VAUGHAN METROPOLITAN CENTRE

Municipal Servicing

Class Environmental Assessment Master Plan

CITY OF VAUGHAN ▪ NOVEMBER 2012

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for double-sided printing

Executive Summary

The Vaughan Metropolitan Centre (VMC) is an area of approximately 190 hectares, presently comprised of mixed use development and vacant lots centred on the Highway 7 corridor east of Highway 400. The VMC is a designated urban growth centre, as identified by Ontario's Growth Plan, with a vision for redevelopment that has been detailed in both the City of Vaughan Official Plan and the VMC Secondary Plan.

The Secondary Plan has advanced a vision for the VMC that includes a distinct downtown containing a mix of uses, civic attractions, and a critical mass of people. 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. The projected population of the VMC area to 2031 is 25,000 residents and 6,500 new jobs (for a total of 11,500 jobs). The projected population under ultimate build-out (2051) is 50,609 residents and 12,345 jobs.

The form of growth anticipated to occur within the VMC will result in greater population densities, enhanced transportation networks, and an increase in the extent of hard surfaces. These changes will lead to an increased demand for water, increased wastewater production, and an increase in surface runoff during rain events.

Assessment of the state of infrastructure present within the VMC indicates that the planned growth cannot be accommodated by the existing infrastructure systems. Therefore, this *Municipal Servicing Class Environmental Assessment Master Plan* has been undertaken to identify and evaluate alternatives for the provision of water, wastewater, and stormwater servicing to support the redevelopment objectives established by the VMC Secondary Plan, culminating in a series of recommended infrastructure improvements. This Class EA Master Plan fulfills the Phase 1 and Phase 2 requirements of the Municipal Class EA process.

The Class EA Master Plan process includes public and review agency consultation, an assessment of the problem and opportunities, evaluation of alternative solutions, assessment of potential effects on the environment, and identification of reasonable measures to mitigate any adverse effects. The preferred solution(s) have been determined based on engineering requirements, environmental considerations, public input, and information gathered during the study.

Opportunities and Constraints

A review of the factors affecting infrastructure planning was undertaken to establish the opportunities and constraints requiring consideration in the implementation of the VMC Secondary Plan. Some of these factors included:

- existing structures, and the associated difficulty in anticipating the phasing of redevelopment;
- features and functions associated with the existing natural environment, existing drainage patterns, and existing subsurface conditions;
- existing and proposed street patterns;
- existing and future watercourse alignments;
- existing stormwater management facilities; and,
- the proposed TTC and BRT alignments and related works.

Recommended Water Servicing Strategy

The analysis of future water demands in relation to existing supply revealed that the Regional supply will be adequate for the redevelopment of the VMC lands, and therefore no major system improvements are necessary. However, new watermains will be required along the new roads identified by the Secondary Plan. The recommended water servicing projects include:

Project	Sched.	Street	From	To	Diam. [mm]	Length [m]
W-01	A	Applewood Cres	Portage Pkwy	Commerce St	300	571
W-02	A	Proposed Road	Commerce St	Edgeley Blvd	400	292
W-03	A	Commerce St	Proposed Road	Interchange Way	400	642
W-04	A	Exchange Ave	Interchange Way	Jane Street	400	984
W-05	A	Interchange Way	Interchange Way	Exchange Ave	300	270
W-06	A	Doughton Road	Interchange Way	Millway Ave	300	300
W-07	A	Millway Ave	Highway 7	Interchange Way	300	460
W-08	A+	Peelar Rd	Jane St	Maplecrete Rd	400	301
W-09	A	Peelar Rd	Maplecrete Rd	Creditstone Rd	300	270
W-10	A	Creditstone Rd	Doughton Rd	Peelar Rd	300	440
W-11	A	Maplecrete Rd	Highway 7	Peelar Rd	400	706
W-12	A	Maplecrete Rd	Portage Pkwy	Highway 7	400	450
W-13	A+	Portage Pkwy	Jane St	Creditstone Rd	300/400	570

Recommended Sanitary Servicing Strategy

The evaluation of the existing sanitary sewer system revealed that the Regional system provides sufficient capacity for the proposed redevelopment of the VMC lands. However, conveyance of local flows to the sanitary trunk sewer and across the TTC subway alignment required an evaluation of alternative approaches, culminating in a recommendation to construct a single, deeper crossing of the subway corridor.

The recommended sanitary servicing strategy provides the main sub-trunk sewer locations through the redeveloped VMC, which can be phased as individual properties redevelop. The recommended sanitary servicing projects include:

Project	Project	From	To	Diam. [mm]	Length [m]
SA-01	Interchange Way Upgrades	North of Highway 7	Jane Street Trunk	450-600	820
SA-02	Barnes Court Upgrade	Barnes Ct	Jane Street Trunk	525	65
SA-03	Doughton Road Upgrade	Maplecrete Rd	Jane St	450	160

While not specifically addressed in this Master Plan, additional local sewers will be required to connect the individual future buildings to these sub-trunks. The exact locations and sizing of these connections can be addressed at the design review stage without any impact to the recommendations presented in this document.

Depending on the phasing of the redevelopment, it is possible that a parcel will propose redevelopment in advance of the reconstruction of the street and sub-trunk that is intended to service that particular property. In that instance, the City can consider slight modifications to this recommendation, such as shifting a recommended sub-trunk one street over from the identified location. These modifications should only be considered in conjunction with an updated system analysis using the Master Plan model. There would be no significant change to the technical, environmental, socio-economic, or financial impacts by installing a sub-trunk in an alternate location in conjunction with a road reconstruction.

Stormwater Management

The stormwater management analysis considered two facets: refinement of drainage patterns within the VMC area to direct all runoff to end-of-pipe treatment facilities, and the provision of suitable stormwater management controls in conjunction with redevelopment to mitigate the environmental impacts of urban runoff.

The VMC area falls entirely within the Black Creek subwatershed, and generally drains in a southerly direction towards the main and west branches of Black Creek. Four distinct drainage areas comprise the VMC area, generally delineated by Highway 7 along the east-west axis and Jane Street along the north-south axis. The north-west, north-east, and south-west quadrants presently drain to existing stormwater management wet ponds. The south-east quadrant presently discharges directly to the main branch of Black Creek without stormwater management controls.

Runoff from the Jane Street and Highway 7 rights-of-way are presently directed, via roadside ditches and culverts, to either the west or main branch of Black Creek.

The recommended future condition for redevelopment of the VMC area includes a drainage regime that is largely consistent with the existing drainage patterns. The recommended stormwater management strategy for the VMC area includes the following components:

- On-site control for each development and redevelopment block. 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 15mm over the building footprint, and an additional 15mm on-site retention over landscaped areas. Capture and utilization of 15mm of every rainfall event to be achieved through the implementation of low impact development measures.
- Remaining runoff from development blocks, rights-of-way, and other uncontrolled areas directed via a dual-drainage storm network to end-of-pipe stormwater management facilities, which discharge to the main and west branches of Black Creek.
- The three existing stormwater management ponds will be retrofitted to satisfy current criteria and targets, with a fourth new pond proposed for the south-east quadrant.

The recommended stormwater management facility projects include:

Project	Project	Location
SF-01	Retrofit of SWM Pond P1	North-east corner of Jane St and Hwy 7
SF-02	Retrofit of SWM Pond P2	South of Portage Pkwy, east of Hwy 400
SF-03	Retrofit of Interchange SWM Pond	South-west corner of VMC, north of Hwy 400 ramp
SF-04	New SWM Pond in SE Quadrant	East of Jane St and the Black Creek main branch, north of Hwy 407 and south of Peelar Road

Conceptual configurations for each stormwater management facility have been developed as part of this study, based on current City of Vaughan design criteria. Design of these facilities should be undertaken as a multi-disciplinary effort that incorporates technical, ecological, and urban design considerations.

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1 Introduction

1.1 Objective and Context

The objective of Ontario's Growth Plan is to develop communities with a better mix of housing, jobs, shopping, and services in close proximity, with policies to guide growth into existing urban areas. The Plan has identified 25 growth centres with associated density targets designed to accommodate future populations of Ontario in a manner that prioritizes sustainability and quality of life.

The Vaughan Metropolitan Centre (VMC) area in Vaughan is a designated urban growth centre, with a vision for redevelopment that has been detailed in both the City of Vaughan Official Plan and the Vaughan Metropolitan Centre Secondary Plan.

This Municipal Servicing Class Environmental Assessment Master Plan has been undertaken to support and complement the recommendations of the VMC Secondary Plan, through evaluation of existing water, wastewater, and stormwater servicing capacities, and the identification of any improvements necessary to service the envisioned forms and densities of development.

1.2 Study Area

The Vaughan Metropolitan Centre comprises an area of approximately 190 hectares, bound by Portage Parkway to the north, Highway 407 to the south, Creditstone Road and Maplecrete Road to the east, and Highway 400 to the west. **Figure 1-1** provides a regional context, while **Figure 1-2** illustrates the study area. The existing urban context may be generally characterized as discontinuous development with a mix of built form and vacant lots.

Figure 1-1: Vaughan Metropolitan Centre Location Plan

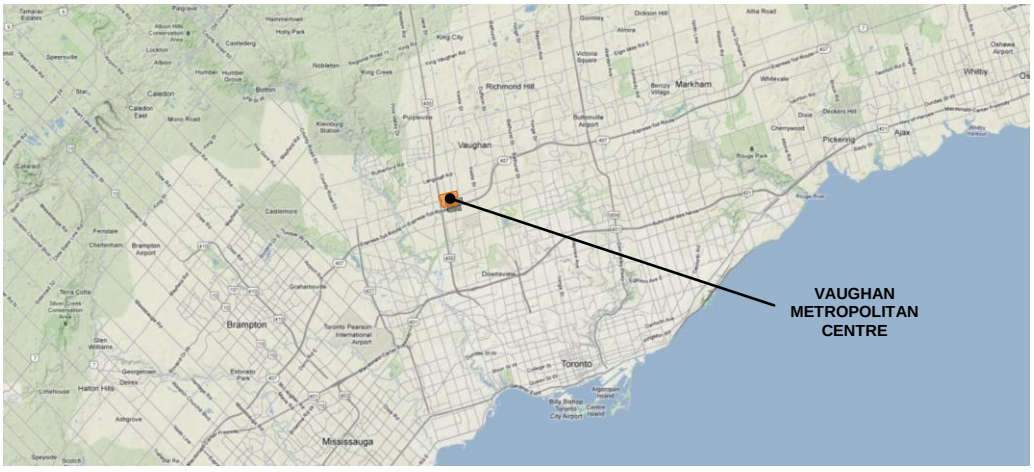
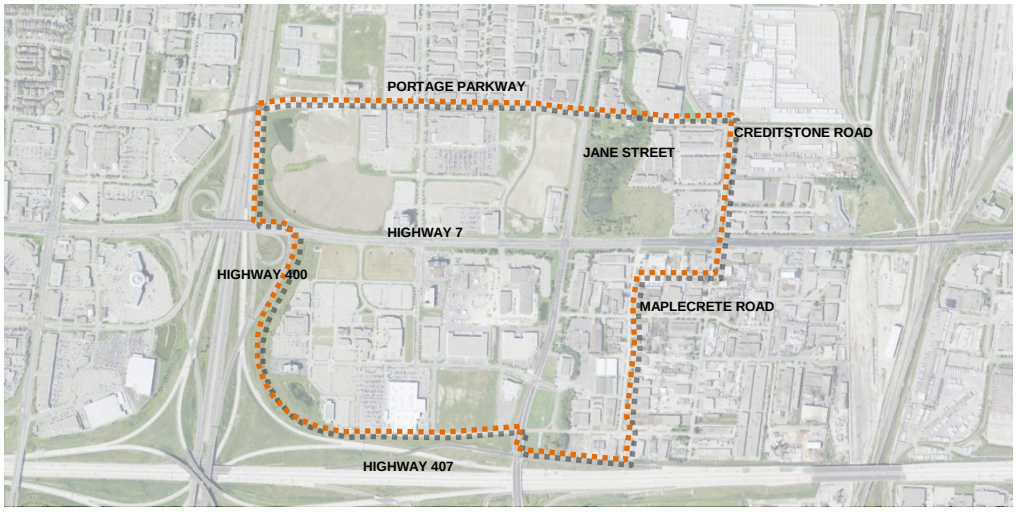


Figure 1-2: Vaughan Metropolitan Centre Study Area



1.3 Master Planning Process

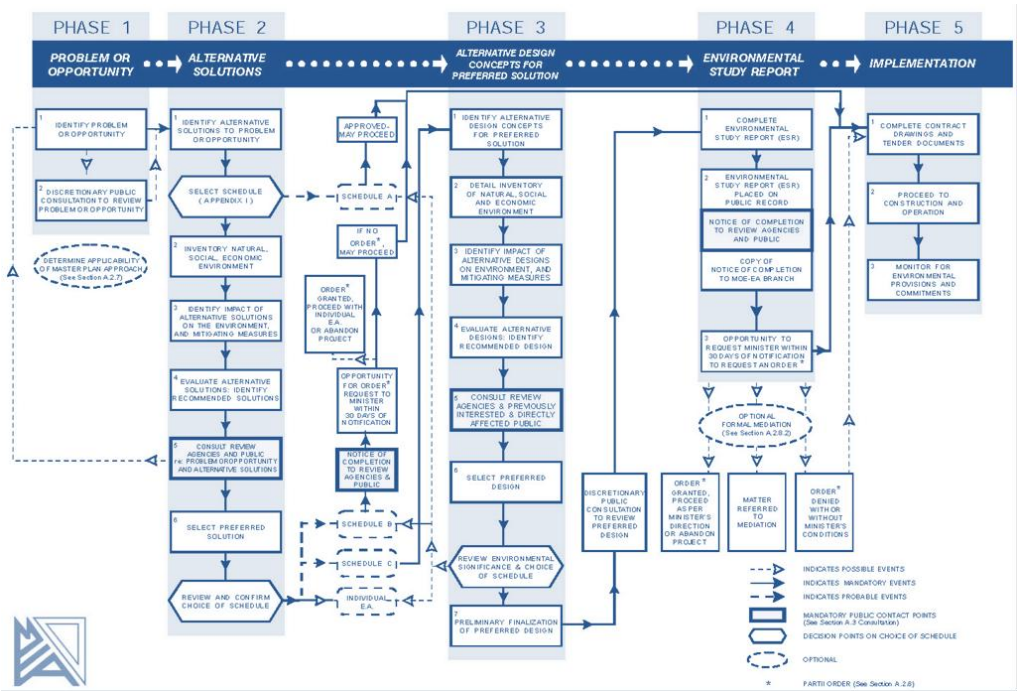
1.3.1 Class Environmental Assessment Process

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

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

A Class EA Master Plan is a long range plan that ties together the various needs of an overall system, and is typically comprised of a set of separate projects that are to be individually implemented over an extended period of time. A Master Plan considers the individual needs of a system within a broader context, and integrates infrastructure needs with environmental assessment planning principals. Master Plans address Phase 1 and 2 of the Municipal Class EA process and include a stakeholder consultation program. **Figure 1-3** illustrates the Class EA planning flowchart.

Figure 1-3: Class EA Planning Flow Chart



A Master Plan is typically subject to the approval of the municipality for which it was prepared. Prior to being approved, a clear and concise Master Plan report is made available for public comment. Following consideration of any public comment and subsequent approval of the Master Plan, the report is reviewed periodically to determine whether there is a need for formal updating of the Master Plan. Details on how and when a specific Master Plan will be reviewed are generally documented in that Master Plan.

The individual projects recommended under a Master Plan may be categorized as Schedule 'A', Schedule 'B' or Schedule 'C' under the Municipal Class EA process. At the time that the individual projects included in the Master Plan are to be implemented, they are subject to the requirements of the Municipal Class EA process. For Schedule 'B' and Schedule 'C' projects identified within a Master Plan, the work undertaken during the development of the Master Plan can be used in support of the requirements of Phases 1 and 2 of the Municipal Class EA.

For example, if an individual project is to be implemented and it is a Schedule 'C' project under the Municipal Class EA process, the work undertaken during the development of the Master Plan can be used in support of the requirements of Phases 1 and 2 of the Municipal Class EA. It would be necessary to fulfill the additional requirements of Phases 3 and 4 in order to consider the project specific issues that were beyond the scope of the Master Planning process. Similarly, for Schedule 'B' projects it would be necessary to fulfill the consultation and documentation requirements

For reference, the Class EA process provides for the following designations for 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 B projects generally include improvements and minor expansions to existing facilities.

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. Schedule C projects generally include the construction of new treatment facilities and major expansions to existing treatment facilities.

1.3.2 VMC Municipal Servicing Class EA Master Plan

The Municipal Infrastructure Group Ltd. (TMIG) was retained by the City of Vaughan to complete this VMC Municipal Servicing Class EA Master Plan, in accordance with the *Municipal Engineers Association Municipal Class Environmental Assessment* document (October 2000, as amended 2007).

The VMC Municipal Servicing Class EA Master Plan has been completed with the intention to fulfill the Phase 1 and Phase 2 requirements of the Municipal Class EA process. Phase 1 involves the identification of the problem (deficiency) or opportunity, while Phase 2 identifies the alternative solutions to address the problem or opportunity by taking into consideration the existing environment, and establishes the preferred solution taking into account public and review agency input.

The Master Plan Class EA process includes public and review agency consultation, an assessment of the problem and opportunities, evaluation of alternative solutions, assessment of potential effects on the environment, and identification of reasonable measures to mitigate any adverse effects. The preferred solution(s) have been determined based on engineering requirements, environmental considerations, public input, and information gathered during the study.

The public consultation component of the EA process is described further in **Section 13**, with associated materials provided in **Appendix A**.

2 Background Information

2.1 Vaughan Metropolitan Centre Secondary Plan

The Vaughan Metropolitan Centre Secondary Plan (**Figure 2-1**) was adopted by Vaughan Council on September 7, 2010. The objectives of the Vaughan Metropolitan Centre Secondary Plan are to expand upon the objectives of the City of Vaughan Official Plan and the Province's Places to Grow framework.

Figure 2-1: VMC Secondary Plan Vision

The Secondary Plan has 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 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 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.

This VMC Municipal Servicing Class EA Master Plan has been undertaken in support of the VMC Secondary Plan, and consequently utilizes the road networks, land use designations, and population projections established through the Secondary Plan process.

2.2 City of Vaughan Official Plan

The Official Plan is a legal document approved by the City of Vaughan and the Region of York, which describes policies and objectives for future land use. It reflects a community vision for future change and development.

Vaughan's new Official Plan 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 Plan provides a policy framework that will guide the following where new development can locate, how existing and future neighbourhoods will be strengthened, how Vaughan's environment will be enhanced, what municipal services will be provided, and when and where Vaughan will grow.

Vaughan's new Official Plan was developed with an extensive program of public consultation, under the banner of Vaughan Tomorrow (www.vaughantomorrow.ca), to establish the framework through which provincial, regional, and municipal planning objectives could be achieved, with particular emphasis on sustainable growth.

The latest update of the Official Plan was completed and adopted by City Council in September 2010, and provides the basis for completion of Secondary Plans throughout the City.

2.3 Green Directions Vaughan

Green Directions Vaughan is the City's Community Sustainability and Environmental Master Plan (CSEMP). It influences virtually 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 Vaughan Metropolitan Centre.

2.4 York Region Official Plan

The Region of York Official Plan is a broad based strategic plan adopted by Council under Section 16 of the Planning Act. The Regional Official Plan provides policies, land use designations and criteria to direct economic, environmental and community-building decisions affecting the use of land. Since there are nine area municipalities within the Region with differing growth aspirations, the Regional Official Plan leaves considerable latitude for an area municipality to provide detailed planning policies within the overall Regional framework. The updated Regional Official Plan was adopted by York Region in December 2009.

2.5 Places to Grow

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

The Growth Plan designated the VMC as one of 25 urban growth centres within the Greater Golden Horseshoe, and provided the basis for the City's Official Plan Update and the VMC Secondary Plan, which together provide the framework for this Municipal Servicing Class EA Master Plan.

2.6 York Region Highway 7 Bus Rapid Transit

York Region's Highway 7 Bus Rapid Transit (BRT) Environmental Assessment 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, including the VMC, with the segment between Highway 400 and Creditstone Road anticipated to be complete by 2015. Design of the Highway 7 improvements necessary to accommodate the BRT were reviewed as part of this Class EA Master Plan.

2.7 Toronto-York Spadina Subway Extension

The Toronto-York Spadina Subway Extension Project will provide 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 6 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 is underway, with an anticipated completion date of 2015.

The designs for both the station and the subway alignment were reviewed in detail in concert with the evaluation of VMC servicing alternatives, as input to the identification of opportunities and constraints, and to optimize the implementation of needed services within the study area where these were proposed in proximity to subway infrastructure.

2.8 York Region Water and Wastewater Master Plan

In November 2009, York Region updated its Water and Wastewater Master Plan to guide the implementation of infrastructure throughout the Region to accommodate the growth projections and land use designations established by the provincial, regional, and municipal planning processes. Completion of the VMC Municipal Servicing Class EA Master Plan included consultation with the Region of York to ensure that the most current water and wastewater infrastructure planning information was utilized in development of the problem statement and corresponding alternative solutions.

2.9 City of Vaughan Water and Wastewater Master Plan

The City of Vaughan is currently completing a Water and Wastewater Master Plan Class EA to identify the infrastructure requirements associated with fulfillment of the projections established by the updated Official Plan. The Water and Wastewater Master Plan will identify alternative infrastructure planning and implementation strategies and select the preferred alternative to meet the City's growth needs, premised upon a time horizon of 2031. Servicing scenarios beyond 2031 will also be

considered to efficiently plan for municipal infrastructure requirements in anticipation of full urbanization and build-out of remaining white belt lands throughout the City. The VMC Municipal Servicing Class EA Master Plan included coordination with the Water and Wastewater Master Plan to ensure consistency in the identification of proposed works.

2.10 City of Vaughan Storm Drainage and Stormwater Management Master Plan

Similar to the Water and Wastewater Master Plan, the City of Vaughan is also completing a Storm Drainage and Stormwater Management Master Plan to identify the storm related infrastructure requirements associated with fulfillment of the updated Official Plan projections. The VMC Municipal Servicing Class EA Master Plan included coordination with the Storm Drainage and Stormwater Management Master Plan to ensure consistency in the identification of proposed works.

2.11 Black Creek Stormwater Optimization Study

The Black Creek Stormwater Optimization Municipal Class EA (Phases 1 and 2, May 2011) has been completed to determine what measures can be implemented to improve stormwater quality and quantity, and minimize erosion and flood potential. The recommendations of this study included the following:

- Regional Storm Flooding Improvements – Provide sufficient capacity within Black Creek to convey the runoff generated by the Regional Storm. The proposed works involve the construction of a new naturalized channel to replace the existing segment of Black Creek between Highway 7 and the Highway 407, with the replacement/addition of crossing structures at Highway 7, Doughton Road, and the future Interchange Way extension east of Jane Street.
- SWM Quality Ponds – These works consist of the retrofit of many existing SWM ponds and the construction of new SWM ponds in the Study Area to provide a water quality control component. Many of these projects have been recommended through previous studies or identified as a requirement for proposed development initiatives.
- Channel Erosion In-stream Restoration Strategies – These works involve in-stream restoration measures to address localized erosion or bank instability issues. In addition, where possible, the retrofit or introduction of SWM ponds will provide supplementary control of stormwater to mitigate erosion potential.

The Black Creek Stormwater Optimization Study incorporated the preliminary findings of this VMC Municipal Servicing Class EA Master Plan, and conversely the findings of the Black Creek Study were used to inform the VMC Secondary Plan, and in the evaluation of stormwater management alternatives as part of this VMC EA.

Specifically, hydrologic modelling completed for the Black Creek subwatershed was utilized to evaluate the extent of stormwater management infrastructure and improvements needed within the VMC, with particular focus on the Edgeley Pond at the northeast corner of Highway 7 and Jane Street.

2.12 Vaughan Metropolitan Centre Streetscape and Open Space Plan

The Vaughan Metropolitan Centre Streetscape and Open Space Plan was initiated by the City in early 2012 to build upon on the planning and urban design framework outlined in the VMC Secondary Plan. Elements of this Municipal Servicing Class EA Master Plan were structured as input to the Streetscape and Open Space Plan.

2.13 City of Vaughan Stormwater Management Retrofit Study

The City of Vaughan Stormwater Management Retrofit Study (Aquafor Beech Limited, December 2007) reviewed the existing state of stormwater management infrastructure throughout the City to generate a prioritized list of potential stormwater management retrofit sites, which included facilities within the VMC study area. As such the study was referenced in the review of stormwater management alternatives considered as part of this VMC Municipal Servicing EA.

3 Description of the Project Area

3.1 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, and the oldest uses within the VMC are industrial. The lands east of Jane are made up of small, individually owned properties with low-scale manufacturing and industrial service uses.

The VMC area presently contains an 8-storey office building, three mid-rise hotels and a number of lowrise, low-density uses, including large-format retail and heavy industrial facilities, all served by surface parking and suburban in their site organization. Although most of the development west of Jane Street was built this century and may remain for the foreseeable future, much of the VMC remains vacant, creating the opportunity for significant intensification and the development of destinations and places befitting a downtown.

Figure 3-1: Vaughan Metropolitan Centre Existing Land Use

3.2 Utilities

Utilities in the VMC area span the full spectrum of services that are typically contained within an employment area. Significant features include an active rail yard to the northeast of the study area, a hydro corridor south of Highway 407, and the Spadina Subway Extension presently under construction, parallel to Jane Street and extending up to Highway 7.

Opportunities to incorporate district heating and cooling strategies as part of the VMC are currently being explored by the City of Vaughan.

3.3 Topography and Drainage

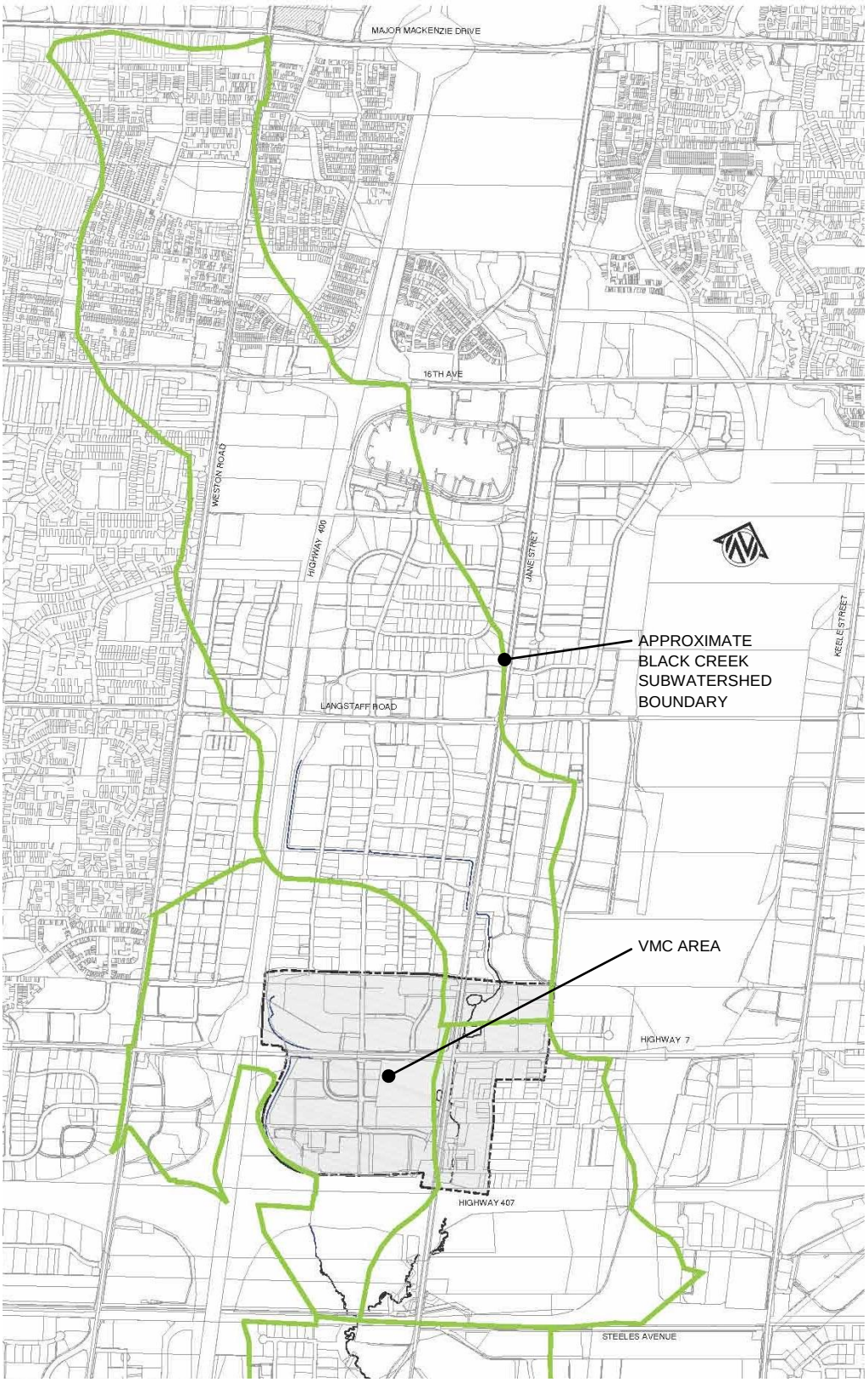
The subject site falls entirely within the Black Creek subwatershed, and generally drains in a southerly direction towards the main and west branches of Black Creek. **Figure 3-2** shows the VMC area within the context of the Black Creek subwatershed. Topography within the VMC area (**Figure 3-3**) shows relatively gentle sloping from the north-east to the south-west.

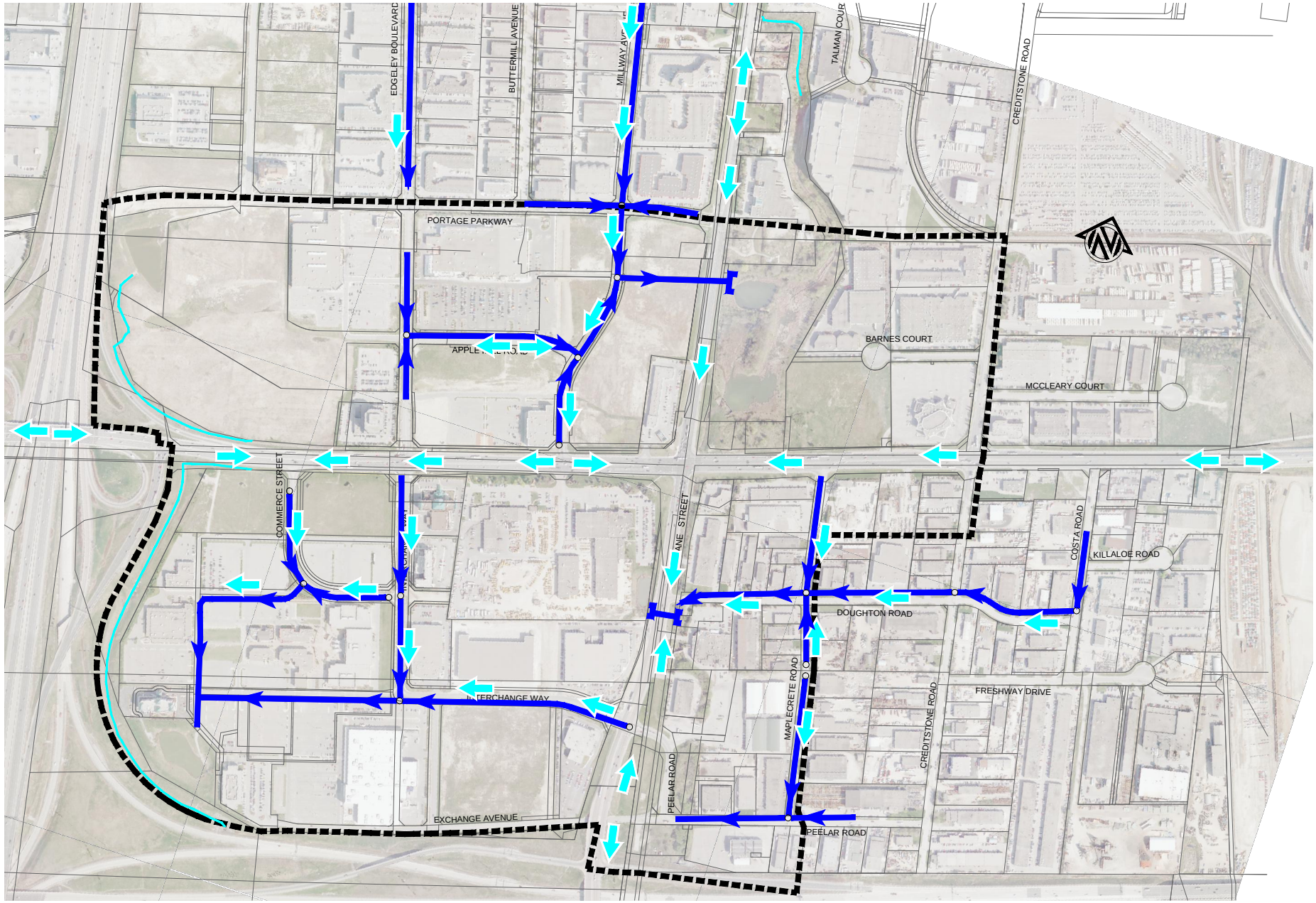
Review of existing road and development patterns within the VMC reveals the following drainage regime:

- *Area north of Highway 7 and east of Jane Street* – This area drains in a westerly direction towards the stormwater management pond located at the north-east corner of the intersection of Highway 7 and Jane Street (the Edgeley Pond).
- *Area north of Highway 7 and west of Jane Street* – Overland flow from this area generally drains in a southerly direction, while storm sewer flow is conveyed to the Edgeley Pond. The undeveloped area approaching Highway 400 and north of Highway 7 drains to the south and west.
- *Area south of Highway 7 and east of Jane Street* – This area drains in a south-westerly direction towards the main branch of Black Creek. There are no SWM facilities in this area.
- *Area south of Highway 7 and west of Jane Street* – This area generally drains to the south and west, towards the Interchange Pond at the south-west limit of the VMC area, adjacent to Highway 400. The existing Toromont commercial block at the south-west corner of Jane Street and Highway 7 possesses a private stormwater management facility, adjacent to Jane Street, which discharges directly to Black Creek via a culvert crossing Jane Street.
- *Jane Street* – Right-of-way drainage is conveyed in a southerly direction via a roadside ditch on the west side of Jane Street, eventually crossing Jane Street via an existing culvert for uncontrolled discharge into the main branch of Black Creek.
- *Highway 7* – For the area east of Millway Avenue the uncontrolled flow is conveyed in a westerly direction through existing roadside ditches and culverts into the main branch of Black Creek. For the area west of Millway Avenue, the uncontrolled flow is conveyed in a westerly direction through existing roadside ditches and culverts into the west branch of Black Creek.

