highly vulnerable aquifers (as shown on Map 14) involving the manufacturing, handling and/or storage of bulk fuel or chemicals (activities prescribed under the Clean Water Act), shall be accompanied by a Contaminant Management Plan, as deemed necessary by the local municipality’.

4.1.5 City of Vaughan Official Plan

The City of Vaughan Official Plan (VOP) 2010 is a legal document approved by the City and York Region, which describes policies and objectives for future land use. It reflects a community vision for future change and development. The latest update of the VOP 2010 City Official Plan was completed and adopted by City Council on September 7, 2010, approved by the Ontario Municipal Board on July 23, 2013, and has subsequently been amended. The VOP 2010 and 2013 provides the basis for completion of Secondary Plans throughout the City.

The VOP provides guidance for the physical development of the municipality to the year 2031 while taking into consideration important social, economic, and environmental issues and objectives. The VOP also provides a policy framework that will guide where new development can locate, how existing and future neighbourhoods will be strengthened, how the City’s environment will be enhanced, what municipal services will be provided, and when and where to grow.

The VOP was developed with an extensive program of public consultation, under the banner of Vaughan Tomorrow, to establish the framework through which provincial, regional, and municipal planning objectives could be achieved, with particular emphasis on sustainable growth. Planning policies for the area that encompasses the study area were also considered within the VMC Secondary Plan.

4.1.6 Vaughan Metropolitan Centre Secondary Plan

The VMC Secondary Plan (**Figure 4-1**) was adopted by Vaughan Council on September 7, 2010, but was modified and later approved by Vaughan Council on December 11, 2012. It was subsequently appealed to the Ontario Municipal Board (OMB) before it was partially approved by the Ontario Municipal Board (OMB) on November 18, 2015, November 18, 2016, January 23, 2017 and June 12, 2017. The objectives of the VMC Secondary Plan are to expand upon the objectives of the City’s Official Plan and the Province’s Places to Grow framework.

The VMC Secondary Plan established a vision for the VMC that includes a distinct downtown containing a mix of uses, civic attractions, and a critical mass of people. The VMC Secondary Plan envisions complete neighbourhoods containing a variety of housing types, a variety of employment uses, and a major institution of higher learning. In addition, in accordance with the overall objectives of the Places to Grow framework, the plan is optimized to complement existing and planned investments in rapid transit, including the Spadina Subway extension to its terminus at the planned Vaughan Metropolitan Centre Station, and the Region’s Highway 7 Bus Rapid Transit system.

Key principles of the VMC Secondary Plan include a hierarchical fine-grain grid network of streets and pathways, a robust and remarkable open space system, improved natural systems and functions, and the incorporation of green infrastructure and green building technologies. The Black Creek Renewal and mitigation of existing flooding problems through the study area is critical for redevelopment within the southeast quadrant of the VMC Secondary Plan area. The development and evaluation of alternative designs considers the road networks, land use designations, and population projections established through the VMC Secondary Plan process.

The VMC Secondary Plan also has specific policies for Open Space. The policies are aimed to create naturalized open spaces that function to protect, enhance and create natural heritage features and functions, accommodate stormwater management, accommodate recreation amenities, create physical connections within the VMC, increase biodiversity, and reduce the urban heat island effect. The Black Creek Renewal EA has incorporated policies for the Black Creek Corridor with respect to buffers and parks.

Figure 4-1 VMC Secondary Plan Long-term Vision



Vaughan Metropolitan Centre Secondary Plan – Appendix D (September 2012)

4.1.7 Green Directions Vaughan

Green Directions Vaughan is the City's Community Sustainability and Environmental Master Plan (CSEMP). It influences nearly all aspects of the City's operational and regulatory activities, including the growth management strategy. The plan establishes the principles of sustainability with respect to environment, vibrant communities, and a strong economy. These principles were considered in the review and selection of alternatives for the renewal of the Black Creek corridor.

4.1.8 Toronto and Region Conservation Authority

The Toronto and Region Conservation Authority (TRCA) regulates works within and adjacent rivers and streams, wetlands, and shorelines under Ontario Regulation 166/06 (Development, Interference with Wetlands and Alterations to Shorelines and Watercourses). More broadly, the TRCA has also produced the Living City Policies for Planning and Development (2014) that outlines the principles, goals, objectives and policies approved by the TRCA for the development process.

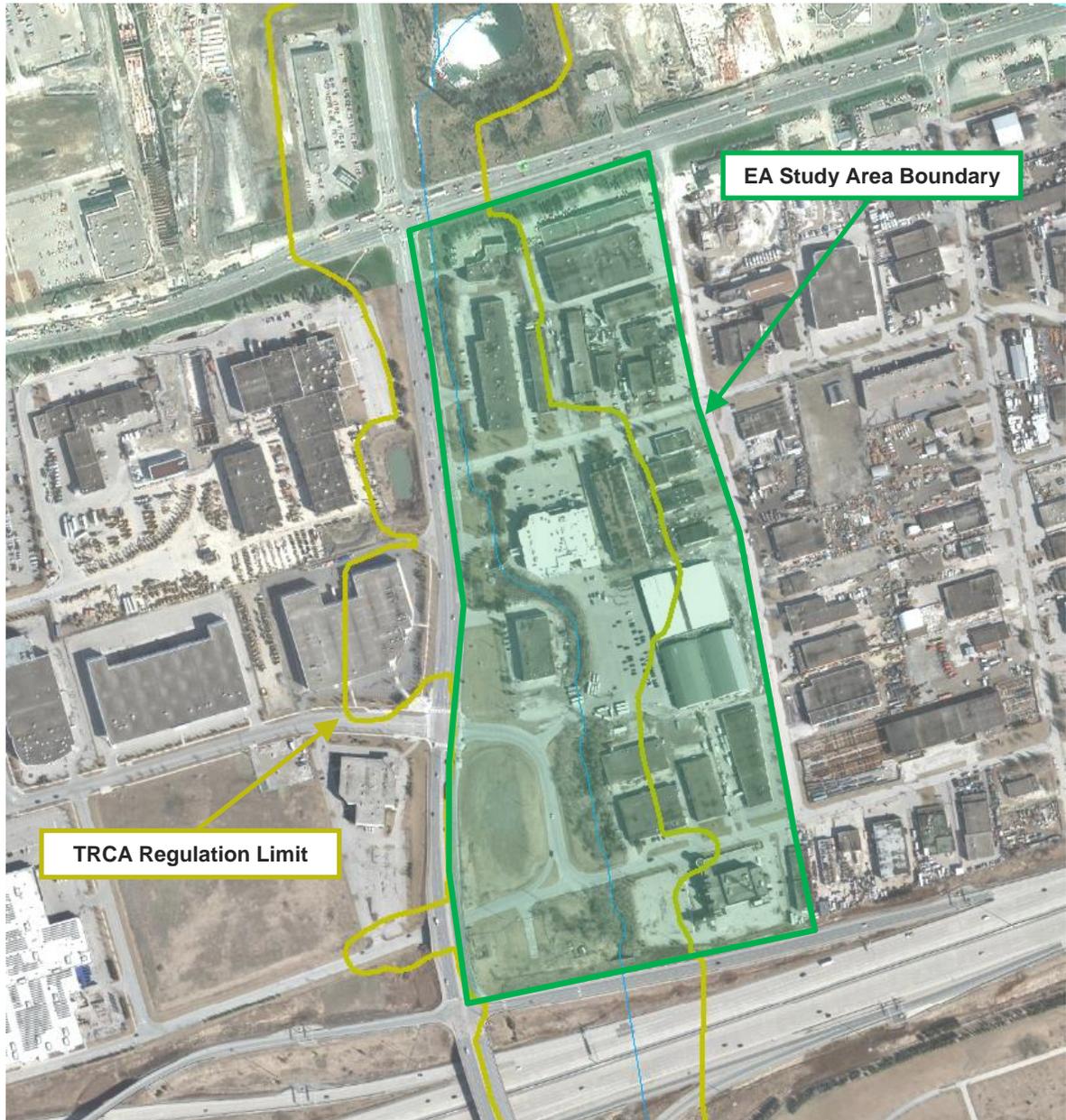
The Regulation Limit extends 15 m beyond the Regulatory flood plain or top of bank associated with defined watercourses such as Black Creek. An excerpt of the TRCA's Regulation limit mapping is presented in **Figure 4-2**. The Regulatory Flood is not confined to the Black Creek Channel. As a result, the TRCA Regulation Limit covers a considerable portion of the study area.

4.1.9 Source Water Protection

Portions of the study area are considered 'Highly Vulnerable Aquifers', though the study area is a considerable distance removed from any wellhead protection areas or significant recharge areas. Highly Vulnerable Aquifers (HVA) are defined in the CTC (Credit Valley-Toronto and Region-Central Lake Ontario Conservation Authorities) Source Protection Plan (CTC, 2015) as areas where there is some potential for groundwater contamination due to proximity to the ground surface and/or permeability of the soil between

the ground surface and local water table. CTC Source Protection Plan policies pertaining to HVA are related to the storage, handling and application of road salt and the handling and storage of potentially hazardous substances. These policies have been incorporated into the Region’s Official Plan, as described in **Section 4.1.4.**

Figure 4-2 TRCA Regulation Limit and Study Area



Regulation Limit obtain from TRCA mapping accessed through Conservation Ontario online mapping (accessed March 2017)

4.2 Natural Environment

4.2.1 Physiography and Topography

The VMC Black Creek Renewal study area is located within the South Slope physiographic region of the Humber River Watershed. The direction of flow within the Humber River Watershed is from the Oak Ridges Moraine in the north towards Lake Ontario in the south (TRCA, 2008).

Locally, the land generally falls eastward from Jane Street to Black Creek, and westward from just west of the CNR MacMillan Yard to Black Creek. Black Creek falls at an average slope of approximately 0.5% from the outlet of the Edgeley Pond to the inlet to the culvert under Highway 407. However, slopes vary significantly along this reach of Black Creek, with a significant drop located north of Peelar Road.

4.2.2 Soils and Groundwater

The soils within the subject site are predominantly clay soils (Chinguacousy Clay Loam) with relatively poor drainage, according to the soil map of York County and the Humber River Watershed Hydrology Update (Civica, 2015). These soils are considered to be Type C/D under the SCS hydrologic soil group classification and provide limited infiltration capacity.

Based on the geotechnical investigations completed in support of the VMC Municipal Servicing Master Plan (Alston Associates Inc., 2012), topsoil and fill in the area around Peelar Road, east of Jane Street, is underlain by a layer of silty clay soils. The native soils are of low permeability and result in the potential for a perched water table at shallow depth; however, boreholes within this EA's study area were dry for depths up to 8 m below ground surface and groundwater conditions inferred (through saturation of soil) at other borehole locations in the VMC indicate levels of about 3 m to 4 m below ground surface.

4.2.3 Fluvial Geomorphic Conditions

A fluvial geomorphological and erosion assessment was completed for the BCSWOS. The reach of Black Creek in the current study area was characterized as an engineered trapezoidal channel that has experienced significant realignment to accommodate development. Bankfull width and depths are approximately 3 m and 0.7 m, respectively, and the channel bed has accumulated fine sediment from road runoff and organic muck.

The rapid geomorphic assessment (RGA) and rapid stream assessment technique (RSAT) results for the current study area reach indicated the channel is in adjustment and in poor condition, respectively. Three locations of erosion were noted along this channel reach. Observations at two of these locations included collapsed banks and a collapsed gabion retaining wall due to down-cutting in the channel. The third erosion site was an old road crossing that was previously overtopped and breached by floods, which resulted in a partial blockage in the channel.

4.2.4 Fisheries and Aquatic Habitat

The existing conditions for fisheries and aquatic habitat were assessed by PECG in the fall of 2016. A review of background information was completed along with a field investigation to document habitat features. The natural environment report by PECG is found in **Appendix B**.

The Black Creek subwatershed is classified as a small to intermediate riverine warmwater habitat of first, second and third order streams. It is adversely affected by urbanization and more degraded than other subwatersheds within the Humber River watershed. Previous studies had concluded that the subwatershed is unable to support coldwater fish species. Fish sampling in previous studies found blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atroomaculatus*) and white sucker (*Catostomus commersonii*), all of which are commonly found in Ontario and secure in status.

The existing fish habitat within the study area is generally of low quality, limited in size and with poor connectivity. Typical conditions in the creek include substrate ranging from sand and silt to cobbles and

boulders, riparian deciduous tree cover in some portions of the study reach, failed channel stabilization works, debris dams and garbage in the channel, and other barriers to fish habitat connectivity.

4.2.5 Wildlife and Terrestrial Habitat

No wildlife was observed in the study area during field surveys with the exception of Grey Squirrel (*Sciurus carolinensis*), and no nests were located in any culverts. Wildlife habitat opportunities within the study area are restricted to urban-adapted species of open or edge habitats. Some areas may support limited frog habitat, though no frogs were observed during field surveys.

