david schaeffer engineering ltd

120 Iber Road, Suite 103
Ottawa, Ontario K2S 1E9
Tel. (613)836-0856
Fax (613) 836-7183
www.DSEL.ca

FUNCTIONAL SERVICING REPORT

FOR

2325483 ONTARIO INC.
195 HUNTMAR DRIVE

CITY OF OTTAWA

PROJECT NO.: 12-624

MAY 2018 – REV 1

FUNCTIONAL SERVICING REPORT
FOR
195 HUNTMAR DRIVE

2325483 ONTARIO INC.

TABLE OF CONTENTS

FIGURES

DRAWINGS

TABLES

APPENDICES

FUNCTIONAL SERVICING REPORT
FOR
195 HUNTMAR DRIVE
2325483 ONTARIO INC.
MAY 2018 – REV 1

CITY OF OTTAWA
PROJECT NO.: 12-624

1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) has been retained to prepare a Functional Servicing Report in support of Official Plan Amendment, Zoning By-law Amendment, and Plan of Subdivision applications for 195 Huntmar Drive.This FSR has been prepared in accordance with City of Ottawa's *Servicing Study Guidelines for Development Applications*, as demonstrated by the checklist included in ***Appendix A***.

The subject property is located within the City of Ottawa urban boundary, in the Stittsville ward. As illustrated in ***Figure 1***, the subject property is located south of the Highway 417 interchange with Palladium Drive and west of Huntmar Drive. The subject property is one unique parcel (PIN 044870339) that measures approximately 55 ha. The property is currently zoned Development Reserve (DR) Zone.

The proposed concept plan would allow for the development of commercial blocks (including automobile dealership blocks), one block of stacked townhomes, townhome lots, single-family home lots, a district park, a parkette, a stormwater management pond, walkways, open space blocks, and a highschool. The proposed concept plan shows the proposed layout of these land uses on a network of local (18m right-of-way), collector (26m right-of-way), and arterial (43m right-of-way) road segments. The subject lands are expected to be developed in distinct phases according to the landowner's preferred timing.

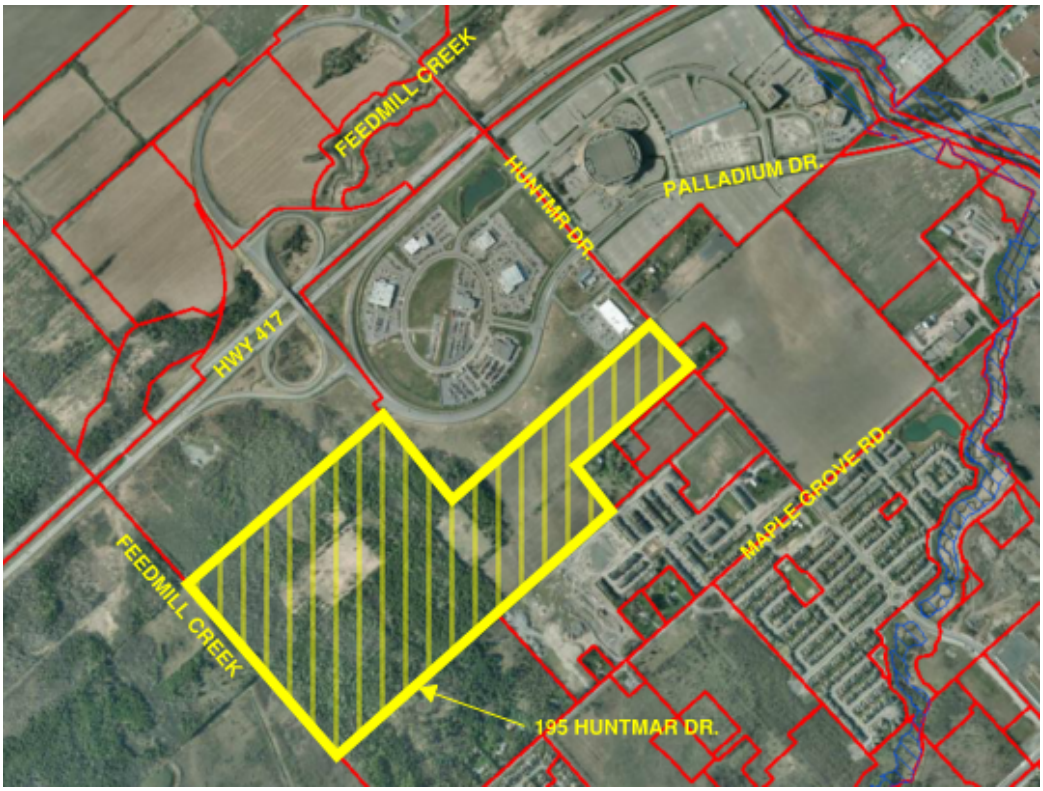


Figure 1: Site Location

The subject property is within the *Kanata West Concept Plan* (KWCP) area and is subject to the associated *Kanata West Master Servicing Study* (KWMSS) (Stantec/CLC/IBI, June 2006) and the *Implementation Plan for the Kanata West Development Area* (Delcan, October 2009) that were completed under the *Municipal Engineers Association Class Environmental Assessment Process* (June 2000). The KWMSS was completed in order to provide a conceptual servicing strategy and cohesive development approach for an overall development area of 725 ha. west of the Carp River and north of Hazeldean Road at the intersection of the former municipalities of Goulbourn, West Carleton, and Kanata. The proposed concept plan differs from the 'prestige business park' and 'extensive employment' land use contemplated in the KWCP and the KWMSS. The approximately 8.3 ha district park identified in the KWCP and KWMSS is proposed to be relocated and re-sized under the current concept plan.

The KWMSS identifies existing infrastructure and environmental constraints, describes the neighbourhood-level trunk services that will service all properties within the study area, establishes quantity and quality control targets for future site-specific stormwater management plans, and identifies required infrastructure upgrades to support the proposed development of the KWMSS area. Since completion of the KWMSS, many of the identified neighbourhood-level infrastructure projects have been completed or are underway, including stormwater management ponds, trunk sewers, and the Kanata West pumpstation. The following outstanding projects related to 195 Huntmar Drive have been

identified in the KWMSS and the *Implementation Plan for the Kanata West Development Area* for future design and construction:

- Sanitary Servicing Projects:
    - Trunk sanitary sewer from Silver Seven & along Carp River between Maple Grove Road and Palladium Drive.
- Watermain Projects:
    - Watermains in Huntmar Road Widening from Maple Grove Road to Campeau Drive.
    - Watermains in North-South Arterial from Hazeldean Road to Campeau Drive Extension.
    - Watermains in Stittsville Main Street Extension from Maple Grove Road to Palladium Drive.
- Stormwater Management Projects:
    - Stormwater Management Pond #4 and associated storm sewers.
    - Stormwater Management Pond #7 and associated storm sewers.

The objectives of this report are to:

- Provide sufficient detail to demonstrate that development of the subject lands will be adequately supported by municipal services, as set out in the Kanata West Master Servicing Study (Stantec, CCL, IBI, June 2006) and as refined during the planning, detailed design, and buildout of the various municipal infrastructure projects within the KWMSS area;
- Define the course of subsequent detailed design, review, and acceptance of the proposed municipal services;
- Demonstrate how the proposed municipal services will conform with current Ministry of the Environment and Climate Change servicing design criteria and other applicable agency guidelines; and,
- Demonstrate good engineering practice for the protection of public safety, the environment, and sustainable operation.

1.1 Existing Conditions

Under existing conditions, the east portion of the subject lands is cultivated for agricultural use and the remainder of the subject lands is a natural wooded area. The existing elevations range approximately between 101m – 108m based on available topographic mapping provided by the City of Ottawa.

The approximate existing drainage is depicted in ***Figure 2.*** The subject lands are within Carp River watershed, and are under the jurisdiction of the Mississippi Valley Conservation Authority (MVCA).

- Part of the lands (23.29 ha.) are believed to naturally drain to Feedmill Creek via the Northwest Swale, as identified in the *Environmental Impact Statement* (Muncaster, May 2018). The Northwest Swale outlets to a series of downstream ditches and culverts associated with the Highway 417/Palladium Drive interchange. A culvert brings flows under Highway 417 to Feedmill Creek, which then discharges to the Carp River.
- The remaining 31.28 ha. are believed to naturally drain through the East Swale – as identified in the Environmental Impact Statement (Muncaster, May 2018) – to the Huntmar Drive roadside ditch which is within the Carp River watershed per the Carp River Watershed/Subwatershed Study (Robinson Consultants, December 2004). A culvert under Huntmar Drive, just north of the site, conveys flows from the western roadside ditch to an east-west ditch that eventually drains through a culvert under Palladium Drive and flows directly into the Carp River (just north of Palladium Drive).

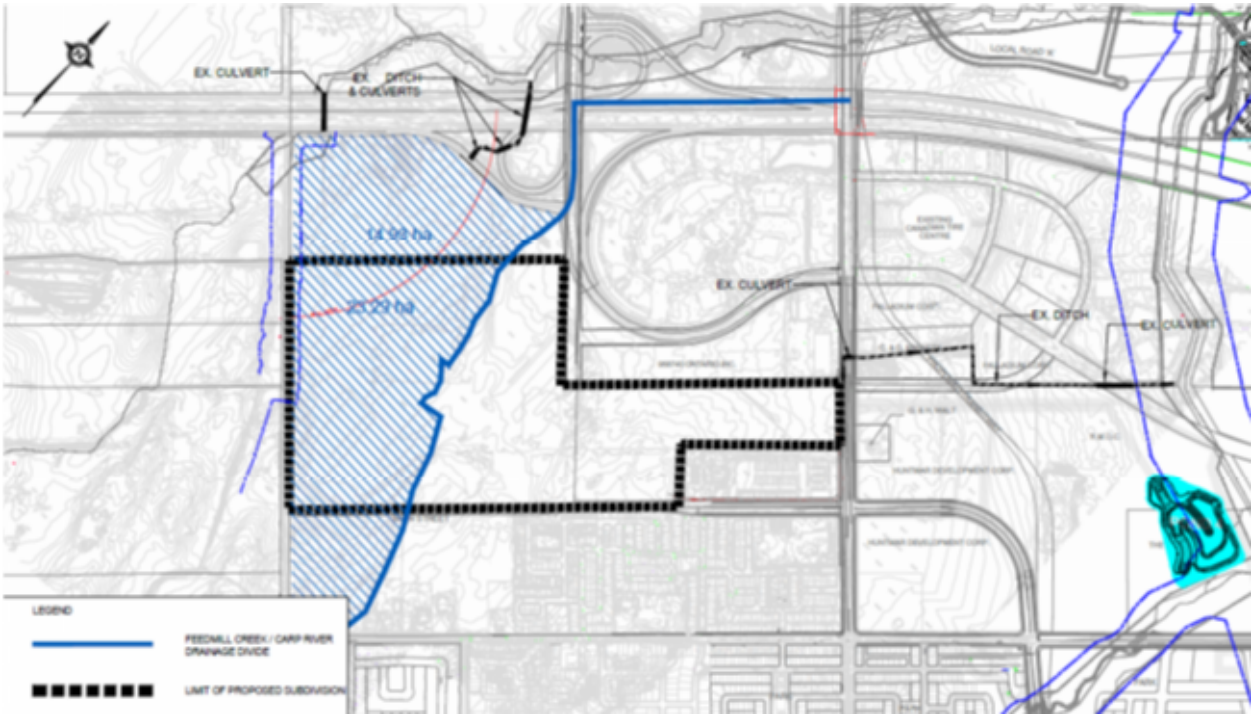


Figure 2: Approximate Existing Drainage Divide

Paterson Group's geotechnical investigations (March 2018) for the subject lands explain that the long-term groundwater table is estimated to be between 2 to 3 m below existing ground surface. The geotechnical investigations (Paterson Group, March 2018) suggest that the east portion of the subject lands consists of a topsoil layer overlying a silty clay layer and glacial till deposit: a permissible grade raise restriction of 2m will be required in the east portion of the site. The other portions of the site consist of topsoil underlain by a silty sand to sandy silt and/or a glacial till deposit (Paterson Group, March 2018). The

inferred bedrock surface is between 0.3 and 3.7 m depth from existing surface (Paterson Group, March 2018).

South of the subject lands, there are existing residential developments and planned residential/mixed use developments, including a development proposal at 173 Huntmar Drive potentially including low rise apartment buildings, townhouses blocks, and commercial buildings with retail on the ground floor and office uses above, complete with surface parking and associated private streets.

West of the subject lands, there is natural vegetated land that is currently zoned Rural Countryside Zone (RU) but is partially identified as a 69.5 ha Developing Community in the City's Official Plan. It is understood that development applications are underway for these lands, and as such, the detailed design of municipal services through the subject lands ought to be coordinated to ensure that sufficient municipal infrastructure capacity is provided.

1.2 Development Concept

The proposed development concept can be seen in ***Appendix A.*** A north-south arterial road bisects the site. The predicted populations associated with the development concept are described in ***Table 1*** below.

Table 1: Development Statistics

Land Use	Total Area (ha)	Projected Residential Units	Residential Population per Unit	Population*
Singles	4.13	131	3.4	446
Towns	8.19	432	2.7	1167
Stacked Towns	1.72	128	2.7	346
Park	6.29			
Commercial	12.30 + 1.15 (beyond 195 Huntmar)			
Highschool	6.12 + 1.73 (beyond 195 Huntmar)			
SWM Pond	4.49			
Roads	11.30 + 1.47 (beyond 195 Huntmar)			
Walkway	0.02			
Open Space	0.36			
Total	54.92 + 4.35 (beyond 195 Huntmar)	691		1959

** NOTE: Population projections may differ from population estimates used in background Transportation Studies, Planning Rationale, and other studies. Population projection and residential population per unit values are based on Ministry of Environment and Climate Change guidelines for servicing demand calculations.*

1.3 Limit of Development

As part of the development application for the subject lands, the limit of the Feedmill Creek corridor is expected to be defined, using the greatest setback from the watercourse based on the following parameters:

- 1:100 year floodplain [Sources: Feedmill Creek Floodplain Mapping (MVCA, January 2017) & Feedmill Creek Floodplain Mapping Study (MVCA, January 2017) (***Appendix G***)];
- Geotechnical limit of hazard lands [Sources: Site-specific Slope Stability Assessment - Feedmill Creek (Paterson Group, October 2016)(***Appendix G***)];
- Meanderbelt allowance [Source: Site-specific Meander Belt Width Assessment and Erosion Analysis (Geomorphix, July 2016) (***Appendix G***)];
- Aquatic buffer - 30 meter setback from Normal High Water Mark [Sources: Site-specific Environmental Impact Statement (Muncaster Environmental Planning, May 2018) and Topographic Survey (Stantec, April 2017) (***Appendix G***)];
- Aquatic Buffer - 15 meter setback from top of valley slope [Sources: Slope Stability Assessment - Feedmill Creek (Paterson Group, October 2016) (***Appendix G***), Environmental Impact Statement (Muncaster Environmental Planning, May 2018) and Topographic Survey (Stantec, April 2017) (***Appendix G***)];
- Tree retention area - 30 meter setback from Normal High Water Mark taken as extents of tree retention area, per Environmental Impact Statement (Muncaster Environmental Planning, May 2018) [Sources: Site-specific Environmental Impact Statement (Muncaster Environmental Planning, May 2018) and Topographic Survey (Stantec, April 2017) (***Appendix G***)]; and,
- 5 meter development / environmental protection setback from top of defined bank – geotechnical limit of hazard lands taken as proxy, since it includes stable slope allowance, toe erosion allowance, and 6m erosion access allowance [Sources: Carp River, Poole Creek and Feedmill Creek Corridor Width Limits Rationale (City of Ottawa, 2009) and site-specific Slope Stability Assessment - Feedmill Creek (Paterson Group, October 2016) (***Appendix G***)].

Appendix G provides a drawing that compiles the constraint lines identified in the above-noted sources. The 30m setback from Normal High Water Mark is proposed to act as a proxy for the development setback limit, until such time as the extents of the 1:100 year floodplain is determined via topographic survey once the 195 Huntmar development site has been raised in conformance with the *Feedmill Creek Floodplain Mapping Study* (MVCA, January 2017). Additional clarification on select parameters is included in ***Section 1.3.1***, ***Section 1.3.2***, and ***Section 1.3.3*** below.

As detailed development concepts are prepared for any pathway systems adjacent to Feedmill Creek, applicable pathway setback requirements are expected to be addressed through consultation with City of Ottawa and MVCA staff.

1.3.1 1:100 Year Floodplain

The 1:100 year floodplain is approximated in the drawing in ***Appendix G*** that compiles the constraint lines to include all lands within the subject property and within the property to the north that are below an elevation of 107.3 m.

However, it is understood that:

- the 1:100 year floodplain elevation adjacent to the 195 Huntmar development is 107.2m to 107.1m, as identified in the *Feedmill Creek Floodplain Mapping* (MVCA, January 2017) (***Appendix G***);

- a 15m setback from the spill hazard line identified in the *Feedmill Creek Floodplain Mapping* (MVCA, January 2017) (***Appendix G***) will act as the MVCA regulation line in this area; and,

- the spill hazard line identified in the Feedmill Creek Floodplain Mapping (MVCA, January 2017) (***Appendix G***) was contemplated to be eliminated by filling the 195 Huntmar development site above the 1:100 year floodplain elevation by means of 3:1 sloping starting from 30m from the low-flow channel of Feedmill Creek, in order to allow for urban development to proceed in general accordance with the KWCP, KWMSS, Official Plan, etc.

Consistent with the *Feedmill Creek Floodplain Mapping Study* (MVCA, January 2017) the 1:100 year floodplain is assumed to be at an elevation of 107.1m adjacent to the spill hazard area for the 195 Huntmar development, which would result in a new 1:100 year floodplain spanning 30m from the low-flow channel of Feedmill Creek plus approximately 3m (for example, considering an existing low point of 106.06m along the property line, filled at 3:1 slope starting 30m from low-flow channel of Feedmill Creek). It is expected that additional topographic survey would be completed at the time of filling the 195 Huntmar development site in order to determine the final extents of the regulatory 1:100 year floodplain.

At this time, given that the Normal High Water Mark is located at the top of bank along parts floodplain (see *Stantec Topographic Mapping* in ***Appendix G***), and is considered to range from approximately 2m to 3.5m from the bottom of bank, a setback of 30m from Normal High Water Mark has been considered to act as proxy for the development setback limit until such time as the extent of the 1:100 year floodplain is determined via topographic survey once the 195 Huntmar development site has been raised in conformance with the *Feedmill Creek Floodplain Mapping Study* (MVCA, January 2017).

1.3.2 Geotechnical Limit of Hazard Lands

Per the *Slope Stability Assessment - Feedmill Creek* (Paterson Group, October 2016): "the geotechnical setback limit (limit of hazard lands) includes the geotechnical stable slope allowance, a toe erosion allowance (where applicable), as well as a 6 m toe erosion access allowance". Signs of erosion were noted along the existing watercourse, especially where the watercourse has meandered in close proximity to the toe of the corridor wall. A toe erosion allowance of 2m is recommended for the corridor walls confining the existing watercourse.

1.3.3 Meanderbelt Allowance

Per the *Kanata West Development Area Meander Belt Width Assessment and Erosion Analysis* report by Geomorphix (***Appendix G***), the existing channel can naturally migrate within its valley setting. Given this, a meanderbelt width for the reach of Feedmill Creek directly adjacent to the 195 Huntmar development site (Reach 5) is recommended to be 27 m based on existing conditions, and 30 m in the event that the channel is realigned. Given that no re-alignment work is known to be proposed for this portion of Feedmill Creek, a 27m meanderbelt width is shown in the drawing in ***Appendix G*** that compiles the constraint lines.

1.4 Required Permits / Approvals

The City of Ottawa must approve detailed engineering design drawings and reports prior to construction of the municipal infrastructure identified in this report. This is expected to occur as part of the Plan of Subdivision application process, and potentially through block-specific Site Plan Control approval processes.

The municipal infrastructure proposed herein deviates from the KWMSS and may form part of a future KWMSS addendum, potentially in concert with other changes currently being proposed by other landowners in the community.

Based on pre-consultation with City staff, the following additional approvals and permits are expected to be required prior to construction of the municipal infrastructure detailed herein.

Table 2: Required Permits/Approvals

Agency	Potential Permit/Approval Required	Potential Trigger	Remarks
MNRF	Butternut removal permit.	Vegetation requiring removal due to development/grading.	MNRF permitting required per Environmental Impact Statement (Muncaster Environmental Planning, May 2018).
MVCA	Permit under Ontario Regulation 153/06, MVCA's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation	Ditches requiring closure due to development/grading, and potential changes to existing downstream culverts/ditches outletting to Feedmill Creek.	Proposed land uses & municipal infrastructure require grading within the subject lands and result in the closure of existing ditches. May also require modifications to downstream drainage features.
MVCA	Permit under Ontario Regulation 153/06, MVCA's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation	Grading within the regulatory limit (15m from spill hazard line) & new definition of regulatory floodplain.	Existing grades in the subject lands are below the 100-year floodplain elevation as reported by Mississippi Valley Conservation Authority (MVCA), based on their Feedmill Creek watershed study, and need to be raised to eliminate the spill hazard.
MOECC	Environmental Compliance Approval	Construction of new stormwater management pond (Pond 7), amendment to existing stormwater management pond (Pond 4), construction of sanitary & storm sewers.	The MOECC is expected to review all stormwater collection system, stormwater management, and wastewater collection system by transfer of review or direct submission (since in KWMSS area) – pre-consultation with MOECC will be required to confirm process.
MOECC	Permit to Take Water	Construction of proposed land uses (e.g. basements for residential homes) and services.	Pumping of groundwater may be required during construction, given groundwater conditions and proposed land uses and on-site/off-site municipal infrastructure.
City of Ottawa	Tree Cut Permit per City of Ottawa Urban Tree Conservation By-law No. 2009-200.	Trees requiring removal due to development/grading.	The subject property contains trees, and re-grading the site to accommodate the proposed development (including municipal services and drainage) may impact or require removal of existing trees. See Tree Conservation Report (Muncaster Environmental Planning, May 2018).
City of Ottawa	MOE Form 1 – Record of Watermains	Construction of watermains.	The City of Ottawa is expected to review the

	Authorized as a Future Alteration.		watermains on behalf of the MOE through the Form 1 – Record of Watermains Authorized as a Future Alteration.
DFO	Request for Review Application	Ditch requiring closure due to development/grading, and potential changes to existing downstream culverts/ditches outletting to Feedmill Creek.	DFO Request for Review may be required for removal/modifications of existing drainage features – see Environmental Impact Statement (Muncaster Environmental Planning, May 2018) for additional details.
MTO	Land agreements & development permits	Stormwater management facility to be constructed on Provincial Lands.	Note that because the proposed development is within 395m of Highway 417 Interchange, additional development permits may be required – permit requirements to be determined through consultation.

1.5 Consultation Summary

Pre-application consultation was conducted with interested parties at the City of Ottawa on March 30, 2016. The municipal servicing approach was discussed, including proposed deviations from the KWMSS. Pre-consultation correspondence is provided in ***Appendix A***.

Subsequent to the pre-consultation meeting, the City of Ottawa provided a suggested 100-year release rate of 8 L/s/ha for the proposed Pond 7 stormwater pond that discharges to Feedmill Creek. A copy of the information is provided in ***Appendix A.***

The first submission of this FSR was completed in June 2016, and a subsequent clarification report was submitted in September 2016 entitled *Summary of Design Refinements to Projects Identified in Kanata West Master Servicing Study, 195 Huntmar Drive*.

MVCA have provided preliminary comments on the development application, including requirements for setting the limit of development/municipal infrastructure and for stormwater management criteria. Correspondence is provided in ***Appendix A***.

MTO have provided preliminary comments on the development application, including their agreement in principle on the stormwater management program presented herein. Correspondence is provided in ***Appendix A***.

A public meeting was held on January 10, 2018 to present a revised development concept and revised servicing strategy to the public and agency stakeholders. The servicing plans that formed the open house boards are provided in ***Appendix A.***

1.6 Summary of Revisions

The following key elements have been incorporated into this FSR since the original submission (DSEL, June 2016) and the subsequent clarification report *Summary of Design Refinements to Projects Identified in Kanata West Master Servicing Study, 195 Huntmar Drive* (DSEL, September 2016):

- All servicing strategies have been updated to address the latest proposed development concept (***Appendix A***);
- Stormwater management Pond 7 has been shifted onto 195 Huntmar development site and sized to accommodate inflows from only the 195 Huntmar development site;
- The Pond 7 outlet has been shifted and entombed, now following the MTO property limit to a new culvert under a segment of the Highway 417/Palladium Drive interchange;
- The Pond 7 outlet has been sized to accommodate the planned development of the 195 Huntmar development site and the development of the MTO lands to the north that are shown to be tributary to Pond 7 in the KWMSS;
- The sanitary sewer system has been designed with an allowance for the lands west of the 195 Huntmar development site;
- Hydraulic modelling has been completed to confirm the watermain servicing strategy;
- Development limit information has been compiled and is summarized in the FSR report; and,
- Impacts of the proposed changes to Pond 4 and Pond 7 on Feedmill Creek have been detailed, and are summarized in this FSR report.

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

The following studies were utilized in the preparation of this report.

- **Ottawa Sewer Design Guidelines**,
  City of Ottawa, *SDG002,* October 2012
  (City Sewer Standards)

  - **Technical Bulletin ISDTB-2014-01, Revisions to Ottawa Design Guidelines - Sewer**
    City of Ottawa, February 5, 2014.
    (ISDTB-2014-01)

  - **Technical Bulletin PIEDTB-2016-01, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, September 6, 2016.
    (PIEDTB-2016-01)

  - **Technical Bulletin ISTB-2018-01, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, March 21, 2018.
    (ISTB-2018-01)

- **Ottawa Design Guidelines – Water Distribution,**
  City of Ottawa, July 2010.
  (City Water Supply Guidelines)

  - **Technical Bulletin ISD-2010-2**
    City of Ottawa, December 15, 2010.
    (*ISDTB-2010-2*)

  - **Technical Bulletin ISDTB-2014-02**
    City of Ottawa, May 27, 2014.
    (*ISDTB-2014-02*)

  - **Technical Bulletin ISTB-2018-02**
    City of Ottawa, March 21, 2018
    (*ISDTB-2018-02*)

- **Fire Underwriters Survey, 1999.**
  (FUS)

- **Design Guidelines for Sewage Works,**
  Ministry of the Environment, 2008.
  (MOECC Design Guidelines)

- **Stormwater Planning and Design Manual,**
  Ministry of the Environment, March 2003.
  (SWMP Design Manual)

- **Ontario Building Code Compendium,**
  Ministry of Municipal Affairs and Housing Building Development Branch, January 1, 2012, as updated from time to time.
  (OBC)

- **Kanata West Master Servicing Study,**
  Stantec, CCL, IBI, June 2006.
  (KWMSS)

- **Carp River Watershed/Subwatershed Study,**
  Robinson Consultants, December 2004.
  (CRWSS)

- **Mississippi-Rideau Source Water Protection Plan,**
  MVCA & RVCA, August 2014.

- **Summary of Design Refinements to Projects Identified in Kanata West Master Servicing Study, 195 Huntmar Drive,**
  David Schaeffer Engineering Ltd, September 2016.
  (KWMSS Refinements Report)

- **Feedmill Creek Floodplain Mapping,**
  MVCA, January 2017.

- **Feedmill Creek Flood Plain Mapping Study, Sections 6.1.1- 8.0,**
  MVCA, January 2017.

- **Building Better and Smarter Suburbs: Strategic Directions and Action Plan,**
  City of Ottawa, February 2015.

- **Feedmill Creek Stormwater Management Criteria Study**
  JFSA & Coldwater Consulting, April 2017.

2.2 Report Integration

Table 2 summarizes the studies that are being completed in support of the development application for 195 Huntmar Drive, and their relationship to this Functional Servicing Report.

Table 3: Associated Reports for 195 Huntmar Drive and Relationship to Functional Servicing Report

Report	Author	Relationship to Functional Servicing Study
Planning Rationale	Fotenn, July 2016 & Addendum May 2018	Delineates the study area and explains the development context. Provides spatial information on land uses, development densities, and projected populations to be serviced.
Environmental Impact Statement	Muncaster Environmental Planning, May 2018	Delineates the natural heritage system. Defines fish habitat within watercourses in the subject lands and adjacent to the subject lands, which influences stormwater management recommendations for the development. Considers impacts of on-site and off-site municipal infrastructure and details any additional studies required prior to construction. Assesses the existing ditches that are proposed to be closed due to proposed concept plan and site grading.
Geotechnical Investigations	Paterson Group, March 2018	Provides grade-raise recommendations, provides bedrock contours, and other subsurface information to inform the detailed design of municipal infrastructure and grading within the subject lands.
Community Transportation Study	Parsons, July 2016 & Addendum May 2018	Identifies required ROW widths and alignments.
KWMSS Refinements Report	DSEL, September 2016	Addresses City staff's request for additional details about the proposed project refinements, with a focus on demonstrating that neighboring properties are not negatively affected by the proposed refinements to the KWMSS.
Feedmill Creek SWM Criteria Study	Coldwater Consulting Ltd., March 2018	Examines the impact of the proposed changes to Pond 4 and Pond 7 (as described in ***Section 5***) to erosion in Feedmill Creek, and recommends additional in-stream protection measures in Feedmill Creek.
Headwaters Report	Bowfin Environmental Consulting Inc., May 2018	Examines existing headwater features within the property, and provides management recommendations (e.g. mitigation, conservation, no management, etc.).
Kanata West Ponds 4 and 7/ Impact of Proposed Changes on Carp River Model	JFSA, June 2017	Describes the methodology and results of a flood analysis for Feedmill Creek and the Carp River under the proposed changes to Pond 4 and Pond 7 (as described in ***Section 5***).
Preliminary Kanata West Pond 7 Sizing	JFSA, May 2018	Provides minimum pond volumes required to meet the defined quality, erosion, and quantity control targets for Pond 7 (as

		described in ***Section 5***), describes the updated methodology and updated results for the flood analysis for Feedmill Creek and the Carp River, and describes the methodology employed for the Feedmill Creek erosion analysis described in the *Feedmill Creek SWM Criteria Study* (Coldwater Consulting Ltd., March 2018).

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The subject property lies adjacent to the existing City of Ottawa 3W pressure zone as shown in the excerpt from the City of Ottawa Water Distribution Mapping in ***Appendix B***. Existing watermain infrastructure is shown in ***Figure 3.***

An existing 600mm diameter trunk watermain extends on Huntmar Drive from north of Highway 417 to Cyclone Taylor Boulevard.

Existing 300mm diameter trunk watermains are located along Palladium Drive, within the Palladium Autopark, along Maple Grove Road and along the portion of Huntmar Drive north of the subject lands. One public 300mm diameter watermain stub is provided in close proximity to the subject lands along Palladium Drive and another private 300mm diameter watermain stub exists in the Palladium Auto Park, as depicted in ***Figure 3.***

The 3W pressure zone network is operational within the existing residential neighbourhood (Mattamy Fairwinds) south of the subject lands, and a 200mm diameter watermain stub is available for connection at the limit of the subject lands, as depicted in ***Figure 3.***

3.2 Water Supply Servicing Design

The proposed ultimate alignment of the trunk watermain network is depicted in ***Figure 3.*** Per the KWMSS, in support of full buildout of the KWMSS area:

- the existing 600mm diameter watermain on Huntmar Drive at Highway 417 is to be extended south to and along the North-South Arterial Road;
- a 400 mm watermain will be required on Huntmar Drive from the North-South Arterial Road to Maple Grove Road;
- 300 mm diameter watermains will be required along Palladium Drive and along the arterial and collector road network within and adjacent to the site; and
- a 300 mm diameter watermain will be required along the future minor arterial to connect to the existing watermain infrastructure at Stittsville Main Street.

All of the watermains listed above are expected to be required at the time of buildout of the 195 Huntmar development site, except for the extension of the 600mm diameter watermain on Huntmar Drive to and along the North-South Arterial Road, which can likely be deferred and is understood to be recommended to be downsized to a 400mm watermain per personal communication with the City of Ottawa (***Appendix C***).

Potential alignments of local watermains are also depicted in ***Figure 3*** to illustrate that a redundant looped network is achievable to support the development of the site, extending from existing and planned infrastructure. At this time, proposed watermains are shown in

road right-of-ways. Servicing easements may be required as detailed designs progress, which may trigger minor amendments to the proposed lot fabric in the concept plan.

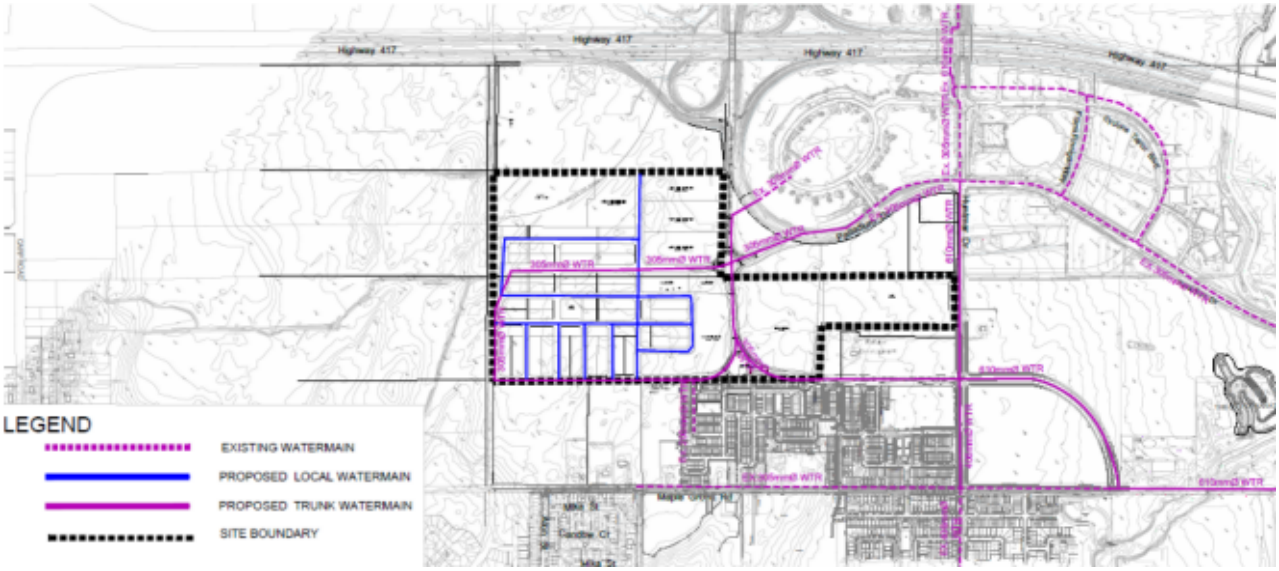


Figure 3: Proposed Watermain Servicing Plan

As detailed designs progress, timing of local watermains will be confirmed. Specifically, the timing of the extension of the 600mm/400mm diameter trunk watermain on Huntmar Drive from Highway 417 to and along the North-South Arterial Road is expected to be determined based on phased development demands for the site and for the surrounding properties.

The subdivision's watermain network will be sized to meet maximum hour and maximum day plus fire flow demands. ***Table 4*** summarizes the Water Supply Guidelines employed in the preparation of the preliminary water demand estimate (***Appendix C*** and ***Table 5***) and that will be applied in future watermain network hydraulic modelling and design.

Fire flow requirements are to be confirmed in accordance with Local Guidelines (Fire Underwriters Survey), City of Ottawa Water Supply Guidelines, and the Ontario Building Code, upon development of detailed concepts for the single family homes, townhouses, stacked towns, commercial blocks, the highschool, and the district park. For planning purposes, fire flow estimates are provided in the preliminary water demand estimate (***Appendix C*** and ***Table 5***) based on the information available in the preliminary concept plan and comparable recent developments in the City of Ottawa.

Table 4: Water Supply Design Criteria

Design Parameter	Value
Residential – Single Family	3.4 p/unit
Residential – Townhome/ Semi	2.7 p/unit
Residential Average Daily Demand	350 L/d/p
Residential – Maximum Daily Demand	2.5 x Average Daily Demand
Residential – Maximum Hourly Demand	2.2 x Maximum Daily Demand
Residential – Minimum Hourly Demand	0.5 x Average Daily Demand
Commercial/Institutional Average Daily Demand	50,000 L/gross ha/day
District Park Average Daily Demand	28,000 L/gross ha/day
Commercial/Institutional Maximum Daily Demand	1.5 x Average Daily Demand
Commercial/Institutional Maximum Hour Demand	1.8 x Maximum Daily Demand
Commercial/Institutional Minimum Hourly Demand	0.5 x Average Daily Demand
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
During normal operating conditions desired operating pressure is within	350kPa and 480kPa
During normal operating conditions pressure must not drop below	275kPa
During normal operating conditions pressure must not exceed	552kPa
During fire flow operating pressure must not drop below	140kPa

Notes:

- *Extracted from Section 4: Ottawa Design Guidelines, Water Distribution (July 2010), Table 4.1 – Per Unit Populations and Table 4.2 – Consumption Rates for Subdivisions of 501 to 3,000 Persons.*
- *No Outdoor Water Demand considered for residential uses.*
- *Park water demand assumed as Commercial/Institutional Use, since potential for community facilities, etc. Apply 'other commercial' rate of 28,000 L/gross ha/day per Table 4.2 & per MOE Design Guidelines: for other Institutional and Commercial flows and tourist-commercial areas, an allowance of 28 m3/(ha·d) average flow should be used in the absence of reliable flow data.*

All Single-Family and Townhomes have been assumed to conform to the City of Ottawa ISDTB-2014-02 for fire flow, resulting in a maximum fire flow of 10,000 L/min (166.67 L/s). Stacked Townhome units that would not conform to the described fire flow requirements in ISDTB-2014-02 are assumed to have a maximum estimated fire flow demand of approximately 17,000 L/min (283.33 L/s). This assumption is based on a conceptual footprint for the stacked townhomes and fire flow demands used for similar developments. Note that the actual building materials selected will affect the estimated flow, and as such, fire flow requirements may change as detailed designs progress. Additional details are provided in ***Appendix C.***

Boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the proposed connections to the site. Two sets of boundary conditions were provided. The first set of boundary conditions represents the interim City water distribution

system conditions (i.e. existing City conditions plus expected subdivision water and fire flow demands). The second set represents the ultimate buildout conditions of the City water distribution system reflecting the 2031 water demands as well as the updated preferred water infrastructure. Per personal communication with the City of Ottawa; "boundary conditions from the City's 2013 Infrastructure Master Plan (IMP) which includes growth for the entire pressure zone 3W under the 2031 planning scenario was provided. The IMP model also incorporates the findings from the original Kanata West MSS and updated water servicing plan undertaken by Stantec in 2013." *(**Appendix C**).* Therefore, it is assumed that both interim and ultimate boundary conditions incorporate all demands from future developments in lands adjacent to the subdivision. Boundary conditions were provided for peak hour, maximum day plus fire and maximum HGL (high pressure check) conditions. The boundary conditions provided are summarized below in **Table 6** and **Table 7** and their associated figures. Details of the boundary conditions can be found in **Appendix C**.

Table 5: Water Demand Estimate

Land Use	Approx Area (ha.)	Units	Pop.	Res. Water Demand (L/s)	Com. Water Demand (L/s)	Inst. Water Demand (L/s)	Total Average Water Demand (L/s)	Fire Flow (L/s)
Singles	4.13	131	446	1.81	-	-	1.81	166.67
Towns	8.19	432	1167	4.73	-	-	4.73	166.67
Stacked Towns	1.72	128	346	1.40	-	-	1.40	283.33
Apartments	0	0	0	0.00	-	-	0.00	-
Community Park	6.29	-	-	-	-	2.04	2.04	250.00
Commercial	13.45	-	-	-	7.78	-	7.78	250.00
Highschool	7.85	-	-	-	-	4.54	4.54	-
SWM Pond	4.49	-	-	-	-	.	-	-
Roads/Walkways/Open Space	13.15	-	-	-	-	-	-	-
Total	**59.27**	**691**	**1959**	**7.94**	**7.78**	**6.58**	**22.30**	

Notes:

- *Stacked Towns are assumed to be 4 storey buildings with surface parking (each unit is Approx. 1,100 sq. ft.) – assume 12 units per building.*
- *District Park calls for a variety of active and passive recreation opportunities which may include a community centre, pool /arena complex, indoor / outdoor rinks, splash pads, children's play areas, pedestrian walkways, seating areas, and shelters, as determined by the City.*
- *Approx areas include areas outside of 195 Huntmar that are proposed for highschool & commercial development, consistent with Table 1.*

Table 6: Interim Boundary Conditions

Condition	Connection 1 HGL (Huntmar and Palladium Drive)	Connection 2 HGL (Huntmar and Maple Grove Road)	Connection 3 HGL (Future minor Arterial and Stittsville Main Street)	Connection 4 HGL (Future minor Arterial and Maestro Avenue)
	(m)	(m)	(m)	(m)
Min Hour (max. pressure)	161.2	160.9	160.7	160.9
Peak Hour (min. pressure)	155.6	155.9	155.6	155.6
Max Day + Fire (167 L/s)	148.4	152.8	151.3	143.1
Max Day + Fire (250 L/s)	145.9	152.5	150.5	136.6
Max Day + Fire (283 L/s)	144.2	152.3	149.1	132.3

Figure 4: Interim Boundary Condition – Existing Watermains

Table 7: Ultimate Boundary Conditions

Condition	Connection 1 HGL (Huntmar and Palladium Drive)	Connection 2 HGL (Huntmar and Maple Grove Road)	Connection 3 HGL (Future minor Arterial and Stittsville Main Street)	Connection 4 HGL (Future minor Arterial and Maestro Avenue)
	(m)	(m)	(m)	(m)
Min Hour (max. pressure)	164.6	163.6	162.4	162.8
Peak Hour (min. pressure)	156.6	156.6	156.5	156.4
Max Day + Fire (167 L/s)	157.7	157.7	155.3	146.7
Max Day + Fire (250 L/s)	157.1	156.6	152.7	137.0
Max Day + Fire (283 L/s)	156.5	156.4	151.4	133.2

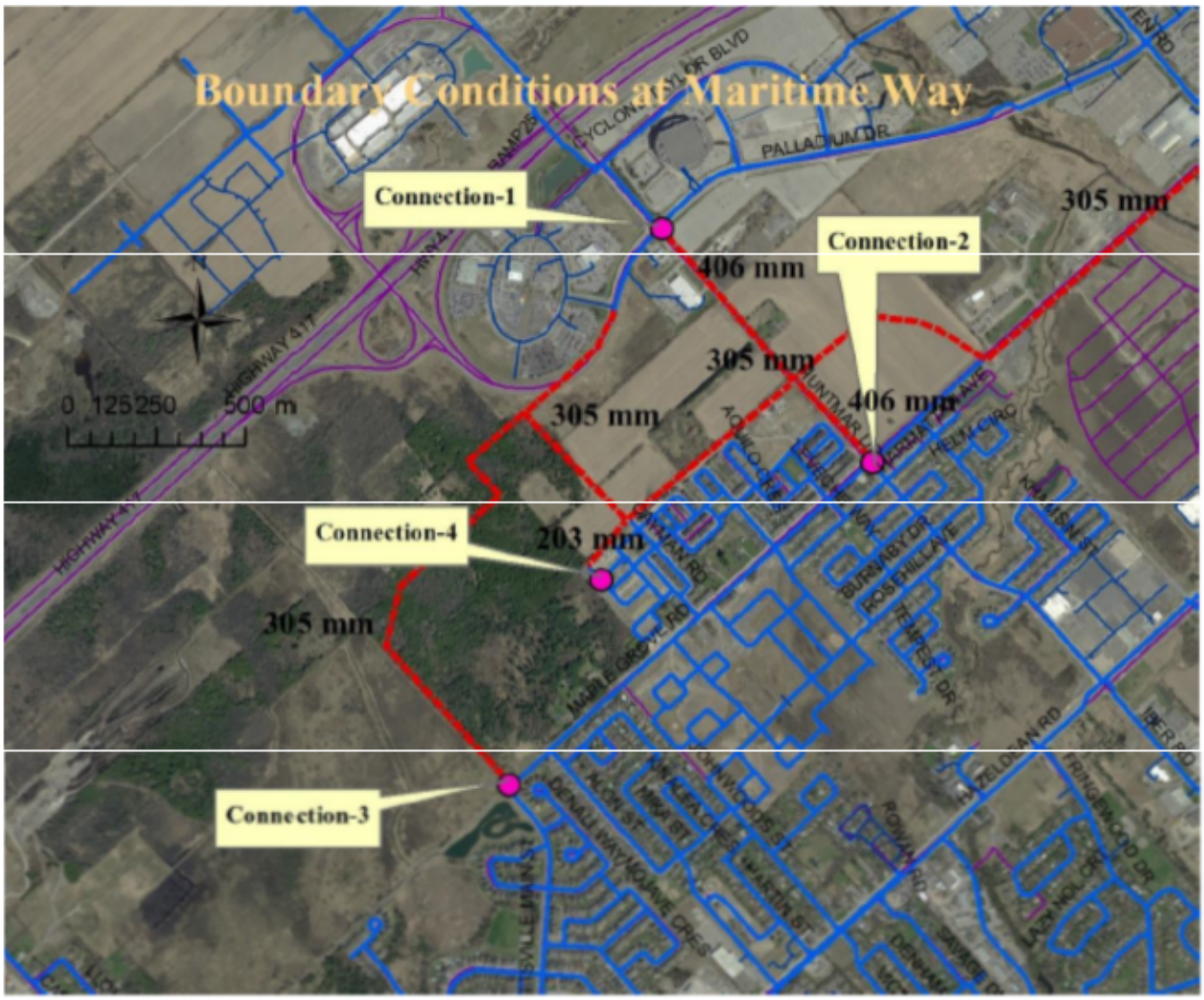


Figure 5: Ultimate Boundary Condition – Future Watermains

Due to a change in the concept plan since the boundary conditions request, the anticipated average daily demand is approximately *2%* higher than that used in the boundary condition request and approximately 2% higher than that used in the detailed hydraulic modelling described in ***Section 3.2.1***. Residential unit types and counts are anticipated to be refined during the detailed design stage; a revised boundary condition request will be submitted if significant changes to water demand or fire flow are proposed, and the hydraulic modelling will be updated if required.

Please note that the proposed alignment of the trunk watermain infrastructure differs from the KWMSS because of changes to the proposed road network. Furthermore, the KWMSS average water demand allowance for the subject lands is inferred to be approximately 4.9 L/s – using the rate of 152 l/d/p and an estimate of 60 employees/ha. for 46.27 ha of 'prestige business park' and 'extensive employment' land uses (total site area less KWMSS district park area of 8.3 ha.) - whereas now residential demands of 22.3 L/s are to be accommodated. The KWMSS fire flow allowance for the subject lands was 13000 L/min, whereas now 17000 L/min is to be accommodated. The increased water and fire flow demand can be adequately serviced by the proposed water main layout as indicated by water modeling results (***Section 3.2.1***).

3.2.1 Watermain Modelling

The proposed watermains within the development have been sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. ***Table 8*** describes three scenarios that were analyzed in order to better understand phasing requirements and impacts on sizing of watermain infrastructure. As noted in ***Section 3.2***, the demands utilized in the modelling are within 2% of the demands associated with the current development concept, but the land uses and layout of land uses differs from the concept plan. As noted in ***Section 3.2***, residential unit types and counts are anticipated to be refined during the detailed design stage; a revised boundary condition request will be submitted if significant changes to water demand or fire flow are proposed, and the hydraulic modelling will be updated if required.

Table 8: Description of Modeling Scenarios

Scenario	1	2	3
Boundary Condition	Ultimate*	Interim	Interim
Internal Subdivision Network	Full Buildout	Full Buildout – Sizes Optimized for Ultimate Conditions	Full Buildout – Sizes Optimized for Interim Conditions
External Offsite Network	Ultimate per the KWMSS & subsequent modifications, as provided by the City of Ottawa per Stantec 2013 study	Existing	Existing
Notes: **Ultimate Boundary conditions represent future buildout conditions of the City water distribution system reflecting the 2031 water demands as well as the updated preferred water infrastructure.*			

The network configuration and sizing for all scenarios are provided in ***Appendix C.***

Modelling was carried out for minimum hour, peak hour and maximum day plus fire flow using InfoWater. Modelling results shown in ***Table 9*** indicate that the development can be adequately serviced in Scenarios 1 to 3 for minimum hour and peak hour criteria.

Table 9: Summary of Available Service Pressures

Scenario	Minimum Hour Demand Maximum Pressure (kPa)	Peak Hour Demand Minimum Pressure (kPa)
1	551	477
2	524	469
3	524	469

Per ***Table 4,*** the minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire. A summary of available fire flows for Scenario 1 (ultimate boundary conditions with ultimate onsite and offsite networks) is shown below in ***Table 10***. The future and existing water main layouts can be found in ***Appendix C****.*

As shown in ***Table 10***, the model predicts that the fire flow requirements can be met throughout the development with the exception of one (1) location. The single deficiency is at the end of the only dead end in the subdivision network and is within 1% of the estimated required fire flow; as such, no network upsizing is recommended to increase the available fire flow at this location.

Table 10: Summary of Available Fire Flows- Scenario 1

Land Use	Estimated Required Fire Flow (L/s)	Minimum Available Fire Flow (L/s)	No. of Nodes where residual pressure is less than 140 kPa
Single/Townhome	167	206 (J-06)	0
Commercial/District Park	250	248 (J-10)	1
Stacked Townhomes	283	289 (J-21)	0

Table 11 summarizes the fire flow results for Scenario 2 (interim boundary conditions with existing offsite network and onsite network optimized for ultimate conditions). As shown in ***Table 11***, the model predicts that there are three (3) locations where fire flow requirements cannot be met throughout the development.

Table 11: Summary of Available Fire Flows- Scenario 2

Land Use	Estimated Required Fire Flow (L/s)	Minimum Available Fire Flow (L/s)	No. of Nodes where residual pressure is less than 140 kPa
Single/Townhome	167	186 (J-06)	0
Commercial/District Park	250	223 (J-10)	1
Stacked Townhomes	283	258 (J-21)	2

Table 12 summarizes the fire flow results for Scenario 3 (interim boundary conditions with existing offsite network and onsite network optimized for interim conditions). The model predicts that the fire flow requirements can be met throughout the development.

Table 12: Summary of Available Fire Flows- Scenario 3

Land Use	Estimated Required Fire Flow (L/s)	Minimum Available Fire Flow (L/s)	No. of Nodes where residual pressure is less than 140 kPa
Single/Townhome	167	187 (J-06)	0
Commercial/District Park	250	327 (J-10)	0
Stacked Townhomes	283	327 (J-21)	0

A summary of the modeling results is described in ***Table 13***. The modelling suggests that much of the proposed development could be serviced off of the existing watermain network, but that - depending on the growth patterns in the KWMSS area and the phasing of the 195 Huntmar development site – there is an opportunity to optimize the size of the onsite network in order to defer construction of part of the ultimate offsite network.

Table 13: Summary of Modeling Results

Scenario	Achievable Fire Flow in all locations	Achievable Domestic Flow in all locations	No. of Deficiencies	Network Upsizing Needed
1	YES*	YES	1*	NO
2	NO	YES	3	YES
3	YES	YES	0	NO
NOTES: **The available fire flow at the deficient location is within 1% of the estimated required and therefore the deficiency is considered negligible. No network upsizing is therefore recommended for Scenario 1.*				

3.3 Water Servicing Conclusions

The City's 3W pressurized water supply network will be expanded to meet the water demands of the proposed concept plan. The proposed water supply design is expected to conform to all relevant City and MOE Guidelines and Policies. Detailed modelling is required at detailed design to confirm phasing of the extensions of trunk watermains per the KWMSS.

The trunk watermain network has shifted from the alignments proposed in the KWMSS, in order to follow the proposed arterial and collector road network. Expected total average water demand has increased from the suggested 4.9 L/s per KWMSS to 22.3 L/s. KWMSS fire flow allowance for the subject lands is 13000 L/min, whereas now 17000 L/min is to be accommodated. The increased water and fire flow demand can be adequately serviced by the proposed water main layout, as indicated by water modelling results.

Three scenarios were analyzed via hydraulic modelling, in order to better understand phasing requirements for watermain infrastructure. The analysis suggests that a proposed interim watermain layout tying into the existing offsite network can achieve the required level of service for the expected water and fire flow demands. As the KWMSS area fully develops, the watermain network can achieve the required level of service for the expected water and fire flow demands for the full buildout of the subdivision and KWMSS area.

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

The subject lands are within the Kanata West Pump Station (KWPS) catchment area, as originally defined in the KWMSS.

An existing sanitary trunk sewer runs along Maple Grove Road (MGR) from John Woods Street to the west side of Poole Creek**.** Sewage from the MGR trunk sewer is currently directed to a privately owned temporary pump station located on the south side of MGR between Huntmar Drive and Poole Creek. Construction of the extension of the MGR trunk sewer under Poole Creek to the KWPS is currently underway. Both the KWPS and the MGR trunk sewer extension are scheduled to be completed in 2018.

Based on the KWMSS design information included in ***Appendix B & Appendix D***, there is expected to be at least 301 L/s residual capacity remaining in the Maple Grove Road 825mm dia. sanitary trunk sewer to the KWPS. Per ECA No. 7443-9Y8Q8R (***Appendix D***), the design of the KWPS will accommodate 528 L/s firm capacity upon completion in 2018, and 1250 L/s in 2031 ultimate conditions.

4.2 Wastewater Design

The subject lands are expected to be serviced by an internal gravity sanitary sewer system that is to follow the local road network. As detailed designs progress, alignment and sizing of local sanitary sewers will be confirmed and servicing easements may be required, which may trigger minor amendments to the proposed lot fabric in the concept plan. The proposed alignment of the trunk sanitary sewer infrastructure within the subject lands differs from the KWMSS because of the changes to the proposed road network.

The KWMSS contemplates that the subject lands will be serviced by a 625mm trunk sanitary sewer draining through servicing easements and/or future road rights-of-way eastwards towards the Palladium Drive crossing of the Carp River, to the north of Pond 4, and finally south to the KWPS. The KWMSS alignment is illustrated in ***Appendix B.***

The land owners affected by this KWMSS trunk sanitary sewer alignment have discussed re-aligning the sewer to take advantage of residual capacity within the MGR trunk sewer and to avoid the requirement to cross undeveloped lands owned by others. An alternative sanitary sewer alignment east & south of the Huntmar and future North-South Arterial intersection is shown in ***Appendix B***, representing the City of Ottawa's & IBI's proposed revisions to KWMSS sanitary routing. The alternative alignment follows Huntmar Drive and the future North South Arterial to outlet to the existing MGR trunk east of Huntmar Drive.

In support of development of 195 Huntmar, an interim solution is proposed, whereby an interim sewer would follow Huntmar Drive directly to the MGR trunk sewer (KWMSS MH 10). This is considered the preferred sanitary trunk sewer alignment to service the subject

lands, as this option avoids the requirement to access undefined road alignments on adjacent private property between the site and the KWPS.

Aligning the trunk sanitary sewer along Huntmar Drive to outlet into the MGR sewer would direct KWMSS sanitary drainage areas 32 and 34 into the MGR sewer at KWMSS MH10. Area 33 & Area 35 (Palladium Autopark) are already developed and wastewater is conveyed through sewers on Cyclone Taylor Boulevard. Area 37 and all other KWMSS drainage areas are assumed to be serviced per the KWMSS and/or any changes via the City of Ottawa's & IBI's proposed revisions to KWMSS sanitary routing. See KWMSS "Preferred Wastewater Option" drawing S-1, accompanying sanitary sewer design sheet, as-built sewershed maps, and the City of Ottawa's/IBI's proposed revisions to KWMSS sanitary routing in ***Appendix B*** and ***Appendix D*** for details.

Applying the wastewater parameters in ***Table 14*** to the development concept described in ***Section 1.0*** (including external drainage areas 32 and 34 and an allowance for future development west of the 195 Huntmar development site), the estimated peak sanitary flow to be introduced at KWMSS MH10 is 136.73 L/s. See ***Appendix D*** for detailed calculations.

According to the KWMSS sanitary sewer design sheet, a peak wastewater flow rate of 368.56 L/s was proposed to be directed to the MGR trunk sanitary sewer east of Huntmar Drive, with a full flowing capacity of 669.89 L/s within the 825 mm sewer. The proposed trunk sewer alignment proposed as part of the 195 Huntmar development would direct an additional 136.73 L/s to the MGR sewer at KWMSS MH10. The total proposed flow rate in the MGR trunk sanitary sewer immediately east of KWMSS MH10A would be expected to be a maximum of 505.34 L/s, which results in at least 24% (164.55 L/s) remaining residual capacity within the MGR trunk sewer.

While the sanitary contributions from the 195 Huntmar development site are comparable to the sanitary outflows predicted in the KWMSS, the overall sanitary outflows conveyed to the downstream sewer system and KWPS represent an increase to that which was previously contemplated, because an allowance of 65.19 Ha of future residential development (4200 population) has been accommodated. This allowance is to be confirmed with affected landowners and City staff as the development application progresses. Capacity in the downstream network is to be analyzed by others, as part of any development application for the lands west of 195 Huntmar, including an analysis of the MGR sewer between MH10 and the KWPS under the City of Ottawa's/IBI's proposed revisions to KWMSS sanitary routing.

Table 14 summarizes the City standards applied in the preliminary sanitary design information above (detailed in ***Appendix D)***. The same ***Table 14*** parameters are to be employed in the detailed design of the proposed wastewater sewer system.

Table 14: Wastewater Design Criteria

Design Parameter	Value
Residential - Single Family	3.4p/unit
Residential – Townhome/ Semi	2.7p/unit
Average Daily Demand	280 L/d/per
Peaking Factor	Harmon's Peaking Factor, where K=0.8
Commercial / Institutional Flows	28,000 L/gross ha/day
Commercial / Institutional Peak Factor	1.5 if contribution >20%, otherwise 1.0
Light Industrial Flows	35,000 L/gross ha/day
Industrial Peaking Factor	Per Figure in Appendix 4-B, City of Ottawa Guidelines
Infiltration and Inflow Allowance	0.33 L/s/gross ha for all areas
Park Flows	9,300 L/ha/d (75 p/acre per Sewer Guidelines Appendix 4-A)
Park Peaking Factor	1.0
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012, Technical Bulletins, and recent residential subdivision in City of Ottawa.	

4.3 Wastewater Servicing Conclusions

The proposed wastewater servicing strategy for the subject lands is to be designed to conform to all relevant City Standards and MOE Guidelines, including the design parameters for the Kanata West Pump Station.

The subject lands will be serviced by off-site trunk sanitary sewer(s) delivering collected wastewater to the Kanata West Pump Station. The preferred offsite trunk sanitary sewer alignment to service the subject lands is an extension of a trunk sewer along Huntmar Drive from the existing Maple Grove Road trunk sewer. The preferred alignment is a deviation from the proposed alignment in the KWMSS because of changes to the proposed road network.

An allowance for future development west of 195 Huntmar has been incorporated into the conceptual sanitary servicing design. This allowance is to be confirmed with affected landowners and City staff as the development application progresses.

Sufficient residual capacity exists within the Maple Grove Road trunk sanitary sewer to accommodate the preferred sanitary sewer alignment and the buildout of the 195 Huntmar development, however additional capacity analysis will be required for the Maple Grove Road trunk sewer between Huntmar Drive and the Kanata West Pump Station as part of serviceability analysis for the developing community lands west of 195 Huntmar.

5.0 STORMWATER MANAGEMENT

5.1 Existing Stormwater Drainage

The subject lands are within Carp River watershed - under the jurisdiction of the Mississippi Valley Conservation Authority (MVCA) - and drain according to the pattern described in ***Section 1.1***.

The existing drainage split between Feedmill Creek and the Carp River is generally consistent with City of Ottawa base mapping and with the drainage boundaries set out in the *Carp River PCSWMM Model Documentation, Draft Report* (City of Ottawa, July 2015).

5.2 Stormwater Management Criteria

Stormwater management requirements for the proposed development have been adopted from the KWMSS, and refined based on consultation with City of Ottawa staff.

The KWMSS proposes that stormwater runoff from the subject lands be treated for quantity control and quality control by two stormwater management wet ponds. Refer to ***Appendix B*** for details. In general:

- The northern 6.6 ha of the subject lands was planned to be treated by Pond 7 (total drainage area approximately 34 ha., Runoff Coefficient C=0.7), which was to be located within the Palladium Drive/ Highway 417 interchange and outlet to Feedmill Creek.
- The remaining 48 ha of the subject lands was planned to be treated by Pond 4 (total drainage area 278 ha., Runoff Coefficient C=0.63), which is located beside and outlets to the Carp River. A Normal Level of quality control is required, given the aquatic habitat in the Carp River.

Pond 4 has been constructed under ECA No. 4298-9Q6HQ3 and is sized to receive site drainage in accordance with the KWMSS (***Appendix B***). The proposed alignment of the trunk storm sewer infrastructure differs from the KWMSS because of changes to the proposed road network. Pond 4 provides Normal Level water quality control, provides erosion protection, and attenuates post-development peak flows to pre-development levels for all storm events up to and including the 10-year storm event for the KWMSS drainage area.

For stormwater runoff destined to Feedmill Creek:

- All stormwater runoff up to and including that generated in a City of Ottawa 100-year design event is required to be attenuated. City of Ottawa staff have provided a suggested 8 L/s/ha release rate for the 100-year 12-hour SCS Type II design storm event for Pond 7, to respect the flow regime of Feedmill Creek (the receiving watercourse). The 8 l/s/ha allowance is to be taken using the original Pond 7 tributary area in the KWMSS.

- An Enhanced Level of quality control is expected to be required, given the aquatic habitat in Feedmill Creek.
- Furthermore, a unit release rate of 0.51 L/s/ha for the 15mm 3-hour Chicago design storm is required, per the *Feedmill Creek Stormwater Management Criteria Study* (JFSA & Coldwater Consulting, April 2017) for erosion protection for the downstream watercourse. The 0.51 l/s/ha allowance is to be taken using the original Pond 7 tributary area in the KWMSS.

The following key City standards will be required for stormwater management within the subject lands and conveyance to the proposed stormwater management ponds, among other requirements:

- Storm sewers on local roads are to be designed to provide a minimum 2-year level of service per the City's latest Technical Bulletin PIEDTB-2016-01.
- Storm sewers on collector roads are to be designed to provide a minimum 5-year level of service per the City's latest Technical Bulletin PIEDTB-2016-01.
- Storm sewers on arterial roads are to be designed to provide a minimum 10-year level of service.
- For less frequent storms (i.e. larger than the minimum level of service), the minor system sewer capture will be restricted with the use of inlet control devices to prevent excessive hydraulic surcharges.
- Under full flow conditions, the allowable velocity in storm sewers is to be no less than 0.80 m/s and no greater than 6.0 m/s.
- For the 100-year storm and for local and collector roads, the maximum depth of water (static and/or dynamic) on streets, rearyards, public space and parking areas shall not exceed 0.35 m at the gutter. For arterial roads, no barrier curb overtopping is permitted.
- The major system shall be designed with sufficient capacity to allow the excess runoff of a 100-year storm to be conveyed within the public ROW or adjacent to the right-of-way provided that the water level must not touch any part of the building envelope, must remain below all building openings during the stress test event (100-year + 20%), and must maintain 15 cm vertical clearance between spill elevation on the street and the ground elevation at the nearest building envelope.
- Arterial roads must leave at least one lane free of water in each direction at all times up to a 100-year return period.
- When catchbasins are installed in rear yards, safe overland flow routes are to be provided to allow the release of excess flows from such areas. A minimum of 30 cm of vertical clearance is required between the rear yard spill elevation and the ground elevation at the adjacent building envelope.

- The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m^2/s on all roads.

5.3 Stormwater Management Design

It is proposed that Pond 7 be constructed within the site boundary and outlet to Feedmill Creek via a proposed 825 mm outlet pipe within the MTO lands. The outlet pipe would connect via a new ditch to an existing culvert under Highway 417. The proposed facility footprint is proposed to shift and expand from that shown in the KWMSS, to achieve orderly and cost-effective development of the subject lands. The expanded Pond 7 is proposed to receive all stormwater runoff within the part of the subject lands that is west of the North-South arterial road, allowing that portion of development to proceed in one phase. Pond 7 could be expanded onto the MTO lands to also receive flows from development north of the subject lands, in accordance with the original KWMSS Pond 7 tributary area. Therefore, the pond outlet pipe has been sized to accommodate future development of the MTO lands. MTO have reviewed the proposed design and offered their agreement in principle – see ***Appendix A.***

The remaining subject lands that are east of the North-South arterial road are to drain to Pond 4, via an off-site 'North Trunk' storm sewer, as planned in the KWMSS (***Appendix B & E***). East of Huntmar Drive, the off-site 'North Trunk' storm sewer is to be aligned through servicing easements and/or future road rights-of-way eastwards to the Pond 4 north forebay.

The proposed stormwater drainage areas for the subject lands differ from the existing drainage split and the drainage pattern proposed in the KWMSS, as detailed in ***Table 15.***

Table 15: Comparison of Subject Land Drainage to Feedmill Creek and Carp River

	Existing Drainage (ha.)	MSS Drainage (ha.)	Proposed Drainage (ha.)
Feedmill Creek (Pond 7)	23.3	6.6	40.1
Carp River (Pond 4)	31.3	48	14.5
Total Subject Land Area	**54.6**	**54.6**	**54.6**

Refer to ***Drawing 2*** for the preferred storm management system for the subject lands. Rational method design sheets are provided in ***Appendix E.*** Based on examples from similar residential subdivisions in Ottawa, predicted runoff coefficients (C-values) have been assigned as follows, considering paved areas at C=0.90 and grassed areas at C=0.20:

- District Park: Allowance of C=0.70 until additional programming information is known;
- Arterial & Collector Roads: C=0.70;
- Single Detached and Townhomes: C=0.70;
- High School: Allowance of C=0.70 until additional programming information is known;

- Park: C=0.40;
- Stacked Townhouses: C=0.80; and,
- Commercial/Auto Park: C=0.80.

Per the drainage areas and runoff coefficients shown in ***Drawing 2***, the estimated average imperviousness for the Pond 7 drainage area is 71%.

The *Preliminary Kanata West Pond 7 Sizing* (JFSA, May 2018) report details the proposed pond size for the new Pond 7, to meet the erosion, quality, and quantity requirements outlined in ***Section 5.2***. The proposed characteristics are summarized in ***Table 16*** and compared to the KWMSS.

Table 16: Comparison of Proposed and KWMSS Pond 7 Design

	Pond 7 KWMSS	**Pond 7 Proposed**
Drainage Area	34.08 ha.	40.8 ha, excluding MTO lands
Average Imperviousness	70%	71% (To be confirmed at detailed design)
Required Permanent Pool Volume	6305 m^3 (185 m^3/ha)	7616 m^3 (185 m^3/ha)
Permanent Pool Elevation	102.20	103.80
Required Quality Control Volume	1363 m^3 (40m^3/ha)	1632 m^3 (40m^3/ha)
100-year Release Rate	3654 L/s (Carp River Restoration Plan – Greenland International Consulting Engineers, Feb 2014)	144 L/s

It is anticipated that approximately 28,500 m^3 (26,880 m^3 plus contingency) of storage will be required in Pond 7 to attenuate stormwater runoff to Feedmill Creek to the established release rate. Actual required storage volumes will vary, and need to be confirmed as the development application progresses based on a number of factors including grading constraints and detailed modelling of the stormwater management plan. A conceptual pond footprint is shown in ***Drawing 2*** to illustrate the scale of attenuation required, but is subject to change as part of detailed design.

Detailed pond design will be completed according to KWMSS, the City of Ottawa Stormwater Management Facility Guidelines (underway), and the MOE SWMP Design Manual, detailing storage requirements and operating characteristics, inlet and outlet structures, orifice sizing, and pond block design including amenity space and pathways. Pond side slopes are to vary and designs are to be approved by a licensed geotechnical engineer prior to construction. Detailed grading, outlet orifices and weirs, and operational characteristics will be developed using modelling at the detailed design level, with input from other professionals (e.g. geomorphologists, geotechnical engineer, etc.) where

required. A spillway will be designed to convey emergency overflow to Feedmill Creek. The detailed design of the stormwater outlet will be required to illustrate that there are no negative erosion, thermal, or water level impacts caused by the introduction of pond discharge to Feedmill Creek and the existing ditches and culverts between Pond 7 and Feedmill Creek.