Figure 3-4 illustrates the existing minor and major storm drainage system patterns, based on available as-built drawings. Discussion surrounding existing stormwater management facilities is provided in **Section 4.4**.

Figure 3-2: Black Creek Subwatershed Context





LEGEND

- STUDY AREA
- TRUNK SEWER DIRECTION
- OVERLAND FLOW ROUTE DIRECTION
- BLACK CREEK

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VAUGHAN METROPOLITAN CENTRE

MUNICIPAL SERVICING CLASS
ENVIRONMENTAL ASSESSMENT
MASTER PLAN

EXISTING MAJOR AND MINOR DRAINAGE

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	3-4

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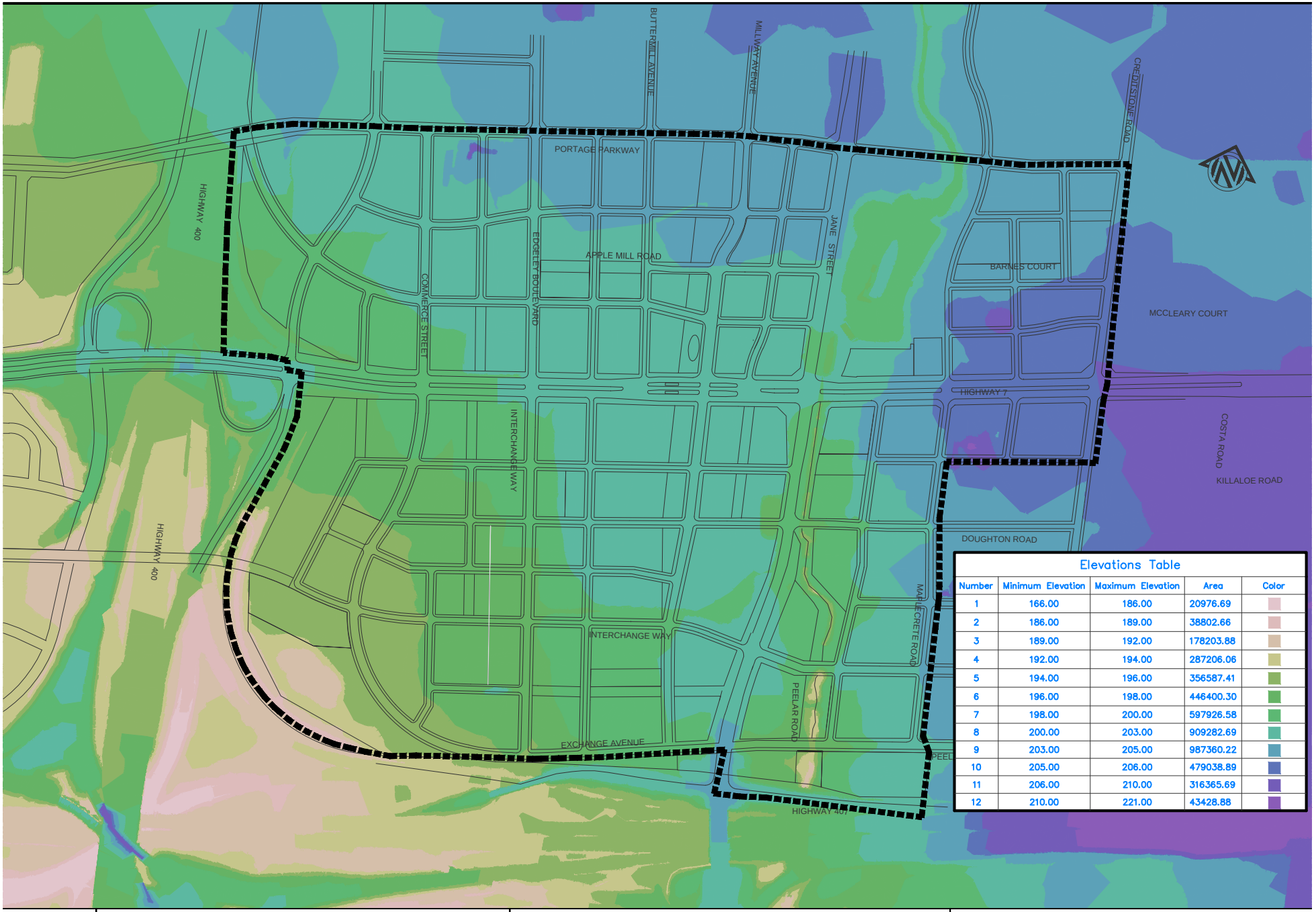

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Area	Color
1	166.00	186.00	20976.69	
2	186.00	189.00	38802.66	
3	189.00	192.00	178203.88	
4	192.00	194.00	287206.06	
5	194.00	196.00	356587.41	
6	196.00	198.00	446400.30	
7	198.00	200.00	597926.58	
8	200.00	203.00	909282.69	
9	203.00	205.00	987360.22	
10	205.00	206.00	479038.89	
11	206.00	210.00	316365.69	
12	210.00	221.00	43428.88	

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LEGEND

STUDY AREA

VAUGHAN METROPOLITAN CENTRE
MUNICIPAL SERVICING CLASS
ENVIRONMENTAL ASSESSMENT
MASTER PLAN

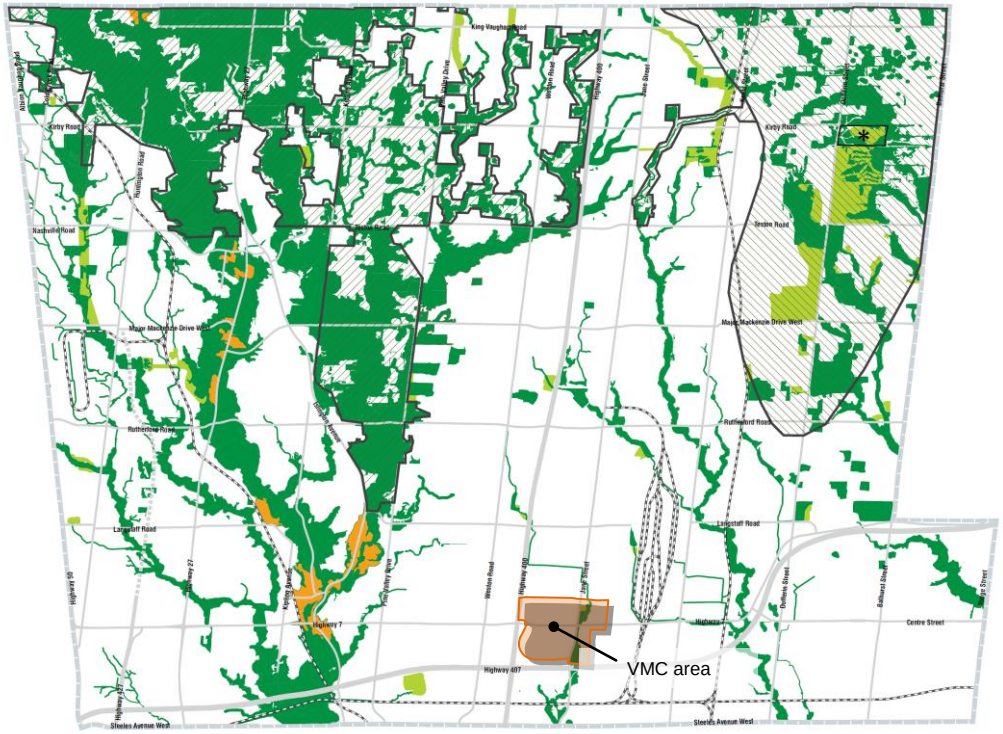
EXISTING CONDITIONS
ELEVATION VIEW

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	3-3

3.4 Natural Environment

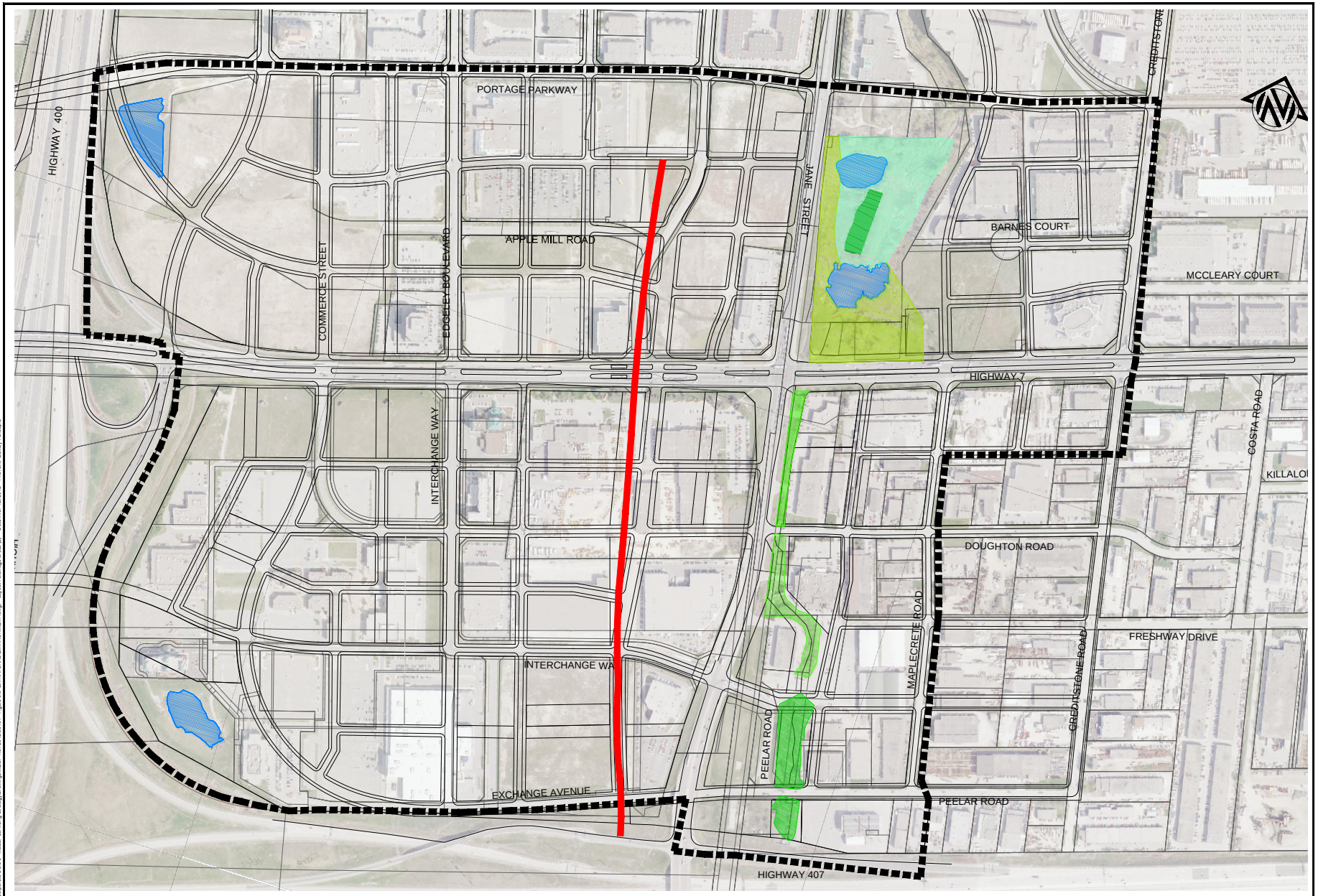
Several studies have been completed in recent years that have provided an assessment of the natural features and functions within the VMC area, including Vaughan's Natural Heritage in the City report (Aecom, April 2010). This document provided input to the Vaughan Official Plan update, and established an overall characterization of Vaughan with respect to the natural environment, through collaboration with York Region, the Toronto and Region Conservation Authority (TRCA), and provincial and federal agencies. **Figure 3-5** illustrates the results of this work, and demonstrates a notable dearth of environmental features within the VMC area.

Figure 3-5: Vaughan Natural Heritage Network (Schedule 2 of Official Plan)



More focused ecological assessment of the study area occurred through the Black Creek Stormwater Optimization Study EA (Phases 1 and 2, Aecom, May 2011), which was referenced as input to this study. Virtually all of the VMC lands are fully urbanized. **Figure 3-6** illustrates the existing stormwater management facilities and channelized watercourses that can be considered for retrofitting, restoration, and enhancement through implementation of the VMC Secondary Plan.

The two SWM ponds near Highway 400 provide no vegetation or aquatic habitat, and enhancement of these areas would be beneficial. The SWM facility at the corner of Highway 7 and Jane Street has become naturalized over the past two decades, and consideration could be given to potentially maintaining portions of this facility. The channelized portions of Black Creek downstream of Highway 7 could be enhanced through the provision of wider buffers and improved vegetation along the stream corridor.



LEGEND

- SWM POND
- OAK DECIDUOUS FOREST
- OPEN CATTAIL MARSH
- CULTURAL MEADOWS AND WOODLANDS
- SHRUBS ALONG CHANNELIZED CREEK
- TRRED FLOODPLAIN
- TTC ALIGNMENT
- STUDY AREA

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EXISTING NATURAL ENVIRONMENT CONDITIONS

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	3-6

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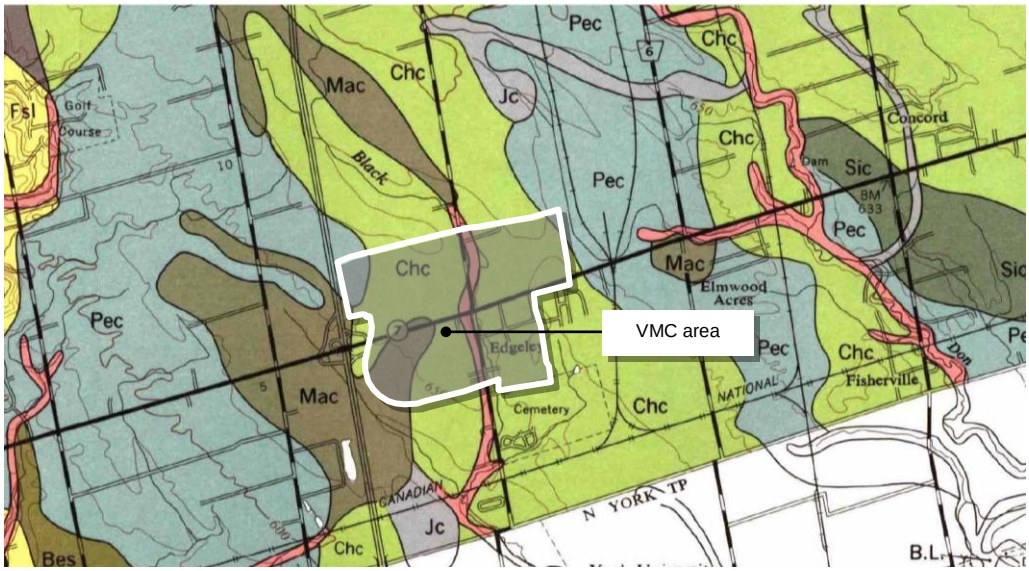
3.5 Surficial Geology

The VMC area is located within the south slope physiographic region of the Humber River Watershed. The groundwater direction of flow within the Humber River Watershed is from the Oak Ridges Moraine in the north towards Lake Ontario in the south (The Humber River Watershed Plan, TRCA, June 2008).

The soils within the subject site are predominantly clay soils (Mac – Malton Clay, Chc – Chinguacousy Clay, Pec – Peel Clay) with low permeability coefficients, according to the soil map of York County and the Humber River Watershed Hydrology Update. These soils are considered to be Type C/D under the SCS hydrologic soil group classification. **Figure 3-7** illustrates the surficial soils present in the VMC area.

More detailed geotechnical investigations were undertaken within the study area, specifically focused in the areas of proposed SWM facilities as input to the design parameters and sizing of these facilities. Results of these investigations are provided in **Section 11.5.3** and **Appendix E**.

Figure 3-7: Surficial Soils



4 Existing Infrastructure

4.1 Water Supply

The VMC area lies within York Region Pressure District 6 (PD-6). PD-6 reservoirs are typically kept with top water levels (TWLs) of approximately 262 m, and about 88 percent of serviced points are located between 190 m and 225 m in elevation. The PD-6 water supply and distribution system (see **Figure 4-1**) consists of City-operated distribution mains and Regional transmission mains. The Regional system generally consists of those pipes that have a diameter of 500 mm and greater.

The water supply for Vaughan PD-6 is provided from six supply points:

- South Maple Reservoir (York Region; TWL = 261.5 m);
- South Richmond Hill Reservoir (York Region; TWL = 262.25 m);
- Bathurst and Major MacKenzie Metering Chamber (Town of Richmond Hill);
- Bathurst and Highway 7 Metering Chamber (Town of Markham; HGL = 260.3);
- Keele Pumping Station (City of Toronto; discharge HGL = 262.83 m); and,
- Weston and Rutherford (Peel Region)

The southern water supply from the City of Toronto is currently being phased out, and the feed from Peel will increase to compensate.

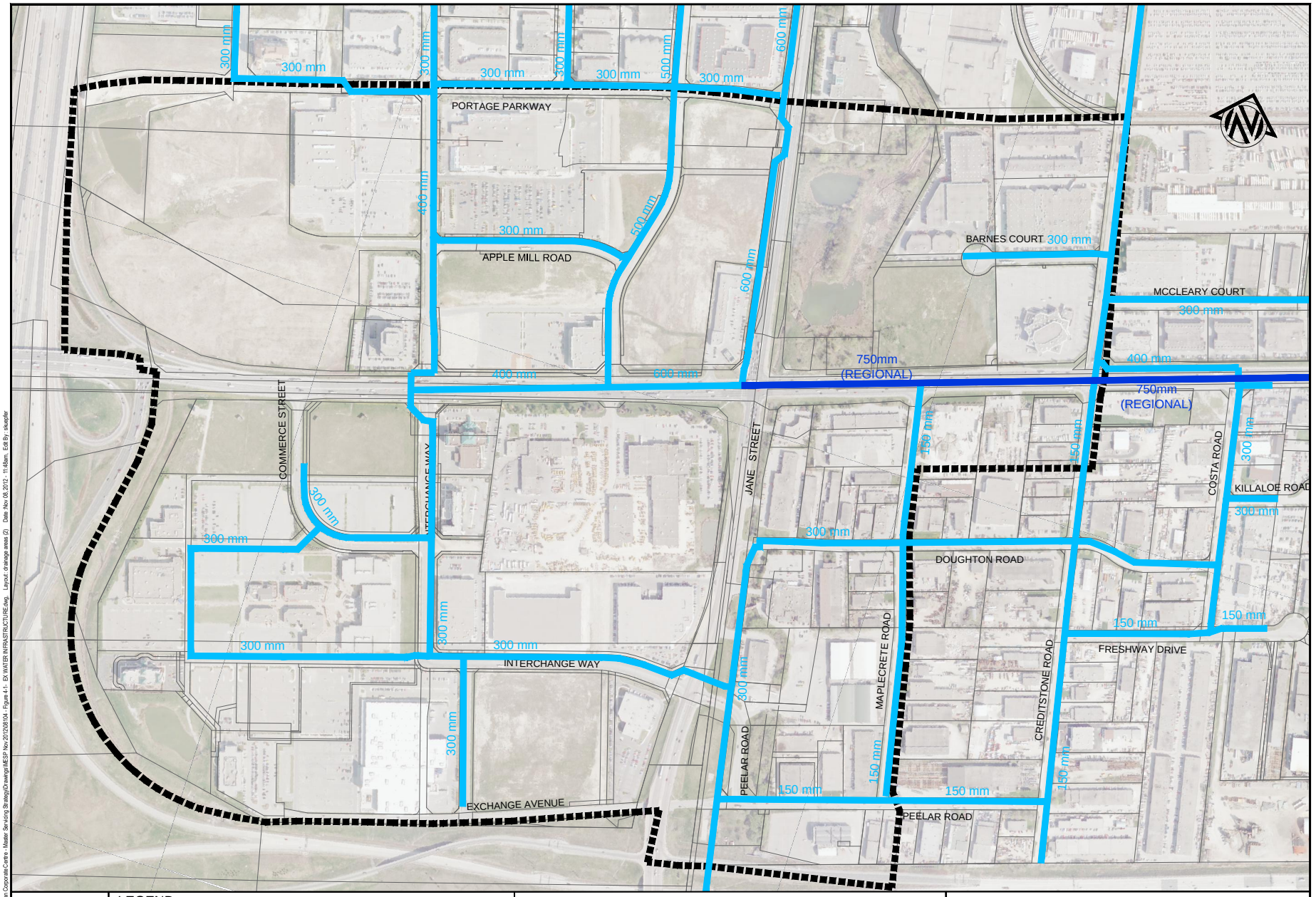
4.2 Sanitary Servicing

The VMC area lies within Vaughan's Jane Street sanitary trunk sewer system (see **Figure 4-2**), which consists of the following sub-trunks:

1. The Jane Street West Collector, which services the area west of Jane Street and north of Highway 7;
2. The Jane Street East Collector, which services the area east of Jane Street and north of Highway 7;
3. The Steeles Avenue Collector, which services the area east of Jane Street and south of the CN Railroad; and,
4. The Adesso Drive Collector, which services the area west of Jane Street and south of the CN Railroad.

These collectors all discharge to York Region's Black Creek Sewage Pumping Station, which pumps the flows through the York-Durham Sewage System (YDSS), terminating at the Duffin Creek Water Pollution Control Plant (WPCP) in Pickering.

The entire VMC area discharges to the Jane Street East and West Collectors.



LEGEND

- STUDY AREA
- EXISTING DISTRIBUTION SYSTEM
- REGIONAL WATERMAIN

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EXISTING WATER SYSTEM

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	4-1

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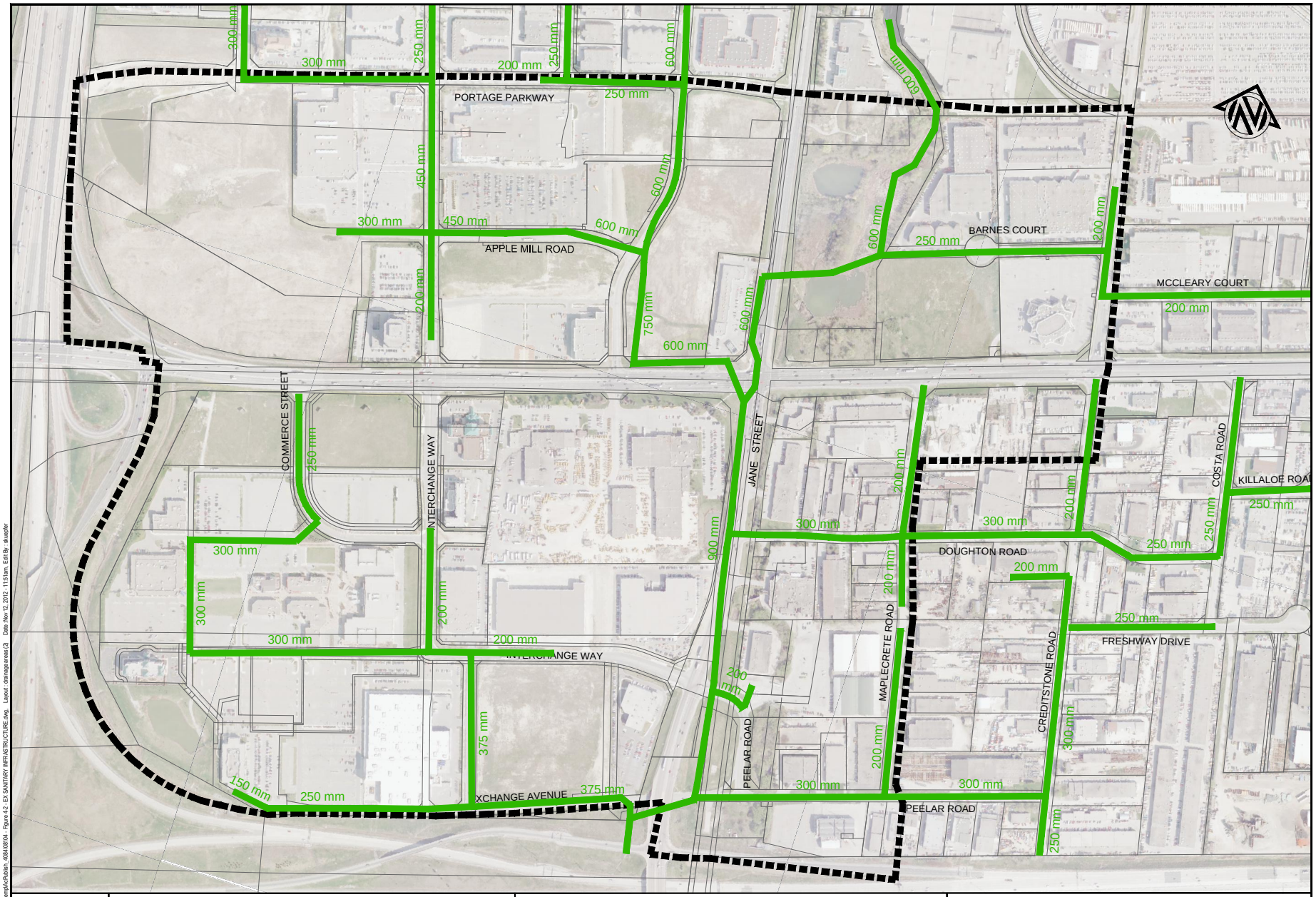

LEGEND

- STUDY AREA
- EXISTING SANITARY SYSTEM

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EXISTING WASTEWATER SYSTEM

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	4-2

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4.3 Storm Drainage Infrastructure and Black Creek

Developed parcels within the VMC area are presently serviced via a dual drainage system designed on the basis of the prevailing City of Vaughan design criteria. Storm sewers were designed to capture and convey runoff from a 5-year return period event. Overland flow routes, primarily roads, provide overland flow conveyance for the excess runoff generated by a 100-year return period event, less the 5-year runoff captured by the storm sewer system.

Individual lots provide on-site control to restrict the peak release rate from the lot to the 2-year post development runoff rate. On-site storage is provided to control runoff generated by the 100-year return period event to the 2-year post development flow rate. In addition, rooftop controls within the VMC were designed to control release rates to 42 L/s/ha. Existing drainage patterns within the VMC were determined using available plan and profile drawings. Elements of the storm sewer and overland flow system are illustrated in **Figure 3-4**, in **Section 3.3**.

From a storm drainage perspective, the west and main branches of the Black Creek traversing the VMC area represent the ultimate destinations for storm runoff generated over the area. The Black Creek Stormwater Optimization Study (Phases 1 and 2, Aecom, May 2011) was commissioned by the City of Vaughan to address a number of challenges presently faced by the system. The following excerpt from the Study summarizes the existing state of the Black Creek system.

- *A significant number of structures and municipal infrastructure is located within the regulatory floodplain, including portions of Highways 400 and 7, and Jane Street;*
- *Due to insufficient capacity of the Black Creek channel and associated hydraulic structures at certain locations, particularly along Jane Street between 407ETR and Highway 7, flooding of structures, roadways and municipal infrastructure occurs during comparatively frequent storm events;*
- *Limited stormwater quality treatment features within a majority of the older industrial areas of the Study Area is contributing to the degraded water quality within Black Creek;*
- *Channel erosion is occurring within the natural portion of the Black Creek between Steeles Avenue and the 407ETR;*
- *The proximity of existing structures and municipal infrastructure adjacent to Black Creek poses a significant constraint to the implementation measures to increase the hydraulic capacity of the existing channel corridor.*

The Black Creek Stormwater Optimization Study has assessed the opportunities, constraints, and alternatives for improvement of the channel both within and beyond the VMC area to address these and other concerns, concluding with a preferred channel configuration and related recommendations. The study was undertaken within the framework of the Class EA Master Plan process, and included coordination with this study as described in **Section 2.11**.

The evaluations of storm related infrastructure within this document have differentiated between those measures associated with drainage and the measures associated with stormwater management, to account for the considerations, limitations, opportunities, and potential solutions that are specific to these elements.

4.4 Stormwater Management Infrastructure

In addition to the storm drainage infrastructure, with corresponding site controls, described in **Section 4.3**, three existing stormwater management ponds service the majority of the VMC area, while a fourth existing pond is under private ownership. **Figure 4-3** illustrates the locations of the existing SWM facilities within the VMC along with their associated tributary areas.

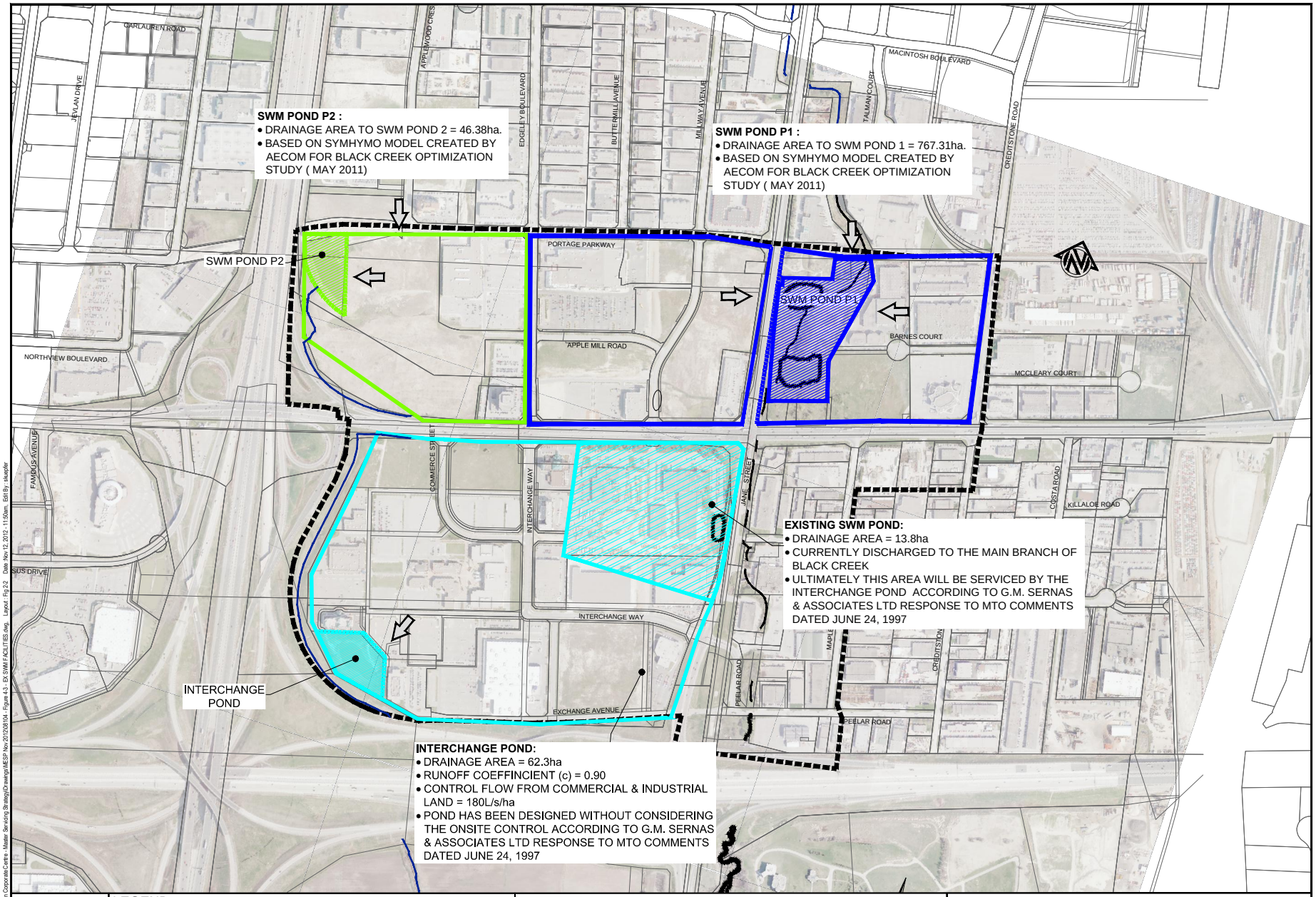
SWM Pond P1 (the Edgeley Pond, north-east quadrant) is located on the north-east corner of Jane Street and Highway 7. The facility was designed in the late 1980's by Ander Engineering, per their report dated July 1986, and provides online quantity control for an upstream drainage area of 767.31 ha along the main branch of Black Creek. Controlled flows from the facility are managed via a control structure and culvert crossing beneath Highway 7 to the downstream reach of Black Creek. This pond was identified as Pond 18 in the City of Vaughan Stormwater Management Retrofit Study (2007).

SWM Pond P2 (north-west quadrant) is located at the north-west corner of the VMC area, adjacent to Highway 404. The facility provides quantity control for an upstream drainage area of 46.38 ha, and discharges to the west branch of Black Creek.

The Interchange Pond (south-west quadrant) provides quality, erosion, and quantity control for a 62.3 ha drainage area located south of Highway 7 and west of Jane Street. The facility discharges controlled flows to the west branch of Black Creek. The facility was designed by G.M. Sernas and Associates in June 1997, and correspondence associated with the design has indicated that the design of the pond did not include consideration for any onsite controls within the drainage area, nor the existence of the Toromont private SWM facility.

The Toromont Pond (private pond, south-west quadrant) appears to have been constructed as an interim stormwater management measure in advance of the construction of the Interchange Pond, specifically to service the 13.8 ha commercial area at the south-west corner of Jane Street and Highway 7. The pond discharges via a culvert under Jane Street to the main branch of Black Creek.

As noted in **Section 3.3**, developed lands south of Highway 7 and east of Jane Street are not presently serviced by a stormwater management pond.