Black Creek through the study area is limited to a thin band of riparian habitat along its length due to the surrounding urban development. The majority of the creek riparian area is representative of ditch habitat and dominated by common and/or weedy herbaceous vegetation (cultural meadow). Narrow forested slope and floodplain habitat is also present within the study reach. In-stream wetland vegetation is limited and, when present, is confined to sparse, isolated occurrences along the channel banks. Away from the channel, vegetation consists of disturbed cultural meadow and roadside ditch surrounded by commercial and industrial area. Of note, road noise and garbage were observed to be severe throughout the study area.

A total of five vegetation communities were identified in the study area, including: Cultural Meadow (CUM1-1), Cultural Thicket (CUT1), Mineral Cattail Shallow Marsh (MAS2-1), Fresh-Moist Lowland Deciduous Forest (FOD7), and Fresh-Moist Willow Lowland Deciduous Forest (FOD7-3).

4.2.6 Species at Risk

A Species at Risk (SAR) screening was completed to determine the potential presence of species listed as Endangered or Threatened under the Ontario *Endangered Species Act* (ESA) (2007). These species are afforded protection from harm or destruction under the ESA. Correspondence with the Ministry of Natural Resources and Forestry (MNR) (completed on November 15, 2016) and a background review identified the potential for occurrences for Barn Swallow (*Hirundo rustica*, listed as Threatened) and Butternut (*Juglans cinerea*, listed as Endangered) within the study area. The field survey searched for these species or suitable habitat and did not find their presence, including nests or foraging / flight activity for Barn Swallows. No other flora or fauna SAR was observed during field surveys; however, the presence of snag trees may indicate potential habitat for threatened and endangered bat species. Correspondence with MNR is found in **Appendix B**.

4.2.7 Significant Natural and Environmentally Sensitive Areas

No Provincially Significant Wetlands, Areas of Natural and Scientific Interest, Environmentally Significant / Sensitive Areas, or other provincially designated environmental features are present within the study area.

4.3 Cultural Environment

4.3.1 Archaeology

The Black Creek Renewal EA study area lies within a region that was first inhabited about 15,000 years ago, following the last ice age. The Hamlet of Edgeley was the first Euro-Canadian settlement, established ca. 1800 at the intersection of Highway 7 and Jane Street at the northwest portion of the study area. Several historic homesteads and a post office were depicted on atlases and maps from the 1860 and 1878. Land use through the study area remained agricultural until the late 1960's when the lands were developed for commercial and industrial uses.

The majority of the study area has been previously disturbed for construction of the commercial and industrial sites, roads, rail lines and other infrastructure. The past construction would have resulted in severe damage to the integrity of any archaeological resources which may have been present, and therefore no further archaeological investigations are warranted for these disturbed areas. However, the study area

has archaeological potential due to its proximity to water (i.e. Black Creek) and the presence of known archaeological sites in and surrounding the study area.

A total of nine archaeological sites have been registered within one kilometre of the study area with five of those sites located within 300 metres of the study area. The presence of these sites indicates elevated archaeological potential within portions of the study area. A Stage 2 Archaeological Assessment (i.e., shovel test pit archaeological survey) is recommended for all areas which contain archaeological potential prior to construction activities.

The Archaeological Assessment study report is included as **Appendix C**.

4.3.2 Cultural Heritage

The City of Vaughan's Heritage Inventory includes all properties that are (i) individually designated under Part IV of the Ontario Heritage Act; (ii) within a Heritage Conservation District; (iii) in the Register of Property of Cultural Heritage Value; (iv) identified as Cultural Heritage Landscapes; and (v) other properties of interest to the City's Cultural Services Division. A search of the Heritage Inventory did not reveal any heritage buildings or features within the study area.

However, there are some heritage features located in close proximity to the study area. There are a number of heritage buildings and pioneer cemetery in the Black Creek valley near the intersection of Jane Street and Steeles Avenue, associated with the historic Dalziel homestead and sawmill on Black Creek. A pioneer cemetery and heritage building associated with the historic Edgeley settlement is located on the east side of Jane Street, north of Portage Parkway. Neither of these heritage sites are expected to be impacted by the Black Creek Renewal.

A checklist for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes (Ministry of Tourism, Culture and Sport) was also completed and included in **Appendix D**. The checklist did not identify any known or recognized culvert heritage value within the study area. The potential for cultural heritage resources was also not identified, with the exception of the study area's location within the Humber River watershed, which is designated a Canadian Heritage River watershed. However, as identified above, there are no heritage features located within the study area.

Buildings in the study area currently consist of commercial and industrial buildings constructed after approximately 1970. Land in the study area is owned by a mix of private and public owners (the City, Region and Province of Ontario). **Figure 4-3** outlines the current mix of land ownership in the study area.

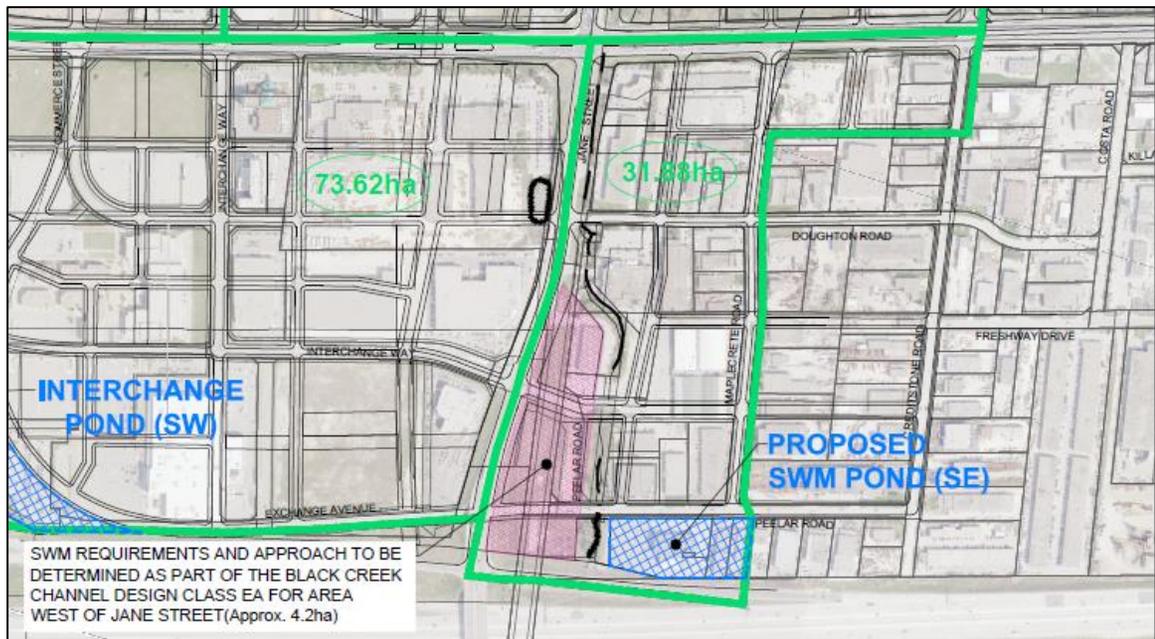
4.4 Engineering Environment

4.4.1 Storm Drainage Infrastructure and Black Creek

The VMC Servicing Strategy Master Plan Class EA completed in 2012 examined the existing storm drainage in the VMC area. For drainage to Black Creek, the EA noted that developed parcels within the VMC are serviced via a dual drainage system designed based on the City's prevailing design criteria. Storm sewers were designed to capture and convey runoff from a 5-year return period event while overland flow routes (primarily roads) provide overland flow conveyance for excess runoff generated by larger return period events.

The major existing stormwater facility affecting Black Creek in the EA study area is the Edgeley SWM pond immediately north of Highway 7 that provides peak flow control for Black Creek north of Highway 7. Other stormwater contributions to Black Creek include the SWM pond south west of Jane Street and Doughton Road, which outlets into Black Creek. The channel is also the outlet for storm runoff generated by the surrounding area, through storm sewer outlets at Doughton Road, Peelar Road and overland flow to the channel.

Figure 4-3 VMC Southeast Quadrant Drainage Area



Adapted from VMC Municipal Servicing Master Plan, Figure 1-1 (TMIG, 2012)

Figure 4-3 provides an overview of the drainage area for the VMC southeast quadrant, which encompasses the Black Creek Renewal study area. There are no apparent SWM controls for the existing development in the study area. However, the VMC Master Servicing EA, completed in 2012, recommends a number of SWM controls for new development within the southeast quadrant of the VMC where the study area is located:

- On-site control for each development and redevelopment block where the peak release rate is controlled to the 2-year post development flow rate, based on an 80% level of imperviousness, with the 100-year less the 2-year excess runoff stored on-site.
- On-site retention of 15 mm over the building footprint, and an additional 15 mm on-site retention over landscaped areas. The capture of rainfall events is to be achieved through the implementation of Low Impact Development practices (LIDs).
- Remaining runoff from development blocks, ROWs, and other uncontrolled areas are to be directed via a dual-drainage storm network to end-of-pipe stormwater management facilities, which discharge to Black Creek. In the case of the VMC southeast quadrant, a new end-of-pipe facility was proposed, to be located east of Jane Street and the Black Creek main branch, north of Highway 407 and south of Peelar Road.

The proposed SWM strategy for the southeast quadrant of the VMC was updated in 2017 with a revised set of recommendations due to the considerable challenges, time and expense to expropriate properties for construction of an end-of-pipe facility and associated conveyance system for the VMC southeast quadrant. It is expected that the majority of the VMC southeast quadrant would be developed with varying forms of interim controls before the end-of-pipe facility and conveyance systems could be implemented.

Rather than managing storm runoff by means of a number of long-term but interim measures, an ‘Alternative SWM Strategy’ was developed to manage stormwater without the need to acquire private lands for a centralized end-of-pipe facility and associated conveyance system. Without an end-of-pipe facility, SWM controls are focused on individual developments and ROWs, which can be implemented sooner on a site by site basis as the VMC southeast quadrant is re-developed. Details regarding the implementation challenges

for the Master Servicing Plan SWM Strategy and the proposed Alternative SWM Strategy are described in **Appendix E – SWM Strategy for VMC Southeast Quadrant**. A summary of the Alternative SWM Strategy is as follows:

- On-site control for each development and redevelopment block where the peak release rate is controlled to the 2-year post development flow rate, based on an 80% level of imperviousness, with the 100-year less the 2-year excess runoff stored on-site. This is consistent with the Master Plan SWM Strategy. An additional provision to provide water quality treatment to Enhanced protection (80% long-term TSS removal) is proposed, to be achieved through oil/grit separators, filtration systems, grassed swales, and/or combinations of multiple types of SWM controls.
- The Master Plan's end-of-pipe facility in the southeast quadrant of the VMC is not included in the Alternative SWM Strategy. The removal of the end-of-pipe facility is partially compensated by an increase in the recommended right-of-way retention controls, recognizing that these controls will not meet peak flow rate reduction targets for greenfield development sites (Humber River unit flow rates), but a reduction in peak flow rates compared to existing conditions is expected. The recommended on-site retention in the Alternative SWM Strategy is as follows:
 - On-site retention of 15 mm over entire development blocks, including building footprint, landscaped areas and driveways. This is an increase in the requirement for on-site retention over the Master Plan by including all areas of development blocks, instead of only the building footprint and landscaped areas. The capture of rainfall events to be achieved through the implementation of LID measures.
 - 15 mm retention over ROWs through the implementation of LID measures. Runoff retention in rights-of-way was not a recommendation in the Master Plan.

4.4.2 Channel and Culvert Characteristics

The existing Black Creek channel through the study area has historically been highly altered to accommodate previous development surrounding the channel. The channel has experienced significant realignment and change in the valley form to become an engineered trapezoidal channel for most of the reach. The channel also has reinforced valley embankments (retaining walls and gabion baskets), of which, some have been outflanked or collapsed.

The channel through the study area also has a large number of crossings for intersecting roads and access to properties adjacent to the channel. Including the Highway 7 and Highway 407 culverts that bound the northern and southern extent of the study area, Black Creek currently has a total of eight road and driveway culvert crossings and one abandoned crossing. These crossings range in size and capacity but overall, these structures do not have enough hydraulic capacity to convey major rainfall event flow which contributes to flooding in the area. **Appendix F** includes a description and photo of each existing channel crossing in the study area.

4.4.3 Watershed Hydrology

Accurately modelled flow rates in Black Creek are a major component for understanding the primary causes of flooding in the system and for evaluating the effectiveness of the new channel corridor design in reducing flooding. Two hydrologic models of Black Creek (as components of Humber River watershed models) have been used in recent studies and were available for the Black Creek Renewal. These models were reviewed to determine their appropriateness for the preliminary design of the new channel corridor.

Hydrology for BCSWOS was based on the SWMHYMO model for the Humber River watershed, prepared in 2002 by the TRCA. A significant refinement of the 2002 Humber River watershed model was completed for the BCSWOS to include stormwater management ponds and on-site quantity controls in the sub-catchments and future land use (AECOM, 2012).

Since the completion of the BCSWOS in 2012, the TRCA has updated the Humber River watershed model using Visual OTTHYMO 4.0 (VO4). The 2015 model update was intended to reflect land use changes since

the previous model update and has become the current model in use by the TRCA for the Humber River watershed, hence its application in the Black Creek Renewal.