To address the change in flow regime in Feedmill Creek under the proposed Pond 7 plan:

- A *Feedmill Creek SWM Criteria Study* (Coldwater Consulting Ltd., March 2018) has been prepared to examine the impact of Pond 7 to erosion in Feedmill Creek, and recommends additional in-stream protection measures in Feedmill Creek beyond those originally identified in the *Feedmill Creek Stormwater Management Criteria Study* (JFSA & Coldwater Consulting, April 2017). This has been discussed with City staff. There is an opportunity for 2325483 Ontario Inc. to enter into a front-ending agreement for the required in-stream erosion protection works in Feedmill Creek, in order to accommodate the proposed stormwater strategy.
- A flood analysis has been prepared (see *Preliminary Kanata West Pond 7 Sizing* (JFSA, May 2018)), showing that water levels may be expected to increase by 5cm on Feedmill Creek and 3cm on the Carp River under the proposed plan under specific modelling comparisons of the 2- to 100-year 12-hour SCS Type II design storm flows.

As the development application progresses, the City and agencies are expected to provide further input on these matters. Prior to construction, MOE Environmental Compliance Approval (ECA) will be required and specific MTO, MNR, DFO, and/or MVCA permits may be required.

Please note that under the proposed stormwater plan, the inflows through the Pond 4 ‘North Trunk’ will be reduced from the KWMSS, providing an opportunity to reduce pipe sizes and reduce capital costs for installation. The change is not expected to have a negative impact to the operation of the pond, and is not associated with negative environmental impacts (Muncaster Environmental Planning, May 2018). On approval of the development and servicing concept for 195 Huntmar, 2325483 Ontario Inc. is expected to work will the Kanata West Owner’s Group to formalize the reduction in storm sewer sizes and negotiate any associated cost-sharing implications.

Conceptual storm sewer sizing and profile information is provided in ***Appendix E***, based on rational method calculations and conservative runoff coefficients of 0.7 for the highschool and district park; however, it is expected that the detailed runoff coefficient will be lowered at detailed design, and on-site storage up to the 100-year design storm event will be required for these blocks in order to ensure that overland flow does not cross the Huntmar Road arterial. This is expected to allow for trunk storm sewer sizes to Pond 4 to be decreased by about one or two pipe sizes. With storage and controlled release rates, there may also be an opportunity to use existing ditch systems as an interim stormwater management strategy prior to the construction of the complete ‘North Trunk’ storm sewer to Pond 4. Regardless of any future proposed changes in the ‘North Trunk’ stormwater

sewer size, ECA No. 4298-9Q6HQ3 for ongoing construction of Pond 4 (***Appendix E***) did not include the 'North Trunk' sewer, so a Pond 4 ECA amendment is expected to be required to support development of the 195 Huntmar development.

5.3.1 Minor System

The subject lands are expected to be serviced by an internal gravity storm sewer system that is to follow the local road network. As detailed designs progress, alignment and sizing of local storm sewers will be confirmed and servicing easements may be required, which may trigger minor amendments to the proposed lot fabric in the concept plan. The proposed alignment of the trunk storm sewer infrastructure within the subject lands differs from the KWMSS because of the changes to the proposed road network.

As part of detailed design, flow from adjacent developments will be further defined – currently some external drainage from south of the site is expected to be required to be picked up in the Pond 4 storm sewer system prior to development of the lands south of the site, as shown by the cut-off swales and ditch inlet catchbasin along the southern property line in ***Drawing 1***. Furthermore, some rear yard drainage is expected to be required to be picked up in the Pond 4 storm system, based on existing drainage in the Mattamy Fairwinds subdivision.

Table 17 summarizes the standards that will be employed in the detailed design of the storm sewer network, meeting the requirements in ***Section 5.2.*** Conceptual trunk storm sewer sizing and profile information is provided in ***Appendix E***, according to the drainage areas and sewer routing shown in ***Drawing 2***, but is subject to change as part of detailed design. The profiles show that frost cover can be achieved with the conceptual grading plan (***Section 5.4***) and that pipe submergence at the pond outlet is not currently proposed.

5.3.2 Hydraulic Grade Line

A detailed hydraulic gradeline (HGL) analysis will be completed for the proposed system at the detailed design level, per the requirements in ***Table 17.*** Detailed grading design and storm sewer design will be modified as required to achieve a 0.3 m freeboard between the 100-year HGL and all underside of footing elevations.

Table 17: Storm Sewer Design Criteria

Design Parameter	Value
Minimum Minor System Design Return Period	1:2 year (PIEDTB-2016-01) (local) or 1:5 year (collector) or 1:10 year (arterial)
Major System Design Return Period	1:100 year
Intensity Duration Frequency Curve (IDF) 2-year storm event: A = 732.951; B = 6.199; C = 0.810 5-year storm event: A = 998.071; B = 6.053; C = 0.814	$i = \frac{A}{(t_c + B)^C}$

Minimum Time of Concentration	10 minutes
Rational Method	$Q = CiA$
Storm sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Runoff coefficient for paved and roof areas	0.9
Runoff coefficient for landscaped areas	0.2
Minimum Sewer Size	250 mm diameter
Minimum Manning's 'n' for pipe flow	0.013
Minimum Depth of Cover	2.0m from crown of sewer to grade (or 1.5m where USF freeboard to HGL is not a constraint, such as in slab-on-grade products)
Minimum Full Flowing Velocity	0.8 m/s
Maximum Full Flowing Velocity	6.0 m/s (where velocities in excess of 3.0 m/s are proposed, provision shall be made to protect against displacement of sewers by sudden movement)
Clearance from 100-Year Hydraulic Grade Line to Building Opening (USF)	0.30 m
Max. Allowable Flow Depth on Municipal Roads	35 cm above gutter (PIEDTB-2016-01)
Extent of Major System	To be contained within the municipal right-of-way or adjacent to the right-of-way provided that the water level must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (100-year + 20%) and 15cm vertical clearance is maintained between spill elevation on the street and the ground elevation at the nearest building envelope (PIEDTB-2016-01)
Stormwater Management Model	DDSWMM (release 2.1), SWMHYMO (v. 5.02) and XPSWMM (v. 10)
Model Parameters	Fo = 76.2 mm/hr, Fc = 13.2 mm/hr, DCAY = 4.14/hr, D.Stor.Imp. = 1.57 mm, D.Stor.Per. = 4.67 mm
Imperviousness	Based on runoff coefficient (C) where Percent Imperviousness = (C - 0.2) / 0.7 x 100%.
Design Storms	Chicago 3-hour Design Storms and 24-hour SCS Type II Design Storms. Maximum intensity averaged over 10 minutes.
Historical Events	July 1st, 1979, August 4th, 1988 and August 8th, 1996
Climate Change Street Test	20% increase in the 100-year, 3-hour Chicago storm
Extracted from City of Ottawa Sewer Design Guidelines, October 2012, and Technical Bulletins	

5.3.3 Major System

Major system conveyance, or overland flow (OLF), will be provided to accommodate flows in excess of the minor system capacity. OLF is accommodated by generally routing surface flow along the road network and service easements to the stormwater management facilities, per the drainage boundaries shown in ***Drawing 2*** and grading shown in ***Drawing 1.***

The grading program described in ***Section 5.4*** and shown in ***Drawing 1*** includes a saw-toothed road design with about 0.1% from highpoint to highpoint, in order to maximize available surface storage for management of flows up to the 100-year design event.

If the detailed design results in violations in the City's flow depth or flow spread parameters (as summarized in ***Section 5.2***), excess flows may be redirected to a different overland flow route, attenuated in surface storage, or captured within the minor system in order to reduce flow depths/spread, if necessary.

Therefore, the proposed drainage systems are expected to safely capture and convey all storms up to and including the 100-year event in accordance with the requirements of the KWMSS and City standards.

5.4 Grading and Drainage

A conceptual grading plan is shown in ***Drawing 1,*** but is subject to change as part of detailed design to minimize earthworks, to respect grade raise restrictions detailed in the geotechnical investigations (Paterson Group, March 2018), and provide major system conveyance to the receiving watercourses. To achieve the planned stormwater drainage program, meet MVCA requirements to eliminate the 1:100 year spill hazard, and meet City of Ottawa guidelines pertaining to road and lot grading, final road grades in the subject lands are planned to be set to between 107.7m and 108.6m west of the North-South Arterial, which requires about 2m – 3m of fill above existing ground.

The following additional grading criteria and guidelines will be applied to detailed design, per ***City of Ottawa Guidelines***:

- Driveway slopes will have a maximum slope of 6%;
- Slope in grassed areas will be between 2% and 5%;
- Grades in excess of 7% will require terracing to a maximum of a 3:1 slope;
- Swales are to be 0.15m deep with 3:1 side slopes unless otherwise indicated on the drawings; and,
- Perforated pipe will be required for drainage swales if they are less than 1.5% in slope.

The proposed concept plan for the subject lands and associated fill requires closure of the Northwest Swale and Eastern Swale that are characterized in the Environmental Impact Statement (Muncaster Environmental Planning, May 2018) and all other on-site watercourses identified in the Headwaters Report (Bowfin, May 2018). Written authorization from MVCA pursuant to Ontario Regulation 153/06, MVCA's *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* regulation is required to fill the two swales, and is being addressed through the separate Headwater Assessment study (Bowfin, May 2018). Additional permits from DFO may also be required.

Existing grades in the subject lands are below the 100-year floodplain elevation as reported in the *Feedmill Creek Floodplain Mapping Study* (MVCA, January 2017). Written authorization from MVCA pursuant to Ontario Regulation 153/06, MVCA's *Development,*

Interference with Wetlands and Alterations to Shorelines and Watercourses regulation is required to fill site areas below the 100-year floodplain elevation that are within 15m of the MVCA spill hazard. See ***Section 1.4, Appendix A,*** and ***Appendix G*** for additional details.

5.5 Infiltration

The following Low Impact Development techniques should be considered for implementation as part of detailed design:

- Rear-yard swales should be designed with minimum grades where possible, to promote infiltration;
- Rear-yard catchbasin leads should be perforated (except for the last segment connecting to the storm sewer within the right-of-way), to promote infiltration;
- Surface ditches could be implemented within the highschool and district park (as opposed to storm sewers) to promote infiltration; and,
- Where evestroughs are provided on residential units, they are to be directed to landscaped surfaces, to promote infiltration.

Furthermore, the following techniques can be examined as part of detailed landscaping design of the stormwater pond block, the highschool block, and the district park block:

- Amended topsoil (minimum 300mm thick) can be considered for use; and,
- Micro-grading can be considered to promote infiltration.

As detailed designs progress, a detailed site-specific water budget is to be undertaken to characterize pre-development and post-development infiltration for the subject lands.

The KWMSS calls for an increase of 25% in infiltration rates from pre-development levels for all areas subject to the KWMSS: for the subject lands, the KWMSS suggests pre-development infiltration rate is 70-100mm/yr. The existing subsurface conditions in the area and the amount of impervious surfaces - among other factors - have made it difficult to achieve this target for development applications to date within the KWMSS area. As such, soil and groundwater conditions will require further site-specific evaluation through the detailed design process, to determine the feasibility of achieving the post-development 25% increase in infiltration. It is expected that the amount of imported fill within the Pond 7 tributary area will provide a benefit to infiltration over the existing soils.

Because the subject lands are not identified as a Significant Groundwater Recharge area in the Mississippi-Rideau Source Water Protection Plan, Schedule M (MVCA & RVCA, August 2014) (***Appendix F***), an infiltration deficit in the post-development scenario for the subject lands is not considered to have a significant negative impact on the natural heritage system (Muncaster Environmental Planning, May 2018).

5.6 Stormwater Servicing Conclusions

The proposed alignment of storm sewers differs from the KWMSS due to modifications to the street network and block layout under the planning application, and due to a proposed change in catchment area for the proposed stormwater management facilities. Whereas the KWMSS proposed drainage from the subject lands to be mainly treated by Pond 4, the current proposal is for Pond 7 to provide erosion protection, Enhanced Level quality treatment, and attenuation of storm events up to the 100-year design storm event for a greater drainage area than previously contemplated (all lands west of the North-South arterial road).

To address the change in flow regime in Feedmill Creek under the proposed Pond 7 plan, a *Feedmill Creek SWM Criteria Study* (Coldwater Consulting Ltd., March 2018) has been prepared to examine the impact of Pond 7 to erosion in Feedmill Creek, and recommends additional in-stream protection measures in Feedmill Creek beyond those originally identified in the *Feedmill Creek Stormwater Management Criteria Study* (JFSA & Coldwater Consulting, April 2017). In addition, a flood analysis has been prepared (see *Preliminary Kanata West Pond 7 Sizing* (JFSA, May 2018)), showing that water levels may be expected to increase by 5cm on Feedmill Creek and 3cm on the Carp River under the proposed plan under specific modelling comparisons of the 2- to 100-year 12-hour SCS Type II design storm flows. As the development application progresses, the City and agencies are expected to provide further input on these matters.

The remaining subject lands that are east of the North-South Arterial are to drain to Pond 4, via an off-site trunk storm sewer, as planned in the KWMSS. Pond 4 has been partially constructed under ECA No. 4298-9Q6HQ3, and is to provide Normal Level water quality control, erosion protection, and attenuate post-development peak flows to pre-development levels for all storm events up to and including the 10-year storm event. Trunk storm sewers destined to Pond 4 can likely be downsized from the KWMSS, due to the decrease in drainage area.

The storm sewers will be sized by the Rational Method and inlet control devices (ICDs) will be used to restrict the capture rates to 2-, 5-, or 10-year flow for local, collector, and arterial roads, respectively. Storm sewers sizing will be confirmed at the detailed design level, in conformance with MOE and City standards.

The major overland flows from the subject lands will be conveyed by public right-of-ways and servicing easements to the proposed stormwater management facilities for treatment. Low Impact Development techniques will be implemented where feasible, to promote infiltration of stormwater.

6.0 UTILITIES

Overhead hydro lines run along the Huntmar Drive right-of-way adjacent to the site. Clearances in accordance with the local authority will need to be observed. It is expected that Hydro One would provide service to the subject lands, however additional consultation is required.

The closest Enbridge gas infrastructure is believed to be located at the intersections of Huntmar Drive-Palladium Drive and Huntmar Drive-Maple Grove Road and within the existing residential neighbourhoods to the south of the subject lands. Service extending to the site may require connections to multiple existing infrastructure points: consultation with Enbridge gas is required to confirm the servicing plan for the subject lands.

Rogers Communications has service adjacent to the subject lands via pole-mounted utilities on Huntmar Road and within the existing residential neighbourhoods to the south of the subject lands. Consultation is required to confirm servicing plan for the subject lands. Similarly, Bell infrastructure is provided within the existing residential neighbourhoods to the south of the subject lands, and consultation is required to confirm the servicing plan for the subject lands.

7.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate and topography. The extent of erosion losses is exaggerated during construction where vegetation has been removed and the top layer of soil becomes agitated.

Prior to topsoil stripping, earthworks or underground construction, erosion and sediment controls will be implemented and will be maintained throughout construction, including protection of any headwater features and areas governed by the MVCA regulatory limit prior to receipt of permits for proposed alterations.

Silt fence will be installed around the perimeter of the active part of the site and will be cleaned and maintained throughout construction. Silt fence will remain in place until the working areas have been stabilized and re-vegetated. Material stockpiles shall not be permitted within the Feedmill Creek corridor.

Catchbasins will have catchbasin inserts installed during construction to protect from silt entering the storm sewer system.

A mud mat will be installed at the construction access in order to prevent mud tracking onto adjacent roads.

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

- Limit extent of exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with plastic or synthetic mulches.
- Install silt fence to prevent sediment from entering existing ditches.
- No refueling or cleaning of equipment near existing watercourses.
- Provide sediment traps and basins during dewatering.
- Install catchbasin inserts.
- Plan construction at proper time to avoid flooding.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

- Verification that water is not flowing under silt barriers.
- Clean and change inserts at catch basins.

8.0 CONCLUSION AND RECOMMENDATIONS

The overall municipal servicing strategy for the subject lands was approved as part of the Kanata West Master Servicing Study (KWMSS) (Stantec, CCL, IBI, June 2006) and can be described as follows:

- Water supply is to be provided through extensions of the existing pressurized trunk watermain system.
- Wastewater is to be conveyed through sanitary trunk gravity sewers to the Kanata West Pumping Station, which is currently being constructed.
- Stormwater runoff is to be conveyed via storm trunk gravity sewers (minor system) and overland flow routes (major system) to designated off-site stormwater management facilities: one new stormwater management pond outletting to Feedmill Creek (Pond 7) and one existing stormwater management pond outletting to the Carp River (Pond 4).

This Functional Servicing Study (FSR) (DSEL, July 2016) provides details on the planned on-site and off-site municipal services for the subject lands, highlights proposed deviations from the KWMSS, and explains that adequate municipal infrastructure capacity is expected to be available for the planned development of the subject lands.

- This FSR proposes alternative alignments for trunk sewer and watermain infrastructure as compared to the KWMSS, to achieve orderly and cost-effective development given the proposed phasing of the subject lands and having regard for how the MSS area has built out since the original 2006 study. Proposed sewer and watermain alignments are within the urban area and within planned municipal road rights-of-way or planned servicing easements. Sanitary flows from the subject lands are proposed to be conveyed in a new wastewater trunk sewer along Huntmar Drive to the existing Maple Grove Road Trunk Sewer and Kanata West Pump Station. There is sufficient capacity in the existing Maple Grove Road Trunk Sewer to accommodate this realignment.
- This FSR details the planned location and sizing of Pond 7, which is a new stormwater management wet pond that is to be constructed within 195 Huntmar. Pond 7 is to outlet to Feedmill Creek via an outlet pipe and new ditch within lands owned by the Ontario Ministry of Transportation, to gain access to an existing culvert under Highway 417 at its interchange with Palladium Drive. Pond 7 was identified in the approved KWMSS, but the proposed facility footprint is proposed to shift and expand in order to achieve orderly and cost-effective development of the subject lands. The expanded Pond 7 is proposed to receive all stormwater runoff within the part of the subject lands that is west of the arterial road (40.8 ha), allowing that portion of development to proceed in one phase. The Pond 7 stormwater management system is to be designed to meet MOE Enhanced Level of suspended solid removal before stormwater is discharged to Feedmill Creek. A maximum 100-year storm event 8 L/s/ha release rate is to be applied to the Pond 7 design, per City of Ottawa direction, to respect the flow regime of Feedmill Creek. As such, Pond 7 is expected to require 28,500 m^3 of storage.

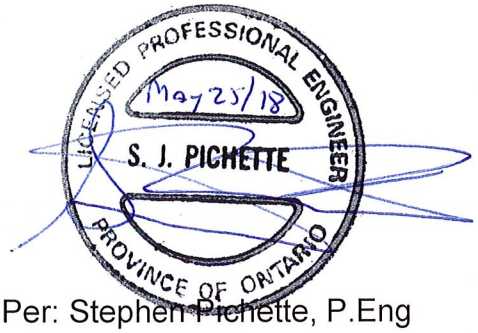
- To address the change in flow regime in Feedmill Creek under the proposed Pond 7 plan, a *Feedmill Creek SWM Criteria Study* (Coldwater Consulting Ltd., March 2018) has been prepared to examine the impact of Pond 7 to erosion in Feedmill Creek, and recommends additional in-stream protection measures in Feedmill Creek beyond those originally identified in the *Feedmill Creek Stormwater Management Criteria Study* (JFSA & Coldwater Consulting, April 2017). In addition, a flood analysis has been prepared (see *Preliminary Kanata West Pond 7 Sizing* (JFSA, May 2018)), showing that water levels may be expected to increase by 5cm on Feedmill Creek and 3cm on the Carp River under the proposed plan under specific modelling comparisons of the 2- to 100-year 12-hour SCS Type II design storm flows. As the development application progresses, the City and agencies are expected to provide further input on these matters.
- The remaining subject lands – the arterial and lands east of the arterial (14.5 ha.) - are to drain to Pond 4, via an off-site trunk storm sewer, as planned in the KWMSS. Pond 4 is partially constructed under ECA No. 4298-9Q6HQ3, and is to: provide Normal Level water quality control; provide erosion protection; and attenuate post-development peak flows to pre-development levels for all storm events up to and including the 10-year storm event. To convey flows to Pond 4, a new stormwater trunk sewer will be required through easements and future road right-of-ways, per the KWMSS, but there is an opportunity to downsize the infrastructure because of the decrease in drainage area to Pond 4.
- To achieve the planned stormwater drainage program, eliminate a 1:100 year floodplain spill hazard identified in the *MVCA Feedmill Creek Floodplain Mapping* (MVCA, January 2017), and meet City of Ottawa guidelines pertaining to road and lot grading, final road grades in the area tributary to Pond 7 are planned to be set to between 107.7m and 108.6m, which requires about 2m – 3m of fill above existing ground.
- Low Impact Development (LID) techniques are to be implemented where possible, as part of detailed design.

Prior to detailed design of the infrastructure presented in this report, this FSR will require approval under the Planning Act as supporting information for the Official Plan Amendment, Zoning By-law Amendment, and Plan of Subdivision applications. Project-specific approvals are also expected to be required from the City of Ottawa, Ministry of Environment and Climate Change, Ministry of Transportation, Department of Fisheries and Oceans, Ministry of Natural Resources and Forestry, and Mississippi Valley Conservation Authority.

Prepared by,
David Schaeffer Engineering Ltd.

Per: Laura Maxwell, B.Sc.(Civil Eng)

Reviewed by,
David Schaeffer Engineering Ltd.



Per: Stephen Pichette, P.Eng

z:\projects\12-624_cavanagh_kanata_west\b_design\b3_reports\b3-2_servicing (dsel)\2018-05-24_fsr\2018-05-24_624_fsr_rev1.docx

APPENDIX A

- Pre-Consultation Notes (City of Ottawa, March 2016)
- MVCA Pre-Consultation Comment Letter (MVCA, April 2016)
- Pond 7 Release Rate Correspondence (City of Ottawa, June 2016)
- MVCA Comment Letter (MVCA, November 2016)
- MTO Agreement in Principle for Stormwater Management Concept (MTO, May 2017)
- Open House Boards (DSEL, January 2018)
- Draft Plan of Subdivision (Stantec, May 2018)
- Servicing Guidelines Checklist (DSEL, May 2018)

MEETING NOTES

Pre-Application Consultation Meeting
Cavanagh/Shenkman Subdivision – Kanata West
March 30, 2016 - Councillors' Lounge, City Hall

Attendees: **City Staff:**
David Wise (Program Manager, City of Ottawa)
Louise Sweet-Lindsay (Planner, City of Ottawa)
Chris Ogilvie (Project Manager, City of Ottawa)
Riley Carter (Transportation Project Manager, City of Ottawa)
Mark Young (Urban Design Planner, City of Ottawa)
Matthew Hayley (Environmental Planner, City of Ottawa)
Diane Emmerson (Parks Planner, City of Ottawa)
Tracy Tang (Planning Student, City of Ottawa)
Royce Fu (Policy Development and Urban Design Branch, City of Ottawa)
Max Walker (OC Transpo)
MVC Staff – Victoria Hard and Craig Cunningham
Applicant:
Kevin McCrann, Shenkman
Peter Hume, HP Urban
Miguel Tremblay, Fotenn Consultants
Doug Kelly, Soloway Wright
Chris Collins, Cavanagh
Chris Gordon, Parsons
Bernie Muncaster

Subject: Pre-Application Consultation Meeting- Official Plan Amendment, Plan of Subdivision and Zoning By-law Amendment Applications– Proposing:
Enterprise Designation - Proposing 50% residential and 50% employment in conjunction with MTO lands to the north. Plan of Subdivision to permit a total of 600-1000 residential units (single detached dwellings, stacked townhouses), 1 block for District Park, 3 blocks for auto dealerships.
Mixed Use Centre – Proposing mixed use including lands for medium density residential (towns, stacked, apartment) and 1-2 blocks for commercial use.

APPLICANT PROPOSAL AND OVERVIEW:

The development is part of the Kanata West Concept Plan. Two concept plans are presented: Concept 3, with a north-south arterial road that forms a t-intersection, and Concept 4, with an alignment which matches the TMP for north-south arterial road. The district park is proposed to be located in the far north-west corner of the Enterprise designation, with a size of 27.5 acres.

- Transportation Comments (Chris Gordon): The June 2006 EA is outdated, and road layouts and functions have changed since it was completed. A rationale has been prepared for the proposed road realignments with the goal of maximizing land uses. Both of the concept plans proposed aim to achieve the same capacity, but the applicant has a preference for Plan 3, which has an orderly grid layout, better connectivity and access points, and a strong combination of transportation and land use.
- Planning Comments (Miguel Tremblay) : For the residential areas, 600-1000 units are proposed, depending on the mixed use. These blocks may be low apartments, townhouses, or stacked townhouses. The "yellow blocks" are proposed to be single detached residential zones. A blended approach is taken based off of the OPA 150, with diversity in the types and height of residential dwellings. The applicant is willing to be flexible with the plan, as long as there is sensitivity to the larger roadways.
- Servicing Comments: The stormwater pond would be located on MTO lands near the on/off ramp to Highway 417. In following the site's natural drainage, the parcel would be squared off and stormwater would drain into Pond 7. Stormwater on the eastern portion of the site would drain into Pond 4, while stormwater on the western portion would drain into Pond 7. In terms of grading, there is a layer of silty clay present in the north-west corner of the property, as well as a 2m grade raise restriction. In this area, the park and auto dealership use are proposed. The development will be served by Kanata West pump station. Trunk sewers will be extended with new sewers going east, which is under the control of Urbandale. Although water servicing in the area is straightforward, a hydraulic study will be conducted.

MVC PRELININARY COMMENTS: - Comments will be provided under separate cover

STAFF PRELMINARY COMMENTS:

Policy (Royce Fu):

- Royce Fu provided an update on the timing of the Employment Lands Study. The draft report will be available in April with a report to Council in the fall of 2016. City initiated OPA will follow in 2017.
- The applicant will need to submit a private Official Plan Amendment for this development if they wish to receive approval of the subdivision and zoning prior to the ELS and implementing OPA being approved by the City. Consideration must be put into how the OPA will impact MTO lands, the stormwater pond, and the road network. It is important to demonstrate that lands for 50% employment uses will be maintained and developed at appropriate density. Staff will have a further meeting with the applicant to discuss the OP policy framework in further detail.

Environmental (Matthew Hayley):

- Matthew Hayley advised that the site is within an area of habitat for a threatened or endangered species and a detailed Environmental Impact Statement (EIS) will be required. Blanding's turtles habitat is present as they were located within 2 km of an observation. Matthew advised that they contact Kemptville District MNRF identify what species at risk need to be addressed in addition to the Butternut trees and Blanding's turtles. EIS must also assess the wetlands on the site and any potential impact to them. **Please contact Laura Melvin** and/or a Management Biologist at MNRF Kemptville and request for additional information. Although we didn't discuss this at the pre-application consultation, working collaboratively with

neighbouring landowners on the Blanding's turtle habitat permitting under the ESA may be advisable.

- Although the wetlands are not Provincially Significant, they maybe MVC Regulated in addition to being regulated under the Endangered Species Act.
- In addition to the species at risk, the EIS will need to address all components of the natural heritage system as described by the OP Section 2.4.2. This would include significant woodlands and significant wildlife habitats among other aspects described in the above referenced policies.
- A tree conservation report (TCR) will be required as well. Matthew suggests that the applicants survey the site for existing trees that can be potentially integrated into the final design. He reiterated the importance of conserving as many healthy existing trees as possible. Please contact Mark Richardson, Planning Forester, for additional details on tree conservation and tree removal permits.
- Feedmill Creek – the watercourse setback for Feedmill Creek may encroach onto part of this property. The setback for Feedmill Creek is the 30 m from normal highwater mark, floodplain or geotechnical hazard (e.g., meander belt and/or unstable slope) whichever is greater. There is also a minimum corridor width.
- The proposal will also require an Integrated Environmental Review (OP Section 4.7.1). We are requesting that the applicant include a draft version of the IER as part of their planning rationale. The intent of this request is to better integrate environmental issues into each of the supporting studies and the proposal's design. As the OP states, "[environmental] design components will be considered basic inputs...and must be assessed and considered prior to establishing an initial design or lot pattern." This will help inform the proposal's design and expedite the registration process. While we understand each study will not be complete at the time of drafting the IER, we request the draft IER to demonstrate that each supporting study has considered the subject property and surrounding environment, and identified potential environmental concerns and constraints, all recommendations and analyses of relevant policies, watershed and sub watershed studies (Feedmill Creek) and federal or provincial assessment documents, and the potential implications of these constraints on each aspect of the proposal and the associated supporting studies and the interactions between these studies and their potential recommendations and how the principles of design with nature have been applied. Full details of the IER requirements are available in OP Section 4.7.1.

Parks (Diane Emmerson):

- Diane Emmerson commented that the vision for the district park is for a fully developed active park with various recreation facilities including: four full size soccer fields, and one mini field (possible on full sized CFL football in lieu of one soccer field), four tennis courts with lighting, a fully board rink with lights, a field house and parking for these facilities and a neighborhood park components for adjacent residential neighborhood. Diane noted that the numerous constraints (environmental, wetland, grade raise restriction, etc.) which have been identified, may make parts of the park non-developable, for active park facilities. Any portion of the park that is constrained and cannot be fully developed will not be acceptable as parkland. She advised that the constraints need to be fully identified and defined (exact shapes and sizes) before locating the park and defining the size of the park block . Any identified constraints located on the proposed District Park will not count towards the required parkland dedication. Consideration could be given to transferring the constraint lands at no cost to the City but it would outside the boundary of the park.

- Following completion of detailed studies in support of the Plan of Subdivision application (i.e. EIS and servicing reports), which better define the type of constraints that exist; it may be staffs' recommendation to not locate the District park in the proposed N-W corner and to locate it as per the KWCP.

Transportation (Riley Carter):

- Riley Carter advised that a Noise Feasibility Study will be required as part of the application package. A detailed study will be required prior to registration.
- If major revisions are proposed to the road network, it will require a revision to KWCP Master Transportation Study. It is recommended that it be done on a comprehensive basis in conjunction with other adjacent landowners who may also be proposing revisions to determine effects on adjacent communities, not just what is on the site. Amendments may be required for any EAs that have been completed and OP Schedules (Schedule E -Urban Road Network) for any major road changes. Do not want the studies to be completed on a piece-meal basis. Please contact Riley Carter at extension 14304 to discuss further (if needed).
- Expiration dates for KWCP completed EAs will need to be investigated.
- If no major changes are made to the already approved KWCP Master Transportation Study then a CTS will be needed for draft plan submission, if changes are made to the approved plan then the updated KWCP Master Transportation Study will be sufficient for the draft plan submission. A TIS will be required at time of subdivision registration.
- Roundabouts must be considered at all intersections before selecting traffic signals.
- OC Transpo (Max Walker): There are plans to have OC Transpo transit service through the proposed subdivision, but because Stittsville Main Street is not yet completed, it is difficult to map transportation routes and predict modal splits. Additionally, the communities to the south of the proposed subdivision will be difficult to get to (Maple Grove Road from Stittsville Main Street) with the layout of the road network. The applicant may be required to front-end Stittsville Main Street.

Servicing and Stormwater Management (Chris Ogilvie):

- Chris commented that given that the proposed land use is different from the KWCP and given the revisions to the transportation network and the routing of the network, a revision to the Master Servicing study will be required.
- JF. Saborin is currently completing a criteria study for feedmill Creek which will give further direction for swm criteria. This study is planned to go to Committee and Council for approval Q4 of 2016.
- The stormwater pond on MTO lands will need to be in City Ownership and possible option is to include on the M-plan for the Plan of Subdivision and transferred to the City at the time of registration.
- There are significant trunk sewers to be constructed for these lands to proceed and any revision to the servicing must be examined to determine impact on adjacent landowners and Master Servicing Study.
- There are no concerns with water services as there is sufficient supply and good access. There may be a requirement for looping down Stittsville Main Street.
- City could not support approval of the OPA to permit single detached housing without first approving the revision to the MSS.

Urban Design (Mark Young):

- A modified grid layout with lower density on the western portion of the lands is the most preferable design. The density should increase as the blocks get closer to the Mixed Use Centre in accordance with the Kanata West Concept Plan, while keeping the single detached dwellings on the western portion of the lands. Please consider fronting units along the collector roads to avoid the use of noise walls. In terms of design and layout, adjustments could be made based on either one of the proposed north-south arterial road concepts (3 or 4).
- Detached Dwellings are not permitted within the Mixed Use Centre designation.
- A design brief (high level) will be required with the application submission package.
- UDRP review is required for the Mixed Use Centre lands.

Other Planning Matters and Closing

- David Wise commented that he was concerned the proposed auto dealerships did not conform to the OP. Miguel Tremblay commented they were given Section 3.6.5 Policy 2 b.
- It was confirmed that a meeting to discuss just the OP and possible amendments will be arranged in the near future.
- Staff encouraged the applicant to forward any revised concepts prior to formally submitting the applications. Staff would also be willing to meet again to discuss any new proposals.
- Show proposed lotting for single detached on the Plan of Subdivision versus large Blocks only.
- The City Staff would appreciate the applicant organizing a site tour in the spring.
- It is recommended that the Ward Councillor be contacted and advised of the proposed applications.
- List of Required Studies and Plans – attached.

Conservation Partners
Partenaires de conservation

Mississippi Valley Conservation Authority / Office de protection de la nature de la vallée Mississippi

OFFICE DE PROTECTION DE LA NATURE DE LA VALLÉE RIDEAU / RIDEAU VALLEY CONSERVATION AUTHORITY

SOUTH NATION CONSERVATION / CONSERVATION DE LA NATION SUD

April 19, 2016

City of Ottawa
Planning and Growth Management Department
110 Laurier Avenue West, 4th Floor
Ottawa, Ontario K1P 1J1

Attention: Louise Sweet-Lindsay

Subject: **Pre-Application Consultation Comments**
Cavanagh/Shenkman Lands – Kanata West
Palladium Drive at Huntmar Drive
City of Ottawa (Kanata)

Dear Ms. Sweet-Lindsay:

The Mississippi Valley Conservation Authority (MVCA) has compiled comments with regards to possible future development on the lands located in Kanata West, City of Ottawa. The site has a total land area of 55.85 hectares (138 acres), east of Palladium Drive and north of Maple Grove Road. We have considered this pre-application relative mainly to MVCA's regulatory requirements under Section 28 of the *Conservation Authorities Act*. The proposal has also been reviewed in association with the Carp River Watershed/Subwatershed Study (CRWSS), 2005, Kanata West Concept Plan (Corridor Width Limits Rationale), 2009, and the Provincial Policy Statement (PPS), 2014. The following is for your consideration.

Development Constraints/Hazards:

Natural Hazards (Meander Belt)

Feedmill Creek is the main natural heritage feature on the subject lands and the focus of MVCA's comments.

1. The Corridor Width Limits Rationale that was prepared for Kanata West describes the Feedmill Creek corridor width to be 70 meters for this section of the watercourse. These corridor calculations precede the flood plain mapping that was completed for Feedmill Creek by MVCA. The new flood plain information supersedes the corridor limits and erosion hazard. The corridor limit for Feedmill Creek is the greater of the following criteria:
    a. Floodplain limit
    b. Setback from normal highwater mark (30 meters)
    c. Meanderbelt allowance
    d. 5 meter setback from top of defined bank or 13 meters from top of defined bank to include pathway requirements (pathway/private lands/development).
2. The Corridor Rationale outlines that an erosion hazard in the form of a meander belt applies along Feedmill Creek.
3. The hazard extends onto the property; therefore the development boundary will need to consider the extent of the meander belt hazard in addition to providing a safe access allowance measured from the edge of the meander belt.

Natural Hazards (Spill/Flood Plain)

1. MVCA floodplain mapping for Feedmill Creek has been completed and approved by MVCA's Board of Directors, however the existing mapping is subject to change as a result of development to the north of the subject lands.
2. A spill area covers the entire property which extends all the way east until it meets the Carp River. The spill hazard must be addressed in order for the subject lands to be developed.
3. A permit from the MVCA is required to develop within the regulation area surrounding Feedmill Creek and the spill hazard.

Setback from Water

1. According to the CRWSS, the current condition of the stream channel for Feedmill Creek within the subject site is Very Good. By maintaining the existing shoreline within the flood plain and a vegetated buffer, it will serve an important function for maintaining water quality of Feedmill Creek and the Carp River.

Wetlands

MVCA's GIS mapping, which is based on the provincial Ministry of Natural Resources and Forestry (MNRF) Natural Resource Values Information System data, shows that a significant portion of the western section of the subject lands contains wetlands.

1. We understand that the aforementioned wetlands have not been evaluated; therefore, they are not currently deemed to be a *significant* natural heritage feature as defined in the Provincial Policy Statement (PPS). However, given the numerous benefits of all wetlands, MVCA strongly encourages their preservation. These benefits include: attenuation of flood water; serving as a groundwater recharge/discharge area and providing a more stable source of water during low water conditions; filtering our drinking water; and providing habitat to many species of flora and fauna (often including fish). They may also provide connectivity and function to *Natural Heritage Systems*, as defined in the PPS (2014). Therefore, a development setback of a minimum 30 m from any wetland is recommended. In absence of a more thorough analysis of the wetland boundary by a professional on site, MVCA will defer to existing GIS mapping for the boundary of the wetlands.
2. MVCA provided comments on February 5, 2016, relating to MVCA's wetland policy updates and how it pertains to the subject lands. It was determined that the wetlands on the subject lands will not be included in any future revisions or subject to any future policies with the update.
3. Wetlands inherently consist of organic soils. Due to the poor drainage and unstable characteristics of these soils, they are not suitable for development. Therefore, development should be directed outside of these areas or the applicant will need to demonstrate how the hazard will be addressed. MVCA's available mapping shows the potential extent of the hazard.
4. The geotechnical investigation that is to be conducted should include a focus on determining the presence and location of organic soils.

Watercourses and Fish Habitat

1. Feedmill Creek flows along the western edge of the property and encompasses the subject lands in its entirety as floodplain. As a result, the property is not currently developable. This hazard will need to be addressed prior to moving forward with this application.
2. Feedmill Creek is classified as a cold water fish community that provides permanent fish habitat. The CRWSS designates the benthic community of the Feedmill Creek to be Good Water Quality.
3. In accordance with the City's planning documents, as well as guidelines prepared in support of the PPS, CRWSS and Kanata West Corridor Rationale, a minimum 30 m development setback is recommended from any watercourse. In addition, we recommend a minimum 15 m vegetated buffer be maintained.

4. If the tributaries on the site are proposed to be realigned, a permit from MVCA will be required. In addition, we require that a natural channel design and enhanced channel conditions be incorporated.
5. The applicant will need to contact the Department of Fisheries and Oceans (DFO) if any fish habitat is to be disturbed or removed due to development.

Storm Water Management:

MVCA engineering staff have provided the following with regards to stormwater quantity and quality management and with reference to the CRWSS.

1. Per the CRWSS, Feedmill Creek supports a Type 1 and 2 fish community and the study includes infiltration and temperature targets. MVCA recommends measures to maintain infiltration and reduce water temperatures be considered and implemented where possible at the site.
2. Per the CRWSS, quality treatment corresponding to an enhanced level of protection is recommended.
3. If the site is proposed to outlet directly to Feedmill Creek, MVCA can provide additional stormwater management recommendations and as well as permit requirements.

Conclusion / Recommendations:

Considering the aforementioned information, please consider the following additional recommendations:

1. Under Ontario Regulation 153/06, written permission from MVCA is required prior to any development within MVCA's regulation limit.
2. MNRF needs to be consulted regarding possible Species at Risk (SAR) and associated habitat on this site.
3. Our opinion is that the vegetated area surrounding Feedmill Creek serves as an important natural buffer. The protecting forest cover helps meet City objectives for tree cover; the forested area is a natural buffer to the watercourse and an important linkage for wildlife; and, the forested area serves an important function for maintaining water quality of Feedmill Creek and the Carp River.
4. We advise that a constraints map be provided outlining all natural heritage features and natural hazards on the subject lands.
5. The MVCA will also review the EIS that the applicant submits to the City. MVCA strongly recommends that the applicant address the EIS/natural heritage feature concerns prior to conducting Geotechnical studies or any other work due to the challenges they will present.
6. DFO may need to be contacted if fish habitat is to be disturbed. It should also be determined in the EIS whether the watercourses and wetland contains/constitutes as fish habitat.

Please note that areas subject to MVCA's Regulation Policies include the following lands identified adjacent to natural heritage features and hazards. The extent of this Regulation Limit is measured from the boundary of the following:

- 15 meters flood plain
- 15 meters meander belt

MVCA's Regulation Limit will extend beyond the greatest hazard, whether it is the meander belt or the spill/flood plain. Under Ontario Regulation 153/06, written permission from MVCA is required prior to any development within the adjacent lands, interference with wetlands and any alterations to shorelines and watercourses. Additional restrictions and limitations will apply to development within the Regulation Limit of natural heritage features and natural hazards.

Thank you for providing the opportunity to the Conservation Authority to provide comments during the pre-consultation period. We trust these comments will meet your requirements at this stage in the review process. Please advise us of any developments with this file. Any questions may be directed to the undersigned.

Yours truly,

Victoria Hard.

Victoria Hard, EPt
Assistant Planner

Steve Pichette

From: Ogilvie, Chris [Chris.Ogilvie@ottawa.ca]
Sent: June-13-16 10:52 AM
To: spichette@dsel.ca
Subject: Pond 7

Hey Steve,

At this time for preliminary sizing a maximum release rate of 8 l/s/ha should be used into Feedmill Creek for pond 7

Thanks
Chris

File: **D07-16-16-0015**

November 23, 2016

City of Ottawa
Planning & Growth Management
110 Laurier Avenue West, 4th Floor
Ottawa, ON K1P 1J1

Attention: Louise Sweet-Lindsay

Dear Ms. Sweet-Lindsay:

SUBJECT: Plan of Subdivision File: **D07-16-16-0015**
195 Huntmar Drive, City of Ottawa

The Mississippi Valley Conservation Authority (MVCA) has reviewed the Serviceability Report, Geotechnical Investigation, Environmental Impact Statement and the Geomorphic Technical studies for the proposed subdivision. Our review has been undertaken within the context of the Natural Hazards, Natural Heritage and Water Quality and Quantity policies of the Provincial Policy Statement under Section 3 of the *Planning Act*. The proposed subdivision is located on the east side of Terry Fox Drive and north of Richardson Side Road. The subject site is located at 195 Huntmar Drive. The site is approximately 54 hectares in size and is located within the Kanata West Community. The subdivision proposal is to develop the site with residential uses, a commercial block, three blocks for automobile dealerships, and a district park block. The site will be serviced with municipal infrastructure. The reports have been reviewed by technical staff, including our Water Resources Engineer and Biologist.

Natural Heritage and Natural Hazards

Watercourse Corridor

Feedmill Creek flows through the subject property along the western boundary of the site. The Carp River Watershed Subwatershed Study (CRWSS) requires a 30 metre setback for all disturbances from high water. Traditionally a 70 metre corridor has been implemented along Feedmill Creek for similar development.

Flood Plain Limits

MVCA has developed new regulations mapping for Feedmill Creek, which delineates the 1:100 year floodplain boundary for the watercourse as well as related erosion hazard limits. MVCA is currently completing a floodplain mapping study for Feedmill Creek. The mapping study completed to date indicates a floodplain spill area extending onto the site to the east of Feedmill Creek. Through development of the property, the spill must be addressed. Options discussed during pre-

consultation included raising the developed area to be adequately above the spill elevation. It is our understanding that the area adjacent to Feedmill Creek could be raised up to 2 metres.

Meander Belt Allowances and Slope Stability

MVCA staff has reviewed the technical reports related to the meander belt and slope stability and concerns are addressed below.

Aquatic Buffers

The CRWSS recognizes Feedmill Creek as a cold water system that supports high quality fish habitat. Based on this habitat type the CRWSS recommends the implementation of a minimum 30 metre development setback from water for each side of the watercourse, and revegetating 75% of the total stream length with native, riparian vegetation (where it does not already exist). Demonstration of meeting this target should be provided on a planting and/or landscaping plan.

MVCA staff has reviewed a report entitled *Environmental Impact Statement and Tree Conservation Report* (EIS), prepared by Muncaster Environmental Planning Inc. dated August 2016.

We recommend as a minimum requirement that any proposed pathway be directed outside of the 30 metre aquatic buffer setback measured from the normal high water mark. This will help to ensure the aquatic buffer remains in an undisturbed state.

EIS Review

MVCA's Biologist, Kelly Stiles has reviewed the EIS and provided comments in the attached Technical Review Memorandum, dated November 18, 2016.

We also note that no headwater assessment has been completed.

The attached Technical Review Memorandum also provides a list of best management practices recommended to be considered during the design and site construction stages of the development process.

MVCA Regulations

MVCA's regulatory jurisdiction extends into the proposed area for development. Any fill or grading within the MVCA jurisdiction, requires written authorization from MVCA pursuant to Ontario Regulation 153/06, MVCA's "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses" regulation. The spill area to the east of Feedmill Creek has been discussed.

Water Quality and Quantity

Mississippi Valley Conservation Authority (MVCA) engineering staff have been circulated the following:

- *Functional Servicing Report for 2325483 Ontario Inc., 195 Huntmar Drive* (DSEL, July 2016)
- *Summary of Design Refinements to Projects Identified in Kanata West Master Servicing Study, for 2325483 Ontario Inc., 195 Huntmar Drive* (DSEL, July 2016)

- *Geotechnical Investigation, Proposed Development, Palladium Drive at Huntmar Drive* (Paterson Group, July 24, 2016)
- *Kanata West Development Area, Meander Belt Width Assessment and Erosion Analysis, Feedmill Creek* (Geomorphix, July 20, 2016)
- *Slope Stability Assessment – Feedmill Creek, Proposed Development – Kanata West, Palladium Drive at Huntmar Drive* (Paterson Group, July 21, 2016)

MVCA staff has reviewed the Servicing Report with a focus on stormwater quantity and quality management. As outlined in the Servicing Report, it is proposed that a portion of the development will be serviced by the proposed Kanata West Pond 7 which outlets to Feedmill Creek. The remainder of the development will be serviced by the Kanata West Pond 4 which outlets to the Carp River. Pond 7 is to be designed to provide an enhanced level of water quality treatment and Pond 4 has been designed to provide a normal level of water quality treatment. MVCA notes that a stormwater criteria study for Feedmill Creek is currently being completed by the City of Ottawa. As outlined in the comments below, it is recommended clarification be provided to ensure that all stormwater criteria can be addressed.

MVCA recommends that the following comments be addressed prior to moving forward:

1. Environmental design criteria:
   a) It is MVCA's understanding that the Feedmill Creek Criteria Study has not been finalized. The required stormwater quantity control should be confirmed with the City to ensure the requirements will be met. Additional details regarding Pond 7 should be provided prior to moving forward. It should be confirmed that the proposed increase in the size of Pond 7 is acceptable and that land agreements will be obtained.
   b) It is noted that a Headwater Assessment study is being completed to address the proposed closure of the Northeast and the East swales. Any requirements for mitigation and/or compensation should be addressed prior to approval.

2. The existing conditions:
   a) The Existing Drainage figure should include the Northwest and the East Swales.
   b) The Existing Drainage figure should provide the pre-development drainage boundaries to clarify if there are any offsite flows currently draining to the site. Prior to the development of the neighboring sites, any drainage currently directed to the site should be addressed for up to and including the 1:100 year storm event.

3. Grading and Drainage Plan:
   a) A preliminary Grading Plan should be prepared. The preliminary Grading Plan should include all environmental constraints; the stable slope setback, the meander belt width, the 30m setback, and the tree retention area. It should be clear that development, including grading, will not extend into the setbacks. Consideration should be given to pathway requirements to ensure there is adequate area for pathway construction where required. Additionally, it should be clear that with filling, the floodplain spill elevation will be addressed.

4. Infiltration:

a) For sites located within the Carp River Watershed, MVCA recommends the targets from the Carp River Watershed/Subwatershed Study be followed. Measures to maximize infiltration and minimize water temperature increases be considered to address the targets of the Carp River Watershed/Subwatershed Study. It is noted that amended topsoil and micro-grading will be considered in the park block and the stormwater block and that a detailed site-specific water budget will be completed with the detailed design for the whole site. The targets identified in the Master Servicing Study related to infiltration should be identified and addressed. The Geotechnical Investigation notes some borehole locations with silty sand. Where feasible, additional infiltration measures should be considered in these areas.

5. Meanderbelt Width Assessment:

a) The conclusions should be clarified. The report indicates a meander belt width of 27m should be applied however the conclusions indicate only 16m. Additionally, the report should be finalized and submitted with a constraints map.

To summarize, the technical review identifies requirements to be addressed at the detailed design stage, including baseflow augmentation, infiltration, thermal treatment and mitigation, and consideration for erosion criteria for Feedmill Creek.

Summary and Recommendations

We do not have any objections in principle to the current proposal. We note the following issues that should be addressed prior to any final approval and all issues identified in our letter should be addressed:

- A constraints map be produced that illustrates all hazards associated with the meander belt and the slope are addressed through the recommended setback from Feedmill Creek.
- The extension of fill and confirmation that grades will be raised to an elevation above the floodplain of Feedmill Creek.
- Headwater Assessment will be completed in 2017 and all technical reports should incorporate the recommendations from the headwaters assessment.
- Landscape Plan is required for the revegation of the stream corridor.

Conclusion

Thank you for providing the opportunity to the Conservation Authority to review this proposal. We trust these comments will meet your requirements at this stage in the review process. We recommend that the technical issues outlined be addressed prior to any approval. Any questions may be directed to the undersigned.

Yours truly,

Matt Craig
Manager of Planning and Regulations

Enclosure: Environmental Assessment Memorandum

Mississippi Valley Conservation Authority

Technical Review Memorandum

November 18, 2016

File Number: D07-16-16-0015

To: Matt Craig, Manager of Planning and Regulatory Services MVCA

Prepared by: Kelly Stiles, MVCA Biologist

Re: Kanata West Lands, 195 Huntmar, Ottawa

Mississippi Valley Conservation Authority (MVCA) has been circulated the following "Environmental Impact Statement and Tree Conservation Report" prepared by Muncaster Environmental Planning Inc., August 2016, in support of the development.

Muncaster Report Summary

A mixed use commercial and residential development is proposed for the 54.6 hectare site, which is currently a mix of cultivated fields, and mixed forest lands. The site historically was a mix of cultivation and pasture lands.

Feedmill Creek will be protected with a 30m no-touch setback. This will also provide a band of tree retention while the rest of the site is cleared to achieve the fill requirements for the development's needs. Patterson (2015) concluded that grade raise restrictions were limited to the east corner and the northwest portion of the site. Grade raises **up to two metres** were considered permissible.

A headwaters assessment will be performed in 2017 to evaluate the two drainage features and develop compensation for their proposed removal.

A district park is proposed for the northwest corner of the land. The park will incorporate the 30m creek setback and tree retention areas.

The storm water facility (Pond 7) will be north of the site adjacent to Highway 417. Drainage will flow north under the highway into Feedmill Creek following the current path of the Northwest Swale.

Watercourses and Wetlands

Feedmill Creek runs north along the western edge of the site and two headwater drainage features cross the site draining to the north and east respectively. Feedmill Creek is considered to support a cold water fish community with good water quality suggested by benthic invertebrate community. "Robinson (2004) recommended a 30 m setback on each side of the watercourse, with an enhanced protection level for total suspended sediments. Revegetating up to 75 percent of the total stream length with native woody, riparian vegetation representing 50 percent of the replanted area is recommended in the CRWSS (Carp River Watershed/Subwatershed Study) for the Feedmill Creek Corridor."

Thermal monitoring of Feedmill Creek downstream of the site indicates that the creek is at the upper limits of the cool range with a maximum temperature of 22 °C.

Summer sampling is required to complete a Headwaters Assessment on the two drainage features in the north and east of the site. Once completed, compensation measures will be developed for the proposed removal of these tributaries.

Currently, approximately 17 hectares of the site drains to Feedmill Creek. In the proposed post-development scenario, approximately 40 hectares will drain to Feedmill Creek. This is not anticipated to have a detectable impact on the flows in the Carp River for the 1km long reach between where they would have naturally entered the system and where Feedmill Creek enters the Carp River. Furthermore

given the observations of the east swale, except during major events, the flows from the site that drain towards the Carp River likely do not reach the River.

There are no PSWs on site. The northwest portion of the site and lower lying areas to the north of the site are mapped as part of the Stittsville Wetland Complex, which was not considered Provincially significant as part of the evaluations conducted by the MNR in the early 2000's. Ecosystem quality is impaired due to filling, ditching, and neighbouring residential developments.

Area of Natural and Scientific Interest (ANSI)
There are no ANSIs on site.

Terrestrial Habitat and Species at Risk (SAR)
The only SAR observed on or adjacent to the site was Butternut. A health assessment and review by the OMNRF is still pending.

One painted turtle was observed along Feedmill Creek just upstream of the Highway 417 culvert.

Much of the site and the MTO land (proposed placement of storm pond 7) are part of the North Maple Grove Urban Natural Area, which is rated moderate overall. Portions of the Sittsville North Natural Area are also represented on the site and receive a score of moderate to high significance for rare vegetation, landform diversity, and hydrological features. The high score was given to "rare vegetation community/landform representation" referring to upland coniferous forest and upland rock/sand barns. Muncaster did identify upland coniferous forest onsite however does not know why they were considered rare by Keddy (1997) as they are a common feature in the Goulbourn area.

Upland white cedar coniferous forest is the dominant community of the onsite forest, occupying most of the western half of the site. There are areas of historical and recent clearing in the northwest of the site. Approximately 17.6 hectares of the site is forest, with 6.9 hectares on interior habitat. Although the forest is generally young, five species of birds that generally require a minimum forest area for successful breeding were observed. Two of these bird species are considered to be species of special concern by the MNRF, and so the site may represent significant wildlife habitat. However the size and age of the woodland do not meet minimum threshold criteria described by the MNRF (2015).

The City of Ottawa's mature stand criteria for a rural forest is not met due to the age and size of the trees in the forest and thus the forest is not considered a significant woodland. Despite the site's location within the urban area, Muncaster chose the rural classification system due to the presence of adjacent rural areas.

Summary and Recommendations from the Muncaster Report
"Although this EIS concludes that the construction and operation of the proposed mixed-use development will have a significant impact on many of the remaining natural heritage features and functions of the site, including further development in the North of Maple Grove Urban Natural Area and Sittsville North Natural Area and associated loss of forests and forest interior habitat, the Feedmill Creek corridor will be retained and protected." (Page 45)

The EIS lists 9 mitigation measures which should be incorporated into approval #1 "Retain the Feedmill Creek corridor, with a 30m setback... and revegetate with native species of local origin where trees have already been removed in the corridor."

MVCA Review and Recommendations

MVCA supports the recommended 30m no-touch buffer to Feedmill Creek and the proposed native species planting plans, mentioned in the tree conservation report, to fill in the currently open areas in this

buffer.

Additionally MVCA recommends the following:

Best Management Practices

- Natural areas to be retained are to be isolated by sturdy construction fencing or similar barrier at least 1 m in height during construction in order to ensure their retention.
- Construction equipment will remain within the areas of active construction and will not cross the sediment control measures.
- Following construction, bare soils will be re-seeded to reduce surface erosion.
- Erosion and sediment control measures will be in place for the duration of construction and until the site is re-vegetated. Erosion and sediment control measures should be maintained in good condition for the duration of construction. These measures should be removed at the completion of construction once the site has stabilized. Follow MTO OPSD standards for appropriate control methods and designs.
- Disturbed areas should be replanted with locally grown native species.
- No woody vegetation should be removed between April 15 and August 15 unless a breeding bird survey is conducted.
- Should any species at risk be discovered and/or should any species at risk or their habitat be potentially impacted by on site activities, the MNRF should be contacted immediately and activities should be modified to avoid impacts until further direction is provided by MNRF.

Development Design

- MVCA recommends the incorporation of LID features into the site's drainage design. It is particularly important for this site to reduce the impacts to Feedmill Creek from the proposed increases in the watershed's size post-development. As well it should be taken into consideration that Muncaster describes the current flows outside of the Feedmill Creek watershed as not likely to actually reach the Carp River, implying that the flows must either naturally soak into the surrounding environment or evaporate. This function of the east swale should be preserved post development.

Additional Information Requirements

- An assessment of the Headwater Drainage Features needs to be performed and submitted for review.
- Butternut Health Assessment pending from field work in summer of 2016.
- The application of the rural instead of the urban criteria for assessing significant woodlands should be reviewed by City staff.
- The impact of adjusting the onsite watershed boundaries on the Carp River's flows has been discussed in the EIS, however the impacts of increasing the Feedmill Creek watershed by 23 hectares has not been discussed.

Kelly Stiles
MVCA Biologist

Ministry of Transportation

Corridor Management Section
1355 John Counter Boulevard
Postal Bag 4000
Kingston, Ontario K7L 5A3
Tel.: 613 545-4834
Fax: 613-540-5106
Stephen.Kapusta@ontario.ca

Ministère des Transports

Section de gestion des couloirs routiers
1355, boulevard John Counter
CP/Service de sacs 4000
Kingston (Ontario) K7L 5A3
Tél.: 613 544-2220
Téléc. 613 540-5106

Ontario

Louise Sweet - Development Review Planner
City of Ottawa – Planning and Growth Management
110 Laurier West, 4th Floor
Ottawa, ON K1P 1J1

May 5th, 2017

Attention: Louise Sweet

RE: 195 Huntmar Drive – Files: D01-01-16-0015, D02-02-16-0055, D07-16-16-0011
Stormwater pond and location of pond's outlet easement to Feedmill Creek
Highway 417 Ottawa Area

The Ministry has completed the review of the proposed location of the stormwater pond and the proposed easement for a culvert connection from the pond to Feedmill Creek for the benefit of the proposed plan of subdivision at 195 Huntmar Drive

Based on the available information detailed on the Storm Concept Plan Dated April 13th, 2017, the Ministry can accept Option 2, pending further review of the overall stormwater management plan for the development. The approximate location of this easement will need to take into account the location of our existing service road to the high mast lighting within the ramp, as well as the existing culvert to Feedmill Creek. The Ministry respectfully asks that this new connection be constructed as deep as possible to prevent or reduce the impact on this connection as a result of any future construction work.

The developer is reminded that there are a number of items that still need to be addressed in order for this development to proceed to the building and land use permit stage.

1) A full stormwater study for the development.
2) A Traffic Impact Study and Ministry Class Environmental Assessment, or an addendum to the existing EA that is in keeping with the requirements of a Ministry Class EA for the proposed changes to Palladium Drive and the balance of the road network affected by the changes to Palladium Drive.

If you have any questions, please do not hesitate to contact me at (613)545-4834.

Sincerely,

Stephen Kapusta MCIP, RPP
Corridor Management Planner

cc Ottawa Area Office
Corridor Management
Peter Hume – HP Urban Inc.

Laura Maxwell

From: Steve Pichette
Sent: Monday, April 17, 2017 11:03 AM
To: Stephen.Kapusta@ontario.ca
Cc: Peter Hume; Laura Maxwell
Subject: FW: Development Application for 195 Huntmar Drive [Palladium Drive & Huntmar Drive @ Highway 417, Ottawa, ON]
Attachments: 2017-04-13_624_Storm_concept-STM-PRF.PDF

Hi Stephen,

Further to the proposed stormwater management pond outlet described in the email below and your conversation with Laura Maxwell from my DSEL office (10 April 2017), we are seeking MTO approval for a new stormwater servicing concept, whereby:

- the pond outlet pipe (and associated easement) would run along the boundary of your lands (*strategically locating the easement and its associated land use impacts to the boundary of your site*) ; and,
- a new culvert would be installed under the Highway 417 eastbound off-ramp at Palladium Drive via jack and bore (*eliminating traffic interuptions*); and,
- the new culvert would outlet to the existing ditch and existing culvert under 417 (*thereby maintaining the outlet to Feedmill Creek that was proposed for the stormwater management pond in the Kanata West Master Servicing Study (Stantec, CCL, IBI, June 2006)*).

See attached for sketch showing the new (Option 2 - Magenta) and old (Option 1 - Green) schemes.

We are seeking MTO agreement with the concept in the short term, so that we may continue to work on planning and engineering design approval processes. Please advise.

Thank you,

Stephen Pichette, P.Eng.
Ottawa Manager

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-2205
cell: (613) 314-6513
email: spichette@DSEL.ca

From: Steve Pichette
Sent: Friday, March 24, 2017 1:47 PM
To: Stephen.Kapusta@ontario.ca
Cc: Laura Maxwell <LMaxwell@dsel.ca>; Peter Hume <peter.hume@hpurban.ca>
Subject: FW: Development Application for 195 Huntmar Drive [Palladium Drive & Huntmar Drive @ Highway 417, Ottawa, ON]

Hi Stephen,

Thank you for meeting with our team about the proposed development at 195 Huntmar Drive.

1. **Feedmill Creek Study**

   As requested:
   1. Here is a link to the MVCA's recent study of Feedmill Creek: http://mvc.on.ca/feedmill-creek-floodplain-mapping/
   2. DSEL have uploaded a copy of the full report and mapping to: 2017-03-24_MVCA_Feedmill_to_MTO.zip *[Your file will expire after 7 days or 100 downloads.]*

   The study identifies the MTO lands (PIN 044870338) and 195 Huntmar Drive (PIN 044870339) as being currently under the 100-year waterlevel of Feedmill Creek.

   The MVCA study anticipates the 195 Huntmar Drive parcel and the MTO lands to be filled or to include a berm above the regulatory 100-year floodplain (outside of a 30 m no-development setback zone from Feedmill Creek), to allow for development and eliminate the flood risk.

2. **Summary of Stormwater Management Proposal**

   In the Kanata West Concept Plan and the associated Kanata West Master Servicing Study (KWMSS) (Stantec, CCL, IBI, June 2006), a pond is shown adjacent to Highway 417, within the lands owned by MTO. The pond was meant to support urban development of the MTO lands (PIN 044870338), part of 195 Huntmar Drive (PIN 044870339), a small part of the Autopark (PIN 1569000000), and a small part of 2499 Palladium Drive (PIN 044871112). The pond was meant to accept drainage from ~ 34 Ha of impervious & pervious surfaces, with an average imperviousness of 70% . The pond was meant to outlet to Feedmill Creek via a connection under Highway 417.

The pond shown in the KWSS – referred to as 'Pond 7' – conflicts with the existing Palladium Drive interchange. Therefore, as part of the development application for 195 Huntmar Drive, Pond 7 is proposed to shift and expand to support urban development of the MTO lands and a larger part of 195 Huntmar Drive than contemplated in earlier studies. A conceptual drawing showing the stormwater management proposal is available for download at: 2017-03-21_624_concept_rev_proposed-STM-PRF.PDF *[Your file will expire after 7 days or 100 downloads.]*

The pond is currently proposed to restrict flows well below pre-development runoff conditions for rainstorms up to and including the 100-year design storm. As required by the City of Ottawa's ongoing *Feedmill Creek Stormwater Management Criteria Study* – a study assessing erosion thresholds – Pond 7 is currently to control outflows to 8 l/s/ha, which is a fraction of the pre-development runoff levels. The pond is currently proposed to service a 40.8 Ha area of impervious & pervious surfaces, which excludes the MTO lands. The pond is strategically located to enable the pond to be expanded to provide treatment for the MTO lands.

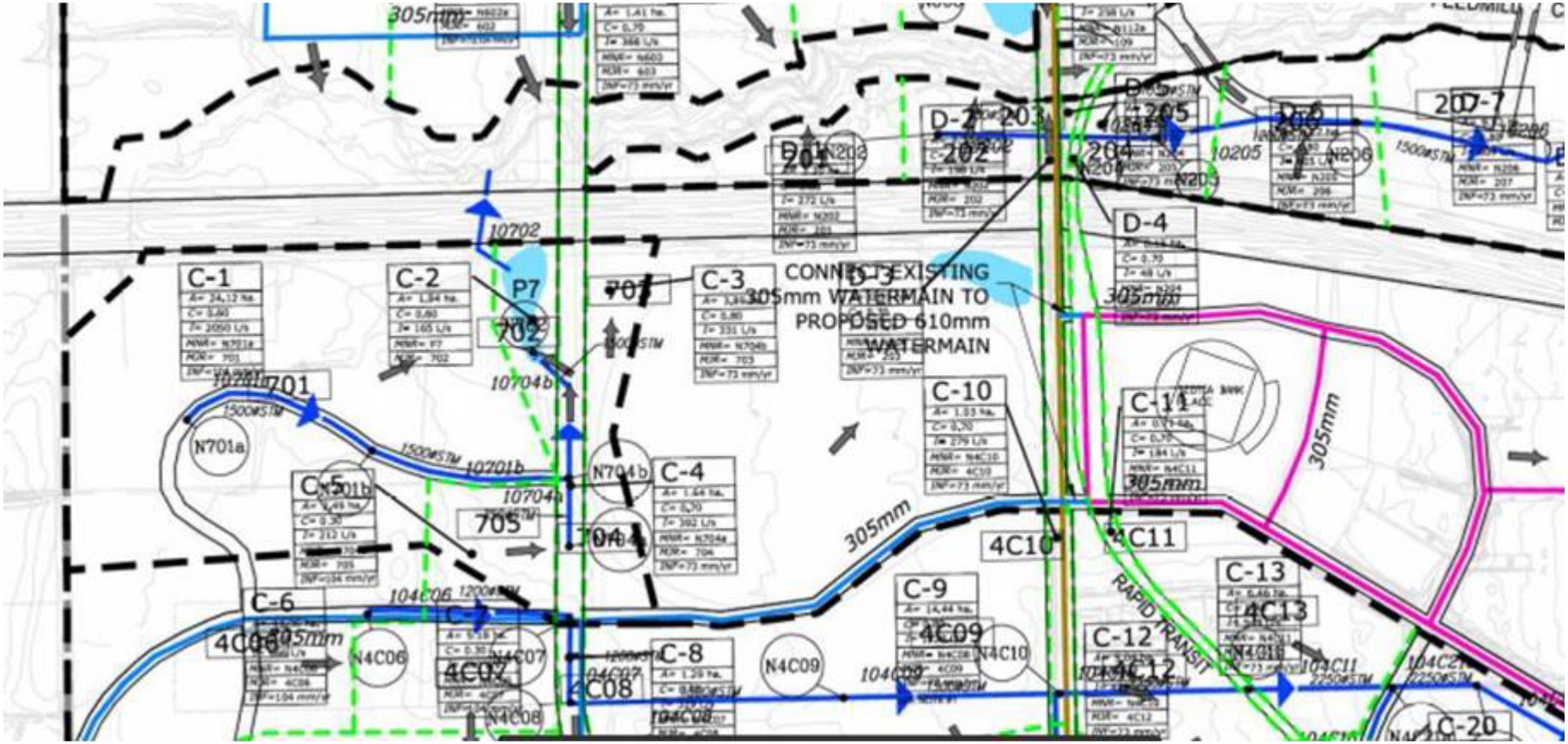
Pond 7 is proposed to outlet to Feedmill Creek via a connection under Highway 417, in conformance with the KWMSS. A pond outlet pipe is proposed between Pond 7 and Highway 417, across the MTO lands. The proposed pipe outlet depicted on the conceptual drawing is sized for the ultimately expanded pond (i.e. anticipating that MTO will provide quality and quantity treatment for development on their site, via expansion of Pond 7). The proposed pipe outlet will enable MTO to develop their property with no surface infrastructure (e.g. open channel) restricting the development area.

We are therefore requesting your permission to allow the installation of a 750mm diameter pond outlet pipe across your site. Please note that an easement of at least 6m would be required for the sewer, and that underground construction and placement of permanent structures are not anticipated to be permitted in the easement.