SWM POND P2 :
• DRAINAGE AREA TO SWM POND 2 = 46.38ha.
• BASED ON SYMHYMO MODEL CREATED BY AECOM FOR BLACK CREEK OPTIMIZATION STUDY (MAY 2011)
SWM POND P1 :
• DRAINAGE AREA TO SWM POND 1 = 767.31ha.
• BASED ON SYMHYMO MODEL CREATED BY AECOM FOR BLACK CREEK OPTIMIZATION STUDY (MAY 2011)
SWM POND P2
SWM POND P1
INTERCHANGE POND
EXISTING SWM POND:
• DRAINAGE AREA = 13.8ha
• CURRENTLY DISCHARGED TO THE MAIN BRANCH OF BLACK CREEK
• ULTIMATELY THIS AREA WILL BE SERVICED BY THE INTERCHANGE POND ACCORDING TO G.M. SERNAS & ASSOCIATES LTD RESPONSE TO MTO COMMENTS DATED JUNE 24, 1997
INTERCHANGE POND:
• DRAINAGE AREA = 62.3ha
• RUNOFF COEFFINCIENT (c) = 0.90
• CONTROL FLOW FROM COMMERCIAL & INDUSTRIAL LAND = 180L/s/ha
• POND HAS BEEN DESIGNED WITHOUT CONSIDERING THE ONSITE CONTROL ACCORDING TO G.M. SERNAS & ASSOCIATES LTD RESPONSE TO MTO COMMENTS DATED JUNE 24, 1997
CARLAUREN ROAD
JEVLAN DRIVE
APPLEWOOD CRES
EDGELEY BOULEVARD
BUTTERMILL AVENUE
MILLWAY AVENUE
TALMAN COURT
MACINTOSH BOULEVARD
CREDITSTONE ROAD
PORTAGE PARKWAY
APPLE MILL ROAD
BARNES COURT
MCCLEARY COURT
NORTHVIEW BOULEVARD
FAMOUS AVENUE
COMMERCE STREET
INTERCHANGE WAY
JANE STREET
COSTA ROAD
KILLALOE ROAD
SUS DRIVE
EXCHANGE AVENUE
PEELAR ROAD
CREDITSTON
LEGEND.
STUDY AREA
SWM POND P1 DRAINAGE AREA BOUNDARY WITHIN OPA 500
SWM POND P1
SWM POND P2 DRAINAGE AREA BOUNDARY WITHIN OPA 500
SWM POND P2
INTERCHANGE POND DRAINAGE AREA BOUNDARY
EXISTING SWM POND DRAINAGE AREA TO MAIN BRANCH OF BLACK CREEK
INTERCHANGE POND
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PROJECT No. 08104
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5 Design Criteria

5.1 Water Servicing

The VMC water system consists of components owned by either the City of Vaughan or the Region of York, and the respective elements must meet the design criteria of the appropriate municipality.

All of the distribution mains (generally 400 mm in diameter and smaller) should be designed based on the City's criteria, and the Regional infrastructure (transmission mains, pumps, etc.) to the Region's criteria. The Municipal and Regional criteria are summarized in **Table 5-1**.

Table 5-1: Water Supply System Design Criteria

	City of Vaughan [1]	York Region
Average Day Domestic Demand	450 Lpcd	298 Lpcd [2]
Average Day Employment Demand	Not specified	267 Lpcd [2]
Maximum Day Demand Factor	2.0	1.61 [2]
Peak Hour Demand Factor	4.5	Not specified
Fire Flow Demand – Commercial	25,000 L/min (417 L/s)	17,000 L/min (283 L/s) [3]
Minimum Pressure (Peak Hour Demand)	275 kPa (40 psi)	275 kPa (40 psi) [3]
Maximum Pressure (Min Hour Demand)	690 kPa (100 psi)	700 kPa (100 psi) [3]
Minimum Fire Flow Pressure	140 kPa (20 psi)	140 kPa (20 psi) [3]

Notes:

1. Source: City of Vaughan Design Criteria – Chapter 6
2. Source: Regional Municipality of York Long Term Water Project Master Plan Update (MacViro Consultants Inc, April 2004).
3. Source: York Region Transportation and Works Department (Water/Wastewater Branch) Design Guidelines – Section 14

5.2 Sanitary Servicing

As with the design criteria for water supply, the sanitary sewer system consists of components owned by either the City of Vaughan or the Region of York, and hence the respective elements must similarly meet the design criteria of the appropriate municipality.

All of the local sewers should be designed based on the City's criteria, and the Regional infrastructure (major collectors, pumping stations, etc.) to the Region's criteria. The Municipal and Regional criteria are summarized in **Table 5-2**.

Table 5-2: Sanitary Sewer System Design Criteria

	City of Vaughan [1]	York Region [2]
Average Daily Residential Flow	450 Lpcd	265 Lpcd
Average Day Industrial Flow	0.500 L/ha/s	160 Lpcd (90-125 persons/ha)
Average Day Commercial Flow	0.400 L/ha/s	160 Lpcd (90-125 persons/ha)
Peaking Factor	Harmon	Harmon
Infiltration Allowance	0.23 L/ha/s	1:25 yr storm
Maximum Velocity	3.0 L/s	3.0 L/s

Notes:

1. Source: City of Vaughan Design Criteria – Chapter 5. The City's Design Criteria are currently under review.
2. Source: York Region Transportation and Works Department (Water/Wastewater Branch) Design Guidelines – Section 15

5.3 Storm Servicing and Drainage

Current City of Vaughan design criteria stipulates that storm sewers shall be designed to capture and convey, at a minimum, runoff generated by a 5-year return period storm, with overland flow routes provided to convey the runoff generated by a 100-year storm less the 5-year runoff captured by the storm sewer system.

Drainage patterns within the VMC area are largely driven by existing topography and historic grading design. In comparing the existing road fabric to the road network proposed by the VMC Secondary Plan, a number of key roads and intersections are to be maintained in the future condition. As a result, within the context of defining a storm drainage and stormwater management strategy as part of the VMC buildout, the ability to modify existing drainage patterns is limited. In addition, the pace and staging of development will be driven by market forces and hence cannot be easily predicted, which further restricts large-scale change to existing drainage, grading, and servicing patterns.

5.4 Stormwater Management

Relevant stormwater management design criteria for the VMC area have been compiled as part of this study and are in accordance with City of Vaughan Design Criteria, Toronto and Region Conservation Authority (TRCA) standards, and the Ontario Ministry of Environment (MOE) Stormwater Management Planning and Design Manual (March 2003). Specific criteria are defined as follows:

Water Quality Control: Enhanced water quality protection, equivalent to the removal of 80% of total suspended solids (TSS) from runoff before discharge to receiving water bodies.

Erosion Control: For the Black Creek subwatershed, TRCA has identified that runoff from a 25mm storm event be detained for 48 hours for erosion attenuation.

Water Quantity Control: The Humber River Watershed Study (1997) has identified that post-development peak flows be controlled to pre-development targets based on established unit flow rates. The unit flow equations are listed in **Table 5-3**. Within the equations *Q* represents peak flow in litres per second per hectare, while *A* represents the pre-development tributary area in hectares. The equations are premised on the use of 6-hour AES storm distributions in the sizing of proposed SWM facilities. Emergency spillways must also consider the regional storm (Hurricane Hazel), with the design of these to be based on peak flows generated by the greater of the 100-year return period or regional storm.

Table 5-3: Humber River Unit Flow Equations

Return Period	Flow-Area Equation
2-Year	Q = 7.745-0.762ln(A)
5-Year	Q = 11.468-1.123ln(A)
10-Year	Q = 13.877-1.342ln(A)
25-Year	Q = 17.381-1.690ln(A)
50-Year	Q = 20.164-1.973ln(A)
100-Year	Q = 22.973-2.256ln(A)

Water Balance: In recent years TRCA has stressed consideration for water balance in the formulation of stormwater management strategies. Similarly, the City of Toronto has established a criterion that stipulates the capture and reuse of 5mm from every rainfall event as part of their Wet Weather Flow Management Guideline. While not directly applicable within the City of Vaughan, the effectiveness of on-site and low impact development (LID) measures should be evaluated given the potential benefits of achieving water balance, reducing storm sewer and end-of-pipe infrastructure requirements, and lessening the severity of observed flooding concerns within the Black Creek subwatershed.

In addition, distributed or non-structural approaches to runoff flow and volume management should be considered for consistency with the principles of sustainability and the Green Directions Vaughan framework, especially where these approaches can be demonstrated to provide an improved level of service with respect to mitigating the impacts of urbanization on the environment, better the adaptability of infrastructure to changing climate, and alleviate long term infrastructure spending requirements through reduced life cycle costs.

6 Future Conditions

6.1 Planned Land Usage and Population

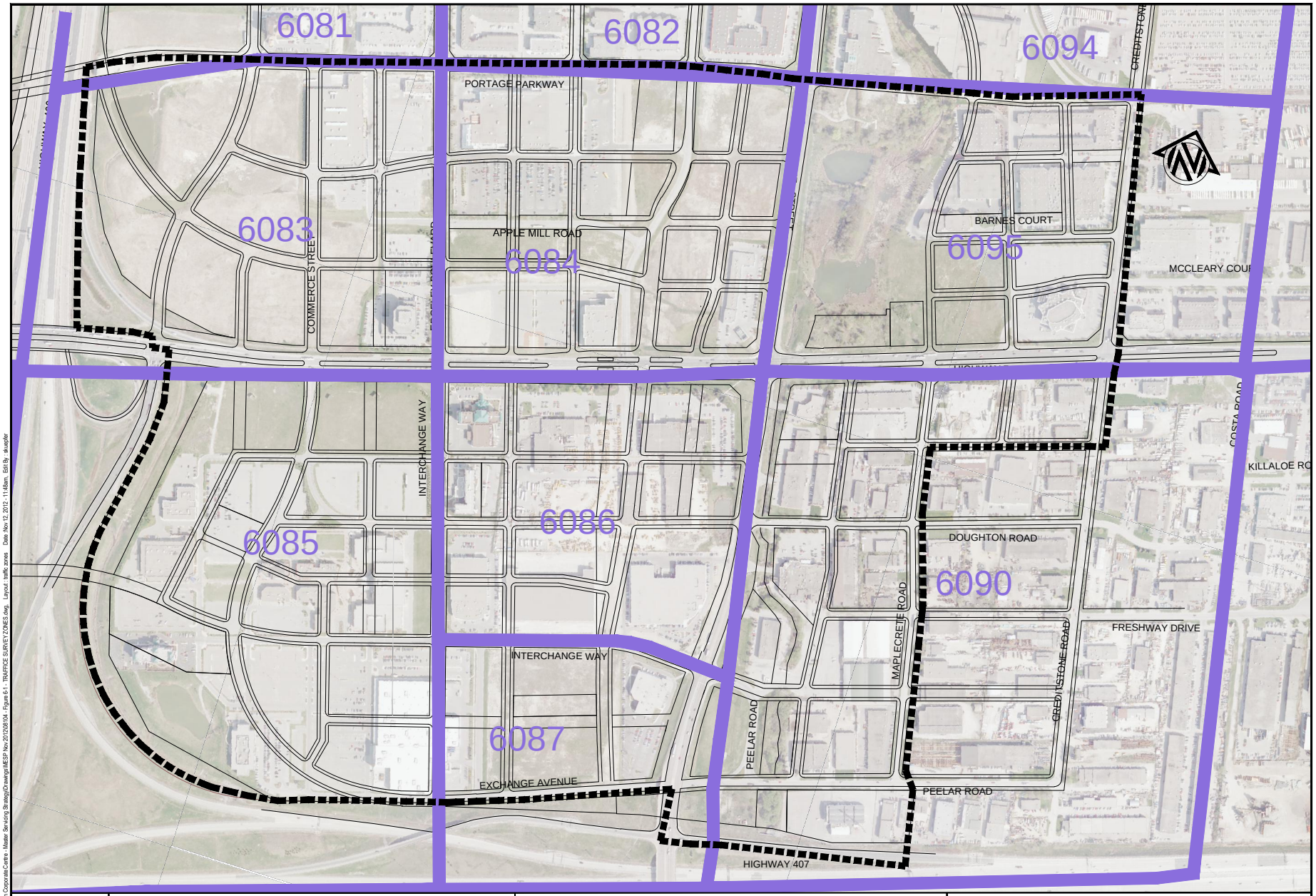
As described in **Section** 2, Vaughan's updated Official Plan and the VMC Secondary Plan have advanced the Province's Growth Plan recommendations to establish the VMC area as an urban centre. The VMC area has been envisioned as a downtown with a compact urban form including an integration of land uses and transit. With its streets, sidewalks, promenades, squares, parks, gardens, and greenways being integral to the image and physical quality of the community, the area will become the centre of urban activity in Vaughan.

From a master servicing perspective, key information necessary in the assessment of infrastructure capacities and requirements includes the proposed land use, corresponding population densities, and the anticipated transportation network, all of which have been defined through the VMC Secondary Plan process.

The VMC is intended to include 12,000 new residential units by 2031, accounting for a total residential population of approximately 25,000. The Secondary Plan area is also expected to accommodate 6,500 new office, retail, and service jobs by 2031, for a potential total employment of 18,000. While not specifically identified in the VMC Secondary Plan, a conservative estimate of the ultimate build-out of the area suggests a total residential population of 55,000, along with 22,000 total jobs. The population projections are summarized in **Table 6-1** for the seven Traffic Survey Zones that comprise the VMC area (see **Figure 6-1**).

Table 6-1: Vaughan Metropolitan Centre Population Projections

Traffic Survey Zone	2006		2021		2031		Build-Out (2051)	
	Pop	Jobs	Pop	Jobs	Pop	Jobs	Pop	Jobs
6083	0	1,973	1,296	2,823	2,100	2,823	5,259	2,072
6084	0	1,973	5,184	4,423	8,400	4,423	11,546	6,500
6085	0	1,025	1,313	1,825	2,100	1,825	7,561	3,975
6086	0	342	2,597	1,942	4,200	1,942	8,036	4,055
6087	0	342	410	692	600	692	2,751	1,677
6090	0	4,954	2,024	5,104	3,100	5,104	7,319	1,455
6095	0	949	2,947	1,249	4,600	1,249	7,644	2,646
TOTALS	**0**	**11,558**	**15,771**	**18,058**	**25,100**	**18,058**	**50,116**	**22,380**



LEGEND

STUDY AREA

TRAFFIC ZONE BOUNDARY

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TRAFFIC SURVEY ZONES

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	6-1

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6.2 Opportunities and Constraints

A review of the factors affecting infrastructure planning was undertaken to establish the opportunities and constraints requiring consideration in the implementation of the VMC Secondary Plan. These factors are summarized below, with opportunities and constraints illustrated on **Figure 6-2** and **Figure 6-3**, respectively.

6.2.1 Existing Structures

While the VMC area is slated for full redevelopment based on the recommendations of the Secondary Plan, the scheduling and phasing of the redevelopment will be driven primarily by market forces. As such, it is difficult to anticipate when individual land parcels will proceed to redevelopment.

As such, some of the proposed streets (where infrastructure would ideally be located) will be constrained indefinitely by the structures that currently occupy those sites. Those constrained future roads are therefore not ideal locations for major trunk infrastructure, or infrastructure that will be required to service the areas closest to the subway station, where early redevelopment potential is most likely.

6.2.2 Existing and Future Watercourse Alignments

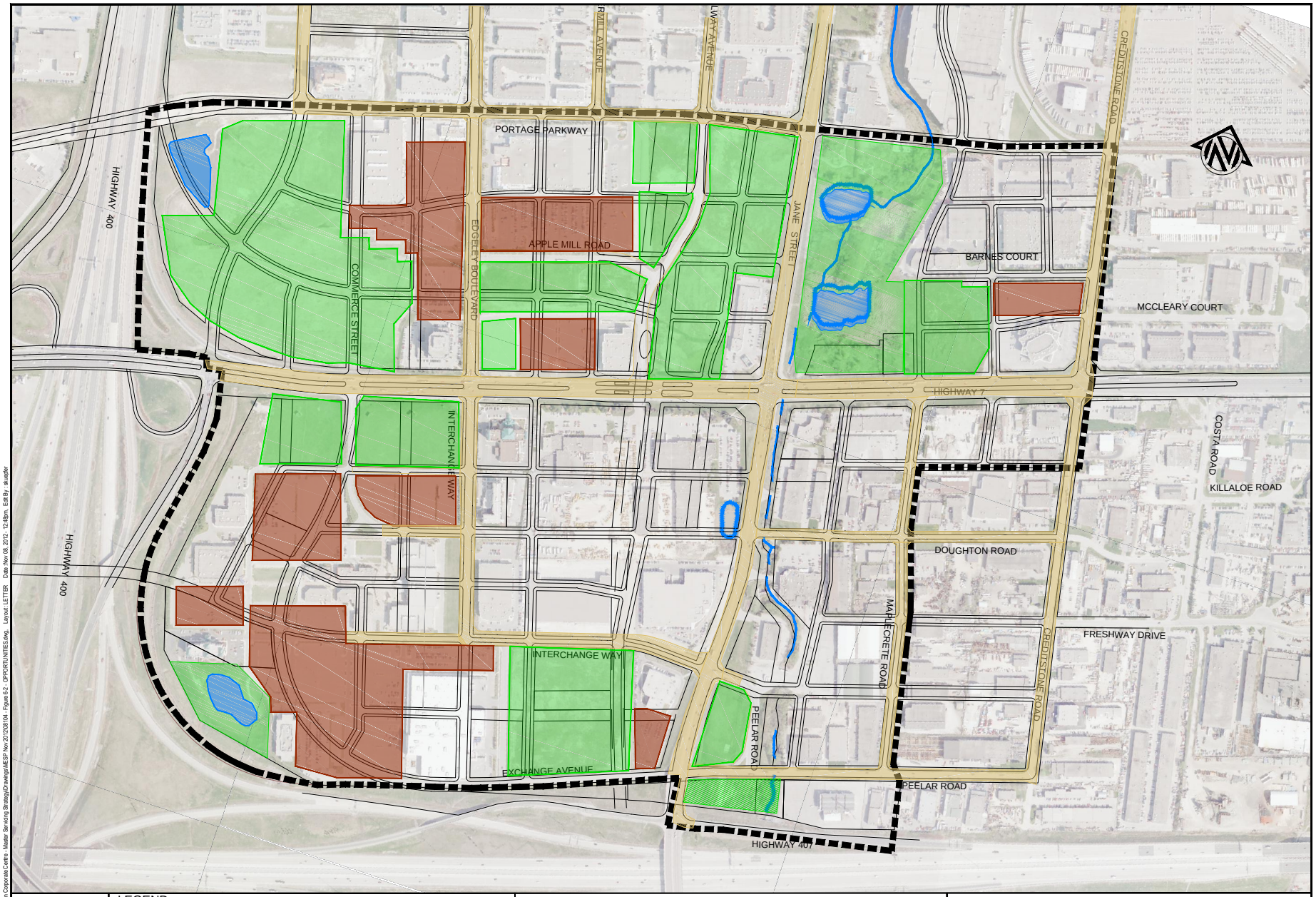
Watercourses often present barriers to infrastructure planning because of the difficulty in locating gravity sewer systems beneath them, as the minimum cover requirements often push the pipes so deep that the costs escalate in building a deeper system, or pumping stations are required to lift the flow up to the trunk system. Additionally, there are environmental considerations when crossing watercourses which can impact the scheduling of the works, or raise costs by requiring trenchless construction methods. As such, watercourse crossings should be avoided where feasible.

6.2.3 Existing Stormwater Management Facilities

Stormwater management facilities are typically placed in the lowest areas of a drainage-shed, and in proximity to a receiving water body. In this sense the existing facilities within the VMC must be respected as the locations are predominantly ideal given the drainage patterns in the area.

Where facilities are to be explored for retrofit potential in conjunction with planned redevelopment, upstream or external drainage areas must also be considered, as the function of these facilities with respect to their existing service areas must be maintained or improved upon in the proposed condition.

Conversely, existing ponds also represent cost-effective retrofit opportunities, where the existing function can be enhanced to increase the level of service to a more current standard, and support redevelopment initiatives.



LEGEND

- EXISTING STORMWATER MANAGEMENT PONDS
- EXISTING PARKING AREAS
- UNDEVELOPED LANDS
- EXISTING ROADS THAT ARE ALIGNED WITH PROPOSED VMC SECONDARY PLAN ROADS
- LIMITS OF STUDY AREA
- VAUGHAN METROPOLITAN CENTRE
- PROPOSED FUTURE ROADS

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OPPORTUNITIES MAP

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	6-2

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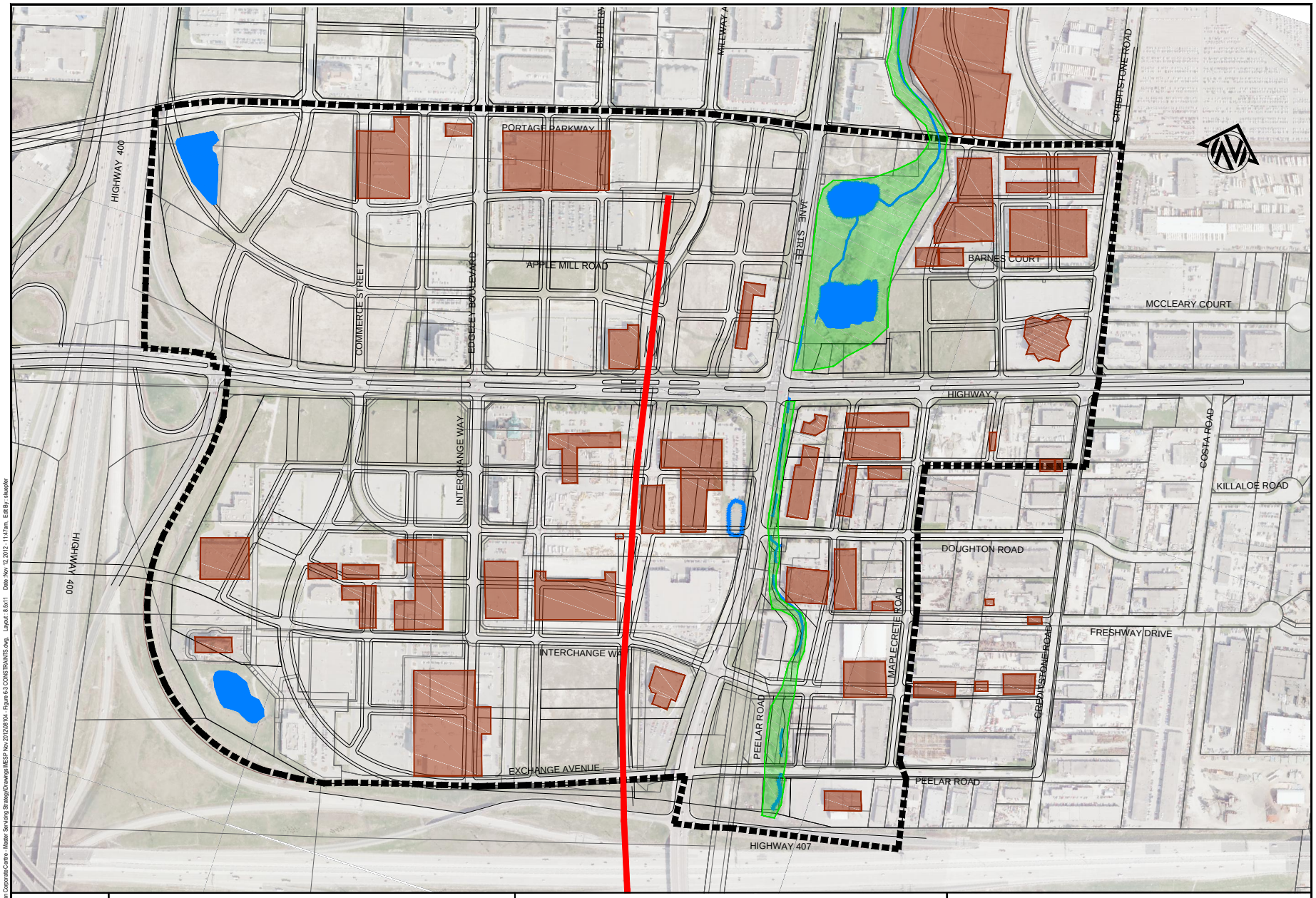

LEGEND

- EXISTING BUILDINGS IN FUTURE VMC PLANNING AREAS
- EXISTING AND FUTURE WATER COURSES
- EXISTING STORMWATER MANAGEMENT PONDS
- LIMITS OF STUDY AREA
- FUTURE TTC ALIGNMENT
- VAUGHAN METROPOLITAN CENTRE PROPOSED FUTURE ROADS

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CONSTRAINTS MAP

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	6-3

6.2.4 Public Transit

A significant constraint to municipal infrastructure planning is the extension of the TTC Subway system to the future Vaughan Metro Centre Station, which is currently under construction. Being below grade, the subway tunnel can create a barrier to gravity sewer systems. As such, the tunnel location, dimension, elevation, and cover requirements must be considered for all proposed crossings.

Slightly less constraining is the proposed light rail surface transit along Highway 7. While the underground interferences are not as significant as the subway tunnel, there will be electrical conduits, supports for the structures that will by carrying the overhead electrical cables, and minimum cover requirements beneath the tracks. As such, infrastructure planning along Highway 7 should be avoided where feasible.

6.2.5 Undeveloped Lands

While there are a number of existing structures that constrain future roads from being candidates for some of the required infrastructure, there are also some currently-undeveloped sites which will be available for earlier installation of some of the required infrastructure. Infrastructure across undeveloped lands could be installed as soon as municipal right-of-ways are established for the future roads, or sooner through temporary easement agreements which would cover the period between construction of the infrastructure and final acquisition of the right-of-way.

6.2.6 Existing Parking Areas

Similarly to pre-building required infrastructure in undeveloped lands, infrastructure can be pre-built through parking areas traversed by future roads through temporary easement agreements with the owners. However, potential disruption to existing businesses and related parking lot uses must be considered and addressed wherever this option is exercised.

6.3 Water Demand

Through the redevelopment of the VMC, the water demands for the area are expected to increase as per the calculation in **Table 6-2**:

Table 6-2: VMC Water Demands

	2006		Build-Out (2051)	
Population	Residential	Employment	Residential	Employment
	0	11,558	50,116	22,380
Per-Capita Demand [Lpcd]	450[1]	267	450[1]	267
Average Day Demand [L/s]	35.7		330.2	
Maximum Day Demand [L/s]	71.4		660.4	
Maximum Day plus Fire Flow [L/s]	**488.4**		1,077.4	
Peak Hour Demand [L/s]	160.7		**1,485.9**	

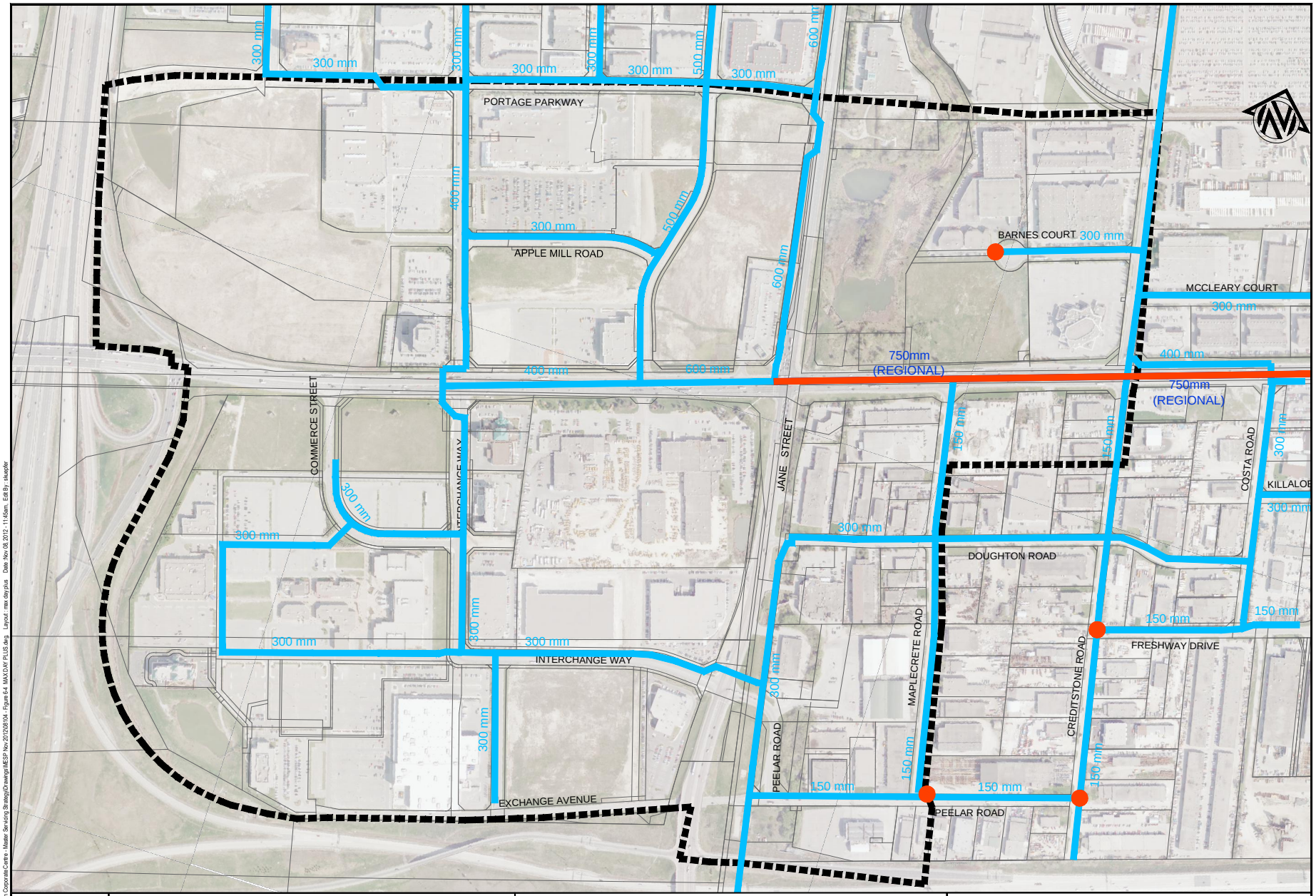
Note:

1. Design Criteria currently under review.

A map showing the existing distribution system based on the proposed road layout is included in **Figure 6-4** and **Figure 6-5**. Any existing pipes that do not coincide with the proposed road network have been deleted, leaving only the elements within the existing system that could potentially remain as part of a reconfigured distribution system.

The existing pipes with insufficient capacity to convey the future demands and the nodes possessing insufficient pressure are identified.

The figures illustrate that the existing collection system does not have capacity to service the full build-out of the VMC area. There are pressure deficiencies in the south-east quadrant, and some pipes have flow velocities in excess of 1 m/s.



LEGEND

- STUDY AREA
- PRESSURE LESS THAN 20 Psi
- PIPE VELOCITY MORE THAN 1.0 m/s
- EXISTING DISTRIBUTION SYSTEM
- REGIONAL WATERMAIN

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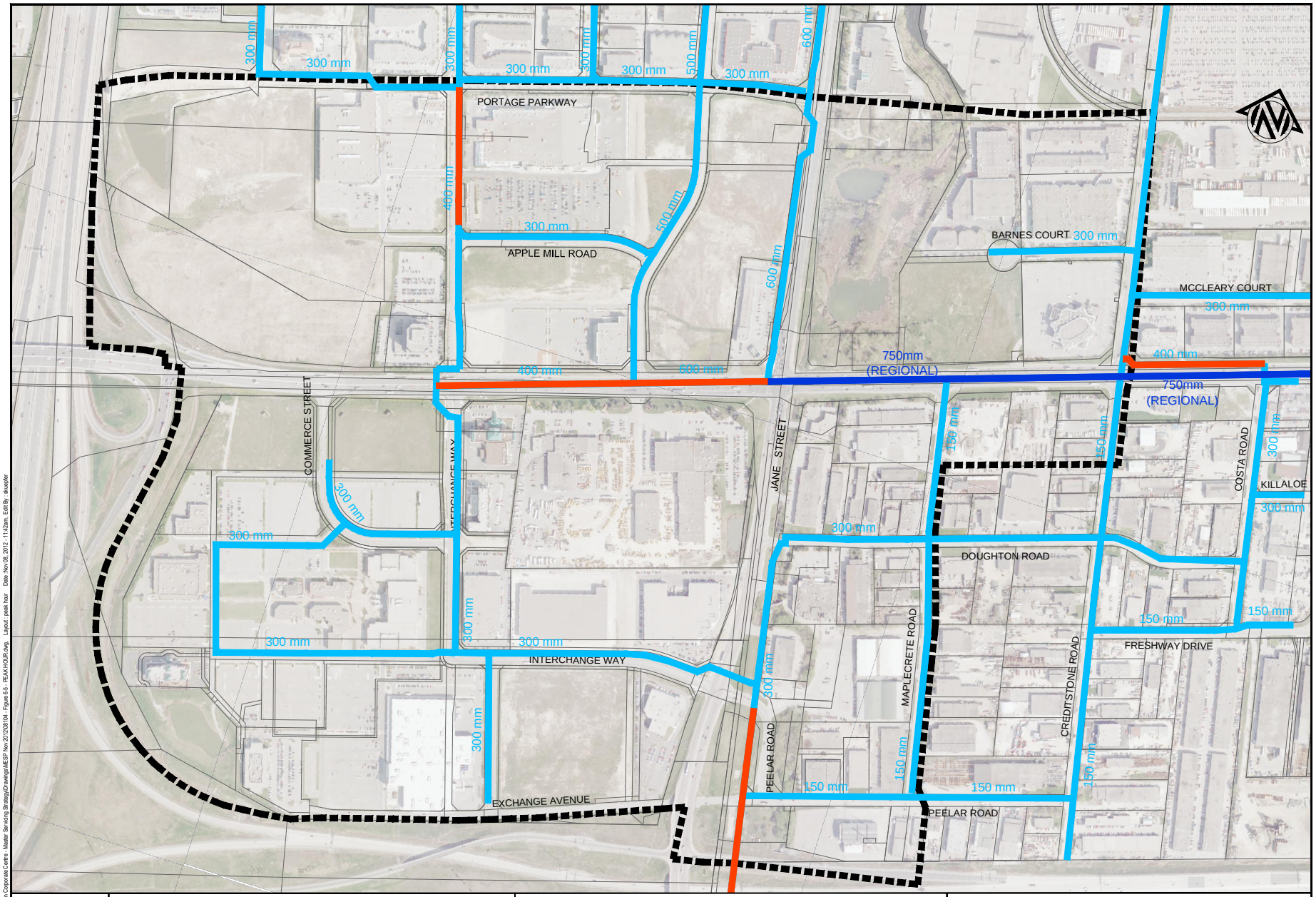
EXISTING WATER SYSTEM UNDER FUTURE DEMAND - MAXIMUM DAY PLUS FIRE

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	6-4

File : G:\Projects\2008\08104 - Vaughan Corporate Centre - Master Servicing Strategy\Drawings\MESP Nov 2012\08104 - Figure 6-4 MAX DAY PLUS.dwg Layout : mw day plus Date: Nov 08, 2012 - 11:45am, Edit By: skaipfer



LEGEND

- STUDY AREA
- PIPE VELOCITY MORE THAN 1.0 m/s
- EXISTING DISTRIBUTION SYSTEM
- REGIONAL WATERMAIN

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EXISTING WATER SYSTEM UNDER FUTURE DEMAND - PEAK HOUR

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	6-5

File : G:\Projects\2008\08104 - Vaughan Corporate Centre - Master Servicing Strategy\Drawings\MESP Nov 2012\08104 - Figure 6-5 - PEAKHOUR.dwg, Layout : peak hour Date: Nov 08, 2012 - 11:42am, Edit By : akwofer

6.4 Sanitary Sewage Flows

Through the redevelopment of the VMC, the wastewater flows for the area are expected to increase as per the calculation in **Table 6-3**.