Existing and future conditions models were set up in the 2015 Humber River watershed model. The peak flow rates in Black Creek are reduced in future conditions, compared to existing conditions, due to better water quantity controls and on-site runoff reduction for future development in the watershed (**Table 4-1**).

The analyses of alternative designs and preliminary design for the renewal of Black Creek through the study area are based peak flow rates from the 2015 Humber River watershed model, in Black Creek at Highway 407. The peak flow rates from the existing conditions model were used for the 2-year to 100-year Storm Events while the peak flow rate from the future conditions model was used for the Regional Storm Event, representing the highest modelled peak flow rates for each respective storm, as a conservative measure.

Table 4-1 2015 Humber River Watershed Model Output for Black Creek

Storm Event	Peak Flow (m ³ /s)			
	Outlet of Edgeley Pond (783 ha) [NHYD 4015 / NHYD 7723]		Black Creek at Highway 407 (889 ha) [NHYD 1514]	
	Existing	Future	Existing	Future
2 Year	5.7	6.8	8.7	7.9
5 Year	9.2	10.7	13.5	11.2
10 Year	15.7	15.1	17.1	15.9
25 Year	22.7	21.6	24.7	22.5
50 Year	27.4	26.4	30.1	27.5
100 Year	32.3	31.4	35.7	32.5
Regional	81.5 ⁽¹⁾	83.6 ⁽¹⁾	91.7	94.8

(1) Regional peak flow obtained from NHYD 2297 located at Highway 7 in the absence of a pond in Regional Storm hydrologic modelling.

4.4.4 Channel Hydraulics

Hydraulic modeling for the study area was most recently updated during the 2012 BCWSOS. It built upon the TRCA’s HEC-RAS hydraulic model and floodplain mapping for Black Creek with a few updates. This included refinements in valley geometry based on a detailed topographic survey of the channel and overbank areas, revised culvert dimensions based on field measurements and observations, and flow data from the updated SWMHYMO hydrology model.

The updated hydraulic model was used to calculate the depth of flooding associated with the different storm events, and the results were plotted on the updated topographic mapping to determine the extent of flooding. The BCWSOS found that the reach of Black Creek between Highway 407 and Highway 7 was particularly prone to flooding. The most constrained sections of this reach can only convey the peak flow from a 5-year return period storm event. The BCSWOS updated hydraulic model also revealed that the existing culvert under Highway 407 causes a significant backwater during severe storm events, contributing to flooding of properties and roads through the upstream reach. **Table 4-2** summarizes the flow capacity of the existing culvert crossings from the BCSWOS. The existing floodplain conditions for the Regional Storm Event are shown on **Figure 4-2**.

Table 4-2 BCSWOS Black Creek HEC-RAS Hydraulic Model Culvert Crossings

Crossing Location	Culvert Properties	Full Flow Capacity	Capacity before Overtopping
Highway 7	3.7 m wide x 1.5 m high concrete box	> 2 Year	25 Year
Private Driveway (7717 Jane Street)	3.8 m wide x 1.5 m high concrete box	> 2 Year	10 Year
Private Driveway (7695 Jane Street)	3.2 m wide x 2.1 m high CSP arch	> 2 Year	5 Year
Doughton Road	3.5 m wide x 2.3 m high CSP arch	2 Year	5 Year
Private Driveway (Paradise Banquet Hall) (7601 Jane Street)	3.2 m wide x 2.1 m high CSP arch	2 Year	25 Year
Private Driveway (Vaughan Iceplex) (7551 Jane Street)	3.2 m wide x 2.1 m high CSP arch	2 Year	50 Year
Peelar Road	3.6 m wide x 2.4 m high concrete box	25 Year	100 Year
Highway 407	6.0 m wide x 4.3 m high concrete box	August 2005 Storm	Regional

From the Black Creek Storm Water Optimization Study Class EA (AECOM, 2012)

4.4.5 Utilities

All relevant utility owners that could potentially have existing or planned infrastructure in the study area were circulated information on the project in June 2016. Correspondence with utilities is provided in **Appendix G**. Information on existing and planned utilities was obtained from the following organizations:

- Rogers Communications
- Bell Canada
- Power Stream
- Enbridge
- TransCanada Pipelines
- Telus
- Cogeco
- MTS Allstream
- Hydro One

In addition, municipal servicing in the study area was described in the VMC Municipal Servicing Master Plan Class EA, completed in 2012. The municipal and private utilities relevant to the study area are shown on **Figure 4-3** and described as follows:

- Above ground power line (and poles) are located east of Jane Street, aligned in a north/south orientation within the study area;
- A buried natural gas line (NPS 12) is east of Jane Street in a north/south orientation from Doughton Road to Highway 407. Buried natural gas lines (NPS 4) are also located along on Doughton Road and Peelar Road, connecting to the larger Jane Street natural gas line;

- The Jane Street sanitary trunk sewer system lies within the study area where there is a 900 mm sanitary trunk sewer line east of Jane Street between Doughton Road and Peelar Road and connections to 300 mm sanitary sewers along Doughton Road and Peelar Road;
- The water distribution system is also present within the study area with a 300 mm watermain located east of Jane Street, running north/south, with connections to Doughton Road and future Interchange Way (going west). There is also a 150 mm watermain along Peelar Road that is connected to the Jane Street watermain;
- Communications infrastructure in the study area consist of buried or aerial lines along Highway 7, parts of Jane Street and Doughton Road; and
- Existing stormwater infrastructure as described in **Section 4.4.1**.

5 ALTERNATIVE ALIGNMENTS

5.1 Overview

The BCSWOS recommended constructing a new channel corridor for Black Creek through the study area that can convey the Regional Storm Event as the preferred solution to fully address flooding (i.e., provide flood protection for rainfall events up to and including the Regional Storm). A summary of the evaluation from the BCSWOS for flood improvements in Black Creek is as follows:

- Technical Environment – A high potential for improving public safety as the proposed works will provide flood protection. Required maintenance will be low; however, infrastructure requirements for implementing the solution are significant.
- Natural Environment – An overall net benefit to terrestrial and aquatic environment would be achieved with low potential for effects on environmentally significant landforms/features. There are no known Species of Concern within the study area and no potential effects on baseflow and/or groundwater resources. There is a high potential for short term construction related effects on the natural environment but will be mitigated through the use of appropriate erosion and sediment controls and other Best Management Practices.
- Social Environment – Low potential for damage to private property from flooding after the implementation of the proposed works and high potential to integrate the new channel corridor into VMC development. There is a high potential to disturb existing land owners, businesses, and community and recreation facilities during construction and high potential for land acquisition.
- Cultural Environment – No likely effects from archaeological and cultural/heritage resources.
- Financial Environment – High costs associated with property acquisition and implementation of the new channel corridor. Moderate annual maintenance costs will be required.

With the preferred solution established, the alternatives for this EA focused on the potential alignment configurations for the Black Creek Renewal. Alignment concept plans were developed to illustrate the configurations and complete the alternatives evaluation. The following sections outline the alternative alignments.

5.2 Alternative #1 – Do Nothing

The 'Do Nothing' alternative is always considered in the environmental assessment process. There may be situations where all feasible alternatives will cause unacceptable impacts to the natural, social and/or cultural environments, or are prohibitively expensive. In such instances, the Do Nothing alternative may be preferred. With respect to the Black Creek Renewal EA, the evaluation of the Do Nothing alternative was presented in the BCSWOS and results from that study are re-iterated in this EA.

5.3 Alternative #2 – New Valley over Existing Alignment

The Alternative #2 alignment plan and profile is shown on **Figure 5-1**. This alignment alternative generally follows the alignment of the existing creek valley, which runs adjacent to Jane Street from Highway 7 to Doughton Road and meanders east before the future Interchange Way crossing and continues straight in a southerly direction to the existing Highway 407 crossing. While the proposed and existing alignments are similar, the new channel corridor is wider than the existing corridor to accommodate the Regional Storm Event flow rate and thus the footprint of the new channel corridor is significantly larger than the existing corridor.

5.3.1.1 Flood Protection

The BCSWOS established the preferred solution to construct a new channel corridor for the conveyance of the Regional Storm Event to provide flood protection, thus the alignment alternatives must satisfy this key technical performance criterion to be considered as an alternative. Alternative #2 was assessed hydraulically using HEC-RAS for the conveyance of the 2-year to 100-year storm events and Regional Storm Event. A summary of modelling methodology and parameters is provided in **Appendix H**. The valley width and depth was sized to accommodate the Regional Storm Event peak flow with a minimum of 0.3 m freeboard, thus this alignment alternative will satisfy the key objective of providing flood protection.

5.3.1.2 Configuration of New Channel Corridor

The cross section configuration for Alternative #2 includes a consistent low flow channel, valley floor and embankment slope grading. These parameters, in combination with the existing ground elevation, determined the overall width of the valley corridor for Alternative #2. The general specifications are summarized below:

- Low flow channel – The proposed low flow channel has a top width of 6 m and depth of 0.6 m to roughly accommodate the current 2-year storm peak flow rate. The dimensions may be refined during detailed design based on the proposed retrofit of the Edgeley Pond north of Highway 7 (currently undergoing study).
- Valley Floor Width – The proposed valley floor width is at least 15 m, established during the BCSWOS for the conveyance of the Regional Storm Event. This is smaller than the estimated meander belt width of 60 m for a natural watercourse with a similar flow regime, determined during the BCSWOS, recognizing that a bottom valley width of 60 m is not feasible within the study area and the existing channel is already a confined system from historical alterations.
- Valley Embankment – Alternative #2 includes a naturalized valley embankment (at a minimum of 3:1 side slope) for the west embankment for the entire length of the new channel corridor. The east embankment from Highway 7 to future Interchange Way is assumed to be an urban park feature (terraced slope with a minimum 2:1 side slope), based on the stakeholder consultation and facilitation process completed in 2014 outside of this EA (described in **Section 3.2.2**). The west embankment from future Interchange Way to Highway 407 is a naturalized valley embankment similar to the west embankment. The configuration of the valley embankment slopes represents a general valley corridor configuration for the purposes of this EA. The final valley design will be completed during detailed design and may incorporate urban design elements outside of the scope of this EA (while maintaining the flood conveyance capacity determined in this EA).
- Buffer – At the top of each valley embankment is a 10 m buffer, which provides the transition to the land surrounding the valley. The buffer located adjacent to the terraced slope feature is marked an urban buffer, with urban park features. All other buffer areas are assumed to have a naturalized design.
- The total valley corridor width, including buffers, ranges from about 50 m at the upstream section between Highway 7 and Doughton Road to 75 m at the future Interchange Way.
- The depth of the valley (from the channel invert to the minimum top of the buffer) varies from approximately 3.7 m, upstream of Doughton Road, to 7.0 m, downstream of future Interchange Way.
- The total length of the valley between the existing Highway 7 culvert (downstream end) and the existing Highway 407 culvert (upstream end) is 790 m.

5.3.1.3 Hydraulic Structures and Crossings

The hydraulic structures for Alternative #2 include the Highway 7 and Highway 407 crossings, which form the upstream and downstream extents of the new channel corridor. In the proposed condition, it is assumed that the existing Highway 7 culvert invert will remain, while it is understood that the future configuration of the culvert and the southeast corner of the intersection between Highway 7 and Jane Street will be determined outside of this EA. The Highway 407 crossing will remain as it currently exists. All other existing hydraulic structures and crossings will be removed in the proposed alternative.

Between Highway 7 and Highway 407, new road crossings are proposed for Doughton Road, future Interchange Way, and Peelar Road as defined in the VMC Secondary Plan. The existing culverts at Doughton Road and Peelar Road will be replaced, while the future Interchange Way is a new crossing. The size of the culverts at the crossings were determined through hydraulic analysis, according to minimum required design flows. For the future Interchange Way, the minimum required design flow was the Regional Storm Event because it is classified as a major collector road under the VMC Secondary Plan, and would provide the primary access across Black Creek between Highway 7 and Highway 407 in the event of a Regional Storm Event.

Doughton Road and Peelar Road are considered minor collector roads in the VMC Secondary Plan and had a minimum required design flow of the 100-year storm. Note that these design flows are greater than the minimum specified under the Ontario Ministry of Transportation (MTO) Drainage Design Standards (MTO, 2008). However, Doughton Road and Peelar Road were specifically set to convey the 100-year storm event because site constraints at those crossings may prevent full conveyance of the Regional Storm Event. In particular, with respect to Peelar Road, the backwater from the Highway 407 culvert influences water levels beyond (upstream of) the Peelar Road crossing. For Doughton Road, the crossing must be at an elevation low enough to facilitate the overland flow route from the Jane Street ROW to the new channel corridor. Backwater effects from these crossings (which convey less than Regional Storm Event peak flow) were taken into consideration for sizing the width of the new channel corridor to conservatively account for these potential site constraints.

Table 5-1 summarizes the configuration of the proposed crossings.