Please also note that:

- The stormwater pond sizing and size of the proposed outlet pipe are subject to change, based on the amount of impervious surfaces proposed for the drainage area and on the stormwater discharge criteria currently being developed through the City of Ottawa's ongoing *Feedmill Creek Stormwater Management Criteria Study*; and,
- Detailed design of the stormwater management pond may result in modifications to the pond footprint and location within the designated stormwater management land use area.

Figure 1: Excerpt of KWMSS, Showing Pond 7 (Stantec, CCL, IBI, June 2006)



Please do not hesitate to contact our office should we be able to assist in your review or answer any questions you might have at this time.

Thank you,

Stephen Pichette, P.Eng.
Ottawa Manager

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-2205
cell: (613) 314-6513
email: spichette@DSEL.ca

FEEDMILL CREEK

FEEDMILL CREEK

HIGHWAY 417

Highway 417

Eastbound On Ramp

HWF 6

OPTION 1

750mm STM OUTLET PIPE
(372m) c/w EASEMENT

16.5HA
70%
TO POND 7
C=0.70

750mm STM OUTLET PIPE
(675m) c/w EASEMENT

30 m OFFSET FROM CREEK

30 m OFFSET FROM QUARRY

NEW DITCH CONNECTION
(100m) TO EXISTING
DITCH/CULVERT

NEW CULVERT (75m)
TO BE INSTALLED
VIA JACK AND BORE

Eastbound On Ramp

Palladium Dr

Future North-South Arterial Road

Autopark

PALLADIUM DRIVE

OPTION 2

Stormwater management pond area

Automobile Dealership
16,078 m² (3.97 ac.)

Automobile Dealership
20,239 m² (5.00 ac.)

Automobile Dealership
20,243 m² (5.00 ac.)

40.8HA
70%
TO POND 7
C=0.70

Automobile Dealership
20,758 m² (5.12 ac.)

NOTE
Stormwater Management Pond location and design not final.

LEGEND

- DRAINAGE BOUNDARY
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- LIMIT OF PROPOSED SUBDIVISION

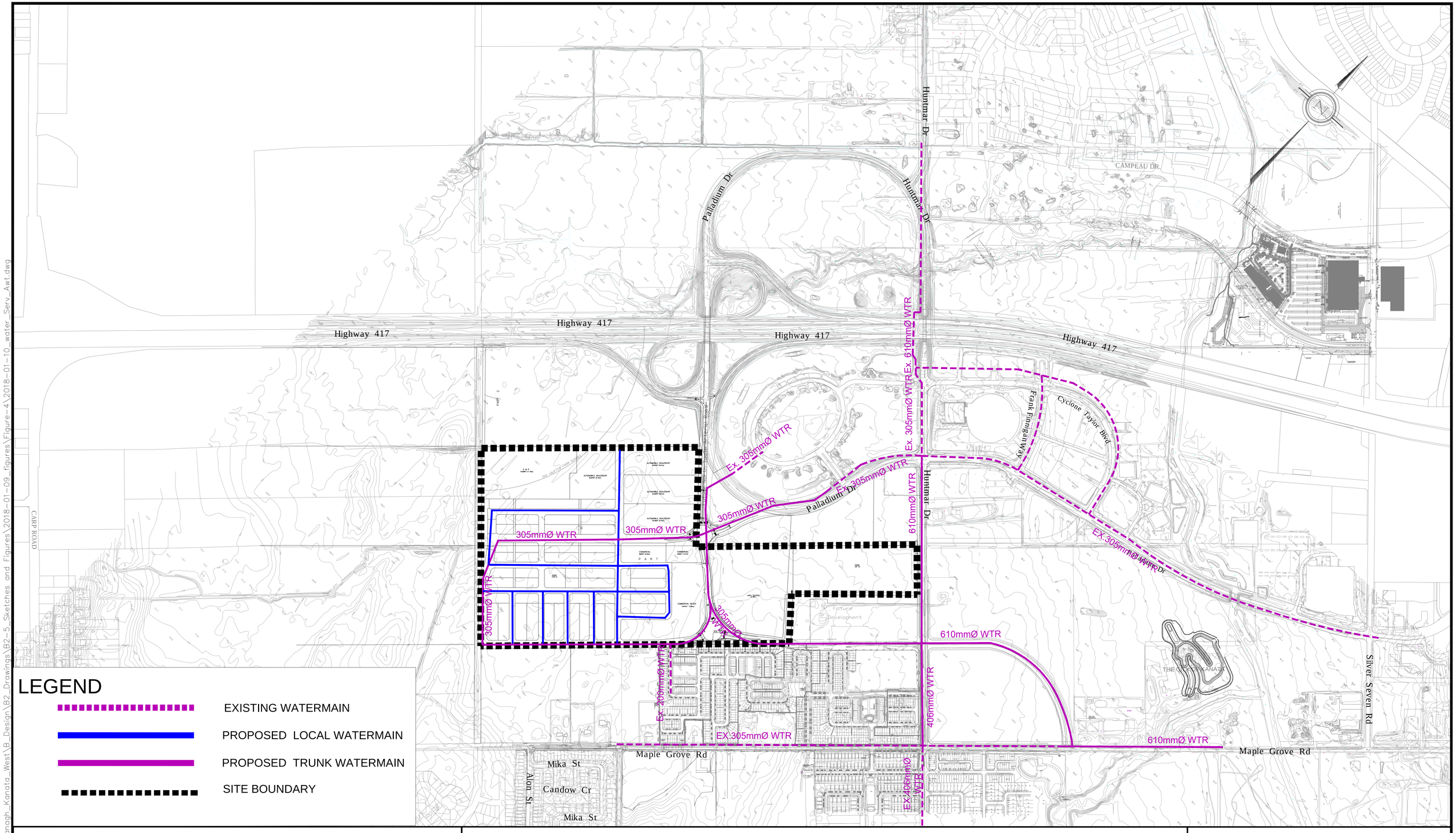
david schaeffer engineering ltd
SMART SUBDIVISIONS™

120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

195 HUNTMAR DRIVE
STORM SERVICING
CITY OF OTTAWA

DATE:
APRIL 13, 2017
SCALE:
1:2000
PROJECT No.:
12-624
FIGURE
STM

Z:\Projects\12-624_Cavanagh_Kanata_West\B_Design\B2_Drawings\B2-5_Sketches and Figures\2017-03-17_Storm_Concept\2017-04-11_624_Storm_concept.dwg



DSEL
david schaeffer engineering ltd
SMART SUBDIVISIONS™

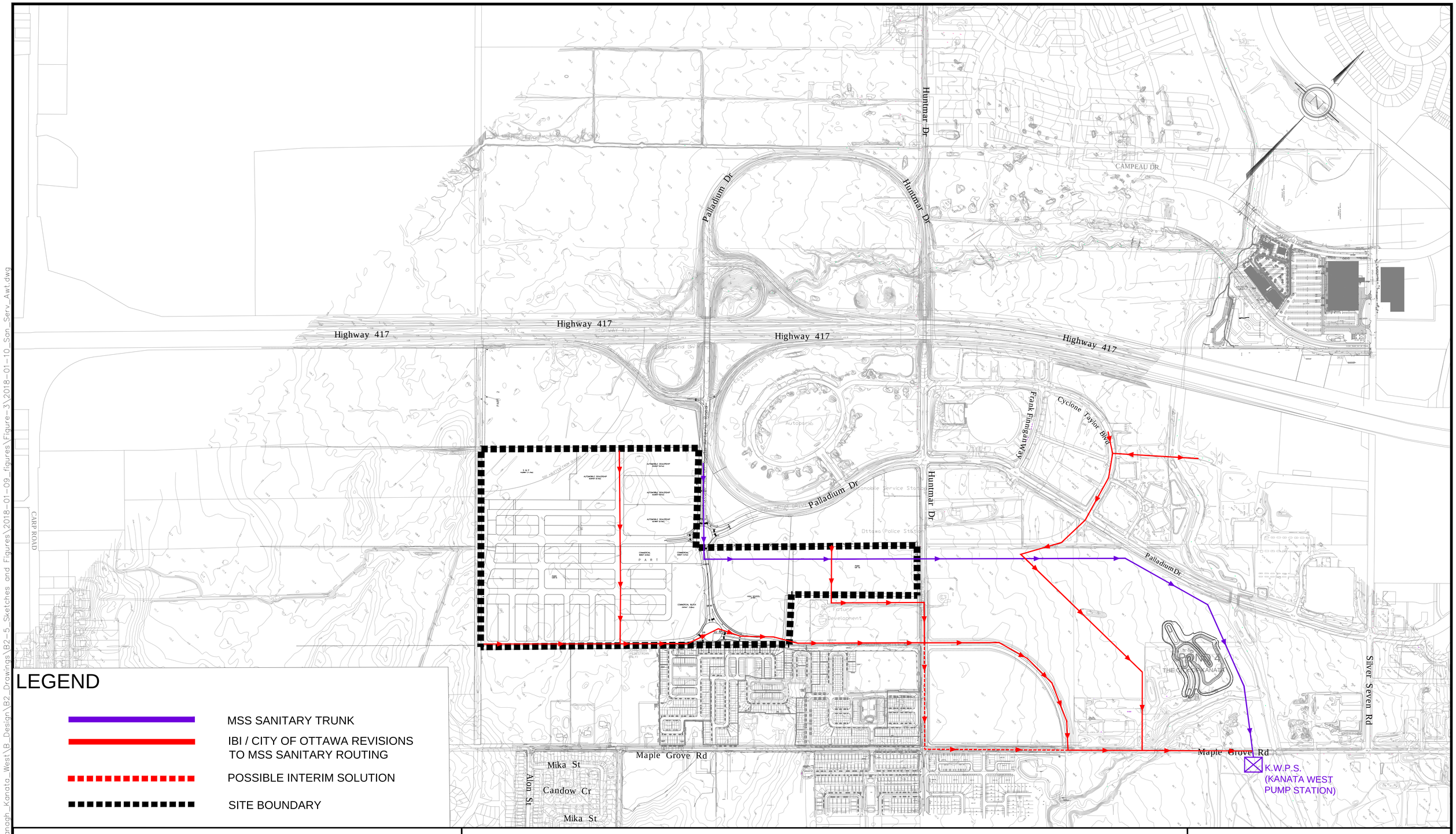
120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

195 HUNTMAR DRIVE
WATER SERVICING PLAN
CITY OF OTTAWA

PROJECT No.:	12-624
SCALE:	1:5000
DATE:	2018-01-10
FIGURE:	WTR 1

D07-16-16-0011

Z:\Projects\12-624_Cavanagh_Kanata_West\B_Design\B2_Drawings\B2-5_Sketches and Figures\2018-01-09_figures\Figures\Figure-4_2018-01-10_water_Serv_Awt.dwg



LEGEND

- MSS SANITARY TRUNK
- IBI / CITY OF OTTAWA REVISIONS TO MSS SANITARY ROUTING
- POSSIBLE INTERIM SOLUTION
- SITE BOUNDARY

david schaeffer engineering ltd
SMART SUBDIVISIONS™

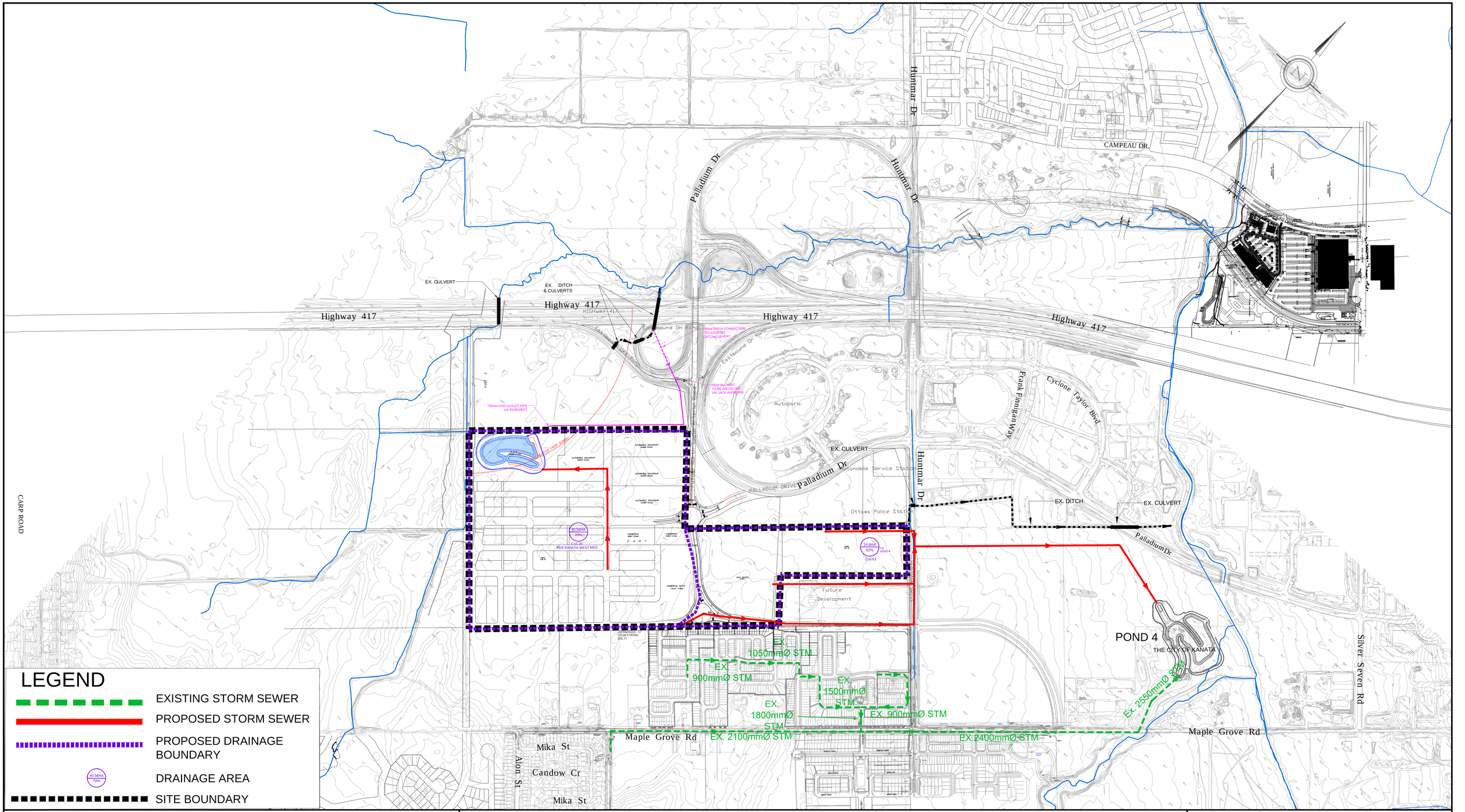
120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

195 HUNTMAR DRIVE, SANITARY SERVICING PLAN CITY OF OTTAWA

PROJECT No.:	12-624
SCALE:	1:5000
DATE:	2018-01-10
FIGURE:	SAN 1

Z:\Projects\12-624_Cavanagh_Kanata_West\B_Design\B2_Drawings\B2-5_Sketches and Figures\2018-01-09_figures\Figures\2018-01-10_San_Serv_Awt.dwg

D07-16-16-0011



DSEL
david schaeffer engineering ltd
SMART SUBDIVISIONS™

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
TEL: (613) 836-0856
FAX: (613) 836-7183
www.DSEL.ca

195 HUNTMAR DRIVE, STORM WATER MANAGEMENT PLAN CITY OF OTTAWA

PROJECT No.:	12-624
SCALE:	1:5000
DATE:	2018-01-10
FIGURE:	STM 1

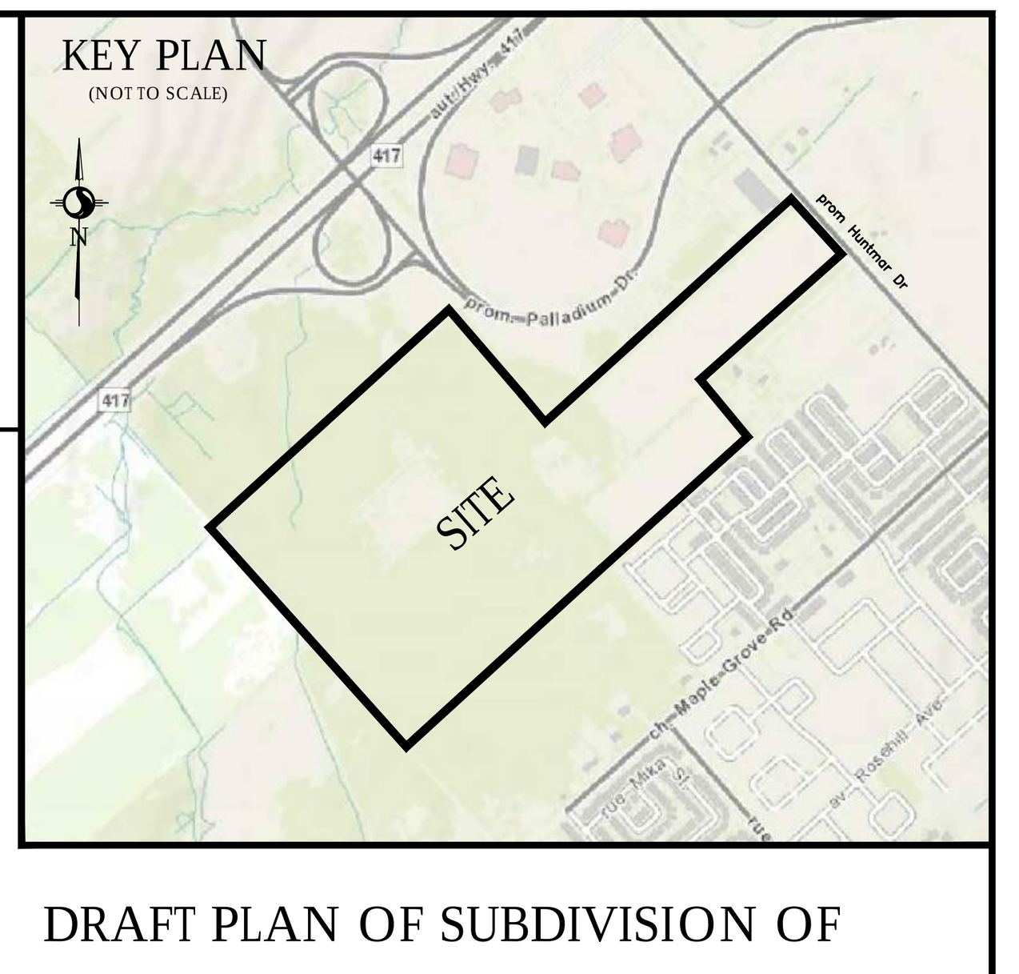
D07-16-16-0011

z:\projects\12-624_cavanagh_kanata_west\b_design\b2_drawings\b2-5_sketches and figures\2018-01-09_figures\figure-2\2018-01-10_624_storm_concept_awt.dwg

SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED ______________________20____ THIS DRAFT PLAN IS APPROVED BY THE CITY OF OTTAWA UNDER SECTION 51 OF THE PLANNING ACT. THIS____DAY OF_____________,2017.

DERRICK MOODIE
MANAGER, DEVELOPMENT REVIEW-WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

KEY PLAN
(NOT TO SCALE)



DRAFT PLAN OF SUBDIVISION OF

PART OF LOTS 1 AND 2
CONCESSION 1
(GEOGRAPHIC TOWNSHIP OF HUNTLEY)
CITY OF OTTAWA

Scale 1:1250

20 0 20 40 60 80 METRES

METRIC CONVERSION

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SCHEDULE OF LAND USE			
LOT/BLOCK	USE	UNITS	AREA (Ha/ac)
1 TO 131	RESIDENTIAL SINGLES	131	4.13 / 10.20
132 TO 228	RESIDENTIAL TOWNS	432	8.19 / 20.24
229	RESIDENTIAL STACKED TOWNS	128	1.72 /4.25
230 AND 231	PARK		6.29 / 15.54
232	SCHOOL		6.12 / 15.13
233 TO 237	COMMERCIAL		12.30 / 30.41
238	S W P		4.49 / 11.10
239	WALKWAY		0.02 / 0.04
240	OPEN SPACE		0.36 / 0.89
STREETS			11.30 / 27.92
TOTAL		691	54.92 / 135.72

INFORMATION: REQUIRED UNDER SECTION 51 (17) OF THE PLANNING ACT R.S.O. 1990

a. SEE PLAN
b. SEE PLAN
c. SEE PLAN
d. SEE PROPOSED LAND USE SCHEDULE (ABOVE)
e. SEE PLAN
f. SEE PLAN
g. SEE PLAN
h. CITY WATER AVAILABLE \ WELL
i. SEE SOIL REPORT
j. SEE TOPOGRAPHICAL INFORMATION
k. ALL CITY SERVICES AVAILABLE
l. NO EASEMENTS REGISTERED ON TITLE

OWNER'S CERTIFICATE

I HEREBY AUTHORIZE STANTEC GEOMATICS LTD. TO SUBMIT THIS DRAFT PLAN OF SUBDIVISION ON MY BEHALF

DATE

KEVIN McCRANN
2325482 ONTARIO INC.

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE SUBJECT LANDS AND THEIR RELATIONSHIP TO ADJOINING LANDS HAVE BEEN ACCURATELY AND CORRECTLY SHOWN.

DATE

BRIAN J. WEBSTER
ONTARIO LAND SURVEYOR

Stantec Geomatics Ltd.
CANADA LANDS SURVEYORS
ONTARIO LAND SURVEYORS
1331 CLYDE AVENUE, SUITE 400
OTTAWA, ONTARIO, K2C 3G4
TEL. (613)722-4420 FAX. (613)722-2799
stantec.com

DRAWN: CEC	CHECKED: FP	PM: FP	FIELD: N\A	PROJECT No.: 161613545-131

DEVELOPMENT SERVICING STUDY CHECKLIST

4.1 General Content		
☒	Executive Summary (for larger reports only).	N/A
☒	Date and revision number of the report.	Title Page & Header
☒	Location map and plan showing municipal address, boundary, and layout of proposed development.	Figure 1
☒	Plan showing the site and location of all existing services.	Fig 3, Dwg 2, Dwg 3
☒	Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Section 1, Section 3-5
☒	Summary of Pre-consultation Meetings with City and other approval agencies.	Appendix A
☒	Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	Section 1, Sections 3-5
☒	Statement of objectives and servicing criteria.	Section 1, Sections 3-5
☒	Identification of existing and proposed infrastructure available in the immediate area.	Sections 3-6
☒	Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	Sections 1, 2, 5
☒	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Section 5, Dwg 1
☒	Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	Addressed in KWMSS, reference to EIS (Muncaster Environmental Planning, May 2018) in Section 2
☒	Proposed phasing of the development, if applicable.	Landowner preference, referenced in Section 1 & 5
☒	Reference to geotechnical studies and recommendations concerning servicing.	Section 1, 2 & 5
☒	All preliminary and formal site plan submissions should have the following information: -Metric scale -North arrow (including construction North) -Key plan -Name and contact information of applicant and property owner -Property limits including bearings and dimensions -Existing and proposed structures and parking areas -Easements, road widening and rights-of-way -Adjacent street names	Bearings, dimensions, easements and ROWs provided in Draft Plan of Subdivision (Stantec, May 2018). All other provided in Drawings & Figs.

4.2 Development Servicing Report: Water		
☒	Confirm consistency with Master Servicing Study, if available	Sections 3
☒	Availability of public infrastructure to service proposed development	Sections 3
☒	Identification of system constraints	Sections 3
☒	Identify boundary conditions	Section 3 & App C
☒	Confirmation of adequate domestic supply and pressure	Section 3 & App C

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

☒	Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Section 3 & App C
☒	Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Section 3 & App C
☒	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design	Section 3 & App C
☒	Address reliability requirements such as appropriate location of shut-off valves	Reference to future hydraulic model using City boundary conditions and future detailed design of watermain network.
☐	Check on the necessity of a pressure zone boundary modification	N/A – to be serviced by Pressure Zone 3W per KWMSS
☒	Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range	To be serviced by Pressure Zone 3W per KWMSS. Section 3 & App C
☒	Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Section 3 & App C
☒	Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	Section 3 & App C
☒	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Section 3 & App C
☒	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	App C

4.3 Development Servicing Report: Wastewater

☒	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Section 4
☒	Confirm consistency with Master Servicing Study and/or justifications for deviations.	Section 4
☒	Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	No special constraints identified to date.
☒	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 4
☒	Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Section 4 & Appendix D
☒	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Section 4 & Appendix D
☒	Description of proposed sewer network including sewers, pumping stations, and forcemains.	Section 4 & Drawing 3

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

☒	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	Section 1 & 2
☒	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	Section 4 – treated by KWPS per KWMSS
☐	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A
☐	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	N/A
☐	Special considerations such as contamination, corrosive environment etc.	N/A

4.4 Development Servicing Report: Stormwater Checklist

☒	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 5
☒	Analysis of available capacity in existing public infrastructure.	Section 5
☒	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Fig 2 & Drawing 2
☒	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Section 5.2, Appendix A
☒	Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Section 5.2
☒	Description of the stormwater management concept with facility locations and descriptions with references and supporting information	Section 5 & Appendix E
☐	Set-back from private sewage disposal systems.	N/A
☒	Watercourse and hazard lands setbacks.	Section 1
☐	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	MOECC - To be addressed as development application proceeds. MVCA – Appendix A
☒	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	Section 5
☒	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Section 5 & Reference to JFSA May 2018 Pond 7 Sizing Memo
☒	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	Sections 1, 2 & 5
☒	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Section 5
☒	Any proposed diversion of drainage catchment areas from one outlet to another.	Section 5, Drawings 1,2, Figure 2
☒	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Section 5, Drawings 1,2

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

☐	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	N/A
☒	Identification of potential impacts to receiving watercourses	Section 5, Drawings 1,2, Fig 2, Reference to JFSA May 2018 Pond 7 Sizing Memo & Coldwater March 2018 SWM Criteria Study
☐	Identification of municipal drains and related approval requirements.	N/A
☒	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Section 5
☒	100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Section 5
☒	Inclusion of hydraulic analysis including hydraulic grade line elevations.	Reference in Section 5
☒	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 7
☒	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	Section 5
☒	Identification of fill constraints related to floodplain and geotechnical investigation.	Sections 1 & 5

4.5 Approval and Permit Requirements: Checklist

☒	Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement ct. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	Table 2
☒	Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	Table 2
☐	Changes to Municipal Drains.	N/A
☒	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	Table 2

4.6 Conclusion Checklist

☒	Clearly stated conclusions and recommendations	Section 8
☐	Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	N/A – First Submission
☒	All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario	Section 8

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

APPENDIX B

- Excerpts from Kanata West Master Servicing Study (Stantec, CCL, IBI, June 2006)
- Excerpts from Autopark Engineering Drawings (JL Richards, May 2003)
- IBI Concept for KWMSS Sanitary Sewer Realignments (IBI Group, December 2015)
- As-Built Sewershed Mapping (City of Ottawa, 2016)
- As-Built Watermain Mapping (City of Ottawa, 2016)
- Excerpt from Pond 4 Design Drawings (DSEL, December 2014)

Stantec Consulting Ltd.
1505 Laperriere Avenue
Ottawa ON Canada
K1Z 7T1
Tel. 613.722.4420
Fax. 613.722.2799
www.stantec.com

Legend

- KANATA–WEST CONCEPT PLAN BOUNDARY
- EXISTING WATERMAIN
- EXISTING 610mm WATERMAIN TO BE UPGRADED TO 914mm
- EXISTING 610mm WATERMAIN TO BE UPGRADED TO 762mm
- PROPOSED 610mm DIA. WATERMAIN
- PROPOSED 406mm DIA. WATERMAIN
- PROPOSED 305mm DIA. WATERMAIN
- PROPOSED 203mm DIA. WATERMAIN

Notes

INTERNAL WATERMAIN SIZE ARE EXPECTED TO VARY FROM 152mm TO 305mm.

CCL/IBI

	Revision	By	Appd.	Date
5	REVISED FOR DEC.21/05 SUBMISSION	GBU	SJP	DEC.21/05
4	REVISED AS PER CITY COMMENTS (Sept.16/05)	GBU	MAF	OCT.28/05
3	REVISED WATER DISTRIBUTION NETWORK	GBU	S.J.P.	AUG 09/05
2	REVISED POND 1 AREA	NI	MAF	JUNE 09/05
1	REVISED LOTTING FOR TARTAN AND MATTAMY	BCB	SJP	JAN.18/05

File Name: Dwn. Chkd. Dsgn. Date

Seals

Client/Project

Kanata West Concept Plan
Master Servicing Study

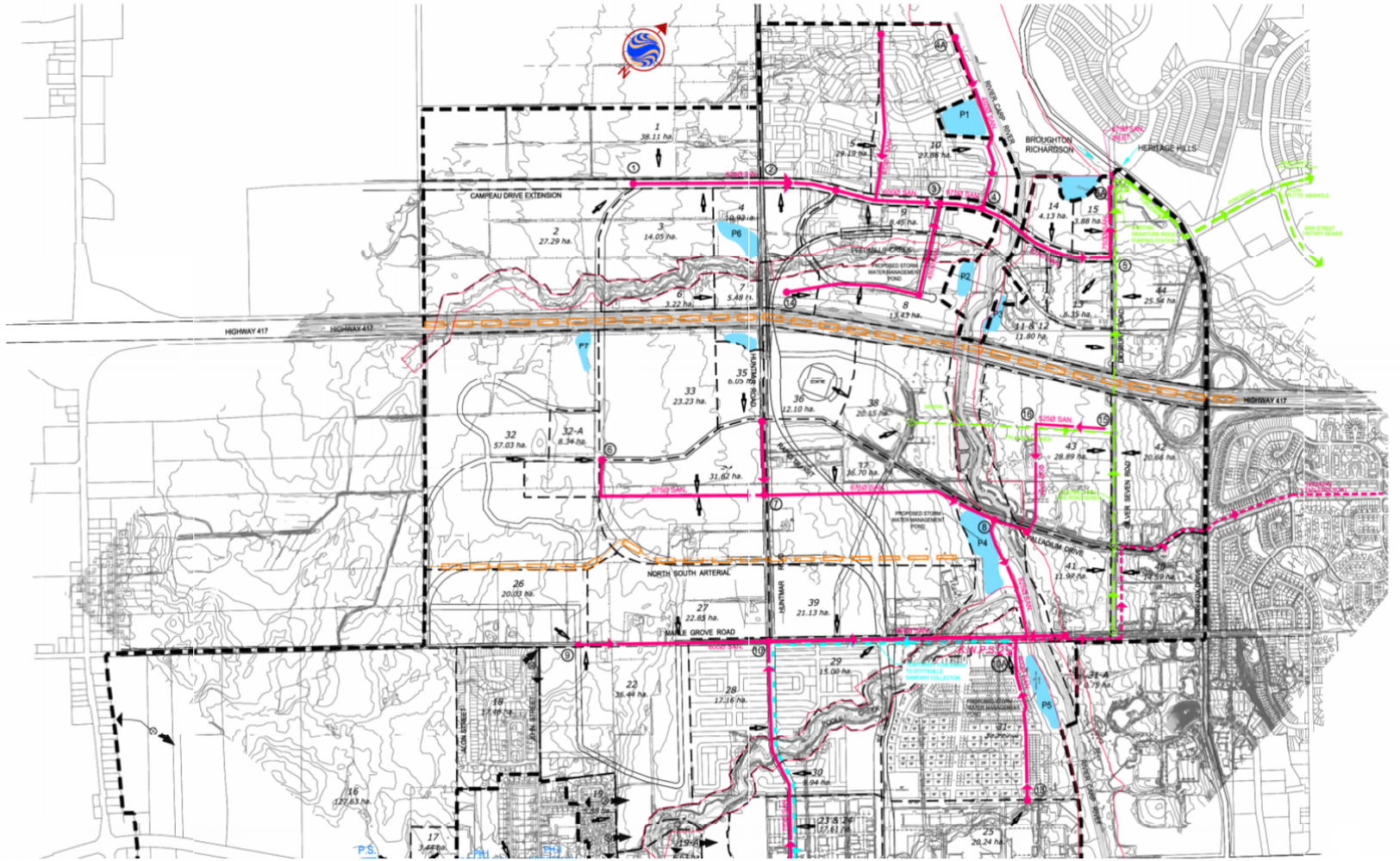
Ottawa, Ontario

Title

Watermain
Final Concept

Project No. 60400406 | Scale 1:7500 | 0 75 225 375m

Drawing No. WM-1 | Sheet 2 of 7 | Revision 5

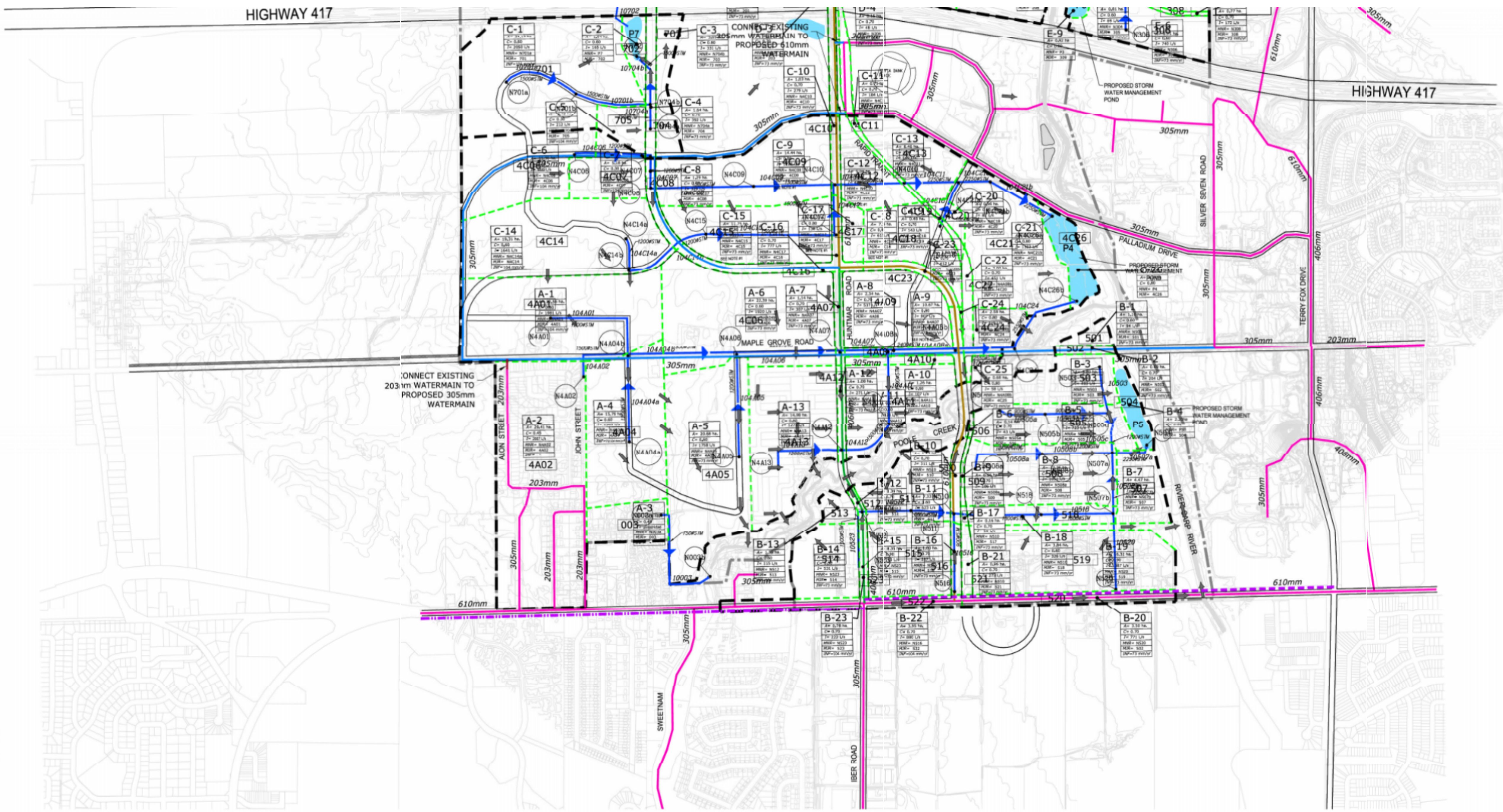


Stantec Consulting Ltd.
1505 Laperriere Avenue
Ottawa ON Canada
K1Z 7T1
Tel. 613.722.4420
Fax. 613.722.2799
www.stantec.com

CCL/IBI Consulting Constance Limited
1770 WOODWARD DR., OTTAWA (613)225-1311

Legend

- ULTIMATE MAJOR DRAINAGE LIMIT
- SUBCATCHMENT AREAS
- PROPOSED TRUNK SEWER
- PROPOSED FORCEMAIN
- TEMPORARY FORCEMAIN
- PROPOSED STITTSVILLE PUMPING STATION AND FORCEMAIN
- EXISTING TRUNK SEWER
- MAJOR DRAINAGE SPLIT
- ① NODES
- EXISTING PUMPING STATION AND FORCEMAIN (TO BE DECOMMISSIONED)
- 44 25.54 ha. INPUT POINT AND AREA IN HECTARES
- EXISTING PUMPING STATION GRAVITY OUTLET



CCL/IBI

2 REVISED FOR DEC.21/05 SUBMISSION	GBU	SJP	DEC.21/05
1 REVISED AS PER CITY COMMENTS (Sept.16/05)	GBU	MAF	OCT.28/05
Revision	By	Appd.	Date

File Name: 160400406	LM	MAF	MAF	AUG./05
	Dwn.	Chkd.	Dsgn.	Date

Seals

Client/Project

Kanata West Concept Plan
Master Servicing Study

Ottawa, Ontario

Title

MODEL SCHEMATIC
STORM SEWER MINOR SYSTEM

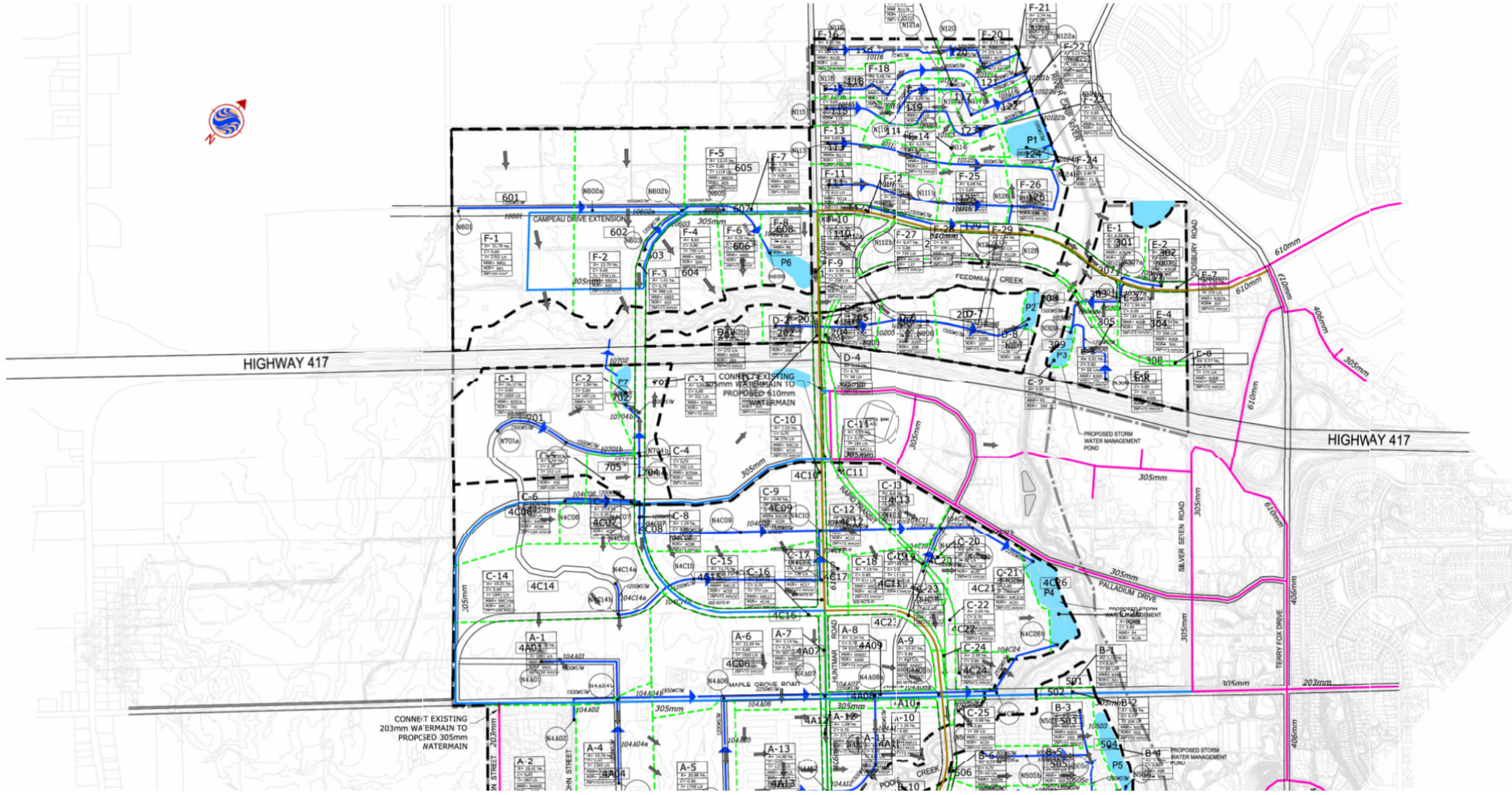
Project No. 60400400

Scale 1:7500 (0 75 225 375m)

Drawing No. ST-MN

Sheet 6 of 7

Revision 2



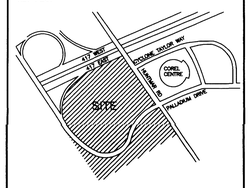
Stantec Consulting Ltd.
1505 Laperriere Avenue
Ottawa ON Canada
K1Z 7T1
Tel. 613.722.4420
Fax. 613.722.2799
www.stantec.com

Legend

- KANATA–WEST CONCEPT PLAN BOUNDARY
- POND DRAINAGE BOUNDARY
- STORM SEWER DRAINAGE LIMIT
- OVERLAND FLOW DIRECTION
- 207 OVERLAND FLOW SEGMENT NUMBER

CCL/IBI

KEY PLAN



LEGEND

- PROPOSED CATCH BASIN
- PROPOSED CATCH BASIN c/w ICD (IPEX TYPE "C" @ 42 L/S)
- PROPOSED CATCH BASIN c/w ICD (IPEX TYPE "D" @ 95 L/S)
- 10 — LOT NUMBER
- 101.5 — PROPOSED ELEVATION AROUND BUILDING
- x101.5 — PROPOSED ELEVATION
- x 101.5 — EXISTING ELEVATION
- PROPOSED DRAINAGE ARROW
- PROPERTY LINE
- DEPRESSED SIDEWALK

BENCH MARK
GEODETIC MONUMENT
70-U-239
ELEVATION 101.588m
IRON PIPE WITH BRASS CAP AT T-INTERSECTION OF HUNTMAR ROAD, WITH MAPLE GROVE ROAD. 28.3 m SOUTH WEST FROM MIDDLE OF ROAD INTERSECTION, 6.7m FROM CENTER LINE OF ROAD AND AT SAME LEVEL.

NO.	REVISION	DATE
8	REVISED BOUNDARY LOTS #1 AND #2	08/12/04
7	REVISED FOR FINAL SITE PLAN APPROVAL	13/04/04
6	REVISED PER CITY OF OTTAWA COMMENTS	15/03/04
5	REVISED LOTS AND ENTRANCES	19/12/03
4	WATERMAIN RELOCATED – ISSUED FOR DISTRIBUTION	08/08/03
3	FOR TENDER	17/06/03
2	PER CITY OF OTTAWA COMMENTS	30/05/03
1	FINAL LAYOUT REVISIONS	23/04/03
NO.	ISSUE	DATE

Ottawa

J.L. Richards & Associates Limited
Consulting Engineers, Architects & Planners
864 LADY ELLEN PLACE, OTTAWA, CANADA K1Z 5M2

PROJECT:

PALLADIUM AUTO PARK

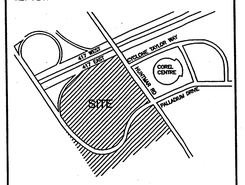
DRAWING:

SITE SERVICES

DESIGN: A.R.	REVISION NO.:
DRAWN: M.G.B.	DRAWING NO.: S1
CHECKED:	
DATE: JUNE 2003	
SCALE: 1:1000	JOB NO.: 15941-04

12308

KEY PLAN



LEGEND

- PROPOSED CATCH BASIN
- PROPOSED CATCH BASIN c/w ICD (IPEX TYPE "C" @ 42 L/S)
- PROPOSED CATCH BASIN c/w ICD (IPEX TYPE "D" @ 95 L/S)
- 10 LOT NUMBER
- 101.5 PROPOSED ELEVATION AROUND BUILDING
- x101.5 PROPOSED ELEVATION
- x 101.5 EXISTING ELEVATION
- PROPOSED DRAINAGE ARROW
- 1.16 / 0.90 STORM DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- 06.0 / 1.0 BUILDING AREA (ha) / RUNOFF COEFFICIENT

NO.	REVISION	DATE
2	PER CITY OF OTTAWA COMMENTS	30/05/03
1	FINAL LAYOUT REVISIONS	23/04/03
NO.	ISSUE	DATE

REGISTERED PROFESSIONAL ENGINEERS — CIVIL — 30729 — M. D. REID — PROVINCE OF ONTARIO

Ottawa

J.L.Richards & Associates Limited
Consulting Engineers, Architects & Planners
864 LADY ELLEN PLACE, OTTAWA, CANADA K1Z 5M2

PROJECT:

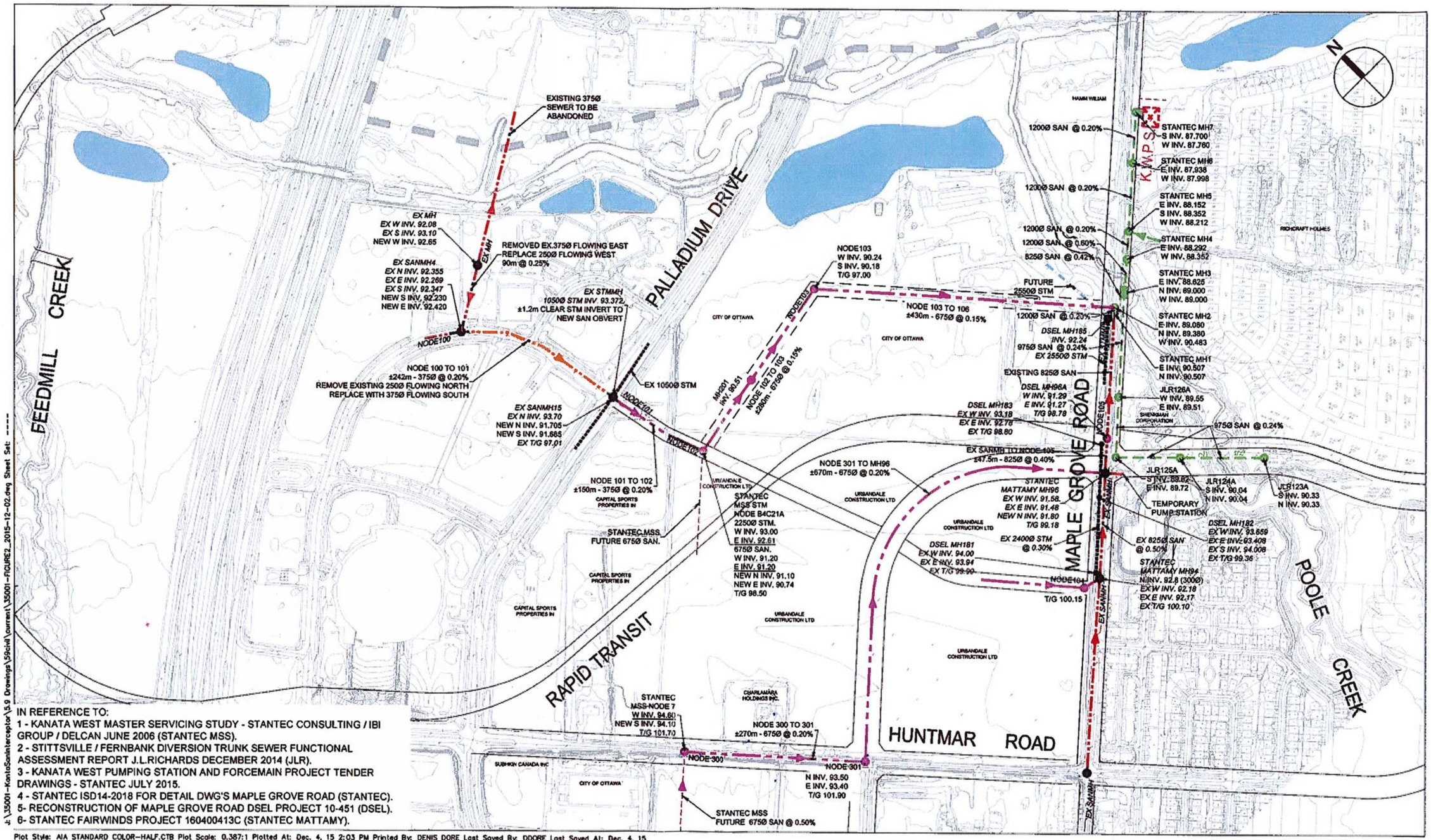
PALLADIUM
AUTO PARK

DRAWING:

DRAINAGE PLAN

DESIGN: G.F.	REVISION NO.:
DRAWN: M.G.B.	DRAWING NO.: D1
CHECKED:	
DATE: MAY 2003	
SCALE: 1:1000	JOB NO.: 15941-04

12308



IN REFERENCE TO:
1 - KANATA WEST MASTER SERVICING STUDY - STANTEC CONSULTING / IBI GROUP / DELCAN JUNE 2006 (STANTEC MSS).
2 - STITTSVILLE / FERNBANK DIVERSION TRUNK SEWER FUNCTIONAL ASSESSMENT REPORT J.L.RICHARDS DECEMBER 2014 (JLR).
3 - KANATA WEST PUMPING STATION AND FORCEMAIN PROJECT TENDER DRAWINGS - STANTEC JULY 2015.
4 - STANTEC ISD14-2018 FOR DETAIL DWG'S MAPLE GROVE ROAD (STANTEC).
5- RECONSTRUCTION OF MAPLE GROVE ROAD DSEL PROJECT 10-451 (DSEL).
6- STANTEC FAIRWINDS PROJECT 1604004413C (STANTEC MATTAMY).

J:\35001-KontoSanInterceptor\5.9 Drawings\59civil\current\35001-FIGURE2_2015-12-02.dwg Sheet Set: ----
Plot Style: AIA STANDARD COLOR-HALF.CTB Plot Scale: 0.387:1 Plotted At: Dec. 4, 15 2:03 PM Printed By: DENIS DORE Last Saved By: DDORE Last Saved At: Dec. 4, 15

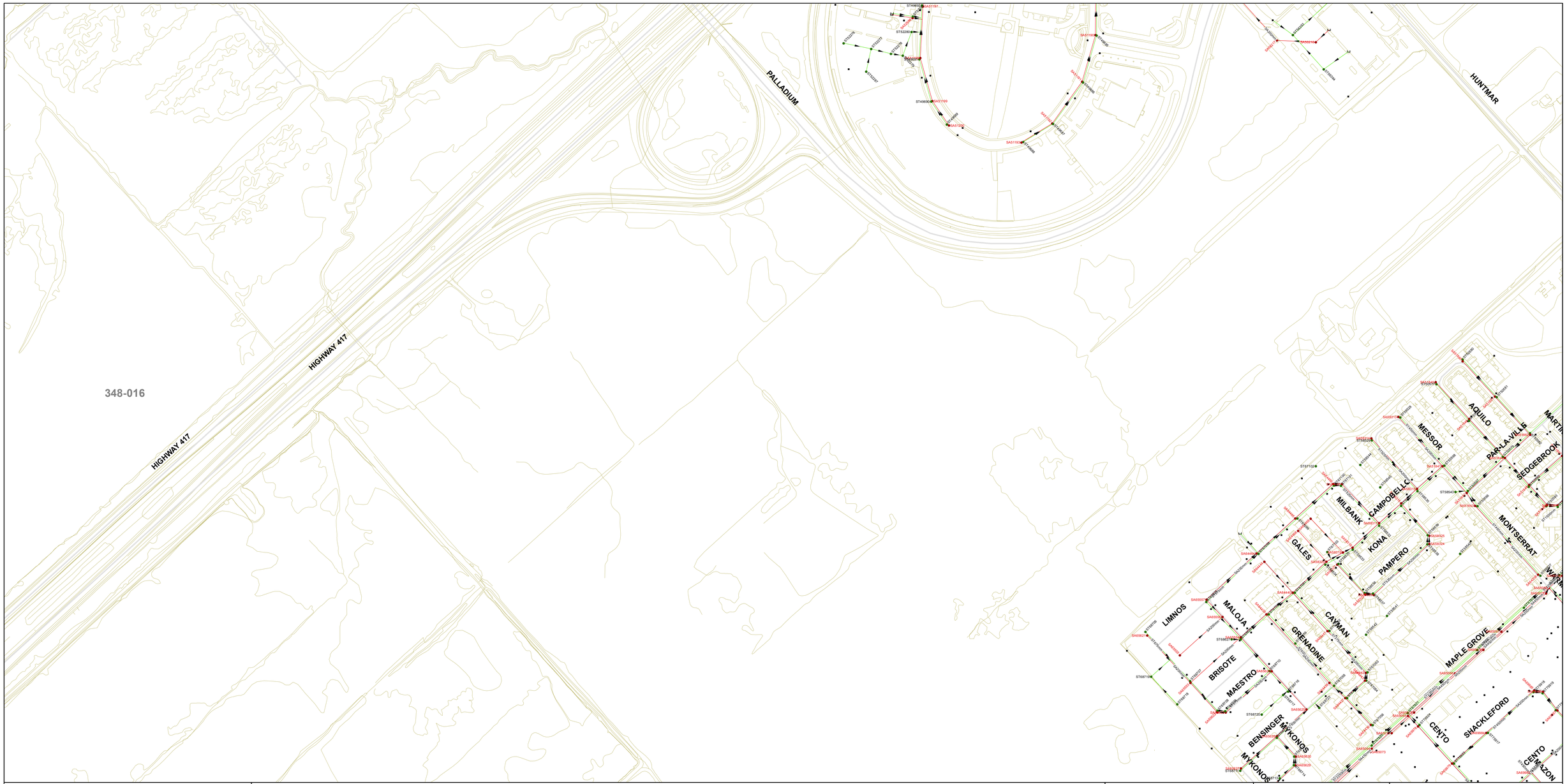
IBI GROUP

Scale: N.T.S.

Project Title: KANATA WEST NORTH SOUTH SANITARY INTERCEPTOR

Drawing Title: PROPOSED ALIGNMENTS FOR KANATA WEST DEVELOPMENT NORTH-SOUTH SANITARY COLLECTOR SEWERS FUNCTIONAL DESIGN STUDY

Sheet No.: FIGURE 1 (2015-12-02)



2016 Sewer Collection System

Department of Infrastructure Services

Scale 1:2500

Ottawa

Legend

- Storm Inlet
- Storm Outlet
- Storm Manhole
- Sanitary Manhole
- Combined Manhole
- Combined Pipe
- Sanitary Pipe
- Storm Pipe
- Pipe Cap
- Combined Trunk Sewer
- Sanitary Trunk Sewer
- Storm Trunk Sewer
- Regulator
- Storm Pumping Station
- Storm Water Management Pond
- Sanitary Pumping Station
- Treatment Plant

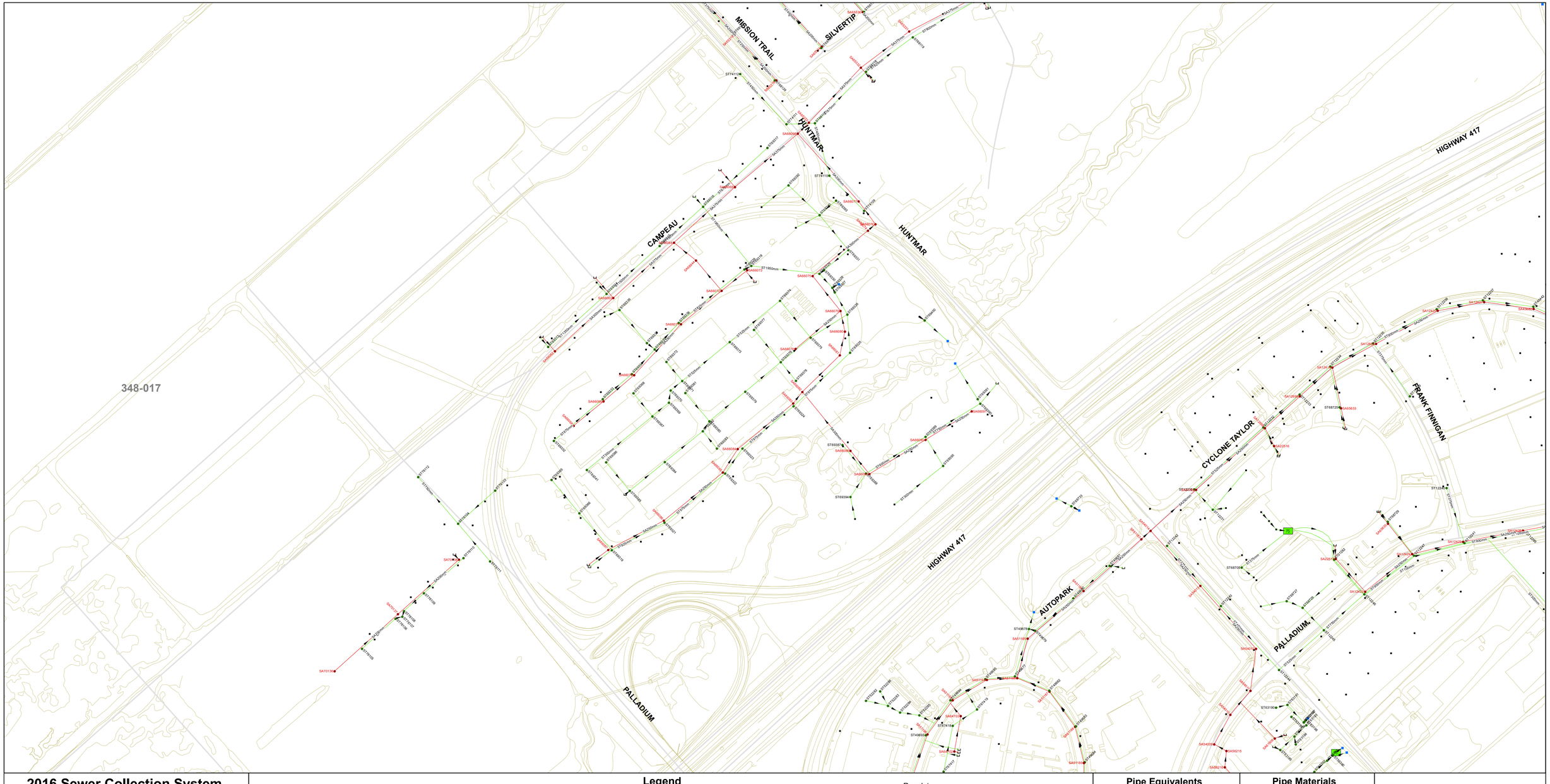
Pipe Equivalents

nominal (mm)	actual (inches)	nominal (mm)	actual (inches)	nominal (mm)	actual (inches)
100	4	675	27	1800	72
150	6	750	30	1950	78
200	8	825	33	2025	80
250	10	900	36	2100	84
300	12	975	39	2250	90
375	15	1050	42	2400	96
400	16	1200	48	2550	102
450	18	1350	54	2700	108
525	21	1500	60	2850	114
600	24	1650	66	3000	120

Pipe Materials

A - ASBESTOS
CI - CAST IRON
CO - COPPER
CO0 - AWWA C300
CO1 - AWWA C301
CO2 - AWWA C302
CO3 - AWWA C303
DI - DUCTILE IRON
PE - POLYETHYLENE (DR11 TO DR21)
PVC - POLYVINYL CHLORIDE
STC - CONCRETE LINED STEEL PIPE
UCI - UNLINED CAST IRON
UNK - UNKNOWN MATERIAL

348-016



2016 Sewer Collection System

Department of Infrastructure Services

This map was compiled from existing & collected engineering Information from the City of Ottawa Geographic Information System and is protected by copyright. The location of Infrastructure is approximate and should not be used for construction purposes.

Scale 1:2500

Ottawa

Legend

- Storm Inlet
- Storm Outlet
- Storm Manhole
- Sanitary Manhole
- Combined Manhole
- Combined Pipe
- Sanitary Pipe
- Storm Pipe
- Pipe Cap
- Combined Trunk Sewer
- Sanitary Trunk Sewer
- Storm Trunk Sewer
- Regulator
- Storm Pumping Station
- Storm Water Management Pond
- Sanitary Pumping Station
- Treatment Plant

Pipe Equivalents

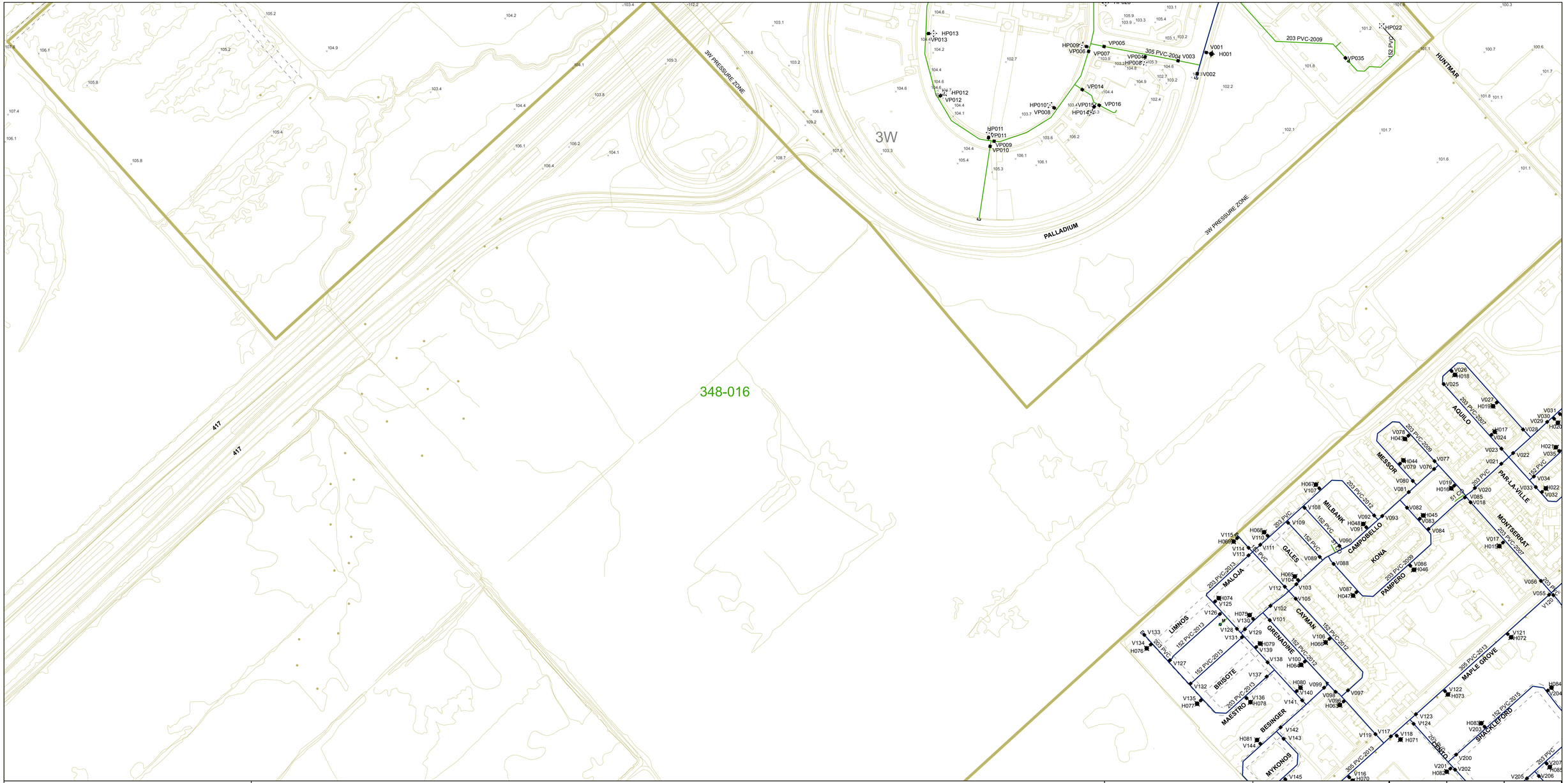
nominal (mm)	actual (inches)	nominal (mm)	actual (inches)	nominal (mm)	actual (inches)
100	4	675	27	1800	72
150	6	750	30	1950	78
200	8	825	33	2025	80
250	10	900	36	2100	84
300	12	975	39	2250	90
375	15	1050	42	2400	96
400	16	1200	48	2550	102
450	18	1350	54	2700	108
525	21	1500	60	2850	114
600	24	1650	66	3000	120

Pipe Materials

A - ASBESTOS
CI - CAST IRON
CO - COPPER
CO0 - AWWA C300
CO1 - AWWA C301
CO2 - AWWA C302
CO3 - AWWA C303
DI - DUCTILE IRON
PE - POLYETHYLENE (DR11 TO DR21)
PVC - POLYVINYL CHLORIDE
STC - CONCRETE LINED STEEL PIPE
UCI - UNLINED CAST IRON
UNK - UNKNOWN MATERIAL

348-017

WEST



2016 Water Distribution System

Department of Infrastructure Services

Scale 1:2500

Ottawa

Legend

- Public Hydrant
- Private Hydrant
- Summer only Flusher Hydrant
- Flusher Hydrant
- Acoustic Fibre Optic
- Gate Valve
- Tapping Valve
- Butterfly Valve (B)
- Buried Valve (BU)
- Drain Pipe
- Check Valve (CV)
- Closed Valve (CL)
- Drain-Out Valve (D)
- Left Hand Valve (L)
- Spot Elevation (X 84.9)
- Pressure Reducing Valve (P)
- Air Relief Valve (A)
- Bypass Valve (Y)
- Feedermain Valve (F000)
- Inspection Plate (IP 363)
- Cap
- Reducer
- Jump
- Water Meter (M)
- Water Service
- Backbone Pipe
- 203 PVC-1981 Watermain with Pipe Diameter, Material and Install Year
- Pipe Casing
- 2W Pressure Zone Delineation and Identifier
- Well (W)
- Elevated Tank (T)
- Water Pumping Station (PS)
- Water Reservoir
- Water Treatment Plant (WTP)

Pipe Equivalents

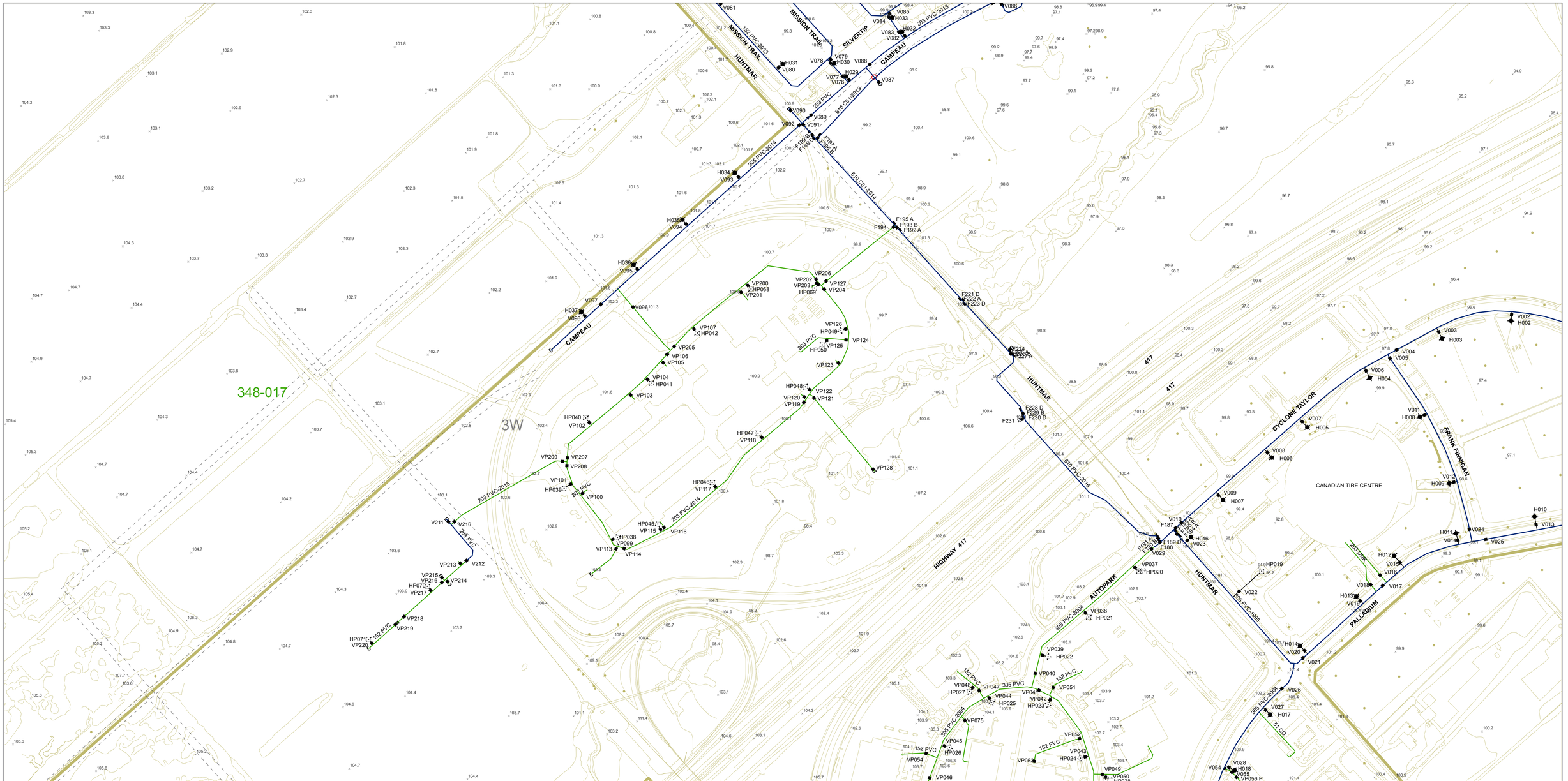
nominal (mm)	actual (inches)	nominal (mm)	actual (inches)	nominal (mm)	actual (inches)
100	4	675	27	1800	72
150	6	750	30	1950	78
200	8	825	33	2025	80
250	10	900	36	2100	84
300	12	975	39	2250	90
375	15	1050	42	2400	96
400	16	1200	48	2550	102
450	18	1350	54	2700	108
525	21	1500	60	2850	114
600	24	1650	66	3000	120

Pipe Materials

A - ASBESTOS
CI - CAST IRON
CO - COPPER
CO0 - AWWA C300
CO1 - AWWA C301
CO2 - AWWA C302
CO3 - AWWA C303
DI - DUCTILE IRON
PE - POLYETHYLENE (DR11 TO DR21)
PVC - POLYVINYL CHLORIDE
STC - CONCRETE LINED STEEL PIPE
UCI - UNLINED CAST IRON
UNK - UNKNOWN MATERIAL

346-017	348-017	350-017
346-016	348-016	350-016
346-015	348-015	350-015

WEST



2016 Water Distribution System

Department of Infrastructure Services

This map was compiled from existing & collected engineering Information from the City of Ottawa Geographic Information System and is protected by copyright. The location of Infrastructure is approximate and should not be used for construction purposes.