Table 6-3: VMC Wastewater Flows

	2006		Build-Out (2051)	
Population	Residential	Employment	Residential	Employment
	0	11,558	50,116	22,380
Per-Capita Flow [Lpcd]	450(1)	267	450(1)	267
Average Day Flow [L/s]	35.7		330.2	
Harmon Peaking Factor	2.89		2.12	
Peak Flow [L/s]	103.2		700.0	
Area [ha]	273.9		273.9	
Infiltration Allowance [L/ha-s]	0.23		0.23	
Infiltration Flow [L/s]	63.0		63.0	
Design Flow [L/s]	**166.2**		**763.2**	

Note:

1. Design criteria are currently under review.

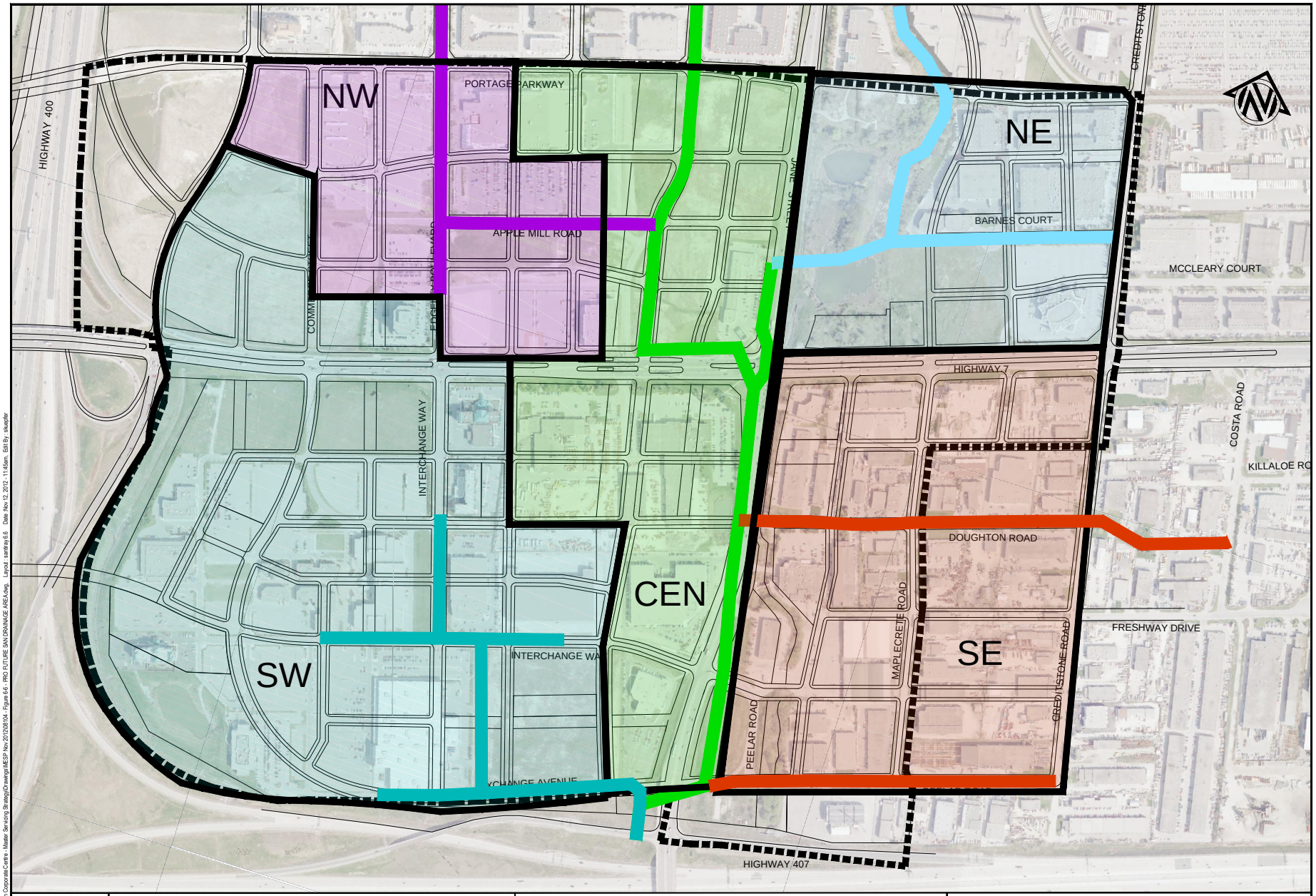
Figure 6-6 illustrates the proposed drainage area boundaries for the redeveloped site, and takes into account the various opportunities and constraints as well as existing topography to identify the areas tributary (via gravity) to the existing sewers.

A map showing the sanitary service areas for the existing sewers based on the proposed land use conditions is included in **Figure 6-7**. Any existing pipes that do not coincide with the proposed road network have been deleted, leaving only the elements within the existing system that could potentially remain as part of a reconfigured distribution system. The existing pipes with insufficient capacity to convey the future flows are identified.

North-West Quadrant: The north-west quadrant currently has sufficient capacity to accommodate the future flows. It should be noted that the existing sanitary sewers along Applemill Road and Millway Avenue are being reconstructed as part of the Subway Station construction, and the modifications provide the required conveyance capacity.

North-East Quadrant: The existing sanitary sewer along Barnes Court does not have sufficient capacity for the future flows from full build-out of the north-east quadrant.

Central Quadrant: Generally constrained between the subway and Black Creek, the properties within the central quadrant will be serviced directly by the Jane Street trunk sewer, which has sufficient capacity for the proposed development.



LEGEND

STUDY AREA

SANITARY DRAINAGE AREA

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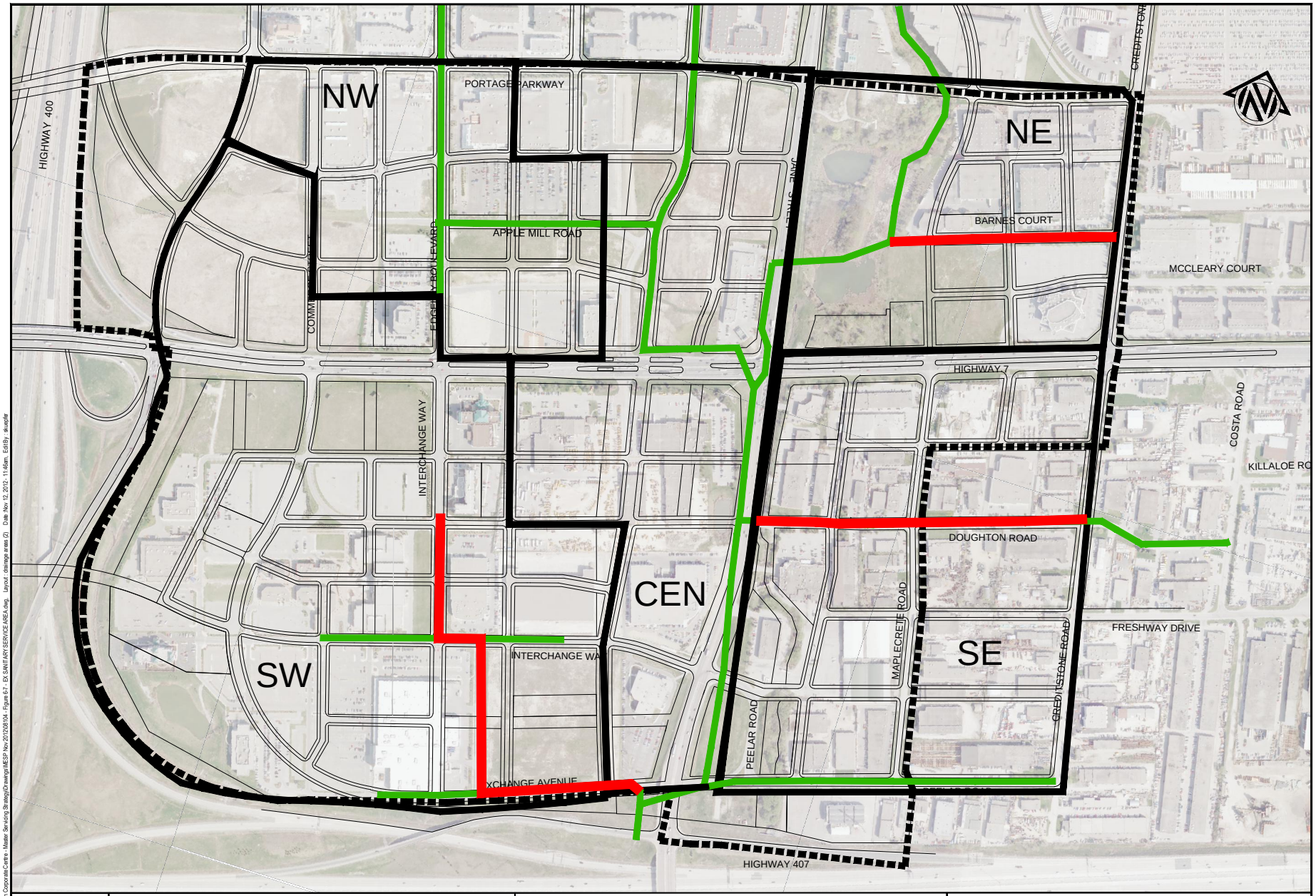
PROPOSED FUTURE SANITARY DRAINAGE AREAS

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	6-6

File : G:\Projects\2008\08104 - Vaughan Corporate Centre - Master Servicing Strategy\Drawings\MESP Nov 2012\08104 - Figure 6-6 - PRO FUTURE SAN DRAINAGE AREA.dwg Layout : sanfrwy 6.6 Date : Nov 12, 2012 - 11:45am, Edd By : skaspler



LEGEND

- STUDY AREA
- EXISTING SEWER WITH INSUFFICIENT CAPACITY FOR BUILD - OUT FLOWS
- SANITARY DRAINAGE AREA

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EXISTING SANITARY SYSTEM UNDER FUTURE FLOWS

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	6-7

File : G:\Projects\2008\08104 - Vaughan Corporate Centre - Master Servicing Strategy\Drawings\MESP Nov 2012\08104 - Figure 6-7 - EX SANITARY SERVICE AREA.dwg, Layout : drainage areas (2), Date :Nov 12, 2012 - 11:46am, EditBy :akuepfer

South-West Quadrant: Because the topography of the VMC area generally slopes down towards Highway 400, some of the lands north of Highway 7 cannot get into the Applemill sewer by gravity. As such, these properties will need to be serviced through the south-west quadrant. The existing sewers do not have sufficient capacity for full build-out of the VMC lands.

South-East Quadrant: There are two existing sewers within the south-east quadrant connecting to the Jane Street trunk; Doughton Road, and Peelar Road. The combined capacity of these sewers – both of which cross under Black Creek – is not sufficient to convey the design flows from the full build-out of those lands.

Trunk Sewer South of the Vaughan Metropolitan Centre: Under full build-out of the VMC area, a few of the sections of sewer in the Jane Street Collector could surcharge slightly under Highway 407.

6.5 Storm Servicing and Stormwater Management

As described in **Sections 4.3** and **4.4**, storm drainage in the VMC area is presently based on Vaughan's design criteria with some end-of-pipe stormwater management, ranging from only quantity control to full erosion/quality/quantity control, with all flows eventually discharging to either the main or west branches of Black Creek.

The VMC Secondary Plan will yield an increase in imperviousness across the VMC area, which will generate increased runoff during storm events. Furthermore, the existing state of storm drainage and stormwater management within the VMC is based on earlier approaches to managing runoff. In a similar fashion, the current challenges faced by the Black Creek system, as described in **Section 4.3**, have necessitated the recommended works as outlined in the Black Creek Stormwater Optimization Study.

Implementation of the VMC Secondary Plan therefore presents an opportunity to apply current stormwater management approaches, in an effort to:

- compensate for the increased imperviousness anticipated for the future condition;
- satisfy current criteria concerned with water quantity, quality, erosion, and water balance, as described in **Section 5.4**;
- complement the recommended Black Creek improvements by reducing the runoff directed to these systems; and,
- fulfill the principles of Green Directions Vaughan by applying sustainable approaches to stormwater management where feasible.

7 Problem Statement

The Vaughan Metropolitan Centre area in Vaughan is a provincially designated urban growth centre, with a vision for redevelopment that has been detailed in both the City of Vaughan Official Plan and the Vaughan Metropolitan Centre Secondary Plan.

The form of growth anticipated to occur within the VMC will result in greater population densities, enhanced transportation networks, and an increase in the extent of hard surfaces. These changes will lead to an increased demand for water, increased wastewater production, and an increase in surface runoff during rain events.

Assessment of the state of infrastructure present within the VMC indicates that the planned growth cannot be accommodated by the existing infrastructure systems.

This Municipal Servicing Class EA Master Plan has been undertaken to identify and evaluate alternatives for the provision of water, wastewater, and stormwater servicing to support the redevelopment objectives established by the VMC Secondary Plan, culminating in a series of recommended infrastructure improvements.

8 Alternative Solutions

8.1 Water Servicing

8.1.1 Do Nothing

This solution would include no changes or improvements to the existing water system. The “Do Nothing” solution does not address the problem with respect to water supply or the goals and objectives of the City of Vaughan Official Plan or the VMC Secondary Plan.

This solution does not provide a viable solution to the problems identified and will not be considered further.

8.1.2 Limit Growth

This solution would limit community growth to the capacity of the existing infrastructure.

Since this solution does not comply with the goals and objectives of the VMC Secondary Plan, it does not provide a viable solution to the problems identified and will not be considered further.

8.1.3 Water Conservation

This solution would include implementing educational and/or incentive programs to promote participation in voluntary conservation initiatives with the goal to reduce water consumption.

While it may be possible to reduce water demands within the VMC by up to 20%, it is currently not possible to force compliance with existing water conservation measures, nor to guarantee that initially-implemented water conservation measures would be maintained indefinitely. So while potentially successful theoretically, this is not a viable solution from a practical standpoint.

The City’s Design Criteria also establishes minimum levels of service based on the current per-capita water demands. If the City were to adopt reduced design criteria – effectively confirming the potential success of water conservation measures long-term – then water conservation could become a solution in the absence of other measures.

As this solution does not address the problem statement on its own, it will not be considered further. Water conservation can be considered as part of the preferred solution, but as a potentially implementable measure that could reduce the impacts with the recommended preferred solution, thereby improving upon the recommendation.

8.1.4 Modify the Existing System

This solution would include expanding and/or enlarging the existing municipal water system to provide adequate water distribution for full build-out of the VMC. This would provide an opportunity to optimize any available capacity within the existing municipal water system.

Within the VMC, it is assumed that watermains will potentially be installed under all of the proposed streets. However, the exploration of this solution will only identify where the larger-diameter looped network would connect to the existing municipal water system. In addition, this solution will confirm the required pipe diameters to meet the required level of service.

8.2 Sanitary Servicing

8.2.1 Do Nothing

No changes or improvements to the existing wastewater system would be undertaken. The “Do Nothing” solution does not address the problem with respect to sanitary servicing or the goals and objectives of the City of Vaughan Official Plan or VMC Secondary Plan.

This solution does not provide a viable solution to the problems identified and will not be considered further.

8.2.2 Limit Growth

The solution would limit community growth to the capacity of the existing sanitary infrastructure.

Since this solution does not comply with the goals and objectives of the VMC Secondary Plan, it does not provide a viable solution to the problems identified and will not be considered further.

8.2.3 Water Conservation

This solution would include implementing educational and/or incentive programs to promote participation in voluntary conservation initiatives with the goal to reduce water consumption, and subsequently wastewater generation.

While it may be possible to reduce water demands – and, subsequently, wastewater flow rates – within the VMC by up to 20%, it is currently not possible to force compliance with existing water conservation measures, nor to guarantee that initially-implemented water conservation measures would be maintained indefinitely. So while potentially successful theoretically, this is not a viable solution from a practical standpoint.

The City’s Design Criteria also establishes minimum levels of service based on the current per-capita sanitary flow generation. If the City were to adopt reduced design criteria – effectively confirming the potential success of water conservation measures long-term – then water conservation could become a solution in the absence of other measures.

As this solution does not address the problem statement on its own, it will not be considered further. Water conservation can be considered as part of the preferred solution, but as a potentially implementable measure that could reduce the impacts with the recommended preferred solution, thereby improving upon the recommendation.

8.2.4 Modify Existing System

This solution would include expanding the existing municipal sanitary system to provide adequate sanitary conveyance the VMC. This would provide an opportunity to optimize any available capacity within the existing municipal sanitary system.

Within the VMC, sanitary sewers will be installed under the proposed streets. Exploration of this solution would identify where the larger trunk sanitary sewers and any required pumping stations would be located for the overall conveyance of the sanitary sewage.

8.3 Storm Drainage

Alternatives associated with storm drainage generally consider the feasibility of modifying drainage patterns within the VMC, to yield variations on the current delineation of catchment areas draining to end-of-pipe facilities. As noted in **Section 5.3**, opportunities to substantially adjust drainage boundaries are limited. However, exploration of variations was undertaken to establish the feasibility and merit of the different approaches.

8.3.1 Do Nothing

No changes or improvements to the existing storm drainage would be undertaken. The “Do Nothing” solution does not address the problem with respect to stormwater drainage and servicing, or the goals and objectives of the City of Vaughan Official Plan or the VMC Secondary Plan.

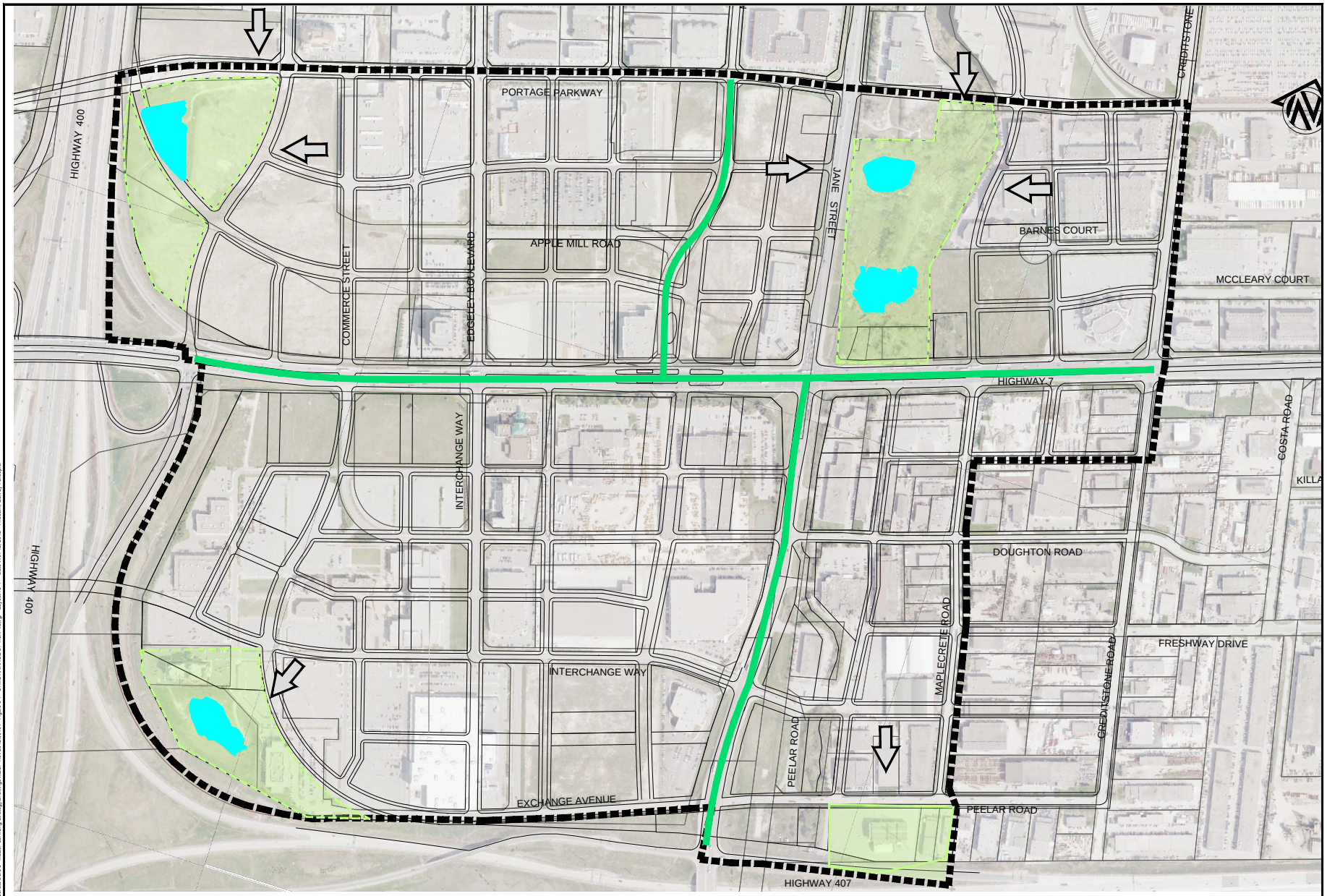
This solution does not provide a viable solution to the problems identified and will not be considered further.

8.3.2 Storm Drainage Option 1

The first storm drainage option is illustrated in **Figure 8-1**. This alternative generally respects the current drainage patterns, but establishes Millway Avenue as the drainage divide between the north-east and north-west quadrants.

An assessment of the facility expansions that would be required to accommodate the additional development and redevelopment areas is required for the north-west, north-east, and south-west quadrants. For the south-east quadrant, the area is presently not serviced by an end-of-pipe facility. Therefore this quadrant will require a new SWM strategy to provide the required level of stormwater management.

In relation to the existing drainage patterns, this alternative would direct less drainage to SWM Pond P1 (Edgeley Pond), which could be beneficial depending on the retrofit potential associated with the existing facility.



LEGEND

- POTENTIAL STORM DRAINAGE AREA BOUNDARY
- STUDY AREA
- LOCATION OF EXISTING STORMWATER MANAGEMENT POND
- STUDY AREA FOR POTENTIAL POND IMPROVEMENTS AND/OR EXPANSION

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STORM DRAINAGE OPTION 1

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	8-1

8.3.3 Storm Drainage Option 2

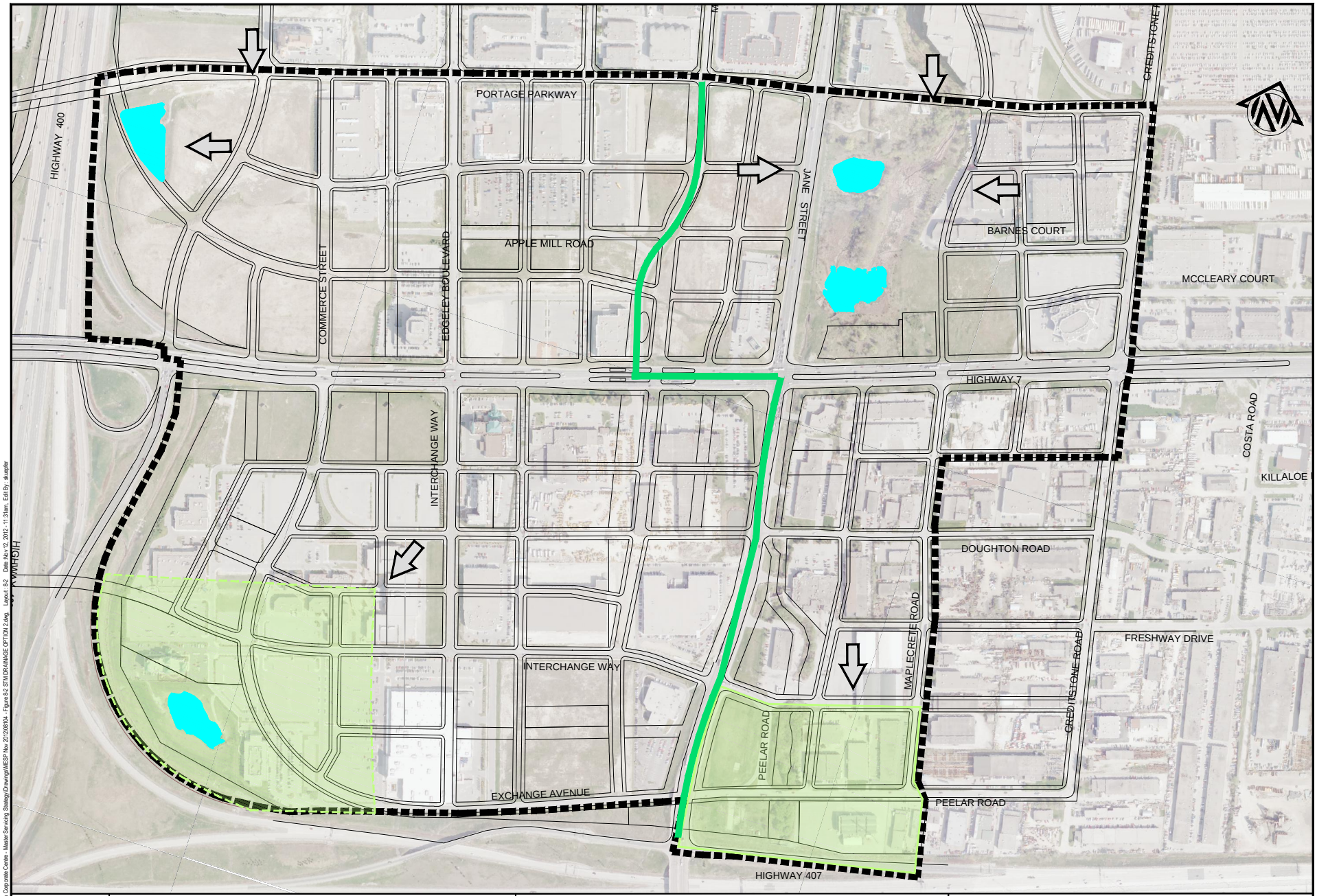
The second storm drainage option is illustrated in **Figure 8-2**. This alternative considers vertically lumping quadrants to centralize end-of-pipe treatment at the south limit of the VMC. The approach establishes Millway Avenue and Jane Street as the east-west drainage divide, and involves significant modification of existing drainage patterns, along with major system conveyance across Highway 7, significant expansion of the Interchange Pond, and introduction of a large pond in the south-east quadrant.

However, this approach would make available tableland in the vicinity of the VMC subway station at Millway and Highway 7, and therefore maximizes the utility of the urban core area established by the VMC Secondary Plan.

8.3.4 Storm Drainage Option 3

This alternative most closely respects the existing drainage regime in the VMC area, with Highway 7 continuing to separate the north and south areas, Jane Street the east-west divide south of Highway 7, and Edgeley Boulevard the east-west divide north of Highway 7.

An assessment of the facility expansions that would be required to accommodate the additional development and redevelopment areas is required for the north-west, north-east, and south-west quadrants. For the south-east quadrant, the area is presently not serviced by an end-of-pipe facility. Therefore this quadrant will require a new SWM strategy to provide the required level of stormwater management.



LEGEND

- POTENTIAL STORM DRAINAGE AREA BOUNDARY
- STUDY AREA
- LOCATION OF EXISTING STORMWATER MANAGEMENT POND
- STUDY AREA FOR POTENTIAL POND IMPROVEMENTS AND/OR EXPANSION

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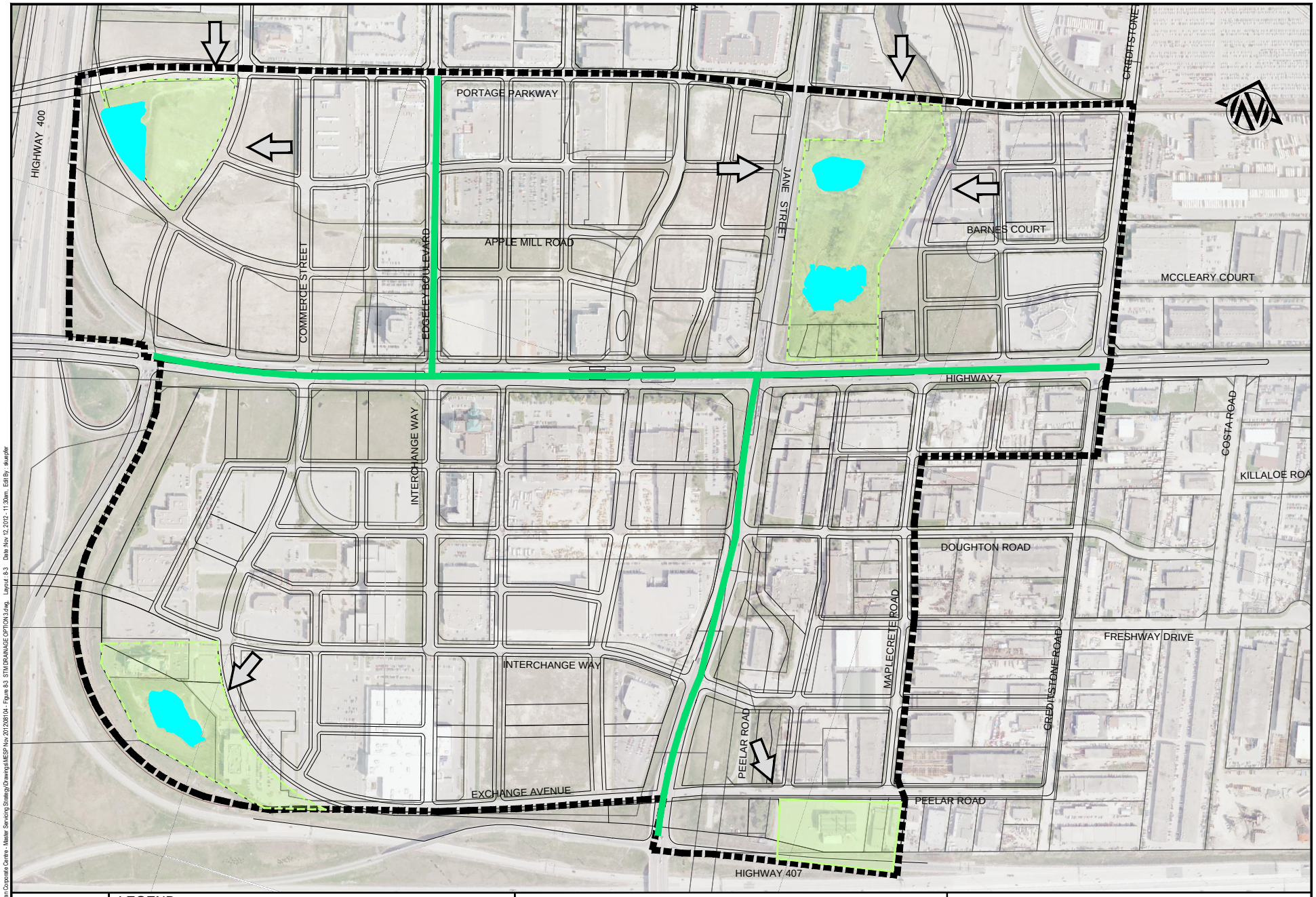
STORM DRAINAGE OPTION 2

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	8-2



LEGEND

- POTENTIAL STORM DRAINAGE AREA BOUNDARY
- STUDY AREA
- LOCATION OF EXISTING STORMWATER MANAGEMENT POND
- STUDY AREA FOR POTENTIAL POND IMPROVEMENTS AND/OR EXPANSION

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STORM DRAINAGE OPTION 3

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	8-3

File : G:\Projects\2008\08104 - Vaughan Corporate Centre - Master Servicing Strategy\Drawings\MESP Nov 2012\08104 - Figure 8-3 STM DRAINAGE OPTION 3.dwg Layout: 8-3 Date: Nov 12, 2012 - 11:30am, Edit By: akuncle

8.4 Stormwater Management

Alternatives associated with stormwater management speak to the measures that need to be put in place to manage the quantity, quality, erosion, and water balance impacts of development within the context of the design criteria established in **Section 5.4**.

8.4.1 Do Nothing

No changes or improvements to stormwater management would be undertaken. The "Do Nothing" solution does not address the problem with respect to stormwater drainage and storm servicing or the goals and objectives of the City of Vaughan Official Plan and the VMC Secondary Plan.

This solution does not provide a viable solution to the problems identified and will not be considered further.

8.4.2 Reduce Level of Service

This option would reduce the level of service for the existing drainage area. For example, this would mean that the system would not meet the target of providing a 100-year level of service, or an enhanced level of water quality treatment. The stormwater management strategy for the VMC development will be designed based on a reduced level of service.

8.4.3 No On-Site Control

Runoff from the development areas are conveyed directly to the proposed SWM ponds through storm sewers and overland flow routes with no on-site control. A traditional dual drainage system will be implemented to collect and drain the runoff resulting from minor storm events characterized by low rainfall intensity and a relatively low return period and the runoff resulting from a major rainfall event that exceeds conveyance capacity of the minor system. Enlargement of the existing SWM facilities and the construction of a new SWM facility will be implemented to accommodate and control the amount of stormwater runoff from the development.

8.4.4 On-Site Control with End-of-Pipe Facilities

On-site control is implemented in each development block, where the peak release rate to the storm sewer is controlled to the 2-year post development flow at a level of 80% imperviousness, and the 100-year less 2-year excess runoff is stored on-site. A traditional dual drainage system is proposed within the rights-of-way.

Excess runoff will be directed to end-of-pipe SWM facilities to satisfy the additional control requirements. Therefore, an assessment of the facility expansions that would be required to accommodate the additional development and redevelopment areas would be required for the existing SWM facilities. An assessment of the implementation of a new SWM facility would be required for the south-east area of the VMC development.