Table 5-1 Proposed Crossings in New Channel Corridor

Crossing Location ⁽¹⁾⁽²⁾	Culvert Properties	Culvert Length ⁽³⁾	Invert Elevation	Minimum Required Design Flow
Doughton Road	12.8 m wide x 3.0 m high Conspan arch	26 m ⁽²⁾	195.45 masl (upstream) 195.27 masl (downstream)	100-year storm
Future Interchange Way	12.8 m wide x 3.0 m high Conspan arch	33 m ⁽²⁾	193.62 masl (upstream) 193.44 masl (downstream)	Regional storm
Peelar Road	12.8 m wide x 3.0 m high Conspan arch	26 m ⁽²⁾	192.46 masl (upstream) 192.20 masl (downstream)	100-year storm

(1) The future Highway 7 crossing is outside the study area of the EA and will be completed under separate study.

(2) The Highway 407 culvert is outside the study area of the EA, but is assumed to be unchanged from existing conditions for the purposes of this study. The culvert is a 6.0 m wide by 4.3 m high concrete box culvert with an upstream invert elevation of 191.73 masl and capacity to convey the Regional Storm Event without overtopping.

(3) Culvert length is assumed to be equal to the road right-of-way under the VMC Secondary Plan.

5.3.1.4 Conflict with Utilities

A number of utilities in the study area may be in conflict with the new channel corridor, where above ground utilities may be located in the channel corridor, buried utilities may not be located deep enough to cross the channel corridor under cover, or cross with insufficient cover to mitigate potential scour in the channel. These utilities are shown on **Figure 4-2**. Alternative #2 may potentially need to re-locate several utilities to accommodate the new channel corridor, such as:

- The current hydro tower corridor east of Jane Street, which is within the channel corridor footprint from Highway 7 to the meander in the corridor, located between Doughton Road and future Interchange Way;
- Water servicing located east of Jane Street and along Doughton Road and Peelar Road, which is within the channel corridor footprint for nearly the entirety of the alignment;

- Sanitary sewers located along Doughton Road and Peelar Road, though this alignment likely avoids the sanitary trunk sewer along Jane Street; and
- A buried natural gas line (NPS 12) within the channel corridor footprint for a section immediately south of Doughton Road and buried natural gas lines (NPS 4) along Doughton Road and Peelar Road.

5.3.1.5 Constructability

In general, phased development along the Alternative #2 alignment can be completed by constructing sections of the new valley corridor and connecting it with the existing Black Creek (where construction will be completed at a later time). Because this alignment generally follows the existing alignment of Black Creek, the tie-in distances will be minimized. However, in this alignment, no section of the valley can be constructed without diverting existing flows around construction (i.e., the channel cannot be constructed in the dry).

The footprint of the new channel corridor, for nearly the entire length of the corridor, overlaps the footprint of existing buildings, which will require the demolition of those buildings before construction of the channel.

5.4 Alternative #3 – Jane Street Alignment

The Alternative #3 alignment plan and profile is shown on **Figure 5-2**. Alternative #3 differs from Alternative #2 in the spatial configuration of the valley corridor. This alignment alternative will be adjacent to Jane Street for most of the new channel corridor and meander sharply east on the downstream side of Peelar Road to meet the existing Highway 407 culvert. Additionally, Alternative #3 is generally the same as Alternative #2 with respect to technical performance (flood protection) and cross-sectional configuration of the valley. Refer to **Section 5.3** for the full description of the alternative, with the following exceptions and/or additions:

- The total valley corridor width ranges from 50 m at the upstream section between Highway 7 and Doughton Road to about 90 m at the sharp meander bend between Peelar Road and Highway 407.
- The depth of the valley (from the channel invert to the minimum top of the buffer) varies from approximately 3.7 m, upstream of Doughton Road, to 6.6 m, downstream of future Interchange Way.
- The total length of the valley between the existing Highway 7 culvert (upstream end) and the existing Highway 407 culvert (downstream end) is 840 m.
- The sharp meander at the downstream-most reach of the channel corridor (south of Peelar Road) will require reinforced low flow channel banks and valley embankments to mitigate against erosion risks. This can be accomplished by incorporating rock armouring in the low flow channel and outer bends in the valley slope.
- The low flow channel is potentially in conflict with utilities located east of Jane Street, between future Interchange Way and Highway 407, including: the hydro pole corridor, 900 mm sanitary trunk sewer, natural gas line (NPS 12) and 300 mm watermain.
- For phased development around this alignment, longer tie-in sections between new and old valley sections would be required between the existing channel meander bend (south of Doughton Road) and Highway 407. However, new valley construction downstream of the existing meander bend (north of future Interchange Way) and Peelar Road can be completed in the dry (i.e., not required diversion of existing creek flows). The footprint of this alignment intersects existing building footprints at the upstream reaches, from Highway 7 to future Interchange Way.

5.5 Alternative #4 – Meander North of Peelar Road

The Alternative #4 alignment plan and profile is shown on **Figure 5-3**. Similar to the previous alternatives, Alternative #4 differs from Alternatives #2 and #3 in the spatial configuration of the valley corridor. This alternative alignment follows the valley alignment from Alternatives #2 and #3 for the upstream section

between Highway 7 and Doughton Road, but features a meander east between future Interchange Way and Peelar Road before continuing to Highway 407. Additionally, Alternative #4 is generally similar to Alternatives #2 and #3 with respect to technical performance (flood protection) and cross-sectional configuration of the valley. Refer to **Section 5.3** for the full description of the alternative, with the following exceptions:

- The total valley corridor width ranges from 50 m at the upstream section near Doughton Road to 75 m downstream of the future Interchange Way.
- The total length of the valley between the existing Highway 7 culvert (upstream end) and the existing Highway 407 culvert (downstream end) is 790 m.
- The depth of the valley (from the channel invert to the minimum top of the buffer) varies from approximately 3.7 m, upstream of Doughton Road, to 6.9 m, downstream of future Interchange Way.
- The low flow channel is in conflict with utilities located east of Jane Street, between future Interchange Way and Peelar Road, including: the hydro pole corridor, natural gas line (NPS 12) and 300 mm watermain.
- For phased development around this alignment, longer tie-in sections between new and old valley sections would be required for sections between the existing meander bend and Peelar Road. However, construction of the new valley between the existing meander bend (north of future Interchange Way) and Peelar Road can be completed in the dry (i.e., not required diversion of existing creek flows). The footprint of this alignment intersects existing building footprints at the upstream reaches, from Highway 7 to Doughton Road, and buildings near Peelar Road.

6 EVALUATION OF ALTERNATIVE DESIGNS

6.1 Evaluation Criteria

The alternative designs were 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, 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.
- Financial, which relates to the capital costs as well as operation and maintenance costs of the alternative solution.

Within each main category, project-specific evaluation criteria were developed based on a review of the Municipal Class EA, the existing conditions of the project area, the alternative solutions being considered, and the problem statement. The resulting evaluation criteria are summarized in **Table 6-1**.

Table 6-1 Evaluation Criteria

Category	Evaluation Criteria
Technical Environment	Potential to achieve technical objectives (i.e. to safely convey the Regional Storm Event) Potential future operation and maintenance requirements Potential impacts on scheduling and coordination with development within VMC Potential impacts on level of effort for approvals and permits Potential constructability of proposed infrastructure, including the phased construction of the channel with development Potential conflicts with existing municipal and utility services
Natural Environment	Potential effects on fish habitat and aquatic ecosystems Potential effects on terrestrial ecosystems Potential effects on known habitat for Species of Concern Potential effects on groundwater Potential impacts on the natural environment during construction
Social/Cultural Environment	Potential for requiring private property Potential impact on Public Safety Opportunity to integrate with planned/future land uses in the surrounding area Potential impact on archaeologically undisturbed lands
Financial Environment	Potential capital costs of implementation Potential operations and maintenance (O&M) costs

6.2 Alternative #1 – Do Nothing Alternative

The Do Nothing Alternative has no direct impacts or benefits to the Technical or Natural Environments, as no works are proposed and there will be no reduction in the potential for flooding and flood damages.

There are no direct impacts to the Social and Cultural Environments, but public safety from flood risks is not improved and property in the flood prone areas of Black Creek will continue to be impacted during extreme storm events. The development of VMC will be severely hindered due to the amount of flood prone land in the area.

There are no capital costs associated with the Do Nothing alternative, but businesses and property owners will incur costs resulting from future flood damage.

6.3 Alternative #2 – New Valley over Existing Alignment

This alternative, described in **Section 5.3**, involves the construction of a new channel corridor that largely follows the existing alignment. The relative benefits and impacts of this alternative are discussed in the following sections.

6.3.1 Technical Environment

Alternative #2 will be able to convey the Regional Storm Event peak flow rate within the valley to provide flood protection for the area. The flood protection performance of this alternative is equal to that of the other alignment alternatives.

With regards to constructability, this alignment alternative includes some advantages and challenges compared to other alternatives, as follows:

- When constructing this alignment in phases (based on property boundaries), this alignment is expected to provide the least issue for connecting the newly constructed channel sections to existing channel sections (that have not yet been developed). The distances to tie-in each section of the channel are minimized because the new channel and old channel are closely aligned.
- Contrary to the other alternatives, there are no sections of new valley corridor for Alternative #2 that can be constructed without diverting flows from the creek (i.e., constructed in the dry), adding some difficulty to the construction effort.
- Nearly the entire length of this alignment intersects existing building footprints and will require the demolition of buildings for each section of the new channel corridor.
- Alternative #2 will likely to encounter the fewest conflicts with existing utilities relative to the other alternatives because its alignment follows the existing creek alignment. For example, the gas line, sanitary truck sewer, and watermain generally run through a corridor to the west of the alignment (see **Figure 4-3**). Conflicts with utilities will generally be limited to those that cross the channel corridor at Doughton Road and future Interchange Way. However, this alternative (and the other alternatives) will be in conflict with the hydro pole corridor between Highway 7 and Doughton Road.
- The required approvals and permits for construction is expected to include the typical set for a project of this type (as described in **Section 9.10**), and is similar to the other alternatives.

Overall, the technical environment challenges and performance for Alternative #2 is roughly equal to the other alignment alternatives, albeit with different challenges with respect to constructability.

6.3.2 Natural Environment

Alternative #2 is expected to improve fish habitat and aquatic ecosystems by removing physical barriers to connectivity, improving substrate quality, and providing a wider, continuous low flow channel. The terrestrial ecosystem will also benefit by having an overall wider and longer valley corridor that is better vegetated.

There is no presence of potential Species of Concern in the existing channel corridor and also no known issues with groundwater and hydrologically sensitive features in the study area that would be affected by Alternative #2. There will be a temporary disturbance of the existing aquatic and terrestrial habitat system during the construction the Alternative #2 valley corridor; however, appropriate mitigation measures will be implemented and, as noted in the existing conditions review, the study area does not contain any significant natural and environmentally sensitive areas.

6.3.3 Social / Cultural Environment

As described in **Section 6.3.1**, Alternative #2 will convey the Regional Storm Event peak flow and thus public safety is improved by providing flooding protection to the area.

The land acquisition requirements are greater with Alternative #2 compared to other alternatives because the footprint will cover approximately 3.0 ha of private land, while the remainder is public land owned by the City, Region and Province. The amount of private land required for this alignment is about 1.3 ha more than Alternatives #3 and #4, as outlined in **Table 6-2** below. Moreover, nearly the entire length of this alignment intersects existing building footprints and will require current properties and businesses to be significantly disturbed during construction. Alternatives #3 and #4 have some sections of the channel that are away from existing buildings.

Table 6-2 Land Ownership Type

Alternative	Channel Area over Land Ownership Type (ha) ⁽¹⁾				
	Private	City	Region	Province	Total
<u>Alternative #2</u> New Valley over Existing Alignment	3.0	0.3	0.1	1.4	4.8
<u>Alternative #3</u> Jane Street Alignment	1.7	0.2	1.5	1.7	5.1
<u>Alternative #4</u> Meander North of Peelar Road	1.7	0.3	1.1	1.6	4.7

(1) The land area includes future rights-of-way that cross the new channel corridor.

With respect to the future use of lands surrounding the valley, the development area between Doughton Road and future Interchange Way will be bisected by the alignment of the valley. This creates an isolated parcel of land at the northeast corner of Jane Street and future Interchange Way that is not well integrated (spatially) with the neighbourhood, which may negatively affect the vibrancy and cultural potential of the area and is not well aligned with VMC Secondary Plan policies. Finally, this alternative will impact some archaeologically undisturbed lands adjacent to the current valley around Doughton Road and south of the future Interchange Way, but the total area impacted is the least among the alternative alignments. A Stage 2 Archaeological Assessment (AA) has been recommended for these lands prior to the construction. There are no expected impacts to the cultural heritage with the new channel corridor.

6.3.4 Financial Environment

Costs for the Alternative #2 alignment are associated with the acquisition of private land, construction of the new valley corridor and operating and maintenance costs. The total capital cost of this alternative is estimated to be approximately \$40.6 million, which is higher than the other alternatives. Some maintenance costs will be incurred for the new channel corridor, but by relative comparison, Alternative #2 is roughly equal to Alternative #4 and slightly less than Alternative #3. There will be no damage costs to adjacent properties and businesses for up to the Regional Storm Event. A summary cost breakdown is included in **Appendix I**.