Scale 1:2500

Ottawa

Legend

- Public Hydrant
- Private Hydrant
- Summer only Flusher Hydrant
- Flusher Hydrant
- Acoustic Fibre Optic
- Gate Valve
- Tapping Valve
- Butterfly Valve
- Buried Valve
- Drain Pipe
- Check Valve
- Closed Valve
- Drain-Out Valve
- Left Hand Valve
- Spot Elevation
- Pressure Reducing Valve
- Air Relief Valve
- Bypass Valve
- Feedermain Valve
- Inspection Plate
- Cap
- Reducer
- Jump
- Water Meter
- Water Service
- Backbone Pipe
- 203 PVC-1981 Watermain with Pipe Diameter, Material and Install Year
- Pipe Casing
- 2W Pressure Zone Delineation and Identifier
- Well
- Elevated Tank
- PS Water Pumping Station
- Water Reservoir
- WTP Water Treatment Plant

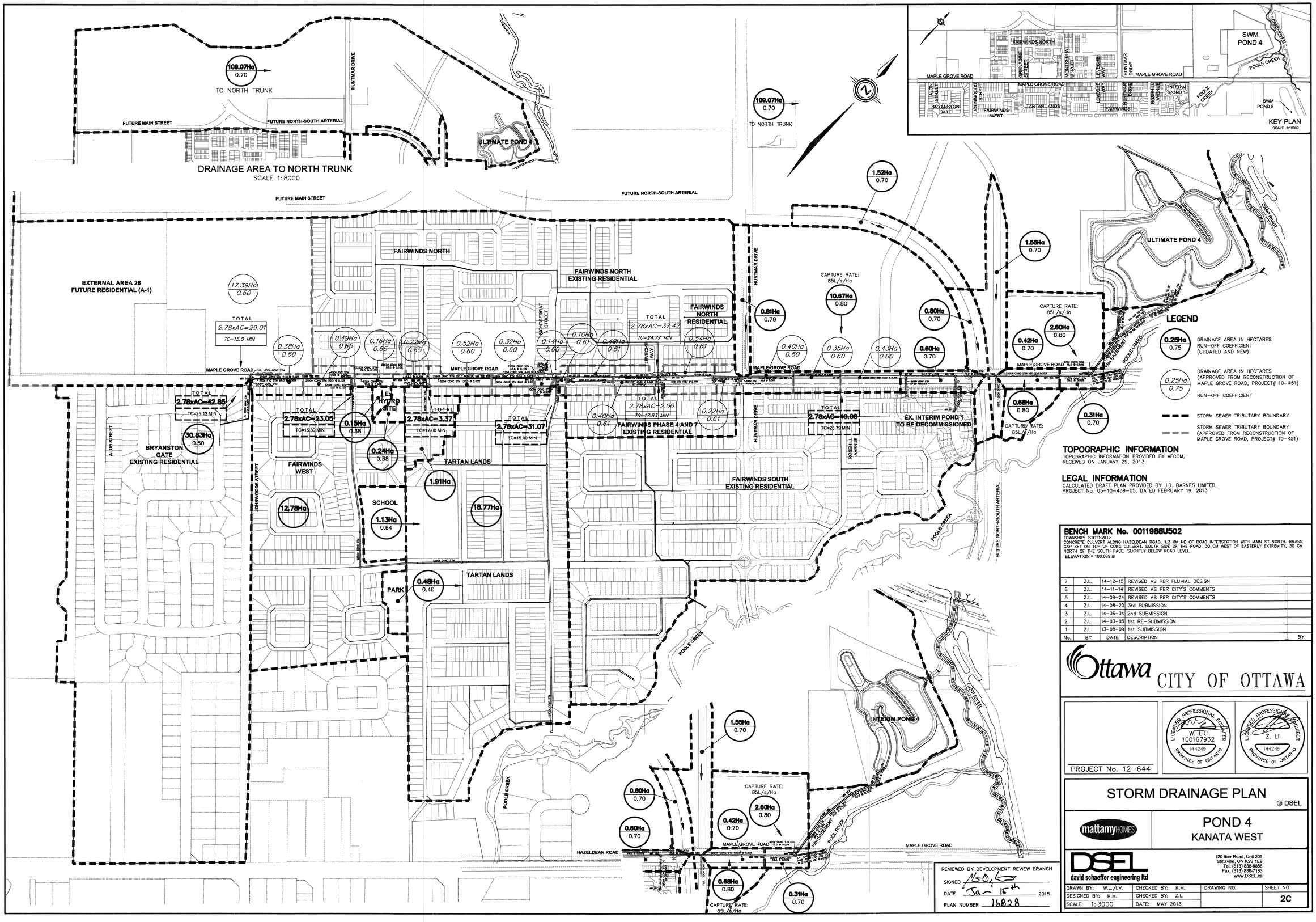
Pipe Equivalents

nominal (mm)	actual (inches)	nominal (mm)	actual (inches)	nominal (mm)	actual (inches)
100	4	675	27	1800	72
150	6	750	30	1950	78
200	8	825	33	2025	80
250	10	900	36	2100	84
300	12	975	39	2250	90
375	15	1050	42	2400	96
400	16	1200	48	2550	102
450	18	1350	54	2700	108
525	21	1500	60	2850	114
600	24	1650	66	3000	120

Pipe Materials

A - ASBESTOS
CI - CAST IRON
CO - COPPER
CO0 - AWWA C300
CO1 - AWWA C301
CO2 - AWWA C302
CO3 - AWWA C303
DI - DUCTILE IRON
PE - POLYETHYLENE (DR11 TO DR21)
PVC - POLYVINYL CHLORIDE
STC - CONCRETE LINED STEEL PIPE
UCI - UNLINED CAST IRON
UNK - UNKNOWN MATERIAL

346-018	348-018	350-018
346-017	348-017	350-017
346-016	348-016	350-016



TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY AECOM, RECEIVED ON JANUARY 29, 2013.

LEGAL INFORMATION

CALCULATED DRAFT PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 05-10-439-05, DATED FEBRUARY 19, 2013.

BENCH MARK No. 0011988U502

TOWNSHIP: STITTSVILLE
CONCRETE CULVERT ALONG HAZELDEAN ROAD, 1.3 KM NE OF ROAD INTERSECTION WITH MAIN ST NORTH. BRASS CAP SET ON TOP OF CONC CULVERT, SOUTH SIDE OF THE ROAD, 30 CM WEST OF EASTERLY EXTREMITY, 30 CM NORTH OF THE SOUTH FACE, SLIGHTLY BELOW ROAD LEVEL.
ELEVATION = 106.039 m

No.	BY	DATE	DESCRIPTION	BY
7	Z.L.	14-12-15	REVISED AS PER FLUVIAL DESIGN	
6	Z.L.	14-11-14	REVISED AS PER CITY'S COMMENTS	
5	Z.L.	14-09-24	REVISED AS PER CITY'S COMMENTS	
4	Z.L.	14-08-20	3rd SUBMISSION	
3	Z.L.	14-06-04	2nd SUBMISSION	
2	Z.L.	14-03-05	1st RE-SUBMISSION	
1	Z.L.	13-08-09	1st SUBMISSION	

CITY OF OTTAWA

PROJECT No. 12-644

W. LIU 100167932 14-12-15 PROVINCE OF ONTARIO

Z. LI 14-12-15 PROVINCE OF ONTARIO

STORM DRAINAGE PLAN

mattamyHOMES

POND 4
KANATA WEST

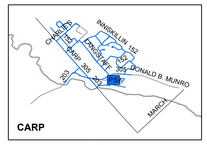
DSEL
david schaeffer engineering ltd
120 Iber Road, Unit 203
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

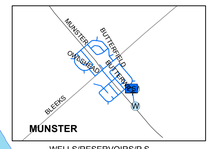
REVIEWED BY DEVELOPMENT REVIEW BRANCH
SIGNED
DATE Jan 15th 2015
PLAN NUMBER 16828

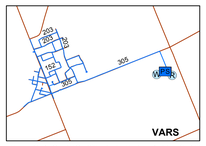
DRAWN BY: W.L./I.V.	CHECKED BY: K.M.	DRAWING NO.	SHEET NO.
DESIGNED BY: K.M.	CHECKED BY: Z.L.		2C
SCALE: 1:3000	DATE: MAY 2013		

M:\12644\Subm_3\Drawings\02C_644_Strm_Drainage.dwg, 02C, 15/01/2015 11:59:01 AM, VY

City of Ottawa - Water Distribution System
Facilities & Feedermains







ORLEANS P.S.
FOREST RIDGE P.S
Ogilvie Rd. Backup P.S.
ORLEANS RES.
MONTREAL ROAD P.S.
BRITTANY DRIVE P.S.
INNES RD ELEVATED TANK
FLEET STREET P.S.
LEMIEUX ISLAND PURIFICATION PLANT & P.S. & RES.
HURDMAN P.S.
Innes Rd Backup P.S.
Innes Rd/BearBrook Rd Backup P.S.
BRITANNIA PURIFICATION PLANT & P.S. & RES.
BILLINGS BRIDGE P.S.
MORGAN'S GRANT P.S.
CARLINGTON HEIGHTS P.S. & RES.
CONROY RD ELEVATED TANK
CAMPEAU DR. P.S.
ENERGY MINES & RESOURCES P.S.
SOUTH GLOUCESTER P.S.
LEITRIM P.S.
GLEN CAIRN P.S. & RES
BARRHAVEN P.S.
Merivale Rd. Backup P.S.
OTTAWA SOUTH P.S & RES.
FALLOWFIELD RD. RES. & P.S.
STITTSVILLE ELEVATED TANK
Abbott/Iber St. Backup P.S.
MOODIE ELEVATED TANK
SHADOW RIDGE P.S. & WELLS

1W 1E 2E 2W2C 3C 3W 4C EMR ME BARR MG MONT

Legend

Water System Structure

- Pump Station
- Backup Pump Station
- Water Treatment Plant
- Well
- Elevated Tank
- Reservoir

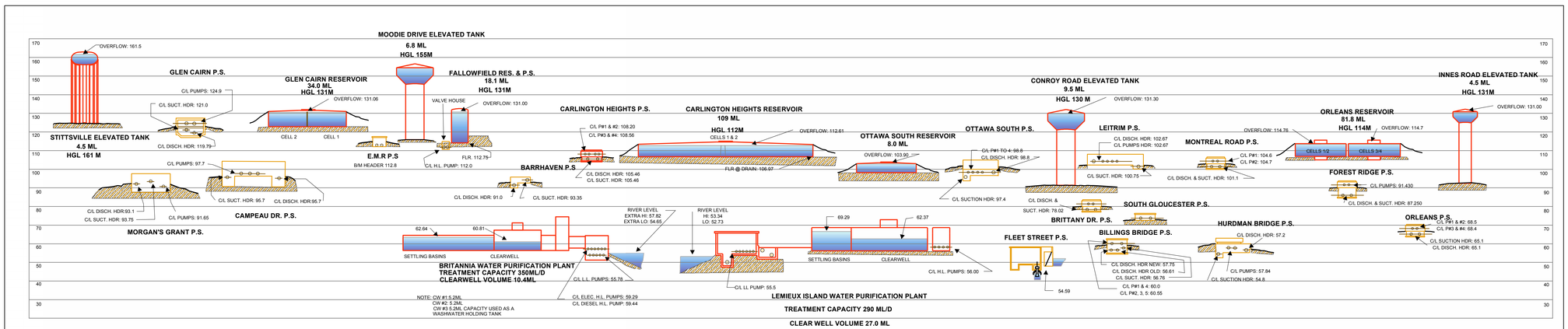
WATERMAINS

Priority, Internal Diameter

- Backbone 1524mm - 1981mm
- Backbone 1067mm - 1372mm
- Backbone 610mm - 914mm
- Backbone 406mm - 508mm
- Backbone 152mm - 305mm
- Distribution 1676mm - 1981mm
- Distribution 1067mm - 1372mm
- Distribution 610mm - 914mm
- Distribution 406mm - 508mm
- Distribution 305mm - 381mm

PRESSURE ZONES

- 1E
- 1W
- 2E
- 2W2C
- 3C
- 3W
- 4C
- BARR
- EMR
- ME
- MG
- MONT
- SHADOW RIDGE



N
W E
S

Ottawa

Planning, Infrastructure and Economic Development Department
Right of Way, Heritage & Urban Design Services
Infrastructure Services

0 1,000 2,000 4,000 6,000

Meters

FIGURE 1-1

Drawn By: Gis & Data Management

Date:23- Oct- 2017

APPENDIX C

- Water Demand Calculations (DSEL, May 2018)
- Hydraulic Capacity and Modeling Analysis, 195 Huntmar Drive Subdivision Development, Technical Memorandum (GeoAdvice, September 2016)

Job: 12-624
195 Huntmar Drive
Water Demand Analysis
Source: Concept Plan, 2018/05/08

Land Use	Approx Area (ha.)	Units	Population	Residential Water Demand (L/s)	Commercial Water Demand (L/s)	Institutional Water Demand (L/s)	Total Water Demand (L/s)	Fire Flow (L/s)
Singles	4.13	131.00	446.00	1.81	-	-	1.81	166.67
Towns	8.19	432.00	1167.00	4.73	-	-	4.73	166.67
Stacked Towns	1.72	128.00	346.00	1.40	-	-	1.40	283.33
Apartments	0.00	0.00	0.00	0.00	-	-	0.00	-
Community Park	6.29	-	-	-	-	2.04	2.04	250.00
Commercial	13.45	-	-	-	7.78	-	7.78	250.00
Highschool*	7.85	-	-	-	-	4.54	4.54	-
SWM Pond	4.49	-	-	-	-	.	-	-
Roads/Walkways/Open Space	13.15	-	-	-	-	-	-	-
Total	**59.27**	**691.00**	**1959.00**	**7.94**	**7.78**	**6.58**	**22.30**	

Notes:
** Towns: Lots 6m x 30m*
** Singles: Lots 10m x 30m*
** Stacked Towns: 4 storey building with surface parking (each unit is approx 1,100 sq. ft.)*
**Community Park: Variety of active and passive recreation opportunities which may include sports fields, tennis courts, multi-purpose courts, ice rinks, skateboard parks, splash pads, children's play areas, open play spaces, pedestrian walkways, seating areas, and shelters, as determined by the City.*

**Approx areas include areas outside of 195 Huntmar that are proposed for highschool & commercial development, consistent with Table 1.*

Water Demand Parameters	Value	Unit
Residential - Single Family	3.4	p/unit
Residential – Townhome/ Semi	2.7	p/unit
Residential – Apartment	1.8	p/unit
Residential Average Daily Demand	350	L/d/p
Residential - Maximum Daily Demand	2.5	x Average Daily Demand
Residential - Maximum Hourly Demand	2.2	x Maximum Daily Demand
Residential – Minimum Hourly Demand	0.5	x Average Daily Demand
Commercial/Institutional Average Daily Demand	50,000	L/gross ha/day
District Park Average Daily Demand	28,000	L/gross ha/day
Commercial/Institutional Maximum Daily Demand	1.5	x Average Daily Demand
Commercial/Institutional Maximum Hour Demand	1.8	x Maximum Daily Demand
Commercial/Institutional Minimum Hourly Demand	0.5	x Average Daily Demand

Notes:
** Extracted from Section 4: Ottawa Design Guidelines, Water Distribution (July 2010), Table 4.1 - Per Unit Populations and Table 4.2 - Consumption Rates for Subdivisions of 501 to 3,000*
** No Outdoor Water Demand considered for residential uses.*
** Park water demand assumed as Commercial/Institutional Use, since potential for community facilities, etc. Apply 'other commercial' rate of 28,000 L/gross ha/day per Table 4.2 & per MOE Design Guidelines: for other Institutional and Commercial flows and tourist-commercial areas, an allowance of 28 m3/(ha·d) average flow should be used in the absence of reliable flow data.*

Fire Flow Demand Parameters	Value	Unit	Source
Singles	166.67	L/s	City of Ottawa, ISDTB-2014-02
Towns	166.67	L/s	City of Ottawa, ISDTB-2014-02
Stacked Towns	283.33	L/s	150 L/s per OBC, 2012, Section A-3.2.5.7.3. 283 L/s for similar developments: Mattamy Back-to-Back Towns 283 L/s (e.g. FSR Summerside West PH2), Minto stacked 4 storey units 283 L/s (e.g. FSR Ampersand). 283 L/s for sample FUS calc - >10m separation three sides, >20m separation on road side, wood construction, no sprinkler, 4 unit footprint, 102 sq.m. per unit x 4 storeys high. Assume firewall separation required to maintain Fire Flow demand at 283 L/s.
Community Park	250.00	L/s	Community Park: Variety of active and passive recreation opportunities which may include sports fields, tennis courts, multi-purpose courts, ice rinks, skateboard parks, splash pads, children's play areas, open play spaces, pedestrian walkways, seating areas, and shelters, as determined by the City. 250 L/s estimate considered adequate for most types of structures and occupancies, but is to be confirmed at the detailed design level.
Commercial	250.00	L/s	Per Arcadia FSR PH 1,2, 5 & 8. 250 L/s estimate considered adequate for most types of structures and occupancies, but is to be confirmed at the detailed design level.

Hydraulic Capacity and Modeling Analysis 195 Huntmar Drive Subdivision Development

Technical Memorandum

Prepared for:
2325483 Ontario Inc.
c/o
David Schaeffer Engineering Ltd.
120 Iber Road, Unit 203
Stittsville, ON K2S 1E9

Prepared by:
GeoAdvice Engineering Inc.
Unit 203, 2502 St. John's Street
Port Moody, BC V3H 2B4

September 14, 2016

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Project ID: 2016-055-DSE

Confidentiality and Copyright

Statement of Qualifications and Limitations

This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinary exercised by member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	September 13, 2016	First Draft	Andrea McCrea	Werner de Schaetzen
R1	September 14, 2016	Final Submission	Andrea McCrea	Werner de Schaetzen

Contents

1 Introduction

GeoAdvice Engineering Inc. (GeoAdvice) was retained by 2325483 Ontario Inc. (Client) care of David Schaeffer Engineering Ltd. (DSEL) to prepare a development servicing report for the 195 Huntmar Drive subdivision development (Development) in the City of Ottawa (City).

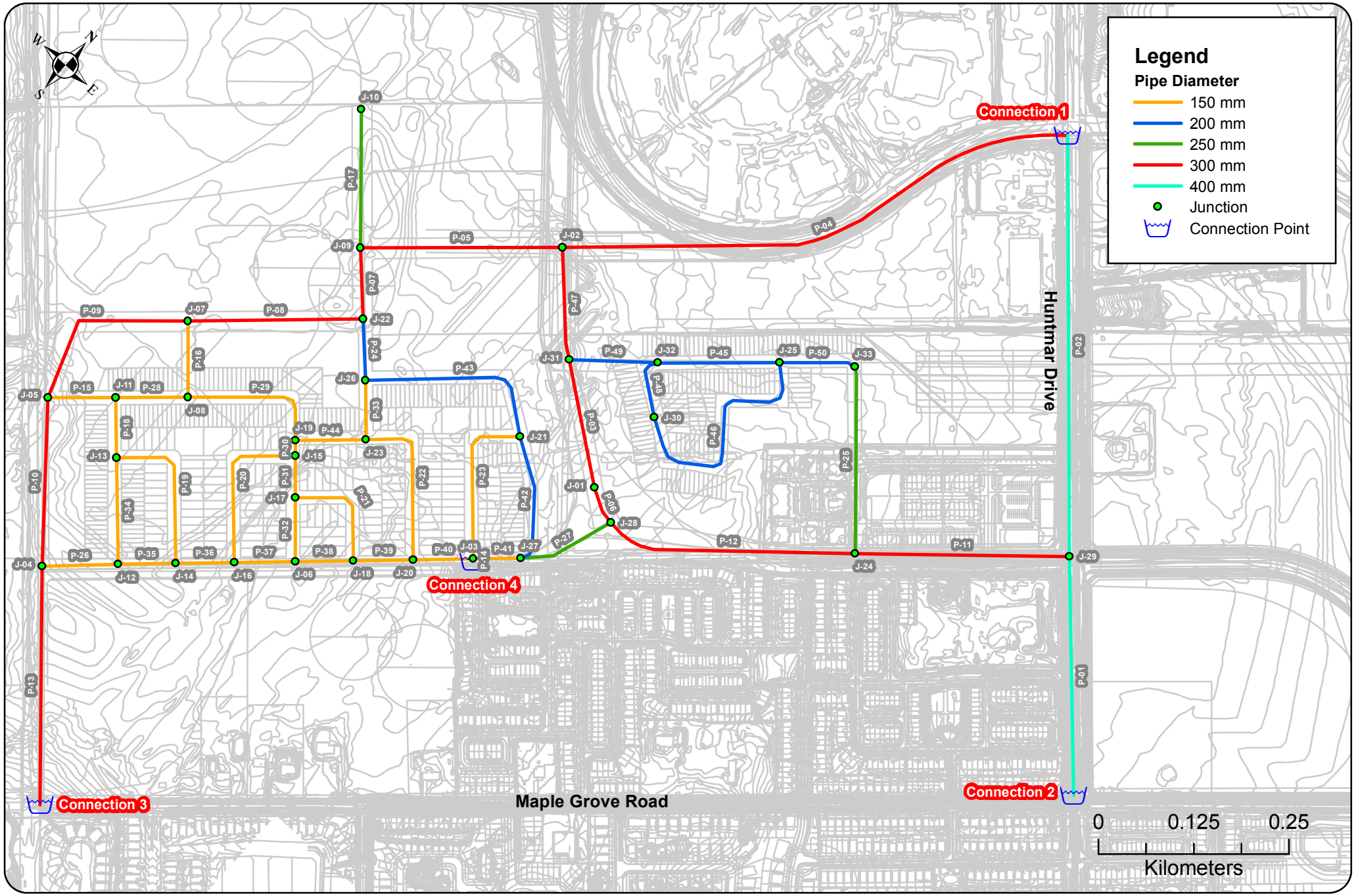
The 195 Huntmar Drive subdivision development is located between Hwy 417 and Maple Grove Road adjacent to Huntmar Drive and the Palladium Autopark. The development site lies adjacent to the existing City of Ottawa 3W pressure zone. An existing 600 mm diameter trunk water main extends on Huntmar Drive from north of Highway 417 to Cyclone Taylor Boulevard. Existing 300 mm diameter trunk water mains are located along Palladium Drive, within the Palladium Autopark, along Maple Grove Road, and along the portion of Huntmar Drive north of the subject lands. Two 300 mm diameter water main stubs are provided in close proximity to the subject lands**.** The 3W pressure zone network is operational within the existing residential neighbourhood (Mattamy Fairwinds) south of the subject lands and a 200 mm diameter water main stub is available for connection at the limit of the subject lands.

To complete the hydraulic modeling and capacity analysis, the entire subdivision was modeled together, with four (4) connections modeled to pressure zone 3W. The development will have a total of 1,237 residential units: 182 single-family dwellings, 345 townhomes, 520 stacked townhomes, and 190 apartments.

The site is shown in **Figure 1.1** on the following page, illustrating the connection points.

This report describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater software program (Innovyze Software). InfoWater is a GIS water distribution system modeling and management software application.

The results presented in this memo are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.



GeoAdvice Engineering Inc.

Project:	**Hydraulic Capacity and Modeling Analysis** **195 Huntmar Drive Subdivision Development**
Client:	**David Schaeffer Engineering Ld.**
Project ID:	**2016-055-DSE**
Date:	**September 2016**
Created by:	**AM**
Reviewed by:	**WdS**

Site Layout and Connection Points (Scenarios 1 & 2)

Figure 1.1

2 Modeling Considerations

2.1 Water Main Configuration

The water main network was laid out based on a pipe network layout prepared by DSEL and provided to GeoAdvice on August 11th, 2016.

2.2 Elevations

Final road grades in the subject lands are planned to be set at least to 106.5 m to 107.5 m, which requires about 2 m of fill above the existing ground elevation. A site grading plan was not available at time of preparation of this report; therefore, all modeled nodes were assigned a global elevation of 107.5 m, the more conservative elevation for analyzing development pressures.

2.3 Consumer Demands

Demand factors used for this analysis were taken from the City of Ottawa Design Guidelines *Table 4.2 Consumption Rate for Subdivisions of 501 to 3000 Persons*. Population densities were assigned according to *Table 4.1 Per Unit Populations* from the City of Ottawa Design Guidelines. A summary of these tables highlighting relevant data for this development is shown in **Table 2.1** below.

Table 2.1: City of Ottawa Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	350	L/c/d
Commercial/Institutional	50,000	L/ha/d
District Park	28,000	L/ha/d
Maximum Daily Demand		
Residential	2.5 x Avg. day	L/c/d
Commercial/Institutional	1.5 x Avg. day	L/c/d
Peak Hour Demand		
Residential	2.2 x Max. day	L/c/d
Commercial/Institutional	1.8 x Max. day	L/c/d
Minimum Hour Demand		
Residential	0.5 x Avg. day	L/c/d
Commercial/Institutional	0.5 x Avg. day	L/c/d

Water demand calculations for the site are shown in **Table 2.2** below. Detailed calculations of demands are shown in **Appendix A**. Demands were grouped and applied to the closest model nodes. The locations of nodes do not necessarily represent hydrant locations.

Table 2.2: Residential Water Demand Calculations

Dwelling Unit		Population		Average Day Demand	Maximum Day Demand	Peak Hour Demand	Minimum Hour Demand
Type	Number of Units	Persons Per Unit	Population	(L/s)	(L/s)	(L/s)	(L/s)
Single	182	3.4	618.8	2.51	6.27	13.79	1.25
Townhome	345	2.7	931.5	3.77	9.43	20.75	1.89
Stacked Townhome	520	2.7	1,404.0	5.69	14.22	31.28	2.84
Apartment	190	1.8	342.0	1.39	3.46	7.62	0.69

Table 2.3: Commercial/Institutional Water Demand Calculations

Land Use	Approx. Area	Average Day Demand	Maximum Day Demand	Peak Hour Demand	Minimum Hour Demand
Type	(ha)	(L/s)	(L/s)	(L/s)	(L/s)
District Park*	11.14	3.61	5.42	9.75	1.81
Commercial	8.71	5.04	7.56	13.61	2.52

*Assumed same peaking factors as for Commercial/Institutional water use.

2.4 Fire Flow

Fire flow requirements are to be confirmed in accordance with Local Guidelines (Fire Underwriters Survey), City of Ottawa Water Supply Guidelines, and the Ontario Building Code, upon development of detailed concepts for the single family homes, townhouses, stacked towns, apartment blocks, commercial blocks, and the district park. For the purposes of this analysis, fire flow estimates are based on the information available in the preliminary concept plan and comparable recent developments in the City of Ottawa and are summarized in **Table 2.4**.

Table 2.4: Estimated Fire Flow Requirements

Land Use Type	Estimated Fire Flow Requirement (L/s)
Single	167
Townhome	167
Stacked Townhome	283
Apartment	283
District Park	250
Commercial	250

2.5 Boundary Conditions

Boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the proposed connections to the site. Two sets of boundary conditions were provided. The first set of boundary conditions represents the existing or interim City water distribution system conditions. The second set represents the future buildout conditions of the City water distribution system. Boundary conditions were provided for peak hour, maximum day plus fire and maximum HGL (high pressure check) conditions. The boundary conditions provided are summarized below in **Table 2.5** and **Table 2.6**.

Table 2.5: Interim Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)	Connection 4 HGL (m)
Min Hour (max. pressure)	161.2	160.9	160.7	160.9
Peak Hour (min. pressure)	155.6	155.9	155.9	155.6
Max Day + Fire (167 L/s)	148.4	152.8	151.3	143.1
Max Day + Fire (250 L/s)	145.9	152.5	150.5	136.6
Max Day + Fire (283 L/s)	144.2	152.3	149.1	132.3

Table 2.6: Future Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)	Connection 4 HGL (m)
Min Hour (max. pressure)	164.4	163.6	162.4	162.8
Peak Hour (min. pressure)	156.6	156.6	156.5	156.4
Max Day + Fire (167 L/s)	157.7	157.7	155.3	146.7
Max Day + Fire (250 L/s)	157.1	156.6	152.7	137.0
Max Day + Fire (283 L/s)	156.5	156.4	151.4	133.2

Details of boundary conditions can be found in **Appendix A**.

2.6 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 2.7** below.

Table 2.7: Model Pipe Characteristics

Nominal Diameter	ID PVC	Hazen Williams C-Factor
(mm)	(mm)	(/)
150	155	100
200	204	110
250	250	110
300	297	120
400	406	120

2.7 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 2.8**.

Table 2.8: City of Ottawa Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-

3 Modeling Results

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand.

Three (3) scenarios were analyzed as follows:

Scenario 1. Future City conditions with subdivision network sized for future City conditions;
Scenario 2. Interim City conditions with subdivision network sized for future City conditions; and
Scenario 3. Interim City conditions with subdivision network sized for interim City conditions.

The network configuration and sizing for all scenarios are provided in **Appendix B**.

Modeling was carried out for minimum hour, peak hour and maximum day plus fire flow using InfoWater.

3.1 System Pressures

Modeled service pressures for the development are summarized in **Table 3.1** below.

Table 3.1: Summary of Available Service Pressures

Scenario	Scenario Description	Minimum Hour Demand Maximum Pressure (kPa)	Peak Hour Demand Minimum Pressure (kPa)
1	Future City conditions w/future subdivision sizing	551	477
2	Interim City conditions w/future subdivision sizing	524	469
3	Interim City conditions w/interim subdivision sizing	524	469

The modeling results indicate that the development can be adequately serviced by the future water main layout under the future and interim City conditions and the interim water main layout under the interim City conditions.

The future and interim water main layouts can be found in **Appendix B**.

Detailed pipe and junction tables are found in **Appendix B** for all scenarios.

3.2 Available Fire Flows

The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

A summary of available fire flows for Scenario 1 (future City conditions w/future subdivision sizing) is shown below in **Table 3.2**.

Table 3.2: Summary of Available Fire Flows – Scenario 1

Land Use	Estimated Required Fire Flow (L/s)	Minimum Available Fire Flow (L/s)	No. of Fire Flow Deficiencies
Single / Townhome	167	206 L/s (J-06)	0
Commercial / District Park	250	248 L/s (J-10)	1
Stacked Townhome / Apartment	283	289 L/s (J-21)	0

As shown in **Table 3.2**, under the future City conditions with the proposed water main layout sized for the future City conditions, the model predicts that the fire flow requirements can be met throughout the development with the exception of one (1) location. The single deficiency is at the end of the only dead end in the subdivision network and is within 1% of the estimated required fire flow; as such, no network upsizing is recommended to increase the available fire flow at this location.

Table 3.3 summarizes the fire flow results for Scenario 2 (interim City conditions w/future subdivision sizing).

Table 3.3: Summary of Available Fire Flows – Scenario 2

Land Use	Estimated Required Fire Flow (L/s)	Minimum Available Fire Flow (L/s)	No. of Fire Flow Deficiencies
Single / Townhome	167	186 L/s (J-06)	0
Commercial / District Park	250	223 L/s (J-10)	1
Stacked Townhome / Apartment	283	258 L/s (J-21)	2

As shown in **Table 3.3**, the model predicts that there are three (3) locations where fire flow requirements cannot be met throughout the development under the interim City conditions with the proposed water main layout sized for the future City conditions.

Table 3.4 summarizes the fire flow results for Scenario 3 (interim City conditions w/interim subdivision sizing).

Table 3.4: Summary of Available Fire Flows – Scenario 3

Land Use	Estimated Required Fire Flow (L/s)	Minimum Available Fire Flow (L/s)	No. of Fire Flow Deficiencies
Single / Townhome	167	187 L/s (J-06)	0
Commercial / District Park	250	327 L/s (J-10)	0
Stacked Townhome / Apartment	283	327 L/s (J-33)	0

As shown in **Table 3.4**, the model predicts that the fire flow requirements can be met throughout the development under the interim City conditions with the proposed water main layout sized for the interim City conditions.

Figures illustrating the fire flow results can be found in **Appendix C**.

3.3 Subdivision Network Sizing

Table 3.5 summarizes the network sizing requirements for interim and future conditions.

Table 3.5: Subdivision Network Sizing

Nominal Diameter (mm)	Interim Pipe Length (m)	Future Pipe Length (m)
150	2,659	2,659
200	412	1,301
250	1,265	557
300	3,239	3,057
400	866	866

4 Conclusions

The hydraulic capacity and modeling analysis of the 195 Huntmar Drive subdivision development yielded the following conclusions:

- Scenario 1:
  - The proposed water main network sized for the future City conditions and analyzed under the future City conditions can deliver all domestic flows, with service pressures expected to range between 477 kPa and 551 kPa.
  - All fire flows are achievable in the development (all residual pressures exceed 140 kPa) as per the estimated required fire flow criteria with the exception of one (1) deficiency. The available fire flow at the deficient location is within 1% of the estimated required fire flow and therefore is considered negligible.
- Scenario 2:
  - The proposed water main network sized for the future City conditions and analyzed under the interim City conditions can deliver all domestic flows, with service pressures expected to range between 469 kPa and 524 kPa.
  - Three (3) locations in the development are not able to achieve the estimated required fire flows (residual pressures below 140 kPa) as per the estimated required fire flow criteria.
- Scenario 3:
  - The proposed water main network sized for the interim City conditions and analyzed under the interim City conditions can deliver all domestic flows, with service pressures expected to range between 469 kPa and 524 kPa.
  - All fire flows are achievable in the development (all residual pressures exceed 140 kPa) as per the estimated required fire flow criteria.

Ultimately, if the subdivision network is sized for future conditions, the network can provide all domestic and fire flows and pressures in the future. Under interim conditions, there are three (3) fire flow deficiencies in the network. In order to alleviate these three (3) fire flow deficiencies, network upsizing is needed under the interim conditions.

It is important to note that the required fire flows assigned in this study are estimated based on similar developments and are conservative. In the detailed design processes to come, the network should be sized to meet required fire flows based on FUS, according to the City of Ottawa design guidelines.

Submission

Prepared by:

Andrea McCrea, E.I.T.
Hydraulic Modeler / Project Engineer

Approved by:

LICENSED PROFESSIONAL ENGINEER
W. B. F. de Schaetzen
100116340
PROVINCE OF ONTARIO

Werner de Schaetzen, Ph.D., P.Eng.
Senior Modeling Review / Project Manager

Appendix A Demand and Fire Flow Calculations & Boundary Conditions

			Population		Average Day Demand			Max Day (L/s)	Peak Hour (L/s)	Min Hour (L/s)
Junction	Dwelling Type	Number of Units/Area	Persons per Unit (Ottawa Design Guidelines)	Population per Dwelling Type	L/c/d or L/ha/d	L/d	L/s			
J-03	Singles	11	3.4	37.4	350	13,090	0.15	0.38	0.83	0.08
	Townhomes	26	2.7	70.2	350	24,570	0.28	0.71	1.56	0.14
J-04	Stacked Townhomes	58	2.7	156.6	350	54,810	0.63	1.59	3.49	0.32
J-05	Stacked Townhomes	56	2.7	151.2	350	52,920	0.61	1.53	3.37	0.31
J-07	Stacked Townhomes	58	2.7	156.6	350	54,810	0.63	1.59	3.49	0.32
J-08	Singles	8	3.4	27.2	350	9,520	0.11	0.28	0.61	0.06
	Townhomes	18	2.7	48.6	350	17,010	0.20	0.49	1.08	0.10
J-09	Commercial	22,206	-	-	50,000	111,030	1.29	1.93	3.47	0.64
J-10	Commercial	40,502	-	-	50,000	202,510	2.34	3.52	6.33	1.17
J-11	Townhomes	17	2.7	45.9	350	16,065	0.19	0.46	1.02	0.09
J-12	Singles	12	3.4	40.8	350	14,280	0.17	0.41	0.91	0.08
	Townhomes	20	2.7	54.0	350	18,900	0.22	0.55	1.20	0.11
J-13	Townhomes	33	2.7	89.1	350	31,185	0.36	0.90	1.99	0.18
J-14	Singles	24	3.4	81.6	350	28,560	0.33	0.83	1.82	0.17
J-15	Singles	8	3.4	27.2	350	9,520	0.11	0.28	0.61	0.06
	Townhomes	18	2.7	48.6	350	17,010	0.20	0.49	1.08	0.10
J-16	Singles	25	3.4	85.0	350	29,750	0.34	0.86	1.89	0.17
J-17	Singles	12	3.4	40.8	350	14,280	0.17	0.41	0.91	0.08
J-18	Singles	40	3.4	136.0	350	47,600	0.55	1.38	3.03	0.28
J-19	Townhomes	39	2.7	105.3	350	36,855	0.43	1.07	2.35	0.21
J-20	Singles	30	3.4	102.0	350	35,700	0.41	1.03	2.27	0.21
J-21	Singles	6	3.4	20.4	350	7,140	0.08	0.21	0.45	0.04
	Townhomes	13	2.7	35.1	350	12,285	0.14	0.36	0.78	0.07
J-22	District Park	111,410	-	-	28,000	311,948	3.61	5.42	9.75	1.81
J-23	Singles	6	3.4	20.4	350	7,140	0.08	0.21	0.45	0.04
	Townhomes	15	2.7	40.5	350	14,175	0.16	0.41	0.90	0.08
J-25	Townhomes	33	2.7	89.1	350	31,185	0.36	0.90	1.99	0.18
J-28	Stacked Townhomes	232	2.7	626.4	350	219,240	2.54	6.34	13.96	1.27
J-30	Townhomes	65	2.7	175.5	350	61,425	0.71	1.78	3.91	0.36
J-31	Stacked Townhomes	116	2.7	313.2	350	109,620	1.27	3.17	6.98	0.63
J-32	Townhomes	48	2.7	129.6	350	45,360	0.53	1.31	2.89	0.26
J-33	Apartment	190	1.8	342.0	350	119,700	1.39	3.46	7.62	0.69
	Commercial	24,400	-	-	50,000	122,000	1.41	2.12	3.81	0.71
Total				**3,296.3**		**1,901,193**	**22.00**	**46.36**	**96.80**	**11.00**

August 15, 2016

Sent by email: lmaxwell@dsel.ca

David Schaeffer Engineering Ltd.
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

Attention: **Ms. Laura Maxwell, B.Sc. (Civil Eng.), M.Pl.**
Project Manager

Re: Water Distribution Network Boundary Condition Request
Cavanagh – Kanata West

Dear Ms. Maxwell,

In order to carry out the water main analysis and hydraulic modeling for the Cavanagh – Kanata West development in the City of Ottawa, we request the hydraulic boundary conditions (HGL) for the proposed connection points as shown on the attached schematic. Flow conditions are outlined in the attached consumer water demand calculations. Required fire flows are based on estimates made for planning purposes based on the information available in the preliminary concept plan and comparable recent developments in the City of Ottawa.

The flow conditions are outlined as follows:

- Minimum hour demand = 11.00 L/s
- Average day demand = 22.00 L/s
- Maximum day demand = 46.36 L/s
- Maximum day demand + fire flow
    - 46.36 L/s + 166.67 L/s = 213.03 L/s
    - 46.36 L/s + 250.00 L/s = 296.36 L/s
    - 46.36 L/s + 283.33 L/s = 329.69 L/s
- Peak hour demand = 96.80 L/s

Please provide the boundary conditions for each flow condition outlined above for the following four (4) scenarios:

A. With connection points 1, 2, and 5 only

B. With connection points 1, 2, 3, and 5 only

C. With connection points 1, 2, 4 and 5 only

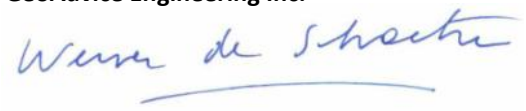
D. With connection point 1, 2, 3, 4, and 5

Please note that the above demands and fire flows should be applied equally between connection points of each scenario.

If you have any questions, please do not hesitate to contact me.

Yours truly,

GeoAdvice Engineering Inc.



Werner de Schaetzen, Ph.D., P.Eng.
President and Chief Executive Officer
werner@geoadvice.com
GeoAdvice Engineering Inc.

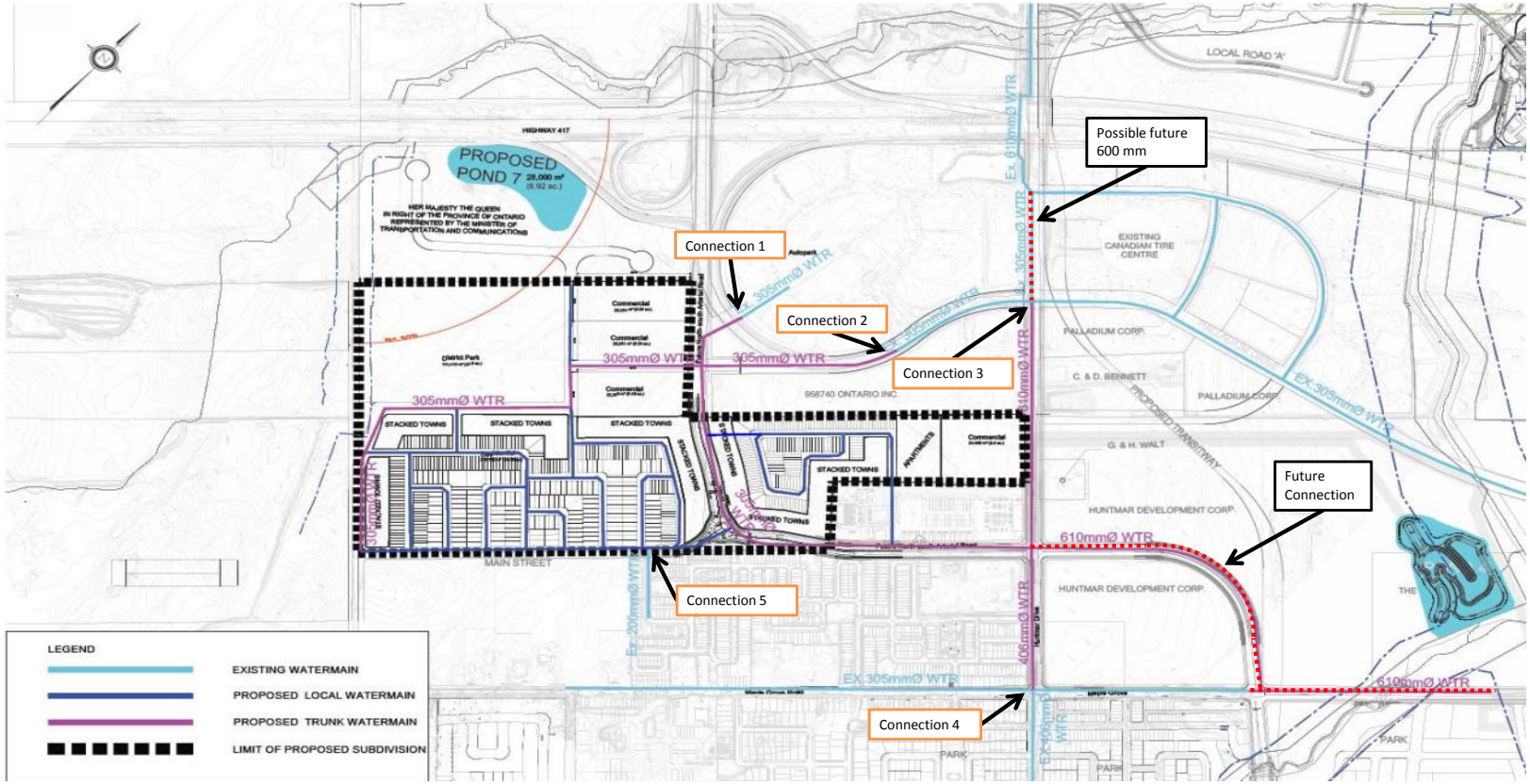
Attachments: Mark up for connection locations & Demand Calculations

			Population		Average Day Demand			Max Day 2.5 x Avg Day	Fire Flow	Peak Hour 2.2 x Max Day	Min Hour 0.5 x Avg Day
Dwelling Type	**Appox. Area (ha)**	**Number of Units**	**Persons per Unit**	**Population Per Dwelling Type**	**(L/c/d)**	**(L/d)**	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**
Singles	6.25	182	3.4	618.8	350	216,580	2.51	6.27	166.67	13.79	1.25
Townhomes	6.75	345	2.7	931.5	350	326,025	3.77	9.43	166.67	20.75	1.89
Stacked Townhomes	8.51	520	2.7	1404.0	350	491,400	5.69	14.22	283.33	31.28	2.84
Apartments	1.34	190	1.8	342.0	350	119,700	1.39	3.46	283.33	7.62	0.69
Subtotal	**22.85**	**1,237**		**3,296**		**1,153,705**	**13.35**	**33.38**		**73.44**	**6.68**

			Average Day Demand			Max Day 1.5 x Avg Day	Fire Flow	Peak Hour 1.8 x Max Day	Min Hour 0.5 x Avg Day
Land Use	**Appox. Area (ha)**		**(L/gross ha/day)**	**(L/d)**	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**
District Park	11.14		28,000	311,948	3.61	5.42	250.00	9.75	1.81
Commercial	8.71		50,000	435,540	5.04	7.56	250.00	13.61	2.52
Subtotal	**19.85**			**747,488**	**8.65**	**12.98**		**23.36**	**4.33**

Total	**42.70**				**1,901,193**	**22.00**	**46.36**		**96.80**	**11.00**

Maximum Day	Fire Flow	Maximum Day + Fire Flow
46.36	166.67	213.03
	250.00	296.36
	283.33	329.69



FW: Boundary Request | Kanata West, 195 Huntmar Drive

Laura Maxwell <LMaxwell@dsel.ca> Thu, Sep 1, 2016 at 9:11 AM
To: "andrea@geoadvice.com" <andrea@geoadvice.com>
Cc: Werner de Schaetzen <werner@geoadvice.com>, Matt Wingate <MWingate@dsel.ca>

Hi Andrea,

See attached & below for boundary condition response from City.

Questions:

1. I've marked up a figure to show my understanding of the expected model. Do you see anything differently?

2. In your work, can you plan to report interim and ultimate results where appropriate, using the interim and ultimate boundary conditions provided? Subdivision demands should be the same for both conditions – assume full buildout.

3. Should I be confirming with the City that the adjacent areas that share services with our site (hatched in aqua) have been incorporated into their boundary conditions? Do you see a need to add some or all of these demands to your model?

4. Do you have concerns with how the City applied the demands?

Once we sort out the questions above, please start your work and call with any questions. If your initial model runs identify any deficiencies in service pressure, fire flows, etc. please call so we can agree on next steps.

Thanks,

Laura Maxwell, B.Sc.(Civil Eng), M.Pl.

Project Manager

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 527
cell: (613) 293-8750
email: lmaxwell@DSEL.ca

From: Hall, James [mailto:James.Hall@ottawa.ca]
Sent: Thursday, September 1, 2016 9:17 AM
To: Laura Maxwell <LMaxwell@dsel.ca>
Cc: Matt Wingate <MWingate@dsel.ca>
Subject: FW: Boundary Request | Kanata West, 195 Huntmar Drive

Hi Laura,

Please see the below and attached regarding your request for Boundary Conditions. If you have any questions, please let me know.

Regards,

Jim

****

Key deviations from DSEL request are explained below:

Interim Conditions:

- HGL for connection #1 shown on DOC081516-08152016164624.pdf was not provided since the watermain is privately owned.

- HGL for connection # 2 was not provided. DSEL should model the existing 305 mm watermain from BC connection # 3 to the proposed development.

- HGL for a new connection at Maple Grove at Stittsville Main was provided since a connection will be required at this location as per Stantec's 2013 Kanata West Master Servicing Study Watermain Sizing – 2013 Water Master Plan Update (see attached report)

- Fire flows were not split equally between connection points. For each connection point, the total fire flow was assigned to the node.

Ultimate:

- Stantec updated the future water infrastructure around the proposed development in 2013 (see Kanata West Master Servicing Study Watermain Sizing – 2013 Water Master Plan Update). The BCs provided reflect the 2031 water demands as well as the updated preferred water infrastructure as shown in Figure 2 in the PDF.

From: Laura Maxwell [mailto:LMaxwell@dsel.ca]
Sent: Monday, August 15, 2016 6:27 PM
To: Hall, James
Cc: Matt Wingate
Subject: RE: Boundary Request | Kanata West, 195 Huntmar Drive

Hi James,

Thank you for speaking with me this morning. As discussed, can you please provide boundary conditions for a trunk-level hydraulic analysis for the development application for 195 Huntmar Drive?

We'd please request boundary conditions for four different connection scenarios, with two time periods given for each:

1. Interim condition – existing offsite watermain network; and,

2. Ultimate condition – planned offsite watermain network, per the MSS.

The attached markup shows the proposed WM network and the proposed connection scenarios.

The boundary request is further detailed in the attached GeoAdvice letter.

The proposed design parameters & demand assumptions are provided in the July 2016 FSR, and have been re-attached here for review and comment. I understand that sometimes different parameters are applied for a trunk infrastructure analysis (e.g. different peaking factors, inclusion of outdoor water demand, etc.) – if that is the case for this subdivision, please provide the suggested parameters.

Thanks again for your assistance. Please let us know if you have any questions or need further information.

Thank you,

Laura Maxwell, B.Sc.(Civil Eng), M.Pl.

Project Manager

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 527

cell: (613) 293-8750
email: lmaxwell@DSEL.ca

3 attachments

mem_CR131216_kanata_west_wm_sizing_ka.pdf
2467K

Boundary Conditions at 195 Huntmar Drive.docx
2442K

DOC090116-09012016115341.pdf
3202K

Boundary Conditions at 195 Huntmar Drive

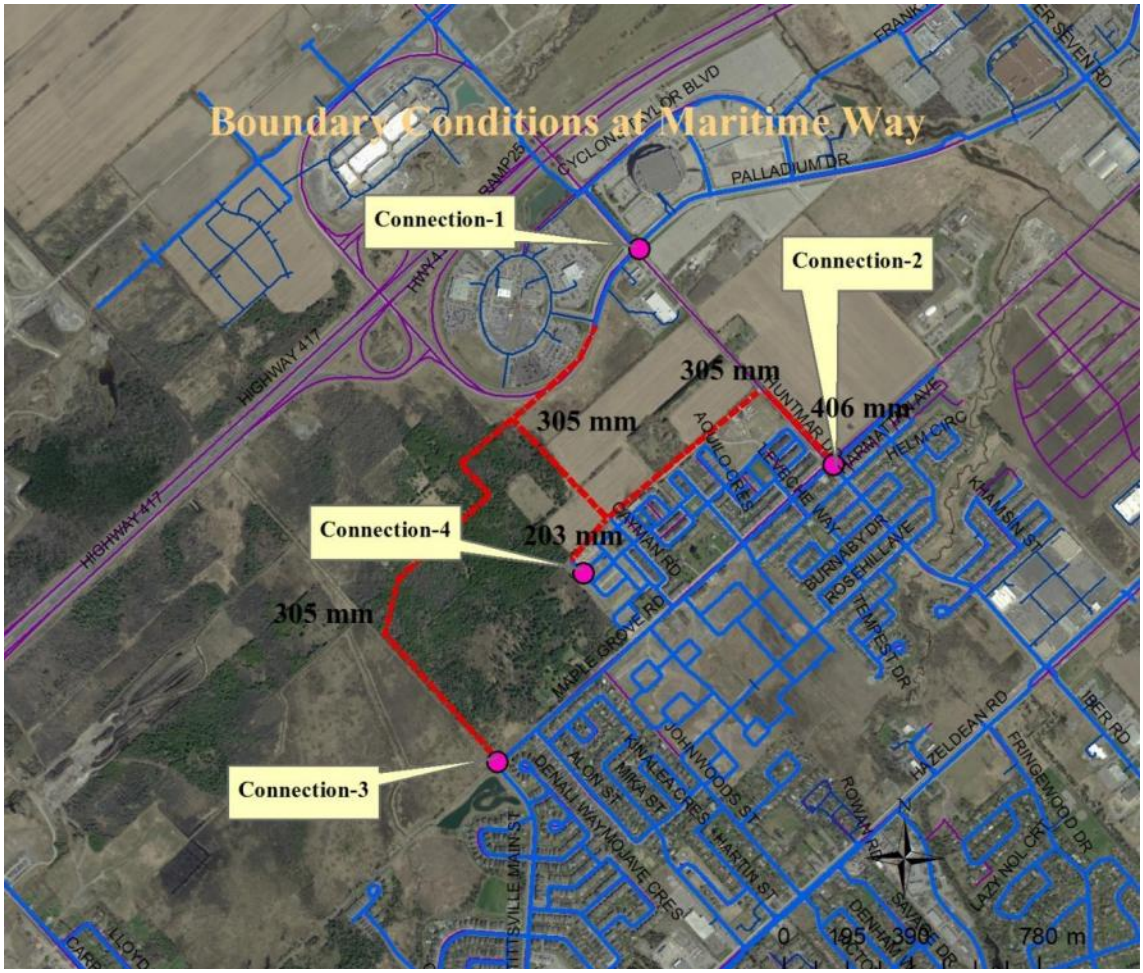
Information Provided:

Date provided: 18 August 2016

Criteria	Demand (L/s)
Average Demand	22
Maximum Daily Demand	46.36
Peak Hourly Demand	96.80
Fire Flow Demand	166.67, 250, 283.33
Maximum Daily + Fire Flow Demand	213.03, 296.36, 329.69

Location:

(Existing watermains)



Results:

Connection-1:

Criteria	Head (m)	Pressure (psi)
Max HGL	161.2	84.9
PKHR	155.6	76.9
MXDY + Fire Flow (166.67 L/s)	148.4	66.6
MXDY + Fire Flow (250.0 L/s)	145.9	63.1
MXDY + Fire Flow (283.33 L/s)	144.2	60.7

Connection-2:

Criteria	Head (m)	Pressure (psi)
Max HGL	160.9	85.1
PKHR	155.9	78.1
MXDY + Fire Flow (166.67 L/s)	152.8	73.8
MXDY + Fire Flow (250.0 L/s)	152.5	73.2
MXDY + Fire Flow (283.33 L/s)	152.3	72.9

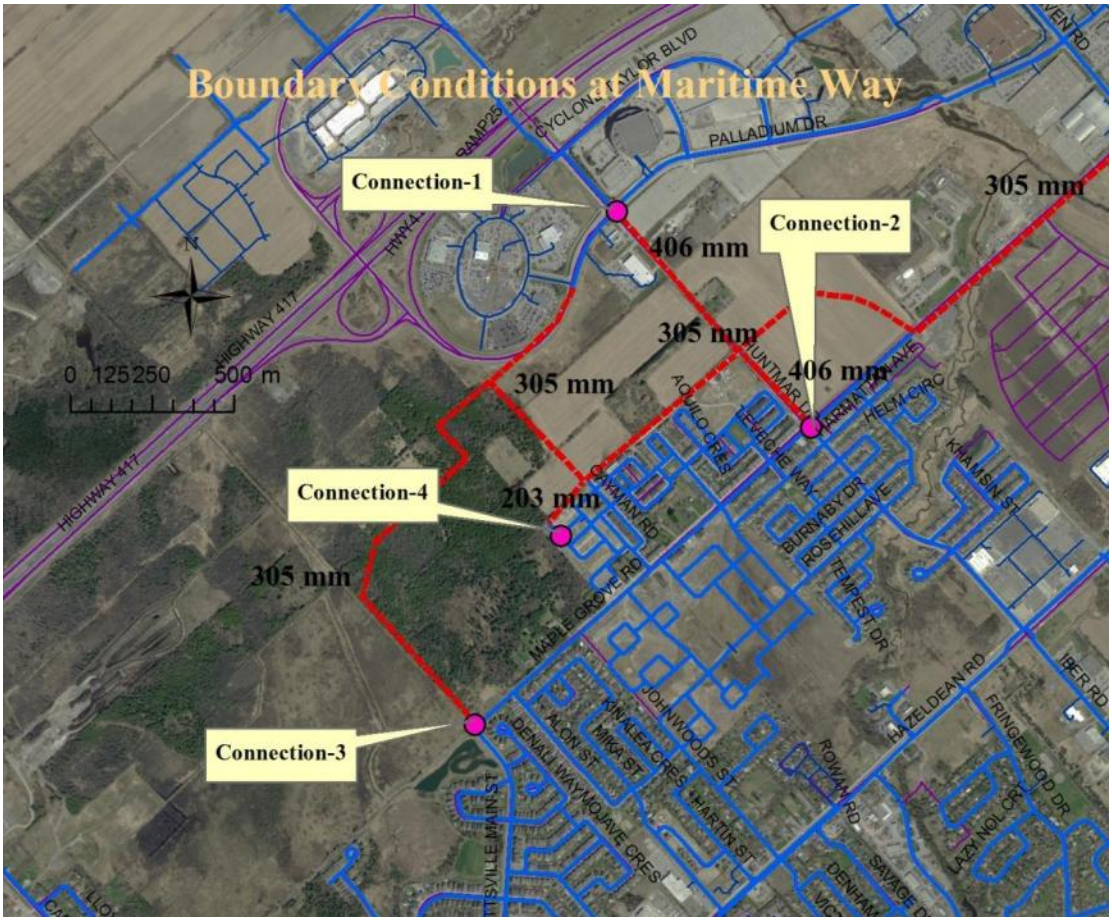
Connection-3:

Criteria	Head (m)	Pressure (psi)
Max HGL	160.7	69.5
PKHR	155.9	62.7
MXDY + Fire Flow (166.67 L/s)	151.3	50.1
MXDY + Fire Flow (250.0 L/s)	150.5	55.0
MXDY + Fire Flow (283.33 L/s)	149.1	53.0

Connection-4:

Criteria	Head (m)	Pressure (psi)
Max HGL	160.9	77.8
PKHR	155.6	70.3
MXDY + Fire Flow (166.67 L/s)	143.1	52.6
MXDY + Fire Flow (250.0 L/s)	136.6	43.4
MXDY + Fire Flow (283.33 L/s)	132.3	37.2

(Future watermains)



Connection-1:

Criteria	Head (m)	Pressure (psi)
Max HGL	164.4	91.5
PKHR	156.6	80.5
MXDY + Fire Flow (166.67 L/s)	157.7	82.1
MXDY + Fire Flow (250.0 L/s)	157.1	81.1
MXDY + Fire Flow (283.33 L/s)	156.5	80.4

Connection-2:

Criteria	Head (m)	Pressure (psi)
Max HGL	163.6	89.0
PKHR	156.6	79.1
MXDY + Fire Flow (166.67 L/s)	157.7	80.1
MXDY + Fire Flow (250.0 L/s)	156.6	79.1
MXDY + Fire Flow (283.33 L/s)	156.4	78.9

Connection-3:

Criteria	Head (m)	Pressure (psi)
Max HGL	162.4	71.9
PKHR	156.5	63.6
MXDY + Fire Flow (166.67 L/s)	155.3	61.8
MXDY + Fire Flow (250.0 L/s)	152.7	58.2
MXDY + Fire Flow (283.33 L/s)	151.4	56.3

Connection-4:

Criteria	Head (m)	Pressure (psi)
Max HGL	162.8	80.5
PKHR	156.4	71.4
MXDY + Fire Flow (166.67 L/s)	146.7	57.7
MXDY + Fire Flow (250.0 L/s)	137.0	44.5
MXDY + Fire Flow (283.33 L/s)	133.2	38.4

Note:

The boundary conditions are generated on the existing watermain as the City strategically provides boundary conditions on its own watermain only. In this case the developer will develop their own hydraulic model to assess the local private watermains. The developer's model must simulate with the above boundary conditions.

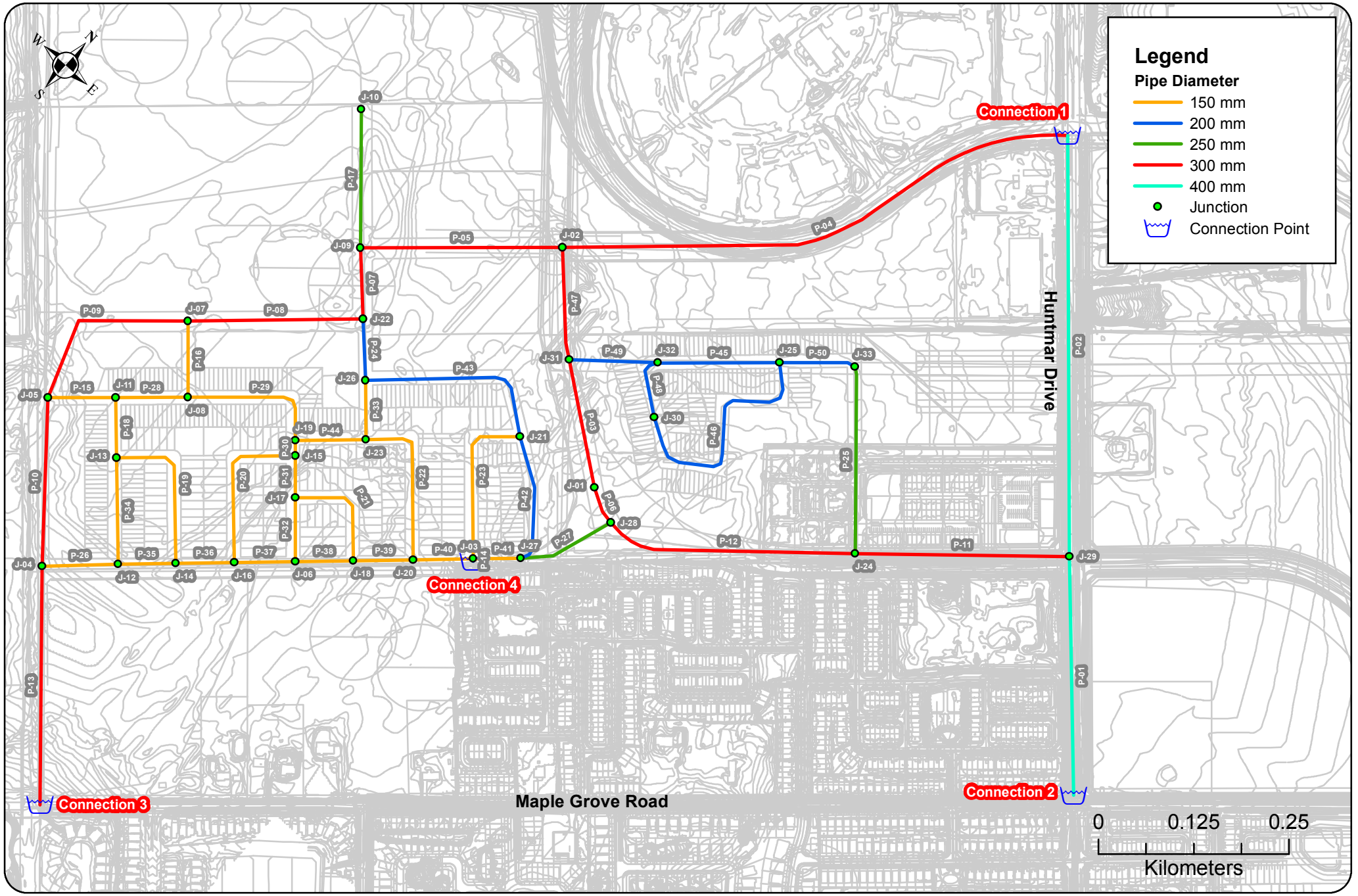
Considerations

1. According to the City of Ottawa Water Design Guidelines as well as the Ontario Building Code, the maximum pressure at any point within a distribution system shall not exceed 80 psi in occupied areas. Measures should be taken to try to reduce the residual pressure below 80 psi without the use of special pressure control equipment. In circumstances where the residual pressure cannot be reduced below 80 psi without the use of pressure control equipment, a pressure reducing valve (**PRV**) should be installed at site.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Appendix B Modeling Schematics – Pipe and Junction Tables

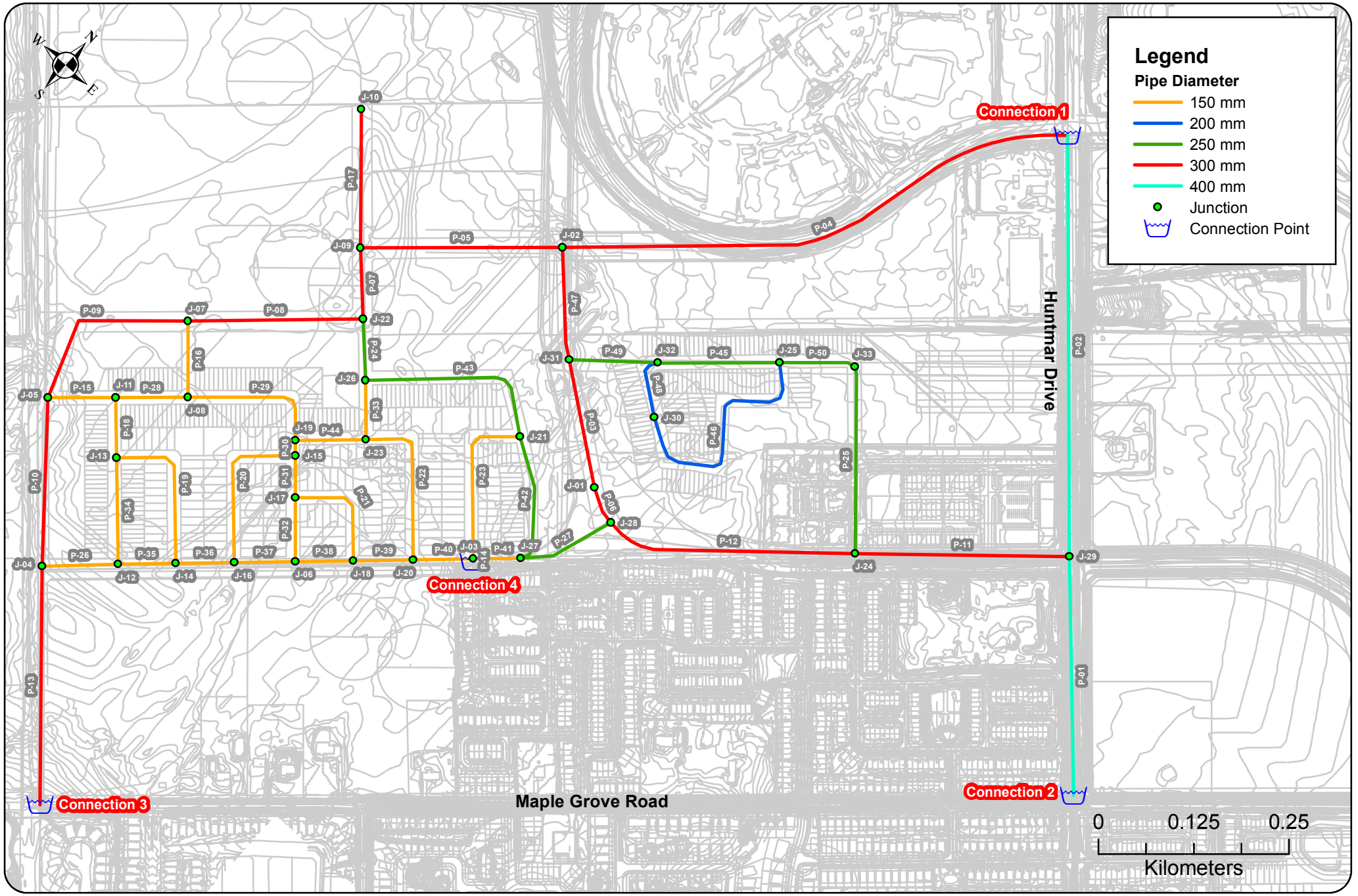


GeoAdvice Engineering Inc.