8.4.5 On-Site Control with 5mm Retention over Building Footprint and End-of-Pipe Facilities

On-site control is implemented in each development block, where the peak release rate to the storm sewer is controlled to the 2-year post development flow at an 80% level of imperviousness, and the 100-year less 2-year excess runoff is stored on-site. Moreover, 5mm of rainfall over the building footprint will be captured and utilized on-site through the implementation of low impact development measures, including but not limited to permeable pavements, green roofs, bioretention, and rainwater harvesting. The 5mm threshold is documented as criteria within the City of Toronto's Wet Weather Flow Management Guideline (November 2006). A traditional dual drainage system is proposed for the rights-of-way.

Excess runoff will be directed to end-of-pipe SWM facilities to satisfy the additional control requirements. Therefore, an assessment of the facility expansions that would be required to accommodate the additional development and redevelopment areas would be required for the existing SWM facilities. An assessment of the implementation of a new SWM facility would be required for the south-east area of the VMC development. The 5mm retention will be used to adjust runoff coefficients for the individual development areas, thereby reducing the end-of-pipe requirements.

8.4.6 On-Site Control with 5mm Site Retention and End-of-Pipe Facilities

On-site control is implemented in each development block, where the peak release rate to the storm sewer is controlled to the 2-year post development flow at an 80% level of imperviousness, and the 100-year less 2-year excess runoff is stored on-site. Moreover, 5mm of rainfall over the entire site will be captured and utilized on-site through the implementation of low impact development measures, including but not limited to permeable pavements, green roofs, bioretention, and rainwater harvesting. The 5mm threshold is documented as criteria within the City of Toronto's Wet Weather Flow Management Guideline (November 2006). A traditional dual drainage system is proposed for the rights-of-way.

Excess runoff will be directed to end-of-pipe SWM facilities to satisfy the additional control requirements. Therefore, an assessment of the facility expansions that would be required to accommodate the additional development and redevelopment areas would be required for the existing SWM facilities. An assessment of the implementation of a new SWM facility would be required for the south-east area of the VMC development. The 5mm retention will be used to adjust runoff coefficients for the individual development areas, thereby reducing the end-of-pipe requirements.

8.4.7 On-Site Control with 15mm Retention over Building and Landscaped Areas, with End-of-Pipe Facilities

On-site control is implemented in each development block, where the peak release rate to the storm sewer is controlled to the 2-year post development flow at an 80% level of imperviousness, and the 100-year less 2-year excess runoff is stored on-site. Moreover, 15mm of rainfall over the building footprint will be captured and utilized on-site through the implementation of low impact development measures, including but not limited to permeable pavements, green roofs, bioretention, and rainwater harvesting. Landscaped surfaces also provide rainfall retention. This level of re-use is

typically achieved by those developments striving for recognition through the *Leadership in Energy and Environmental Design* (LEED) accreditation program. A traditional dual drainage system is proposed for the rights-of-way.

Excess runoff will be directed to end-of-pipe SWM facilities to satisfy the additional control requirements. Therefore, an assessment of the facility expansions that would be required to accommodate the additional development and redevelopment areas would be required for the existing SWM facilities. An assessment of the implementation of a new SWM facility would be required for the south-east area of the VMC development. The 15mm retention will be used to adjust runoff coefficients for the individual development areas, thereby reducing the end-of-pipe requirements.

9 Evaluation of Alternative Solutions

9.1 Evaluation Criteria

The alternative solutions 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 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.

Table 9-1: Evaluation Criteria

Category	Evaluation Criteria
Technical Criteria	Potential to service future demands Potential constructability of proposed infrastructure Potential accessibility for future maintenance Potential conflicts with existing municipal and utility services. Potential effects on infrastructure security Potential impacts on scheduling and coordination with Development within VMC Potential to achieve technical objectives Potential impacts on level of effort for approvals and permits
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 effects on hydrologically sensitive features
Social/Cultural Environment	Potential effects on existing facilities during construction Potential for requiring private property Potential impact on Public Safety Opportunity to integrate with planned/future land uses in the surrounding area
Financial	Potential costs of implementation Potential annual operations and maintenance (O&M) costs

9.2 Water Servicing

As it is the only viable solution, the preferred water servicing alternative is to modify and expand the existing system.

This solution is technically feasible, has minimal adverse environmental impacts (all construction will be contained within road right-of-ways), and is the only solution that meets the objectives of the Official Plan and the VMC Secondary Plan, both of which are based on the Province's "Places to Grow" objectives. Details of the recommended water servicing solution are provided in **Section 10.1**.

Table 9-2: Water Servicing Alternatives Evaluation

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	**Limit Growth**	**Water Conservation**	**Expand Existing System**
Natural Environmental				
Potential to minimize effects on terrestrial habitat	Low - No adverse effects on the terrestrial habitat.	Low - No adverse effects on the terrestrial habitat.	Low - No adverse effects on the terrestrial habitat.	Low - Existing area is already developed as industrial land.
Potential effects on fish habitat and aquatic ecosystems	Low - No adverse effects on the aquatic habitat.	Low - No adverse effects on the aquatic habitat.	Low - No adverse effects on the aquatic habitat.	Low - Existing area is already developed as industrial land.
Potential effects on known habitat for Species of Concern	Low - No adverse effects on habitat of known Species of Concern	Low - No adverse effects on habitat of known Species of Concern	Low - No adverse effects on habitat of known Species of Concern	Low - Existing area is already developed as industrial land.

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	**Limit Growth**	**Water Conservation**	**Expand Existing System**
Potential groundwater effects	Low - No adverse effects on baseflow or groundwater resources.	Low - No adverse effects on baseflow or groundwater resources.	Low - No adverse effects on baseflow or groundwater resources.	Low - Existing area is already developed as industrial land.
Potential effects on hydrologically sensitive features	Low - No adverse effects on hydrologically-sensitive features	Low - No adverse effects on hydrologically-sensitive features	Low - No adverse effects on hydrologically-sensitive features	Low - Existing area is already developed as industrial land.
Natural Environmental Summary	**LOW IMPACT**	**LOW IMPACT**	**LOW IMPACT**	**LOW IMPACT**
Social/Cultural Environment				
Potential to minimize effects on existing facilities during construction	High - No construction associated with the 'Do Nothing' alternative.	High - No construction associated with the 'Limit Growth' alternative.	High - No construction associated with the 'Water Conservation' alternative.	High - Level of service will be maintained by looping, no impact on existing service
Potential to minimize impacts to private property	High - Doesn't permit private property to be redeveloped to the approved densities	High - Doesn't permit private property to be redeveloped to the approved densities	High - Doesn't permit private property to be redeveloped to the approved densities	Low - Redevelopment proposal will enhance existing private properties
Potential to minimize impact to Public Safety	High - No safety concerns associated with the 'Do Nothing' alternative.	High - No safety concerns associated with the 'Limit Growth' alternative.	High - No safety concerns associated with the 'Water Conservation' alternative.	Moderate - Safety concerns associated with development can be mitigated through proper construction safety measures.
Opportunity to integrate with planned/future land uses in the surrounding area	Low - This prevents the redevelopment of the VMC lands	Low - This prevents the redevelopment of the VMC lands	Low - This prevents the full redevelopment of the VMC lands	High - Required sewer improvements will be incorporated into required road works
Social/Cultural Environmental Summary	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**
Cost				
Costs for implementation	High - "lost opportunity" cost due to not achieving the objectives of the Official Plan.	High - "lost opportunity" cost due to not achieving the objectives of the Official Plan.	High - "lost opportunity" cost due to not achieving the objectives of the Official Plan.	Moderate - Capital cost.
Annual operations and maintenance (O&M) Costs	Low - No additional cost.	Low - No additional cost.	Low - No additional cost.	Moderate - Additional cost.
Cost Summary	**MODERATE**	**MODERATE**	**MODERATE**	**MODERATE**
Technical				
Potential constructability of proposed infrastructure	High – No infrastructure is required for the 'Do Nothing' alternative.	High – No infrastructure is required for the 'Do Nothing' alternative.	Moderate - Potential for conservation program to not be successful to the extent desired/required.	High - No constructability concerns

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	**Limit Growth**	**Water Conservation**	**Expand Existing System**
Potential to minimize future maintenance requirements	Low – Potential for future maintenance required due to ongoing development of surrounding area.	High - No additional future maintenance.	Moderate - Additional future maintenance.	Moderate - Additional future maintenance.
Potential to minimize conflicts with existing municipal and utility services	High - No potential impacts.	Moderate - Some potential impacts	Moderate - Some potential impacts	Moderate - Some potential impacts
Potential flexibility of system to service future demands	Low - No flexibility of system to service future demands	Low - No flexibility of system to service future demands	Low - No flexibility of system to service future demands	High - Good flexibility of system to service future demands
Potential to minimize impacts on scheduling and coordination with Development within VMC	High - No scheduling impacts	Moderate - Some scheduling impacts	Moderate - Some scheduling impacts	Moderate - Some scheduling impacts
Potential to achieve technical objectives	Low - No potential to achieve technical objectives	Low - No potential to achieve technical objectives	Low - No potential to achieve technical objectives	High – Technical objectives are fully met by this alternative
Potential to minimize level of effort for approvals and permits	High - No approvals are required	High - No approvals are required	High - No approvals are required	High - Minimal approvals are required
Technical Summary	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**HIGH POTENTIAL**
Summary and Rank				
Summary	**MODERATE IMPACT, MODERATE POTENTIAL**	**MODERATE IMPACT, MODERATE POTENTIAL**	**MODERATE IMPACT, MODERATE POTENTIAL**	**LOW IMPACT, HIGH POTENTIAL**

9.3 Sanitary Servicing

As it is the only viable solution, the preferred sanitary servicing alternative is to modify and expand the existing system.

This solution is technically feasible, has minimal adverse environmental impacts (all construction will be contained within road right-of-ways), and is the only solution that meets the objectives of the Official Plan and the VMC Secondary Plan, both of which are based on the Province's "Places to Grow" objectives. Details of the recommended sanitary servicing solution are provided in **Section 10.2**.

Table 9-3: Sanitary Servicing Alternatives Evaluation

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	**Limit Growth**	**Water Conservation**	**Expand Existing System**
Natural Environmental				
Potential effects on terrestrial habitat	Low - No adverse effects on the terrestrial habitat.	Low - No adverse effects on the terrestrial habitat.	Low - No adverse effects on the terrestrial habitat.	Low - Existing area is already developed as industrial land.

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	**Limit Growth**	**Water Conservation**	**Expand Existing System**
Potential effects on fish habitat and aquatic ecosystems	Low - No adverse effects on the aquatic habitat.	Low - No adverse effects on the aquatic habitat.	Low - No adverse effects on the aquatic habitat.	Low - Existing area is already developed as industrial land.
Potential effects on known habitat for Species of Concern	Low - No adverse effects on habitat of known Species of Concern	Low - No adverse effects on habitat of known Species of Concern	Low - No adverse effects on habitat of known Species of Concern	Low - Existing area is already developed as industrial land.
Potential groundwater effects	Low - No adverse effects on baseflow or groundwater resources.	Low - No adverse effects on baseflow or groundwater resources.	Low - No adverse effects on baseflow or groundwater resources.	Low - Existing area is already developed as industrial land.
Potential effects on hydrologically sensitive features	Low - No adverse effects on hydrologically-sensitive features	Low - No adverse effects on hydrologically-sensitive features	Low - No adverse effects on hydrologically-sensitive features	Low - Existing area is already developed as industrial land.
Natural Environmental Summary	**LOW IMPACT**	**LOW IMPACT**	**LOW IMPACT**	**LOW IMPACT**
Social/Cultural Environment				
Potential effects on existing facilities during construction	High - No construction associated with the 'Do Nothing' alternative.	High - No construction associated with the 'Limit Growth' alternative.	Moderate - Some bypass pumping will be required by level of service will be maintained	Moderate - Some bypass pumping will be required by level of service will be maintained
Potential to minimize impacts to private property	Moderate - Doesn't permit private property to be redeveloped to the approved densities	Moderate - Doesn't permit private property to be redeveloped to the approved densities	Moderate - Doesn't permit private property to be redeveloped to the approved densities	High - Redevelopment proposal will enhance existing private properties
Potential to minimize impact to Public Safety	High - No safety concerns associated with the 'Do Nothing' alternative.	High - No safety concerns associated with the 'Do Nothing' alternative.	Moderate - Safety concerns associated with development can be mitigated through proper construction safety measures.	Moderate - Safety concerns associated with development can be mitigated through proper construction safety measures.
Opportunity to integrate with planned/future land uses in the surrounding area	Low - This prevents the redevelopment of the VMC lands	Low - This prevents the full redevelopment of the VMC lands	Low - This prevents the full redevelopment of the VMC lands	High - Required sewer improvements will be incorporated into required road works
Social/Cultural Environmental Summary	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**HIGH POTENTIAL**
Cost				
Costs for implementation	High "lost opportunity" cost due to not achieving the objectives of the Official Plan.	High "lost opportunity" cost due to not achieving the objectives of the Official Plan.	High "lost opportunity" cost due to not achieving the objectives of the Official Plan.	Moderate capital cost.
Annual operations and maintenance (O&M) Costs	Low - No additional cost.	Low - No additional cost.	Low - No additional cost.	Moderate additional cost.
Cost Summary	**MODERATE**	**MODERATE**	**MODERATE**	**MODERATE**

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	Limit Growth	Water Conservation	Expand Existing System
Technical				
Potential constructability of proposed infrastructure	High - No impact.	High - No impact.	Moderate - Potential for conservation program to not be successful to the extent desired/required.	High - No constructability concerns
Potential to minimize future maintenance requirements	High - No additional future maintenance.	High - No additional future maintenance.	Moderate - additional future maintenance.	Moderate - additional future maintenance.
Potential to optimize the existing infrastructure	Low - No optimization of existing infrastructure.	Moderate - Some optimization potential.	Moderate - Some optimization potential.	Moderate - Some optimization potential.
Potential to minimize conflicts with existing municipal and utility services	High - No potential impacts.	Moderate - Some potential impacts	Moderate - Some potential impacts	Moderate - Some potential impacts
Potential to minimize implementation requirements	High - No implementation requirements	Moderate - Some implementation requirements	Moderate - Some implementation requirements	Moderate - Some implementation requirements
Potential to minimize impacts on scheduling and coordination with Development within VMC	High - No scheduling impacts	Moderate - Some potential scheduling impacts	Moderate - Some potential scheduling impacts	Moderate - Some potential scheduling impacts
Potential to achieve technical objectives	Low – Technical objectives are not met for the 'Do Nothing' alternative.	Low – Technical objectives are not met for the 'Limit Growth' alternative.	Low – Technical objectives are not met for the 'Limit Growth' alternative.	High – Technical objectives are fully met by this alternative.
Potential to minimize level of effort for approvals and permits	High - No approvals required.	High - No approvals required.	High - No approvals required.	Moderate - Minimal approvals required as all works will be within road right-of-ways
Technical Summary	**HIGH POTENTIAL**	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**HIGH POTENTIAL**
Summary and Rank				
Summary	**MODERATE IMPACT, HIGH POTENTIAL**	**MODERATE IMPACT, MODERATE POTENTIAL**	**MODERATE IMPACT, MODERATE POTENTIAL**	**LOW IMPACT, HIGH POTENTIAL**

9.4 Storm Drainage

Based on the evaluation of the alternative solutions, the preferred storm drainage alternative is the Storm Drainage Option 3, which most closely maintains existing drainage patterns. This solution is technically feasible, has minimal adverse environmental impacts, and faces fewer challenges as compared to the other alternatives. Details of the recommended storm drainage solution are provided in **Section 11.1**.

Table 9-4: Storm Drainage Alternatives Evaluation

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4

	Do Nothing	Storm Drainage Option 1	Storm Drainage Option 2	Storm Drainage Option 3
Natural Environmental				
Potential effects on terrestrial habitat	Low - No adverse effects on the terrestrial habitat.	Moderate - Potential effects on terrestrial habitat but will have the opportunity to be mitigated.	Low - Potential effects on terrestrial habitat is low as the construction of these ponds does not interfere with existing vegetation.	Moderate - Potential effects on terrestrial habitat but will have the opportunity to be mitigated.
Potential effects on fish habitat and aquatic ecosystems	High – unmitigated impacts of urbanization on ecosystems	Low - Improved water quality and aquatic accessibility for the fish habitat will increase the stability of the aquatic ecosystem.	Low/Moderate – potential ecological impacts to upstream reaches of Black Creek.	Low/Moderate – potential ecological impacts to upstream reaches of Black Creek.
Potential effects on known habitat for Species of Concern	Low - No potential impacts	Low - No potential impacts	Low - No potential impacts	Low - No potential impacts
Potential groundwater effects	High –unmitigated impacts of urbanization, water balance will not be maintained	Moderate – modification of existing drainage regime may impact groundwater resources	High – significant modification of drainage regime will impact groundwater resources	Low – maintaining existing drainage regime
Potential effects on hydrologically sensitive features	Low - No adverse effects on existing hydrologically sensitive features.	Moderate - Slight adverse effects on existing hydrologically sensitive features.	High - Adverse effects on existing hydrologically sensitive features.	Moderate - Slight adverse effects on existing hydrologically sensitive features.
Natural Environmental Summary	**MODERATE IMPACT**	**MODERATE IMPACT**	**MODERATE IMPACT**	**LOW IMPACT**
Social/Cultural Environment				
Potential to minimize effects on existing facilities during construction	High - No construction associated with the 'Do Nothing' alternative.	Moderate - Potential effects on the existing SWM ponds.	Moderate - Potential effects on the existing SWM ponds.	Moderate - Potential effects on the existing SWM ponds.
Potential to minimize impacts to private property	High - Private property will not be impacted with the 'Do Nothing' alternative.	Moderate - Private property has the potential to be impacted during the re-grading of the storm drainage divides.	Low - Private property has significant potential to be impacted during the re-grading of the storm drainage divides.	High – Existing drainage regime is maintained and therefore will not impact private property.
Potential to minimize impact to Public Safety	Low – urbanization without flood control	High	High	High
Opportunity to integrate with planned/future land uses in the surrounding area	Low - No opportunity to integrate with future land uses.	Moderate - Storm drainage increases the ability for the SWM ponds to integrate with the land uses in the surrounding area.	Moderate - Storm drainage increases the ability for the SWM ponds to integrate with the land uses in the surrounding area.	Moderate - Storm drainage increases the ability for the SWM ponds to integrate with the land uses in the surrounding area.
Social/Cultural Environmental Summary	**MODERATE POTENTIAL**	**HIGH POTENTIAL**	**MODERATE POTENTIAL**	**HIGH POTENTIAL**

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	**Storm Drainage Option 1**	**Storm Drainage Option 2**	**Storm Drainage Option 3**
Cost				
Costs for implementation	Low - No costs associated with the 'Do Nothing' alternative.	High - Altering the drainage pattern and grading increases the cost of implementing this alternative significantly.	High - Altering the drainage pattern and grading increases the cost of implementing this alternative significantly.	Low - Minimal re-grading is required for this alternative as the proposed drainage pattern is consistent with the existing conditions.
Annual operations and maintenance (O&M) Costs	High - Annual maintenance costs due to ongoing stormwater management concerns.	Moderate - Annual operations and maintenance costs of SWM facilities.	Moderate - Annual operations and maintenance costs of SWM facilities.	Moderate - Annual operations and maintenance costs of SWM facilities.
Cost Summary	**HIGH**	**HIGH**	**HIGH**	**MODERATE**
Technical				
Potential constructability of proposed infrastructure	High - No infrastructure is required for the 'Do Nothing' alternative	Moderate - Proposed infrastructure has good constructible potential.	Low – Challenges with large shift in drainage patterns.	Moderate - Proposed infrastructure has good constructible potential.
Potential to minimize future maintenance requirements	Low - Potential for future maintenance requirements due to ongoing storm drainage problems.	Moderate - Annual operations and maintenance costs of SWM facilities.	High - Annual operations and maintenance costs of SWM facilities, plus large scale conveyance system.	Moderate - Annual operations and maintenance costs of SWM facilities.
Potential to minimize conflicts with existing municipal and utility services	High - No potential conflicts with existing utilities with the 'Do Nothing' alternative.	Low - Potential conflicts with existing municipal and utility services to adjust drainage patterns	Low – Significant conflict potential	High - Minimal potential conflicts
Potential flexibility of system to service future demands	Low - The 'Do Nothing' alternative does not provide the ability to service future demands.	High - Greater flexibility of system to service future demands due to storm drainage pattern and SWM pond locations.	Moderate - Possibility that future demands will not be met due to the unpredictability of the weather and climate change.	High - Greater flexibility of system to service future demands due to storm drainage pattern and SWM pond locations.
Potential to minimize impacts on scheduling and coordination with Development within VMC	High - Scheduling and coordination with Development within VMC is not required for the 'Do Nothing' alternative.	Moderate - Some conflicts with the City can arise with the scheduling and coordination of constructing the SWM ponds in the appropriate locations.	Low –Shifting drainage will require more effort and time	Moderate - Some conflicts with the City can arise with the scheduling and coordination of constructing the SWM ponds in the appropriate locations.
Potential to achieve technical objectives	Low - Technical objectives are not met for the 'Do Nothing' alternative.	High - Technical objectives are fully met by this alternative.	Moderate - Technical objectives are not fully met by this alternative.	High - Technical objectives are fully met by this alternative.
Potential to minimize level of effort for approvals and permits	High - No approvals or permits are required for the 'Do Nothing' alternative.	Moderate – shifting drainage patterns	Moderate – shifting drainage patterns	High – maintaining drainage patterns
Technical Summary	**HIGH POTENTIAL**	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**HIGH POTENTIAL**

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	Storm Drainage Option 1	Storm Drainage Option 2	Storm Drainage Option 3
Summary and Rank				
Summary	**HIGH IMPACT, LOW POTENTIAL**	**MODERATE IMPACT, MODERATE POTENTIAL**	**MODERATE IMPACT, MODERATE POTENTIAL**	**LOW IMPACT, HIGH POTENTIAL**

9.5 Stormwater Management

Based on the evaluation of the alternative solutions, the preferred stormwater management alternative is on-site control with 15mm retention over the building footprint and landscaped areas, along with end-of-pipe facilities.

This solution is technically feasible, has the greatest potential to satisfy the technical requirements, provides the greatest flexibility for future conditions, and has the least impact on social and environmental conditions. Details of the recommended stormwater management solution are provided in **Section 11.2**.

Table 9-5: Stormwater Management Alternatives Evaluation (Alternatives 1 – 4)

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	Reduce Level of Service	No On-Site Control	On-Site Control with End-of-Pipe
Natural Environmental				
Potential effects on terrestrial habitat	High – unmitigated impacts of urbanization	Moderate – partially mitigated impacts of urbanization	Moderate – unmitigated water balance impacts, pond expansion impacts to existing features	Moderate – unmitigated water balance impacts, pond expansion impacts to existing features
Potential effects on fish habitat and aquatic ecosystems	High – unmitigated impacts of urbanization	Moderate – partially mitigated impacts of urbanization	Moderate – partially mitigated impacts of urbanization	Moderate – partially mitigated impacts of urbanization
Potential effects on known habitat for Species of Concern	No potential impacts	No potential impacts	No potential impacts	No potential impacts
Potential groundwater effects	High – unmitigated impacts of urbanization	Moderate – partially mitigated impacts of urbanization affecting water balance	Moderate – partially mitigated impacts of urbanization affecting water balance	Moderate – partially mitigated impacts of urbanization affecting water balance
Potential effects on hydrologically sensitive features	High – unmitigated impacts of urbanization	Moderate – partially mitigated impacts of urbanization affecting water balance	Moderate – partially mitigated impacts of urbanization affecting water balance	Moderate – partially mitigated impacts of urbanization affecting water balance
Natural Environmental Summary	**HIGH IMPACT**	**MODERATE IMPACT**	**MODERATE IMPACT**	**MODERATE IMPACT**
Social/Cultural Environment				
Potential effects on existing facilities during construction	Low	Low	High	High

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	**Reduce Level of Service**	**No On-Site Control**	**On-Site Control with End-of-Pipe**
Potential to minimize impacts to private property	Low - Damage to private property will occur due to inadequate stormwater runoff quality and quantity control	Low - Damage to private property will occur due to inadequate stormwater runoff quality and quantity control	Moderate - Potential impacts on private property due to inadequate stormwater runoff quality and quantity control	Moderate - Potential impacts on private property due to inadequate stormwater runoff quality and quantity control
Potential to minimize impact to Public Safety	Low – flood and water quality impacts of urbanization not mitigated	Low – flood and water quality impacts of urbanization not fully mitigated	Moderate - Potential for improving water quality and reducing flood potential	Moderate - Potential for improving water quality and reducing flood potential
Opportunity to integrate with planned/future land uses in the surrounding area	Low	Low	Moderate - Potential opportunity to integrate with future land uses by SWM facility improvements.	Moderate - Potential opportunity to integrate with future land uses by SWM facility improvements.
Social/Cultural Environmental Summary	**LOW POTENTIAL**	**LOW POTENTIAL**	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**
Cost				
Costs for implementation	Low	Low	High - Costs associated with the dual drainage system and the improvements of the SWM facilities.	Moderate - Costs associated with the dual drainage system and the improvements of the SWM facilities.
Annual operations and maintenance (O&M) Costs	High - Annual maintenance costs due to ongoing stormwater management concerns.	High - Annual maintenance costs due to ongoing stormwater management concerns.	High – all control at end-of-pipe – more frequent and extensive maintenance of ponds	Moderate – majority of control at end-of-pipe – more frequent and extensive maintenance of ponds
Cost Summary	**HIGH IMPACT**	**HIGH IMPACT**	**HIGH IMPACT**	**MODERATE IMPACT**
Technical				
Potential constructability of proposed infrastructure	Low	Low	Moderate	Moderate
Potential to minimize future maintenance requirements	Low - Potential for future maintenance requirements due to ongoing stormwater management problems. Periodic maintenance will continue to be required for the existing SWM ponds.	Low - Potential for future maintenance requirements due to ongoing stormwater management problems. Periodic maintenance will continue to be required for the existing SWM ponds.	Moderate - Periodic maintenance will be required for the SWM ponds.	Moderate - Periodic maintenance will be required for the SWM ponds.
Potential to minimize conflicts with existing municipal and utility services	High - No potential conflicts with existing utilities.	High - No potential conflicts with existing utilities.	Low – larger storm conveyance infrastructure needed	Moderate
Potential to maximize infrastructure security	Low – Flood risks	Low – Flood Risks	Moderate	Moderate

Analysis Criteria	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
	Do Nothing	**Reduce Level of Service**	**No On-Site Control**	**On-Site Control with End-of-Pipe**
Potential flexibility of system to service future demands	Low - The 'Do Nothing' alternative does not provide the ability to service future demands.	Low - Future demands will not be met by reducing the level of service.	Moderate - Possibility that future demands will not be met due to the unpredictability of the weather and climate changes.	Moderate - Possibility that future demands will not be met due to the unpredictability of the weather and climate changes.
Potential to minimize impacts on scheduling and coordination with Development within VMC	High - Scheduling and coordination with Development within VMC is not required for the 'Do Nothing' alternative.	High - Scheduling and coordination with Development within VMC is not required for this alternative.	Low – work associated with pond expansions and increased conveyance	Moderate – work associated with pond expansion
Potential to achieve technical objectives	Low - Technical objectives are not met with the 'Do Nothing' alternative.	Low - Technical objectives are not met by reducing the level of service.	Low - Minimal technical objectives are met by incorporating a traditional dual drainage system and improving the SWM facilities.	Low - Technical objectives are not fully met by this alternative.
Potential to minimize level of effort for approvals and permits	Low – does not satisfy regulatory criteria	Low – does not satisfy regulatory criteria	Moderate – standard approaches	Moderate – standard approaches
Technical Summary	**LOW POTENTIAL**	**LOW POTENTIAL**	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**
Summary and Rank				
Summary	**HIGH IMPACT, LOW POTENTIAL**	**HIGH IMPACT, LOW POTENTIAL**	**HIGH IMPACT, MODERATE POTENTIAL**	**MODERATE IMPACT, MODERATE POTENTIAL**

Table 9-6: Stormwater Management Alternatives Evaluation (Alternatives 5 – 7)

Analysis Criteria	Alternative No. 5	Alternative No. 6	Alternative No. 7
	On-Site Control with 5mm Building Retention and End-of-Pipe	**On-Site Control with 5mm Retention over Entire Site and End-of-Pipe**	**On-Site Control with 15mm Retention over Building and Landscape, and End-of-Pipe**
Natural Environmental			
Potential effects on terrestrial habitat	Moderate – partially maintained water balance, disturbance to existing pond features	Moderate – partially maintained water balance, disturbance to existing pond features	Low – maximum mitigation of impacts of urbanization
Potential effects on fish habitat and aquatic ecosystems	Low - Improved water quality increases fish habitat and aquatic ecosystem stability.	Low - Improved water quality increases fish habitat and aquatic ecosystem stability.	Low - Improved water quality increases fish habitat and aquatic ecosystem stability.
Potential effects on known habitat for Species of Concern	No potential impacts	No potential impacts	No potential impacts
Potential groundwater effects	Low - Greater opportunity for infiltration encourages groundwater stability.	Low - Greater opportunity for infiltration encourages groundwater stability.	Low - Greater opportunity for infiltration encourages groundwater stability.
Potential effects on hydrologically sensitive features	Low - Increased low impact development measures more accurately mimics the existing water cycle.	Low - Increased low impact development measures more accurately mimics the existing water cycle.	Low - Increased low impact development measures more accurately mimics the existing water cycle.

Analysis Criteria	Alternative No. 5 On-Site Control with 5mm Building Retention and End-of-Pipe	Alternative No. 6 On-Site Control with 5mm Retention over Entire Site and End-of-Pipe	Alternative No. 7 On-Site Control with 15mm Retention over Building and Landscape, and End-of-Pipe
Natural Environmental Summary	**LOW IMPACT**	**LOW IMPACT**	**LOW IMPACT**
Social/Cultural Environment			
Potential effects on existing facilities during construction	Moderate	Moderate	Low – least expansion due to upstream controls and LID's
Potential to minimize impacts to private property	High - Minimal impact on private property due to an effective approach to improve stormwater runoff water quality and quantity.	High - Minimal impact on private property due to an effective approach to improve stormwater runoff water quality and quantity.	High - Minimal impact on private property due to an effective approach to improve stormwater runoff water quality and quantity.
Potential to minimize impact to Public Safety	Moderate	Moderate	High
Opportunity to integrate with planned/future land uses in the surrounding area	Moderate - Potential opportunity to integrate with future land uses by SWM facility improvements and low impact development measures.	Moderate - Potential opportunity to integrate with future land uses by SWM facility improvements and low impact development measures.	High - Opportunity to integrate with future land uses by SWM facility improvements and low impact development measures
Social/Cultural Environmental Summary	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**HIGH POTENTIAL**
Cost			
Costs for implementation	Moderate - Costs associated with the dual drainage system and the improvements of the SWM facilities.	Moderate - Costs associated with the dual drainage system and the improvements of the SWM facilities.	Moderate - Costs associated with the dual drainage system and the improvements of the SWM facilities.
Annual operations and maintenance (O&M) Costs	Moderate - Annual operations and maintenance costs of SWM facilities.	Moderate - Annual operations and maintenance costs of SWM facilities.	Moderate - Annual operations and maintenance costs of SWM facilities.
Cost Summary	**MODERATE IMPACT**	**MODERATE IMPACT**	**MODERATE IMPACT**
Technical			
Potential constructability of proposed infrastructure	Moderate	Moderate	Moderate
Potential to minimize future maintenance requirements	High - Decreased level of maintenance required after implementation of low impact development practices. Periodic maintenance will be required for the SWM ponds.	High - Decreased level of maintenance required after implementation of low impact development practices. Periodic maintenance will be required for the SWM ponds.	High – Decreased level of maintenance required after implementation of low impact development practices. Periodic maintenance will be required for the SWM ponds.
Potential to minimize conflicts with existing municipal and utility services	Moderate	Moderate	Moderate
Potential to maximize infrastructure security	High – Decentralization with LID's	High – Decentralization with LID's	High – Decentralization with LID's
Potential flexibility of system to service future demands	Moderate – Some flexibility to meet future demands with LIDs.	Moderate – Some flexibility to service future demands with LIDs.	High - Greater flexibility to service future demands with LIDs.