6.4 Alternative #3 – Jane Street Alignment

This alternative, described in **Section 5.4**, involves the construction of a new channel corridor that is mostly adjacent to Jane Street until south of Peelar Road where it meanders sharply east towards the existing Highway 407 culvert. The benefits and impacts of this alternative are similar to Alternative #2 (refer to **Section 6.3**), with some notable exceptions discussed below.

With respect to the Technical Environment, this alternative will be able to convey the Regional Storm Event peak flow rate within the valley to provide flood protection for the area, which is similar to the other alignment alternatives. This alignment includes an additional challenge at the sharp meander bend south of Peelar Road. The increased erosion / slope failure risk due to the sharp meander will require the construction of additional channel and embankment stabilization measures and more maintenance after construction. With regards to constructability, this alignment alternative includes some advantages and challenges, but overall, it is relatively similar to the other alternatives. The key differences in constructability compared with the other alternatives is described below.

- Contrary to Alternative #2 (though similar to Alternative #4), this alignment is expected to be more problematic for connecting newly constructed channel sections to existing channel sections (on lands that have not yet been developed). The distances between sections of the new channel and old channel are larger as they are not closely aligned. In particular, this affects the construction phasing for the new channel in and around the future Interchange Way. Greater coordination for construction phasing will be required. Conversely, the lower reach of the new channel corridor is located on public lands, which will allow a large portion of the channel to be constructed without private land acquisition.
- The sections of new channel corridor from immediately upstream of future Interchange Way to downstream of Peelar Road can be constructed without diverting existing flows from the creek (i.e., constructed in the dry). This is an advantage over Alternative #2 (no dry construction) and Alternative #4 (less channel length available for dry construction).
- The section of new channel corridor between future Interchange Way and Highway 407 is on public land and can be initiated without disturbing surrounding buildings (similar to Alternative #4). This is an advantage over the Alternative #2 alignment which intersects existing building footprints for nearly the entire length of the proposed channel.
- The alignment of the channel crosses more existing utilities compared to Alternatives #2 and #4, including the hydro pole corridor, 900 mm sanitary trunk sewer, natural gas line (NPS 12) and 300 mm watermain), which increases the potential need to relocate utilities.
- The required approvals and permits for construction is expected to include the typical set for a project of this type (as described in **Section 9.10**), and is similar to the other alternatives.

For Natural Environment, the benefits and impacts are similar to Alternative #2 with the exception of the impact created by the sharp meander bend, which may reduce the amount of slope vegetation and natural channel because harder, erosion resistant materials will be required for that meander section of the channel corridor.

With the exception of improved public safety from providing flood protection, which is the same for all alternative alignments, the impacts to the Social / Cultural Environment relative to Alternatives #2 and #4 are discussed below. The amount of private land required for the alignment is about 1.7 ha, which is less than Alternative #2 (see **Table 6-2**). There is also a slightly increased risk to public safety with a valley that is entirely adjacent to the Jane Street, where vehicles have a chance to enter. In terms of future development adjacent to the valley, this alternative does not create isolated a parcels of land (unlike Alternative #2, but similar to Alternative #4), and therefore provides better integration of future VMC development in the neighbourhood to benefit the Social / Cultural Environment and is better aligned with policies in the VMC Secondary Plan. Similar to Alternative #2, there are no expected impacts to the cultural heritage with the new channel corridor and a Stage 2 Archaeological Assessment (AA) has been recommended for these lands prior to the construction. There is a slight increase in the area subject to a Stage 2 AA for lands affected by this alternative, relative to others.

The sharper meander bend and slightly longer channel in Alternative #3 results in estimated total capital costs of \$41.9 million, which is less than Alternative #2 and slightly higher than Alternative #4. The relative maintenance costs for this alternative are expected to be slightly higher than the other alternatives because of the increased monitoring and restoration requirements of the sharp meander bend south of Peelar Road.

6.5 Alternative #4 – Meander North of Peelar Road

This alternative, described in **Section 5.5**, involves the construction of a new channel corridor that is adjacent to Jane Street until south of future Interchange Way where it meanders east before reaching Peelar Road near the creek's existing location. The relative benefits and impacts of this alternative are similar to Alternatives #2 and #3 (refer to **Sections 6.3 and 6.4**), with some notable exceptions discussed below.

For the Technical Environment, Alternative #4 will be able to convey the Regional Storm Event peak flow rate within the valley to provide flood protection for the area, which is similar to the other alignment alternatives. With regards to constructability, Alternative #4 is most similar to Alternative #3 and has the following key considerations:

- Compared to Alternative #2 (though similar to Alternative #3), this alignment is expected to be more challenging for connecting newly constructed channel sections to existing channel sections (on lands that have not yet been developed). The distances between sections of the new channel and old channel are larger as they are not closely aligned. In particular, this affects the construction phasing for the new channel in and around the future Interchange Way. Greater effort for construction phasing will be required. Conversely, the lower reach of the new channel corridor is located on public lands, which will allow a large portion of the channel to be constructed without private land acquisition.
- Sections of the new channel corridor for Alternative #4 upstream and downstream of future Interchange Way can be constructed without diverting existing flows from the creek (i.e., constructed in the dry). This is an advantage over Alternative #2, but the length of channel available for construction in the dry is less than Alternative #3.
- The section of new channel corridor between future Interchange Way and Highway 407 is on public land and can be constructed without disturbing surrounding buildings (similar to Alternative #3). This is an advantage over the Alternative #2 alignment which intersects existing building footprints for nearly the entire length of the proposed channel.
- The Alternative #4 alignment crosses more existing utilities compared to Alternative #2, but fewer utilities compared to Alternative #3. These utilities include the hydro pole corridor, natural gas line (NPS 12) and 300 mm watermain, which increases the potential need to relocate utilities; however, the 900 mm sanitary trunk sewer can be avoided.
- The required approvals and permits for construction is expected to include the typical set for a project of this type (as described in **Section 9.10**), and is similar to the other alternatives.

The impacts to the Social / Cultural Environment relative to Alternatives #2 and #3 are discussed below. Public safety is improved by providing flood protection, which is the same for all alternative alignments. The amount of private land required for the alignment is about 1.7 ha, which is less than Alternative #2 but similar to Alternative #3 (see **Table 6-2**). In terms of future development adjacent to Alternative #4, similar to Alternative #3, this alternative does not isolate a development parcel like Alternative #2 to provide better integration of future VMC development in the neighbourhood to benefit the Social / Cultural Environment and be aligned with policies in the VMC Secondary Plan. Similar to Alternatives #2 and 3, there are no expected impacts to the cultural heritage with the new channel corridor and a Stage 2 Archaeological Assessment (AA) has been recommended for these lands prior to the construction.

The estimated total capital costs of Alternative #4 are \$39.7 million and are less than Alternatives #2 and #3. Relative maintenance costs are expected to be similar to Alternative #2 but slightly less than Alternative #3.

6.6 Preferred Alternative

The results of the evaluation for each alternative described in **Sections 6.2 to 6.5** are summarized in **Table 6-3**. Alternative #4 was selected as the preferred alignment due to a number of advantages compared to the other alternatives. A summary of the key impacts and benefits of Alternative #4 is provided below:

- **Technical Environment** – Alternative #4 will be able to convey the Regional Storm Event peak flow rate within the valley to provide flood protection for the area to satisfy the key objective of the Black Creek Renewal. Some construction challenges are expected because sections of the new channel corridor are located away from the existing alignment and will require long tie-in sections if constructed separately from other sections. Conversely, the lower reach of the new channel corridor is located on public lands, which will allow a large portion of the channel to be constructed without private land development, disturbing existing buildings, and in the dry outside of the existing watercourse. Some utilities are potentially in conflict with the new channel corridor and will require relocation, including the hydro pole corridor, natural gas line (NPS 12) and 300 mm watermain; however, the 900 mm sanitary trunk sewer appears to be avoided.
- **Natural Environment** – This alternative is expected to improve fish habitat and aquatic ecosystems by removing physical barriers to connectivity, improving substrate quality, and providing a wider, continuous low flow channel. The terrestrial ecosystem will also benefit by having an overall wider and longer valley corridor that is better vegetated compared to existing conditions. There will be a temporary disturbance of the existing aquatic and terrestrial habitat system during the construction; however, the study area does not contain any significant natural and environmentally sensitive areas and appropriate mitigation measures will be implemented.
- **Social / Cultural Environment** – There are no expected impacts to the cultural heritage with the new channel corridor; however, a Stage 2 Archaeological Assessment (AA) has been recommended for these lands prior to the construction. The land acquisition requirement for this alternative is the lowest amongst the alternatives. In addition, future development blocks adjacent to the new channel in this alternative will be more contiguous with the neighbourhood and aligned with policies in the VMC Secondary Plan.
- **Financial Environment** – The capital costs associated with Alternative #4 are estimated at \$39.7 million. Some maintenance costs will be incurred for the new channel corridor, but is roughly equal to the other alternatives. Finally, there will be no damage costs to adjacent properties and businesses for up to the Regional Storm Event.

Table 6-3 Evaluation Summary

Alternative	Technical Environment		Natural Environment		Social/Cultural Environment		Overall		Financial Environment
	Challenges	Performance	Impacts	Benefits	Impacts	Benefits	Cumulative Impact	Cumulative Benefit	
Alternative #1: Do Nothing	● No challenges, as no works are proposed.	○ No reduction in frequency and severity of flooding.	● No impacts, as no works are proposed.	○ No benefits, as poor quality aquatic and terrestrial habitat will remain as existing.	● No impacts, as no works are proposed.	○ No benefits, as no works are proposed.	● NOT RECOMMENDED Does not reduce flooding and VMC development hindered due to large area prone to flooding.	○	No capital cost but costs will be incurred from future flooding
Alternative #2: New Valley over Existing Alignment	◐ Channel sections cannot be constructed in the dry and alignment intersects existing building footprints for entire length of channel. Fewest potential conflict with utilities of the alternatives.	● Flooding will be contained within corridor, up to the Regulatory Storm Event.	◐ Temporary disturbance from construction activity.	● Reconstructed low flow channel to remove barriers to aquatic habitat connectivity and provide overall wider valley corridor with increased vegetation.	◐ Potential archaeological impact to previously undisturbed area and more private land is required (2.8 ha private land versus 4.4 ha of total land).	◐ Public safety is improved and development in the VMC can proceed with flood protection in place, albeit with a parcel of land that is isolated from the neighbourhood.	◐ NOT RECOMMENDED Flooding will be contained in the corridor, but this alignment will require the acquisition of more private land and will create one development block that is isolated from the neighbourhood.	◐	\$40.6 million in estimated capital costs
Alternative #3: Jane Street Alignment	◑ Increased risk for erosion / slope failure at sharp meander bend requiring more channel and embankment protection and increased maintenance requirements, as well as highest level of potential conflicts with existing utilities.	● Flooding will be contained within corridor, up to the Regulatory Storm Event.	◐ Temporary disturbance from construction activity, but less for section south of future Interchange Way.	◐ Reconstructed low flow channel to remove barriers to aquatic habitat connectivity and provide overall wider valley corridor with increased vegetation. Channel at sharp meander bend will be less natural due to channel armoring.	◐ Additional potential archaeological impact to previously undisturbed area and higher risk to public safety as nearly the entire valley corridor is adjacent to Jane Street. Less private land required (1.7 ha private land versus 4.8 ha of total land).	● Public safety is improved and development in the VMC can proceed with flood protection in place.	◐ NOT RECOMMENDED Flooding will be contained in the corridor, but the sharp meander bend will have increased risk for erosion / slope failure and this alignment has the greatest potential for conflicts with utilities.	◐	\$41.9 million in estimated capital costs
Alternative #4: Meander North of Peelar Road	◐ Phased construction of the channel will require longer tie-in distances because the channel alignment is away from existing alignment, as well as moderate level of conflict with existing utilities.	● Flooding will be contained within corridor, up to the Regulatory Storm Event.	◐ Temporary disturbance from construction activity, but less for section south of future Interchange Way.	● Reconstructed low flow channel to remove barriers to aquatic habitat connectivity and provide overall wider valley corridor with increased vegetation.	◐ Potential archaeological impact to previously undisturbed area. Less private and total land required (1.7 ha private land versus total land of 4.0 ha).	● Public safety is improved and development in the VMC can proceed with flood protection in place.	◐ RECOMMENDED Flooding will be contained in the corridor and will provide the greatest integration with VMC development. The least private land and total land required of the alternatives.	●	\$39.7 million in estimated capital costs

Least Impact or Greatest Benefit ● → ◐ → ◑ → ○ Greatest Impact or Least Benefit

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7 THE PREFERRED DESIGN

As described in **Section 6.6**, the Meander North of Peelar Road alignment is the preferred design for the Black Creek renewal. The following sections describe the preliminary design and construction staging/phasing.

7.1 Preliminary Design

Preliminary design drawings were prepared for the proposed Black Creek Renewal based on the preferred alternative design (Meander North of Peelar Road). Plan and profile views of the channel with preliminary proposed grading are found on **Drawing Nos. CH01 through CH04** and sections views are found on **Drawing Nos. CH05 and CH06**. Plan and profile views of the proposed new channel corridor crossings at Doughton Road, future Interchange Way, and Peelar Road are found on **Drawing No. CH07**.