Project:	**Hydraulic Capacity and Modeling Analysis** **195 Huntmar Drive Subdivision Development**
Client:	**David Schaeffer Engineering Ld.**
Project ID:	**2016-055-DSE**
Date:	**September 2016**
Created by:	**AM**
Reviewed by:	**WdS**

Future System Layout (Scenarios 1 & 2)

Figure B.1

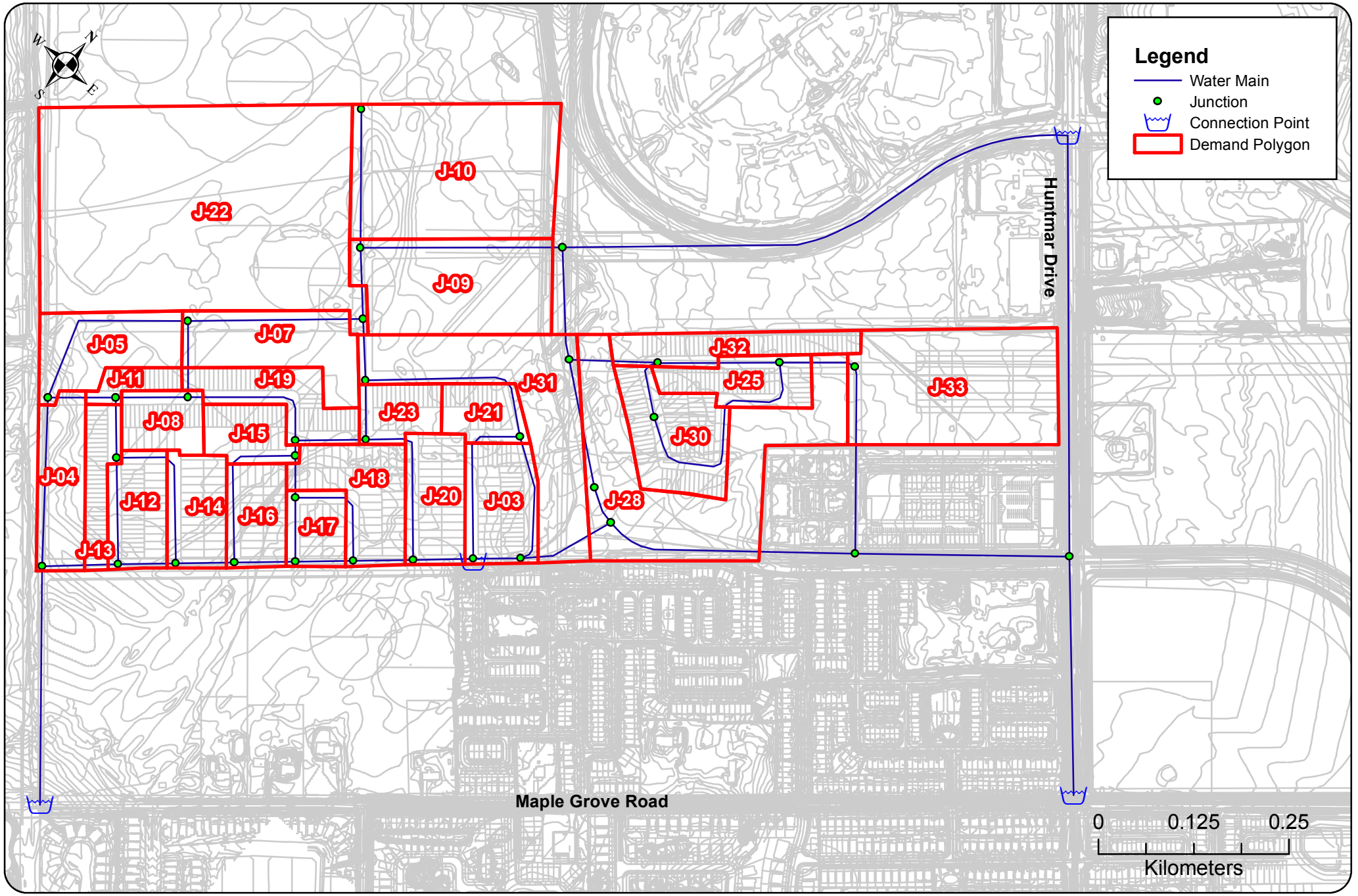


GeoAdvice Engineering Inc.

Project:	**Hydraulic Capacity and Modeling Analysis** **195 Huntmar Drive Subdivision Development**
Client:	**David Schaeffer Engineering Ld.**
Project ID:	**2016-055-DSE**
Date:	**September 2016**
Created by:	**AM**
Reviewed by:	**WdS**

Interim System Layout (Scenario 3)

Figure B.2



GeoAdvice Engineering Inc.

Project:	**Hydraulic Capacity and Modeling Analysis** **195 Huntmar Drive Subdivision Development**
Client:	**David Schaeffer Engineering Ld.**
Project ID:	**2016-055-DSE**
Date:	**September 2016**
Created by:	**AM**
Reviewed by:	**WdS**

Demand Allocation (Scenarios 1, 2, & 3)

Figure B.3

Future Model Inputs (Scenario 1 and 2)

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness ()
P-01	J-29	RES-2	313.28	406	120
P-02	RES-1	J-29	552.35	406	120
P-03	J-01	J-31	171.09	297	120
P-04	J-02	RES-1	698.67	297	120
P-05	J-02	J-09	264.74	297	120
P-06	J-01	J-28	51.01	297	120
P-07	J-09	J-22	93.11	297	120
P-08	J-22	J-07	230.24	297	120
P-09	J-07	J-05	252.27	297	120
P-10	J-05	J-04	221.60	297	120
P-11	J-24	J-29	280.71	297	120
P-12	J-28	J-24	332.73	297	120
P-13	RES-3	J-04	312.73	297	120
P-14	RES-4	J-03	3.02	204	110
P-15	J-05	J-11	89.15	155	100
P-16	J-07	J-08	99.85	155	100
P-17	J-09	J-10	181.97	250	110
P-18	J-11	J-13	78.93	155	100
P-19	J-13	J-14	208.22	155	100
P-20	J-15	J-16	215.66	155	100
P-21	J-17	J-18	151.69	155	100
P-22	J-23	J-20	215.13	155	100
P-23	J-21	J-03	217.33	155	100
P-24	J-22	J-26	80.79	204	110
P-25	J-24	J-33	245.38	250	110
P-26	J-04	J-12	100.27	155	100
P-27	J-27	J-28	129.64	250	110
P-28	J-11	J-08	95.00	155	100
P-29	J-08	J-19	190.90	155	100
P-30	J-19	J-15	20.02	155	100
P-31	J-15	J-17	55.22	155	100
P-32	J-17	J-06	83.74	155	100
P-33	J-26	J-23	77.39	155	100
P-34	J-13	J-12	139.45	155	100
P-35	J-12	J-14	75.45	155	100
P-36	J-14	J-16	76.66	155	100
P-37	J-16	J-06	80.14	155	100
P-38	J-06	J-18	76.36	155	100
P-39	J-18	J-20	78.48	155	100
P-40	J-20	J-03	78.86	155	100
P-41	J-03	J-27	62.15	155	100
P-42	J-27	J-21	170.86	204	110
P-43	J-21	J-26	261.65	204	110
P-44	J-23	J-19	92.92	155	100
P-45	J-25	J-32	159.71	204	110
P-46	J-30	J-25	325.15	204	110
P-47	J-31	J-02	148.17	297	120
P-48	J-32	J-30	83.58	204	110
P-49	J-31	J-32	116.34	204	110
P-50	J-33	J-25	100.25	204	110

ID	Elevation (m)	ADD (L/s)
J-01	107.50	0.00
J-02	107.50	0.00
J-03	107.50	0.44
J-04	107.50	0.63
J-05	107.50	0.61
J-06	107.50	0.00
J-07	107.50	0.63
J-08	107.50	0.31
J-09	107.50	1.29
J-10	107.50	2.34
J-11	107.50	0.19
J-12	107.50	0.38
J-13	107.50	0.36
J-14	107.50	0.33
J-15	107.50	0.31
J-16	107.50	0.34
J-17	107.50	0.17
J-18	107.50	0.55
J-19	107.50	0.43
J-20	107.50	0.41
J-21	107.50	0.22
J-22	107.50	3.61
J-23	107.50	0.25
J-24	107.50	0.00
J-25	107.50	0.36
J-26	107.50	0.00
J-27	107.50	0.00
J-28	107.50	2.54
J-29	107.50	0.00
J-30	107.50	0.71
J-31	107.50	1.27
J-32	107.50	0.52
J-33	107.50	2.80

Interim Model Inputs (Scenario 3)

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness ()
P-01	J-29	RES-2	313.28	406	120
P-02	RES-1	J-29	552.35	406	120
P-03	J-01	J-31	171.09	297	120
P-04	J-02	RES-1	698.67	297	120
P-05	J-02	J-09	264.74	297	120
P-06	J-01	J-28	51.01	297	120
P-07	J-09	J-22	93.11	297	120
P-08	J-22	J-07	230.24	297	120
P-09	J-07	J-05	252.27	297	120
P-10	J-05	J-04	221.60	297	120
P-11	J-24	J-29	280.71	297	120
P-12	J-28	J-24	332.73	297	120
P-13	RES-3	J-04	312.73	297	120
P-14	RES-4	J-03	3.02	204	110
P-15	J-05	J-11	89.15	155	100
P-16	J-07	J-08	99.85	155	100
P-17	J-09	J-10	181.97	297	120
P-18	J-11	J-13	78.93	155	100
P-19	J-13	J-14	208.22	155	100
P-20	J-15	J-16	215.66	155	100
P-21	J-17	J-18	151.69	155	100
P-22	J-23	J-20	215.13	155	100
P-23	J-21	J-03	217.33	155	100
P-24	J-22	J-26	80.79	250	110
P-25	J-24	J-33	245.38	250	110
P-26	J-04	J-12	100.27	155	100
P-27	J-27	J-28	129.64	250	110
P-28	J-11	J-08	95.00	155	100
P-29	J-08	J-19	190.90	155	100
P-30	J-19	J-15	20.02	155	100
P-31	J-15	J-17	55.22	155	100
P-32	J-17	J-06	83.74	155	100
P-33	J-26	J-23	77.39	155	100
P-34	J-13	J-12	139.45	155	100
P-35	J-12	J-14	75.45	155	100
P-36	J-14	J-16	76.66	155	100
P-37	J-16	J-06	80.14	155	100
P-38	J-06	J-18	76.36	155	100
P-39	J-18	J-20	78.48	155	100
P-40	J-20	J-03	78.86	155	100
P-41	J-03	J-27	62.15	155	100
P-42	J-27	J-21	170.86	250	110
P-43	J-21	J-26	261.65	250	110
P-44	J-23	J-19	92.92	155	100
P-45	J-25	J-32	159.71	250	110
P-46	J-30	J-25	325.15	204	110
P-47	J-31	J-02	148.17	297	120
P-48	J-32	J-30	83.58	204	110
P-49	J-31	J-32	116.34	250	110
P-50	J-33	J-25	100.25	250	110

ID	Elevation (m)	ADD (L/s)
J-01	107.50	0.00
J-02	107.50	0.00
J-03	107.50	0.44
J-04	107.50	0.63
J-05	107.50	0.61
J-06	107.50	0.00
J-07	107.50	0.63
J-08	107.50	0.31
J-09	107.50	1.29
J-10	107.50	2.34
J-11	107.50	0.19
J-12	107.50	0.38
J-13	107.50	0.36
J-14	107.50	0.33
J-15	107.50	0.31
J-16	107.50	0.34
J-17	107.50	0.17
J-18	107.50	0.55
J-19	107.50	0.43
J-20	107.50	0.41
J-21	107.50	0.22
J-22	107.50	3.61
J-23	107.50	0.25
J-24	107.50	0.00
J-25	107.50	0.36
J-26	107.50	0.00
J-27	107.50	0.00
J-28	107.50	2.54
J-29	107.50	0.00
J-30	107.50	0.71
J-31	107.50	1.27
J-32	107.50	0.52
J-33	107.50	2.80

Scenario 1 Minimum Hour Demand Modeling Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-01	J-29	RES-2	313.28	406	120	54.39	0.42	0.17	0.55
P-02	RES-1	J-29	552.35	406	120	80.22	0.62	0.63	1.13
P-03	J-01	J-31	171.09	297	120	-7.10	0.10	0.01	0.06
P-04	J-02	RES-1	698.67	297	120	-37.97	0.55	0.91	1.30
P-05	J-02	J-09	264.74	297	120	35.01	0.51	0.30	1.12
P-06	J-01	J-28	51.01	297	120	7.10	0.10	0.00	0.06
P-07	J-09	J-22	93.11	297	120	33.19	0.48	0.09	1.02
P-08	J-22	J-07	230.24	297	120	27.97	0.40	0.17	0.74
P-09	J-07	J-05	252.27	297	120	23.71	0.34	0.14	0.54
P-10	J-05	J-04	221.60	297	120	25.05	0.36	0.13	0.60
P-11	J-24	J-29	280.71	297	120	-25.83	0.37	0.18	0.64
P-12	J-28	J-24	332.73	297	120	-18.86	0.27	0.12	0.36
P-13	RES-3	J-04	312.73	297	120	-29.66	0.43	0.26	0.82
P-14	RES-4	J-03	3.02	204	110	-23.14	0.71	0.01	3.81
P-15	J-05	J-11	89.15	155	100	-1.65	0.09	0.01	0.13
P-16	J-07	J-08	99.85	155	100	3.94	0.21	0.07	0.65
P-17	J-09	J-10	181.97	250	110	1.17	0.02	0.00	0.01
P-18	J-11	J-13	78.93	155	100	2.15	0.11	0.02	0.21
P-19	J-13	J-14	208.22	155	100	-0.16	0.01	0.00	0.00
P-20	J-15	J-16	215.66	155	100	1.66	0.09	0.03	0.13
P-21	J-17	J-18	151.69	155	100	0.71	0.04	0.00	0.03
P-22	J-23	J-20	215.13	155	100	3.13	0.17	0.09	0.43
P-23	J-21	J-03	217.33	155	100	6.07	0.32	0.32	1.45
P-24	J-22	J-26	80.79	204	110	3.42	0.10	0.01	0.11
P-25	J-24	J-33	245.38	250	110	6.97	0.14	0.04	0.15
P-26	J-04	J-12	100.27	155	100	-4.93	0.26	0.10	0.99
P-27	J-27	J-28	129.64	250	110	-24.69	0.50	0.21	1.60
P-28	J-11	J-08	95.00	155	100	-3.89	0.21	0.06	0.64
P-29	J-08	J-19	190.90	155	100	-0.10	0.01	0.00	0.00
P-30	J-19	J-15	20.02	155	100	3.79	0.20	0.01	0.61
P-31	J-15	J-17	55.22	155	100	1.98	0.10	0.01	0.18
P-32	J-17	J-06	83.74	155	100	1.18	0.06	0.01	0.07
P-33	J-26	J-23	77.39	155	100	7.36	0.39	0.16	2.08
P-34	J-13	J-12	139.45	155	100	2.13	0.11	0.03	0.21
P-35	J-12	J-14	75.45	155	100	-2.99	0.16	0.03	0.39
P-36	J-14	J-16	76.66	155	100	-3.32	0.18	0.04	0.47
P-37	J-16	J-06	80.14	155	100	-1.83	0.10	0.01	0.16
P-38	J-06	J-18	76.36	155	100	-0.64	0.03	0.00	0.02
P-39	J-18	J-20	78.48	155	100	-0.21	0.01	0.00	0.00
P-40	J-20	J-03	78.86	155	100	2.72	0.14	0.03	0.33
P-41	J-03	J-27	62.15	155	100	-14.57	0.77	0.46	7.35
P-42	J-27	J-21	170.86	204	110	10.13	0.31	0.14	0.82
P-43	J-21	J-26	261.65	204	110	3.94	0.12	0.04	0.14
P-44	J-23	J-19	92.92	155	100	4.11	0.22	0.07	0.71
P-45	J-25	J-32	159.71	204	110	3.32	0.10	0.02	0.10
P-46	J-30	J-25	325.15	204	110	-2.07	0.06	0.01	0.04
P-47	J-31	J-02	148.17	297	120	-2.96	0.04	0.00	0.01
P-48	J-32	J-30	83.58	204	110	-1.71	0.05	0.00	0.03
P-49	J-31	J-32	116.34	204	110	-4.78	0.15	0.02	0.21
P-50	J-33	J-25	100.25	204	110	5.57	0.17	0.03	0.27

Scenario 1 Minimum Hour Demand Modeling Results

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
J-01	0.00	107.50	163	549
J-02	0.00	107.50	163	549
J-03	0.22	107.50	163	542
J-04	0.32	107.50	163	541
J-05	0.31	107.50	163	542
J-06	0.00	107.50	163	542
J-07	0.32	107.50	163	543
J-08	0.15	107.50	163	543
J-09	0.64	107.50	163	546
J-10	1.17	107.50	163	546
J-11	0.09	107.50	163	542
J-12	0.19	107.50	163	541
J-13	0.18	107.50	163	542
J-14	0.17	107.50	163	542
J-15	0.15	107.50	163	542
J-16	0.17	107.50	163	542
J-17	0.08	107.50	163	542
J-18	0.28	107.50	163	542
J-19	0.21	107.50	163	543
J-20	0.21	107.50	163	542
J-21	0.11	107.50	163	545
J-22	1.81	107.50	163	545
J-23	0.12	107.50	163	543
J-24	0.00	107.50	164	550
J-25	0.18	107.50	164	549
J-26	0.00	107.50	163	545
J-27	0.00	107.50	163	546
J-28	1.27	107.50	163	549
J-29	0.00	107.50	164	551
J-30	0.36	107.50	164	549
J-31	0.63	107.50	163	549
J-32	0.26	107.50	164	549
J-33	1.40	107.50	164	549

Scenario 1 Peak Hour Demand Modeling Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-01	J-29	RES-2	313.28	406	120	-16.80	0.13	0.02	0.06
P-02	RES-1	J-29	552.35	406	120	12.37	0.10	0.02	0.04
P-03	J-01	J-31	171.09	297	120	5.90	0.09	0.01	0.04
P-04	J-02	RES-1	698.67	297	120	-21.81	0.31	0.33	0.47
P-05	J-02	J-09	264.74	297	120	14.19	0.20	0.06	0.21
P-06	J-01	J-28	51.01	297	120	-5.90	0.09	0.00	0.04
P-07	J-09	J-22	93.11	297	120	4.39	0.06	0.00	0.02
P-08	J-22	J-07	230.24	297	120	-3.33	0.05	0.00	0.01
P-09	J-07	J-05	252.27	297	120	-9.42	0.14	0.02	0.10
P-10	J-05	J-04	221.60	297	120	-16.50	0.24	0.06	0.28
P-11	J-24	J-29	280.71	297	120	-29.18	0.42	0.22	0.80
P-12	J-28	J-24	332.73	297	120	-15.51	0.22	0.08	0.25
P-13	RES-3	J-04	312.73	297	120	25.45	0.37	0.19	0.62
P-14	RES-4	J-03	3.02	204	110	20.37	0.62	0.01	3.00
P-15	J-05	J-11	89.15	155	100	3.71	0.20	0.05	0.58
P-16	J-07	J-08	99.85	155	100	2.60	0.14	0.03	0.30
P-17	J-09	J-10	181.97	250	110	6.33	0.13	0.02	0.13
P-18	J-11	J-13	78.93	155	100	1.93	0.10	0.01	0.17
P-19	J-13	J-14	208.22	155	100	0.99	0.05	0.01	0.05
P-20	J-15	J-16	215.66	155	100	0.13	0.01	0.00	0.00
P-21	J-17	J-18	151.69	155	100	-0.43	0.02	0.00	0.01
P-22	J-23	J-20	215.13	155	100	-1.38	0.07	0.02	0.09
P-23	J-21	J-03	217.33	155	100	-3.58	0.19	0.12	0.55
P-24	J-22	J-26	80.79	204	110	-2.03	0.06	0.00	0.04
P-25	J-24	J-33	245.38	250	110	13.67	0.28	0.13	0.53
P-26	J-04	J-12	100.27	155	100	5.46	0.29	0.12	1.19
P-27	J-27	J-28	129.64	250	110	4.35	0.09	0.01	0.06
P-28	J-11	J-08	95.00	155	100	0.76	0.04	0.00	0.03
P-29	J-08	J-19	190.90	155	100	1.67	0.09	0.03	0.13
P-30	J-19	J-15	20.02	155	100	2.04	0.11	0.00	0.19
P-31	J-15	J-17	55.22	155	100	0.22	0.01	0.00	0.00
P-32	J-17	J-06	83.74	155	100	-0.26	0.01	0.00	0.00
P-33	J-26	J-23	77.39	155	100	2.70	0.14	0.03	0.32
P-34	J-13	J-12	139.45	155	100	-1.04	0.06	0.01	0.06
P-35	J-12	J-14	75.45	155	100	2.30	0.12	0.02	0.24
P-36	J-14	J-16	76.66	155	100	1.47	0.08	0.01	0.11
P-37	J-16	J-06	80.14	155	100	-0.29	0.02	0.00	0.01
P-38	J-06	J-18	76.36	155	100	-0.55	0.03	0.00	0.02
P-39	J-18	J-20	78.48	155	100	-4.01	0.21	0.05	0.67
P-40	J-20	J-03	78.86	155	100	-7.66	0.41	0.18	2.24
P-41	J-03	J-27	62.15	155	100	6.73	0.36	0.11	1.76
P-42	J-27	J-21	170.86	204	110	2.38	0.07	0.01	0.06
P-43	J-21	J-26	261.65	204	110	4.72	0.14	0.05	0.20
P-44	J-23	J-19	92.92	155	100	2.72	0.14	0.03	0.33
P-45	J-25	J-32	159.71	204	110	-0.90	0.03	0.00	0.01
P-46	J-30	J-25	325.15	204	110	-1.15	0.04	0.00	0.01
P-47	J-31	J-02	148.17	297	120	-7.62	0.11	0.01	0.07
P-48	J-32	J-30	83.58	204	110	2.76	0.08	0.01	0.07
P-49	J-31	J-32	116.34	204	110	6.55	0.20	0.04	0.37
P-50	J-33	J-25	100.25	204	110	2.24	0.07	0.01	0.05

Scenario 1 Peak Hour Demand Modeling Results

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
J-01	0.00	107.50	156	478
J-02	0.00	107.50	156	478
J-03	2.40	107.50	156	479
J-04	3.49	107.50	156	478
J-05	3.37	107.50	156	478
J-06	0.00	107.50	156	477
J-07	3.49	107.50	156	477
J-08	1.69	107.50	156	477
J-09	3.47	107.50	156	477
J-10	6.33	107.50	156	477
J-11	1.02	107.50	156	477
J-12	2.11	107.50	156	477
J-13	1.99	107.50	156	477
J-14	1.82	107.50	156	477
J-15	1.69	107.50	156	477
J-16	1.89	107.50	156	477
J-17	0.91	107.50	156	477
J-18	3.03	107.50	156	477
J-19	2.35	107.50	156	477
J-20	2.27	107.50	156	477
J-21	1.24	107.50	156	478
J-22	9.75	107.50	156	477
J-23	1.36	107.50	156	477
J-24	0.00	107.50	156	479
J-25	1.99	107.50	156	477
J-26	0.00	107.50	156	477
J-27	0.00	107.50	156	478
J-28	13.96	107.50	156	478
J-29	0.00	107.50	157	481
J-30	3.91	107.50	156	477
J-31	6.98	107.50	156	478
J-32	2.89	107.50	156	477
J-33	11.43	107.50	156	477

Scenario 2 Minimum Hour Demand Modeling Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-01	J-29	RES-2	313.28	406	120	37.03	0.29	0.08	0.27
P-02	RES-1	J-29	552.35	406	120	45.02	0.35	0.22	0.39
P-03	J-01	J-31	171.09	297	120	-3.27	0.05	0.00	0.01
P-04	J-02	RES-1	698.67	297	120	-18.56	0.27	0.24	0.35
P-05	J-02	J-09	264.74	297	120	15.05	0.22	0.06	0.23
P-06	J-01	J-28	51.01	297	120	3.27	0.05	0.00	0.01
P-07	J-09	J-22	93.11	297	120	13.24	0.19	0.02	0.19
P-08	J-22	J-07	230.24	297	120	12.70	0.18	0.04	0.17
P-09	J-07	J-05	252.27	297	120	11.25	0.16	0.03	0.14
P-10	J-05	J-04	221.60	297	120	12.25	0.18	0.04	0.16
P-11	J-24	J-29	280.71	297	120	-7.98	0.12	0.02	0.07
P-12	J-28	J-24	332.73	297	120	-5.39	0.08	0.01	0.04
P-13	RES-3	J-04	312.73	297	120	-14.62	0.21	0.07	0.22
P-14	RES-4	J-03	3.02	204	110	-0.91	0.03	0.00	0.01
P-15	J-05	J-11	89.15	155	100	-1.31	0.07	0.01	0.08
P-16	J-07	J-08	99.85	155	100	1.14	0.06	0.01	0.07
P-17	J-09	J-10	181.97	250	110	1.17	0.02	0.00	0.01
P-18	J-11	J-13	78.93	155	100	0.76	0.04	0.00	0.03
P-19	J-13	J-14	208.22	155	100	-0.51	0.03	0.00	0.01
P-20	J-15	J-16	215.66	155	100	0.99	0.05	0.01	0.05
P-21	J-17	J-18	151.69	155	100	-0.79	0.04	0.01	0.03
P-22	J-23	J-20	215.13	155	100	-0.44	0.02	0.00	0.01
P-23	J-21	J-03	217.33	155	100	0.70	0.04	0.01	0.03
P-24	J-22	J-26	80.79	204	110	-1.27	0.04	0.00	0.02
P-25	J-24	J-33	245.38	250	110	2.59	0.05	0.01	0.02
P-26	J-04	J-12	100.27	155	100	-2.69	0.14	0.03	0.32
P-27	J-27	J-28	129.64	250	110	-7.39	0.15	0.02	0.17
P-28	J-11	J-08	95.00	155	100	-2.16	0.11	0.02	0.21
P-29	J-08	J-19	190.90	155	100	-1.17	0.06	0.01	0.07
P-30	J-19	J-15	20.02	155	100	0.85	0.04	0.00	0.04
P-31	J-15	J-17	55.22	155	100	-0.30	0.02	0.00	0.01
P-32	J-17	J-06	83.74	155	100	0.41	0.02	0.00	0.01
P-33	J-26	J-23	77.39	155	100	1.91	0.10	0.01	0.17
P-34	J-13	J-12	139.45	155	100	1.09	0.06	0.01	0.06
P-35	J-12	J-14	75.45	155	100	-1.79	0.10	0.01	0.15
P-36	J-14	J-16	76.66	155	100	-2.47	0.13	0.02	0.27
P-37	J-16	J-06	80.14	155	100	-1.65	0.09	0.01	0.13
P-38	J-06	J-18	76.36	155	100	-1.24	0.07	0.01	0.08
P-39	J-18	J-20	78.48	155	100	-2.31	0.12	0.02	0.24
P-40	J-20	J-03	78.86	155	100	-2.96	0.16	0.03	0.38
P-41	J-03	J-27	62.15	155	100	-3.40	0.18	0.03	0.50
P-42	J-27	J-21	170.86	204	110	3.99	0.12	0.03	0.15
P-43	J-21	J-26	261.65	204	110	3.18	0.10	0.03	0.10
P-44	J-23	J-19	92.92	155	100	2.23	0.12	0.02	0.23
P-45	J-25	J-32	159.71	204	110	0.60	0.02	0.00	0.00
P-46	J-30	J-25	325.15	204	110	-0.41	0.01	0.00	0.00
P-47	J-31	J-02	148.17	297	120	-3.50	0.05	0.00	0.02
P-48	J-32	J-30	83.58	204	110	-0.06	0.00	0.00	0.00
P-49	J-31	J-32	116.34	204	110	-0.40	0.01	0.00	0.00
P-50	J-33	J-25	100.25	204	110	1.20	0.04	0.00	0.02

Scenario 2 Minimum Hour Demand Modeling Results

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
J-01	0.00	107.50	161	524
J-02	0.00	107.50	161	524
J-03	0.22	107.50	161	523
J-04	0.32	107.50	161	522
J-05	0.31	107.50	161	522
J-06	0.00	107.50	161	523
J-07	0.32	107.50	161	523
J-08	0.15	107.50	161	523
J-09	0.64	107.50	161	523
J-10	1.17	107.50	161	523
J-11	0.09	107.50	161	522
J-12	0.19	107.50	161	522
J-13	0.18	107.50	161	522
J-14	0.17	107.50	161	522
J-15	0.15	107.50	161	523
J-16	0.17	107.50	161	523
J-17	0.08	107.50	161	523
J-18	0.28	107.50	161	523
J-19	0.21	107.50	161	523
J-20	0.21	107.50	161	523
J-21	0.11	107.50	161	523
J-22	1.81	107.50	161	523
J-23	0.12	107.50	161	523
J-24	0.00	107.50	161	524
J-25	0.18	107.50	161	524
J-26	0.00	107.50	161	523
J-27	0.00	107.50	161	524
J-28	1.27	107.50	161	524
J-29	0.00	107.50	161	524
J-30	0.36	107.50	161	524
J-31	0.63	107.50	161	524
J-32	0.26	107.50	161	524
J-33	1.40	107.50	161	524

Scenario 2 Peak Hour Demand Modeling Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-01	J-29	RES-2	313.28	406	120	-58.07	0.45	0.20	0.62
P-02	RES-1	J-29	552.35	406	120	-30.50	0.24	0.10	0.19
P-03	J-01	J-31	171.09	297	120	6.76	0.10	0.01	0.05
P-04	J-02	RES-1	698.67	297	120	-15.38	0.22	0.17	0.24
P-05	J-02	J-09	264.74	297	120	8.33	0.12	0.02	0.08
P-06	J-01	J-28	51.01	297	120	-6.76	0.10	0.00	0.05
P-07	J-09	J-22	93.11	297	120	-1.46	0.02	0.00	0.00
P-08	J-22	J-07	230.24	297	120	-9.26	0.13	0.02	0.10
P-09	J-07	J-05	252.27	297	120	-14.78	0.21	0.06	0.23
P-10	J-05	J-04	221.60	297	120	-22.35	0.32	0.11	0.49
P-11	J-24	J-29	280.71	297	120	-27.56	0.40	0.20	0.72
P-12	J-28	J-24	332.73	297	120	-14.17	0.20	0.07	0.21
P-13	RES-3	J-04	312.73	297	120	32.41	0.47	0.30	0.97
P-14	RES-4	J-03	3.02	204	110	21.45	0.66	0.01	3.31
P-15	J-05	J-11	89.15	155	100	4.20	0.22	0.07	0.74
P-16	J-07	J-08	99.85	155	100	2.03	0.11	0.02	0.19
P-17	J-09	J-10	181.97	250	110	6.33	0.13	0.02	0.13
P-18	J-11	J-13	78.93	155	100	1.66	0.09	0.01	0.13
P-19	J-13	J-14	208.22	155	100	1.16	0.06	0.01	0.07
P-20	J-15	J-16	215.66	155	100	-0.26	0.01	0.00	0.00
P-21	J-17	J-18	151.69	155	100	-0.35	0.02	0.00	0.01
P-22	J-23	J-20	215.13	155	100	-1.53	0.08	0.02	0.11
P-23	J-21	J-03	217.33	155	100	-3.94	0.21	0.14	0.65
P-24	J-22	J-26	80.79	204	110	-1.95	0.06	0.00	0.04
P-25	J-24	J-33	245.38	250	110	13.39	0.27	0.13	0.51
P-26	J-04	J-12	100.27	155	100	6.58	0.35	0.17	1.69
P-27	J-27	J-28	129.64	250	110	6.54	0.13	0.02	0.14
P-28	J-11	J-08	95.00	155	100	1.52	0.08	0.01	0.11
P-29	J-08	J-19	190.90	155	100	1.86	0.10	0.03	0.16
P-30	J-19	J-15	20.02	155	100	1.58	0.08	0.00	0.12
P-31	J-15	J-17	55.22	155	100	0.15	0.01	0.00	0.00
P-32	J-17	J-06	83.74	155	100	-0.41	0.02	0.00	0.01
P-33	J-26	J-23	77.39	155	100	1.89	0.10	0.01	0.17
P-34	J-13	J-12	139.45	155	100	-1.49	0.08	0.02	0.11
P-35	J-12	J-14	75.45	155	100	2.97	0.16	0.03	0.39
P-36	J-14	J-16	76.66	155	100	2.32	0.12	0.02	0.24
P-37	J-16	J-06	80.14	155	100	0.17	0.01	0.00	0.00
P-38	J-06	J-18	76.36	155	100	-0.25	0.01	0.00	0.00
P-39	J-18	J-20	78.48	155	100	-3.63	0.19	0.04	0.56
P-40	J-20	J-03	78.86	155	100	-7.43	0.39	0.17	2.11
P-41	J-03	J-27	62.15	155	100	7.68	0.41	0.14	2.25
P-42	J-27	J-21	170.86	204	110	1.14	0.03	0.00	0.01
P-43	J-21	J-26	261.65	204	110	3.84	0.12	0.04	0.14
P-44	J-23	J-19	92.92	155	100	2.06	0.11	0.02	0.20
P-45	J-25	J-32	159.71	204	110	-1.11	0.03	0.00	0.01
P-46	J-30	J-25	325.15	204	110	-1.09	0.03	0.00	0.01
P-47	J-31	J-02	148.17	297	120	-7.04	0.10	0.01	0.06
P-48	J-32	J-30	83.58	204	110	2.82	0.09	0.01	0.08
P-49	J-31	J-32	116.34	204	110	6.82	0.21	0.05	0.40
P-50	J-33	J-25	100.25	204	110	1.96	0.06	0.00	0.04

Scenario 2 Peak Hour Demand Modeling Results

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
J-01	0.00	107.50	155	470
J-02	0.00	107.50	155	470
J-03	2.40	107.50	156	471
J-04	3.49	107.50	156	471
J-05	3.37	107.50	155	470
J-06	0.00	107.50	155	469
J-07	3.49	107.50	155	470
J-08	1.69	107.50	155	470
J-09	3.47	107.50	155	469
J-10	6.33	107.50	155	469
J-11	1.02	107.50	155	470
J-12	2.11	107.50	155	470
J-13	1.99	107.50	155	470
J-14	1.82	107.50	155	469
J-15	1.69	107.50	155	469
J-16	1.89	107.50	155	469
J-17	0.91	107.50	155	469
J-18	3.03	107.50	155	469
J-19	2.35	107.50	155	469
J-20	2.27	107.50	155	470
J-21	1.24	107.50	155	470
J-22	9.75	107.50	155	469
J-23	1.36	107.50	155	469
J-24	0.00	107.50	156	470
J-25	1.99	107.50	155	469
J-26	0.00	107.50	155	470
J-27	0.00	107.50	155	470
J-28	13.96	107.50	155	470
J-29	0.00	107.50	156	472
J-30	3.91	107.50	155	469
J-31	6.98	107.50	155	470
J-32	2.89	107.50	155	469
J-33	11.43	107.50	155	469

Scenario 3 Minimum Hour Demand Modeling Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-01	J-29	RES-2	313.28	406	120	36.90	0.29	0.08	0.27
P-02	RES-1	J-29	552.35	406	120	45.08	0.35	0.22	0.39
P-03	J-01	J-31	171.09	297	120	-4.08	0.06	0.00	0.02
P-04	J-02	RES-1	698.67	297	120	-18.53	0.27	0.24	0.34
P-05	J-02	J-09	264.74	297	120	14.28	0.21	0.06	0.21
P-06	J-01	J-28	51.01	297	120	4.08	0.06	0.00	0.02
P-07	J-09	J-22	93.11	297	120	12.46	0.18	0.02	0.17
P-08	J-22	J-07	230.24	297	120	13.05	0.19	0.04	0.18
P-09	J-07	J-05	252.27	297	120	11.53	0.17	0.04	0.14
P-10	J-05	J-04	221.60	297	120	12.54	0.18	0.04	0.17
P-11	J-24	J-29	280.71	297	120	-8.17	0.12	0.02	0.08
P-12	J-28	J-24	332.73	297	120	-5.51	0.08	0.01	0.04
P-13	RES-3	J-04	312.73	297	120	-14.96	0.22	0.07	0.23
P-14	RES-4	J-03	3.02	204	110	-0.74	0.02	0.00	0.01
P-15	J-05	J-11	89.15	155	100	-1.32	0.07	0.01	0.09
P-16	J-07	J-08	99.85	155	100	1.21	0.06	0.01	0.07
P-17	J-09	J-10	181.97	297	120	1.17	0.02	0.00	0.00
P-18	J-11	J-13	78.93	155	100	0.79	0.04	0.00	0.03
P-19	J-13	J-14	208.22	155	100	-0.50	0.03	0.00	0.01
P-20	J-15	J-16	215.66	155	100	1.00	0.05	0.01	0.05
P-21	J-17	J-18	151.69	155	100	-0.77	0.04	0.00	0.03
P-22	J-23	J-20	215.13	155	100	-0.26	0.01	0.00	0.00
P-23	J-21	J-03	217.33	155	100	0.77	0.04	0.01	0.03
P-24	J-22	J-26	80.79	250	110	-2.40	0.05	0.00	0.02
P-25	J-24	J-33	245.38	250	110	2.66	0.05	0.01	0.03
P-26	J-04	J-12	100.27	155	100	-2.74	0.15	0.03	0.33
P-27	J-27	J-28	129.64	250	110	-8.33	0.17	0.03	0.21
P-28	J-11	J-08	95.00	155	100	-2.20	0.12	0.02	0.22
P-29	J-08	J-19	190.90	155	100	-1.15	0.06	0.01	0.07
P-30	J-19	J-15	20.02	155	100	0.90	0.05	0.00	0.04
P-31	J-15	J-17	55.22	155	100	-0.26	0.01	0.00	0.00
P-32	J-17	J-06	83.74	155	100	0.43	0.02	0.00	0.01
P-33	J-26	J-23	77.39	155	100	2.13	0.11	0.02	0.21
P-34	J-13	J-12	139.45	155	100	1.11	0.06	0.01	0.06
P-35	J-12	J-14	75.45	155	100	-1.82	0.10	0.01	0.16
P-36	J-14	J-16	76.66	155	100	-2.49	0.13	0.02	0.28
P-37	J-16	J-06	80.14	155	100	-1.66	0.09	0.01	0.13
P-38	J-06	J-18	76.36	155	100	-1.22	0.06	0.01	0.08
P-39	J-18	J-20	78.48	155	100	-2.27	0.12	0.02	0.23
P-40	J-20	J-03	78.86	155	100	-2.74	0.15	0.03	0.33
P-41	J-03	J-27	62.15	155	100	-2.92	0.15	0.02	0.38
P-42	J-27	J-21	170.86	250	110	5.41	0.11	0.02	0.10
P-43	J-21	J-26	261.65	250	110	4.52	0.09	0.02	0.07
P-44	J-23	J-19	92.92	155	100	2.26	0.12	0.02	0.23
P-45	J-25	J-32	159.71	250	110	0.77	0.02	0.00	0.00
P-46	J-30	J-25	325.15	204	110	-0.31	0.01	0.00	0.00
P-47	J-31	J-02	148.17	297	120	-4.26	0.06	0.00	0.02
P-48	J-32	J-30	83.58	204	110	0.05	0.00	0.00	0.00
P-49	J-31	J-32	116.34	250	110	-0.46	0.01	0.00	0.00
P-50	J-33	J-25	100.25	250	110	1.26	0.03	0.00	0.01

Scenario 3 Minimum Hour Demand Modeling Results

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
J-01	0.00	107.50	161	524
J-02	0.00	107.50	161	524
J-03	0.22	107.50	161	523
J-04	0.32	107.50	161	522
J-05	0.31	107.50	161	522
J-06	0.00	107.50	161	523
J-07	0.32	107.50	161	523
J-08	0.15	107.50	161	523
J-09	0.64	107.50	161	523
J-10	1.17	107.50	161	523
J-11	0.09	107.50	161	522
J-12	0.19	107.50	161	522
J-13	0.18	107.50	161	522
J-14	0.17	107.50	161	522
J-15	0.15	107.50	161	523
J-16	0.17	107.50	161	523
J-17	0.08	107.50	161	523
J-18	0.28	107.50	161	523
J-19	0.21	107.50	161	523
J-20	0.21	107.50	161	523
J-21	0.11	107.50	161	523
J-22	1.81	107.50	161	523
J-23	0.12	107.50	161	523
J-24	0.00	107.50	161	524
J-25	0.18	107.50	161	524
J-26	0.00	107.50	161	523
J-27	0.00	107.50	161	524
J-28	1.27	107.50	161	524
J-29	0.00	107.50	161	524
J-30	0.36	107.50	161	524
J-31	0.63	107.50	161	524
J-32	0.26	107.50	161	524
J-33	1.40	107.50	161	524

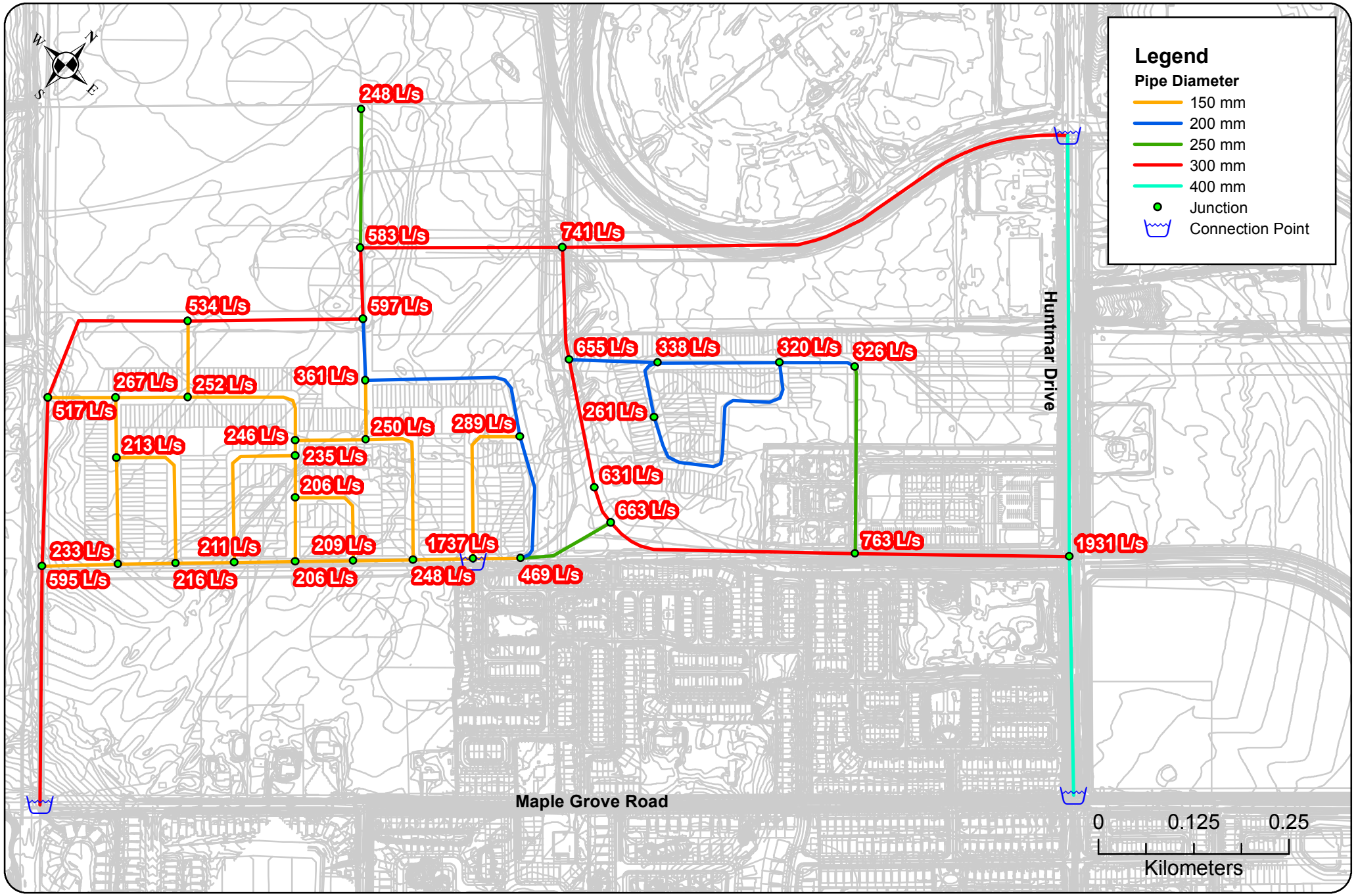
Scenario 3 Peak Hour Demand Modeling Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-01	J-29	RES-2	313.28	406	120	-57.98	0.45	0.19	0.62
P-02	RES-1	J-29	552.35	406	120	-30.59	0.24	0.11	0.19
P-03	J-01	J-31	171.09	297	120	6.56	0.09	0.01	0.05
P-04	J-02	RES-1	698.67	297	120	-15.40	0.22	0.17	0.24
P-05	J-02	J-09	264.74	297	120	7.27	0.10	0.02	0.06
P-06	J-01	J-28	51.01	297	120	-6.56	0.09	0.00	0.05
P-07	J-09	J-22	93.11	297	120	-2.53	0.04	0.00	0.01
P-08	J-22	J-07	230.24	297	120	-9.12	0.13	0.02	0.09
P-09	J-07	J-05	252.27	297	120	-14.66	0.21	0.06	0.22
P-10	J-05	J-04	221.60	297	120	-22.23	0.32	0.11	0.48
P-11	J-24	J-29	280.71	297	120	-27.39	0.40	0.20	0.71
P-12	J-28	J-24	332.73	297	120	-14.88	0.21	0.08	0.23
P-13	RES-3	J-04	312.73	297	120	32.28	0.47	0.30	0.96
P-14	RES-4	J-03	3.02	204	110	21.73	0.66	0.01	3.39
P-15	J-05	J-11	89.15	155	100	4.20	0.22	0.07	0.73
P-16	J-07	J-08	99.85	155	100	2.05	0.11	0.02	0.20
P-17	J-09	J-10	181.97	297	120	6.33	0.09	0.01	0.05
P-18	J-11	J-13	78.93	155	100	1.67	0.09	0.01	0.13
P-19	J-13	J-14	208.22	155	100	1.17	0.06	0.01	0.07
P-20	J-15	J-16	215.66	155	100	-0.25	0.01	0.00	0.00
P-21	J-17	J-18	151.69	155	100	-0.34	0.02	0.00	0.01
P-22	J-23	J-20	215.13	155	100	-1.49	0.08	0.02	0.11
P-23	J-21	J-03	217.33	155	100	-4.07	0.22	0.15	0.69
P-24	J-22	J-26	80.79	250	110	-3.16	0.06	0.00	0.04
P-25	J-24	J-33	245.38	250	110	12.50	0.25	0.11	0.45
P-26	J-04	J-12	100.27	155	100	6.56	0.35	0.17	1.68
P-27	J-27	J-28	129.64	250	110	5.63	0.11	0.01	0.10
P-28	J-11	J-08	95.00	155	100	1.51	0.08	0.01	0.11
P-29	J-08	J-19	190.90	155	100	1.87	0.10	0.03	0.16
P-30	J-19	J-15	20.02	155	100	1.61	0.09	0.00	0.12
P-31	J-15	J-17	55.22	155	100	0.17	0.01	0.00	0.00
P-32	J-17	J-06	83.74	155	100	-0.40	0.02	0.00	0.01
P-33	J-26	J-23	77.39	155	100	1.95	0.10	0.01	0.18
P-34	J-13	J-12	139.45	155	100	-1.48	0.08	0.01	0.11
P-35	J-12	J-14	75.45	155	100	2.97	0.16	0.03	0.39
P-36	J-14	J-16	76.66	155	100	2.31	0.12	0.02	0.24
P-37	J-16	J-06	80.14	155	100	0.17	0.01	0.00	0.00
P-38	J-06	J-18	76.36	155	100	-0.23	0.01	0.00	0.00
P-39	J-18	J-20	78.48	155	100	-3.60	0.19	0.04	0.55
P-40	J-20	J-03	78.86	155	100	-7.36	0.39	0.16	2.08
P-41	J-03	J-27	62.15	155	100	7.91	0.42	0.15	2.37
P-42	J-27	J-21	170.86	250	110	2.28	0.05	0.00	0.02
P-43	J-21	J-26	261.65	250	110	5.11	0.10	0.02	0.09
P-44	J-23	J-19	92.92	155	100	2.08	0.11	0.02	0.20
P-45	J-25	J-32	159.71	250	110	-1.98	0.04	0.00	0.01
P-46	J-30	J-25	325.15	204	110	-1.07	0.03	0.00	0.01
P-47	J-31	J-02	148.17	297	120	-8.13	0.12	0.01	0.08
P-48	J-32	J-30	83.58	204	110	2.84	0.09	0.01	0.08
P-49	J-31	J-32	116.34	250	110	7.71	0.16	0.02	0.18
P-50	J-33	J-25	100.25	250	110	1.07	0.02	0.00	0.00

Scenario 3 Peak Hour Demand Modeling Results

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
J-01	0.00	107.50	155	470
J-02	0.00	107.50	155	470
J-03	2.40	107.50	156	471
J-04	3.49	107.50	156	471
J-05	3.37	107.50	155	470
J-06	0.00	107.50	155	469
J-07	3.49	107.50	155	470
J-08	1.69	107.50	155	470
J-09	3.47	107.50	155	470
J-10	6.33	107.50	155	469
J-11	1.02	107.50	155	470
J-12	2.11	107.50	155	470
J-13	1.99	107.50	155	470
J-14	1.82	107.50	155	469
J-15	1.69	107.50	155	469
J-16	1.89	107.50	155	469
J-17	0.91	107.50	155	469
J-18	3.03	107.50	155	469
J-19	2.35	107.50	155	469
J-20	2.27	107.50	155	470
J-21	1.24	107.50	155	470
J-22	9.75	107.50	155	470
J-23	1.36	107.50	155	469
J-24	0.00	107.50	156	470
J-25	1.99	107.50	155	469
J-26	0.00	107.50	155	470
J-27	0.00	107.50	155	470
J-28	13.96	107.50	155	470
J-29	0.00	107.50	156	472
J-30	3.91	107.50	155	469
J-31	6.98	107.50	155	470
J-32	2.89	107.50	155	469
J-33	11.43	107.50	155	469

Appendix C Fire Flow Results

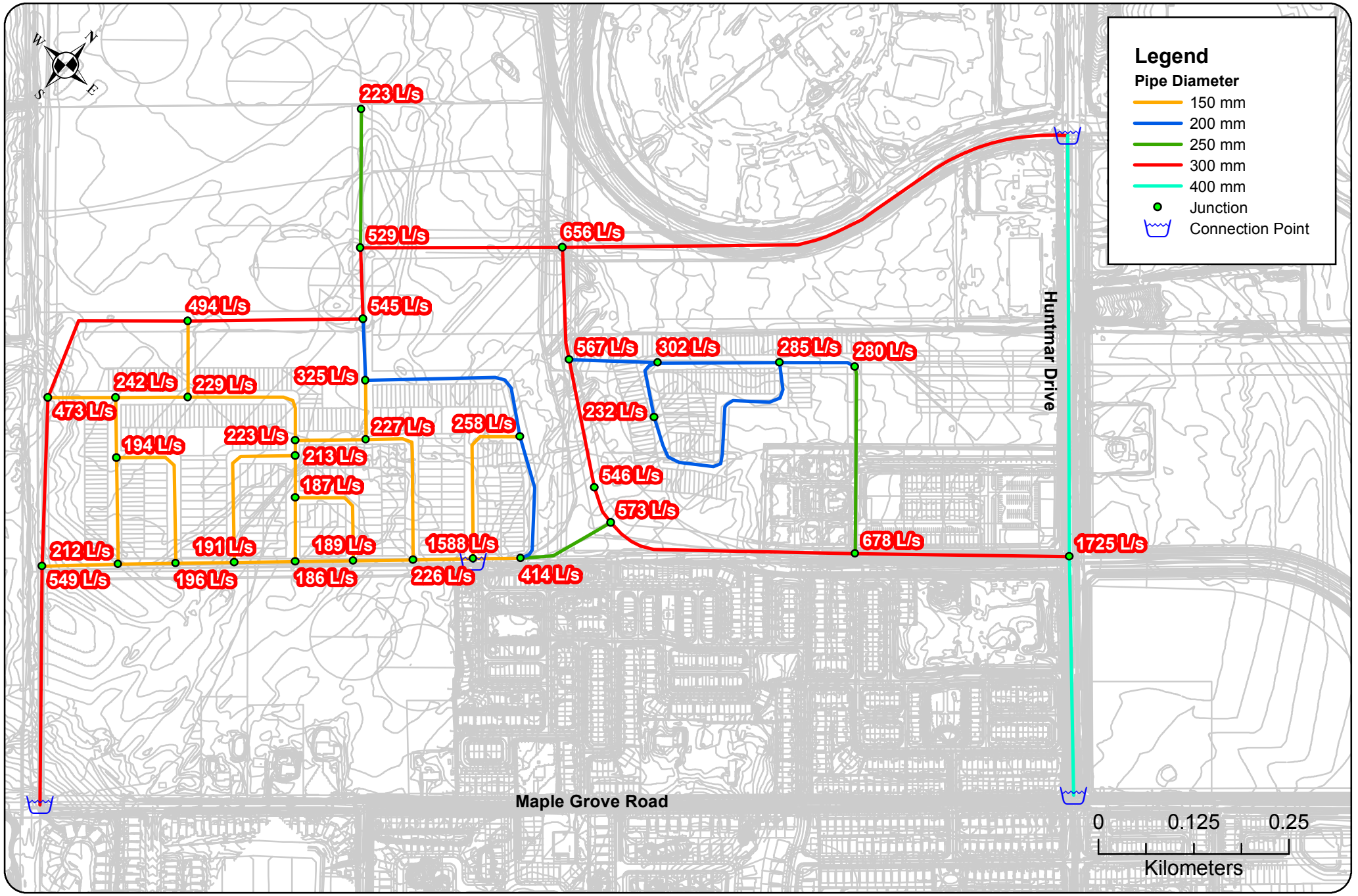


GeoAdvice Engineering Inc.

Project:	**Hydraulic Capacity and Modeling Analysis** **195 Huntmar Drive Subdivision Development**
Client:	**David Schaeffer Engineering Ld.**
Project ID:	**2016-055-DSE**
Date:	**September 2016**
Created by:	**AM**
Reviewed by:	**WdS**

Scenario 1
Available Fire Flow
Results @ 20 psi

Figure C.1

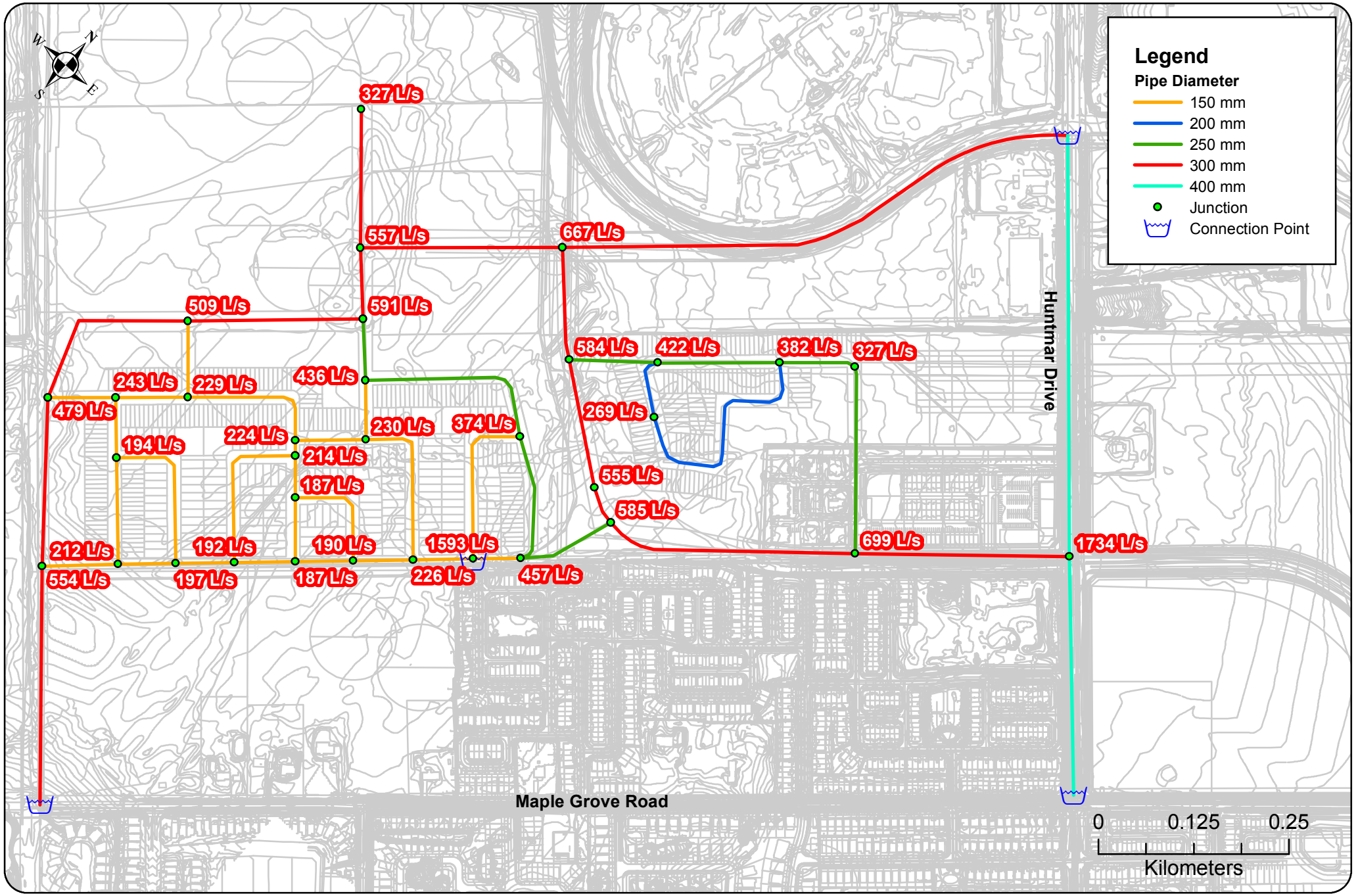


GeoAdvice Engineering Inc.

Project:	**Hydraulic Capacity and Modeling Analysis** **195 Huntmar Drive Subdivision Development**
Client:	**David Schaeffer Engineering Ld.**
Project ID:	**2016-055-DSE**
Date:	**September 2016**
Created by:	**AM**
Reviewed by:	**WdS**

Scenario 2
Available Fire Flow
Results @ 20 psi

Figure C.2



GeoAdvice Engineering Inc.