Analysis Criteria	Alternative No. 5	Alternative No. 6	Alternative No. 7
	On-Site Control with 5mm Building Retention and End-of-Pipe	**On-Site Control with 5mm Retention over Entire Site and End-of-Pipe**	**On-Site Control with 15mm Retention over Building and Landscape, and End-of-Pipe**
Potential to minimize impacts on scheduling and coordination with Development within VMC	Moderate – work associated with pond expansion	Moderate – work associated with pond expansion	High – work associated with pond retrofits, but reduced due to extent of LIDs
Potential to achieve technical objectives	Moderate – Many of the technical objectives are met with this alternative.	Moderate – Many of the technical objectives are met with this alternative.	High - Technical objectives are most closely met by this alternative.
Potential to minimize level of effort for approvals and permits	Low – LIDs may require more effort for approval	Low – LIDs may require more effort for approval	Low – LIDs may require more effort for approval
Technical Summary	**MODERATE POTENTIAL**	**MODERATE POTENTIAL**	**HIGH POTENTIAL**
Summary and Rank			
Summary	**MODERATE IMPACT, MODERATE POTENTIAL**	**MODERATE IMPACT, LOW POTENTIAL**	**MODERATE IMPACT, HIGH POTENTIAL**

10 Description, Implementation, and Monitoring of the Project – Water and Wastewater Servicing

10.1 Description of Recommended Solution – Water Servicing

10.1.1 Water Servicing Strategy Recommendation

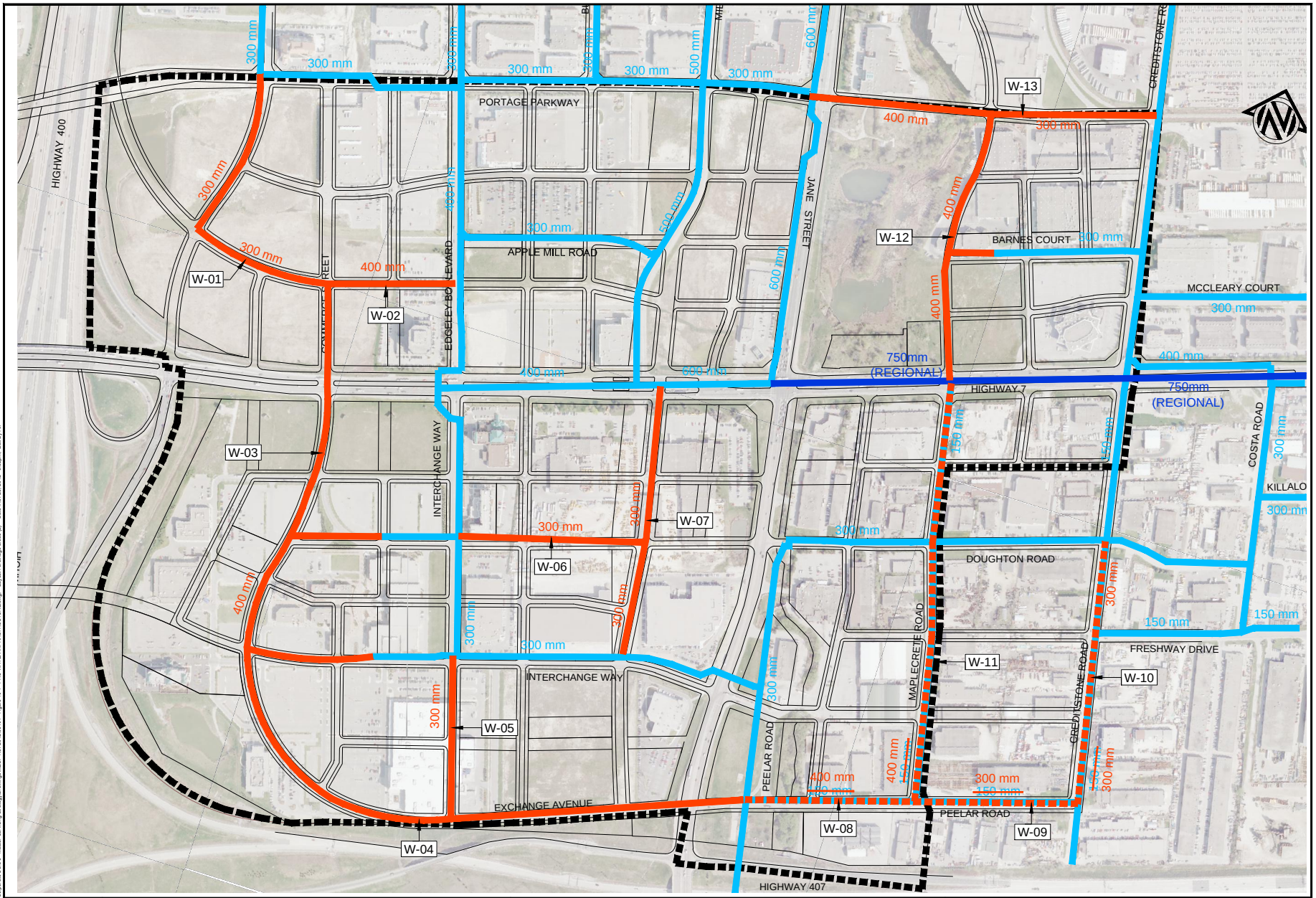
At the onset of the EA process, three potential servicing strategies were identified in order to provide the water demands required at the mandated pressures:

1. Increase the size and capacity of the Regional feed along Highway 7 from Keele Street;
2. Increase the size of the internal system to reduce pressure losses from the point where the Region feed meets the City's system to the end users; and,
3. Bolster the Regional feed into the VMC through a booster station from PD-5 to the west.

These system expansion options were presented at the first Public Information Centre, and were based primarily on concerns that the hydraulic losses along the Regional supply on Highway would result in a low hydraulic grade line elevation at Jane Street.

Subsequent to that, further investigation revealed that this was in fact not a constraint, and that the Regional supply was adequate. As a result, no major system improvements are required, other than constructing new watermains along new roads as redevelopment occurs, ensuring that the new watermains are of sufficient diameter to meet the required level of service.

Hydraulic modelling of the required improvements was undertaken by modifying the City's WaterCAD model of the area. This confirmed the pipe size requirements for the ultimate build-out of the VMC. A map of the required projects is provided in **Figure 10-1**, and a list of projects is provided in **Table 10-1**.



LEGEND

- STUDY AREA
- EXISTING DISTRIBUTION SYSTEM
- PROPOSED DISTRIBUTION SYSTEM
- REGIONAL WATERMAIN

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PROPOSED WATER SERVICING STRATEGY

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	10-1

Table 10-1: Proposed Water System Projects

Project	Sched.	Street	From	To	Diam. [mm]	Length [m]
W-01	A	Applewood Cres	Portage Pkwy	Commerce St	300	571
W-02	A	Proposed Road	Commerce St	Edgeley Blvd	400	292
W-03	A	Commerce St	Proposed Road	Interchange Way	400	642
W-04	A	Exchange Ave	Interchange Way	Jane Street	400	984
W-05	A	Interchange Way	Interchange Way	Exchange Ave	300	270
W-06	A	Doughton Road	Interchange Way	Millway Ave	300	300
W-07	A	Millway Ave	Highway 7	Interchange Way	300	460
W-08	A+	Peelar Rd	Jane St	Maplecrete Rd	400	301
W-09	A	Peelar Rd	Maplecrete Rd	Creditstone Rd	300	270
W-10	A	Creditstone Rd	Doughton Rd	Peelar Rd	300	440
W-11	A	Maplecrete Rd	Highway 7	Peelar Rd	400	706
W-12	A	Maplecrete Rd	Portage Pkwy	Highway 7	400	450
W-13	A+	Portage Pkwy	Jane St	Creditstone Rd	300/400	570

Eleven of the water projects listed in **Table 10-1** are Schedule A projects, and therefore have no further requirements under the Class EA prior to implementation.

Projects W-08 and W-13 are listed as a Schedule A+ projects, as they consist of trenchless crossings of Black Creek within the existing right-of-way.

If any modifications are determined during the detail design stage, any additional impacts to the environment must be mitigated to ensure that all Class EA requirements are met.

10.1.2 Water Servicing Implementation Strategy

The preferred water servicing strategy provides the main looping through the redeveloped Vaughan Metropolitan Centre, and can be phased as individual properties redevelop. While not specifically addressed in this Master Plan, additional local watermains will be required to connect the individual future buildings to these main loops, but the exact locations and sizing of these connections can be addressed at the design review stage without any impact to the recommendations presented here.

Depending on the phasing of the redevelopment, it is possible that a parcel will propose redevelopment in advance of the reconstruction of the street and looped watermain that is intended to service that particular property. In that instance, the City

can consider slight modifications to this recommendation, such as shifting the recommended watermains one street over from the location identified here. These modifications should only be considered in conjunction with an updated system analysis using the Master Plan model. There would be no significant change to the technical, environmental, socio-economic or financial impacts to installing a watermain in an alternate location in conjunction with a road reconstruction.

10.2 Description of Recommended Solution – Sanitary Servicing

10.2.1 Sanitary Servicing Strategy Recommendation

At the onset of the EA process, three potential servicing strategies were identified in order to convey the sanitary flows to the trunk sewer:

1. Two crossings of the Subway to facilitate phasing of the required modifications;
2. A single, deeper crossing of the subway; and,
3. A pumping station and shallow crossing of the subway.

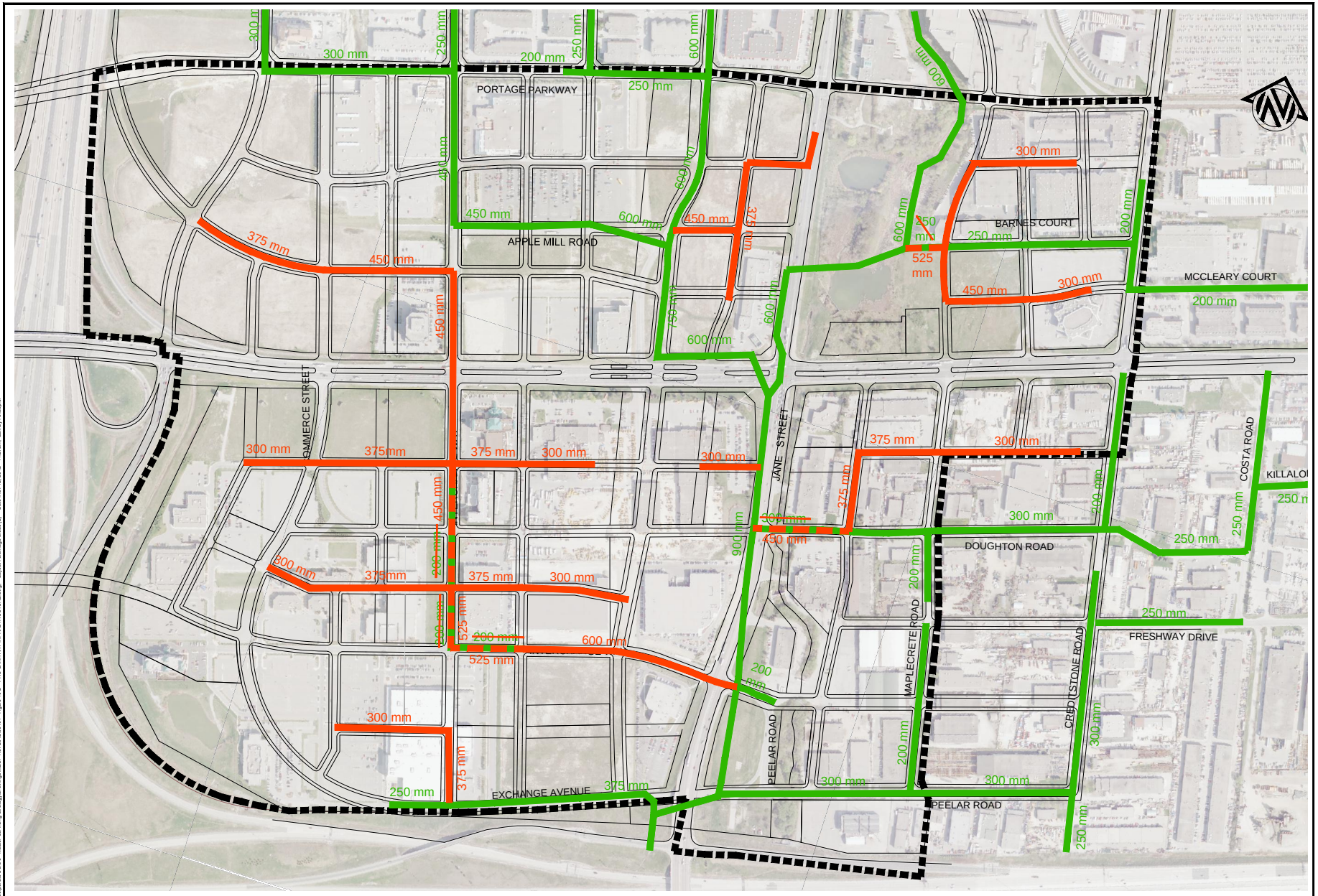
Further evaluation of these ruled out Option 1, as there would be insufficient cover over the Subway tunnel to facilitate the connections at the proposed locations.

Option 2 is a viable alternative as there is sufficient cover over the proposed Subway to permit a sanitary sewer that is deep enough to service the drainage area to the north.

As it is possible to convey flows from the entire drainage area to the trunk sewer by gravity, the pumping station (with higher initial capital costs and ongoing operation and maintenance costs) is not recommended.

Hydraulic modelling of the required improvements was undertaken by modifying the City's SewerCAD model of the area. This confirmed the pipe size requirements for the ultimate build-out of the VMC. A map of the required projects is provided in **Figure 10-2**, and a list of projects is provided in **Table 10-2**. **Figure 10-3** illustrates the proposed sanitary drainage areas.

While the modelling results indicate that the two sections of the Jane Street Collector immediately south of the Vaughan Metro Centre could surcharge under design flow conditions, the projected amount of surcharge is only 15 L/s and 150 L/s respectively, amounting to 1% and 17% in excess of the full-pipe capacity. Given that these pipes are located under Highway 407, enlarging them would be extremely difficult and disruptive. Given the conservative nature of the design criteria, the depth of these sewers (approximately 10 m of cover, and the fact that no services connect directly to these sewers, it is proposed that these sections not be upgraded. A hydraulic grade line analysis of the sewers has been prepared, and the expected depth of surcharging is only slightly above the crown of the pipes, and is fully contained within the pipe along Jane Street and Peelar Road. The level of service is then not affected by leaving the existing sewers in place under Highway 407.



LEGEND

- STUDY AREA
- EXISTING SANITARY SYSTEM
- PROPOSED SANITARY SYSTEM

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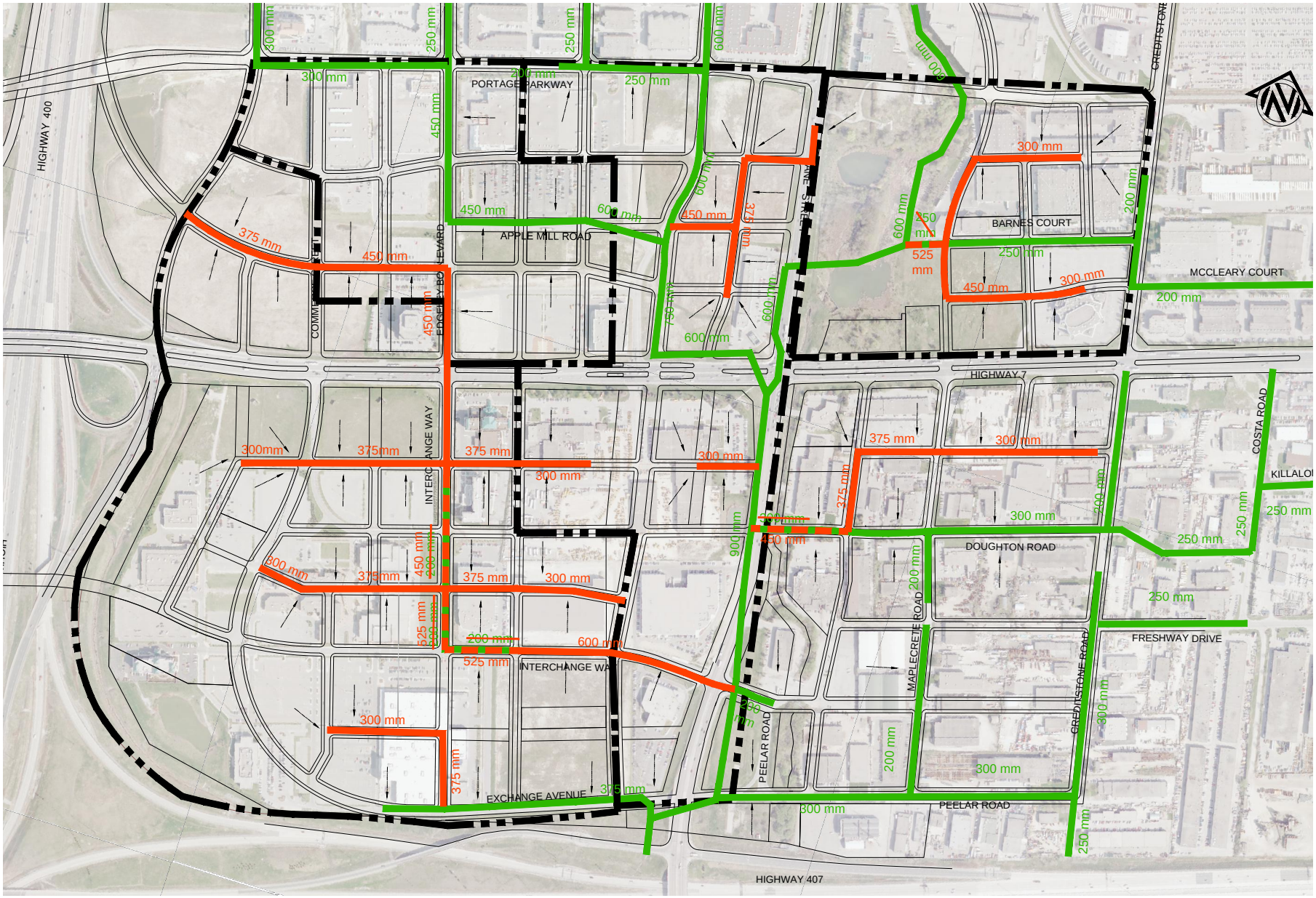
PROPOSED SANITARY
SERVICING STRATEGY

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	10-2

File : G:\Projects\2008\08104 - Vaughan Corporate Centre - Master Servicing Strategy\Drawings\MESP Nov 2012\08104 - Figure 10-2 - PRO SANITARY INFRASTRUCTURE.dwg, Layout : drainage areas (2) Date: Nov 12, 2012 - 11:27am, Edit By: lalasifer



LEGEND

- DRAINAGE AREA
- EXISTING SANITARY SYSTEM
- PROPOSED SANITARY SYSTEM

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PROPOSED SANITARY DRAINAGE AREAS

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	10-3

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Table 10-2: Proposed Sanitary System Projects

Project	Sched.	Project	From	To	Diam. [mm]	Length [m]
SA-01	A	Interchange Way Upgrades	North of Highway 7	Jane Street Trunk	450-600	820
SA-02	A	Barnes Court Upgrade	Barnes Ct	Jane Street Trunk	525	65
SA-03	A	Doughton Road Upgrade	Maplecrete Rd	Jane St	450	160

All of the sanitary projects listed in **Table 10-2** are Schedule A projects, and will therefore not require individual Class EAs prior to implementation.

10.2.2 Sanitary Servicing Implementation Strategy

The recommended sanitary servicing strategy provides the main sub-trunk sewers locations through the redeveloped Vaughan Metropolitan Centre, and can be phased as individual properties redevelop. While not specifically addressed in this Master Plan, additional local sewers will be required to connect the individual future buildings to these sub-trunks, but the exact locations and sizing of these connections can be addressed at the design review stage without any impact to the recommendations presented here.

Depending on the phasing of the redevelopment, it is possible that a parcel will propose redevelopment in advance of the reconstruction of the street and sub-trunk that is intended to service that particular property. In that instance, the City can consider slight modifications to this recommendation, such as shifting a recommended sub-trunk one street over from the location identified here. These modifications should only be considered in conjunction with an updated system analysis using the Master Plan model. There would be no significant change to the technical, environmental, socio-economic or financial impacts to installing a sub-trunk in an alternate location in conjunction with a road reconstruction.

11 Description, Implementation, and Monitoring of the Project – Storm Drainage and Stormwater Management

11.1 Description of Recommended Solution – Storm Drainage

11.1.1 Drainage Patterns

As described in **Section 2.10**, the VMC area presently has four drainage pockets, corresponding to the four study area quadrants. The storm drainage alternatives essentially considered either maintaining the current drainage patterns, or modifying these to direct more or less runoff to the different end-of-pipe facilities.

The evaluation described in **Section 9.4** recommends storm drainage option 3, which is largely consistent with the existing drainage patterns. **Figure 11-1** illustrates the preferred storm drainage option.

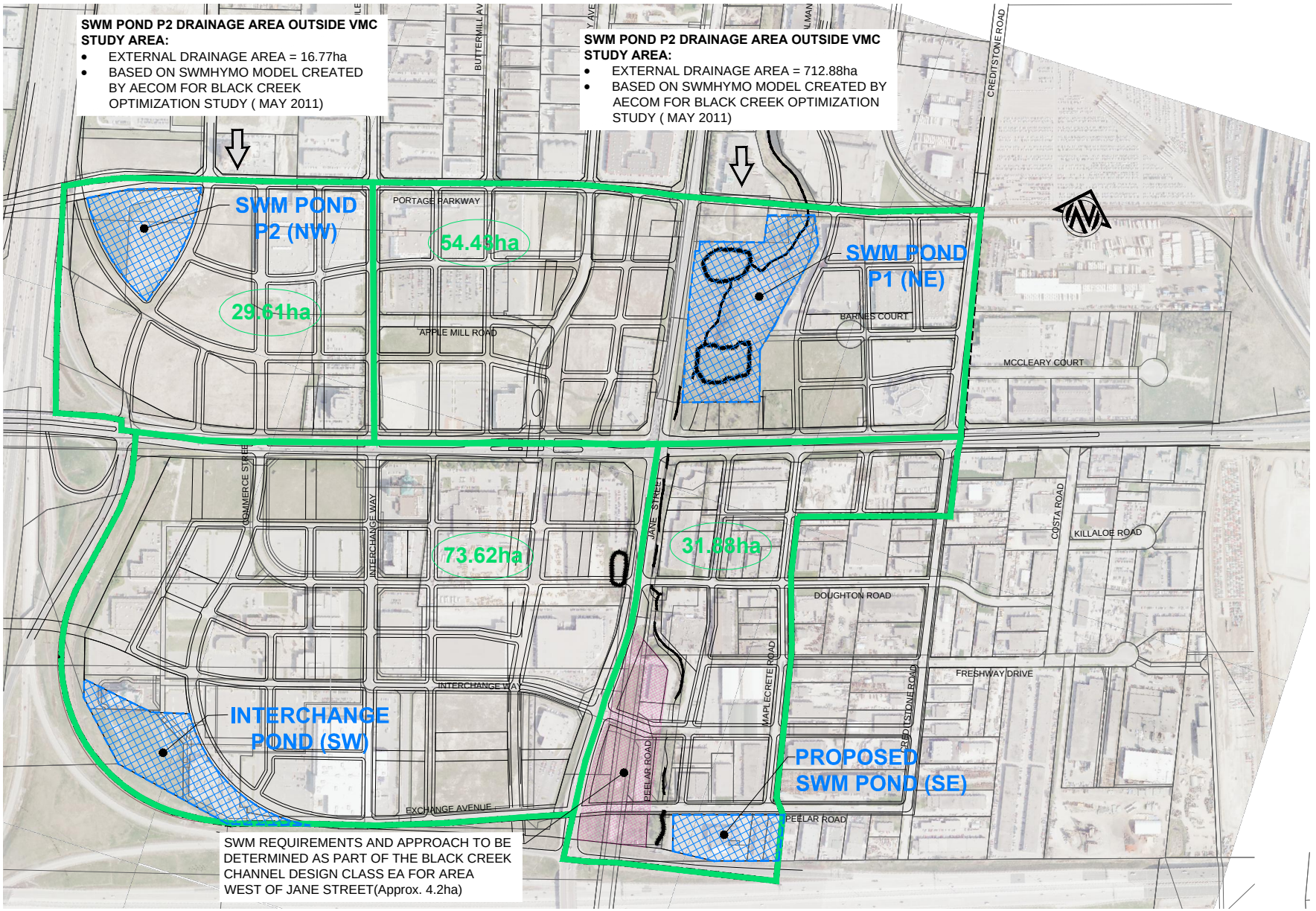
As shown in **Figure 11-1**, the VMC area is divided into four quadrants. SWM Pond P1 (the "Edgeley Pond") is located within the north-east quadrant, which has a total drainage area of 54.43 ha within the VMC lands. This facility also receives drainage from a 712.88 ha area external to the VMC lands. A proposed SWM pond within the south-east quadrant has a total drainage area of 31.88 ha. The south-west quadrant has a total drainage area of 73.62 ha, draining to the Interchange Pond. SWM Pond P2 is located within the north-west quadrant, which has a total drainage area of 29.61 ha with in the VMC lands. This facility also receives drainage from a 16.77 ha area external to the VMC lands. The recommended SWM facility configurations are provided in **Section 11.5**, as part of the overall VMC SWM strategy.

Within the south-east quadrant, a 4.2 ha redevelopment area falls between Jane Street and the Black Creek corridor. Several drainage and stormwater management control options exist for this area, described further in **Section 11.3.3**.

11.1.2 Runoff Conveyance

Drainage to the SWM facilities will continue to be conveyed via a dual drainage system that consists of a network of storm sewers and overland flow routes (predominantly rights-of-way).

Storm sewers within the VMC will continue to be designed in accordance with current City of Vaughan criteria, where the minor system (storm sewers) will convey runoff from storms up to and including the 5-year event. The major system (overland flow routes) will convey all runoff that isn't captured by the minor system, up to and including the 100-year event. It is anticipated that the design and construction of new storm sewers and overland flow routes will occur as part of new road construction and related improvements as development of the VMC area progresses.



LEGEND

- STUDY AREA
- FUTURE REFINEMENTS
- PROPOSED SWM POND BLOCK
- DRAINAGE BOUNDARY
- 35.64ha DRAINAGE AREA WITHIN OPA 500 BOUNDARY
- WATERCOURSE

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PROPOSED PREFERRED STORM DRAINAGE

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	11-1

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11.2 Description of Recommended Solution – Stormwater Management

The recommended stormwater management solution for the VMC area proposes a treatment-train approach that provides control and treatment at the source (on-site) and at the end-of-pipe. Conveyance control measures were also considered, but do not presently form part of the recommended solution. The opportunities to incorporate conveyance controls are discussed further in **Section 11.4**. The recommended solution includes the following components:

- On-site control for each development and redevelopment block – 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 15mm over the building footprint, and an additional 15mm on-site retention over landscaped areas. Capture and utilization of 15mm of every rainfall event to be achieved through the implementation of low impact development measures, with examples described in **Section 11.3.2**.
- Remaining runoff from development blocks, rights-of-way, and other uncontrolled areas directed via a dual-drainage storm network to end-of-pipe stormwater management facilities, which discharge to the main and west branches of Black Creek.
- The three existing stormwater management ponds will be retrofitted to satisfy current criteria and targets, with a fourth pond proposed for the south-east quadrant where no SWM controls currently exist. Details of the stormwater management facility configurations are provided in **Section 11.5**.

11.3 Source Control

The on-site controls are required for each of the development and redevelopment projects that will occur within the VMC area. The stipulated extent of control is necessary to ensure that the overall stormwater management strategy satisfies the established targets before discharging to the Black Creek system.

11.3.1 Peak Flow Management

On-site control for peak flow management involves conventional mechanisms including rooftop and parking lot controls to store and attenuate runoff from return period events, prior to discharge to the City's storm sewer system. The City of Vaughan's design criteria provides guidance on the acceptable methods and standards for on-site peak flow control.

The peak flow generated by storms up to and including the 100-year return period event are to be attenuated to the 2-year post development flow rate, using the City of Vaughan's intensity-duration-frequency (IDF) parameters.

For sites with a proposed imperviousness of 80% or less, the peak flow target is based on the 2-year post development flow rate using the calculated site imperviousness. For example, a site with a proposed imperviousness of 70% would use the 70% value in determining the peak flow target.

For sites with a proposed imperviousness greater than 80%, the peak flow target is based on the 2-year post development flow rate using an imperviousness of 80%.

For example, a site with a proposed imperviousness of 90% would use an imperviousness value of 80% in determining the peak flow target.

11.3.2 Volume Management

Volume management is a more recent stormwater management approach that better simulates the natural hydrologic cycle and better mitigates the impacts of urbanization on natural systems. Volume management is achieved through mechanisms that capture and retain site runoff via infiltration, reuse, and/or evapotranspiration.

Low impact development practices (LID's) refer to those measures that are intended to provide volume management, and in other words manage the rain where it lands. Examples of LID approaches within urban settings include permeable pavements, green roofs, bioretention, and rainwater harvesting. More guidance on the planning and design of LID practices can be found in the "*Low Impact Development Stormwater Management Planning and Design Guide*", issued by the Toronto and Region and Credit Valley Conservation Authorities (2010, downloadable at *www.sustainabletechnologies.ca*).

Determining the runoff benefit of volume controls requires the formulation of assumptions regarding the relative proportions of building, hardscape, and landscape within a proposed redevelopment. Based on the urban form established by the VMC Secondary Plan, and consideration for configurations typified by standard runoff coefficients, the following proportions have been assumed for the purposes of further analysis, with supporting calculations provided in **Appendix D**.

- impervious areas occupy 79% of each development block;
- within the impervious area, 75% of the area is occupied by building footprint, while the remaining 25% is occupied by paved surfaces / hardscaping (driveways, surface parking, walkways, etc.). Of the total site area these values equate to 59% building footprint and 20% hardscaping; and,
- pervious / landscaped areas occupy 21% of the total site area.

The volume management target is the capture and retention of **15mm of every rainfall event** over the proposed building footprint and landscaped area. For landscaped areas, it is recognized that initial abstractions can retain about 5mm of every rainfall event, therefore the requirement for landscaped areas becomes 10mm of every rainfall event.

Identifying the extent of volume management infrastructure required to achieve the noted targets must assume proposed site characteristics as described above, namely 59% building, 20% hardscape, and 21% landscape. For example, a 1-hectare development site within the VMC area would need to provide an equivalent storage volume based on the following:

- 0.59 ha building footprint x 15mm retention = 88.5 m^3
- 0.21 ha landscaped area x 10mm retention = 21.0 m^3 (5mm initial abstraction already taken into account)

On this basis, the 1-hectare site would need to provide 109.5 m^3 of equivalent storage, with the actual volume dependent on the types and extent of low impact

development measures proposed, and the approach in quantifying the effectiveness of the LID practices. The extent of volume management provided on the individual development blocks has been considered in determining the sizing of end-of-pipe facilities, as described in **Section 11.5**.

11.3.3 Isolated Parcels

The preferred alignment of the main branch of Black Creek established by the Black Creek Stormwater Optimization Study (May 2011) includes an eastward bend north of Highway 407. This bend has created a space between Jane Street and the Black Creek Corridor north of Highway 407 which has been reflected in the VMC Secondary Plan.

The result of this alignment is the isolation of a 4.2 ha area on the east side of Jane Street, within the south-east quadrant of the VMC.

Conveying runoff from this area to the new facility proposed to service the south-east quadrant (**Section 11.5.5**) may be challenging, as a crossing of Black Creek would be required. Nevertheless, the sizing of the new south-east pond has included this isolated area in the event that conveyance is deemed possible.

Alternatively, but also challenging, is the conveyance of flow across Jane Street and through the south-west quadrant to the Interchange Pond, which is also recommended to be retrofitted. However, this facility has not been sized to accommodate flow from east of Jane Street.

A third alternative is the provision of appropriate on-site peak flow and volume controls, with controlled overland flow directed to either Jane Street or Black Creek. The extent of control required in this area will be dependent on the proposed form of redevelopment and a detailed investigation of drainage patterns to establish suitable targets and flow directions.

Therefore, the provision of stormwater management for the noted area requires a more detailed investigation, as part of the redevelopment process, of the feasibility of draining to one of the VMC SWM facilities or the ability to provide the necessary level of on-site control.

11.4 Conveyance Control – LIDs in the Public Realm

Conveyance refers to the mechanism by which runoff is conveyed from the source (where runoff is generated) to the destination (such as a receiving water body or SWM facility). Within the VMC, the storm sewer network receives runoff from the roads and individual parcels and provides conveyance to the end-of-pipe SWM facilities, as described in **Section 11.1.2**.

Conveyance controls refer to controls placed en route from the source where runoff is generated to the outlet or receiving water body, and these function by providing attenuation, retention, or active water quality treatment while runoff is in transit from source to outlet. Some forms of conveyance controls include oil-grit separators, infiltration galleries, or bioswales, and the majority of these measures can be categorized as either active controls or low impact development measures.

Within the VMC, active controls, which could include oversized storm sewers or oil-grit separators, were generally not considered. However, the recommended storm drainage and stormwater management strategies do not preclude the incorporation of these approaches where deemed appropriate during detailed design.

Similarly, the feasibility of incorporating low impact development into rights-of-way and open spaces requires a detailed review of the other demands of these spaces with respect to utilities, services, transportation modes, and other urban design considerations. The level of detail required to assess the extent of these considerations is beyond the scope of this study, therefore this option has not been considered in the evaluation of alternatives. However, an evaluation of the anticipated benefits of incorporating low impact development practices into the public realm has been completed to provide future guidance on the feasibility of these approaches, to be reviewed in concert with detailed streetscape and open space planning. Details of the analysis are provided in **Appendix D**.

The analysis considered as a sample area the south-west quadrant of the VMC, having a total drainage area of 73.62 ha. Retrofit of the existing SWM facility is proposed to provide treatment of runoff from this area, as detailed in **Section 11.5.6**. Within this quadrant, and per the VMC Secondary Plan, redevelopment parcels occupy 34.07 ha, which are to be developed with source control measures as described in **Section 11.3**. The remainder of the quadrant will be uncontrolled, with 18.21 ha occupied by parks and open space, and 21.34 ha occupied by rights-of-way (ROWs). The total length of the ROWs within this quadrant is 5700 m, with a corresponding runoff coefficient of 0.90.

A suitable low impact development approach within ROWs consists of infiltration trenches / linear bioretention trenches, equipped with porous filter media to provide runoff attenuation to address quality and erosion control requirements. **Figure 11-2** illustrates a similar installation, which was developed and installed for a section of Elm Drive West in Mississauga, and included concrete planter boxes as part of the design to integrate with the urban character of the ROW.

Figure 11-2: Example Low Impact Development Approach within the ROW

Analysis of this configuration has considered the following:

- total ROW length of 5700 m;
- implementation of LIDs on both sides of ROW, yielding total possible LID length of 11400 m;
- assumed LID section of 1m width by 1.2 m depth; and,
- filter media porosity of 0.40.

Based on the above, the total volume of storage available within the ROW LIDs in the south-west quadrant is about 5500 m^3, assuming that 100% of the ROWs are equipped with LIDs on both sides.

For the ROW area of 21.34 ha, having a runoff coefficient of 0.90, the volume of runoff generated by a 25mm storm is about 4800 m^3. Therefore, it can be assumed that the ROW LIDs can store runoff generated over the ROW area during a 25mm event, and the runoff coefficient reduction of 25 mm can be applied to the road area, using the methodology described in **Section 11.5.2**.

Hydrologic modelling was undertaken using the modified runoff coefficients to estimate the reduction in SWM pond volume that could be realized with the application of LIDs within the ROWs. The results of the analysis are summarized in **Table 11-1**.

Table 11-1: Possible Volume Reductions in South-West SWM Pond with ROW LIDs

Event	No LIDs within ROW	LIDs applied to 50% of ROWs on both sides		LIDs applied to 100% of ROWs on both sides	
	Required SWM Pond Volume (m^3)	Required SWM Pond Volume (m^3)	% Reduction	Required SWM Pond Volume (m^3)	% Reduction
25mm	11,412	10,563	7%	9,714	15%
2-year	16,135	15,054	7%	14,000	13%
5-year	21,584	20,319	6%	19,083	12%
10-year	25,393	24,031	5%	22,684	11%
25-year	30,208	28,734	5%	27,268	10%
50-year	33,584	32,274	4%	30,779	9%
100-year	37,481	35,833	4%	34,284	9%

Assessment of the correlation between SWM pond volume and tableland area was also completed, and concluded that the percentage volume reduction that could be realized through the implementation of ROW LIDs was equivalent to the percentage reduction in tableland area reduction. Therefore, with the application of LIDs to 50% of the ROWs on both sides, the estimated SWM pond area reduction would be 4% or

0.07 ha (700 m^2). With the application of LIDs to 100% of the ROWs on both sides, the estimated SWM pond area reduction would be 9% or 0.15 ha (1,500 m^2).