The new channel corridor preliminary design provided herein represents a configuration that is based on the preferred alternative concept design, which was refined using information collected or determined during the EA and assumptions for the development of the lands surrounding the new channel corridor. Many elements of the channel and public realm will be determined outside the scope of this EA; such as landscaping (within the new channel corridor, on adjacent developments, and public lands); streetscape design; and utilities relocations. Additional studies are also required in detailed design to confirm and refine the preliminary design for geotechnical considerations, culvert design, low flow channel configuration, and etc. **Section 8** provides a description of recommended future studies. To that end, several assumptions were applied to the preferred alternative alignment for preliminary design to determine a channel configuration that requires the minimum area of land, recognizing the need to optimize the available space in the VMC. The key assumptions and refinements for the preliminary design are as follows:

- Grading for the new channel invert was based on the existing channel inverts at Highway 7, Doughton Road, and Highway 407 to facilitate phased construction of the new channel corridor concurrently with redevelopment. The new channel invert between the above locations were assumed to be constant gradients.
- Culvert crossing sizes were modified to better suit existing road surface elevations. Hydraulic analysis was updated to reflect the changes and confirm the conveyance of the Regional Storm Event.
- The future Highway 7 culvert configuration was assumed to include an extension and widening to accommodate Regional Storm Event flows, as coordinated with the Edgeley Pond preliminary design. In particular, the preliminary design assumed that, in the future, the culvert will be widened immediately to the east of the existing culvert, based on available information to date. The configuration and specifications will be determined in further study or detailed design outside of this EA.
- The low flow channel and the valley floor width remained unchanged from the configuration used during concept alignment.
- Slope for the buffers were set at a constant 2.0% towards the channel.
- Slope for the channel embankments were set at a constant 3:1 ratio for naturalized embankments and 2:1 for amenitized (urban) embankments.
- Grading at the edge of the new channel corridor for sections that abut the Jane Street right-of-way was based on the existing topographic elevation of the Jane Street right-of-way. In particular, consultation with York Region determined that grading for the buffer is required match the existing grade at the edge of the Jane Street right-of-way, where applicable.
- For channel edges not adjacent to the Jane Street ROW, the grade was determined by including a 0.3 m freeboard above the Regional Storm Event water level to set the embankment elevation, plus an additional 0.2 m rise in the buffer (i.e., from the 2.0% slope towards the channel within the 10 m wide buffer). In general, the resulting grade at the edge of the new channel corridor was similar or slightly

below the existing grade (up to 1.0 m). It was assumed that proposed development adjacent to the new channel corridor will be graded to match the channel. The grading will be refined in detailed design.

- The road elevations at the culvert crossings (Doughton Road, future Interchange Way, and Peelar Road), were assumed based on the approximate elevation of the existing road or ground surface elevation, with increases in road elevation to provide sufficient cover on the proposed culverts where needed, while considering intersections with Jane Street and overland flow routes to the new channel corridor.

The refined configuration of the new channel corridor from preliminary design differs slightly from the preferred concept design, presented as Alternative #4 in **Section 5.5**, namely with the following:

- The alignment of the new channel corridor follows the boundary of the future Jane Street right-of-way, which fluctuates along the new channel corridor between 45 m and 49 m in width. The channel corridor edges will be refined in detailed design.
- Culvert sizes were refined as follows:
 - The culvert at Doughton Road was specified as a 12.81 m W by 2.44 m H Conspan unit. The culvert can accommodate the 100-year storm event without overtopping, while the Regional Storm Event was approximately 0.10 m above the road deck elevation. The grading constraints surrounding the crossing prevent the installation of a larger culvert, in particular, the road elevation immediately west of the channel must be sufficiently low to facilitate an overland flow route from the Jane Street right-of-way to the new channel corridor.
 - The culvert at future Interchange Way was specified as a 12.81 m W by 3.66 m H Conspan unit. The culvert can accommodate the Regional Storm Event without overtopping.
 - The culvert at Peelar Road was specified as a 12.81 m W by 3.00 m H Conspan unit. The culvert can accommodate the 100-year storm event without overtopping, while the Regional Storm Event is governed by the downstream Highway 407 culvert and was approximately 0.12 m above the road deck elevation.
- A grading buffer was added to the section of new channel corridor adjacent to the future Jane Street right-of-way between Highway 7 and Doughton Road to facilitate grading where Jane Street is lower in elevation than the minimum required top of channel elevation for conveyance of the Regional Storm Event.
- The freeboard above the Regional Storm Event is a total of 0.5 m along the new channel corridor (0.3 m to the top of the embankment plus 0.2 m to the top of the buffer).
- Total valley corridor width, including buffers, ranges from 52.1 m to 72.4 m.
- The depth of the valley (from channel invert to the minimum top of buffer) varies from 3.39 m, downstream of Doughton Road, to 5.51 m, upstream of Highway 407.
- The total length of the valley between the existing Highway 7 culvert (downstream end) and the existing Highway 407 culvert (upstream end) is 795 m.

With respect to vegetation communities, the preliminary design includes tree communities in the naturalized buffer and naturalized embankments, which will provide a total of 2.33 ha of treed vegetation community. This is an increase of about 1.0 ha of riparian tree cover compared to existing conditions (1.32 ha). The proposed treed areas are also distributed along the entire reach, whereas existing treed vegetation communities are only distributed across roughly half the reach. The low flow channel and valley floor will incorporate ecological function and long-term erosional stability features that will be determined in detailed design.

Further specifications of the new channel corridor and road crossings will be completed during detailed design, which will use or consider the results of a detailed utility investigation and relocation plan, detailed topographic survey, geotechnical investigation, detailed grading, natural channel design, and landscape and urban design. The recommended studies are described in **Section 8**.

7.2 Property Requirements

The area and locations of private and public property required for the Black Creek Renewal is found on **Figure 7-1**. Private lands required for the new channel corridor are expected to be conveyed to the City at the time of re-development, according to the Black Creek Financial Strategy. The conveyance of lands will be a condition of re-development. The City will require agreements with York Region and the MTO for public lands not owned by the City. For the purposes of the capital cost estimate for the Black Creek EA (**Section 7.4**), all land required for the new channel corridor was assigned a value consistent with the Black Creek Financial Strategy.

7.3 Construction Staging / Phasing

Conceptual construction staging was considered for the Black Creek Renewal. Staging scenarios were developed with an aim to construct the new channel corridor in individual sections on both private and public land, concurrent with the re-development of individual parcels of land adjacent to Black Creek. This will allow for maximum flexibility and benefit to reduce flooding because sections of new channel corridor can be constructed as soon as adjacent properties are ready for redevelopment. In general, the new channel corridor construction was divided into four major sections, each of which can be constructed individually in any order and integrated together as other sections are completed (**Figure 7-2**). However, no re-development can occur in existing floodplain while the new channel corridor is partially complete (interim conditions) during the phased construction. All re-development plans must demonstrate that flooding is mitigated in interim conditions before proceeding.

Each of the four sections of the new channel corridor were delineated based on potential construction phasing sequences within the sections. For example, all works with major dependencies on other works in the channel were grouped together. The section below outlines the limits of each section, construction phasing within each section, and the potential tie-in connections or interim works that would be required. From downstream to upstream:

- **Highway 407 to Upstream of Peelar Road (Figure 7-3)**

The downstream-most section of the new channel corridor is bounded by Highway 407 at the downstream end and the Peelar Road culvert at the upstream end, and includes the new culvert. In this section, the construction may potentially involve a sequence whereby the Peelar Road culvert, the base of the channel, and west embankment of the new channel corridor is constructed first, while the east embankment between Highway 407 and Peelar Road can be constructed when the adjacent property (99 Peelar Road) is redeveloped at a later date.

Construction of this new channel corridor section requires the closing of the existing north-south section of Peelar Road located north of the existing east-west section of Peelar Road. The north-south section of Peelar Road will be removed in the future according to the VMC Secondary Plan. Flow diversion or pump around of creek flows will also be required for constructing this section of the new channel corridor.

In the scenario that the section upstream is not constructed, an interim tie-in channel is required from the existing channel north of Peelar Road to the new Peelar Road culvert. During construction of this new channel corridor section, flow diversion or pump around for creek flows will be required.

- **North of Peelar Road to Downstream of Doughton Road (Figure 7-4)**

This section of the new channel corridor represents the longest section for construction phasing and includes most of the proposed park block between Peelar Road and future Interchange Way, and two private properties (7601 Jane Street and 7581 Jane Street) between future Interchange Way and Doughton Road. The future Interchange Way road and culvert is also located within this section.

This section will include the most works, relative to the other parts of the new channel corridor, due to the change in channel alignment and the construction of future Interchange Way. The redevelopment of 7601 Jane Street will be the catalyst for constructing this section of the new channel corridor

because, at this property, the Black Creek channel will need to be moved from its existing alignment (meander to the east) to the proposed alignment (along Jane Street). When re-development of 7601 Jane Street occurs, the proposed meander of the new channel corridor between future Interchange Way and Peelar Road will need to be constructed to avoid lengthy interim channels south of future Interchange Way. As such, the recommendation is to construct this section of the new channel corridor together, with the following general sequence:

- Similar to the downstream section, construction of the new channel corridor in this section requires the closing of the existing north-south section of Peelar Road located north of the east-west section of Peelar Road. The north-south section of Peelar Road is not a part of the future road network, according to the VMC Secondary Plan.
 - Construction will be completed in the dry for the new Interchange Way crossing, new channel corridor between future Interchange Way and Peelar Road, and new channel corridor north of future Interchange Way to the existing meander bend. If 7581 Jane Street is not redeveloped at the same time as 7601 Jane Street, an interim channel will be required for the section adjacent to the property. This interim channel to the west of 7581 Jane Street will have to be designed with enough capacity to mitigate flooding at 7601 Jane Street (as a minimum) for re-development to proceed at that property. Due to the grades along Jane Street and the relatively confined width, this interim channel will likely require retaining walls along its length. Potential utility relocations between future Interchange Way and Peelar Road may also be completed during this phase.
 - Flow diversion or pump around of creek flows will be required for constructing the section of new channel corridor between the existing meander bend and Doughton Road.
 - A short tie-in connection to the existing channel corridor immediately north of Peelar Road will be required if the new channel corridor downstream of this section is not completed. Similarly a short tie-in connection to the existing Doughton Road culvert may be required if the new Doughton Road culvert is not constructed.
 - After the new channel corridor is completed in this section, Black Creek flows can be diverted to the new channel corridor and the existing channel can be filled and graded for development at the private properties, the public park, and the remainder of future Interchange Way.
- **Doughton Road and 7683 to 7695 Jane Street (Figure 7-5)**

The redevelopment of 7683 to 7695 Jane Street and construction of new channel corridor in this section will trigger the replacement of the Doughton Road culvert due to its proximity to the properties. Short tie-in channels will be required at the upstream and downstream end of this section, if the construction of the new channel corridor through this section is completed before adjacent sections. A diversion or pump around of creek flows is required during construction of this section.
 - **7725 Jane Street to Highway 7 (Figure 7-6)**

The re-development of 7725 Jane Street will include the urban plaza and any applicable modifications (i.e., extension and widening) to the Highway 7 culvert. A tie-in connection to the existing Black Creek channel will be required if the downstream section of the new channel corridor is not completed before construction of this section. A diversion or pump around of creek flows is required during construction of this section.

7.4 Capital Cost

The estimated capital cost of the proposed Black Creek Renewal is provided in **Table 7-1**, which is a refinement of the capital cost estimate provided during the alternatives evaluation based on the preliminary design of the preferred alternative. The estimate includes the major components of the new channel corridor construction, but excludes several items that are difficult to estimate at this time, including the urban plaza at Highway 7 and Jane Street (which will be designed in a future study), major utility relocations (such as the hydro poles), works outside of the new channel corridor (such as grading for adjacent properties or the public park), and road works for the crossing structures. Interim channel works during phased

construction are assumed to be covered under the contingency estimates and will be refined in detailed design.

The capital cost estimate includes the total estimated land value for the entire new channel corridor, regardless of whether the land is private or publicly owned, or if the land will be acquired or conveyed to the City for the Black Creek Renewal.

7.5 Funding

The Black Creek Financial Strategy completed in 2016 identified appropriate funding sources for improvements to the Edgeley Pond (located to the north of the EA study area) and the Black Creek Renewal. The study assessed the functional benefits of the projects and the benefitting interest groups to support Area-Specific Development Charges by-law(s) to fund the projects.

A capital cost estimate was developed for the Edgeley Pond and Black Creek Renewal during the study and was used, in part, to inform the capital cost estimate for the Black Creek Renewal EA. In general, the EA's cost estimate (**Table 7-1**) is within the Black Creek Financial Strategy's cost estimate for all directly comparable items, noting that the cost estimates from each study included different study areas and proposed works. Overall, the EA's cost estimate is not greater than the Black Creek Financial Strategy for the components that were considered in both estimates and thus, no changes to the Black Creek Financial Strategy are warranted for the new channel corridor at this time.