Project:	**Hydraulic Capacity and Modeling Analysis** **195 Huntmar Drive Subdivision Development**
Client:	**David Schaeffer Engineering Ld.**
Project ID:	**2016-055-DSE**
Date:	**September 2016**
Created by:	**AM**
Reviewed by:	**WdS**

Scenario 3
Available Fire Flow
Results @ 20 psi

Figure C.3

Scenario 1 Fire Flow Modeling Results

ID	Static Demand (L/s)	Fire-Flow Demand (L/s)	Residual Pressure (kPa)	Available Flow at Hydrant (L/s)	Available Flow Pressure (kPa)
J-01	0.00	283	316	631	140
J-02	0.00	250	373	741	140
J-03	1.09	167	384	1737	140
J-04	1.59	283	325	595	140
J-05	1.53	283	301	517	140
J-06	0.00	167	233	206	140
J-07	1.59	250	331	534	140
J-08	0.77	167	296	252	140
J-09	1.93	250	342	583	140
J-10	3.52	250	129	248	140
J-11	0.46	167	311	267	140
J-12	0.96	167	276	233	140
J-13	0.90	167	245	213	140
J-14	0.83	167	252	216	140
J-15	0.77	167	275	235	140
J-16	0.86	167	242	211	140
J-17	0.41	167	233	206	140
J-18	1.38	167	235	209	140
J-19	1.07	167	287	246	140
J-20	1.03	167	283	248	140
J-21	0.56	283	146	289	140
J-22	5.42	250	340	597	140
J-23	0.62	167	292	250	140
J-24	0.00	167	435	763	140
J-25	0.90	167	358	320	140
J-26	0.00	283	214	361	140
J-27	0.00	283	252	469	140
J-28	6.34	283	316	663	140
J-29	0.00	167	483	1931	140
J-30	1.78	167	314	261	140
J-31	3.17	283	331	655	140
J-32	1.31	167	366	338	140
J-33	5.58	283	194	326	140

Scenario 2 Fire Flow Modeling Results

ID	Static Demand (L/s)	Fire-Flow Demand (L/s)	Residual Pressure (kPa)	Available Flow at Hydrant (L/s)	Available Flow Pressure (kPa)
J-01	0.00	283	260	546	140
J-02	0	250	315	656	140
J-03	1.09	167	348	1588	140
J-04	1.59	283	285	549	140
J-05	1.53	283	259	473	140
J-06	0	167	185	186	140
J-07	1.59	250	291	494	140
J-08	0.77	167	248	229	140
J-09	1.93	250	295	529	140
J-10	3.52	250	82	223	140
J-11	0.46	167	263	242	140
J-12	0.96	167	228	212	140
J-13	0.9	167	198	194	140
J-14	0.83	167	203	196	140
J-15	0.77	167	227	213	140
J-16	0.86	167	193	191	140
J-17	0.41	167	185	187	140
J-18	1.38	167	187	189	140
J-19	1.07	167	239	223	140
J-20	1.03	167	238	226	140
J-21	0.56	283	108	258	140
J-22	5.42	250	297	545	140
J-23	0.62	167	243	227	140
J-24	0	167	372	678	140
J-25	0.9	167	295	285	140
J-26	0	283	177	325	140
J-27	0	283	220	414	140
J-28	6.34	283	262	573	140
J-29	0	167	406	1725	140
J-30	1.78	167	252	232	140
J-31	3.17	283	270	567	140
J-32	1.31	167	304	302	140
J-33	5.58	283	128	280	140

Scenario 3 Fire Flow Modeling Results

ID	Static Demand (L/s)	Fire-Flow Demand (L/s)	Residual Pressure (kPa)	Available Flow at Hydrant (L/s)	Available Flow Pressure (kPa)
J-01	0	283	264	555	140
J-02	0	250	316	667	140
J-03	1.09	167	348	1593	140
J-04	1.59	283	286	554	140
J-05	1.53	283	261	479	140
J-06	0	167	186	187	140
J-07	1.59	250	294	509	140
J-08	0.77	167	248	229	140
J-09	1.93	250	298	557	140
J-10	3.52	250	220	327	140
J-11	0.46	167	263	243	140
J-12	0.96	167	228	212	140
J-13	0.90	167	198	194	140
J-14	0.83	167	203	197	140
J-15	0.77	167	228	214	140
J-16	0.86	167	194	192	140
J-17	0.41	167	186	187	140
J-18	1.38	167	188	190	140
J-19	1.07	167	240	224	140
J-20	1.03	167	239	226	140
J-21	0.56	283	200	374	140
J-22	5.42	250	301	591	140
J-23	0.62	167	247	230	140
J-24	0	167	373	699	140
J-25	0.9	167	333	382	140
J-26	0	283	232	436	140
J-27	0	283	233	457	140
J-28	6.34	283	267	585	140
J-29	0	167	406	1734	140
J-30	1.78	167	284	269	140
J-31	3.17	283	273	584	140
J-32	1.31	167	341	422	140
J-33	5.58	283	181	327	140

APPENDIX D

- Sanitary Sewer Design Sheet (DSEL, May 2018)
- Excerpt from Maple Grove Trunk Sanitary Sewer Design Sheet (Stantec, CCL, IBI, June 2006)
- KWPS ECA (MOECC, September 2015)

SANITARY SEWER CALCULATION SHEET

CLIENT: **2325483 Ontario Inc.**
LOCATION: **195 Huntmar Drive**
FILE REF: **12-624**
DATE: **24-May-18**

DESIGN PARAMETERS

Avg. Daily Flow Res.	280	L/p/d	Peak Fact Res. Per Harmons, where K=0.8				Infiltration / Inflow	0.33 L/s/ha
Avg. Daily Flow Comm.	28,000	L/ha/d	Peak Fact. Comm.	1.5	or	1	Min. Pipe Velocity	0.60 m/s full flowing
Avg. Daily Flow Instit.	28,000	L/ha/d	Peak Fact. Instit.	1.5	or	1	Max. Pipe Velocity	3.00 m/s full flowing
Avg. Daily Flow Indust.	35,000	L/ha/d	Peak Fact. Indust. per MOE graph				Mannings N	0.013
Avg. Park Flow	9,300	L/ha/d						

Location			Residential Area and Population									Commercial		Park		Institutional		Industrial			Infiltration				Pipe Data							
Area ID	Up	Down	Area	Number of Units				Pop.	Cumulative		Peak.	Q_{res}	Area	Accu.	Area	Accu.	Area	Accu.	Area	Accu.	Q_{C+I+I}	Total	Accu.	Infiltration	Total	DIA	Slope	Length	$A_{hydraulic}$	R	Velocity	Q_{cap}	Q / Q full
				by type					Area	Pop.	Fact.			Area		Area		Area		Area				Flow	Flow								
			(ha)	Singles	Semi's	Town's	Apt's		(ha)		(-)	(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(mm)	(%)	(m)	(m^2)	(m)	(m/s)	(L/s)	(-)
A			65.190					4200.0	65.190	4200.0	2.85	38.81		0.00		0.00		0.00		0.00	0.00	65.190	65.190	21.513	60.32								
B			0.000					0.0	65.190	4200.0	2.85	38.81		0.000	0.38	0.380		0.000		0.000	0.04	0.380	65.570	21.638	60.49								
C			19.480					1593.0	84.670	5793.0	2.75	51.59		0.000		0.380		0.000		0.000	0.04	19.480	85.050	28.067	79.70								
D			2.270					346.0	86.940	6139.0	2.73	54.29		0.000		0.380		0.000		0.000	0.04	2.270	87.320	28.816	83.15								
E			0.000						86.940	6139.0	2.73	54.29	4.08	4.080		0.380		0.000		0.000	2.02	4.080	91.400	30.162	86.48								
F			0.000						86.940	6139.0	2.73	54.29	1.57	5.650		0.380		0.000		0.000	2.79	1.570	92.970	30.680	87.76								
G			0.510					20.0	87.450	6159.0	2.73	54.45		5.650		0.380		0.000		0.000	2.79	0.510	93.480	30.848	88.08								
H			0.000						87.450	6159.0	2.73	54.45	5.95	11.600		0.380		0.000		0.000	5.68	5.950	99.430	32.812	92.94								
I			0.000						87.450	6159.0	2.73	54.45	1.30	12.900		0.380		0.000		0.000	6.31	1.300	100.730	33.241	94.00								
J			0.000						87.450	6159.0	2.73	54.45	2.28	15.180		0.380		0.000		0.000	7.42	2.280	103.010	33.993	95.86								
K			0.000						87.450	6159.0	2.73	54.45		15.180		0.380		0.000		0.000	7.42	0.000	103.010	33.993	95.86								
Part of MSS 32			0.000						87.450	6159.0	2.73	54.45	16.04	31.220		0.380		0.000		0.000	15.22	16.040	119.050	39.287	108.95								
Part of MSS 32	1	2	0.000						87.450	6159.0	2.73	54.45	5.73	36.950		0.380		0.000		0.000	18.00	5.730	124.780	41.177	113.63	450	0.35	900.0	0.159	0.113	1.06	168.7	0.67
L			0.000					0.0	0.000	0.0	3.80	0.00		0.000		0.000	3.11	3.11		0.000	1.51	3.110	3.110	1.026	2.54								
M			0.000					0.0	0.000	0.0	3.80	0.00		0.000		0.000	7.23	10.340		0.000	5.03	7.230	10.340	3.412	8.44								
N			0.000					0.0	0.000	0.0	3.80	0.00		0.000	5.98	5.980		10.340		0.000	5.67	5.980	16.320	5.386	11.06								
Part of MSS 34			0.000					0.0	0.000	0.0	3.80	0.00	8.15	8.150		5.980		10.340		0.000	9.63	8.150	24.470	8.075	17.71								
Part of MSS 34	3	2	0.000					0.0	0.000	0.0	3.80	0.00	6.61	14.760		5.980		10.340		0.000	12.85	6.610	31.080	10.256	23.10	250	0.30	300.0	0.049	0.063	0.66	32.6	0.71
-	2	10	0.000					0.0	87.450	6159.0	2.73	54.45		51.71		6.36		10.34		0.00	30.85	0.000	155.860	51.434	136.73	450	0.30	315.0	0.159	0.113	0.98	156.2	0.88

SANITARY SEWER DESIGN SHEET
PROJECT : Kanata West Servicibility Study
LOCATION : CITY OF OTTAWA

PROJECT: 3598-LD-03
DATE: April 2005
DESIGN: JM
FILE: 3598LD.sewers.XLS

MODEL 1 ULTIMATE (population based criteria..ICI simultaneous peaking)

LOCATION				TOTAL AREA	RESIDENTIAL							EMPLOYMENT/RETAIL/BUSINESS PARK/OPEN SPACES							INFILTRATION			TOTAL FLOW	PROPOSED SEWER						HARMON PF	ACTUAL q/Q	va/Vf	ACTUAL VELOCITY
STREET	FROM MH	TO MH			APPLIC AREA	UNIT/Ha	TOTAL UNITS	POPULATION INDIV	POPULATION ACCUM	PEAK FACTOR	PEAK FLOW	APPLIC AREA	ACCUM AREA	TOTAL AREA	FLOW RATE	PEAK FLOW INDIV	PEAK FLOW ACCUM	PEAK FLOW TOTAL	AREA (Ha) INDIV	AREA (Ha) CUMUL	TOTAL CUMUL	PEAK FLOW		CAPACITY	VELOCITY (full)	LGTH.	PIPE	GRADE	AVAIL. CAP.				
				(Ha)	(Ha)						(l/s)	(Ha)	(Ha)	(Ha)	(l/Ha/d)	(l/s)	(l/s)	(l/s)				(l/s)	(l/s)	l/s	m/s	(m)	(mm)	%	(%)				(m/s)
Campeau Drive Trunk Sewer	1	2	Area 1 (PBP)	38.11								38.11	38.11		35000	23.16	23.16		38.11	38.11												
			Area 2 (PBP)	27.29								27.29	65.40		35000	16.58	39.74		27.29	65.40												
			Area 3 Ext Employment	14.05								14.05	79.45		50000	12.20	51.94		14.05	79.45												
			Area 4 HP Employment	10.93								10.93	90.38	90.38	50000	9.49	61.42	61.42	10.93	90.38	90.38	25.31	86.73	283.79	1.27	525.0	525	0.40	69.44%				
	2	3	Area 5 Residential	29.19	29.19	19	555	1664	1664	3.65	24.58			90.38				61.42	29.19	29.19									3.65			
			Area 9 Ext Employment	8.45							24.58	8.45	8.45	98.83	50000	7.34	7.34	68.76	8.45	128.02	128.02	35.85	129.18	286.61	0.98	700.0	600	0.20	54.93%		0.451	0.830	0.815
	14	3	Area 6/8 Ext Employment	16.65								16.65	16.65		50000	14.45	14.45		16.65	16.65												
			Area 7 HP Employment	5.48								5.48	22.13	22.13	50000	4.76	19.21	19.21	5.48	22.13	22.13	6.20	25.41	148.74	0.91	910.0	450	0.25	82.92%		0.171	0.630	0.571
	3	4							1664	3.65	24.58	0.00	0.00	120.96		0.00	0.00	87.97	0.00	0.00	150.15	42.04	154.59	392.29	1.06	300.0	675	0.20	60.59%	3.65	0.394	0.790	0.839
	4A	4	Area 10 Residential	27.86	27.86	19	529	1588	1588	3.66	23.55								27.86	27.86	27.86	7.80	31.36	148.74	0.91	750.0	450	0.25	78.92%	3.66	0.211	0.660	0.598
	4	5	14 Mixed Use	4.13	1.76	50	88	263	3515	3.38	48.17	2.37	2.37	123.33	35000	1.44	1.44	89.41	4.13	4.13	182.14	51.00	188.58	392.29	1.06	450.0	675	0.20	51.93%	3.38	0.481	0.840	0.892
	Queensway	5	Area 13 Community Retail	6.35								6.35	6.35	6.35	35000	3.86	3.86	3.86	6.35													
			Area 11/12 Mixed Use	11.80	5.02	50	251	752	752	3.88	11.81	6.79	13.14	13.14	35000	4.12	7.98	7.98	11.80	18.15	18.15	5.08	24.88	43.88	0.87	420.0	250	0.50	43.31%	3.88	0.567	0.880	0.762
	5	5A	Area 15 Community Retail	3.88				0	4267	3.31	57.19	3.88			35000	2.36			3.88											3.31			
First Line Road Sewer			Area 44	25.54							57.19	25.54	29.42	165.89	35000	15.52	17.88	115.27	25.54	29.42	229.71	64.32	236.77	519.43	1.14	300.0	750	*0.20*	54.42%		0.456	0.830	0.945
				229.71							57.19							115.27				64.32	236.77							3.23			
Signature Ridge		5A	Area 100 Residential	90.20	90.20	19	1714	5141	5141	3.23	67.35	0.00											65.00										
Signature Ridge		5A	Area 100 Non-Residential	4.88							67.35	4.88	4.88	4.88	50000	4.24	4.24	4.24	95.08	95.08	95.08	26.62	98.21										
Intersticial Lands & Broughton/Richardson		5A																															
Total To SRPS	**5A**	**SRPS**		**324.79**	**154.02**		**3136**		**9409**		**124.54**	**170.77**						**119.51**			**324.79**	**90.94**	**399.98**	**580.53**	**1.27**	**30.0**	**750**	**0.25**	**31.10%**	2.98	0.689	0.940	1.197
Palladium Drive Trunk Sewer	6	7	Area 32 (PBP)	57.03								57.03	57.03		50000	49.51	49.51		57.03	57.03													
			Area 32A Park	8.34								8.34	65.37		0	0.00	49.51		8.34	65.37													
			Area 33/34 Ext Employment	54.85								54.85	120.22	120.22	50000	47.61	97.12	97.12	54.85	120.22	120.22													
	7	8	Area 37 Mixed Use	36.70	15.60	50	780	2340	2340	3.53	33.47	21.10	21.10	141.32	50000	18.32	18.32	115.44	36.70	36.70	156.92	43.94	192.85	455.83	1.23	925.0	675	0.27	57.69%	3.53	0.423	0.810	1.000
				156.92	15.60		780		2340		33.47	141.32						115.44	156.92		156.92	43.94	192.85							3.53			
Corel Centre Etc. (Existing Sewer) *		16	Area 35 HP Employment	6.05								6.05	6.05		30000	3.15	3.15		6.05													
		16	Area 36 (Corel Centre)																			30.00											
		16	Area 38 Exten Employment	20.15								20.15	26.20	26.20	14400	5.04	8.19	8.19	20.15	26.20	26.20	7.34	45.52				*Existing*						
First Line Road Sewer	15	16	Area 40 Employment	14.59								14.59	14.59		35000	8.87	8.87		14.59	14.59													
			Area 41 Employment	11.97								11.97	26.56		35000	7.27	16.14		11.97	26.56													
			Area 42 Employment	20.66								20.66	47.22		35000	12.55	28.69		20.66	47.22													
			Area 43 Employment	28.89								28.89	76.11	76.11	35000	17.55	46.25	46.25	28.89	76.11	76.11	21.31	67.56	224.35	1.00	525.0	525	0.25	69.89%		0.301	0.730	0.733
Carp River Trunk	16	8	Nothing To Add	102.31	15.60		780		2340	3.53	33.47	102.31	102.31	102.31	0	0.00	54.44	54.44	0.00	102.31	102.31	28.65	113.08	286.61	0.98	400.0	600	0.20	60.54%	3.53	0.395	0.790	0.776
Carp River Trunk	8	10A	Nothing To Add	259.23	15.60		780		2340		33.47	0.00	0.00	243.63		0.00	0.00	169.87	0.00	139.01	259.23	109.92	305.93	579.95	1.05	550.0	825	0.15	47.25%	3.53	0.528	0.860	0.904
																														3.72			
Marie Grove Road Trunk Sewer	9	10	Area 18/19 Exist. Residential	23.34	23.34	19	443	1330	1330										23.34	23.34										3.03	0.327	0.740	1.027
			Area 22/26/27 Residential	79.32	79.32	30	2380	7139	8469	3.03	103.82								79.32	102.66	102.66	28.74	132.56	405.11	1.39	775.0	600	0.40	67.28%				
																														3.20			
Hazeldean/Huntmar Trunk Sewer	11	12	Area 16/20 Residential	99.01	99.01	19	1881	5644	5644	3.20	73.06								99.01	99.01													
			Area 16/20 Commercial	33.50								33.50	33.50	33.50	50000	29.08	29.08	29.08	33.50	132.51													
			Area 16/20 Open Space	14.13								14.13							14.13	146.64													
			Area 17 Ex. Commercial	3.44							73.06	3.44	36.94	36.94	35000	2.09	31.17	31.17	3.44	150.08	150.08	42.02	146.26	554.82	1.50	775.0	675	0.40	73.64%		0.264	0.700	1.051
	12	10	Area 21 Exist. Employment	10.89								10.89	10.89	10.89	50000	9.45	9.45		10.89	10.89													
			Area 19A Exist Residential	6.63	6.63	19	126	378									9.45		6.63	17.52													
			Area 23/24 Community Retail	17.61								17.61	28.50	28.50	35000	10.70	20.15	51.32	17.61	35.13													
			Area 28/30 Residential	27.10	27.10	30	813	2439	8460	3.03	103.72	0.00	0.00	65.44				51.32	27.10	62.23	212.31	59.45	214.49	519.43	1.14	950.0	750	0.20	58.71%	3.03	0.413	0.800	0.911
Marie Grove Road Trunk Sewer	10	10A	Area 39 Mixed Use	21.13	8.98	50	449	1347				12.15	12.15	77.59	35000	7.38	7.38	58.71	21.13											2.66	0.550	0.870	1.056
			Area 29 Residential	15.00	15.00	30	450	1350	19627	2.66	211.54							58.71	15.00	36.13	351.10	98.31	368.56	669.89	1.21	1000.0	825	0.20	44.98%				
Carp River Trunk Sewer	13	10A	Area 25 Community Retail	20.24								20.24	20.24	20.24	35000	12.30	12.30	12.30	20.24														
			Area 31 residential	38.72	38.72	30	1162	3485	3485	3.39	47.80							12.30	38.72	58.96	58.96	16.51	76.61	320.17	1.10	1000.0	600	0.25	76.07%	3.39	0.239	0.680	0.746
		10A	Area 31A (PBP)	0.75								0.75	0.75	0.75	50000	0.65	0.65	0.65	0.75	0.75	0.75	0.21	0.86	36.69	0.72	100.0	250	0.35	97.65%		0.023	0.340	0.246
Pumping Station 2 to KWPS	**10A**	**KWPS**		**670.04**	**313.70**		**8484**		**25451**		**292.82**	**356.34**						**241.53**			**670.04**	**224.95**	**759.29**	**1273.71**	**1.43**	**30.0**	**1050**	**0.20**	**40.39%**	2.55	0.596	0.900	1.283
																														2.41			
STUDY TOTALS				994.83	467.72		11620		34860			527.11																				

Average Daily Per capita Flow Rate =	350 l/cap/d
Infiltration Allowance Flow Rate =	0.28 l/sec/Ha
Residential Peaking Factor = 1+(14/(4+(P^0.5))), P=Pop. in 1000's, Max of 4	
Population density per unit =	3.00
Peak Fof Employment/Retail/Business Park =	1.50

Mixed Uses Assumes: 15% Community Retail, 42.5% Business Park and 42.5% Residential

Revision No. 1: April 01, 2005
Revision No. 2: April 11, 2005
Revision No. 3: April 21, 2005
Revision No. 4: June 07, 2005
Revision No. 5: August 10, 2005
Revision No. 6: Oct. 14, 2005
Revision No. 7: Nov. 10, 2005
Revision No. 8: Nov. 11, 2005
Revision No. 9: Apr. 19, 2006

Stantec
CCL/IBI

FIG. 4.2-1

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 7443-9Y8Q8R
Issue Date: September 9, 2015

City of Ottawa
100 Constellation Dr
Nepean, Ontario
K2G 6J8

Site Location: 1590 Maple Grove Road
Ottawa City, Ontario

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

construction of the proposed Kanata West sanitary sewage Pumping Station and dual forcemains, located on Maple Grove Road to service the Kanata West community development area south of Highway 417 and adjacent areas in Stittsville for a sanitary drainage area consisting of about 6,300 residences and commercial space for about 24,000 employees, as part of the Kanata West Concept Plan development, in the City of Ottawa, Ontario.

SANITARY SEWAGE PUMP STATION

- one (1) sanitary sewage pump station (Kanata West Pumping Station) to service both residential and commercial land use; initially the Kanata West Pumping Station will have a firm capacity at a firm peak flow of 528 L/s, with a TDH of 41.2 metres; with an ultimate firm peak flow of 1250 L/s (anticipated by 2031) with a TDH of 48.2 metres; the pump station will convey wastewater from the pumping station to the existing Glen Cairn Trunk Sewer on Eagleson Road; pump station has a submersible dry pit and consists of the following:
  - = bypass chamber upstream of the pump station (to directly bypass sewage flows to the forcemain downstream of the pump station for maintenance or emergency purposes);
  - = two (2) wet wells each with two pumps (1 duty and 1 standby); only one wet well to be in operation at the initial stage; the other can be used during emergency situations or for maintenance requirements;
  - = two (2) variable speed frequency pumps (one duty and one standby) for each wet well;
  - = inlet sanitary sewer (1200 mm diameter, with an invert elevation of approximately 87.64 metres);
  - = mechanical bar screens, inlet isolation gates, forcemain plug valves, weir gates for level control, swab launchers, HVAC system and heating boilers, and liquid and vapour phase odour control systems;
  - = level transducers to allow for differential level control of the mechanical screen and pump cycling; and

monitoring equipment for methane and hydrogen sulphide gas;

= emergency overflow elevation at about 94.80 metres, with level meter for overflow monitoring, the pumping station overflow is sized for the ultimate station capacity of 1,250 L/s;
= overflow will discharge to the Carp River under initial conditions and subsequently, to the adjacent proposed stormwater management pond under the ultimate conditions;
= SCADA communications monitors pump station with a backup communications system;
= forcemain discharge chamber, controlled and monitored remotely through fibre optic telecommunications connection to the City SCADA network, discharge chamber includes a UPS with 4 hours of power backup; and
= 1763 kW emergency standby generator (separate Environmental Compliance Approval Number 7754-9YAKHB, Issued August 20, 2015) on site to provide 24 hour standby power at peak demand during power failure;

FORCEMAIN

- twin 600 mm (inside diameter) HDPE forcemains that are each 3.7 kilometres in length and run east, from the pump station, along Maple Grove, north on Terry Fox, and west on Katimavik and discharges to the existing sanitary Glen Cairn Trunk Sewer on Eagleson Road; each forcemain outlet is controlled by an electrically actuated plug valve in the discharge chamber preventing the forcemains from partially draining between pumping cycles;
- two forcemain by-passes in the event of blockage:
  = one (1) by-pass at the pump station in a bypass chamber with a manually installed bypass, and
  = one (1) by-pass at approximately the halfway point on the length of the twin forcemains with manually operated valves.

all in accordance with:

1. the application dated December 15, 2014 and received on December 30, 2014;
2. all correspondences with the consultant Colin Goodwin, Stantec Consulting Ltd.
3. Memo titled, 'mem_kwps_MOE ECA Summary', dated August 10, 2015, by Colin Goodwin / Andrew Bernius / Gerald Bauer, Stantec Consulting Ltd.
4. final specifications and drawings provided by Colin Goodwin, Stantec Consulting Ltd.

For the purpose of this environmental compliance approval, the following definitions apply:

"Act" means the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended;

"Approval" means this entire document and any schedules attached to it, and the application;

"BOD5" (also known as TBOD5) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand;

"Director" means a person appointed by the Minister pursuant to section 5 of the EPA for the purposes of Part II.1 of the EPA;

"EPA" means the *Environmental Protection Act,* R.S.O. 1990, c.E.19, as amended;

"E. Coli" refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius;

"Emergency Situation" means a structural, mechanical or electrical failure that causes a temporary reduction in the capacity of the Sewage Pumping Station or an unforeseen flow condition that may result in:

a) danger to the health or safety of any person; or
b) injury or damage to any property, or serious risk of injury or damage to any property.

"Equivalent equipment" means a substituted equipment or like-for-like equipment that meets the required quality and performance standards of a named equipment;

"Event" in the context the Sewage Pumping Station located outside the Sewage Treatment Plant, means an action or occurrence, at the Sewage Pumping Station that causes a Sewage Pumping Station Overflow. An Event ends when there is no recurrence of a Sewage Pumping Station Overflow in the 12-hour period following the last Sewage Pumping Station Overflow. Two Events are separated by at least 12 hours during which there has been no recurrence of a Sewage Pumping Station Overflow;

"Limited Operational Flexibility" (LOF)) means any modifications that the Owner is permitted to make to the Works under this Approval;

"Ministry" means the ministry of the government of Ontario responsible for the EPA and OWRA and includes all officials, employees or other persons acting on its behalf;

"Notice of Modifications" means the form entitled "Notice of Modifications to Sewage Works";

"Owner" means The City of Ottawa and includes its successors and assignees;

"Previous Works" means those portions of the sewage works previously constructed and approved under an Approval;

"Professional Engineer" means a person entitled to practise as a Professional Engineer in the Province of Ontario under a licence issued under the Professional Engineers Act;

"Proposed Works" means the sewage works described in the Owner's application, this Approval, to the extent approved by this Approval;

"Sewage Pumping Station Overflow" means any discharge from a Sewage Pumping Station located outside the Sewage Treatment Plant that does not undergo any treatment or only receives partial treatment before it is discharged to the environment;

"Substantial Completion" has the same meaning as "substantial performance" in the Construction Lien Act; and

"Water Supervisor" means the Water Supervisor for the local safe drinking water branch office of the Ministry;

"Works" means the sewage works described in the Owner's application, and this Approval, and includes Proposed Works, Previous Works, and modifications made under Limited Operational Flexibility.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

1.1 The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

1.2 Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this Approval.

1.3 Where there is a conflict between a provision of any submitted document referred to in this Approval and the Conditions of this Approval, the Conditions in this Approval shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

1.4 Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

1.5 The requirements of this Approval are severable. If any requirement of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this Approval shall not be affected thereby.

1.6 The issuance of, and compliance with the Conditions of this Approval does not:

(a) relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement, including, but not limited to, the obligation to obtain approval from the local conservation authority necessary to construct or operate the sewage Works; or

(b) limit in any way the authority of the Ministry to require certain steps be taken to require the Owner to furnish any further information related to compliance with this Approval.

2. EXPIRY OF APPROVAL

2.1 The approval issued by this Approval will cease to apply to those parts of the Works which have not been constructed within **five (5) years** of the date of this Approval.

3. CHANGE OF OWNER

3.1 The Owner shall notify the Water Supervisor and the Director, in writing, of any of the following changes within thirty (30) days of the change occurring:

(a) change of Owner.

(b) change of address of the Owner.

(c) change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the *Business Names Act,* R.S.O. 1990, c.B17 shall be included in the notification to the Water Supervisor.

(d) change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the *Corporations Informations Act,* R.S.O. 1990, c. C39 shall be included in the notification to the Water Supervisor.

3.2 In the event of any change in ownership of the Works, other than a change to a successor municipality, the Owner shall notify in writing the succeeding owner of the existence of this Approval, and a copy of such notice shall be forwarded to the Water Supervisor and the Director.

4. UPON THE SUBSTANTIAL COMPLETION OF THE WORKS

4.1 Upon the Substantial Completion of the Works, the Owner shall prepare a statement, certified by a Professional Engineer, that the Works are constructed in accordance with this Approval, and upon request, shall make the written statement available for inspection by Ministry personnel.

4.2 Within **one (1) year** of the Substantial Completion of the Works, a set of as-built drawings showing the Works "as constructed" shall be prepared. These drawings shall be kept up to date through revisions undertaken from time to time and a copy shall be retained at the Works for the operational life of the Works.

5. SEWAGE PUMPING STATION OVERFLOW

5.1 Any Sewage Pumping Station Overflow is prohibited, except:

(a) in an Emergency Situation;

(b) where the Sewage Pumping Station Overflow is a direct and unavoidable result of a planned maintenance procedure, the Owner notified the Water Supervisor **fifteen (15) days** prior to the Sewage Pumping Station Overflow and the Water Supervisor has given written consent of the Sewage Pumping Station Overflow; or,

(c) where the Sewage Pumping Station Overflow is planned for research or training purposes, the discharger notified the Water Supervisor **fifteen (15) days** prior to the Sewage Pumping Station Overflow and the Water Supervisor has given written consent of the Sewage Pumping Station Overflow.

5.2 The Owner shall forthwith notify the Spills Action Centre (SAC) at 1-800-268-6060 or e-mail at moe.sac.moe@ontario.ca and the Medical Officer of Health of every Sewage Pumping Station Overflow Events. This notice shall include, at a minimum, the following information:

(a) the date and time at which the Event(s) started,

(b) duration of the Event(s);

(c) the location of the Event**(s)**;

(d) the measured or estimated volume of the Event(s) (unless the Event(s) is/are ongoing);

(e) the reason for the Event (s), and

(f) the date and time of contact along with the names of all persons who were contacted and informed by the Owner about the Event(s) in order for such persons to make decisions regarding the occupational health and safety of the workers they supervise, in the case of a contractor working in the Carp River corridor between the pump station and Richardson Side Road.;

5.3 The Owner shall submit Sewage Pumping Station Overflow Event Reports to the Ministry's local office on an annual basis, no later than forty-five (45) days following the end of the calendar year covered by the Event Report. Event Reports maybe in an electronic format as acceptable to the Ministry. In each Event Report the Owner shall include, at a minimum, the following information on every Event(s) that occurred:

(a) the date and time at which the Event(s) started,

(b) duration of the Event(s);

(c) the location of the Event**(s)**;

(d) the measured or estimated volume of the Event(s) (unless the Event(s) is/are ongoing);

(e) the reason for the Event(s), and

(f) the date and time of contact along with the names of all persons who were contacted and informed by the Owner about the Event(s) in order for such persons to make decisions regarding the occupational health and safety of the workers they supervise, in the case of a contractor working in the Carp River corridor between the pump station and Richardson Side Road.;

(5.4) Within one (1) year from the date of issuance of this Approval, the Owner shall provide to the Director and the Water Supervisor a risk communication plan that will have been endorsed in writing by the Medical Officer of Health of the City of Ottawa. This risk communication plan shall address how the Owner will communicate the hazards, created by an Event, to those persons who use, for recreational purposes, the Carp River corridor between the pump station and Richardson Side Road.

5.5 The Owner shall use best efforts to collect a representative sample consisting of a minimum of two (2) grab samples of the Sewage Pumping Station Overflow and have it analysed for parameters outlined in Table 1 of Condition 7.2 using the protocols specified in Condition 7.3, one at the beginning of the Event and the second approximately near the end of the Event, to best reflect the effluent quality of such Sewage Pumping Station Overflow.

5.6 The Owner shall maintain a logbook of all Sewage Pumping Station Overflow(s), which shall contain, at a minimum, the types of information set out in Condition 5.2(a) to 5.2(f) in respect of each Sewage Pumping Station Overflow.

5.7 In the event the Overflow outlet pipe from the Kanata West sanitary sewage pump station needs to be altered, resulting in the Overflow effluent discharging along a different route, the Owner shall submit an application to amend this Approval, no less than six (6) months before the date of alteration;

6. OPERATION AND MAINTENANCE

6.1 The Owner shall exercise due diligence in ensuring that, at all times, the Works and the related equipment and appurtenances used to achieve compliance with this Approval are properly operated and maintained. Proper operation and maintenance shall include

effective performance, adequate funding, adequate operator staffing and training, including training in all procedures and other requirements of this Approval and the Act and regulations, adequate laboratory facilities, process controls and alarms and the use of process chemicals and other substances used in the Works.

6.2 The Owner shall prepare an operations manual within **six (6) months** of Substantial Completion of the Works, that includes, but not necessarily limited to, the following information:

(a) operating procedures for routine operation of the Works;

(b) inspection programs, including frequency of inspection, for the Works and the methods or tests employed to detect when maintenance is necessary;

(c) repair and maintenance programs, including the frequency of repair and maintenance for the Works;

(d) procedures for the inspection and calibration of monitoring equipment;

(e) a spill prevention control and countermeasures plan, consisting of contingency plans and procedures for dealing with equipment breakdowns, potential spills and any other abnormal situations, including notification of the Water Supervisor; and

(f) procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.

6.3 The Owner shall maintain the operations manual current and retain a copy at the location of the Works for the operational life of the Works. Upon request, the Owner shall make the manual available to Ministry staff.

6.4 The Owner shall, upon request, make all manuals, plans, records, data, procedures and supporting documentation available to Ministry staff.

7. MONITORING AND RECORDING

The Owner shall, upon the issuance of this Approval, carry out the following monitoring program:

7.1 All samples and measurements taken for the purposes of this Approval are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.

7.2 Samples shall be collected at the following sampling points, at the frequency specified, by means of the specified sample type and analysed for each parameter listed and all results recorded:

Table 1 - Monitoring during a Sewage Pumping Station Overflow Event (Samples to be collected from the Sewage Pumping Station Overflow stream at the Sewage Pumping Station)	
Sample Type	Grab
Parameters	BOD5, Total Suspended Solids, Total Phosphorus, E. Coli

7.3 The methods and protocols for sampling, analysis and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

(a) the Ministry's Procedure F-10-1, "Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only), as amended from time to time by more recently published editions;

(b) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (January 1999), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions; and

(c) the publication "Standard Methods for the Examination of Water and Wastewater" (21st edition), as amended from time to time by more recently published editions.

8. REPORTING

8.1 **Fifteen (15) days** prior to the date of a planned Sewage Pumping Station Overflow being conducted pursuant to Condition 5 and as soon as possible for an unplanned Sewage Pumping Station Overflow, the Owner shall notify the Water Supervisor in writing of the pending start date, in addition to an assessment of the potential adverse effects on the environment and the duration of the Sewage Pumping Station Overflow.

8.2 In addition to the obligations under Part X of the Environmental Protection Act, (which includes contacting the Spills Action Centre (SAC) at 1-800-268-6060 or e-mail at moe.sac.moe@ontario.ca), the Owner shall, within **ten (10) working days** of the occurrence of any reportable spill as defined in Ontario Regulation 675/98, Bypass or loss of any product, by-product, intermediate product, oil, solvent, waste material or any other polluting substance into the environment, (with the exception of a sanitary sewage discharged during an Event), submit a full written report of the occurrence to the Water Supervisor describing the cause and discovery of the spill or loss, clean-up and recovery measures taken, preventative measures to be taken and schedule of implementation.

8.3 The Owner shall prepare and submit a report to the District Manager on an annual basis. The reports shall contain the following information:

(a) a copy of all Notice of Modifications submitted to the District Manager as a result of Schedule A, Section 1 (Limited Operational Flexibility) with a status report on the implementation of each modification;

(b) a report summarizing all modifications completed as a result of Schedule A, Section 3; and

9. LIMITED OPERATIONAL FLEXIBILITY

9.1 The Owner may make modifications to the Works in accordance with the Terms and Conditions of this Approval and subject to the Ministry's "Limited Operational Flexibility Criteria for Modifications to Sewage Works", included under Schedule B of this Approval, as amended.

9.2 Sewage works proposed under Limited Operational Flexibility shall adhere to the design guidelines contained within the Ministry's publication "Design Guidelines for Sewage Works 2008", as amended.

9.3 The Owner shall ensure at all times, that the Works, related equipment and appurtenances which are installed or used to achieve compliance are operated in accordance with all Terms and Conditions of this Approval.

9.4 For greater certainty, the following are not permitted as part of Limited Operational Flexibility:

(a) Modifications to the Works that result in an increase of the approved Rated Capacity of the Works;

(b) Modifications to the Works that may adversely affect the approved effluent quality criteria or the location of the discharge/outfall;

(c) Modifications to the treatment process technology of the Works, or modifications that involve construction of new reactors (tanks) or alter the treatment train process design;

(c) Modifications to the Works approved under s.9 of the EPA, and

(d) Modifications to the Works pursuant to an order issued by the Ministry.

9.5 Implementation of Limited Operational Flexibility is not intended to be used for piecemeal measures that result in major alterations or expansions.

9.6 If the implementation of Limited Operational Flexibility requires changes to be made to the Emergency Response, Spill Reporting and Contingency Plan, the Owner shall, as deemed necessary in consultation with the Water Supervisor, provide a revised copy of this plan for approval to the local fire services authority prior to implementing Limited Operational Flexibility.

9.7 For greater certainty, any alteration made under the Limited Operational Flexibility may only be carried out after other legal obligations have been complied with including those arising from the *Environmental Protection Act, Niagara Escarpment Planning and Development Act, Oak Ridges Moraine Conservation Act, Lake Simcoe Protection Act* and *Greenbelt Act.*

9.8 Prior to implementing Limited Operational Flexibility, the Owner shall complete a Notice of Modifications describing any proposed modifications to the Works and submit it to the Water Supervisor.

SCHEDULE 'A'

Limited Operational Flexibility Criteria for Modifications to Sewage Works

1. The modifications to sewage works approved under an Environmental Compliance Approval (Approval) that are permitted under the Limited Operational Flexibility (LOF), are outlined below and are subject to the LOF conditions in the Approval, and require the submission of the Notice of Modifications. If there is a conflict between the sewage works listed below and the Terms and Conditions in the Approval, the Terms and Conditions in the Approval shall take precedence.

   1.1 Sewage Pumping Stations

   a. Adding or replacing equipment where new equipment is located within the existing sewage pumping station site, provided that the facility approved Rated Capacity is not exceeded and the existing flow process and/or treatment train, if any, are maintained.

   b. Forcemain relining and replacement with similar pipe size within the pumping station site, where the nominal diameter is not greater than 1,200 mm.

   1.2 Pilot Systems

   a. Installation of pilot systems for new or existing technologies provided that:

      i. any effluent from the pilot system is discharged to the inlet of the sewage pumping station or hauled off-site for proper disposal,
      ii. any effluent from the pilot system discharged to the inlet of the sewage pumping station or sewage conveyance system does not significantly alter the composition/concentration of the influent sewage to be treated in the downstream process; and that it does not add any inhibiting substances to the downstream process, and
      iii. the pilot system's duration does not exceed a maximum of two years; and a report with results is submitted to the Director and Water Supervisor three months after completion of the pilot project.

2. Sewage works that are exempt from section 53 of the OWRA by O. Reg. 525/98 continue to be exempt and are not required to follow the notification process under this Limited Operational Flexibility.

3. Normal or emergency operational modifications, such as repairs, reconstructions, or other improvements that are part of maintenance activities, including cleaning, renovations to existing approved sewage works equipment, provided that the modification is made with Equivalent Equipment, are considered pre-approved.

4. The modifications noted in section (3) above are not required to follow the notification protocols

under Limited Operational Flexibility, provided that the number of pieces and description of the equipment as described in the Approval does not change.

Ontario
Ministry of
the Environment

Notice of Modification to Sewage Works

RETAIN COPY OF COMPLETED FORM AS PART OF THE ECA AND SEND A COPY TO THE WATER SUPERVISOR (FOR MUNICIPAL) OR DISTRICT MANAGER (FOR NON-MUNICIPAL SYSTEMS)

Part 1 – Environmental Compliance Approval (ECA) with Limited Operational Flexibility
(Insert the ECA's owner, number, issuance date and notice number, which should start with "01" and consecutive numbers thereafter)

ECA Number	Issuance Date (mm/dd/yy)	Notice number (if applicable)

ECA Owner	Municipality

Part 2: Description of the modifications as part of the Limited Operational Flexibility
(Attach a detailed description of the sewage works)

Description shall include:
1. A detail description of the modifications and/or operations to the sewage works (e.g. sewage work component, location, size, equipment type/model, material, process name, etc.)
2. Confirmation that the anticipated environmental effects are negligible.
3. List of updated versions of, or amendments to, all relevant technical documents that are affected by the modifications as applicable, i.e. submission of documentation is not required, but the listing of updated documents is (design brief, drawings, emergency plan, etc.)

Part 3 – Declaration by Professional Engineer

I hereby declare that I have verified the scope and technical aspects of this modification and confirm that the design:
1. Has been prepared or reviewed by a Professional Engineer who is licensed to practice in the Province of Ontario;
2. Conforms with the Limited Operational Flexibility as per the ECA;
3. Has been designed consistent with Ministry's Design Guidelines, adhering to engineering standards, industry's best management practices, and demonstrating ongoing compliance with s.53 of the Ontario Water Resources Act; and other appropriate regulations.

I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate.

Name (Print)	PEO License Number

Signature	Date (mm/dd/yy)

Name of Employer

Part 4 – Declaration by Owner

I hereby declare that:
1. I am authorized by the Owner to complete this Declaration;
2. The Owner consents to the modification; and
3. These modifications to the sewage works are proposed in accordance with the Limited Operational Flexibility as described in the ECA.
4. The Owner has fulfilled all applicable requirements of the *Environmental Assessment Act.*

I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate.

Name of Owner Representative (Print)	Owner representative's title (Print)

Owner Representative's Signature	Date (mm/dd/yy)

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the Works are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The condition also advises the Owners their responsibility to notify any person they authorized to carry out work pursuant to this Approval the existence of this Approval. Condition 1.6 is included to emphasize that the issuance of this Approval does not diminish any other statutory and regulatory obligations to which the Owner is subject in the construction, maintenance and operation of the Works. The condition specifically highlights the need to obtain any necessary conservation authority approvals. The condition also emphasizes the fact that this Approval doesn't limit the authority of the Ministry to require further information.

2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to the approved works and to ensure that subsequent owners of the Works are made aware of the Approval and continue to operate the Works in compliance with it.

4. Condition 4 is included to ensure that the Works are constructed in accordance with the Approval and that record drawings of the Works "as constructed" are maintained for future references.

5. Conditions 5 and 7 are included to indicate that Sewage Pumping Station Overflow of untreated and/or partially treated sewage to the environment is prohibited, save in certain limited circumstances where the failure to do so could result in greater injury to the public interest than the Sewage Pumping Station Overflow itself, or where the Sewage Pumping Station Overflow can be limited or otherwise mitigated by handling it in accordance with an approved contingency plan. The notification and documentation requirements allow the Ministry to take action in an informed manner and will ensure the Owner is aware of the extent and frequency of Sewage Pumping Station Overflow Event(s). Furthermore, conditions 5.4 and 5.7 are intended to ensure that the Owner has an effective risk communications plan to inform the public of the potential risks of recreational areas of the Carp River recreational corridor between the pump station and Richardson Side Road and to ensure that when the overflow pipe is redirected to discharge any Overflows from the Carp River to the future stormwater management facility (Kanata West Pond No. 5), the Approval will be amended to reflect that change in Overflow piping;

6. Condition 6 is included to require that the Works be properly operated, maintained, funded, staffed and equipped such that the environment is protected and deterioration, loss, injury or damage to any person or property is prevented. As well, the inclusion of a comprehensive operations manual governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the Owner and

made available to the Ministry. Such a manual is an integral part of the operation of the Works. Its compilation and use should assist the Owner in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for Ministry staff when reviewing the Owner's operation of the Works.

7. Condition 8 is included to provide a performance record for future references, to ensure that the Ministry is made aware of problems as they arise, so that the Ministry can work with the Owner in resolving any problems in a timely manner.

8. Condition 9 is included to ensure that the Works are operated in accordance with the application and supporting documentation submitted by the Owner, and not in a manner which the Director has not been asked to consider. These Conditions are also included to ensure that a Professional Engineer has reviewed the proposed modifications and attests that the modifications are in line with that of Limited Operational Flexibility, and provide assurance that the proposed modifications comply with the Ministry's requirements stipulated in the Terms and Conditions of this Approval, MOECC policies, guidelines, and industry engineering standards and best management practices.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of
Part II.1 of the Environmental Protection Act
Ministry of the Environment and
Climate Change
135 St. Clair Avenue West, 1st Floor
Toronto, Ontario

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 314-3717 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 9th day of September, 2015

Gregory Zimmer, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

RS/
c: DWMD Supervisor, MOECC Ottawa
Colin Goodwin, Stantec Consulting Ltd.

APPENDIX E

- Storm Sewer Design Sheet (DSEL, May 2018)
- Storm Servicing Profiles (DSEL, May 2018)
- Pond 4 ECA (MOE, October 2014)

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

	LOCATION		AREA (Ha)														FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
TRUNK 3																																	
					0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00	13.47														
			2.37	0.70	4.61	4.61			0.00	0.00			0.00	0.00			0.00	0.00															
	11	12			0.00	4.61			0.00	0.00	4.29	0.70	8.35	8.35			0.00	0.00	13.47	65.63	88.85	104.08	152.04	1172	1050	1050	CONC	0.30	97.5	1495.6798	1.7273	0.9408	0.783
	12	19			0.00	4.61			0.00	0.00			0.00	8.35			0.00	0.00	14.41	63.20	85.51	100.15	146.27	1128	1050	1050	CONC	0.30	23.0	1495.6798	1.7273	0.2219	0.754
			0.28	0.70	0.54	5.16			0.00	0.00			0.00	8.35			0.00	0.00															
	19	20			0.00	5.16			0.00	0.00			0.00	8.35			0.00	0.00	14.63	62.65	84.77	99.28	144.98	1152	1350	1350	CONC	0.25	74.5	2668.7010	1.8644	0.6660	0.432
					0.00	5.16			0.00	0.00	0.00	0.00	0.00	8.35			0.00	0.00	15.30														
					0.00	5.16			0.00	0.00	0.71	0.70	1.38	9.73			0.00	0.00															
	20	21	5.54	0.70	10.78	15.94			0.00	0.00			0.00	9.73			0.00	0.00	15.30	61.07	82.61	96.74	141.26	1915	1350	1350	CONC	0.40	97.5	3375.6694	2.3583	0.6891	0.567
To CENTERLINE14, Pipe 21 - 22						15.94				0.00				9.73				0.00	15.99														
TRUNK 4																																	
	1	2	5.32	0.70	10.35	10.35			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	795	750	750	CONC	0.80	106.5	995.7452	2.2539	0.7875	0.799
	2	3	6.22	0.70	12.10	22.46			0.00	0.00			0.00	0.00			0.00	0.00	10.79	73.91	100.21	117.45	171.67	1660	1050	1050	CONC	0.75	115.0	2364.8774	2.7311	0.7018	0.702
	3	4			0.00	22.46			0.00	0.00			0.00	0.00			0.00	0.00	11.49	71.52	96.93	113.59	166.00	1606	1050	1050	CONC	0.75	117.0	2364.8774	2.7311	0.7140	0.679
	4	21	6.14	0.70	11.95	34.41			0.00	0.00			0.00	0.00			0.00	0.00	12.20	69.27	93.84	109.95	160.65	2383	1200	1200	CONC	1.00	98.0	3898.7303	3.4472	0.4738	0.611
Contribution From CENTERLINE13, Pipe 20 - 21						15.94				0.00				9.73				0.00	15.99														
			0.93	0.70	1.81	52.15			0.00	0.00			0.00	9.73			0.00	0.00															
	21	22			0.00	52.15			0.00	0.00	4.40	0.70	8.56	18.29			0.00	0.00	15.99	59.53	80.50	94.26	137.62	4829	1650	1650	CONC	0.45	106.0	6114.1578	2.8594	0.6178	0.790
	22	23			0.00	52.15			0.00	0.00			0.00	18.29			0.00	0.00	16.60	58.22	78.71	92.15	134.53	4722	1950	1950	CONC	0.20	106.0	6363.7605	2.1309	0.8291	0.742
	23	24			0.00	52.15			0.00	0.00			0.00	18.29			0.00	0.00	17.43	56.56	76.44	89.48	130.62	4587	1950	1950	CONC	0.20	109.5	6363.7605	2.1309	0.8565	0.721
	24	25	23.65	0.70	46.02	98.18			0.00	0.00			0.00	18.29			0.00	0.00	18.29	54.96	74.24	86.90	126.83	6985	1950	1950	CONC	0.40	121.0	8999.7165	3.0135	0.6692	0.776
	25	26			0.00	98.18			0.00	0.00			0.00	18.29			0.00	0.00	18.96	53.77	72.62	85.00	124.04	6834	1950	1950	CONC	0.40	117.5	8999.7165	3.0135	0.6499	0.759
	26	27	14.30	0.70	27.83	126.00			0.00	0.00			0.00	18.29			0.00	0.00	19.61	52.67	71.12	83.23	121.45	8159	2100	2100	CONC	0.50	75.0	12260.5416	3.5398	0.3531	0.665
	27	28			0.00	126.00			0.00	0.00			0.00	18.29			0.00	0.00	19.96	52.09	70.33	82.31	120.09	8069	2250	2250	CONC	0.25	117.5	10420.6927	2.6208	0.7472	0.774
	28	29			0.00	126.00			0.00	0.00			0.00	18.29			0.00	0.00	20.71	50.92	68.73	80.43	117.33	7887	2250	2250	CONC	0.25	111.5	10420.6927	2.6208	0.7091	0.757
To Pond 4						126.00				0.00				18.29				0.00	20.71														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: A.K.	PROJECT: **195 Huntmar**		
Checked: V.C.	LOCATION: **City of Ottawa**		
Dwg. Reference:	File Ref: 12-624	Date: May, 2018	Sheet No. 1

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

	LOCATION		AREA (Ha)														FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
TRUNK 1																																
			0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00														
					0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	13.09													
					0.00	0.00	0.07	0.70	0.14	0.14			0.00	0.00			0.00	0.00														
					0.00	0.00	0.11	0.70	0.21	0.35			0.00	0.00			0.00	0.00														
					0.00	0.00	0.33	0.70	0.64	0.99			0.00	0.00			0.00	0.00														
	13	16	0.92	0.70	1.79	1.79			0.00	0.99			0.00	0.00			0.00	0.00	13.09	66.69	90.30	0.00	154.54	209	600	600	PVC	0.16	90.0	246	0.87	1.73	0.85
			0.00	0.00	0.00	1.79			0.00	0.99			0.00	0.00			0.00	0.00	12.86													
					0.00	1.79	0.10	0.70	0.19	1.19			0.00	0.00			0.00	0.00														
					0.00	1.79	0.16	0.70	0.31	1.50			0.00	0.00			0.00	0.00														
	16	17	1.64	0.70	3.19	4.98			0.00	1.50			0.00	0.00			0.00	0.00	14.81	62.21	84.17	0.00	143.95	436	900	900	CONC	0.10	90.0	572	0.90	1.67	0.76
			0.00	0.00	0.00	4.98			0.00	1.50			0.00	0.00			0.00	0.00	15.77													
					0.00	4.98	0.30	0.70	0.58	2.08			0.00	0.00			0.00	0.00														
					0.00	4.98	0.43	0.70	0.84	2.92			0.00	0.00			0.00	0.00														
	17	18	3.82	0.70	7.43	12.42			0.00	2.92			0.00	0.00			0.00	0.00	16.48	58.48	79.06	0.00	135.14	957	975	975	CONC	0.29	78.0	1207	1.62	0.80	0.79
			0.00	0.00	0.00	12.42			0.00	2.92			0.00	0.00			0.00	0.00	12.91													
			0.38	0.40	0.42	12.84	0.02	0.70	0.04	2.96			0.00	0.00			0.00	0.00														
	18	21	1.41	0.70	2.74	15.58	0.19	0.70	0.37	3.33			0.00	0.00			0.00	0.00	17.28	56.86	76.84	0.00	131.31	1142	1200	1200	CONC	0.13	64.0	1406	1.24	0.86	0.81
			0.00	0.00	0.00	15.58			0.00	3.33			0.00	0.00			0.00	0.00	13.26													
	21	26	1.34	0.70	2.61	18.19			0.00	3.33			0.00	0.00			0.00	0.00	18.14	55.23	74.61	0.00	127.47	1253	1200	1200	CONC	0.16	82.0	1559	1.38	0.99	0.80
			0.00	0.00	0.00	18.19			0.00	3.33			0.00	0.00			0.00	0.00	13.90													
					0.00	18.19	0.00	0.00	0.00	3.33			0.00	0.00			0.00	0.00	13.90													
					0.00	18.19	0.42	0.70	0.82	4.14			0.00	0.00			0.00	0.00														
			0.45	0.70	0.88	19.07			0.00	4.14			0.00	0.00			0.00	0.00														
			0.59	0.70	1.15	20.21			0.00	4.14			0.00	0.00			0.00	0.00														
					0.00	20.21	0.72	0.70	1.40	5.55			0.00	0.00			0.00	0.00														
	26	46	1.17	0.70	2.28	22.49			0.00	5.55			0.00	0.00			0.00	0.00	19.13	53.47	72.21	0.00	123.33	1603	1350	1350	CONC	0.14	82.0	1997	1.40	0.98	0.80
			0.00	0.00	0.00	22.49			0.00	5.55			0.00	0.00			0.00	0.00	14.27													
					0.00	22.49	0.20	0.70	0.39	5.94			0.00	0.00			0.00	0.00														
			0.34	0.70	0.66	23.15			0.00	5.94			0.00	0.00			0.00	0.00														
	46	47	2.88	0.70	5.60	28.76			0.00	5.94			0.00	0.00			0.00	0.00	20.11	51.85	70.01	0.00	119.53	1907	1350	1350	CONC	0.20	51.5	2387	1.67	0.51	0.80
	47	HW			0.00	28.76			0.00	5.94			0.00	0.00			0.00	0.00	20.63	51.04	68.90	0.00	117.63	1877	1350	1350	CONC	0.20	39.0	2387	1.67	0.39	0.79
To Pond 7						28.76				5.94				0.00				0.00	21.02													
TRUNK 2																																
			0.42	0.70	0.82	0.82			0.00	0.00			0.00	0.00			0.00	0.00														
	32	33	1.98	0.80	4.40	5.22			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	401	825	825	CONC	0.13	64.5	518	0.97	1.11	0.77
	33	36	0.34	0.70	0.66	5.88			0.00	0.00			0.00	0.00			0.00	0.00	11.11	72.79	98.67	0.00	169.01	428	825	825	CONC	0.14	81.0	537	1.00	1.34	0.80
			0.00	0.00	0.00	5.88			0.00	0.00			0.00	0.00			0.00	0.00	12.21													
					0.00	5.88	0.13	0.70	0.25	0.25			0.00	0.00			0.00	0.00														
					0.00	5.88	0.18	0.70	0.35	0.60			0.00	0.00			0.00	0.00														
			0.66	0.70	1.28	7.17			0.00	0.60			0.00	0.00			0.00	0.00														
	36	37	1.72	0.80	3.83	10.99			0.00	0.60			0.00	0.00			0.00	0.00	12.45	68.51	92.80	0.00	158.86	809	1050	1050	CONC	0.14	25.0	1022	1.18	0.35	0.79
			0.00	0.00	0.00	10.99			0.00	0.60			0.00	0.00			0.00	0.00	11.23													
	37	38	0.42	0.70	0.82	11.81			0.00	0.60			0.00	0.00			0.00	0.00	12.81	67.48	91.38	0.00	156.41	852	1050	1050	CONC	0.16	47.0	1092	1.26	0.62	0.78
			0.00	0.00	0.00	11.81			0.00	0.60			0.00	0.00			0.00	0.00	12.97													
	38	39	0.82	0.70	1.60	13.41			0.00	0.60			0.00	0.00			0.00	0.00	13.43	65.74	89.01	0.00	152.30	935	1050	1050	CONC	0.19	31.0	1190	1.37	0.38	0.79
	39	41	0.14	0.70	0.27	13.68			0.00	0.60			0.00	0.00			0.00	0.00	13.80	64.74	87.63	0.00	149.93	938	1050	1050	CONC	0.19	82.0	1190	1.37	0.99	0.79
					0.00	13.68	0.00	0.00	0.00	0.60			0.00	0.00			0.00	0.00	11.43													
					0.00	13.68	0.63	0.70	1.23	1.83			0.00	0.00			0.00	0.00														
	41	44	2.11	0.80	4.69	18.37			0.00	1.83			0.00	0.00			0.00	0.00	14.80	62.25	84.22	0.00	144.03	1298	1200	1200	CONC	0.18	82.0	1654	1.46	0.93	0.78
					0.00	18.37	0.10	0.70	0.19	2.02			0.00	0.00			0.00	0.00														
	44	43	3.21	0.80	7.14	25.51			0.00	2.02			0.00	0.00			0.00	0.00	15.73	60.09	81.26	0.00	138.93	1697	1200	1200	CONC	0.31	39.0	2171	1.92	0.34	0.78
					0.00	25.51	0.41	0.70	0.80	2.82			0.00	0.00			0.00	0.00														
	43	430	2.92	0.80	6.49	32.00			0.00	2.82			0.00	0.00			0.00	0.00	16.07	59.35	80.25	0.00	137.19	2126	1500	1500	CONC	0.15	74.5	2738	1.55	0.80	0.78
	430	490			0.00	32.00			0.00	2.82			0.00	0.00			0.00	0.00	16.87	57.67	77.96	0.00	133.23	2066	1500	1500	CONC	0.18	74.5	2999	1.70	0.73	0.69
	490	HW	2.09	0.80	4.65	36.65			0.00	2.82			0.00	0.00			0.00	0.00	17.60	56.23	75.99	0.00	129.84	2275	1500	1500	CONC	0.17	65.5	2915	1.65	0.66	0.78
To Pond 7						36.65				2.82				0.00				0.00	18.27													

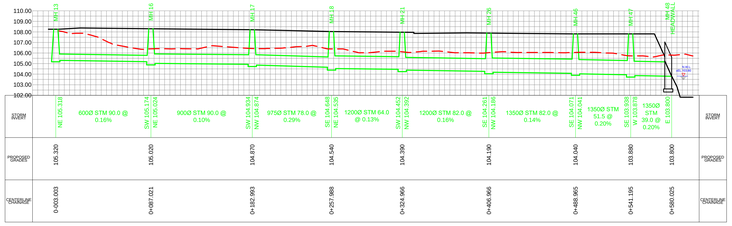
Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

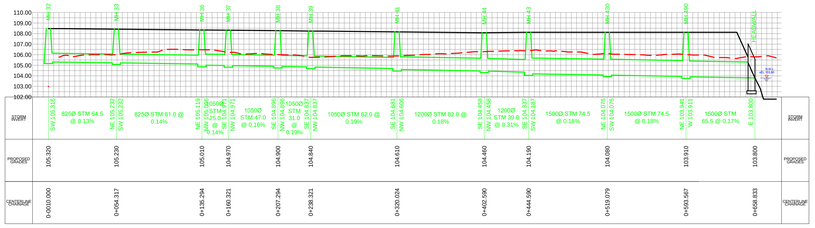
Designed: A.K.	PROJECT: **195 Huntmar Drive**	
Checked: V.C.	LOCATION: **City of Ottawa**	
Dwg. Reference:	File Ref: 12-624	Date: May, 2018
		Sheet No. 1

WEST TRUNKS TO SWM POND 7

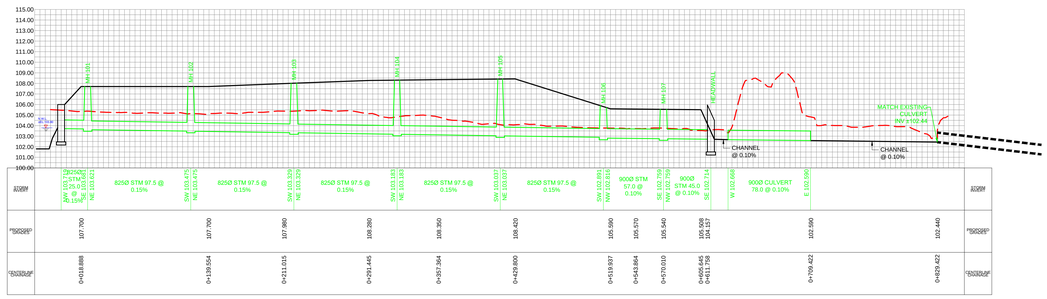
TRUNK 1



TRUNK 2

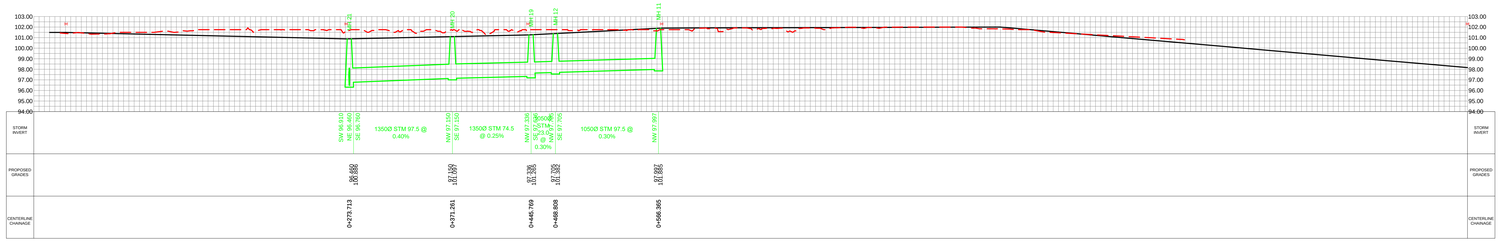


SWM POND 7 OUTFALL

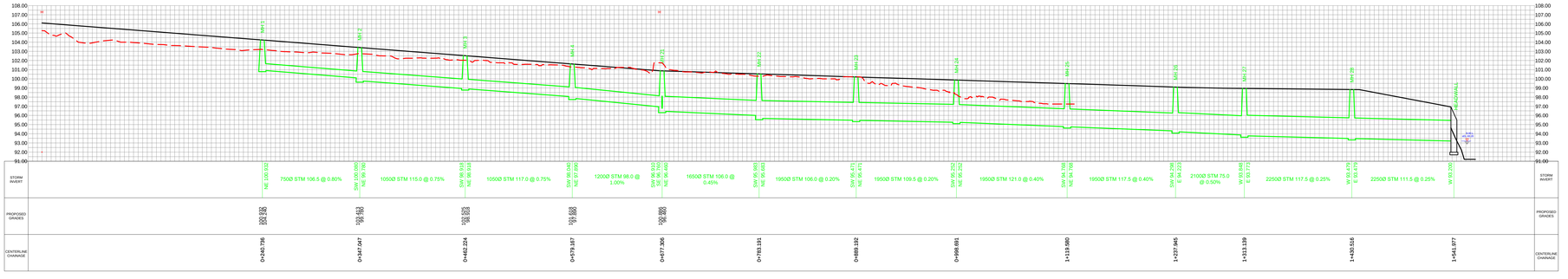


EAST TRUNKS TO SWM POND 4

TRUNK 3



TRUNK 4



david schaeffer engineering ltd

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

LEGEND:

- EXISTING GROUND
- PROPOSED GRADE
- STORM TRUNK

KANATA WEST - 195 HUNTMAR DRIVE

STORM SERVICING PROFILES

CITY OF OTTAWA

PROJECT No. :	14-624
SCALE	1:2000
DATE:	MAY 2018
DRAWING No.	3

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 4298-9Q6HQ3
Issue Date: October 31, 2014

Mattamy (Fairwinds West) Limited
50 Hines Road, Suite 100
City of Ottawa, Ontario
K2K 2M5

Site Location: Part of Lot 1, Concession 1 (March)
Kanata West Development Area
City of Ottawa

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

an amendment of the stormwater management Works for the collection, treatment and disposal of stormwater run-off from a number of subdivision developments located along Maple Grove Road in the vicinity of Johnwoods Street and Huntmar Drive, serving a major part of the Kanata West Community located north of Hazeldean Road, south of Palladium Drive, west of the Carp River and Poole Creek in the City of Ottawa, providing Normal Level water quality control and erosion protection and attenuating post-development peak flows to pre-development levels for all storm events up to and including the 10-year storm event, to consolidate previous approvals and to modify the stormwater management facilities and outfalls to Poole Creek and the Carp River, consisting of the following:

Proposed Works:

storm sewer: - modification of the outfall of the storm sewer on Maple Grove Road by extending the 2550 mm diameter storm sewer on Maple Grove Road from the existing manhole (MH 185) approximately 228 m in a northerly direction, discharging to Interim Pond 4, identified below, and removing the outlet storm sewer from approximately 60 m west of Poole Creek (MH 185) to Poole Creek;

stormwater management facility (Interim Pond 4 - catchment area 278.3 hectares): - one (1) wet pond with two (2) sediment forebays and one (1) inlet pipe, located north of Maple Grove Road, south of Palladium Drive west of the Carp River, having a permanent pool volume of 29,736 m^3, an extended detention volume of 22,288 m^3, and a total storage volume of approximately 62,820 m^3, including the permanent pool volume, at a total depth of approximately 3.9 m, discharging eastward through an outlet structure to the Carp River, and ultimately to the Ottawa River;

stormwater management facility (Interim Pond 1): - decommissioning and removal of the wet pond located on the south side of Maple Grove Road, east of Huntmar Drive upon completion of construction of Interim Pond 4;

Previous Works:

Under Approval 6206-8X7JWX, issued August 16, 2012:

storm and sanitary sewers on Maple Grove Road, consisting of the following:
- trunk and local storm sewer on Maple Grove Road from Johnwoods Street (MH 401) to Montserrat Street (MH 107), from approximately 120 m east of Rosehill Avenue (existing MH 181) to approximately 60 m west of Poole Creek (MH 185), and an outlet storm sewer from approximately 60 m west of Poole Creek (MH 185) to Poole Creek;
- trunk sanitary sewer on Maple Grove Road from Johnwoods Street (MH 104A) to Montserrat Street (MH 110A), and from approximately 245 m east of Rosehill Avenue (existing MH 96) to approximately 50 m west of Poole Creek (MH 98);
- local sanitary sewers along the Maple Grove Road frontage of Fairwinds West subdivision and Poole Creek Village (Tartan) subdivision connecting to the trunk sanitary sewer from MH 118A to MH 107A and from MH 117A to MH 110A;

Under Approval 1716-9CHP4Z, issued November 4, 2013:

oil and grit separator at the inlet to Interim Pond 1; (Note: This oil and grit separator was approved but never constructed.)

stormwater management facility (Interim Pond 1 - catchment area 125.47 hectares): - a wet pond with a sediment forebay, located on the south side of Maple Grove Road, east of Huntmar Drive, providing Enhanced Level water quality control and erosion protection and attenuating post-development peak flows to pre-development levels for all storm events up to and including the 100-year storm event, discharging to Poole Creek;

temporary stormwater diversion ditch: - a temporary storm conveyance ditch to divert flows from the Bryanston Gate subdivision to an existing storm sewer on Maple Grove Road to allow for deep service construction west on Maple Grove Road from its current termination at Montserrat Street to Johnwoods Street, ultimately discharging to the Interim Pond 1; (Note: The temporary diversion ditch was removed upon completion of construction of the trunk storm sewer on Maple Grove Road under 6206-8X7JWX.)

including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the submitted supporting documents listed in Schedule "A" forming part of this Approval.

For the purpose of this environmental compliance approval, the following definitions apply:

"Approval" means this entire document including the application and any supporting documents listed in any schedules in this Approval;

"Director" means a person appointed by the Minister pursuant to section 5 of the Environmental Protection Act for the purposes of Part II.1 of the Environmental Protection Act;

"District Manager" means the District Manager of the Ottawa office of the Ministry;

"Ministry" means the ministry of the government of Ontario responsible for the Environmental Protection Act and the Ontario Water Resources Act and includes all officials, employees or other persons acting on its behalf;

"Owner" means the Mattamy (Fairwinds West) Limited and includes their successors and assignees;

"Previous Works" means those portions of the sewage Works previously approved under an Approval;

"Water Supervisor" means the Water Supervisor of the Ottawa-Cornwall office of the Ministry;

"Works" means the sewage works described in the Owner's application(s) and this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

(1) The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the Conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

(2) The designation of The City of Ottawa as the operating authority of the site on the application for approval of the Works does not relieve the Owner from the responsibility of complying with any and all of the Conditions of this Approval.

(3) Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, and the application for approval of the Works.

(4) Where there is a conflict between a provision of any submitted document referred to in this Approval and the Conditions of this Approval, the Conditions in this Approval shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

(5) Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

(6) The Conditions of this Approval are severable. If any Condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such Condition to other circumstances and the remainder of this Approval shall not be affected thereby.

(7) The issuance of, and compliance with the Conditions of this Approval does not:

(a) relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement, including, but not limited to, the obligation to obtain approval from the local conservation authority necessary to construct or operate the sewage Works; or

(b) limit in any way the authority of the Ministry to require certain steps be taken to require the Owner to furnish any further information related to compliance with this Approval.

(8) This Approval includes the treatment and disposal of stormwater run-off from a catchment area of 278.3 hectares draining to Interim Pond 4, assuming an average imperviousness of 37%. Any future development changes within the total drainage area that might increase the required storage volumes or increase the flows to or from Interim Pond 4 or any structural/physical changes to Interim Pond 4, including the inlets or outlets, will require an amendment to this Approval.

2. EXPIRY OF APPROVAL

(1) This Approval will cease to apply to those parts of the proposed Works which have not been constructed within **five (5) years** of the date of this Approval.

3. CHANGE OF OWNER

(1) The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within **thirty (30) days** of the change occurring:

(a) change of Owner;

(b) change of address of the Owner;

(c) change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c. B17 shall be included in the notification to the District Manager;

(d) change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.

(2) In the event of any change in ownership of the Works, other than a change in ownership to the

municipal, i.e. assumption of the Works, the Owner shall notify the succeeding owner in writing of the existence of this Approval, and a copy of such notice shall be forwarded to the District Manager and the Director.

(3) Notwithstanding any other requirements in this Approval, upon transfer of the ownership of the Works to a municipality, if applicable, any reference to the "District Manager" within the Terms and Conditions of this Approval shall be replaced with "Water Supervisor".

4. OPERATION AND MAINTENANCE

The Owner shall, upon issuance of this Approval, carry out the following operation and maintenance program:

(1) The Owner shall undertake routine visual inspections of the Works over the lifetime of the Works including inspection of the facility after each large event (15 mm or greater in the previous 24 hours as required by the City of Ottawa's Kanata West Overall Monitoring Plan) to ensure proper functioning of the facility including confirming adequacy of the general site conditions (erosion / landscaping etc.), depth of sediment accumulation, proper functioning of the monitoring equipment, and Works' inlet and outlet controls. As required the Owner shall clean and maintain the Works to to ensure proper functioning of the facility and to prevent excessive build up of sediments and/or vegetation within Interim Pond 4.

(2) The Owner shall ensure that the design minimum liquid retention volume (permanent pool) is maintained within the main cell, and that the water levels are monitored to determine draw down characteristics of the facility (typically 24 – 48 hours). Flow monitoring is not proposed in this program.

(3) The Owner shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook at the Owner's local office for inspection by the Ministry.The logbook shall include the following:

(a) the name of the Works; and

(b) the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed.

(4) The Owner shall prepare an operations manual within **three (3) months** of the issuance of this Approval, that includes, but is not limited to, the following information:

(a) operating procedures for routine operation of the Works;

(b) inspection programs, including frequency of inspection, for the Works and the methods or tests employed to detect when maintenance is necessary;

(c) repair and maintenance programs, including the frequency of repair and maintenance for the Works; and

(d) procedures for the inspection and calibration of monitoring equipment.

(5) The Owner shall maintain the operations manual current and retain a copy at the Owner's local office for the operational life of the Works and upon request make the manual available to the staff of the Ministry as well as the City of Ottawa.

5. MONITORING AND RECORDING

(1) The Owner shall carry out a monitoring program for the inspection and maintenance of the Works as per the standardized SWM monitoring program specified by the City of Ottawa for the Kanata West Area and the requirements of the Mississippi Valley Conservation Authority.

(2) The Owner shall copy the District Manager/Water Supervisor on any and all reports submitted to the City of Ottawa and/or the Mississippi Valley Conservation Authority related to the operation and maintenance of the Works.

(3) A minimum of **two (2) years** after 90% of the homes in the residential subdivisions within the drainage catchment area of Interim Pond 4 have been occupied and the monitoring program for the maintenance and inspection of the Works has been rigorously followed, the requirement to copy the District Manager in Subsection (2), above, may be modified by the District Manager in writing from time to time.