The freed up tableland area would continue to fall within the pond block area established by the VMC Secondary Plan, but could be used for park or open space uses suitable to the proximity to the SWM facility.

11.5 End-of-Pipe Controls

11.5.1 Land Use Parameters and Assumptions

The end-of-pipe stormwater management facilities provide quantity, quality, and erosion control for runoff generated by each tributary drainage area. As a result, the size of each facility is in large part a function of the contributing area and the runoff coefficient for that area. The VMC Secondary Plan land use distribution was used as a basis for the determination of the base runoff coefficients used to size the SWM ponds, with consideration for the following:

- a runoff coefficient of 0.75 has been applied to residential blocks, due to the high density nature of development anticipated for the VMC development;
- a runoff coefficient of 0.75 has been applied to commercial blocks, due to the high density nature of development anticipated for the VMC development;
- it is assumed that parkland blocks will consist of 50% Community Park (with a runoff coefficient of 0.75 in accordance with the City's design criteria) and 50% open space (with a runoff coefficient of 0.25), therefore an average runoff coefficient of 0.50 was applied to all major parks and open spaces blocks;
- the peak release rate to the storm sewer is controlled to the 2-year post development flow at an assumed level of 80% imperviousness; and,
- all remaining runoff coefficients were assigned in accordance with the City's design criteria.

Base runoff coefficients described above culminate in a lumped runoff coefficient of 0.79 for the majority of development areas. These values were then adjusted to account for the stipulated volume controls, as described in **Section 11.5.2**.

11.5.2 Runoff Coefficient Review

The capture and reuse of runoff achieves the benefit of reduced runoff. This reduction in runoff at the source decreases the extent of control (and hence infrastructure) required at the end-of-pipe facility. To quantify the contribution of such measures to the overall stormwater management strategy, reduced runoff coefficients have been established that reflect the anticipated extent and form of on-site volume control measures to be implemented, per **Section 11.3.2**.

The reduction in runoff coefficient varies with each storm event. The depth of each return-period 6-hour AES storm event was obtained from the TRCA, and summarized in **Table 11-2**.

Table 11-2: Rainfall Depths

Event	Rainfall Depth (mm)
25mm	25.00
2-Year	36.00
5-Year	47.80
10-Year	55.70
25-Year	65.60
50-Year	73.00
100-Year	80.30

As defined in the preceding section, all land use areas that are delineated as residential, commercial or mixed use have an overall level of imperviousness of 79%. The impervious area for each development or redevelopment site was divided into defined proportions of building footprint area and paved area, as described in **Section 11.3.2**, concluding with a building footprint area of 75% of each site's impervious area, with the remaining 25% being paved surface or hardscaping.

Runoff coefficients were adjusted for the building footprint areas within all residential, commercial, and mixed use areas to account for the application of volume control (LID) measures. The base coefficient of 0.90 for building footprint was reduced by the 15mm storm retention requirement, to quantify the expected reduction in runoff for each of the 25mm and 2-year through 100-year return period storm events.

The landscaped areas with the residential, commercial and mixed use blocks will account for 21% of the overall block area. The target runoff reduction is also 15mm of rainfall. However, the runoff coefficient adjustment for the base coefficient of 0.25 is proportionate to the reduction in expected runoff by only 10mm, to account for the 5mm initial abstraction within the landscape area, for each of the 25mm and 2 through 100-year return-period storm events described above. **Table 11-3** and **Table 11-4** illustrate the method and results of this evaluation for the 15mm and 10mm reductions, respectively.

Table 11-3: Runoff Coefficient Adjustments for Hard Surfaces (15mm Runoff Reduction)

Event	Rainfall Depth (mm)	Base Runoff Coefficient (C_{BASE})	Base Runoff (mm)	Runoff Reduced by 15mm (mm)	Adjusted C (C_{15})
25mm	25.00	0.90	22.50	7.50	0.30
2 year	36.00	0.90	32.40	17.40	0.48
5 year	47.80	0.90	43.02	28.02	0.59
10 year	55.70	0.90	50.13	35.13	0.63
25 year	65.60	0.90	59.04	44.04	0.67
50 year	73.00	0.90	65.70	50.70	0.69
100 year	80.30	0.90	72.27	57.27	0.71

Table 11-4: Runoff Coefficient Adjustments for Landscaped Surfaces (10mm Runoff Reduction)

Event	Rainfall Depth (mm)	Base Runoff Coefficient (C_{BASE})	Base Runoff (mm)	Runoff Reduced by 10mm (mm)	Adjusted C (C_{10})
25mm	25.00	0.25	6.25	0.00	0.00
2 year	36.00	0.25	9.00	0.00	0.00
5 year	47.80	0.25	11.95	1.95	0.04
10 year	55.70	0.25	13.93	3.93	0.07
25 year	65.60	0.25	16.40	6.40	0.10
50 year	73.00	0.25	18.25	8.25	0.11
100 year	80.30	0.25	20.08	10.08	0.13

Detailed calculations yielding the above results are provided in **Appendix D**.

11.5.3 Geotechnical Conditions

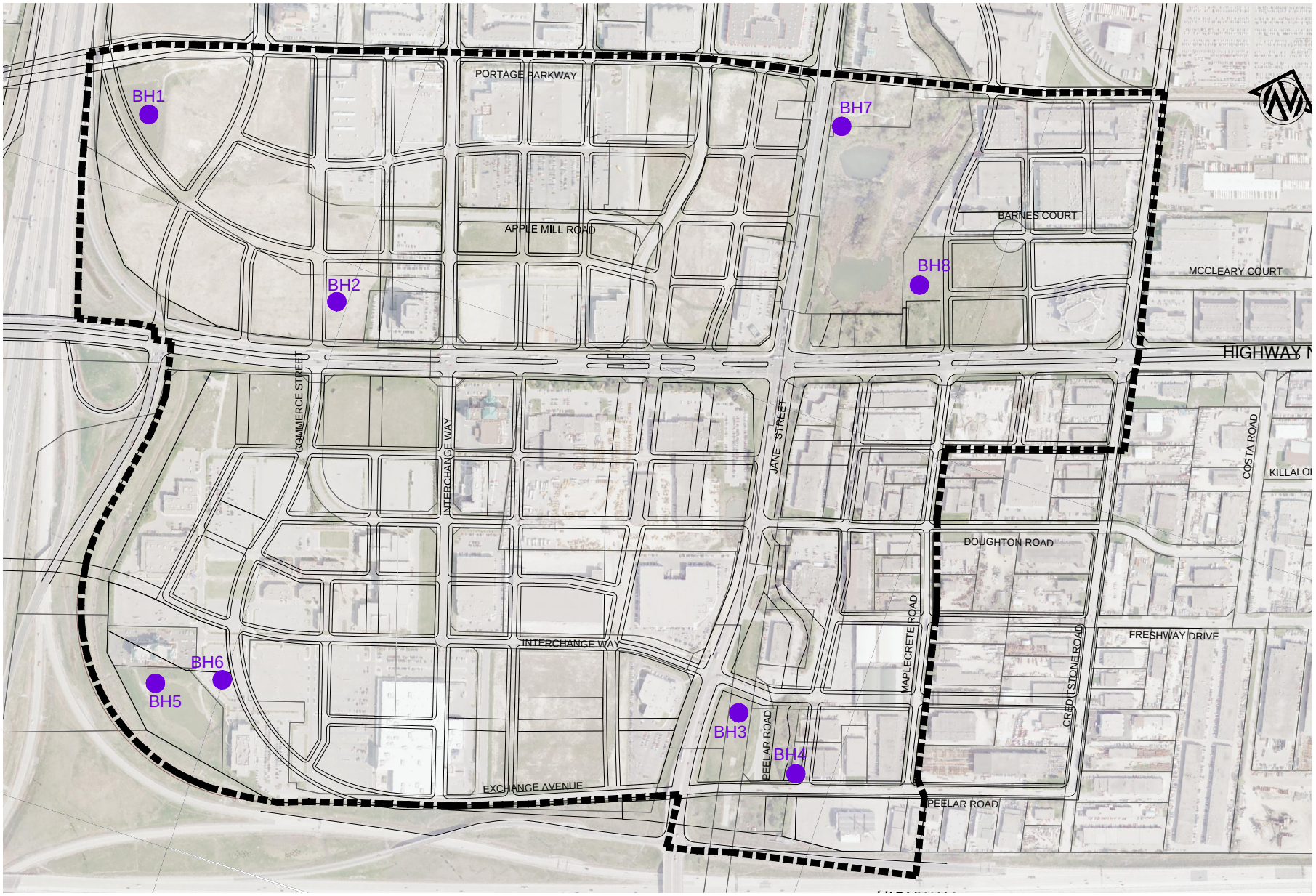
A geotechnical investigation was undertaken in the locations of the proposed stormwater management facility works, as input to establishing the facility configurations and confirming the sizing of each facility. The results of the analysis are provided in **Appendix E**.

Boreholes were advanced to depths ranging from 7.7 to 8.2 metres below the existing ground surface. The borehole locations are illustrated in **Figure 11-3**. The borehole locations included the sites of the existing SWM Pond P1, SWM Pond P2, Interchange Pond, and the recommended SWM pond block within the south-east quadrant.

The boreholes determined that the topsoil and fill are underlain by a layer of silty clay soils which includes a trace of embedded gravel at the sites of SWM Pond P2 and the Interchange Pond. The boreholes were dry with a saturated silty sand soil at a depth of 4m below the existing ground surface. It has been inferred that the position of the saturation in the soil profile lies at a depth of 3m.

The boreholes completed within the areas of SWM Pond P1 and the new pond within the southeast quadrant identified a stratum of silty clay with a trace of sand, trace of gravel and the occasional silt seams. The boreholes were dry and open at completion. The water table was approximately 2.5 to 3m below the existing ground surface. Additional details are provided in **Appendix E**.

The findings of the geotechnical investigation were considered in developing the stormwater management facility concepts, as described in the following subsections.



LEGEND

STUDY AREA

BOREHOLE LOCATION

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MASTER PLAN

BOREHOLE LOCATIONS

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	11-3

11.5.4 Stormwater Management Pond Retrofit - North-East Quadrant

The existing dry pond located in the north-east corner of Jane Street and Highway 7 (the Edgeley Pond, SWM Pond P1) is proposed to be retrofitted to accommodate development within the VMC, and simultaneously increase the level of service to at or near current regulatory standards. The facility presently provides erosion and quantity control for storm events up to and including the Regional storm event, and was recognized as a retrofit priority in the City of Vaughan Stormwater Management Retrofit Study (2007). The facility was designed and constructed prior to development of the current TRCA unit flow rates for the Humber River Watershed. Consequently the pond outflows at present greatly exceed the target release rates.

Exploring the retrofit potential of the facility required development of a hydrologic model that would allow for the modification of land uses within the VMC, and the iterative evaluation of increased volumes and reduced outflow rates. In general the approach to retrofitting this facility considered the maximum available volume that could be achieved within the current pond block, based on existing property boundaries and the land use designations of the VMC Secondary Plan.

The Black Creek Optimization Study (May 2011) updated the hydrologic modelling of the Black Creek subwatershed made available by TRCA. The updated SWMHYMO model established a total drainage area to SWM Pond P1 (Node 46.30) of 767.31 ha. Within the total pond drainage area, the VMC area occupies 54.43 ha, including the pond block area, while 712.88 ha represents drainage external to the VMC area.

A Visual Otthymo (v2.0) was created for the purposes of identifying the optimum pond retrofit scenario. The VO2 model considered the facility drainage area as two catchments. The area upstream of Jane Street of 576.31 ha was incorporated into the model as an input hydrograph, thereby ensuring that the SWMHYMO results were replicated in the VO2 model for this area. The remaining area of 190.40 ha downstream of Jane Street was modelled as a STANDHYD, with existing condition parameters adjusted to calibrate the outflow from the catchment to that generated by the SWMHYMO model. Details of the calibration and associated parameter adjustments are provided in **Appendix D**.

To simulate proposed conditions, the catchment area downstream of Jane Street was then delineated to separate out the areas inside and outside of the VMC area. Catchments within the VMC were modelled to reflect the on-site quantity and volume control requirements described in **Section 11.3**. The catchments within the VMC area fall on the east and west sides of SWM facility, with drainage area parameters as described in **Table 11-5**. Detailed calculations are provided in **Appendix D**.

Table 11-5: Drainage Area Parameters (North-East Quadrant)

	Drainage Area	Weighted Imperviousness
West of SWM Pond P1	31.13 ha	67%
East of SWM Pond P1	17.38 ha	68%

The existing condition model provided an understanding of the current inflow and outflow characteristics of SWM Pond P1. **Table 11-6** summarizes the existing inflow and outflow rates, as well as the targets based on the Humber River unit flow equations.

Table 11-6: SWM Pond P1 Existing and Target Flows

Event (6hr AES)	Existing Condition Flows (m^3/s)		Target Outflow (m^3/s)
	Inflow to Pond	Outflow from Pond	
2 year	15.07	3.62	2.06
5 year	21.77	7.08	3.08
10 year	26.27	10.27	3.81
25 year	32.18	14.91	4.72
50 year	36.39	18.54	5.42
100 year	41.94	24.50	6.13

The above table reveals the significant difference between the existing pond outflows and the target outflows, and the reality that the retrofit of the facility will not likely achieve the target outflows, largely due to the magnitude of the upstream drainage area.

A preliminary concept for the facility was prepared that identified the maximum achievable volume within the pond block area established by the Secondary Plan. Two forebays were also incorporated into the preliminary concept to receive runoff from the east and west sides of the facility, to provide water quality treatment for drainage from within the VMC area, and to maintain a low flow area for the continued ecological and hydraulic functioning of the main branch of Black Creek. The forebay volumes in combination with the overall maximized facility volume were used to evaluate the maximum available reduction in pond outflows, as listed in **Table 11-7**.

Table 11-7: Existing and Proposed SWM Pond P1 Outflows

Event (6hr AES)	Target Outflow (m^3/s)	Existing Outflow (m^3/s)	Proposed Outflow (m^3/s)
2 year	2.06	3.62	3.21
5 year	3.08	7.08	4.24
10 year	3.81	10.27	6.64
25 year	4.72	14.91	10.72
50 year	5.42	18.54	14.02
100 year	6.13	24.50	17.42

Table 11-7 demonstrates a significant reduction in pond outflows over the existing condition, but also confirms the inability to achieve the quantity targets within a facility of reasonable size. However, in concert with the planned Black Creek improvements per the Black Creek Stormwater Optimization Study, downstream conditions will be significantly improved by implementing the pond retrofit.

The water quality storage requirement for SWM Pond P1 was evaluated based on MOE criteria for Enhanced protection (80% long-term TSS removal), for the areas within the VMC for which flows could be directed to the planned forebays. The adjusted runoff coefficient for the 5-year event (**Section 11.5.2**) was applied to the proposed development areas as this value conservatively represents the first flush and similar frequent storms. The resulting permanent pool volumes listed in **Table 11-8** correspond to the areas to the east and west of SWM Pond P1, respectively,

and were used to identify suitable forebay configurations. Detailed calculations are provided in **Appendix D**.

Table 11-8: Water Quality Requirements (SWM Pond P1)

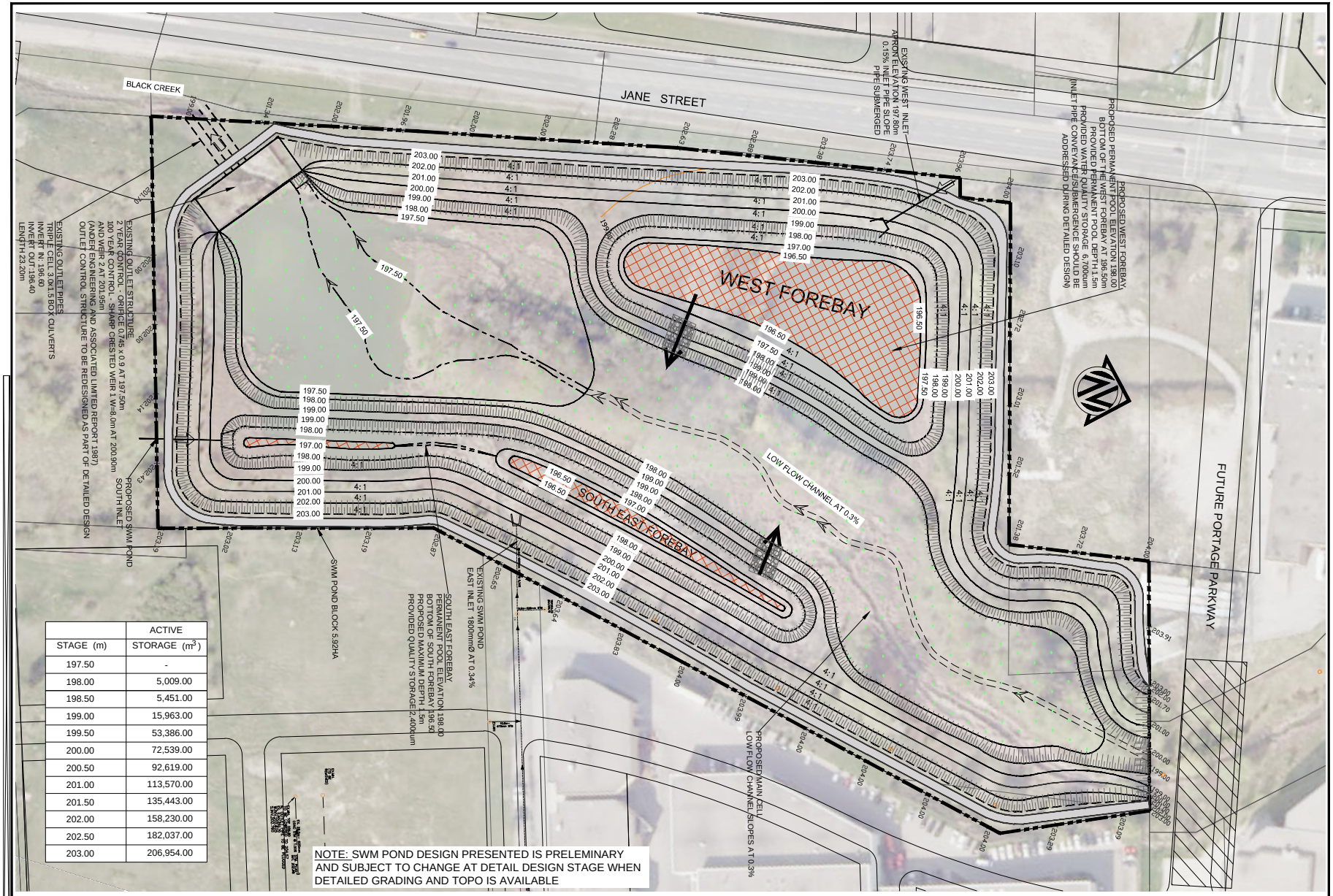
	Area (ha)	Permanent Pool Requirement (m^3/ha)	Required Permanent Pool Storage Volume (m^3)	Provided Forebay Volume (m^3)
West of SWM Pond P1	31.13	175.70	5,470	6,700
East of SWM Pond P1	17.38	175.70	3,054	2,400

The erosion control storage requirements for SWM Pond P1 are based on providing a minimum of 48-hour detention of the runoff generated by a 25 mm storm event as mentioned in **Section 5.4**, which was greater than the extended detention volume requirement based on 40 m^3/ha. The required erosion control storage volumes are summarized in **Table 11-9**. Detailed calculations are provided in **Appendix D** for reference. For all extended detention elements the adjusted 100-year storm event runoff coefficients have been applied for development areas, as listed in **Section 11.5.2**.

Table 11-9: Erosion Control Requirements (SWM Pond P1)

	Area (ha)	25mm Runoff Volume (mm)	Required Erosion Volume (m^3)	Detention Time (hours)	Average Release Rate (m^3/s)	Peak Release Rate (1.5x Average, m^3/s)
West of SWM Pond P1	31.13	16.88	5,254	48	0.030	0.046
East of SWM Pond P1	17.38	17.11	2,974	48	0.017	0.026

Figure 11-4 illustrates the conceptual expansion of SWM Pond P1.



	ACTIVE
STAGE (m)	STORAGE (m^3)
197.50	-
198.00	5,009.00
198.50	5,451.00
199.00	15,963.00
199.50	53,386.00
200.00	72,539.00
200.50	92,619.00
201.00	113,570.00
201.50	135,443.00
202.00	158,230.00
202.50	182,037.00
203.00	206,954.00

NOTE: SWM POND DESIGN PRESENTED IS PRELEMINARY AND SUBJECT TO CHANGE AT DETAIL DESIGN STAGE WHEN DETAILED GRADING AND TOPO IS AVAILABLE

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PROPOSED EXPANSION OF EXISTING SWM FACILITY (NE QUADRANT - SWM POND P1)

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	11-4

11.5.5 New Stormwater Management Pond - South-East Quadrant

The south-east quadrant is not presently serviced by an end-of-pipe facility, and as such the recommended VMC stormwater management strategy includes the introduction of a new SWM facility in this area. **Table 11-10** summarizes the drainage area parameters for this quadrant. Detailed calculations are provided in **Appendix D**. As described in **Section 11.3.3**, an isolated area exists within the proposed VMC plan between Jane Street and the Black Creek corridor, within the south-east quadrant. This area has been included in the total drainage area to the proposed SWM facility in the south-east quadrant, in the event that these redevelopment areas are able to direct runoff to the facility.

Table 11-10: Drainage Area Parameters (South-East Quadrant)

	Drainage Area	Weighted Imperviousness
South-East Quadrant	31.88 ha	67 %

The water quality storage requirement for the proposed new south-east quadrant SWM facility is based on MOE criteria for Enhanced protection (80% long-term TSS removal). The adjusted runoff coefficient (**Section 11.5.2**) for the 5-year event was applied to the proposed development areas as this value conservatively represents the first flush and similar frequent storms. The resulting permanent pool volume is listed in **Table 11-11**. Detailed calculations are provided in **Appendix D** for reference.

Table 11-11: Water Quality Requirements (South-East Quadrant)

	Area (ha)	Permanent Pool Requirement (m^3/ha)	Required Permanent Pool Storage Volume (m^3)	Provided Permanent Pool Volume (m^3)
South-East Quadrant	31.88	178	5,675	8,000

The erosion control storage requirements for the new SWM facility are based on providing a minimum of 48-hour detention of the runoff generated by a 25 mm storm event as mentioned in **Section 5.4**, which is greater than the extended detention volume requirement based on 40 m^3/ha. The required erosion control storage volume is listed in **Table 11-12**. Detailed calculations are provided in **Appendix D** for reference. For all extended detention elements the adjusted 100-year storm event runoff coefficients have been applied for development areas, as listed in **Section 11.5.2**.

Table 11-12: Erosion Control Requirements (South-East Quadrant)

	Area (ha)	25mm Runoff Volume (mm)	Required Erosion Volume (m^3)	Detention Time (hours)	Average Release Rate (m^3/s)	Peak Release Rate (1.5x Average, m^3/s)
South-East Quadrant	31.88	18.96	6,044	48	0.035	0.052

The quantity targets for the new SWM facility are based on the Humber River unit flow equations, and listed in **Table 11-13**.

Table 11-13: Target Release Rates (South-East Quadrant)

Event	Target Outflow (m^3/s)
2 year	0.16
5 year	0.24
10 year	0.29
25 year	0.37
50 year	0.42
100 year	0.48

A hydrologic model (VO2) was completed to establish the active storage volume needed to meet the target outflows. The hydrologic model considered the on-site peak flow and volume controls described in **Section 11.3**. **Table 11-14** summarizes the volume requirements for the new SWM pond, with details provided in **Appendix D**.

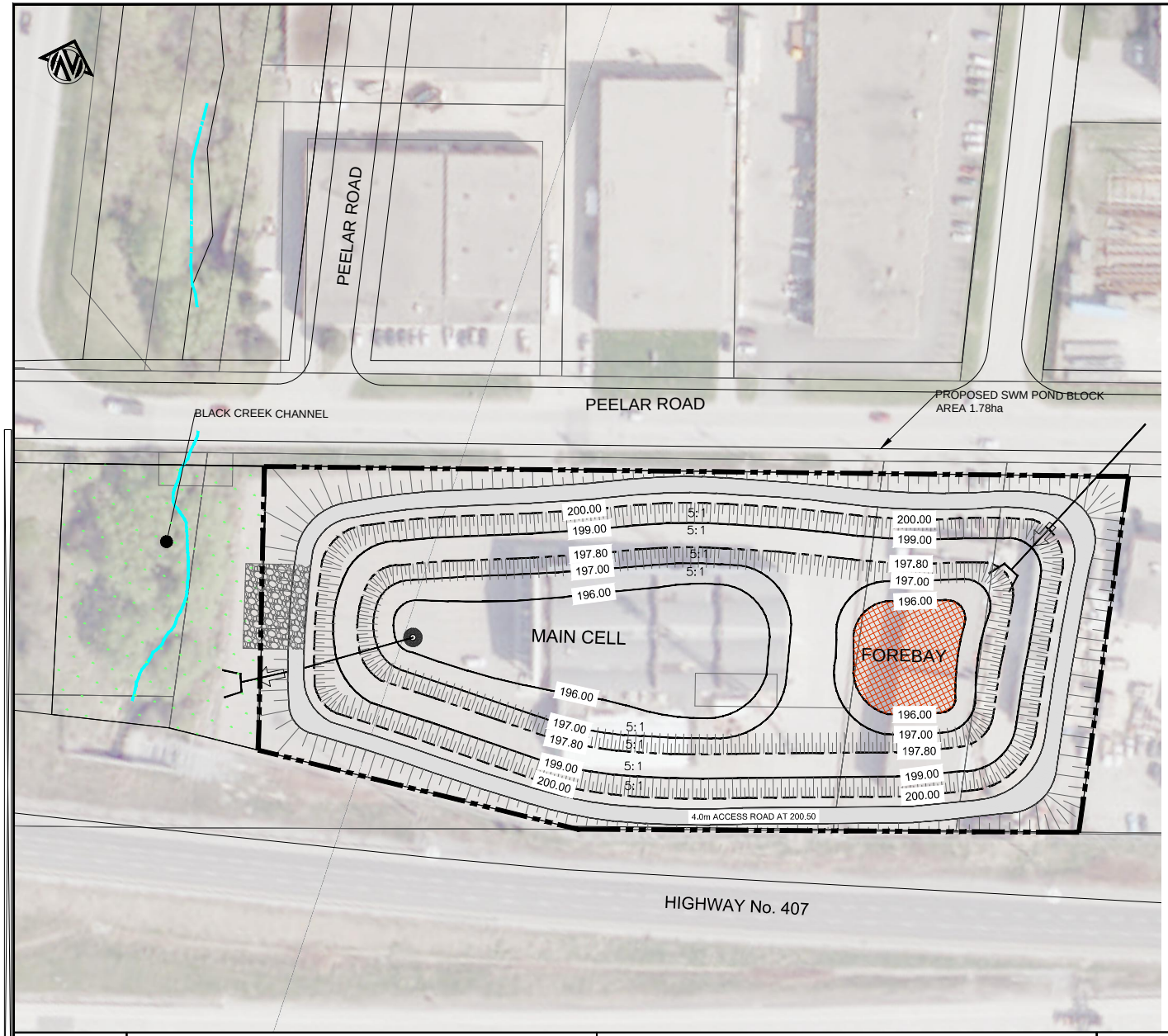
Table 11-14: SWM Pond Storage Volume Requirement Summary (South-East Quadrant)

	Permanent Pool Volume (m^3)	Active Storage Volume (m^3)	Total SWM Pond Volume (m^3)
South-East Quadrant	5,675	16,325	22,000

The conceptual configuration of the new SWM facility is illustrated in **Figure 11-5**, and demonstrates that the required volumes can be accommodated within the established pond block area of 1.78 ha. **Table 11-15** summarizes the required and provided storage volumes.

Table 11-15: SWM Pond Provided Storage Volumes (South-East Quadrant)

Component	Required Volume (m^3)	Provided Volume (m^3)
Permanent Pool	5,675	8,000
25 mm	6,044	5,230
2 year	--	7,202
5 year	--	9,521
10 year	--	11,158
25 year	--	13,234
50 year	--	14,787
100 year	16,325	16,325



DESCRIPTION	REQUIRED STORAGE	PROVIDED STORAGE
PERMANENT POOL (WQS) EL.196.00 - EL.197.80	5,675 m^3	8,000 m^3
ACTIVE STORAGE EL.197.80 - EL.200.00	16,324 m^3	20,000 m^3

NOTE: SWM POND DESIGN PRESENTED IS PRELEMINARY AND SUBJECT TO CHANGE AT DETAIL DESIGN STAGE WHEN DETAILED GRADING AND TOPO IS AVAILABLE

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PROPOSED SE QUADRANT SWM POND

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	11-5

11.5.6 Stormwater Management Pond Retrofit - South-West Quadrant

The existing SWM facility (Interchange Pond) located within the south-west quadrant of the VMC is proposed to be retrofitted to accommodate development within the VMC, and simultaneously increase the level of service to at or near current regulatory standards. **Table 11-16** summarizes the drainage area parameters of this quadrant. Detailed calculations are provided in **Appendix D** for reference.

Table 11-16: Drainage Area Parameters (South-West Quadrant)

	Drainage Area	Weighted Imperviousness
South-West Quadrant	73.62 ha	63%

The water quality storage requirement for the Interchange Pond retrofit is based on MOE criteria for Enhanced protection (80% long-term TSS removal). The adjusted runoff coefficient (**Section 11.5.2**) for the 5-year event was applied to the proposed development areas as this value conservatively represents the first flush and similar frequent storms. The resulting permanent pool volume is listed in **Table 11-17**. Detailed calculations are provided in **Appendix D** for reference.

Table 11-17: Water Quality Requirements (South-West Quadrant)

	Area (ha)	Permanent Pool Requirement (m^3/ha)	Required Permanent Pool Storage Volume (m^3)	Provided Permanent Pool Volume (m^3)
South-West Quadrant (Interchange)	73.62	168.70	12,420	17,000

The erosion control storage requirements for the Interchange Pond retrofit are based on providing a minimum of 48-hour detention of the runoff generated by a 25 mm storm event as mentioned in **Section 5.4**, which is greater than the extended detention volume requirement based on 40 m^3/ha. The required erosion control storage volume is listed in **Table 11-18**. Detailed calculations are provided in **Appendix D** for reference. For all extended detention elements the adjusted 100-year storm event runoff coefficients have been applied for development areas, as listed in **Section 11.5.2**.

Table 11-18: Erosion Control Requirements (South-West Quadrant)

	Area (ha)	25mm Runoff Volume (mm)	Required Erosion Volume (m^3)	Detention Time (hours)	Average Release Rate (m^3/s)	Peak Release Rate (1.5x Average, m^3/s)
South-West Quadrant (Interchange)	73.62	18.26	13,445	48	0.078	0.117

The quantity targets for the Interchange SWM Pond retrofit are based on the Humber River unit flow equations, and listed in **Table 11-19**.

Table 11-19: Target Release Rates (South-West Quadrant)

Event	Target Outflow (m^3/s)
2 year	0.33
5 year	0.49
10 year	0.60
25 year	0.74
50 year	0.86
100 year	0.98

A hydrologic model (VO2) was completed to establish the active storage volume needed to meet the target outflows. The hydrologic model considered the on-site peak flow and volume controls described in **Section 11.3**. **Table 11-20** summarizes the volume requirements for the Interchange SWM pond retrofit, with details provided in **Appendix D**.

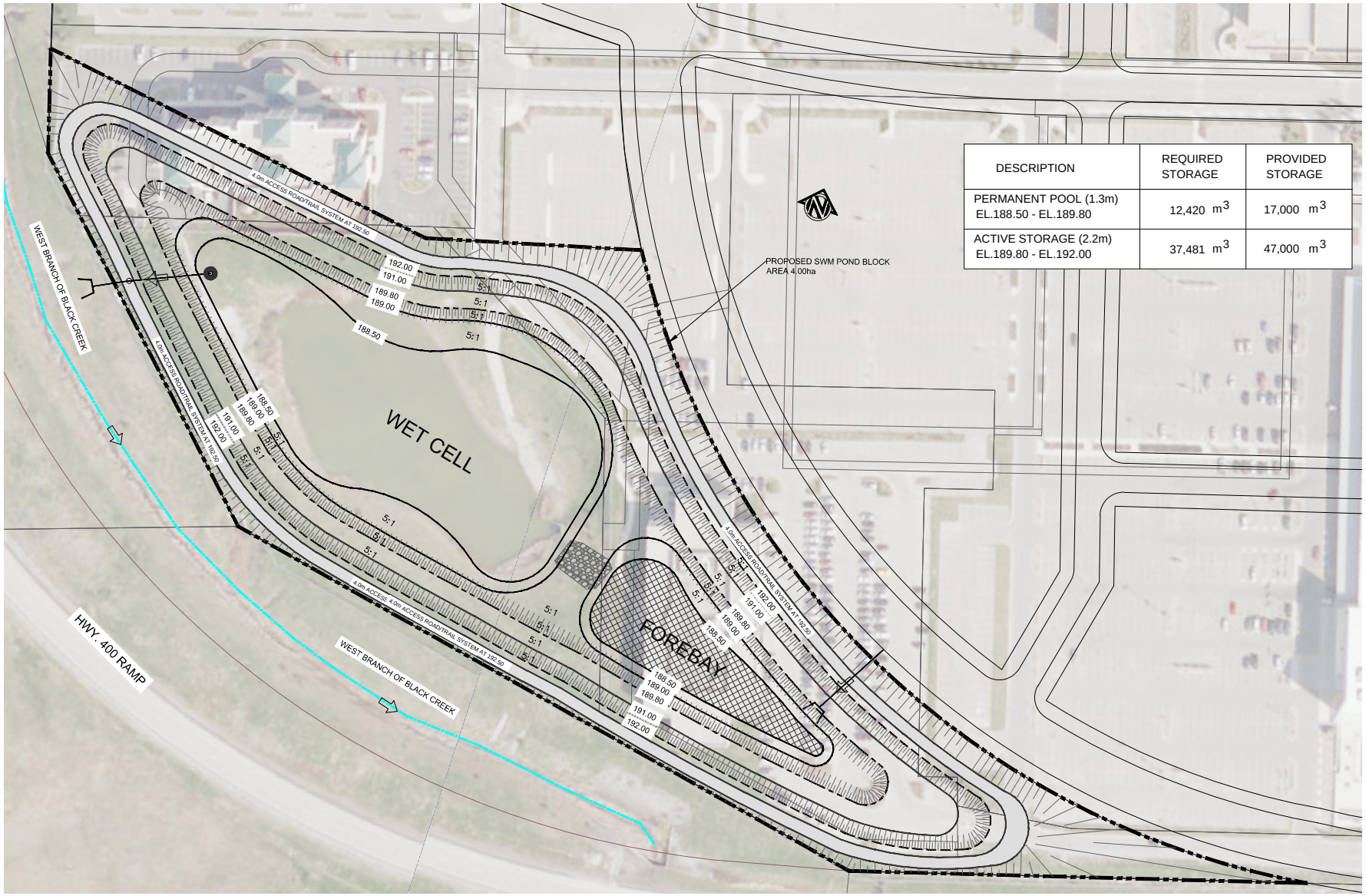
Table 11-20: SWM Pond Storage Volume Requirement Summary (South-West Quadrant)

	Permanent Pool Volume (m^3)	Active Storage Volume (m^3)	Total SWM Pond Volume (m^3)
South-West Quadrant	12,420	37,482	49,902

The conceptual configuration of the Interchange SWM facility retrofit is illustrated in **Figure 11-6**, and demonstrates that the required volumes can be accommodated within the established pond block area of 3.80 ha. **Table 11-21** summarizes the required and provided storage volumes.