Table 7-1 Estimated Capital Cost

Item	Estimated Quantity	Unit Cost	Total Cost
<u>Land Value</u>			
Value of private land acquisition or conveyance, based on the blended price per ha rate estimated in the Black Creek Financial Strategy	1.74 ha	\$2,700,000 per ha	\$4,698,000
Value of public land, based on the blended price per ha rate estimated in the Black Creek Financial Strategy	2.79 ha	\$2,700,000 per ha	\$7,533,000
Contingency	30%		\$3,669,000
Subtotal, Land			\$15,901,000
<u>Construction</u>			
<i>Channel Works and Buffers</i>			
Realignment, earthworks, restoration, based on conventional greenfield channel realignment works	795	\$5,000 per linear meter	\$3,975,000
Retaining wall at urban plaza, recognizing that the configuration is subject to future study	145	\$1,500 per linear meter	\$220,000
Naturalized buffer (plantings, trails, lighting)	965	\$750 per linear meter	\$720,000
Urban buffer (promenade paving, furniture, lighting)	420	\$5,000 per linear meter	\$2,100,000
Terraced steps	420	\$5,000 per linear meter	\$2,100,000
Contingency (soil quality, dewatering, basic utility relocation, stabilization, materials, etc.)	30%		\$2,730,000
Subtotal, Channel Works and Buffers			\$11,845,000
<i>Structures</i>			
Doughton Road crossing (12.8 m Conspan Arch, assumes 23 m ROW)	1 unit	\$1,040,000 per unit	\$1,040,000
Peelar Road crossing (12.8 m Conspan Arch, assumes 23 m ROW)	1 unit	\$1,040,000 per unit	\$1,040,000
Interchange Way crossing (12.8 m Conspan Arch, assumes 28 m ROW)	1 unit	\$1,260,000 per unit	\$1,260,000
Contingency	30%		\$1,000,000
Subtotal, Structures			\$4,340,000
<i>Construction Contingency</i>			
Sequencing, environmental controls, flow management, etc.	30%		\$4,860,000
<i>HST</i>	13%		\$2,740,000
Subtotal, Construction			\$23,785,000
<u>Total</u>			\$39,686,000

8 RECOMMENDATIONS FOR FUTURE STUDY

The detailed design and construction of the Black Creek Renewal will require a number of additional coordinated studies. The detailed design must consider the recommendations from the studies described below to ensure that the final design will function as intended, be safe, adhere to VMC planning and urban design principles, and meet the requirements for construction approvals.

8.1 Detailed Utility Investigation

The utilities circulation for this EA revealed a number of utilities within the study area. In particular, the preferred alternative is potentially in conflict with the hydro pole corridor, natural gas line (NPS 12) and 300 mm watermain. A detailed utility investigation is required for detailed design, to determine which utilities need to be relocated and options for relocation.

Of particular concern is the hydro pole corridor that is currently within the new channel corridor from Highway 7 to just downstream of future Interchange Way. A total of 14 hydro poles are within the footprint of the new channel corridor. The utility investigation should consider relocating the hydro lines underground between Highway 7 and Highway 407 and removing the existing hydro poles prior to or during the construction of the new channel corridor. The above ground hydro poles within the new channel corridor will potentially reduce conveyance capacity of the channel and increase the risk for scour and erosion within the channel at the bases of the hydro poles. With respect to the VMC Streetscape and Open Space Plan, the hydro poles were noted to have a negative impact on the public realm in terms of visual effect.

8.2 Detailed Topographic Survey

Topographic information for this study was provided by the City and TRCA, and was sufficient for the development of alternative designs and preliminary design. However, a detailed topographic survey will be required for detailed design, for all areas potentially impacted by the new channel corridor design or the construction staging. The detailed topographic survey will include existing ground elevations, detailed channel elevations, relevant structures (culverts, roads, buildings, etc.), all visible utilities (manholes, hydro poles, lamp posts, etc.), and all markings for verified subsurface utilities.

8.3 Stage 2 Archaeological Assessment

As described in **Section 4.3.1**, the Stage 1 AA recommended a Stage 2 AA for all areas containing archaeological potential prior to construction activities. These areas are outlined in **Appendix C**.

A Stage 2 AA involves a shovel test pit archaeological survey, given that all sites with archaeological potential are in an urban setting with manicured or overgrown areas (contrary to greenfield sites on agricultural lands where the field is ploughed and a walking survey is conducted). Findings from the Stage 2 AA will determine whether a Stage 3 AA (site specific assessment) is required. Indigenous community engagement will be continued throughout all future archaeological assessments.

8.4 Geotechnical Investigation

A geotechnical investigation is required to determine the subsurface soil conditions along the new channel corridor to inform the detailed design. In particular, design recommendations for culvert footings, retaining walls, and the slope stability for the embankments (especially the amenitized embankment at 2:1 slope) will be required. All slopes must satisfy minimum safety factors against slope stability and requirements associated with landforms structures where needed. At the crossings, the geotechnical requirements under the TRCA's Crossing Guideline for Valley and Stream Corridors must be adhered to. The investigation will

also determine groundwater levels and requirements for groundwater management (and permits) during construction.

8.5 Detailed Grading

The detailed design will require a final grading assessment to confirm the minimum freeboard from the Regional Storm Event water surface elevation (0.3 m) and determine overland flow routes into the new channel corridor. Coordination is also required with the detailed design of future road construction at Jane Street, and at Doughton Road, Interchange Way and Peelar Road for the proposed crossings.

8.6 Natural Channel Design

The design of the low flow channel and valley floor will need to address a number of important considerations for the ecological function and long-term erosional stability of the new channel corridor. With respect to erosion, the long-term stability of the channel and embankments will require appropriate toe protection and channel planform design (i.e., pool-riffle sequences) that can mitigate against erosive forces. The low flow channel must also be appropriate for fish habitat and fish passage to support the ecological health of the new channel corridor. Recommendations from fluvial geomorphology and fish habitat studies are to be coordinated with the detailed design of the new channel corridor to incorporate these features.

The TRCA's Crossing Guideline for Valley and Stream Corridors also provides guidance on fluvial geomorphological and ecological requirements with respect to crossing designs that should be incorporated at detailed design. The ecological and engineering considerations for wildlife passage through crossings include the location, length, width/diameter of the passage; type of structure and material; and substrate in the passage.

8.7 Landscape and Urban Design

Landscape design is required for the park and amenity areas adjacent to the new channel corridor to create social and recreational spaces appropriate for this prominent area of the VMC. As described in the VMC Streetscape and Open Space Plan, key elements for the new channel corridor can include native plantings, pedestrian and cycling amenities, strong pedestrian and cycling connections at street intersections, gathering spaces, public art, feature lighting, and others elements to create landscape character and identity.

In particular, the VMC Consultation and Facilitation process conducted in 2013 and 2014 explored key design principles for the new channel corridor and established the urban design vision which includes, among other elements, the urban plaza and amenitized embankment that has been referenced and included as part of the alternative designs and preliminary design. Moving forward, the urban design vision for landscape and urban design will be coordinated with the detailed design of the new channel corridor. A Tree Inventory, Preservation Plan and Restoration Plan will also need to be completed in detailed design for the naturalized areas of the new channel corridor.

8.7.1 Southeast Corner of Intersection between Highway 7 and Jane Street

The channel corridor located immediately south of Highway 7 is one of the most challenging components of the Black Creek Renewal due to several constraints including: grade differential, constrained channel and Jane Street right-of-way width, existing culvert location, vehicular access requirements, land development potential and aquatic habitat needs.

This corner is important for the public realm because of the prominence of the intersection, but safety and ecological considerations also need to be addressed to maintain the integrity of the overall new channel corridor. During detailed design of the corridor and the urban plaza immediately south of Highway 7, the

City will need to continue to work with agencies, stakeholders and landowners to achieve the overall integrated vision for the Black Creek Renewal.

The following principles have been established to inform the detailed design of the Black Creek channel corridor at the southeast corner of Jane Street and Highway 7, and should be demonstrated to the satisfaction of the City of Vaughan and TRCA:

- Ensure public safety (mitigate flood risk, pedestrian safety, etc.);
- Facilitate access and connectivity (vehicular and pedestrian);
- Provide ecological net benefit; and
- Ensure the implementation of the VMC Secondary Plan policies and related design plans/guidelines.

9 POTENTIAL CONSTRUCTION IMPACTS AND MITIGATION

The potential construction impacts of the preferred Black Creek Renewal alternative and recommended mitigation measures are described in the following sections.

9.1 Terrestrial Features

The construction of the new channel corridor would require the removal of vegetation from the existing Black Creek channel corridor. The study area consists of a thin band of riparian area, consisting of predominantly common and/or weedy herbaceous vegetation (cultural meadow), towards the upstream reaches of Black Creek within the study area and narrow forested slope within the downstream reaches.

Regardless, a detailed tree inventory and preservation plan will be prepared for the entire area potentially impacted for construction of new channel corridor. Vegetation clearing should occur outside of the breeding bird season (April 1st to August 31st) to prevent nest destruction (see **Section 9.2**). A comprehensive restoration plan will also be completed during detailed design that will comply with the Provincial Policy Statement, the City's Official Plan, VMC Secondary Plan and VMC Streetscape and Open Space Plan, and will demonstrate no net negative impacts on the natural features or their ecological functions associated with the Black Creek Renewal.

9.2 Breeding Birds and Bats

As previously mentioned in **Section 9.1**, the construction of the new channel corridor would remove a considerable amount of vegetation from the existing channel corridor. During detailed design, the need for tree removals will be refined, and assessments will be carried out on any trees that may be removed. It is possible that some of these trees may provide habitat for breeding birds or bats.

The Migratory Bird Convention Act restricts tree removals or any other activity that could be construed as impacting nesting or breeding of a range of bird species from April 1st to August 31st. The nesting window should be confirmed during detailed design, and if tree removals cannot occur outside of this window, a qualified biologist will be required to complete a survey to determine the presence of any nesting activity prior to any removals. Bat surveys will also be conducted prior to tree removals and consultation with the MNRF will be completed.

9.3 Surface Water and Aquatic Habitat Protection

The recommended works have the potential to impact fish habitat, and therefore a Self-Assessment will be undertaken during detailed design to determine if a review by Fisheries and Oceans Canada (DFO) is required (see **Section 9.10**). Any in-water works could be subject to the warm water fisheries timing window, which only permits construction activity in or near the water between July 1st and March 31st. Fisheries timing windows will need to be confirmed with the MNRF and TRCA prior to construction.

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, debris and other contaminants within the work site.

Best Management Practices (BMPs) for the protection of aquatic habitat and source water protection will be reviewed at the detailed design stage and incorporated into the detailed design package. The use of erosion and sediment control devices and techniques should adhere to the principles limiting soil

mobilization and trapping sediment as close to the source as possible. The Greater Golden Horseshoe Area Conservation Authorities, Erosion and Sediment Control Guidelines for Urban Construction (GGHA, 2006) will be followed for the development and implementation of the comprehensive Erosion and Sediment Control (ESC) plan. BMPs to prevent contaminants from entering surface water and groundwater will also be in place, for example, implementation of appropriate fuel storage and refueling methods during construction.

9.4 Groundwater Management

It is expected that some local dewatering will be required for the construction of the new channel corridor. The future geotechnical study (and potential hydrogeological study) required for detailed design will help determine the groundwater level and requirements for dewatering. However, any groundwater impacts during construction are likely to be localized and temporary as the anticipated zone of influence will be minimal. During detailed design, it will be necessary to develop appropriate strategies to minimize, treat and dispose of any dewatering discharge water. Should construction site dewatering requirements be greater than 50,000 L/day, permitting with the MECP will be required. Construction site dewatering of more than 50,000 L/day but less than 400,000 L/day (under normal site conditions) will require registration on the MECP Environmental Activity and Sector Registry (EASR) and fulfillment of EASR regulation monitoring and mitigation requirements. A Permit to Take Water (PTTW) will be required if any of the construction requires dewatering of over 400,000 L/day.

9.5 Soils Management

The proposed improvements will involve topsoil stripping, excavation, and filling. All excess and unsuitable materials generated during construction will be managed appropriately. The materials may be reused as a construction material or transported from the site. Materials may also be temporarily stockpiled in preparation for these uses or temporarily removed from the site if required. A construction staging plan will detail the locations and mitigation requirements for stockpiles. Any soil stockpiles will be stabilized in accordance with the Greater Golden Horseshoe Area Conservation Authorities, Erosion and Sediment Control Guidelines for Urban Construction (GGHA, 2006), and any excess fill should be managed in accordance with the 'Management of Excess Soil – A Guide for Best Management Practices' (MOECC, 2016). In addition, a comprehensive ESC plan will be prepared in the detailed design stage.

Although no contaminated wastes are anticipated to exist on the site, if such wastes are encountered either naturally or through the Contractor's efforts (e.g., diesel spill) they must be taken to an appropriately approved waste disposal site by an appropriately licensed waste disposal carrier as per the operational constraint for the management of contaminated materials, and the MECP's York Durham District Office be contacted for further guidance. The Contractor will be required to manage all waste materials generated by construction activities in accordance with all provincial and federal regulations/approval requirements.