6. TEMPORARY EROSION AND SEDIMENT CONTROL

(1) The Owner shall install and maintain temporary sediment and erosion control measures during construction and conduct inspections once every **two (2) weeks** and after each significant storm event (a significant storm event is defined as a minimum of 25 mm of rain in any 24 hours period). The inspections and maintenance of the temporary sediment and erosion control measures shall continue until they are no longer required and at which time they shall be removed and all disturbed areas reinstated properly.

(2) The Owner shall maintain records of inspections and maintenance which shall be made available for inspection by the Ministry, upon request. The record shall include the name of the inspector, date of inspection, and the remedial measures, if any, undertaken to maintain the temporary sediment and erosion control measures.

7. RECORD KEEPING

The Owner shall retain for a minimum of **five (5) years** from the date of their creation, all records and information related to or resulting from the operation and maintenance activities required by this Approval.

Schedule "A"

1. Application from Mattamy (Fairwinds North) Limited, dated April 12, 2012, including final plans and specifications prepared by David Schaeffer Engineering Ltd.;

2. Application for Environmental Compliance Approval, dated September 10, 2014 and received on September 23, 2014, submitted by David Schaeffer Engineering Ltd.;

3. Design Brief for Pond 4 Kanata West, dated August 25, 2014, prepared by J.F. Sabourin and Associates Inc. and David Schaeffer Engineering Ltd.;

4. Set of Engineering Drawings (22 drawings) dated August 20, 2014, prepared by David Schaeffer Engineering Ltd.;

5. Geotechnical Review, Proposed Stormwater Management Pond (SWMP) Design - Pond 4, dated September 18, 2014, prepared by Paterson Group Inc,;

6. Pipe Data Form and Storm Sewer Design Sheet, prepared by David Schaeffer Engineering Ltd.;

7. Copy of a letter from John Price of the Mississippi Valley Conservation Authority to David Schaeffer Engineering Ltd., dated August 29, 2014;

8. Copy of a Memorandum from Greenland International Consulting Ltd. to City of Ottawa, dated September 4, 2014;

9. Three (3) e-mails from Jennifer Ailey of David Schaeffer Engineering Ltd. to the Ministry, dated October 23, 2014; and

10. Two (2) e-mails from Jennifer Ailey of David Schaeffer Engineering Ltd. to the Ministry, dated October 31, 2014.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the Works are built and operated in the manner in which they were described for review and upon which approval was granted. This Condition is also included to emphasize the precedence of Conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.

2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment..

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to approved Works and to ensure that any subsequent Owner of the Works is made aware of the Approval and continue to operate the Works in compliance with it.

4. Condition 4 is included to require that the Works be properly operated and maintained such that the environment is protected.

5. Condition 5 is included to enable the Owner to evaluate and demonstrate the performance of the Works, on a continual basis, so that the Works are properly operated and maintained at a level which is consistent with the design objectives specified in the Approval and that the Works do not cause any impairment to the receiving watercourse.

6. Condition 6 is included as installation, regular inspection and maintenance of the temporary sediment and erosion control measures is required to mitigate the impact on the downstream receiving watercourse during construction, until they are no longer required.

7. Condition 7 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the Works.

Upon issuance of the environmental compliance approval, I hereby revoke Approval No(s). 6206-8X7JWX, and 1716-9CHP4Z issued on August 16, 2012 and November 4, 2013, respectively.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are

substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of
Part II.1 of the Environmental Protection Act
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 31st day of October, 2014

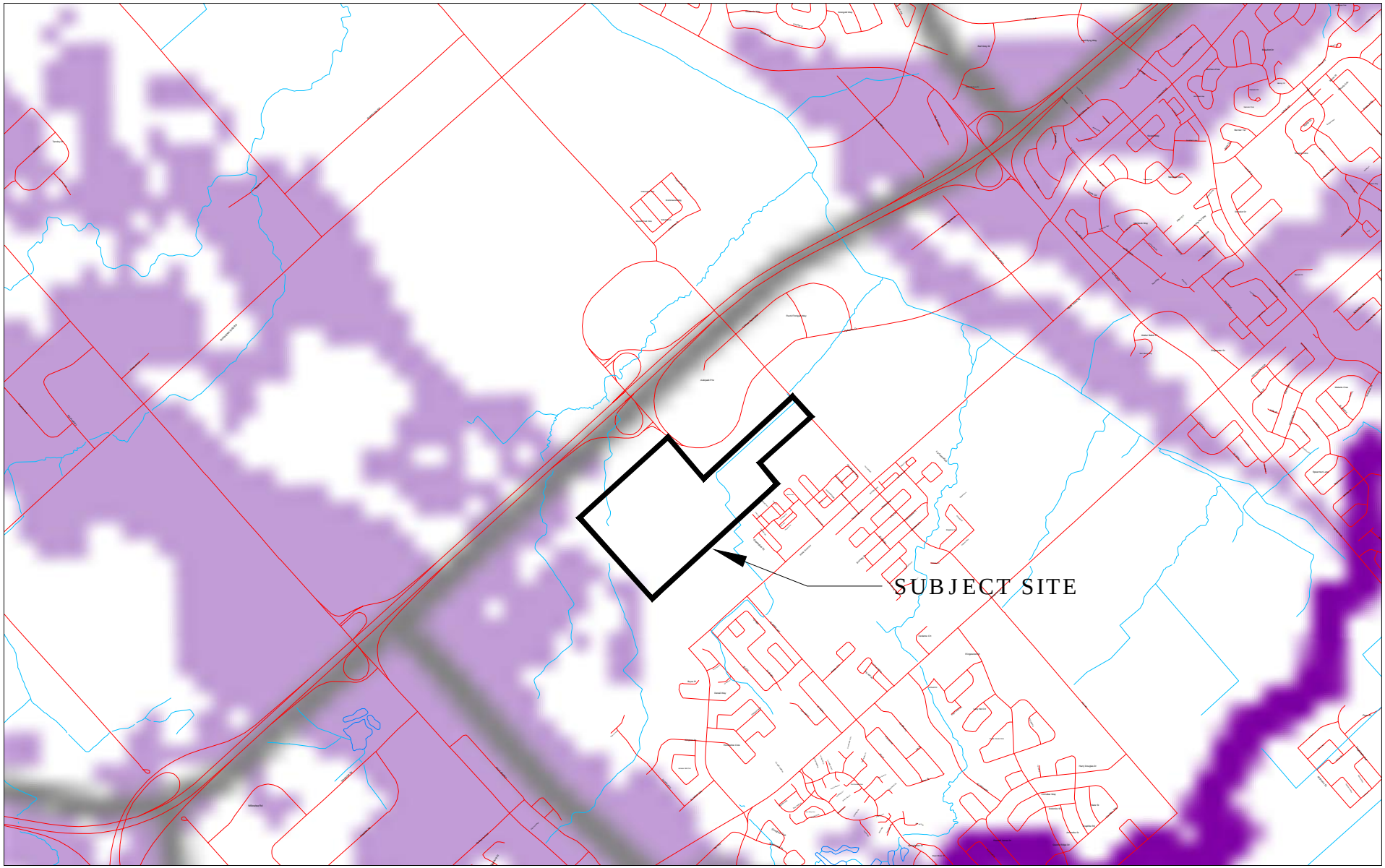
Edgardo Tovilla
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

DC/
c: District Manager, MOE Ottawa office
Water Supervisor, MOE Ottawa-Cornwall office
Jennifer Ailey, David Schaeffer Engineering Ltd. (DSEL)

APPENDIX F

- Excerpt from Mississippi-Rideau Source Water Protection Plan, Schedule M (MVCA & RVCA, August 2014)

Overlay of Subject Site on Mississippi-Rideau Source Water Protection Plan, Schedule M (August 28, 2014)



Significant Groundwater Recharge Area

Prepared By: DSEL, June 2016

APPENDIX G

- Kanata West Development Area Meander Belt Width Assessment and Erosion Analysis (GEOMorphix, July 2016)
- Slope Stability Assessment - Feedmill Creek, Proposed Development - Kanata West, Palladium Drive at Huntmar Drive – Ottawa (Paterson Group, October 2016)
- 195 Huntmar Feedmill Creek Cross Sections & Setbacks (DSEL, April 2017)
- Topographic Survey of Normal High Water Mark (Stantec, April 2017)
- Flood Risk Map Feedmill Creek (MVCA, January 2017)

Kanata West Development Area Meander Belt Width Assessment and Erosion Analysis

Feedmill Creek

Draft Report

Prepared for:
David Schaeffer Engineering Limited
120 Iber Road, Unit 103
Stittsville, ON K2S 1E5

July 20, 2016
PN16059

GEO MORPHIX
Geomorphology
Earth Science
Observations

Report Prepared by:	GEO Morphix Ltd. 2800 High Point Drive Suite 100A Milton, ON L9T 6P4
Report Title:	Kanata West Development Area Meander Belt Assessment and Erosion Analysis, Feedmill Creek
Project Number:	PN16059
Status:	Draft
Version:	1.0
First Submission Date:	July 20, 2016
Prepared by:	Allison Day, Jason Krompart, Emily Rick
Approved by:	Paul Villard, Ph.D., P.Geo.

Table of Contents

List of Tables

Appendices

1 Introduction

GEO Morphix Ltd. was retained by 2325483 Ontario Inc. to delineate the meander belt width and to assess and mitigate erosion potential within Feedmill Creek in the Kanata West Development Area. We understand that the valley corridor along the western boundary of the property may eventually be realigned to accommodate development activities. As such, the findings of this assessment will also inform the corridor design requirements in the case where natural corridor design is required.

The primary goal of this assessment was to determine meander belt, which may be used as the limit of development.

This assessment included the following components:

- Review available background reports and mapping (geology, topography, etc.);
- Desktop reach delineation;
- Completion of a rapid geomorphological field assessment to document channel conditions and verify the desktop assessment; and
- Review historical and recent aerial photographs to determine the limits of the meander belt width and to calculate channel migration rates, or estimate the meander belt width using models if the channel is not visible in the aerial imagery or is to be realigned.

With regards to future erosion potential, an assessment of channel sensitivity along with determination of an erosion threshold for the receiving watercourse. The goal of this component of the assessment was to characterize erosion potential in Feedmill Creek in order to help mitigate future impacts and support development of a suitable SWM plan as part of the mitigation strategy.

This component of the assessment included the following tasks:

- A desktop analysis for determining the potential zone of impact;
- Apply rapid geomorphic assessments to determine the overall stability of the receiving watercourse and to identify areas of erosion concern or at risk drainage feature based on field observations;
- A detailed geomorphic assessment of a sensitive reach, the primary objective of which is to determine the critical flow or erosion threshold; and
- Support appropriate strategies to address erosion concerns.

2 Background Review

2.1 Watershed Characteristics

Feedmill Creek originates southwest of the study area, within the Carp Valley. The creek generally flows northeast through agricultural fields, bending to the northwest and flowing along the western boundary of the subject property. It continues across Highway 417 and then flows northeast through a mix of industrial, forested and agricultural areas to its outlet at Carp River in Kanata. The study area contains a mix of the aforementioned land use types. Portions of the channel have been historically or recently straightened and others retain more natural features. Reach delineation was refined through field observation.

Channel morphology and planform are largely governed by the flow regime and the availability and type of sediments (i.e., surficial geology) within the stream corridor. Physiography, riparian vegetation and land use also physically influence the channel. These factors are explored as they

not only offer insight into existing conditions, but also potential changes that could be expected in the future as they relate to a proposed activity.

Physiographically, the majority of Feedmill Creek within the Kanata West Development Area project site overlies fine-textured glaciomarine deposits containing silt and clay with minor sand and gravel, associated with the former marine bed of the Champlain Sea. Upstream reaches of Feedmill Creek, including the northwest reach along the subject property overlies organic deposits containing peat, muck and marl. Underlying Paleozoic bedrock is exposed in localized areas and acts as a topographic control through the area (OGS, 2010).

Monthly precipitation averages at Ottawa MacDonald-Cartier Int'l A (Climate ID 6106000) range from a low of 54.3 mm in February to a high of 92.8 mm in July. During the winter months, most of the precipitation is in the form of snow. During spring, snowmelt and rain-on-snow events likely generate long-duration high flows in watercourses, which result in the most significant flows with respect to shaping the channel. Convective storms during the summer are also likely to have a role in shaping the channel, but are less significant due to the short duration of high flows.

2.2 Reach Delineation

Reaches are homogeneous segments of channel used in geomorphological investigations. They are studied semi-independently as each is expected to function in a manner that is at least slightly different from adjoining reaches. This allows for a meaningful characterization of a watercourse as the aggregate of reaches, or an understanding of a particular reach, for example, as it relates to a proposed activity.

Reaches are delineated based on changes in the following:

- Channel planform;
- Channel gradient;
- Physiography;
- Land cover (land use or vegetation);
- Flow, due to tributary inputs;
- Soil type and surficial geology; and
- Certain types of channel modifications by humans.

This follows scientifically defensible methodology proposed by Montgomery and Buffington (1997), Richards et al. (1997) and the Toronto and Region Conservation Authority (2004) as well as others.

Reaches were first delineated as a desktop exercise using available data and information, such as aerial photography, topographic maps, geology information, and physiography maps. These results were then verified in the field.

Five (5) reaches were delineated for Feedmill Creek including one reach (**Reach 5**) along the boundary of the subject property. Four additional reaches were defined within the length of stream downstream that was investigated as part of the assessment. These reaches were defined based on the location of road crossings as well as changes in land use, planform and gradient. Reaches were numbered from downstream to upstream to provide a geographic context. A reach map is provided in **Appendix A**.

2.3 Historical Assessment

3 Field Observations

Reach observations and channel measurements were collected on July 5th and 6th, 2016. Photographs are provided in **Appendix B** and field observations are provided in **Appendix C** for reference. Rapid geomorphological assessments for each reach were completed on July 5th, 2016. A detailed assessment for one reach was completed on July 6th, 2016.

3.1 Rapid Geomorphological Assessments

The rapid geomorphological assessments included the following reach observations:

- Characterization of stream form, process, and evolution using the Rapid Geomorphological Assessment (RGA) (MOE, 2003, VANR, 2007);
- Assessment of the ecological function of the watercourse using the Rapid Stream Assessment Technique (RSAT) (Galli, 1996);
- Stream classification following a modified Downs (1995) and a modified Brierley and Fryirs (2005) River Styles Classification approach;
- Reach-scale habitat sketch maps based on Newson and Newson (2000) outlining channel substrate, flow behaviour, geomorphological units, and riparian vegetation on the day;
- Instream estimates of bankfull channel dimensions;
- Bed and bank material composition and structure; and
- Georeferenced photographs to document the location of all observed erosion and infrastructure.

Five (5) reaches were defined within the study area. **Table 3.1** and **Table 3.2**, below, outline field observations for the observed reaches.

Channel instability was objectively quantified through the application of the Ontario Ministry of the Environment's (2003) Rapid Geomorphic Assessment (RGA). Observations were quantified using an index that identifies channel sensitivity based on evidence of aggradation, degradation, channel widening, and planimetric adjustment. The index produces values that indicate whether the channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40) or adjusting (score >0.41).

The Rapid Stream Assessment Technique (RSAT) was also employed to provide a broader view of the system and consider the ecological functioning of the watercourse (Galli, 1996). Observations were made of channel stability, channel scouring or sediment deposition, instream and riparian habitats, and water quality. The RSAT score ranks the channel as maintaining a poor (<13), fair (13-24), good (25-34) or excellent (35-42) degree of stream health.

The tributary was classified according to a modified Downs (1995) Channel Evolution Model, which describes successional stages of a channel as a result of a perturbation, namely hydromodification. Understanding the current stage of the system is beneficial as this allows one to predict how the channel will continue to evolve, or respond to an alteration to the system.

The River Styles Framework (Brierley and Fryirs, 2005) provides a geomorphic approach to examining river character, behaviour, condition and recovery potential through the identification of the Geomorphic Process Zone. Geomorphic attributes are assessed, larger scale interactions between zones are analyzed, and historical data are studies in order to understand the historical evolution and future trajectories of those reaches. This ultimately provides a physical template

for river management. A modified classification approach was applied to the study reaches. **Table 1** below summarizes the results of the rapid geomorphological assessments.

Table 3.1. Rapid Assessment results by reach

Reach	RGA (MOE, 2003)			RSAT (Galli, 1996)			Downs' Channel Evolution Model (1995)	River Styles Framework (Brierley and Fryirs, 2005)
	Score	Condition	Dominant Systematic Adjustment	Score	Condition	Limiting Features		
1	0.25	In Transition/ Stress	Aggradation	27	Good	Riparian Habitat Conditions	d - Selective deposition resulting in reduced channel width	Meandering, relatively stable, suspended load dominated, low to moderate stream power
2	0.28	In Transition/ Stress	Aggradation	29	Good	Riparian Habitat Conditions	d - Selective deposition resulting in reduced channel width	Meandering, relatively stable, suspended load dominated, low to moderate stream power
3	0.30	In Transition/ Stress	Aggradation, Widening	34	Good	Scouring /Sediment Deposition	d - Selective deposition resulting in reduced channel width	Meandering, relatively stable, suspended load dominated, moderate stream power
4	0.19	In Regime	Widening	27	Good	Riparian Habitat Conditions	d - Selective deposition resulting in reduced channel width	Meandering, relatively stable, suspended load dominated, low stream power
5	0.19	In Regime	Aggradation	23	Good	Riparian Habitat Conditions	d - Selective deposition resulting in reduced channel width	Straight, relatively stable, suspended load dominated, low stream power

Reach 1 was classified according to the River Styles framework as a suspended load channel with a low to moderate gradient and stream power. The creek exists as a single channel and follows a meandering pattern, partially confined by valley sides both historically occurring and associated with recent development activities. A portion of the channel, mid-reach, has been recently straightened and realigned along the south valley wall; historically the entire reach has been meandering, with some meanders contacting the valley wall. A new crossing has been established along the straightened portion of the reach. Aggradation was noted throughout a substantial portion of the reach, including large sand deposits along bars, on the bed and sand deposits on top of banks. Erosion was less prominent (approximately 5-30%) and consisted mainly of undercutting, measured up to 0.33 m. Generally, bank angles ranged 30° to 90°. Riparian vegetation consisted mainly of dense grasses with shrubs along limited sections, both providing stability to channel bank material. Bank material was composed of clay to sand. Bed material ranged from clay to cobbles in riffles and from clay to silt in pools. Riffles comprised approximately 30% and pools / run features comprised approximately 70% of the length of the reach. Average

bankfull width and depth were 3.83 m and 0.89 m, respectfully. Woody debris was present in the channel and cutbank at a moderate density. The stream was clear and odourless.

According to the Downs' Model of Channel Evolution (1995), **Reach 1** was classified as "d – depositional" due to selective deposition resulting in reduced channel width. The Rapid Geomorphic Assessment produced a score of 0.25 or, "In Transition/Stress" with the dominant process being "Evidence of Aggradation" as shown by embedded riffle materials, siltation in pools, accretion of point bars and deposition in the overbank zone. The Rapid Stream Assessment Technique produced a score of 27, or "Good" with riparian habitat conditions as the limiting factor.

Reach 2 exists as a sinuous single channel. It follows an irregularly meandering pattern, partially confined by valley sides. The meanders are smaller and less-regular than in Reach 1. Similar to Reach 1, it was classified as a suspended load channel with low to moderate gradient and stream power. Aggradation, however notable, was somewhat less-dominant a feature in this reach. Further defining this reach was exposed till along the stream bed through a large portion at the downstream end. Bank erosion and bank conditions were similar to Reach 1 with erosion approximately 5-30%, bank angles generally ranging 60° to 90° and undercuts averaging 0.28 m. Bank composition was also similar, ranging from clay to sand. Bed material ranged from clay to cobbles in riffles and clay to silt in pools with exposed till in both types of geomorphic unit. Riffles were present through approximately 20% of the reach and pools or run features were present through approximately 80% of the reach. Average bankfull width and depth were 2.83 m and 1.05 m, respectfully. Riparian vegetation consisted of dense grasses and shrubs through a limited extent of the reach. Woody debris was less commonly present in the channel and cutbank than it was in Reach 1, as was woody vegetation. Upstream of Reach 2 lie two sections running through culverts beneath on and off-ramps of Highway 417. The stream was clear and odourless.

Rapid assessment techniques produced similar results in **Reach 2** as in **Reach 1**. According to the Downs' Model of Channel Evolution (1995), Reach 2 was classified as "d – depositional" due to selective deposition resulting in reduced channel width. The Rapid Geomorphic Assessment produced a score of 0.28 or, "In Transition/Stress" with slightly less dominance on "Evidence of Aggradation" and a greater amount of "Evidence of Degradation" than Reach 1. The Rapid Stream Assessment Technique produced a score of 29, or "Good" with riparian habitat conditions as the limiting factor.

Reach 3 was classified according to the River Styles Framework as a suspended load channel with a moderate gradient and moderate stream power. This reach flowed as a single, well-defined, meandering channel. The valley setting and meanders were generally wider than in other reaches observed however the channel still exhibited partial confinement. The channel flowed through a dense cedar forest. As such, bank material was comprised of a greater fraction of mineral soil and was stabilized by a greater proportion of tree roots as compared to other observed reaches. Also resulting from the forested surroundings was a greater amount of woody debris in the channel and on banks. Evidence of both erosion and deposition were noted throughout the reach. Bank erosion ranged approximately 30-60% with bank angles ranging 60° to 90° and undercuts ranging 0.2 to 0.5 m. Exposed roots and leaning trees were common. Bank composition ranged from clay to sand. Sand deposits were noted on outer bends, tops of banks and in pools. Bed material ranged from gravel to cobbles in riffles and from clay to sand in pools. Geomorphic units were well-developed, with riffles present along approximately 70% of the reach and pools approximately 30% of the reach. Average bankfull width and depth were 4.40 m and 0.80 m, respectfully. A length of the downstream portion flows over exposed Paleozoic bedrock. One informal farm crossing was noted. Reach 3 was the most sensitive reach observed in the study. The stream was clear and odourless.

According to the Downs' Model of Channel Evolution (1995), **Reach 3** was classified as "d – depositional" due to selective deposition resulting in reduced channel width. The Rapid Geomorphic Assessment produced a score of 0.30 or, "In Transition/Stress" with the dominant processes being "Evidence of Aggradation" and "Evidence of Widening". The Rapid Stream Assessment Technique produced a score of 34, on the high end of ranking "Good" with channel scouring / sediment deposition as the limiting factor.

Reach 4 was classified as a suspended load channel with a low to moderate gradient and stream power according to the River Styles Framework. The observed length of reach flows through an unconfined grassy floodplain with a history of beaver activity and localized ponding. Dead trees were noted throughout the flood plain on the bank or in the channel in several locations. This reach exists as a single, well-defined channel with moderate sinuosity and irregular meanders. Average bankfull width and depth were 2.23 m and 0.88 m, respectfully. Bed and bank material ranged from clay to sand with notable sand deposits in pools. Geomorphic units were less-well developed than in downstream reaches with riffles comprising just 10% of the stream length and pools/run features the remaining 90%. Deposition in pools was noted but generally less dominant than in downstream reaches. Bank erosion was similar in extent to reaches 1 and 2, at approximately 5-30%, with bank angles ranging 60° to 90° and undercuts up to 0.33 m. The stream was clear and odourless.

According to the Downs' Model of Channel Evolution (1995), **Reach 4** was classified as "d – depositional" due to selective deposition resulting in reduced channel width. The Rapid Geomorphic Assessment produced a score of 0.19 or, "In Regime" with the dominant processes being "Evidence of Widening". The Rapid Stream Assessment Technique produced a score of 27, or "Good" with riparian habitat conditions as the limiting factor.

Reach 5 exists as a straight single channel having been previously channelized and maintained as such. It flows along the western border of the subject property, though a predominantly grassy, unconfined, agricultural/wooded setting. According to the River Styles Framework, it was classified as a suspended load channel with low gradient and low stream power. Average bankfull width and depth were 2.30 m and 0.52 m, respectfully. Geomorphic units were nearly absent through this reach; a single riffle was noted downstream of an informal farm crossing in a short shrubby section of the channel. The remainder of the channel exists as a run feature. Bed material ranged from clay to gravel in runs and from clay to cobbles in riffles with a high degree of embeddedness. Rooted emergent vegetation and rootlets were present along a substantial extent of the reach. This reach exists within an area dominated by wetlands and organic soils. Bank erosion was under 5% in this reach with undercutting up to 0.12 m observed but generally quite low. Bank angles ranged from 60° to 90°. Deposition was noted in the channel and on top of banks.

According to the Downs' Model of Channel Evolution (1995), **Reach 5** was classified as "d – depositional" due to selective deposition resulting in reduced channel width. The Rapid Geomorphic Assessment produced a score of 0.19 or, "In Regime" with the dominant processes being "Evidence of Aggradation". The Rapid Stream Assessment Technique produced a score of 23, or "Good" with riparian habitat conditions as the limiting factor.

Table 3.2. General channel characteristics by reach

Reach	Average Bankfull Width (m)	Average Bankfull Depth (m)	Substrate		Valley Type	Riparian Vegetation	Notes
			Riffle	Pool			
1	3.83	0.89	Clay to sand, cobble	Clay to silt	Partially confined	Shrubs and grasses	Straightened section mid-reach with new crossing; over-bank and bar sand deposits common
2	2.83	1.05	Cobble, till	Clay to silt, till	Partially confined	Shrubs and grasses	Undercut along entire reach length; till exposed along bed
3	4.4	0.8	Sand to cobble, bedrock	Clay to sand, cobble	Partially confined	Continuous cedar forest	Well developed riffles and pools; reach in natural state; bedrock exposure along bed
4	2.23	0.88	Clay to silt	Clay to sand, cobble	Partially confined	Mainly grasses, forested areas	Geomorphic units not as well defined as downstream reaches; previous flooding in area; upstream portion not observed
5	2.3	0.52	Clay to cobble, rootlets	Clay to fine gravel, rootlets	Unconfined	Mainly grasses	Previously straightened channel dominated by run feature

3.2 Detailed Geomorphological Assessments

Following the initial rapid assessments, **Reach 3** was identified for detailed assessment. This reach was selected because it is most sensitive reaches downstream of the reach that flows along the western boundary of the subject property that may eventually be realigned to accommodate development activities. **Reach 3** was identified as 'In Transition' as a result of aggradation and widening and as such was deemed suitable for determining an appropriate erosion threshold for the upstream subject reach.

The detailed assessment was completed on July 6th, 2016 and included the following:

- Long-profile, level survey of the channel centre line;
- 8 detailed cross-sectional surveys of the watercourse;
- Detailed instream measurements at each cross-section location including bankfull channel geometry, riparian conditions, bank material, bank height/angle, and bank root density;
- Bed material sampling at each cross-section following a modified Wolman's (1954) Pebble Count Technique or substrate sample; and
- Velocity, discharge and observations of active/inactive sediment transport at select representative cross-sections.

A summary of the detailed assessment results is provided in **Appendix D**.

Table 3.3. Bankfull parameters of the sensitive reach

Channel parameter	Results
Measured	
Average bankfull channel width (m)	3.79
Average bankfull channel depth (m)	0.41
Bankfull channel gradient (%)	0.33
D_{50} (mm)	< 2
D_{84} (mm)	50.8
Manning's n roughness coefficient	0.030
Computed	
Bankfull discharge (m^3/s) *	0.45
Average bankfull velocity (m/s)	0.60
Unit stream power at bankfull discharge (W/m^2)	13.96
Tractive force at bankfull (N/m^2)	13.24
Critical shear stress (N/m^2) **	7.02
Flow competency for D_{50} (m/s) ***	N/A
Flow competency for D_{84} (m/s) ***	1.20

* Based on Manning's equation
** Based on Shields diagram from Miller et al. (1997)
*** Based on Komar (1987)

Bank pins were installed on the tops of banks and erosion pins were installed for bank erosion monitoring at two representative cross sections (one riffle and one pool). Detailed measurements were taken at these two cross sections in order to establish a baseline should future monitoring activities be required. Velocity was measured at select cross sections (typically monitoring cross-sections or riffles) to provide an estimate of stream flow at the time of observations.

4 Meander Belt Width Assessment

4.1 Methodology

Most watercourses in Ontario have a natural tendency to develop and maintain a meandering planform, provided there are no spatial constraints. A meander belt width assessment estimates the lateral extent that a meandering channel has historically occupied and will likely occupy in the future. This assessment is therefore useful for determining the potential hazard to proposed activities in the vicinity of a stream.

When defining the meander belt width for a creek system, unconfined and confined systems are treated differently. Unconfined systems are those with poorly defined valleys or slopes well-outside where the channel could realistically migrate. Confined systems are those where the watercourse in contained within a defined valley, where valley wall contact is possible.

In unconfined systems, the meander belt width can be graphically defined using orthorectified aerial imagery or through survey by determining the channel centreline and the channel's central tendency (i.e. meander belt axis).

When watercourses are fully confined within a valley, an erosion setback is employed along with delineation of a stable top of slope. Stability of the valley wall should be assessed by a qualified geotechnical engineer.

Meander belt widths were estimated for two channel reaches. **Reach 5** is the reach that flows along the western boundary of the subject property and which may eventually require realignment to accommodate development activities. This reach was unconfined and previously straightened. **Reach 3** represents a reference reach located downstream exhibiting natural meandering features, indicators of sensitivity and partial confinement within a wide valley system. Both reaches exhibited defined channel banks.

Reach 3 lies mainly within a forested area containing a high density of evergreen vegetation and as such, banks are not clearly visible in aerial photographs. **Reach 5**, as mentioned, was previously straightened. As such, empirical models were used to provide estimates of the meander belt width.

The empirical relations from Williams (1986) were modified to include channel area and width, and applied using the bankfull channel dimensions such that:

$$B_w = (18A^{0.65} + W_b) \times 1.2 \quad \text{[Eq. 1]}$$

$$B_w = (4.3{W_b}^{1.12} + W_b) \times 1.2 \quad \text{[Eq. 2]}$$

where *Bw* is meander belt width (m), *A* is bankfull cross-sectional area (m^2), and *Wb* is bankfull channel width (m). An additional 20% buffer, or factor of safety, was applied to the computed belt width values. This addresses issues of under prediction and provides a factor of safety.

The results of these empirical models were compared with field-measured values of meander amplitude, for a reference meander within the immediate vicinity of the study area. In order to account for the active channel, the average bankfull width, as well as a 20% factor of safety was applied to this meander amplitude, similar to the empirical modelling approach.

Results of the meander belt width assessment, including the empirical modelling and desktop-based approaches are presented in **Table 4.1**.

Table 4.1. Meander belt width estimates for subject and reference reaches.

	Meander Belt Width Method			
	*Williams – Area (1986) (m)	*Williams – Width (1986) (m)	Reference Meander Amplitude Approach (m)	Recommended Meander Belt Width (m)
Reach 3	33	28	23	23
Reach 5	27	16	N/A	27

4.2 Results and Discussion

Meander belt width calculations completed in the Carp River Watershed Study (CRWS) take a very conservative approach of 20 to 40 times the bankfull width. This is substantially higher than recommended by the MNRF under their Guidelines (MNRF, 2001). To provide a more site appropriate meander belt width, a detailed assessment of the reach adjacent to the development and a downstream reference reach was completed. The assessment suggests the meander belt

widths range from 16 to 33 m (based on the reference reach). We suggest 27 m provides an adequate meander belt width for **Reach 5** adjacent to the development. This is greater than the measured meander belt width from **Reach 3** (23 m). We note that the area approach from Williams (1984) is more conservative than the width method that we usually employ, due to the uncertainty regarding a potential channel realignment. If a realignment is proposed, this can have an impact on the meander belt width, and should be refined based on the design geometry of the restored bankfull channel.

5 Erosion Analysis

5.1 Erosion Threshold Analysis

An erosion threshold can be defined as the magnitude of flow required to potentially entrain and transport channel bed and/or bank materials. Threshold targets are therefore provided to guide the design of the proposed SWMFs to ensure that natural erosion rates in the receiving watercourse are not accelerated.

The erosion threshold analysis provides a depth, velocity, or discharge at which sediments of a particular size may potentially be entrained. The results of the detailed geomorphic assessments for **Reach 3** (**Table 3.3**) were used to inform the erosion threshold analysis. We note that, due to natural variability of channel morphology and sediment characteristics within the reach, the computed flow characteristics only provide first approximations of erosion thresholds.

Erosion thresholds are determined using different methods that are dependent on channel and sediment characteristics. An erosion threshold, in the form of a critical discharge, was calculated based on the bed and bank materials and local channel geometry, as determined in the detailed geomorphological assessments. Theoretically, above this discharge, entrainment and transport of sediment can occur. Erosion thresholds for non-cohesive sediments may be estimated using either a shear stress or a velocity approach.

One such velocity approach follows that of Komar (1987), which is based on a velocity approach, whereby:

$$Vcr = 57D^{0.46} \quad \text{[Eq. 5]}$$

where *Vcr* is the critical velocity (cm/s) required to entrain a grain size of *D* (cm).

The velocity in an average channel cross section, *U*, is calculated at various depths, until the average velocity in the cross section exceeds the critical velocity of the bed materials. The velocity in the typical cross section is determined using a Manning's approach, where the Manning's *n* value is visually estimated, or by using the Limerinos (1970) equation:

$$n = \frac{(0.1129)\ R^{1/6}}{1.16+2.0\ \log\left(\frac{R}{D_{84}}\right)} \quad \text{[Eq. 6]}$$

where *R* is the hydraulic radius (m) and D_{84} is the grain size at which 84% of the material is finer (m). Mathematically, the velocity, *U*, is calculated as:

$$U = \frac{1}{n} d^{2/3} S^{1/2} \quad \text{[Eq. 7]}$$

where *n* is the Manning's roughness coefficient, *d* is the depth (m), and *S* is the channel gradient. The critical discharge is then calculated using the flow area of the cross section at the depth where the average velocity in the cross section exceeds the critical velocity of the bed materials.

Determining the erosive resistance of cohesive and/or vegetated bank materials depends on a number of factors, including particle size, cohesion of bank materials, and vegetation effects due to rooting. A typical approach to determine thresholds for the banks is to use empirically derived values for various materials, such as those by Julien (1995). To estimate the erosion threshold of the channel banks, it is assumed that 75% of the bed shear stress and velocity act on the banks in a simplified cross section, following Chow (1959). In this case, as for the bed materials, flow depth is increased until the average velocity in the cross section acting on the banks exceeds the permissible velocity of the bank materials, as outlined by Julien (1995).

The results of the erosion threshold analyses are provided in **Table 5.1**.

Table 5.1. Erosion thresholds of bed and bank materials

Erosion Thresholds (Reach 3)	
Bankfull Conditions	
Bankfull width (m)	3.79
Maximum bankfull depth (m)	0.59
Average bankfull depth (m)	0.41
Slope (%)	0.33
Bankfull Manning's n	0.030
Manning's n applied for erosion thresholds	0.033
Bankfull discharge (m^3/s)	1.64
Bankfull velocity (m/s)	1.05
Bankfull shear stress (N/m^2)	13.24
D50 (m)†	0.01130
Erosion Threshold - Bed Materials	
Critical discharge (m^3/s)	0.45
Critical velocity (m/s)*	0.60
Apparent shear stress (N/m^2)	7.02
Water depth at critical discharge (m)	0.24
Erosion Threshold - Bank Materials	
Critical discharge (m^3/s)	0.71
Critical velocity (m/s)**	0.53
Apparent shear stress (N/m^2)	9.38
Water depth at critical discharge (m)	0.32

* Based on Komar (1987)
** Based on Julien (1995)
† Average grain size excluding fine materials in pools to eliminate bias

The critical discharge needed to entrain the bed materials in **Reach 3** was determined to be 0.45 m^3/s, based on a critical velocity of 0.60 m/s determined using Komar's (1987) method. As the bank materials in this reach consisted of a sandy loam, a permissible velocity of 0.53 m/s was used (Julien, 1995). The critical discharge for the bank materials, based on this velocity, was determined to be 0.71 m^3/s. The critical discharge for the bank materials, of 0.45 m^3/s, was determined to be appropriate for the reach, as it provides a conservative estimate.

It should be noted that the modelling approach applied to determine the erosion thresholds has the potential to underestimate the erosion threshold. As such, field verification is recommended. While the erosion thresholds are based on surveyed cross sections, field verification beyond the water depths on the day of the surveys have not been completed.

6 Summary and Recommendations

The subject reach of Feedmill Creek within the subject lands, **Reach 5**, is not confined. As such the channel can naturally migrate within its valley setting. Given this, Williams (1986) meander belt width protocol was employed. The assessment was based on a measurement of the bankfull width, and was modified to accommodate cross-sectional area. This resulted in recommendations for the meander belt width for Reach 5 of 27 m based on existing conditions, and 30 m in the event that the channel is realigned.

Rapid field assessments identified a reach of potential erosion sensitivity downstream of the proposed development. The detailed assessments were completed in one reach that was identified as sensitive and indicative of natural channel conditions. An erosion threshold was defined for the bed and banks of **Reach 3**, and a critical discharge of 0.45 m^3/s was defined. We note a DRC approach is recommended in the subwatershed study to address erosion concerns. The erosion threshold can be employed in several ways to assess erosion mitigation strategies.

We trust this report meets your requirements. Should you have any questions please contact the undersigned.

Respectfully submitted,

Paul Villard Ph.D., P.Geo., CAN-CISEC
Director, Geomorphologist

Emily Rick, B.Sc.
Environmental Scientist

7 References

Brierley, G.J. and Fryiers, K.A. 2005. Geomorphology and River Management: Applications of the River Styles Framework. Blackwell Publishing, Oxford, UK, 398pp.

Chow, V.T. 1959. Open channel hydraulics. McGraw Hill, New York.

City of Ottawa. Carp River Watershed/Subwatershed Study Volume I – Main Report. Prepared by Robinson Consultants Inc. et al., 2004.

Downs, P.W. 1995. Estimating the probability of river channel adjustment. Earth Surface Processes and Landforms, 20: 687-705.

Environmental Canada. 2016. Canadian Climate Normals, 1981-2010 Climate Normals & Averages. http://climate.weather.gc.ca/climate_normals/index_e.html (accessed March 1, 2016).

Galli, J. 1996. Rapid Stream Assessment Technique, Field Methods. Metropolitan Washington Council of Governments.

Julien, P.Y., and Klaassen, G.J. 1995. Sand-dune geometry of large rivers during floods. Journal of Hydrology, 53, 73-84.

Komar, P.D. 1987. Selective gravel entrainment and the empirical evaluation of flow competence. Sedimentology, 34: 1165-1176

Ministry of Natural Resources and Forestry. 2001. Understanding Natural Hazards. Queen's Printer for Ontario, Ontario, Canada.

Montgomery, D.R. and Buffington, J.M. 1997. Channel-reach morphology in mountain drainage basins. Geological Society of America Bulletin, (109) 5: 596-611.

Ontario Geological Survey (OGS). 2010. Surficial Geology of Southern Ontario.

Richards, K.S., Brooks, S., Clifford, N.J., Harris, T. and Lane, S.N. 1997. Real geomorphology: theory, observation and testing. In Stoddard, D.R. (ed.), Process and Form in Geomorphology. London, Routledge, pp. 265-292.

Toronto and Region Conservation Authority. 2004. Belt Width Delineation Procedures.

Vermont Agency of Natural Resources (VANR). 2007. Step 7: Rapid Geomorphic Assessment (RGA). Phase 2 Stream Geomorphic Assessment.

Williams, G.P. 1986. River meanders and channel size. Journal of Hydrology, 88 (1-2): 147-164.

Appendix A
Reach Map

Legend

- Reach break
- Watercourse
- 25 cm Contour

Reach Delineation
Feedmill Creek

Cavanagh Kanata West

GEO MORPHIX

0 100
Metres

Imagery: Google Earth Pro, 2016.
Reach break: GEO Morphix Ltd., 2016.
Watercourse: MNR (2010). 25 cm Contour: DSEL (2016).

Appendix B
Photographic Record

Photo 1	
	Reach 1 – upstream facing to run feature; grassy banks, partial confinement, undercutting on inner bank, sandy deposit out outer bank
Photo 2	
	Reach 1 – upstream facing upstream of new crossing; large sandy deposit with cut face on bank

Photo 3	
	Reach 2 – till on stream bed
Photo 4	
	Reach 2 – upstream facing – wooded section of reach; undercut banks, woody debris; riffle feature with cobbles; embedded cobbles at downstream end; sand on bank

Photo 5	
	Reach 3 – upstream facing downstream end of reach; large undercut, large sandy deposit, exposed tree roots and woody debris
Photo 6	
	Reach 3 – upstream facing at downstream end of reach; riffle over exposed bedrock on bed

Photo 7	
	Reach 3 – upstream facing at surveyed cross section 3 (mid-reach) - riffle feature; bed material mainly cobbles
Photo 8	
	Reach 3 – downstream facing at surveyed cross-section 5 (mid-reach) – pool feature; bed material clay to sand with embedded cobbles; sand on inner bank, undercut outer bank

Photo 9	
	Reach 4 - upstream facing; grassy undercut banks; silt to cobbles on bed
Photo 10	
	Reach 4 - upstream facing; run feature with undercut banks and large woody debris; dead trees throughout floodplain

Photo 11	
	Reach 5 - upstream facing; grassy undercut banks; run feature; clay to silt bed with rooted submergent vegetation
Photo 12	
	Reach 5 – upstream facing in scrubby wooded section of reach showing bankfull dimensions and straight nature of reach; clay to cobble bed material, embeddedness

Appendix C
Field Observations

General Site Characteristics

Project Code/Phase: PN 16059

Date:	July 5 2016	Stream/Reach:	Reach 1
Weather:	Sun/clouds 33°C	Location:	Feedmill Creek
Field Staff:	AD / ER	Watershed/Subwatershed:	Carp River

Features

- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Island/bar
- Eroded bank
- Undercut bank
- XXXXXX Rip rap/stabilization
- Instream log/tree
- Fence
- Culvert
- Swamp
- Grasses
- Tree

Flow Type

H1	Standing water
H2	Scarcely perceptible flow
H3	Smooth surface flow
H4	Upwelling
H5	Rippled
H6	Unbroken standing wave
H7	Broken standing wave
H8	Chute
H9	Free fall

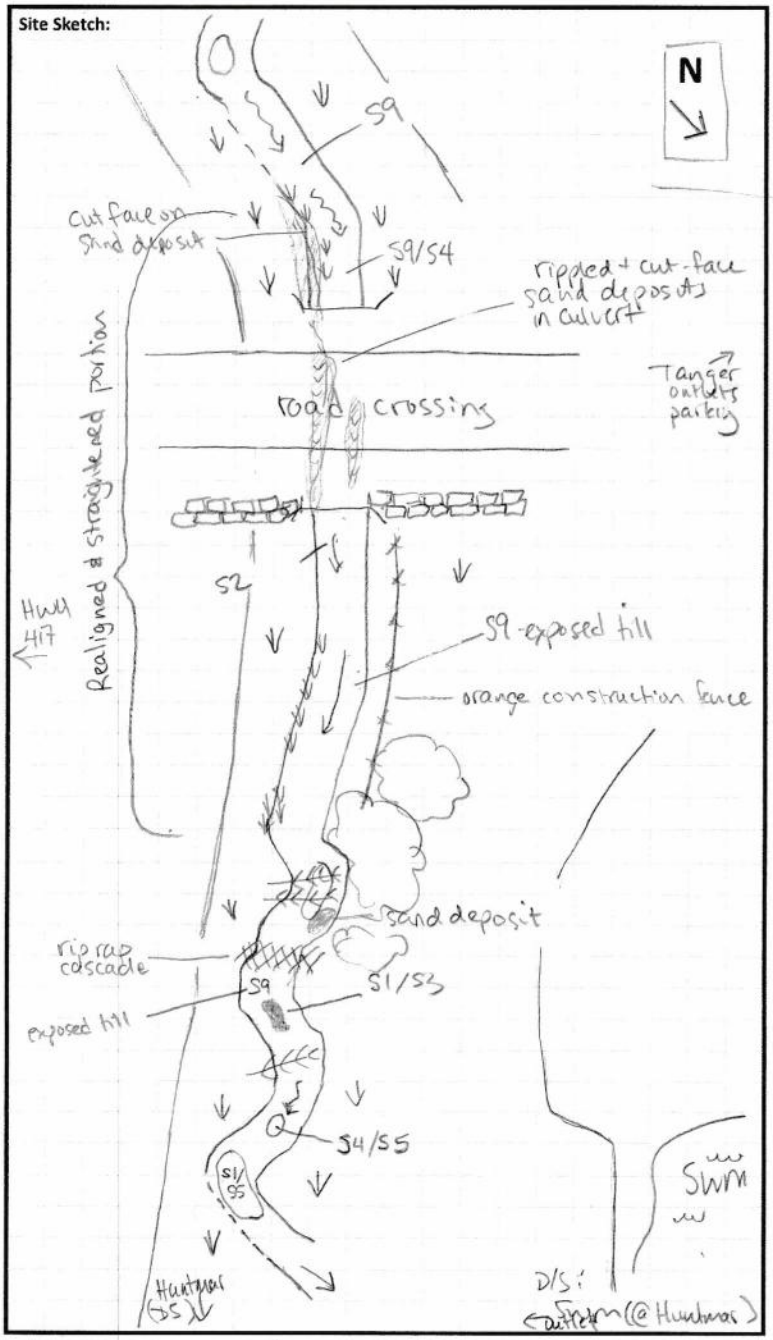
Substrate

S1	Silt
S2	Sand
S3	Gravel
S4	Small cobble
S5	Large cobble
S6	Small boulder
S7	Large boulder
S8	Bimodal
S9	Bedrock/till

Other

BM	Benchmark	TR	Terrace
FC	Flood chute	BOS	Bottom of slope
FP	Floodplain	TOS	Top of slope
GC	Grade control	VWC	Valley wall contact
KP	Knick point	WDJ	Woody debris jam

Site Sketch:



Additional notes: beaver cut wood in creek. Siltation in pools
overbank sand deposits common
rooted submergent and emergent.

- realigned (straightened portion extends u/s & d/s of new crossing (2014).

GEO MORPHIX

Completed by: ER Checked by: AD

GEO MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code/Phase: pn16059

Date:	July 5, 2016	**Stream/Reach:**	Reach 1
Weather:	33°C, sunny	**Location:**	Feedmill Creek
Field staff:	ER/AD	**Watershed/Subwatershed:**	Carp River
UTM (Upstream)	426642.13 mE, 5016410.23 mN	**UTM (Downstream)**	426842.80 mE, 5016548.96 mN

Land Use (Table 1): 4 | **Valley Type** (Table 2): 2 | **Channel Type** (Table 3): 13 | **Channel Zone** (Table 4): 2 | **Flow Type** (Table 5): 1 | ☐ Groundwater | Evidence: _____

Riparian Vegetation

Dominant Type: (Table 6): 2/3
Species: unknown

Coverage:
- ☐ None
- ☑ Fragmented
- ☐ Continuous

Channel widths
- ☐ 1-4
- ☑ 4-10
- ☐ > 10

Age Class (yrs) :
- ☐ Immature (<5)
- ☑ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 2

Aquatic/Instream Vegetation

Type (Table8): 1/2 | **Coverage of Reach (%):** 10

Woody Debris
- ☑ Present in Cutbank
- ☑ Present in Channel
- ☐ Not Present

Density of WD:
- ☐ Low
- ☑ Moderate
- ☐ High

WDJ/50m: 2

Water Quality

Odour (Table 16): 1 very clear

Turbidity (Table 17): 1 cool

no substrate fouling

Channel Characteristics

Sinuosity (Type) (Table 9): 2 | **Sinuosity (Degree)** (Table 10): 2 | **Gradient** (Table 11): 1/2 | **Number of Channels** (Table 12): 1

Entrenchment (Table 13): 1 | **Type of Bank Failure** (Table 14): 2 | **Downs's Classification** (Table 15): d

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☑	☐	☑	☑	☐	☐	☐
Pool Substrate	☑	☐	☐	☐	☐	☐	☐
Bank Material	☑	☑	☐	☐	☐	☐	☐

	Pool	Cascade	Riffle
Bankfull Width (m)	3.50	3.70	4.30
Bankfull Depth (m)	1.30	0.70	0.67
Wetted Width (m)	2.50	3.0	2.30
Wetted Depth (m)	0.61	0.30	0.15

Riffle/Pool Spacing (m): 30 | **% Riffles:** 30 | **% Pools:** 70 | **Meander Amplitude:**

Pool Depth (m) (BF): 1.6 | 1.30 | 0.60 | 0.61

Riffle Length (m): 3-4 | **Undercuts (m):** 6.33

Velocity (m/s): Not measured.

Wiffle ball / ADV / Estimated

Bank Angle
- ☐ 0 – 30
- ☑ 30 – 60
- ☑ 60 – 90
- ☑ Undercut

Bank Erosion
- ☐ < 5%
- ☑ 5 – 30%
- ☐ 30 – 60%
- ☐ 60 – 100%

Comments: overbank + bar deposits common

Notes:

Completed by: ER | Checked by: AD

GEO | MORPHIX

Rapid Geomorphic Assessment

Project Code/Phase: PN 16059

Date:	July 5, 2016	Stream/Reach:	Reach 1
Weather:	33°C Sun/clouds	Location:	Feedmill Creek
Field Staff:	AD, ER	Watershed/Subwatershed:	Cano River

Process	No.	Geomorphic Indicator: Description	Present? Yes	Present? No	Factor Value
Evidence of Aggradation (AI)	1	Lobate bar		✓	4/7
	2	Coarse materials in riffles embedded	✓		
	3	Siltation in pools	✓		
	4	Medial bars		✓	
	5	Accretion on point bars	✓		
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in the overbank zone	✓		
		Sum of indices =	4	3	0.57
Evidence of Degradation (DI)	1	Exposed bridge footing(s)		✓	1/8
	2	Exposed sanitary / storm sewer / pipeline / etc.		N/A	
	3	Elevated storm sewer outfall(s)		✓	
	4	Undermined gabion baskets / concrete aprons / etc.		N/A	
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms	✓		
	7	Head cutting due to knick point migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
		Sum of indices =	1	7	0.125
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		2/7
	2	Occurrence of large organic debris	✓		
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.		N/A	
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.		N/A	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation		N/A	
		Sum of indices =	2	5	0.29
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	0/7
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase meander form		✓	
	7	Bar forms poorly formed / reworked / removed		✓	
		Sum of indices =	0	7	0

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.25

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☐ 0.00 - 0.20	☑ 0.21 - 0.40	☐ 0.41

Completed by: AD, ER Checked by: _____

Rapid Stream Assessment Technique **Project Number:** PN 16059

Date:	July 5, 2016	Stream/Reach:	Reach 1
Weather:	Sunclouds 33°C	Location:	Feedmill Creek
Field Staff:	AD ER	Watershed/Subwatershed:	Carp River

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9 m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☒ 10 ☐ 11

Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition: > 81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition: 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition: 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition: < 30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☒ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high percentage of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ≤ ; ≥ 1.51:1	• Riffle/Pool ratio 0.5-0.69:1; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☒ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15 m below surface	• Objects visible to depth 0.15-0.5 m below surface	• Objects visible to depth 0.5-1.0 m below surface	• Objects visible to depth > 1.0 m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☒ 8

Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: < 50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☒ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☐ 6 ☐ 7

Additional notes:

Total overall score (0 - 42) = 27

Ranking	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
			27	

Completed by: AD, ER Checked by: _____

General Site Characteristics

Project Code/Phase: PN 16059

Date:	July 5, 2016	Stream/Reach:	Reach 2
Weather:	Sun/clouds 33°C	Location:	Feedmill Creek
Field Staff:	AD, ER	Watershed/Subwatershed:	Carp River

Features

- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Island/bar
- Eroded bank
- Undercut bank
- XXXXXX Rip rap/stabilization
- Instream log/tree
- Fence
- Culvert
- Swamp
- Grasses
- Tree

Flow Type

H1	Standing water
H2	Scarcely perceptible flow
H3	Smooth surface flow
H4	Upwelling
H5	Rippled
H6	Unbroken standing wave
H7	Broken standing wave
H8	Chute
H9	Free fall

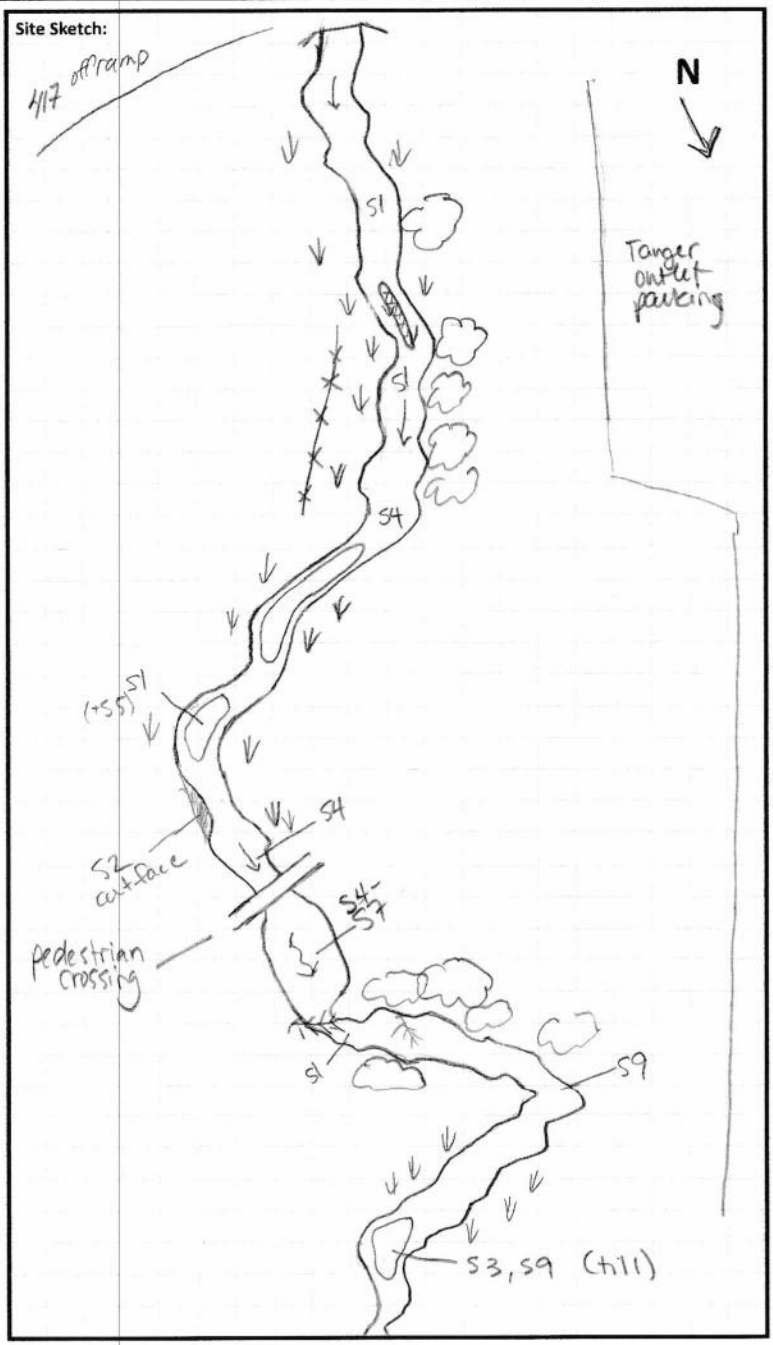
Substrate

S1	Silt
S2	Sand
S3	Gravel
S4	Small cobble
S5	Large cobble
S6	Small boulder
S7	Large boulder
S8	Bimodal
S9	Bedrock/till

Other

BM	Benchmark	TR	Terrace
FC	Flood chute	BOS	Bottom of slope
FP	Floodplain	TOS	Top of slope
GC	Grade control	VWC	Valley wall contact
KP	Knick point	WDJ	Woody debris jam

Site Sketch:



Additional notes: undercut along entire reach

till exposed on bed extensively, esp through d/s end of reach

GEO MORPHIX

Completed by: ER Checked by: AD

GEO MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code/Phase: phil6059

Date:	July 5, 2016	**Stream/Reach:**	Reach 2
Weather:	sun/clouds 33°C	**Location:**	Feedmill Creek
Field staff:	AD, ER	**Watershed/Subwatershed:**	Carp River
UTM (Upstream)	426581.47 mE, 5016248.45 mN	**UTM (Downstream)**	426 6213 mE, 5016410.23 mN

Land Use (Table 1): 4 | **Valley Type** (Table 2): 2 | **Channel Type** (Table 3): 13 | **Channel Zone** (Table 4): 2 | **Flow Type** (Table 5): 1 | ☐ Groundwater | Evidence: _____

Riparian Vegetation

Dominant Type: (Table 6): 2/3
Species: Watercress

Coverage:
- ☐ None
- ☑ Fragmented
- ☐ Continuous

Channel widths
- ☐ 1-4
- ☑ 4-10
- ☐ > 10

Age Class (yrs) :
- ☐ Immature (<5)
- ☑ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 2

Aquatic/Instream Vegetation

Type (Table8): 1/6 | **Coverage of Reach (%):** 15

Woody Debris
- ☐ Present in Cutbank
- ☑ Present in Channel
- ☐ Not Present

Density of WD:
- ☑ Low
- ☐ Moderate
- ☐ High

WDJ/50m: 1

Water Quality

Odour (Table 16): 1

Turbidity (Table 17): 1

Channel Characteristics

Sinuosity (Type) (Table 9): 2 | **Sinuosity (Degree)** (Table 10): 2 | **Gradient** (Table 11): 1/2 | **Number of Channels** (Table 12): 1

Entrenchment (Table 13): 1 | **Type of Bank Failure** (Table 14): 2 | **Downs's Classification** (Table 15): d

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☐	☐	☐	☑	☐	☑	☐
Pool Substrate	☑	☐	☐	☐	☐	☑	☐
Bank Material	☑	☑	☐	☐	☐	☐	☐

	Pool	Pool		Pool	Pool	
Bankfull Width (m)	3.0	2.65		**Wetted Width (m)**	2.30	2.20	
Bankfull Depth (m)	1.05	1.05		**Wetted Depth (m)**	6.50	6.48	

Riffle/Pool Spacing (m): 50 | **% Riffles:** 20 | **% Pools:** 80 | **Meander Amplitude:**

Pool Depth (m): 0.50 | **Riffle Length (m):** 3.4 | **Undercuts (m):** 6.30, 6.25 | **Comments:**

Velocity (m/s): Not measured | **Wiffle ball / ADV / Estimated**

Bank Angle
- ☐ 0 – 30
- ☐ 30 – 60
- ☑ 60 – 90
- ☑ Undercut

Bank Erosion
- ☐ < 5%
- ☑ 5 – 30%
- ☐ 30 – 60%
- ☐ 60 – 100%

Notes:

Completed by: ER | Checked by: AD

GEO | MORPHIX

Rapid Geomorphic Assessment

Project Code/Phase: PN160594

Date:	July 5, 2016	Stream/Reach:	Reach 2
Weather:	Sun, clouds 33°C	Location:	Feedmill Creek
Field Staff:	AD, ER	Watershed/Subwatershed:	Carp River

Process	No.	Geomorphic Indicator	Present? Yes	Present? No	Factor Value
Evidence of Aggradation (AI)	1	Lobate bar		✓	3/4
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools	✓		
	4	Medial bars		✓	
	5	Accretion on point bars	✓		
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in the overbank zone	✓		
		Sum of indices =	3	4	0.43
Evidence of Degradation (DI)	1	Exposed bridge footing(s)		N/A	2/5
	2	Exposed sanitary / storm sewer / pipeline / etc.		N/A	
	3	Elevated storm sewer outfall(s)		N/A	
	4	Undermined gabion baskets / concrete aprons / etc.		N/A	
	5	Scour pools downstream of culverts / storm sewer outlets		N/A	
	6	Cut face on bar forms	✓		
	7	Head cutting due to knick point migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock (till)	✓		
		Sum of indices =	2	3	0.40
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		2/7
	2	Occurrence of large organic debris	✓		
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.		N/A	
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.		N/A	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation		N/A	
		Sum of indices =	2	5	0.29
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	0
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase meander form		✓	
	7	Bar forms poorly formed / reworked / removed		✓	
		Sum of indices =	0	7	0

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.28

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☐ 0.00 - 0.20	☒ 0.21 - 0.40	☐ 0.41

Completed by: AD, ER Checked by: _____

Rapid Stream Assessment Technique **Project Number:** PN 16059

Date:	July 5, 2016	Stream/Reach:	Reach 2
Weather:	Sun/clouds 33C	Location:	Feedmill Creek
Field Staff:	ADFR	Watershed/Subwatershed:	Carp River

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9 m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☒ 10 ☐ 11

Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition: > 81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition: 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition: 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition: < 30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☒ 5 ☐ 6	☐ 7 ☐ 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high percentage of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ≤ ; ≥ 1.51:1	• Riffle/Pool ratio 0.5-0.69:1; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
N/A	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☒ 5 ☐ 6	☐ 7 ☐ 8

Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15 m below surface	• Objects visible to depth 0.15-0.5 m below surface	• Objects visible to depth 0.5-1.0 m below surface	• Objects visible to depth > 1.0 m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☒ 8

Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: <50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☒ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☐ 6 ☐ 7

Additional notes:

Total overall score (0 - 42) = 29

Ranking	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
			29	

Completed by: AD, ER Checked by: _____

General Site Characteristics

Project Code/Phase: PIV 16059

Date:	July 5, 2016	Stream/Reach:	Reach 3
Weather:	mainly sunny 33c	Location:	Feedmill Creek
Field Staff:	AD/ER	Watershed/Subwatershed:	Carp River

Features

- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Island/bar
- Eroded bank
- Undercut bank
- XXXXXX Rip rap/stabilization
- Instream log/tree
- Fence
- Culvert
- Swamp
- Grasses
- Tree

Flow Type

H1	Standing water
H2	Scarcely perceptible flow
H3	Smooth surface flow
H4	Upwelling
H5	Rippled
H6	Unbroken standing wave
H7	Broken standing wave
H8	Chute
H9	Free fall

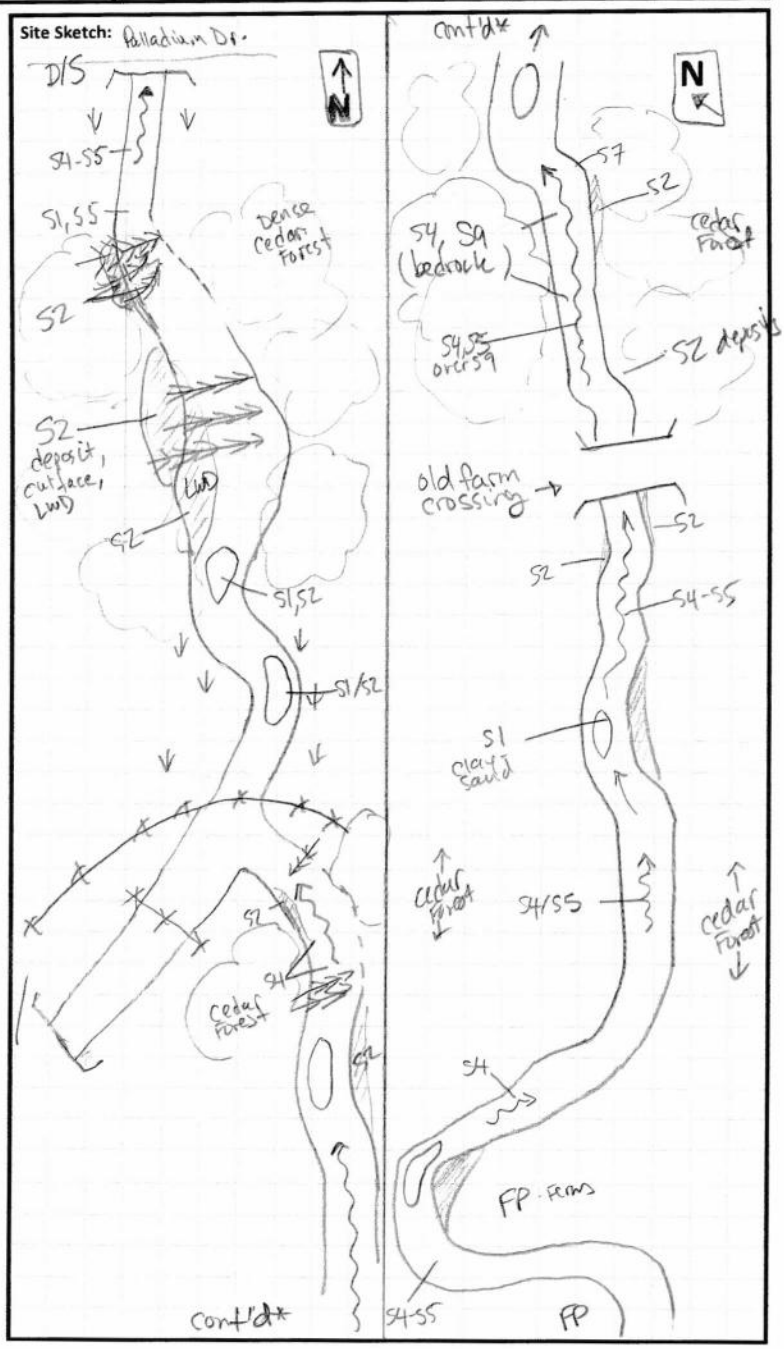
Substrate

S1	Silt
S2	Sand
S3	Gravel
S4	Small cobble
S5	Large cobble
S6	Small boulder
S7	Large boulder
S8	Bimodal
S9	Bedrock/till

Other

BM	Benchmark	TR	Terrace
FC	Flood chute	BOS	Bottom of slope
FP	Floodplain	TOS	Top of slope
GC	Grade control	VWC	Valley wall contact
KP	Knick point	WDJ	Woody debris jam

Site Sketch: Palladium Dr.