Table 11-21: SWM Pond Provided Storage Volumes (South-West Quadrant)

Component	Required Volume (m^3)	Provided Volume (m^3)
Permanent Pool	12,420	17,000
25 mm	13,445	11,416
2 year	--	16,185
5 year	--	21,619
10 year	--	25,409
25 year	--	30,229
50 year	--	33,869
100 year	37,482	37,482



DESCRIPTION	REQUIRED STORAGE	PROVIDED STORAGE
PERMANENT POOL (1.3m) EL.188.50 - EL.189.80	12,420 m^3	17,000 m^3
ACTIVE STORAGE (2.2m) EL.189.80 - EL.192.00	37,481 m^3	47,000 m^3

NOTE: SWM POND DESIGN PRESENTED IS PRELEMINARY AND SUBJECT TO CHANGE AT DETAIL DESIGN STAGE WHEN DETAILED GRADING AND TOPO IS AVAILABLE

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PROPOSED EXPANSION OF EXISTING SWM FACILITY (SW QUADRANT - INTERCHANGE POND)

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	11-6

11.5.7 Stormwater Management Pond Retrofit - North-West Quadrant

The existing SWM facility (SWM Pond P2) located within the north-west quadrant of the VMC is proposed to be retrofitted to accommodate development within the VMC, and simultaneously increase the level of service to at or near current regulatory standards. **Table 11-22** summarizes the drainage area parameters of this quadrant. Detailed calculations are provided in **Appendix D** for reference.

Table 11-22: Drainage Area Parameters (North-West Quadrant)

	Drainage Area	Weighted Imperviousness
North-West Quadrant	46.38 ha	70%

The drainage area for SWM Pond P2 presently includes lands both within and external to the VMC area. The SWMHYMO modelling updated as part of the Black Creek Stormwater Optimization Study indicates that the portion of the facility drainage area falling within the VMC is 29.61 ha, while the external area to the north is 16.77 ha. The evaluation of retrofit potential has included quality, erosion, and quantity control for the entire facility drainage area of 46.38 ha.

The water quality storage requirement for the SWM Pond P2 retrofit is based on MOE criteria for Enhanced protection (80% long-term TSS removal). The adjusted runoff coefficient (**Section 11.5.2**) for the 5-year event was applied to the proposed development areas as this value conservatively represents the first flush and similar frequent storms. The resulting permanent pool volume is listed in **Table 11-23**. Detailed calculations are provided in **Appendix D** for reference.

Table 11-23: Water Quality Requirements (North-West Quadrant)

	Area (ha)	Permanent Pool Requirement (m^3/ha)	Required Permanent Pool Storage Volume (m^3)	Provided Permanent Pool Volume (m^3)
North-West Quadrant (SWM Pond P2)	46.38	185	8,580	16,000

The erosion control storage requirements for the SWM Pond P2 retrofit are based on providing a minimum of 48-hour detention of the runoff generated by a 25 mm storm event as mentioned in **Section 5.4**, which is greater than the extended detention volume requirement based on 40 m^3/ha. The required erosion control storage volume is listed in **Table 11-24**. Detailed calculations are provided in **Appendix D** for reference. For all extended detention elements the adjusted 100-year storm event runoff coefficients have been applied for development areas, as listed in **Section 11.5.2**.

Table 11-24: Erosion Control Requirements (North-West Quadrant)

	Area (ha)	25mm Runoff Volume (mm)	Required Erosion Volume (m^3)	Detention Time (hours)	Average Release Rate (m^3/s)	Peak Release Rate (1.5x Average, m^3/s)
North-West Quadrant (SWM Pond P2)	46.38	18.73	8,686	48	0.050	0.075

The quantity targets for the Interchange SWM Pond retrofit are based on the Humber River unit flow equations, and listed in **Table 11-25**.

Table 11-25: Target Release Rates (North-West Quadrant)

Event	Target Outflow (m^3/s)
2 year	0.22
5 year	0.33
10 year	0.40
25 year	0.50
50 year	0.58
100 year	0.66

A hydrologic model (VO2) was completed to establish the active storage volume needed to meet the target outflows. The model utilized parameters from the Black Creek Stormwater Optimization Study to ensure consistency between the different models, and considered the on-site peak flow and volume controls described in **Section 11.3**. **Table 11-26** summarizes the volume requirements for the SWM Pond P2 retrofit, with details provided in **Appendix D**.

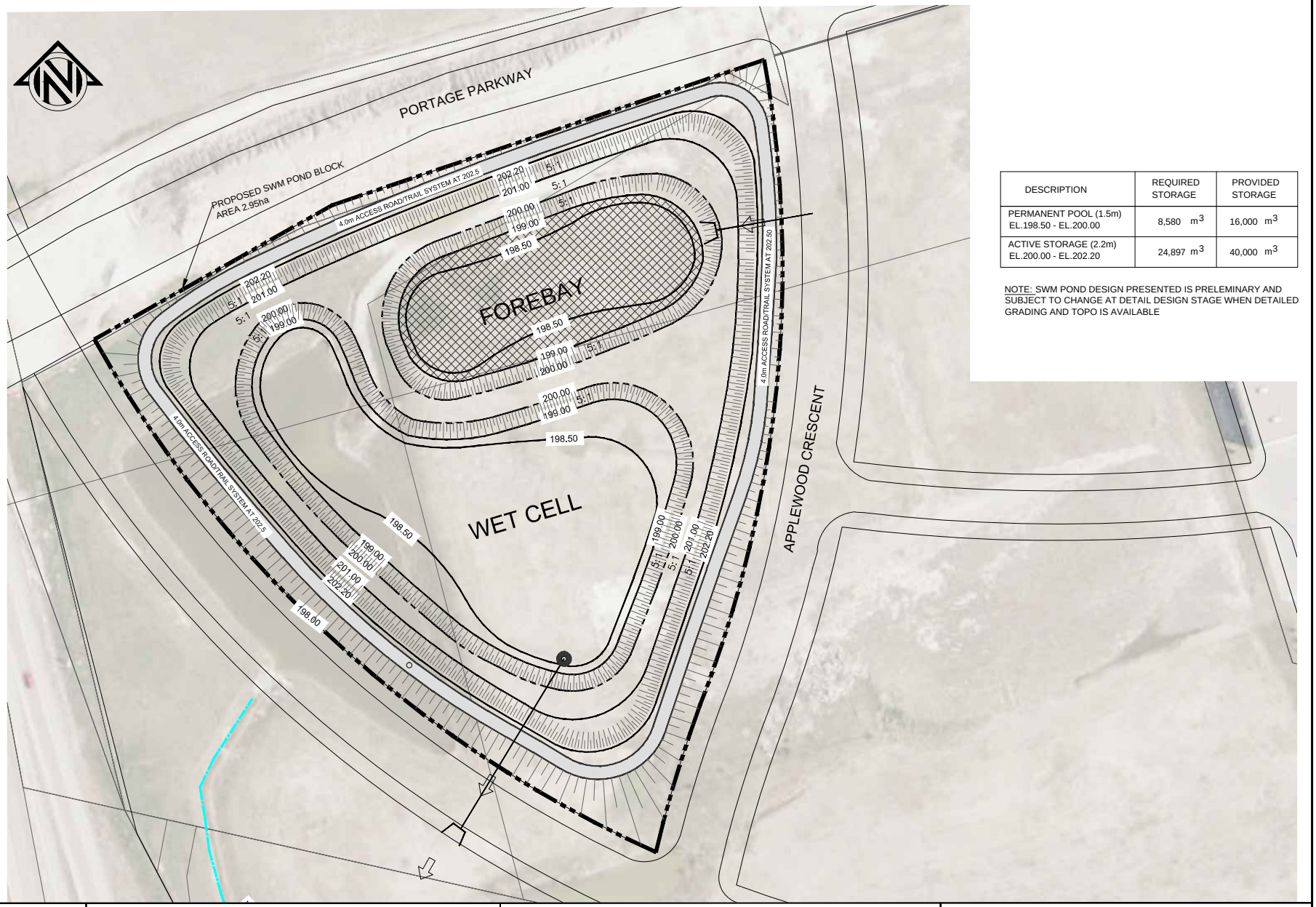
Table 11-26: SWM Pond Storage Volume Requirement Summary (North-West Quadrant)

	Permanent Pool Volume (m^3)	Active Storage Volume (m^3)	Total SWM Pond Volume (m^3)
North-West Quadrant (SWM Pond P2)	8,580	25,000	33,580

The conceptual configuration of the SWM Pond P2 retrofit is illustrated in **Figure 11-7**, and demonstrates that the required volumes can be accommodated within the established pond block area of 2.95 ha. **Table 11-27** summarizes the required and provided storage volumes.

Table 11-27: SWM Pond Provided Storage Volumes (North-West Quadrant)

Component	Required Volume (m^3)	Provided Volume (m^3)
Permanent Pool	8,580	16,000
25 mm	8,686	7,700
2 year	--	11,000
5 year	--	15,000
10 year	--	17,000
25 year	--	20,500
50 year	--	22,500
100 year	25,000	40,000



DESCRIPTION	REQUIRED STORAGE	PROVIDED STORAGE
PERMANENT POOL (1.5m) EL.198.50 - EL.200.00	8,580 m^3	16,000 m^3
ACTIVE STORAGE (2.2m) EL.200.00 - EL.202.20	24,897 m^3	40,000 m^3

NOTE: SWM POND DESIGN PRESENTED IS PRELEMINARY AND SUBJECT TO CHANGE AT DETAIL DESIGN STAGE WHEN DETAILED GRADING AND TOPO IS AVAILABLE

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PROPOSED EXPANSION OF EXISTING SWM FACILITY (NW QUADRANT - SWM POND P2)

PROJECT No.	DATE:	FIGURE No.
08104	NOV 2012	11-7

11.6 Storm Drainage and Stormwater Management Implementation Summary

Evaluations associated with the recommended SWM pond works have confirmed the adequacy of the SWM pond blocks as designated within the VMC Secondary Plan. **Table 11-28** summarizes the proposed stormwater management projects that are recommended to support implementation of the VMC Secondary Plan. All of the recommended SWM facility works are classified as Schedule B projects, and subject to comments received as a result of the completion of this EA document can proceed to implementation.

Table 11-28: Proposed Stormwater Management Facility Projects

Project	Project	Location
SF-01	Retrofit of SWM Pond P1	North-east corner of Jane St and Hwy 7
SF-02	Retrofit of SWM Pond P2	South of Portage Pkwy, east of Hwy 400
SF-03	Retrofit of Interchange SWM Pond	South-west corner of VMC, north of Hwy 400 ramp
SF-04	New SWM Pond in SE Quadrant	East of Jane St and the Black Creek main branch, north of Hwy 407 and south of Peelar Road

11.7 SWM Facility Design Considerations

Additional optimization of the tableland requirements of the SWM facilities could be explored through the detailed design process.

The current configurations have applied City of Vaughan design criteria, but the provision of ledge rock or armour stone treatments rather than gradual side slopes could complement the aesthetic urban fabric envisioned for the community, and at the same time reduce the overall tableland requirement.

The implementation of low impact development approaches as part of the Streetscape and Open Space Plan could also reduce the magnitude of runoff directed to the facilities, as described in **Section 11.4**, which would yield a corresponding reduction in the required treatment volumes and tableland areas.

With respect to urban design, the configurations of the SWM facilities should endeavour to integrate with the surrounding urban fabric, streetscape and urban design vision, and the ultimate configuration of the Black Creek corridor.

12 Implementation and Recommendation Summary

12.1 Capital Cost Evaluation

Table 12-1 through **Table 12-3** list the capital projects recommended by this Municipal Servicing Class EA Master Plan, broken down into the water servicing, sanitary servicing and stormwater management costs. A preliminary estimate of the costs associated with these works is provided within each table, to inform capital planning efforts.

The cost estimates for the stormwater management ponds have been based on unit rates for typical similar works and the watermain and sanitary servicing has been based on unit rates from the City of Vaughan's Unit Cost Database (2012), in the absence of detailed design and site specific information, and as such the estimates may vary significantly from the actual cost for these works. Details of the cost estimate are provided in **Appendix G**.

Table 12-1: Estimated Cost of Water Servicing Recommended Works

Project	Street	Section	Diam. [mm]	Length [m]	Unit Cost (per m)	Subtotal	Contingency (25%)	Engineering (15%, including contingency)	Total Cost
W-01	Commerce St	Portage Pkwy to Interchange Way	300	1,090	$860	$937,400	$234,350	$175,763	$1,347,513
W-02	Exchange Ave	Interchange Way to Interchange Way	300	510	$860	$438,600	$109,650	$82,238	$630,488
W-03	Interchange Way	Interchange Way to Exchange Ave	300	270	$860	$232,200	$58,050	$43,538	$333,788
W-04	Doughton Road	Interchange Way to Millway Ave	400	300	$1,030	$309,000	$77,250	$57,938	$444,188
W-05	Millway Ave	Highway 7 to Interchange Way	300	460	$860	$395,600	$98,900	$74,175	$568,675
W-06	Portage Parkway	Jane St to Creditstone Rd	300	570	$860	$490,200	$122,550	$91,913	$704,663
W-07	Maplecrete Rd	Portage Pkwy to Highway 7	300	450	$860	$387,000	$96,750	$72,563	$556,313

Project	Street	Section	Diam. [mm]	Length [m]	Unit Cost (per m)	Subtotal	Contingency (25%)	Engineering (15%, including contingency)	Total Cost
W-08	Maplecrete Rd	Doughton Rd to Peelar Rd	300	430	$860	$369,800	$92,450	$69,338	$531,588
W-09	Creditstone Rd	Doughton Rd to Peelar Rd	300	440	$860	$378,400	$94,600	$70,950	$543,950
W-10	Peelar Rd	Jane St to Creditstone Rd	300	570	$860	$490,200	$122,550	$91,913	$704,663
Watermain Subtotal						$4,428,400	$1,107,100	$830,325	**$6,365,825**

Table 12-2: Estimated Cost of Sanitary Servicing Recommended Works

Project	Project	Section	Diam. [mm]	Length [m]	Unit Cost (per m)	Subtotal	Contingency (25%)	Engineering (15%, including contingency)	Total Cost
SA-01	Interchange Way Upgrades	North of Highway 7 to Jane Street Trunk	450-600	820	$1,115	$914,300	$228,575	$171,431	$1,314,306
SA-02	Barnes Court Upgrade	Barnes Ct to Jane Street Trunk	525	65	$1,040	$67,600	$16,900	$12,675	$97,175
SA-03	Doughton Road Upgrade	Maplecrete Rd to Jane St	450	160	$980	$156,800	$39,200	$29,400	$225,400
Sanitary Subtotal						$1,138,700	$284,675	$213,506	**$1,636,881**

Stormwater management facility costs have been divided into several components, each based on the total facility area. The base cost includes the earthworks associated with retrofitting the existing ponds or establishing the new pond (SE), with a unit cost of $450,000 per hectare. Landscaping for each facility is based on a unit cost of $175,000 per hectare. Maintenance is based on a unit cost of $150,000 per hectare, and includes development of an Operations and Maintenance manual for the facility, as well as the first cleanout upon completion of the facility's construction.

Contingencies and engineering costs have been assigned as 25% and 15% respectively, with contingencies accounting for the uncertainties associated with the use of conceptual designs rather than detailed designs for the estimation of costs. These estimates do not include land costs, given the variability of land value in the VMC due to market conditions. Applicable taxes are also not included in the total costs.

Table 12-3: Estimated Cost of Stormwater Management Recommended Works (costs in millions)

SWM Pond	Area (ha)	Base Cost	Landscaping	Maintenance	Subtotal	Contingency (25%)	Engineering (15%, including contingency)	Total Cost
North-West Quadrant (SWM Pond P2)	2.95	$1.327	$0.516	$0.442	$2.286	$0.572	$0.429	$3.287
North-East Quadrant (Edgeley Pond)	5.92	$2.664	$1.036	$0.888	$4.588	$1.147	$0.860	$6.595
South-West Quadrant (Interchange Pond)	4.00	$1.800	$0.700	$0.600	$3.100	$0.775	$0.581	$4.456
South- East Quadrant (New SWM Pond)	1.78	$0.801	$0.312	$0.267	$1.379	$0.345	$0.259	$1.983
Stormwater Management Subtotal					$11.354 million	$2.838 million	$2.129 million	**$16.321 million**

Table 12-4: Estimated Cost of Overall Recommended Works (costs in millions)

Category	Total
Water Servicing	$6.366 million
Sanitary Servicing	$1.637 million
Stormwater Management	$16.321 million
Total	$24.324 million

12.2 Implementation and Staging

Implementation of the VMC Secondary Plan is to a large degree driven by market forces, and as such the planning of infrastructure to accommodate redevelopment will need to maintain flexibility.

For watermains, sanitary sewers, and storm sewers, these have primarily been aligned with either existing or proposed roads, and design and construction of these services will generally be undertaken in conjunction with the road works.

The recommended stormwater management facility works would ideally be completed early in the overall redevelopment process, in order to minimize potential impacts to downstream receiving systems. This is particularly true due to the differential between current regulatory criteria and the existing level of stormwater management provided by the existing facilities. However, practical and economic limitations will need to be considered as part of the staging strategy for the proposed stormwater management facilities.

12.3 Monitoring of the Project

12.3.1 SWM Facility Monitoring

Regular SWM facility monitoring is recommended by MOE during the first two years of operation followed by annual inspections. Detailed monitoring plans should be completed as part of detailed design with approval agency input.

Monitoring of SWM facilities should be undertaken to confirm their effectiveness with respect to the design objectives, and also to verify the runoff assumptions and calculations associated with the upstream source controls.

All new or modified SWM facilities should be added to the City of Vaughan's SWM Pond Database, for inclusion in long term maintenance planning efforts.

12.3.2 Proposed Construction Monitoring

As part of implementing this project, monitoring and maintenance must be conducted during construction to ensure that:

- individual mitigating measures are continuously providing the expected control and / or protection;
- the mitigating measures are adequate to minimize or eliminate adverse effects;
- additional mitigating measures are provided if required to address any unanticipated environmental adverse effects which arise, and;
- adequate information is available for the assessment of the mitigative measures.

12.3.3 Implementation Status

Further plans for monitoring within the Vaughan Metropolitan Centre will be determined throughout the development process. The construction that will occur on a local basis within the VMC must be tracked in order to create opportunity for the development of site-specific monitoring.

12.4 Property Requirements

As noted in **Section 6.2**, the evaluation of servicing alignments and infrastructure locations has endeavoured to respect the land use designations of the VMC Secondary Plan. In this way, water, sanitary, and storm sewers will generally align with either existing or proposed roadways and open space areas, and the required size of stormwater management facilities have been confirmed to fit within the designated SWM pond blocks. Therefore, property requirements associated with the recommendations of this study are consistent with the property requirements associated with the VMC Secondary Plan.

12.5 Summary of Potential Effects and Recommended Mitigating Measures

The following identifies the potential adverse effects associated with constructing the recommended infrastructure improvements, along with the various mitigative measures developed during the course of the Class EA in order to minimize and/or eliminate these adverse effects. A summary of these environmental effects and mitigative measures are described in more detail in the following sub-sections.

12.5.1 Natural Environment

Disturbances to Terrestrial Features: Areas of environmental significance within the VMC area are limited to the Black Creek corridor and the existing Edgeley Pond (SWM Pond P2), which has been recommended for retrofit to address stormwater management objectives. Anticipated impacts of the recommended expansion of SWM Pond P2 are associated with the loss and potential replacement of terrestrial features within the existing site. Detailed design of the facility retrofit will quantify vegetation loss and prescribe appropriate compensation. The compensation plan will provide a long-term net benefit to the terrestrial resources of the site by restoring all portions disturbed during construction and improving the diversity of native species.

Temporary Construction Related Effects on Groundwater: The proposed construction of the recommended works will likely have minimal adverse effects on the groundwater regime beneath the project area. Extensive dewatering is not anticipated since the local surficial groundwater table is generally below the estimated depth of works.

As part of detailed design, additional geotechnical investigations will be carried out to identify the extent of dewatering requirements and the associated mitigation strategies.

Impacts to Stormwater Management: Erosion and Sedimentation control measures should be implemented and monitored through the construction of all recommended works to maintain water quality. Detailed erosion and sedimentation control plans for all phases of construction will be developed during the detailed design stages and will be subject to review and approval by the various regulatory agencies involved in the project.

Impacts to Aquatic Habitat: Construction of works in proximity to aquatic habitats should be conducted during periods that are least likely to result in in-stream impacts to downstream fish habitats. Potential impacts can also be reduced by the implementation of best management practices and various other special provisions.

12.5.2 Social Environment

Temporary Access to Private Property and Property Access: For the recommended works, detailed design should establish appropriate staging and specifications to minimize impacts on adjacent private properties, and should confine all construction activities to working areas, unless written permission from the landowner has been obtained in advance. Should access to private property be granted, the property will be restored to its original condition or better following the completion of construction operations.

Similarly, access to private properties, via driveways and boulevards shall be maintained through construction periods. If the need for access restrictions arises, appropriate mitigation measures must be put in place in consultation with affected landowners.

Temporary Construction Related Nuisance Effects: The recommended works will require construction activity and the operation of construction equipment that may result in a temporary increase in noise, vibration, dust and odours in the project areas during the construction periods. Appropriate construction management and mitigation measures must be established and implemented to mitigate potential effects.

A comprehensive Sediment and Erosion Control plan will be prepared in the detailed design stage.

Contractors will be required to manage all waste materials generated by construction activities in accordance with all provincial and federal regulations/approval requirements.

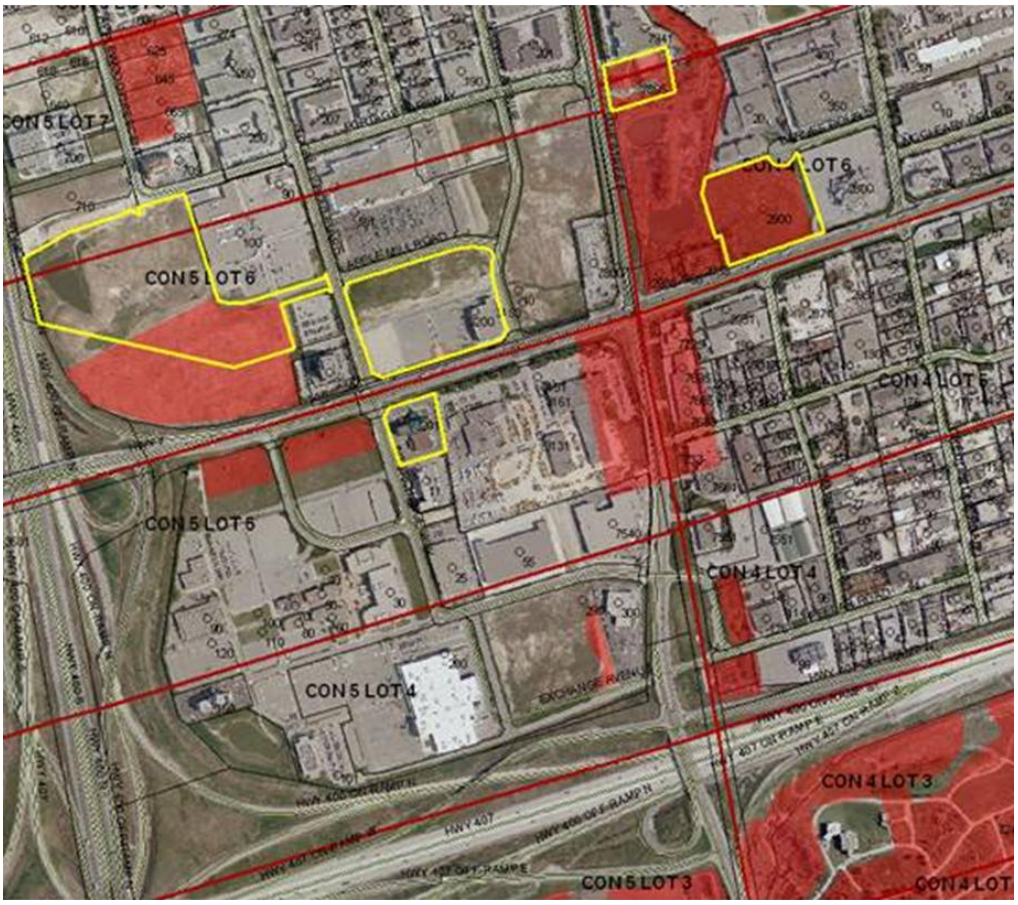
Temporary Disruption of Traffic on Roads: Where applicable, traffic management plans will be developed in accordance with Ontario Health and Safety Book 7 to ensure the least possible impact, and standard traffic control measures will be implemented to safely co-ordinate traffic flow. Signage and Flagmen will be posted appropriately during these events.

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

12.6 Archaeological Investigations

The City of Vaughan Official Plan update included an Archaeology and First Nations Policy Study that established areas of high archaeological potential. The report can be accessed at *www.vaughantomorrow.ca/OPR/background.html*. **Figure 12-1** illustrates these areas within the VMC study area. For works recommended within the shaded areas, Phase 2 archaeological assessments will be undertaken during detail design. Background information and correspondence for archaeological investigations within the study area is provided in **Appendix F**.

Figure 12-1: Areas of High Archaeological Potential



12.7 Ongoing Development Applications

A number of development applications have been submitted, with design and construction activity already underway within portions of the VMC area, including the proposed Vaughan Metro Centre Subway Station.

A sizeable parcel within the north-west quadrant of the VMC area is currently under single ownership. An alternative planning and urban design structure has been tentatively proposed for this area that varies from the recommendations of the VMC Secondary Plan.

As part of this Municipal Servicing Class EA Master Plan, a cursory review of the development concept has been completed to identify potential servicing implications.

With respect to water and wastewater services, the alignments of works recommended by this Class EA Master Plan are generally consistent with the alternative plan, and can be adapted as required through the planning and design processes. Confirmation of population densities and alignments will be required to confirm consistency with those used in this study, to confirm that the water and wastewater demands associated with the alternative plan can be accommodated by the recommended municipal servicing strategy.

With respect to storm drainage and stormwater management, the designated stormwater management facility block appears to be smaller than that defined by the VMC Secondary Plan. Confirmation will be required that the proposed development concept will achieve the stormwater management targets and objectives defined by this Class EA Master Plan. In particular, SWM Pond P2 in this area has been recommended for improvement to provide quality, quantity, and erosion control for areas within the VMC area and an external area to the north. Therefore the proposed stormwater management strategy for the alternative development concept must demonstrate provision for managing drainage from the external area.

Similarly, the VMC stormwater management strategy recommends on site peak flow and volume management, to be achieved by a combination of conventional on-site controls and low impact development approaches. The alternative development concept must include stormwater management measures to achieve the objectives of the broader VMC strategy.

13 Public Consultation

13.1 Notice of Study Commencement

A Notice of Commencement was prepared and circulated on March 11, 2010, on behalf of the City of Vaughan. A copy of the Notice is provided in **Appendix A** for reference. The Notice was mailed directly to review agencies, utilities, property owners, and other stakeholders identified during the VMC Secondary Plan process.

The Notice of Commencement was also posted within the Vaughan Citizen, the City of Vaughan website, and TMIG's website.

The Notice summarized the purpose and scope of the study, and invited interested parties to comment. Comments received and corresponding actions are summarized in **Appendix A**.

13.2 Stakeholder Consultation

Over the course of the study numerous meetings were held with City of Vaughan staff to report on progress, findings, and obtain input. Extensive consultation with City staff and external consultants also took place in regards to concurrent studies, to ensure consistency of source information and to identify opportunities for the integration of common requirements. The concurrent studies included:

- the VMC Secondary Plan, to ensure that the planning framework and vision considered relevant infrastructure requirements;
- the Black Creek Stormwater Optimization Study (Phases 1 and 2);
- the VMC Streetscape and Open Space Master Plan;
- the Vaughan City-Wide Water and Wastewater Master Plan;
- the Vaughan City-Wide Stormwater Management Master Plan;
- designs for the TTC subway extension and VMC subway station;
- design of the Highway 7 improvements associated with implementing the bus rapid transit system.

Consultation with the Region of York and the Toronto and Region Conservation Authority (TRCA) also occurred throughout the course of the study on specific issues. A final meeting with TRCA was held on January 16, 2012, to present the findings of the stormwater management investigations and obtain feedback. A draft version of this EA report was circulated to the City of Vaughan, York Region, TRCA, and MOE. Comments received were addressed in this final EA report, with the comment letters and responses included in **Appendix A**.

Two formal public information centres were also held, as described in **Sections 13.3** and **13.4**.

13.3 Public Information Centre No. 1

The first Public Information Centre (PIC) was held on Thursday April 15, 2010, between 7pm and 9pm at the Hilton Garden Inn (3201 Highway 7 West, Vaughan), which is located within the study area.

Notice of the PIC was issued to the stakeholders described in **Section 13.1** via direct mailings, and posted on the City of Vaughan and TMIG websites.

The first PIC followed an open house format with display boards summarizing project information. The PIC provided stakeholders with an overview of the project scope, the requirements of the EA process, the existing conditions within the study area, the problem statement, and the preliminary identification of constraints, opportunities, and possible alternatives.

Stakeholders were invited to meet the project team and discuss specific elements of the study. Twenty-three individuals attended the first PIC. Attendees were encouraged to provide written comments on the provided comment sheets, of which four were completed and submitted.

Copies of the Notice, Information Package, Display Boards, Attendance Sheets, and Comment Sheets received at the PIC are included in **Appendix A**.

13.4 Public Information Centre No. 2

A second Public Information Centre was held on Thursday, December 8, 2011, between 7pm and 9pm at Vaughan City Hall (2141 Major MacKenzie Drive, Vaughan). Notice for this PIC was issued in the same manner as the first PIC.

The second PIC included a presentation to attendees, along with an open house format with display boards summarizing project information. Attendees were provided with an update on the progress of the project, with elaboration on the evaluation of alternatives and recommended water, sanitary, and stormwater management solutions. The updated project schedule and overview of the EA process were also presented.

Stakeholders were again invited to meet the project team and discuss specific elements of the study, with particular focus on the recommended solutions. Sixteen individuals attended the second PIC. Attendees were encouraged to provide written comments on the provided comment sheets, of which one was completed and submitted.

13.5 Notice of Study Completion and Report Review

The final stage in the Class EA process for this project is the finalization of the Class EA report (this document), and issuance of a Notice of Completion to stakeholders. The Notice will be issued in the same manner as the PIC notices, and will alert stakeholders to the availability of the document for review for a period of 30 calendar days.

13.6 Confirmation of EA Schedule

DATE	TASK
March 11, 2010	Notice of Study Commencement
April 12, 2010	Public Information Centre No.1 notice mailed
April 15, 2010	Public Information Centre No. 1
November 24, 2011	Public Information Centre No. 2 notice mailed
December 8, 2011	Public Information Centre No. 2
April - June, 2012	EA Report Completion, Issuance of Notice of Completion, 30-Day Review Period, Finalization of Class EA Master Plan

14 References

1. City of Vaughan Engineering Department Design Criteria (City of Vaughan, March 2004)
2. City of Vaughan Stormwater Management Retrofit Study (Aquafor Beech Limited, December 2007)
3. Functional Servicing Report – Empress Gardens Residential Development, City of Vaughan (Sernas Associates, March 2008)
4. Humber River Watershed Hydrology Update (Aquafor Beech Limited, November 2002)
5. Humber River Watershed Plan – Pathways to a Healthy Humber (Toronto and Region Conservation, June 2008)
6. Hydrological Analyses of the Black Creek Watershed and the Resolution of Post Development Stormwater Runoff Controls and Facilities for the Vaughan/400 Industrial Park Located in Lots 6 to 11 Inclusive Concession 4 and 5, Town of Vaughan (Ander Engineering & Associates Limited Consulting Engineers, January 1986)
7. Jane Street Industrial Area Stormwater Management Report (Paul Theil Associates Limited, December 1982)
8. Master Stormwater Management Strategy Report – Official Plan Amendment (OPA) 620 Steeles Corridor – Jane to Keele Lands, City of Vaughan (The Sernas Group, May 2007)
9. Request for Proposal and Terms of Reference – Engineering Consulting Services for the Preparation of the Vaughan Corporate Centre Node Master Servicing Strategy Report and Associated Engineering Plans (City of Vaughan, November 2007)
10. Stormwater Management Planning and Design Manual (MOE, 2003)
11. Stormwater Management Report- Beutel Goodman Real Estate, The Interchange Phase I (Hwy 400/407) (G.M. Sernas & Associates Limited, June 1997)
12. TRCA Presentation on Black Creek Watershed (TRCA, 2008)
13. Vaughan Corporate Centre Streetscape and Open Space Master Plan Study (EDA Collaborative Inc.; Young + Wright Architects; JH Stevens Planning and Development Consultants; Reich + Petch Design International; Read, Voorhees & Associates; MacViro Consultants Inc., November 2007)
14. Wet Weather Flow Management Guidelines (City of Toronto, November 2006)
15. York Region Transportation and Works Committee - Report No. 4, Regional Council Meeting (April 27, 2006)
16. York Region Transportation and Works Department, Water and Wastewater Branch Design Criteria (York Region, December 2006)
17. City of Vaughan, Black Creek Stormwater Optimization Study Class EA Phases 1 and 2 (AECOM, 2010)