9.6 Property Impacts

Where the new channel corridor is adjacent to a re-development block, construction of the channel will occur as re-development is taking place, which will lessen the impact on private properties during construction. Nevertheless, 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 and proof of which is provided to the City before entering the property. Should access to private property be granted, the property will be restored to its original condition or better following the completion of construction operations.

Pre-construction condition surveys, including photographs, are recommended for properties adjacent the new channel corridor. These surveys document the physical conditions of the structures and other features

on the neighbouring properties prior to construction and may assist the City, property owners and the contractor in the event of a claim for damage.

Other than minor, temporary restrictions, access to businesses will be maintained during and following construction, in the cases where the property is not being re-developed at the same time as the new channel corridor construction. The use of temporary driveways for some entrances may be required during the construction period.

9.7 Air Quality, Noise and Vibration

The Contractor's activities, specifically the operation of construction equipment, will result in a temporary increase in noise, vibration and dust in the project area during the construction period. It is anticipated that these effects will be short in duration and limited to periods of construction machinery operation, and can be effectively mitigated by providing advance notice of construction to the adjacent businesses, by limiting construction activities to normal working hours, and applying best management practices. If warranted, only non-chloride dust suppressants are to be applied during construction. A comprehensive list of dust prevention and control measures can be found in Environment Canada's "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" (Cheminfo, 2005).

9.8 Traffic and Transportation

Traffic on Jane Street, Highway 7, Doughton Road, and Peelar Road may be temporarily impacted in order to undertake the works and construction access may be from any of these roads depending on the reach of channel that is being constructed. A traffic management plan will be developed in accordance with Ontario Health and Safety Book 7 to ensure the least possible impact, and standard traffic control measures will be implemented to safely co-ordinate traffic flow. Signage and Flagmen will be posted if necessary during these events.

9.9 Construction Monitoring

A monitoring program is recommended to verify the effectiveness of many of the mitigation measures described in the preceding sections, which will be documented in an Environmental Management Plan (EMP). The EMP, which will be developed during detailed design, should include monitoring prior to, during and following construction, and should cover hydrometric as well as ecological parameters to measure and verify the success of the project.

9.10 Permits and Approvals

The complete list of required permits and approvals will be established during detailed design. However, it is expected that the following permits and approvals will be required for construction of the recommended option.

- **Toronto and Region Conservation Authority:** A permit will be required for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 166/06).
- **York Region:** Engineering Approval will be required because the new channel corridor is located adjacent to the Region's right-of-way and other infrastructure.
- **City of Vaughan:** Formal approvals from the City are not required, as the City is the proponent and owns (or will acquire) the lands in the Black Creek Renewal. However, the detailed design must consider input and be coordinated with or reviewed by a number of City departments including Urban Forestry, Parks Development, Development Engineering, and others if required. Confirmation that the project continues to comply with all applicable City policies and by-laws should be sought.

- **Ministry of the Environment, Conservation and Parks:** Depending on construction requirements, registration on the Environmental Activity and Sector Registry or a Permit to Take Water will be required for construction site dewatering.
- **Ministry of Natural Resources and Forestry:** An Information Gathering Form will be submitted at the completion of the Environmental Assessment. While no further approvals are anticipated under the Endangered Species Act, it is recommended that this be confirmed through additional consultation with MNRF staff during detailed design.
- **Ministry of Transportation:** Highway Corridor Management permits are required for construction works within the right-of-way of provincial highways. Additional agreements must also be determined for parts of the new channel corridor that are located on MTO lands.
- **Fisheries and Oceans Canada:** A Self-Assessment will be undertaken during detailed design to determine if a review by Fisheries and Oceans Canada is warranted. If the review by Fisheries and Oceans Canada determines that the project will cause serious harm to fish that are part of or that support a commercial, recreational or Aboriginal fishery, it may be necessary to apply for an Authorization (*Paragraph 35(2)(b)*) Fisheries Act Authorization from the Minister of Fisheries and Oceans). As the proposed design will require the realignment and reconstruction of the watercourse reach, there is the possibility that an Authorization may be needed, and therefore, submission of a Request for Project Review to the DFO would be recommended.
- **Utilities:** Approvals will be required for utility owners for protection and/or relocation of existing above and below ground utilities.

10 SUMMARY

The Vaughan Metropolitan Centre (VMC) – Black Creek Renewal Class Environmental Assessment (Black Creek Renewal EA or EA) builds upon the Black Creek Storm Water Optimization Study Master Plan Class Environmental Assessment (BCSWOS) that was completed by the City in 2012. The BCSWOS identified a range of alternative solutions to reduce flooding and flood damages, improve water quality and limit stream bank erosion in Black Creek within the City. The preferred solution to address flooding was determined to be the reconstruction and renewal of Black Creek between the Edgeley Pond (north of Highway 7) and Highway 407 (referred to herein as the ‘Black Creek Renewal’ or ‘new channel corridor’).

The EA’s purpose is to develop and evaluate potential channel alignments and physical forms for the Black Creek Renewal between Highway 7 and Highway 407. It considers the requirement to mitigate the current flooding and erosion problems in Black Creek as well as potential enhancements to the natural heritage system and public realm associated with the Black Creek corridor. The EA was carried out as a Schedule C project.

The study area is primarily located east of Jane Street, from Highway 7 to Highway 407. The existing urban context is generally characterized as discontinuous development with a mix of built form and vacant lots. The majority of Black Creek through the study area has been realigned and confined to a relatively narrow corridor and does not have adequate capacity to convey storm runoff from large storm events. Multiple driveway and road crossings currently exist along this reach of the creek that also contribute to the flooding issues.

The VMC Black Creek Renewal Class EA study confirmed that there is an opportunity to implement effective flood controls works, enhance the natural heritage system and enhance the public realm through the reconstruction and renewal of the Black Creek valley corridor between Highway 7 and Highway 407.

Public Consultation

A Notice of Study Commencement was prepared and circulated on July 5, 2012 to the stakeholders, which included regulatory agencies, Aboriginal Communities, utilities, and local business and property owners. A Project Status Update was circulated on January 16, 2017, after a period of consultation and facilitation from 2013 to 2016 that was undertaken to resolve a number of land use planning issues affecting the study area. The outcome of the consultation and facilitation process was a land use framework to develop alternative alignments for the Black Creek Renewal. As part of the process, preliminary hydraulic analyses were completed to establish key design elements such as the required channel size and general configuration of the channel embankments and buffer areas, which were carried forward into the Black Creek Renewal EA.

The Public Information Centre (PIC) was held on May 10, 2017. The purpose of the PIC was to present the alternative designs, the evaluation methodology and the preferred design. During the PIC, members of the public and agency representatives were invited to provide comments for consideration in the EA, which were documented and followed up with a response. A Notice of Study Completion was issued on August 9, 2018.

Alternative Designs

The alternatives for this EA focused on the potential alignment configurations for the Black Creek Renewal. The following outlines the alternative alignments.

- Alternative #1 – Do Nothing
- Alternative #2 – New Valley over Existing Alignment

This alignment alternative generally follows the alignment of the existing creek valley, which runs adjacent to Jane Street from Highway 7 to Doughton Road and meanders east before the future

Interchange Way crossing and continues straight in a southerly direction to the existing Highway 407 crossing.

- Alternative #3 – Jane Street Alignment

This alignment alternative will be adjacent to Jane Street for most of the new channel corridor and meander sharply east on the downstream side of Peelar Road to meet the existing Highway 407 culvert.

- Alternative #4 – Meander North of Peelar Road

This alternative alignment follows the valley alignment from Alternatives #2 and #3 for the upstream section up to Doughton Road, but features a meander east between future Interchange Way and Peelar Road before continuing to Highway 407.

Preferred Alternative Design

The alternative designs were comparatively and qualitatively evaluated based on criteria developed within five main categories (technical, natural environment, social, cultural, and financial considerations), which represent the broad definition of the environment in the EA Act. Alternative #4 (Meander North of Peelar Road) was selected as the preferred alignment due to a number of advantages compared to the other alternatives. A summary of the key impacts and benefits of Alternative #4 is provided below:

- Technical Environment – Alternative #4 will be able to convey the Regional Storm Event peak flow rate within the valley to provide flood protection for the area to satisfy the key objective of the Black Creek Renewal. Some construction challenges are expected because sections of the new channel corridor are located away from the existing alignment and will require long tie-in sections if constructed separately from other sections. Conversely, the lower reach of the new channel corridor is located on public lands, which will allow a large portion of the channel to be constructed without private land development, disturbing existing buildings, and in dry conditions, away from the existing watercourse. Some utilities are potentially in conflict with the new channel corridor and will require relocation, including the hydro pole corridor, natural gas line (NPS 12) and 300 mm watermain; however, the 900 mm sanitary trunk sewer appears to be avoided.
- Natural Environment – This alternative is expected to improve fish habitat and aquatic ecosystems by removing physical barriers to connectivity, improving substrate quality, and providing a wider, continuous low flow channel. The terrestrial ecosystem will also benefit by having an overall wider and longer valley corridor that is better vegetated compared to existing conditions. There will be a temporary disturbance of the existing aquatic and terrestrial habitat system during the construction; however, the study area does not contain any significant natural and environmentally sensitive areas and appropriate mitigation measures will be implemented.
- Social / Cultural Environment – There are no expected impacts to the cultural heritage with the new channel corridor; however, a Stage 2 Archaeological Assessment (AA) has been recommended for these lands prior to the construction. The land acquisition requirement for this alternative is the lowest amongst the alternatives. In addition, future development blocks adjacent to the new channel in this alternative will be more contiguous with the neighbourhood and aligned with policies in the VMC Secondary Plan.
- Financial Environment – The capital costs associated with Alternative #4 are estimated at \$39.7 million, which is within the costs for a new channel corridor that was outlined in the Black Creek Financial Strategy completed in 2016 for directly comparable items. Some maintenance costs will be incurred for the new channel corridor, but is roughly equal to the other alternatives. Finally, there will be no damage costs to adjacent properties and businesses for up to the Regional Storm Event.

A preliminary design was prepared for the proposed Black Creek Renewal based on the preferred alternative design (Meander North of Peelar Road), which refined the design based on surrounding grading constraints. Plan, profile and section views of the preliminary design are found on **Drawing Nos. CH01 through CH07**.

Conceptual construction staging was considered for the Black Creek Renewal. Staging scenarios were developed with an aim to construct the new channel corridor in individual sections on both private and public

land, concurrent with the re-development of individual parcels of land adjacent to Black Creek. This will allow for maximum flexibility and benefit to reduce flooding because sections of the new channel corridor can be constructed as soon as adjacent properties are ready for redevelopment. In general, the new channel corridor construction was divided into four major sections, each of which can be constructed individually and integrated together as other sections are completed. From downstream to upstream, the sections are (1) Highway 407 to upstream of Peelar Road, (2) North of Peelar Road to immediately downstream of Doughton Road, (3) Doughton Road and 7683 to 7695 Jane Street, and (4) 7725 Jane Street to Highway 7.

Recommendations for Future Study

A number of studies are required for the detailed design of the Black Creek Renewal:

- Several utility conflicts were identified in this EA and a detailed utility investigation is necessary to determine which utilities need to be relocated and the options of relocation.
- A detailed topographic survey is required to support final grading design for the new channel corridor and identify existing features.
- The archaeological assessments (AA) will continue to a Stage 2 AA, as recommended by the Stage 1 AA completed as part of this EA. If necessary, a Stage 3 AA will be completed.
- A geotechnical investigation is required to determine subsurface soil conditions, groundwater levels, and design recommendations for culvert footings, retaining walls, and slope stability.
- A final grading assessment is required to confirm the minimum freeboard from the Regional Storm Event water surface elevation and overland flow routes into the new channel corridor. Coordination is also required with the detailed design of future road construction surrounding the new channel corridor.
- Natural channel design for the low flow channel necessary in detailed design will need to incorporate recommendations from fluvial geomorphological and aquatic habitat studies for long-term erosion protection and provide fish habitat and passage in the new channel corridor. The TRCA's Crossing Guideline for Valley and Stream Corridors will also need to be incorporated at detailed design.
- Landscape and urban design will be completed for the park areas and other public amenities adjacent to the new channel corridor. In particular, the VMC Consultation and Facilitation process established the urban design vision which will need to be incorporated in detailed design. A Tree Inventory, Preservation Plan and Restoration Plan will be required in detailed design. The southeast corner of the intersection between Highway 7 and Jane Street will also require future study and stakeholder consultation during detailed design.

Construction Impacts and Mitigation

The construction of the new channel corridor will have impacts on the surrounding area including terrestrial features; breeding birds, threatened and endangered bat species; surface water and aquatic habitat; local groundwater; soils; adjacent private and public properties; air quality, noise and vibration; utilities; and traffic and transportation. Best management practices are required to mitigate these impacts and will be detailed specifically for the site in an Environmental Management Plan (EMP), construction staging plans, and Erosion and Sediment Control (ESC) Plans.

A number of permits and approvals are also required with the Toronto and Region Conservation Authority, York Region, Ministry of the Environment, Conservation and Parks, Ministry of Natural Resources and Forestry, Fisheries and Oceans Canada, and local utility owners.

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