Additional notes:

GEO MORPHIX

Completed by: AD/ER Checked by: _____

GEO MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code/Phase: pn16059

Date:	July 5, 2016	**Stream/Reach:**	Reach 3
Weather:	mainly Sunny 33°C	**Location:**	Feedmill Creek
Field staff:	AD/ER	**Watershed/Subwatershed:**	Carp River
UTM (Upstream)	426100.42 mE, 5015886.35 mN	**UTM (Downstream)**	426344 mE, 5016093.89 mN

Land Use (Table 1): 1/4 | **Valley Type** (Table 2): 2 | **Channel Type** (Table 3): 13 | **Channel Zone** (Table 4): 2 | **Flow Type** (Table 5): 1 | ☐ Groundwater | Evidence: _____

Riparian Vegetation

Dominant Type: (Table 6): 1
Species: cedar

Coverage:
- ☐ None
- ☐ Fragmented
- ☒ Continuous

Channel widths
- ☐ 1-4
- ☐ 4-10
- ☒ > 10

Age Class (yrs) :
- ☐ Immature (<5)
- ☐ Established (5-30)
- ☒ Mature (>30)

Encroachment: (Table 7): 1

Aquatic/Instream Vegetation

Type (Table8): 2 | Coverage of Reach (%): 10

Woody Debris
- ☒ Present in Cutbank
- ☒ Present in Channel
- ☐ Not Present

Density of WD:
- ☐ Low
- ☒ Moderate
- ☐ High

WDJ/50m: 2

Water Quality

Odour (Table 16): 1

Turbidity (Table 17): 1

Channel Characteristics

Sinuosity (Type) (Table 9): 2 | **Sinuosity (Degree)** (Table 10): 2 | **Gradient** (Table 11): 2 | **Number of Channels** (Table 12): 1

Entrenchment (Table 13): 1 | **Type of Bank Failure** (Table 14): 2 | **Downs's Classification** (Table 15): d

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☐	☐	☑	☑	☐	☑	☐
Pool Substrate	☑	☑	☐	☑	☐	☐	☐
Bank Material	☑	☑	☐	☐	☐	☐	☐

	POOL	RIFF	RUN	POOL	RIFF	RUN
Bankfull Width (m)	5.4	3.8	4.0	**Wetted Width (m)**	2.80	2.5	2.13
Bankfull Depth (m)	1.25	0.52	0.64	**Wetted Depth (m)**	0.60	0.11	0.19

Riffle/Pool Spacing (m): 20-30 | **% Riffles:** 70 | **% Pools:** 30 | **Meander Amplitude:** 15

Pool Depth (m): | **Riffle Length (m):** 15/20 | **Undercuts (m):** 0.20, 0.50

Velocity (m/s): | | | **Wiffle ball / ADV / Estimated**

Bank Angle
- ☐ 0 – 30
- ☐ 30 – 60
- ☑ 60 – 90
- ☑ Undercut

Bank Erosion
- ☐ < 5%
- ☐ 5 – 30%
- ☑ 30 – 60%
- ☐ 60 – 100%

Comments:

Notes:

Completed by: ER | Checked by: _____

GEO | MORPHIX

Rapid Geomorphic Assessment

Project Code/Phase: PN 160059

Date:	July 5, 2016	Stream/Reach:	Reach 3
Weather:	Sun/clouds 33°C	Location:	Feedmill Creek
Field Staff:	AD, ER	Watershed/Subwatershed:	Carp River

Process	No.	Geomorphic Indicator	Present? Yes	Present? No	Factor Value
Evidence of Aggradation (AI)	1	Lobate bar		✓	3/7
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools	✓		
	4	Medial bars		✓	
	5	Accretion on point bars	✓		
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in the overbank zone	✓		
		Sum of indices =	3	4	0.43
Evidence of Degradation (DI)	1	Exposed bridge footing(s)	N	A	2/6
	2	Exposed sanitary / storm sewer / pipeline / etc.	N	A	
	3	Elevated storm sewer outfall(s)	N	A	
	4	Undermined gabion baskets / concrete aprons / etc.	N	A	
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms	✓		
	7	Head cutting due to knick point migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock	✓		
		Sum of indices =	2	4	0.33
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		3/7
	2	Occurrence of large organic debris	✓		
	3	Exposed tree roots	✓		
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.	N	A	
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.	N	A	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation	N	A	
		Sum of indices =	3	4	0.43
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	0
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase meander form		✓	
	7	Bar forms poorly formed / reworked / removed		✓	
		Sum of indices =	0	7	0

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.30

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☐ 0.00 - 0.20	☒ 0.21 - 0.40	☐ 0.41

Completed by: AD/ER Checked by: _____

Rapid Stream Assessment Technique **Project Number:** PN 16059

Date:	July 5, 2016	Stream/Reach:	Reach 3
Weather:	Sun/clouds 33°C	Location:	Feedmill Creek
Field Staff:	ADER	Watershed/Subwatershed:	Carp River

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9 m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☑ 9 ☐ 10 ☐ 11

Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition: > 81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition: 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition: 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition: < 30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☑ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high percentage of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ≤ ; ≥ 1.51:1	• Riffle/Pool ratio 0.5-0.69:1; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
N/A	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☑ 5 ☐ 6	☐ 7 ☐ 8

Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15 m below surface	• Objects visible to depth 0.15-0.5 m below surface	• Objects visible to depth 0.5-1.0 m below surface	• Objects visible to depth > 1.0 m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☑ 8

Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: < 50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☐ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☑ 6 ☐ 7

Additional notes:

Total overall score (0 - 42) = 34

Ranking	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
			34	

Completed by: AD/ER Checked by: _____

General Site Characteristics

Project Code/Phase: PN 16059

Date:	July 5 2016	Stream/Reach:	Reach 4
Weather:	Sun/clouds 33°C	Location:	Feedmill Creek
Field Staff:	AD EJR	Watershed/Subwatershed:	Carp River

Features

- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Island/bar
- Eroded bank
- Undercut bank
- XXXXXX Rip rap/stabilization
- Instream log/tree
- Fence
- Culvert
- Swamp
- Grasses
- Tree

Flow Type

H1	Standing water
H2	Scarcely perceptible flow
H3	Smooth surface flow
H4	Upwelling
H5	Rippled
H6	Unbroken standing wave
H7	Broken standing wave
H8	Chute
H9	Free fall

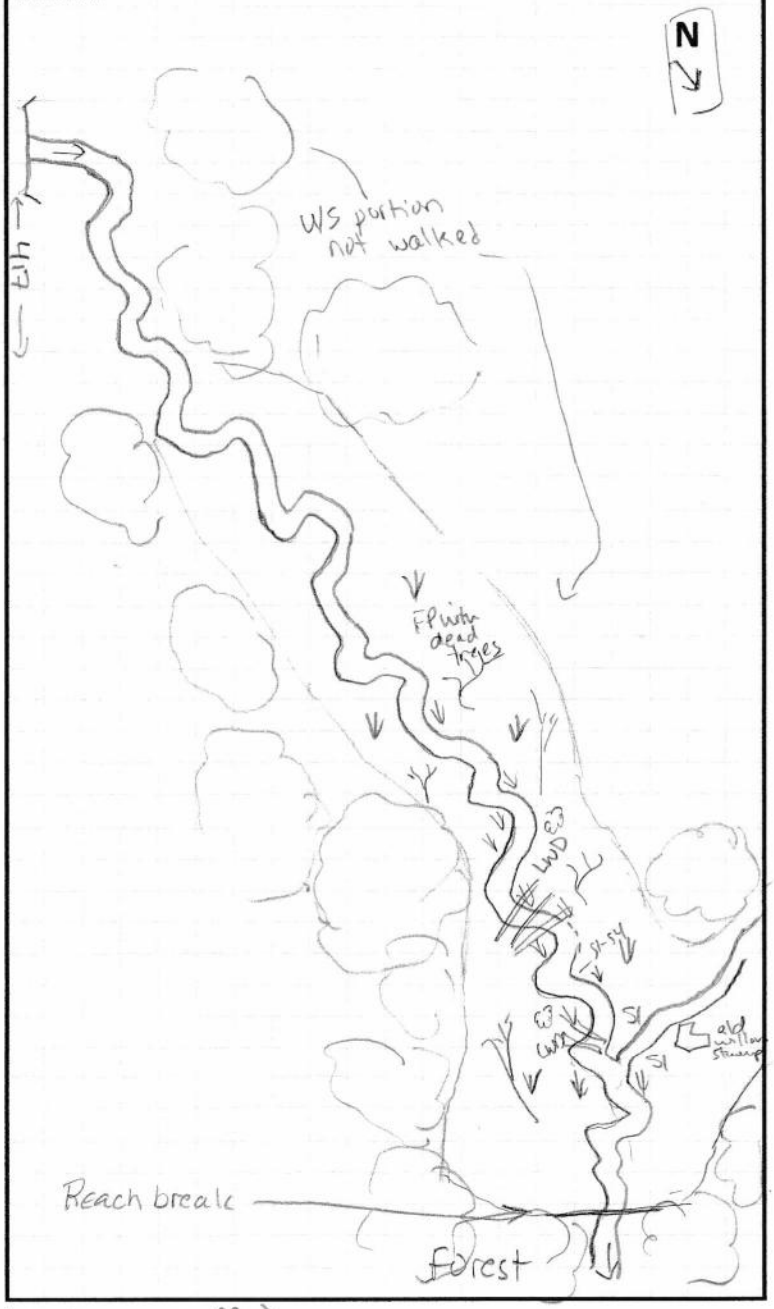
Substrate

S1	Silt
S2	Sand
S3	Gravel
S4	Small cobble
S5	Large cobble
S6	Small boulder
S7	Large boulder
S8	Bimodal
S9	Bedrock/till

Other

BM	Benchmark	TR	Terrace
FC	Flood chute	BOS	Bottom of slope
FP	Floodplain	TOS	Top of slope
GC	Grade control	VWC	Valley wall contact
KP	Knick point	WDJ	Woody debris jam

Site Sketch:



Additional notes: Tributary almost dry (some cut off)
Floodplain occupied by grasses, few shrubs and dead trees – Former Beaver dam d/s end of reach likely cause.
Cedar forest d/s of reach and outside FP. US extent not observed.

GEO MORPHIX

Completed by: AD Checked by: _____

GEO MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code/Phase: PN 16059

Date:	June 5, 2016	**Stream/Reach:**	Reach 4
Weather:	Sun/clouds 33°C	**Location:**	Feedmill Creek
Field staff:	AD, ER	**Watershed/Subwatershed:**	Carp River
UTM (Upstream)	425995.12mE, 5015614.83mN	**UTM (Downstream)**	426100.42mE, 5015886.35mN

Land Use (Table 1): 1/4 | **Valley Type** (Table 2): 1 | **Channel Type** (Table 3): 12 | **Channel Zone** (Table 4): 2 | **Flow Type** (Table 5): 1 | ☐ Groundwater | Evidence: _____

Riparian Vegetation

Dominant Type: (Table 6): 3
Species: _____
dead trees – none alive

Coverage:
- ☐ None
- ☐ Fragmented
- ☑ Continuous

Channel widths
- ☐ 1-4
- ☑ 4-10
- ☐ > 10

Age Class (yrs):
- ☑ Immature (<5)
- ☐ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 2

Aquatic/Instream Vegetation

Type (Table8): 2 | Coverage of Reach (%): 5

Woody Debris
- ☑ Present in Cutbank
- ☑ Present in Channel
- ☐ Not Present

Density of WD:
- ☐ Low
- ☑ Moderate
- ☐ High

WDJ/50m: 2

Water Quality

Odour (Table 16): 1

Turbidity (Table 17): 1

Channel Characteristics

Sinuosity (Type) (Table 9): 1
Sinuosity (Degree) (Table 10): 2
Gradient (Table 11): 1/2
Number of Channels (Table 12): 1
Entrenchment (Table 13): 1
Type of Bank Failure (Table 14): 2
Downs's Classification (Table 15): d

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☑	☐	☐	☐	☐	☐	☐
Pool Substrate	☑	☑	☐	☐	☐	☐	☐
Bank Material	☑	☐	☐	☐	☐	☐	☐

	RUN	POOL			RUN	POOL	
Bankfull Width (m)	2.35	2.10		**Wetted Width (m)**	1.70	1.78	
Bankfull Depth (m)	0.83	0.92		**Wetted Depth (m)**	0.29	0.18	

Riffle/Pool Spacing (m): _____ | **% Riffles:** 10 | **% Pools:** 90 | **Meander Amplitude:** _____

Pool Depth (m): _____ | **Riffle Length (m):** 4 | **Undercuts (m):** 6.05, 0.24

Velocity (m/s): not measured | **Wiffle ball / ADV / Estimated** 0.33

Bank Angle
- ☐ 0 – 30
- ☐ 30 – 60
- ☑ 60 – 90
- ☑ Undercut

Bank Erosion
- ☐ < 5%
- ☑ 5 – 30%
- ☐ 30 – 60%
- ☐ 60 – 100%

Comments: beaver chewed wood
geomorph units not as present

Notes:
Stream flowing

Completed by: ER | Checked by: _____

GEO | MORPHIX

Rapid Geomorphic Assessment

Project Code/Phase: AV160S9

Date:	July 5, 2016	Stream/Reach:	Reach 4
Weather:	Sun/clouds 33C	Location:	Feedmill Creek
Field Staff:	AD, ER	Watershed/Subwatershed:	Carp River

Process	No.	Geomorphic Indicator	Present? Yes	Present? No	Factor Value
Evidence of Aggradation (AI)	1	Lobate bar		✓	2/6
	2	Coarse materials in riffles embedded		N/A	
	3	Siltation in pools	✓		
	4	Medial bars		✓	
	5	Accretion on point bars		✓	
	6	Poor longitudinal sorting of bed materials	✓		
	7	Deposition in the overbank zone		✓	
		Sum of indices =	2	4	0.33
Evidence of Degradation (DI)	1	Exposed bridge footing(s)		N/A	9/5
	2	Exposed sanitary / storm sewer / pipeline / etc.		N/A	
	3	Elevated storm sewer outfall(s)		N/A	
	4	Undermined gabion baskets / concrete aprons / etc.		N/A	
	5	Scour pools downstream of culverts / storm sewer outlets		N/A	
	6	Cut face on bar forms		✓	
	7	Head cutting due to knick point migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
		Sum of indices =	0	5	0
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		3/7
	2	Occurrence of large organic debris	✓		
	3	Exposed tree roots	✓		
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.		N/A	
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.		N/A	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation		N/A	
		Sum of indices =	3	4	0.43
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	0/7
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase meander form		✓	
	7	Bar forms poorly formed / reworked / removed		✓	
		Sum of indices =	0	7	0

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.19

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☒ 0.00 - 0.20	☐ 0.21 - 0.40	☐ 0.41

Completed by: AD/ER Checked by: _____

Rapid Stream Assessment Technique **Project Number:** PN 16059

Date:	July 5, 2016	Stream/Reach:	Reach 4
Weather:	Sun/clouds 33°C	Location:	Feedmill creek
Field Staff:	AO, ER	Watershed/Subwatershed:	Carp River

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9 m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☒ 10 ☐ 11

Channel Scouring/ Sediment Deposition	NA • > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition: > 81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition: 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition: 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition: < 30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☒ 5 ☐ 6	☐ 7 ☐ 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high percentage of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ≤ ; ≥ 1.51:1	• Riffle/Pool ratio 0.5-0.69:1; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
NA	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☒ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15 m below surface	• Objects visible to depth 0.15-0.5 m below surface	• Objects visible to depth 0.5-1.0 m below surface	• Objects visible to depth > 1.0 m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☒ 8

Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: < 50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☒ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☐ 6 ☐ 7

Additional notes:

Total overall score (0 - 42) = 27

Ranking	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
			27	

Completed by: AD/ER Checked by: _____

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high percentage of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ≤ ; ≥ 1.51:1	• Riffle/Pool ratio 0.5-0.69:1; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
NA	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☒ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15 m below surface	• Objects visible to depth 0.15-0.5 m below surface	• Objects visible to depth 0.5-1.0 m below surface	• Objects visible to depth > 1.0 m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☒ 8

Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: < 50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☒ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☐ 6 ☐ 7

Additional notes:

Total overall score (0 - 42) = 27

Ranking	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
			27	

Completed by: AD/ER Checked by: _____

General Site Characteristics

Project Code/Phase: PN160059

Date:	July 5, 2016	Stream/Reach:	Reach 5
Weather:	Sunny 33°C	Location:	Feedmill Creek
Field Staff:	AD ER	Watershed/Subwatershed:	Carp River

Features

- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Island/bar
- Eroded bank
- Undercut bank
- XXXXXX Rip rap/stabilization
- Instream log/tree
- Fence
- Culvert
- Swamp
- Grasses
- Tree

Flow Type

H1	Standing water
H2	Scarcely perceptible flow
H3	Smooth surface flow
H4	Upwelling
H5	Rippled
H6	Unbroken standing wave
H7	Broken standing wave
H8	Chute
H9	Free fall

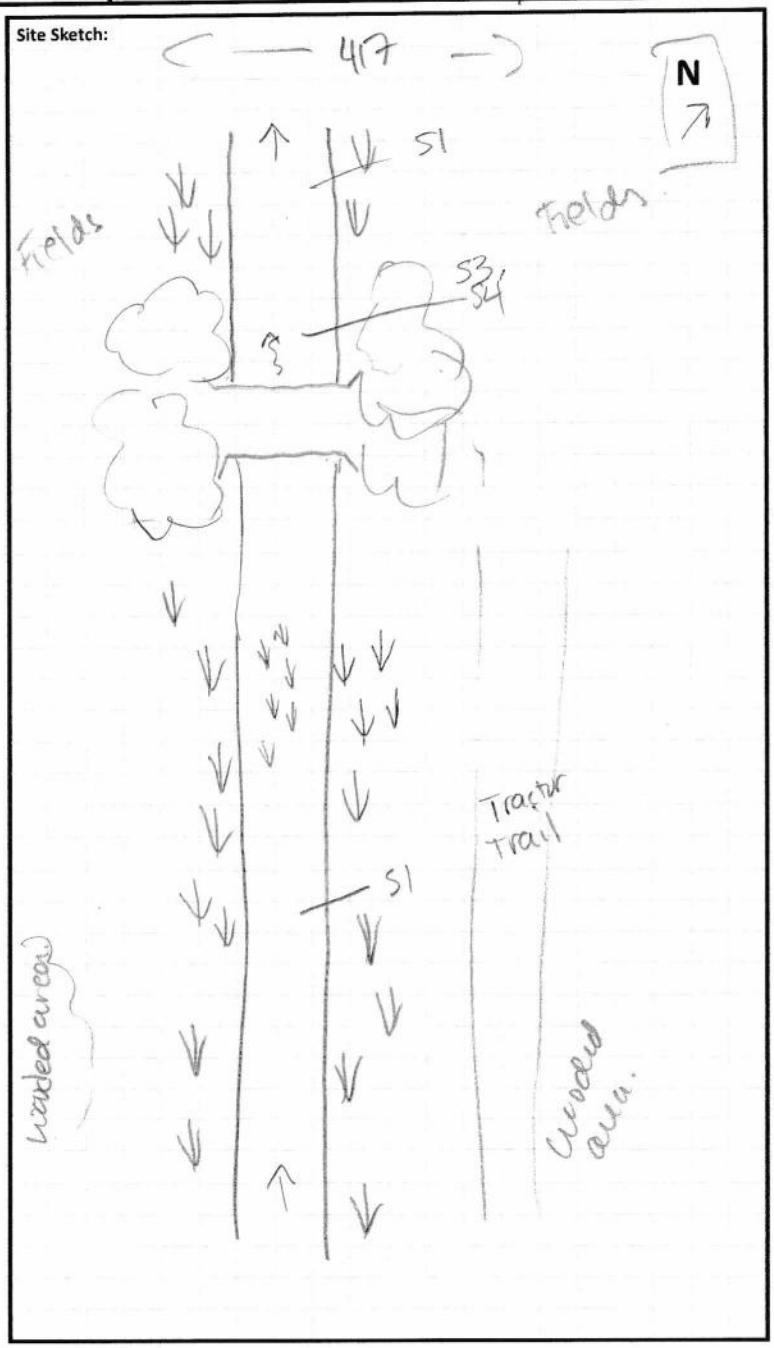
Substrate

S1	Silt
S2	Sand
S3	Gravel
S4	Small cobble
S5	Large cobble
S6	Small boulder
S7	Large boulder
S8	Bimodal
S9	Bedrock/till

Other

BM	Benchmark	TR	Terrace
FC	Flood chute	BOS	Bottom of slope
FP	Floodplain	TOS	Top of slope
GC	Grade control	VWC	Valley wall contact
KP	Knick point	WDJ	Woody debris jam

Site Sketch:



Additional notes: straightened channel
more encroachment than d/s reaches

GEO MORPHIX

Completed by: AD, ER Checked by: _____

GEO | MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code/Phase: pnl6059

Date:	July 5, 2016	**Stream/Reach:**	Reach 5
Weather:	mainly sunny, 33°C	**Location:**	Feedmill Creek
Field staff:	AD ER	**Watershed/Subwatershed:**	Carp River
UTM (Upstream)	426383.46mE, 5015021.22mN	**UTM (Downstream)**	425980.34 mE, 5015484.58 mN

Land Use (Table 1): 7/4 | **Valley Type** (Table 2): 1 | **Channel Type** (Table 3): 11 | **Channel Zone** (Table 4): 2 | **Flow Type** (Table 5): 1 | ☐ Groundwater | Evidence: _____

Riparian Vegetation

Dominant Type: (Table 6): 3
Species: mixed/unknown

Coverage:
- ☐ None
- ☐ Fragmented
- ☒ Continuous

Channel widths
- ☐ 1-4
- ☒ 4-10
- ☐ > 10

Age Class (yrs) :
- ☒ Immature (<5)
- ☐ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 2

Aquatic/Instream Vegetation

Type (Table8): 2 | Coverage of Reach (%): 50

Woody Debris
- ☐ Present in Cutbank
- ☐ Present in Channel
- ☑ Not Present

Density of WD:
- ☑ Low
- ☐ Moderate
- ☐ High

WDJ/50m: 0

Water Quality

Odour (Table 16): 1

Turbidity (Table 17): 1

Channel Characteristics

Sinuosity (Type) (Table 9): /
Sinuosity (Degree) (Table 10): 1
Gradient (Table 11): 1
Number of Channels (Table 12): 1
Entrenchment (Table 13): 1
Type of Bank Failure (Table 14): 2
Downs's Classification (Table 15): d

	Clay/Silt	Sand (coarse)	Gravel (fine)	Cobble	Boulder	Parent	Rootlets
Riffle Substrate (RUN)	☑	☑	☑	☑	☐	☐	☑
Pool Substrate	☑	☑	☑	☐	☐	☐	☑
Bank Material	☑	☐	☐	☐	☐	☐	☑

	RUN	RUN	RUN		RUN	RUN	RUN
Bankfull Width (m)	2.0	2.40	2.50	**Wetted Width (m)**	1.6	1.80	1.65
Bankfull Depth (m)	0.54	0.61	0.42	**Wetted Depth (m)**	0.17	0.28	0.27

Riffle/Pool Spacing (m): N/A | **% Riffles:** 5 | **% Pools:** (RUN) 95 | **Meander Amplitude:**

Pool Depth (m) wetted not BF: 0.28 | **Riffle Length (m):** | **Undercuts (m):** 0.12,

Velocity (m/s) Not measured | **Wiffle ball / ADV / Estimated**

Bank Angle
- ☐ 0 – 30
- ☐ 30 – 60
- ☑ 60 – 90
- ☑ Undercut

Bank Erosion
- ☑ < 5%
- ☐ 5 – 30%
- ☐ 30 – 60%
- ☐ 60 – 100%

Comments: - all runs (one small riffle)
- embedded

Notes:
- straightened
- flowing.

Completed by: ER | Checked by: _____

GEO | MORPHIX

Rapid Geomorphic Assessment

Project Code/Phase: PN 16059

Date:	July 5, 2016	Stream/Reach:	Reach 5
Weather:	Mainly Sunny 33°C	Location:	Feedmill Creek
Field Staff:	AO, ER	Watershed/Subwatershed:	Carp River

Process	No.	Geomorphic Indicator: Description	Present? Yes	Present? No	Factor Value
Evidence of Aggradation (AI)	1	Lobate bar		✓	4/7
	2	Coarse materials in riffles embedded	✓		
	3	Siltation in pools	✓		
	4	Medial bars		✓	
	5	Accretion on point bars		✓	
	6	Poor longitudinal sorting of bed materials	✓		
	7	Deposition in the overbank zone	✓		
		Sum of indices =	4	3	0.57
Evidence of Degradation (DI)	1	Exposed bridge footing(s)		N/A	0/8
	2	Exposed sanitary / storm sewer / pipeline / etc.		✓	
	3	Elevated storm sewer outfall(s)		✓	
	4	Undermined gabion baskets / concrete aprons / etc.		N/A	
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms		✓	
	7	Head cutting due to knick point migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
		Sum of indices =	0	8	0
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.		✓	1/6
	2	Occurrence of large organic debris	✓		
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.		N/A	
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.		N/A	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation		N/A	
		Sum of indices =	1	6	0.17
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	0/7
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase meander form		✓	
	7	Bar forms poorly formed / reworked / removed		✓	
		Sum of indices =	0	7	0

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.19

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☒ 0.00 - 0.20	☐ 0.21 - 0.40	☐ 0.41

Completed by: AO/ER Checked by: _____

Rapid Stream Assessment Technique **Project Number:** PN 16059

Date:	July 5 2016	Stream/Reach:	Reach 5
Weather:	Sunny 33°C	Location:	Feedmill Creek
Field Staff:	AIDER.	Watershed/Subwatershed:	Carp River

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9 m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☑ 10 ☐ 11

Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition: > 81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition: 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition: 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition: < 30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☑ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high percentage of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ≤ ; ≥ 1.51:1	• Riffle/Pool ratio 0.5-0.69:1; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
NA	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☒ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15 m below surface	• Objects visible to depth 0.15-0.5 m below surface	• Objects visible to depth 0.5-1.0 m below surface	• Objects visible to depth > 1.0 m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☒ 6	☐ 7 ☐ 8

Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: < 50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☒ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☐ 6 ☐ 7

Additional notes:

Total overall score (0 - 42) = 23

Ranking	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
			23	

Completed by: AO/ER Checked by: _____

Appendix D
Detailed Assessment Summary

Detailed Geomorphological Assessment Summary

Project Number:	PN16059	**Date:**	July 6, 2016
Client:	DSEL	**Length Surveyed (m):**	104.1
Location:	Feedmill Creek	**# of Cross-Sections:**	8

Reach Characteristics

Drainage Area:	Not measured	**Dominant Riparian Vegetation Type:**	Cedar forest
Geology/Soils:	Glaciolacustrine	**Extent of Riparian Cover:**	Continuous
Surrounding Land Use:	Industrial/forest	**Width of Riparian Cover:**	> 10 channel widths
Valley Type:	Partially confined	**Age Class of Riparian Vegetation:**	Mature (>30 years)
Dominant Instream Vegetation Type:	Rooted submergent	**Extent of Encroachment into Channel:**	No encroachment
Portion of Reach with Vegetation:	10%	**Density of Woody Debris:**	Moderate

Hydrology

Measured Discharge (m^3/s):	#DIV/0!	**Calculated Bankfull Discharge (m^3/s):**	1.64
Modelled 2-year Discharge (m^3/s):	Not modelled	**Calculated Bankfull Velocity (m/s):**	1.05
Modelled 2-year Velocity (m/s):	Not modelled		

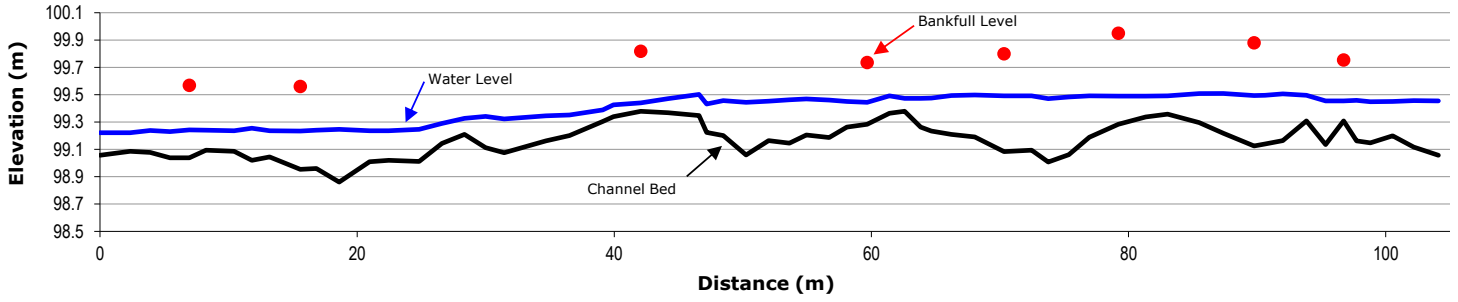
Profile Characteristics

Bankfull Gradient (%):	0.33
Channel Bed Gradient (%):	0.17
Riffle Gradient (%):	2.63
Riffle Length (m):	8.13
Riffle-Pool Spacing (m):	17.54

Planform Characteristics

Sinuosity:	1.83
Meander Belt Width (m):	Not measured
Radius of Curvature (m):	Not measured
Meander Amplitude (m):	Not measured
Meander wavelength (m):	Not measured

Longitudinal Profile



Bank Characteristics

	Minimum	Maximum	Average
Bank Height (m):	0.25	0.65	0.38
Bank Angle (deg):	30	90	65
Root Depth (m):	0.05	0.30	0.18
Root Density (%):	4	35	17
Bank Undercut (m):	0.00	0.28	0.04

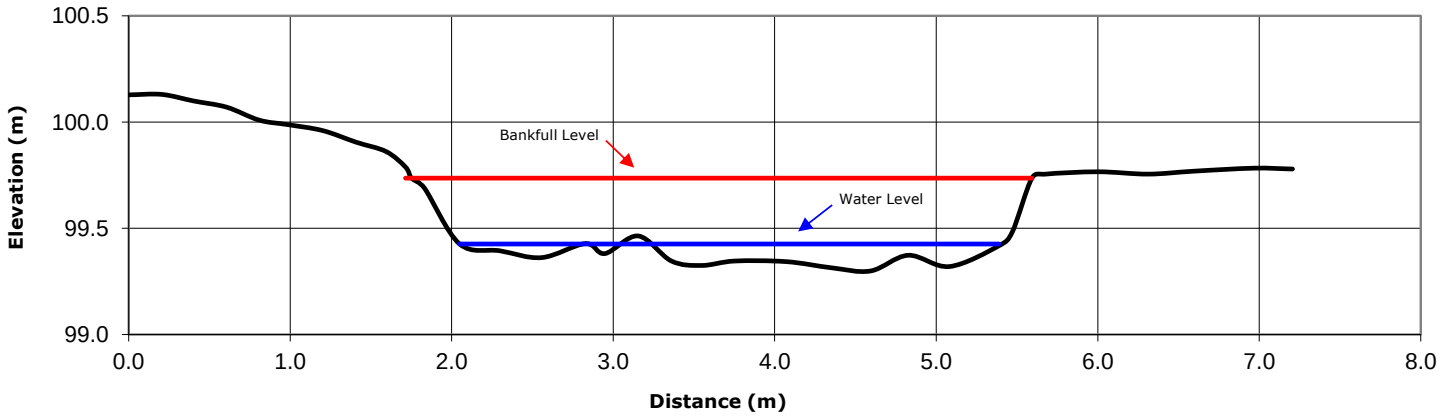
	Minimum	Maximum	Average
Torvane Value (kg/cm^2):		Not measured	
Penetrometer Value (kg/cm^3):		Not measured	
Bank Material (range):		Clay to sand	

Cross-Sectional Characteristics

	Minimum	Maximum	Average
Bankfull Width (m):	3.33	4.69	3.79
Average Bankfull Depth (m):	0.32	0.54	0.41
Bankfull Width/Depth (m/m):	6	13	10
Wetted Width (m):	2.05	3.34	2.59
Average Water Depth (m):	0.06	0.32	0.15
Wetted Width/Depth (m/m):	6	52	24
Entrenchment (m):		Not measured	
Entrenchment Ratio (m/m):		Not measured	
Maximum Water Depth (m):	0.08	0.40	0.22
Manning's *n*:		0.030	

Photograph at cross section 4 (looking downstream)

Representative Cross-Section # 4



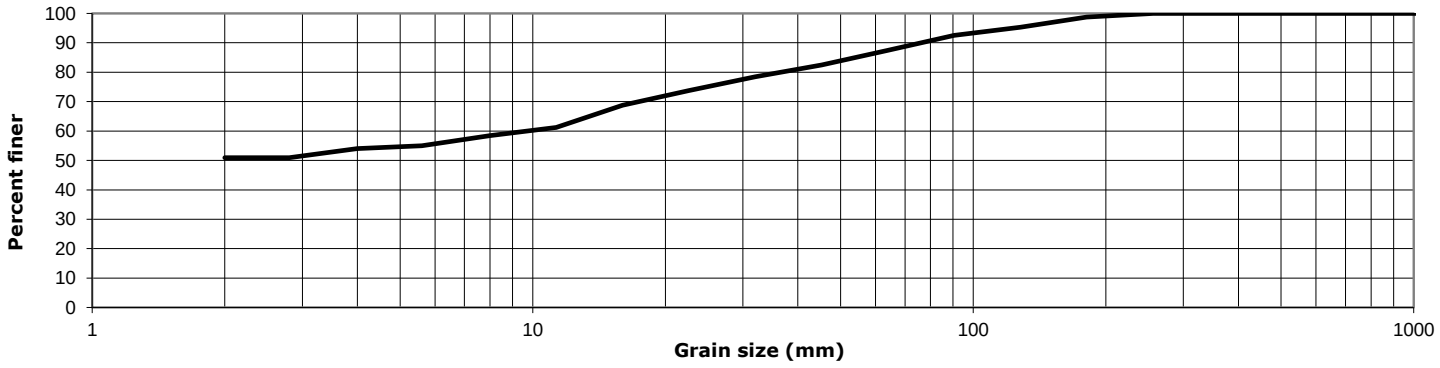
Substrate Characteristics

Particle Size (mm)

D_{10} :	<2
D_{50} :	<2
D_{84} :	50.8

Subpavement:	Gravel, cobble
Particle shape:	Subangular
Embeddedness (%):	10 - 100%
Particle range (riffle):	Sand to cobble
Particle Range (pool):	Clay to cobble

Cumulative Particle Size Distribution



Channel Thresholds

Flow Competency (m/s):		**Tractive Force at Bankfull (N/m^2):**	13.24
for D_{50}:	N/A	**Tractive Force at 2-year flow (N/m^2):**	Not modelled
for D_{84}:	1.20	**Critical Shear Stress (D_{50}) (N/m^2):**	N/A
Unit Stream Power at Bankfull (W/m^2):	13.96		

General Field Observations

Channel Description

Reach 3 follows a meandering path within a continuous cedar forest. The reach is partially confined, has a moderate gradient and a meander amplitude of approximately 15 m. Riffles and pools are well-developed. Some riffles within the reach but outside of the surveyed extent were much longer than those surveyed. Bed substrate ranged from clay to large cobbles. Sand deposits were noted on meander bends. Bank angles ranged from 60 to 90° with undercuts up to 0.5 m but typically in the range of 0.20 m. Bank erosion was 30-60%. Most banks were well supported by both fine and large woody root matrix. Woody debris was frequently encountered in the channel.

Cross Section 6 - Looking Downstream

patersongroup

Consulting Engineers

154 Colonnade Road South
Ottawa, Ontario
K2E 7J5
Tel: (613) 226-7381
Fax: (613) 226-6344

October 13, 2016
Report: PG3520-LET.01R

Geotechnical Engineering
Environmental Engineering
Hydrogeology
Geological Engineering
Materials Testing
Building Science
Archaeological Services

www.patersongroup.ca

2325483 Ontario Inc.
9094 Cavanagh Road
Highway 7
Ashton, Ontario
K0A 1B0

Attention: **Mr. Chris Collins**

Subject: **Slope Stability Assessment - Feedmill Creek**
Proposed Development - Kanata West
Palladium Drive at Huntmar Drive - Ottawa

Dear Sir,

Upon your request, Paterson Group (Paterson) completed a slope stability assessment to determine the limit of hazard lands designation line for the subject alignment of Feedmill Creek adjacent to the aforementioned site. The present letter summarizes our findings and presents our limit of hazard lands recommendations.

1.0 Background Information

A site visit was conducted on June 25, 2016 by Paterson personnel to assess the watercourse and existing slope conditions of the subject section of Feedmill Creek. The subject section of Feedmill Creek borders the north section of the west boundary of the subject site. The shallow watercourse observed at the bottom of the 0.7 to 1.1 m high deep ditch which varies between 1.5 to 2 m in width at the bottom and approximately 5.5 to 7.5 m wide at the top. The ditch is mainly grass covered with some bushes and sparse trees. Some of the grass root system was noted to be exposed beyond bank face at the water's edge with some sloughing and minor undercutting along the slope face noted where the watercourse has meandered in close proximity to the slope.

Three (3) slope profiles were completed for the subject site by Paterson personnel.

Boreholes completed as part of a previous geotechnical investigation and hand auger holes competed on June 25, 2016 within the creek alignment indicate the subsurface profile in the area of the subject section of Feedmill Creek consists of a thin layer of topsoil overlying a weathered brown silty clay and/or glacial till consisting of a silty sand with gravel, cobbles and boulders overlying inferred bedrock.

2.0 Slope Stability Analysis

A slope stability analysis was completed by Paterson for the subject slope. Three (3) slope sections were studied based on information obtained by Paterson field personnel, recent topographic survey information completed by Stantec and topographical mapping from the City of Ottawa.

The analysis of the stability of the slope was carried out using SLIDE, a computer program which permits a two-dimensional slope stability analysis using several methods including the Bishop's method, which is a widely used and accepted analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to those favouring failure. Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsoil and groundwater conditions, a factor of safety greater than one is usually required to ascertain the risks of failure are acceptable. A minimum factor of safety of 1.5 is generally recommended for conditions where the failure of the slope would endanger permanent structures. Under seismic loading, a minimum factor of safety of 1.1 is considered to be satisfactory.

The sections were analyzed taking into account a groundwater level at ground surface. Subsoil conditions at the cross-sections were inferred based on the findings at nearby borehole locations, hand auger holes and general knowledge of the area's geology.

Static Conditions Analysis

The results for the existing slope conditions at Sections A, B and C are shown in Figures 2a, 3a and 4a, respectively, and are attached to the present report. The results of the slope stability analysis indicate that all sections are considered stable from a geotechnical perspective.

Seismic Loading Analysis

An analysis considering seismic loading was also completed. A horizontal seismic acceleration, K_h, of 0.16G was considered for the analyzed sections. A factor of safety of 1.1 is considered to be satisfactory for stability analysis including seismic loading.

The results of the analysis including seismic loading are shown in Figures 2b, 3b and 4b for the slope sections. The overall slope stability factors of safety for the subject sections when considering a seismic loading were found to be greater than 1.1. Based on these results, the slopes are considered to be stable under seismic loading.

Geotechnical Setback - Limit of Hazard Lands

The geotechnical setback limits (limit of hazard lands) includes the geotechnical stable slope allowance, a toe erosion allowance (where applicable) as well as a 6 m toe erosion access allowance.

The toe erosion allowance for the valley corridor wall slopes was based on the cohesive nature of the soils, the observed current erosional activities and the width and location of the current watercourse. Signs of erosion were noted along the existing watercourse, especially where the watercourse has meandered in close proximity to the toe of the corridor wall. It is considered that a toe erosion allowance of 2 m is appropriate for the corridor walls confining the existing watercourse.

It should be noted that based on our analysis results, the slopes are considered stable. The limit of hazard lands designation line for the subject site is indicated on Drawing PG3520-3 - Test Hole Location Plan and further detailed in Drawing PG3520-4 - Limit of Hazard Lands attached to the current report.

The existing vegetation on the slope face should not be removed as it contributes to the stability of the slope and reduces erosion. If the existing vegetation needs to be removed, it is recommended that a 100 to 150 mm of topsoil mixed with a hardy seed or an erosional control blanket be placed across the exposed slope face.

3.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. Should any conditions at the site be encountered which differ from those at the test locations, we request that we be notified immediately in order to permit reassessment of our recommendations.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than 2325483 Ontario Inc. or their agents, without review by this firm for the applicability of our recommendations to the altered use of the report.

We trust that this information satisfies your requirements.

Best Regards,

Paterson Group Inc.

Richard Groniger, C. Tech.

David J. Gilbert, P.Eng.

Attachments

- ❑ Soil Profile and Test Data Sheets
- ❑ Figure 1 - Key Plan
- ❑ Figure 2a - Section A - Static Conditions
- ❑ Figure 2b - Section A - Seismic Loading
- ❑ Figure 3a - Section B - Static Conditions
- ❑ Figure 3b - Section B - Seismic Loading
- ❑ Figure 4a - Section C - Static Conditions
- ❑ Figure 4b - Section C - Seismic Loading
- ❑ Drawing PG3520-3 - Test Hole Location Plan
- ❑ Drawing PG3520-4 - Limit of Hazard Lands

Report Distribution

- ❑ 2325483 Ontario Inc. (3 copies)
- ❑ Paterson Group (1 copy)

patersongroup

Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Development - Palladium Dr. & Huntmar Dr.
Ottawa, Ontario

DATUM Ground surface elevations provided by Cavanaugh Construction.

FILE NO. PG3520

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** June 9, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	107.24
TOPSOIL 0.10		SS	1	75	4		
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders		SS	2	92	34	1	106.24
		SS	3	100	41		
- grey by 2.0m depth						2	105.24
		SS	4	78	59		
						3	104.24
		SS	5	75	33		
3.71							
End of Borehole							
Practical refusal to augering @ 3.71m depth							
(GWL @ 0.13m-June 16, 2015)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup

Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Development - Palladium Dr. & Huntmar Dr.
Ottawa, Ontario

DATUM Ground surface elevations provided by Cavanaugh Construction.

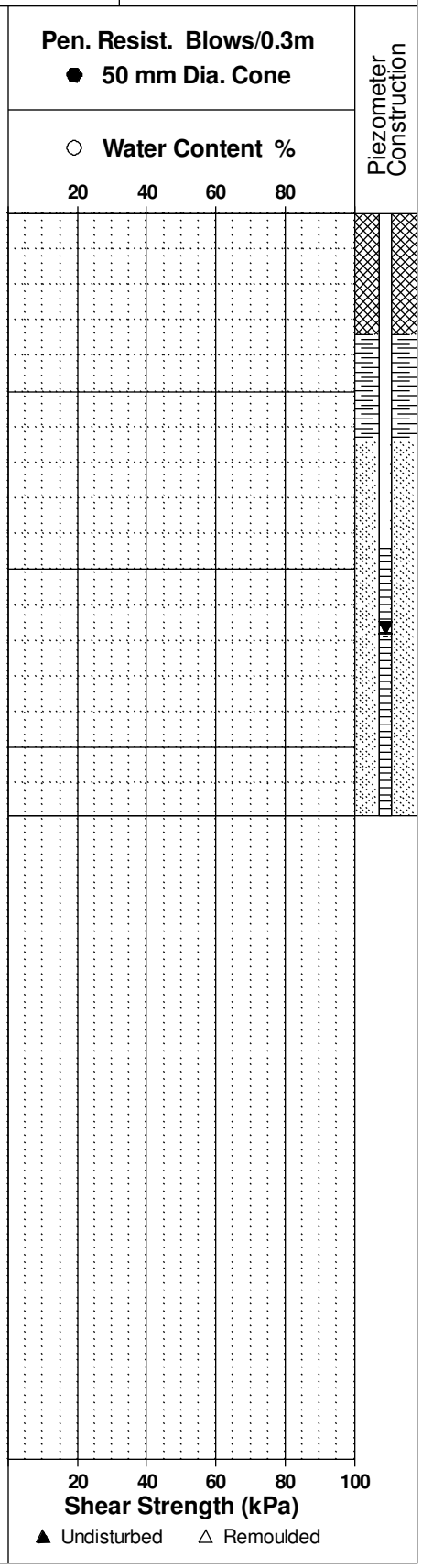
FILE NO. PG3520

REMARKS

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger **DATE** June 9, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.77
TOPSOIL 0.30		AU	1				
Brown **SILTY CLAY,** some sand		SS	2	58	24	1	104.77
1.30							
GLACIAL TILL: Grey silty sand with clay, gravel, cobbles and boulders		SS	3	42	8	2	103.77
		SS	4	100	2		
		SS	5	100	50+	3	102.77
3.38							
End of Borehole							
Practical refusal to augering at 3.38m depth							
(GWL @ 2.36m-June 16, 2015)							



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

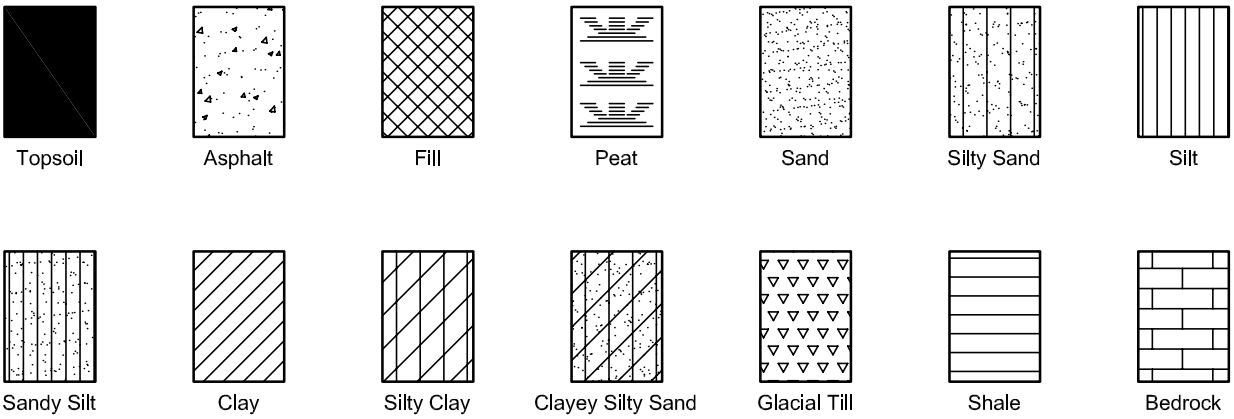
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

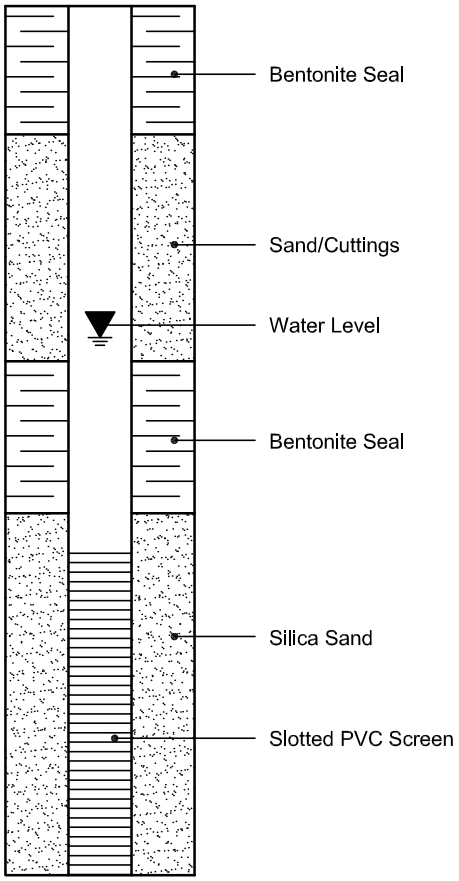
SYMBOLS AND TERMS (continued)

STRATA PLOT

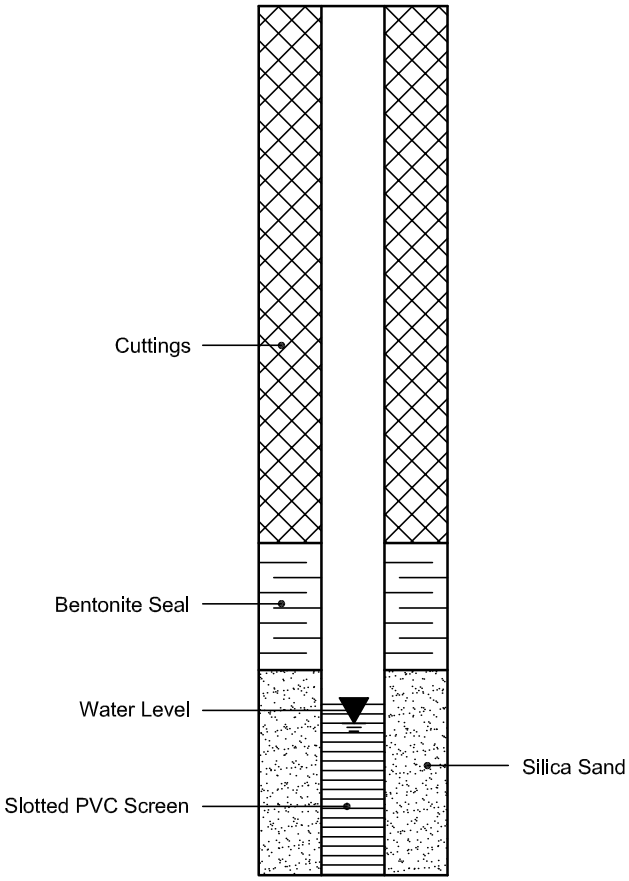


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



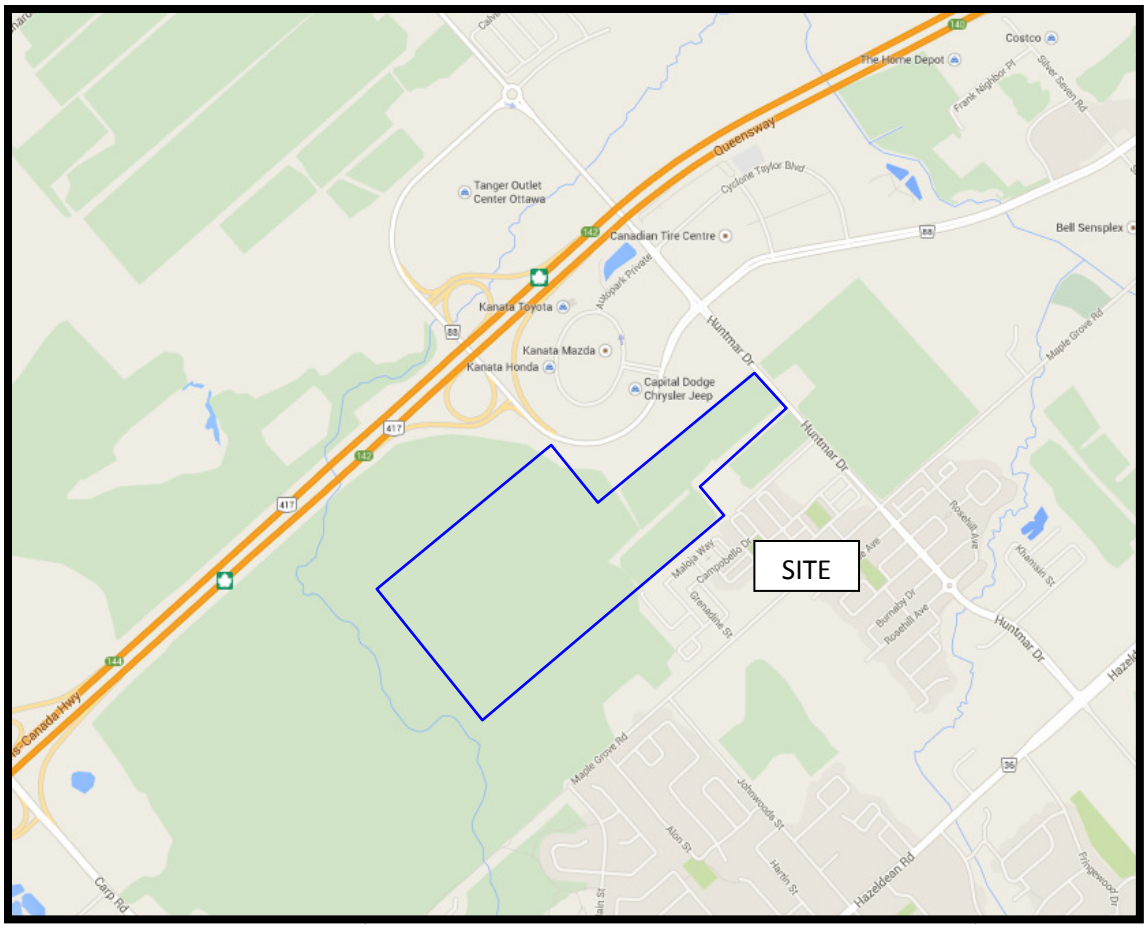
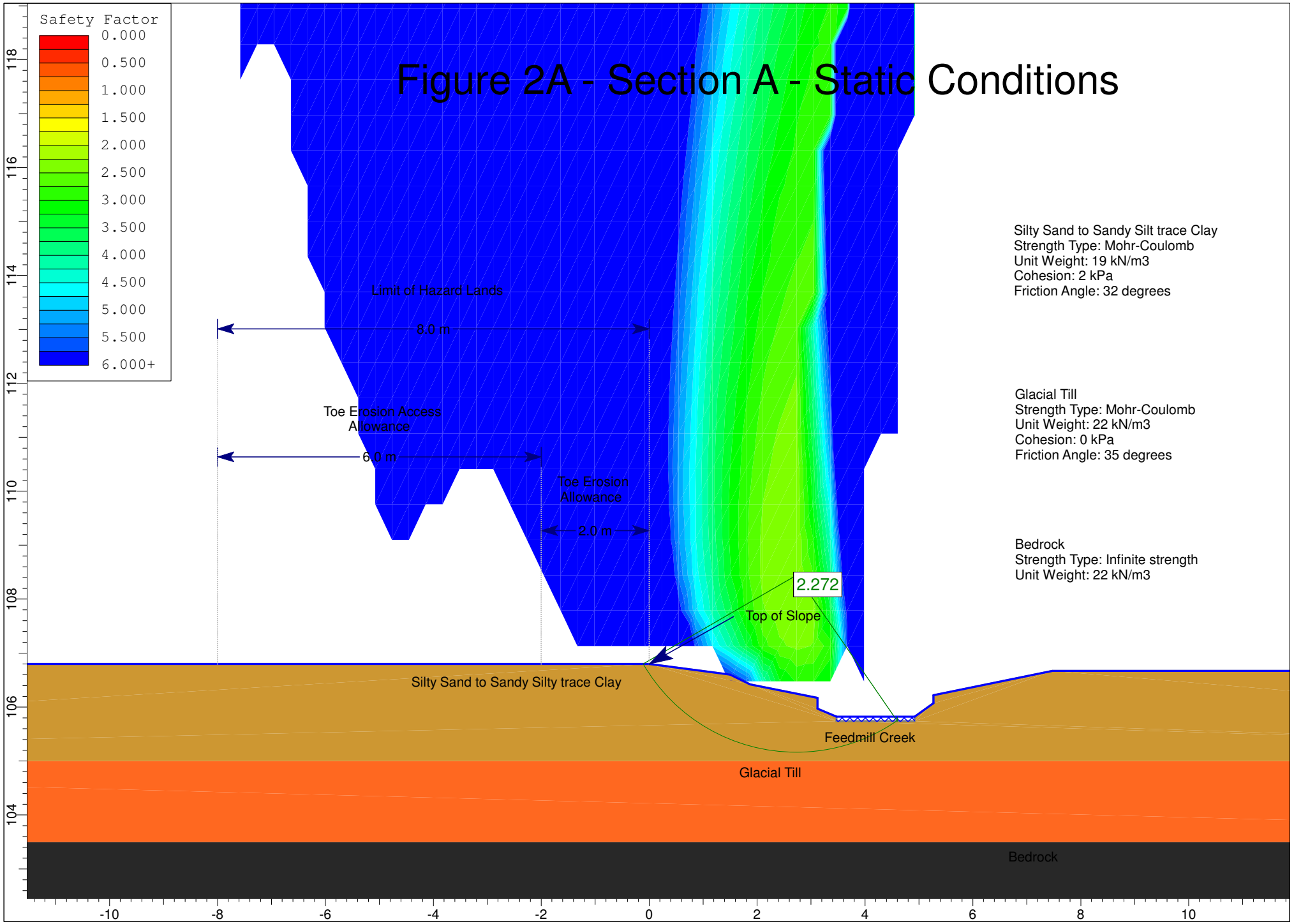


FIGURE 1

KEY PLAN


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Figure 2A - Section A - Static Conditions
Silty Sand to Sandy Silt trace Clay
Strength Type: Mohr-Coulomb
Unit Weight: 19 kN/m3
Cohesion: 2 kPa
Friction Angle: 32 degrees
Limit of Hazard Lands
8.0 m
Toe Erosion Access Allowance
6.0 m
Toe Erosion Allowance
2.0 m
Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 22 kN/m3
Cohesion: 0 kPa
Friction Angle: 35 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
2.272
Top of Slope
Silty Sand to Sandy Silty trace Clay
Feedmill Creek
Glacial Till
Bedrock
118
116
114
112
110
108
106
104
-10
-8
-6
-4
-2
0
2
4
6
8
10

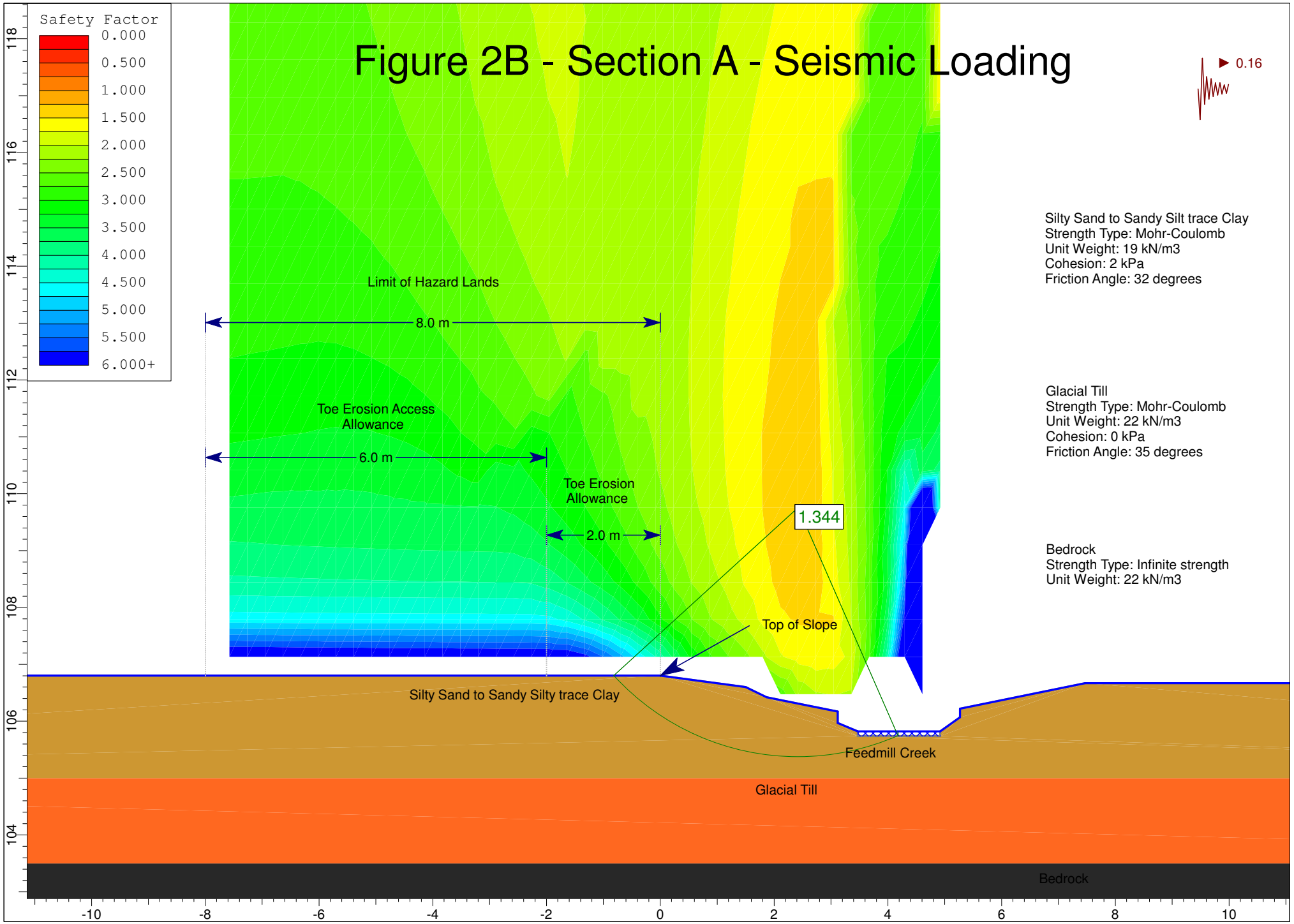
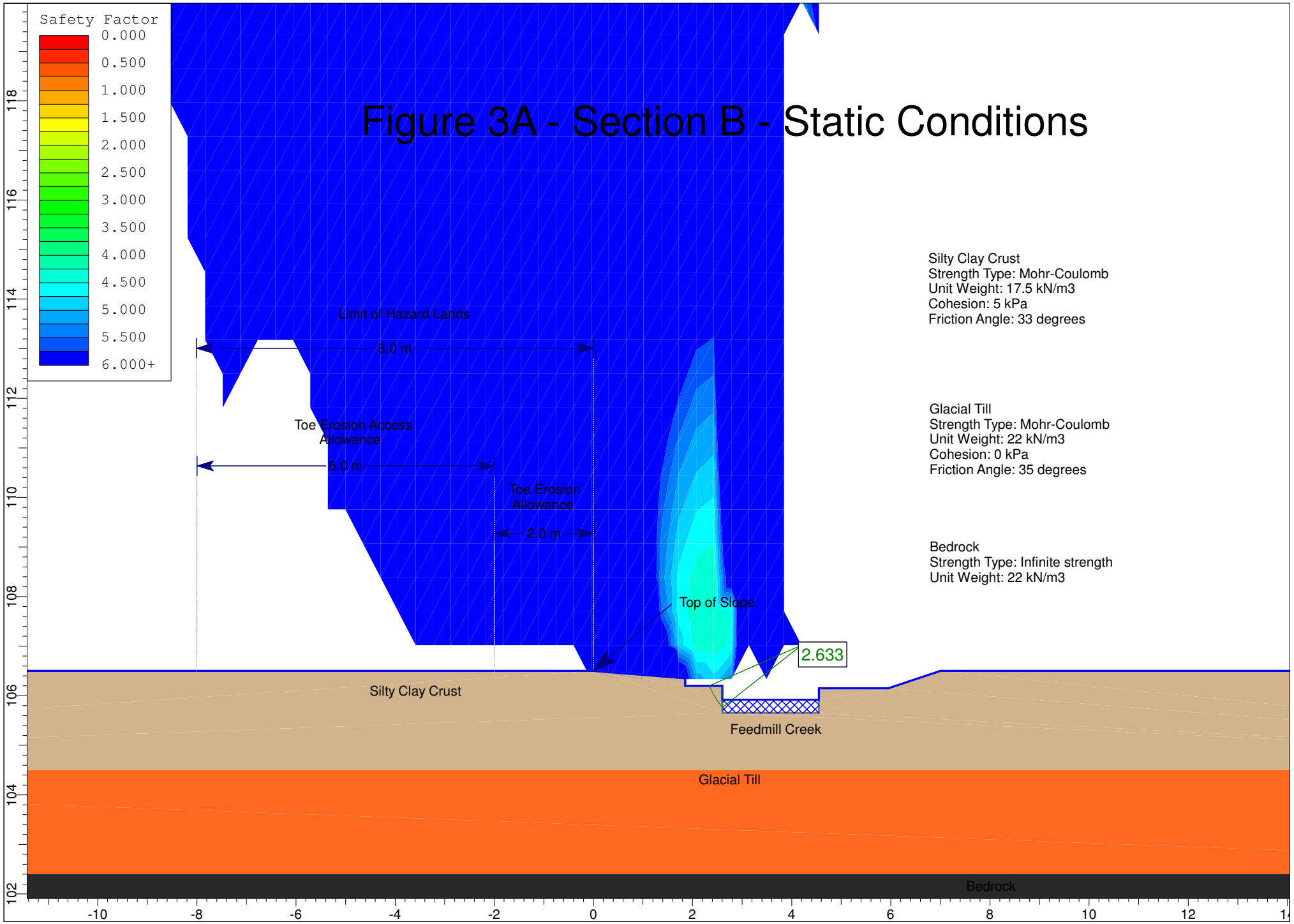


Figure 2B - Section A - Seismic Loading
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
0.16
Limit of Hazard Lands
8.0 m
Toe Erosion Access Allowance
6.0 m
Toe Erosion Allowance
2.0 m
1.344
Top of Slope
Silty Sand to Sandy Silty trace Clay
Feedmill Creek
Glacial Till
Bedrock
Silty Sand to Sandy Silt trace Clay
Strength Type: Mohr-Coulomb
Unit Weight: 19 kN/m3
Cohesion: 2 kPa
Friction Angle: 32 degrees
Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 22 kN/m3
Cohesion: 0 kPa
Friction Angle: 35 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
118
116
114
112
110
108
106
104
-10
-8
-6
-4
-2
0
2
4
6
8
10


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Figure 3A - Section B - Static Conditions
Silty Clay Crust
Strength Type: Mohr-Coulomb
Unit Weight: 17.5 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 22 kN/m3
Cohesion: 0 kPa
Friction Angle: 35 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
Limit of Hazard Lands
8.0 m
Toe Erosion Access Allowance
6.0 m
Toe Erosion Allowance
2.0 m
Top of Slope
2.633
Silty Clay Crust
Feedmill Creek
Glacial Till
Bedrock
118
116
114
112
110
108
106
104
102
-10
-8
-6
-4
-2
0
2
4
6
8
10
12

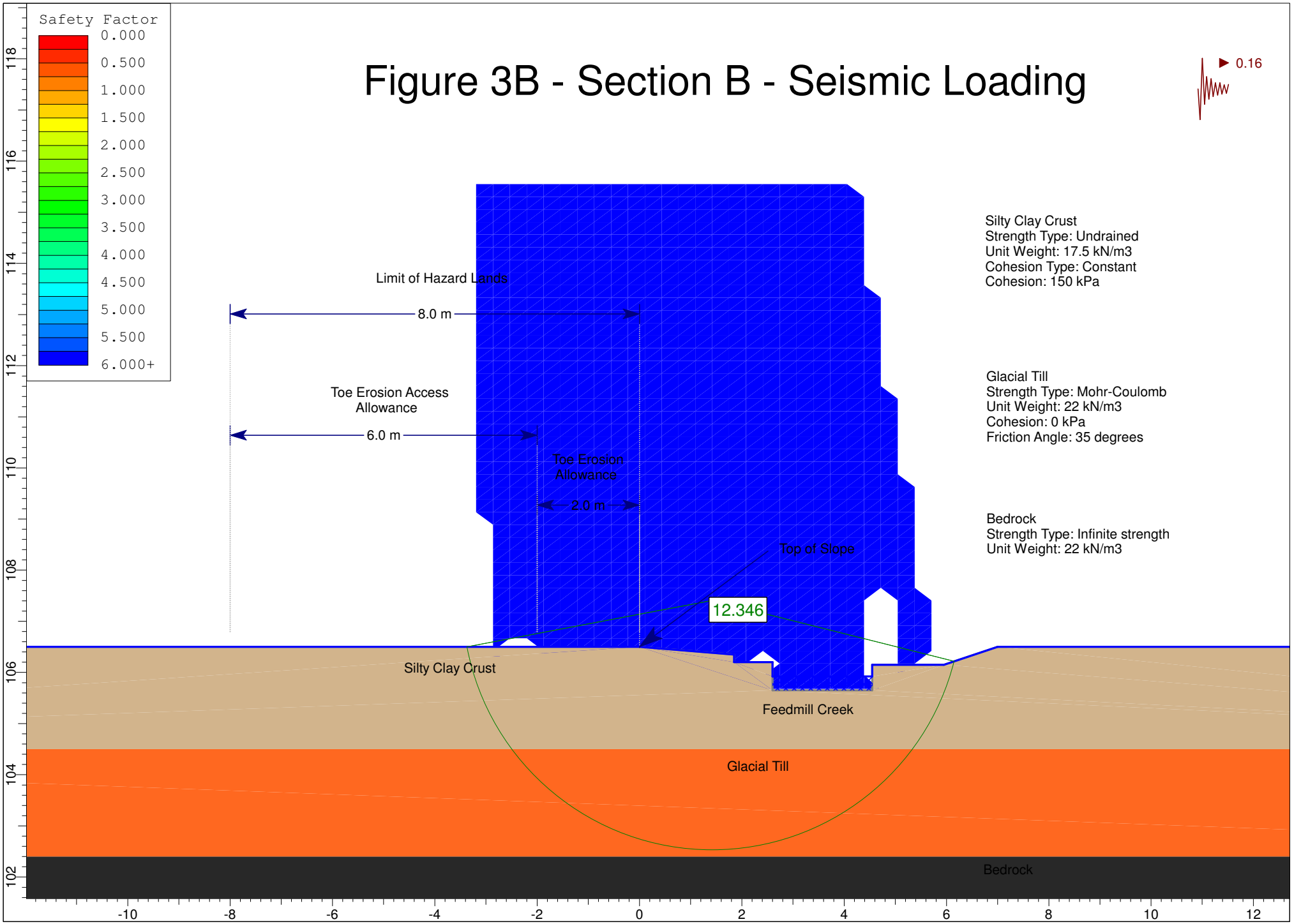


Figure 3B - Section B - Seismic Loading
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
0.16
Limit of Hazard Lands
8.0 m
Toe Erosion Access Allowance
6.0 m
Toe Erosion Allowance
2.0 m
Top of Slope
12.346
Silty Clay Crust
Strength Type: Undrained
Unit Weight: 17.5 kN/m3
Cohesion Type: Constant
Cohesion: 150 kPa
Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 22 kN/m3
Cohesion: 0 kPa
Friction Angle: 35 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
Silty Clay Crust
Feedmill Creek
Glacial Till
Bedrock
118
116
114
112
110
108
106
104
102
-10
-8
-6
-4
-2
0
2
4
6
8
10
12

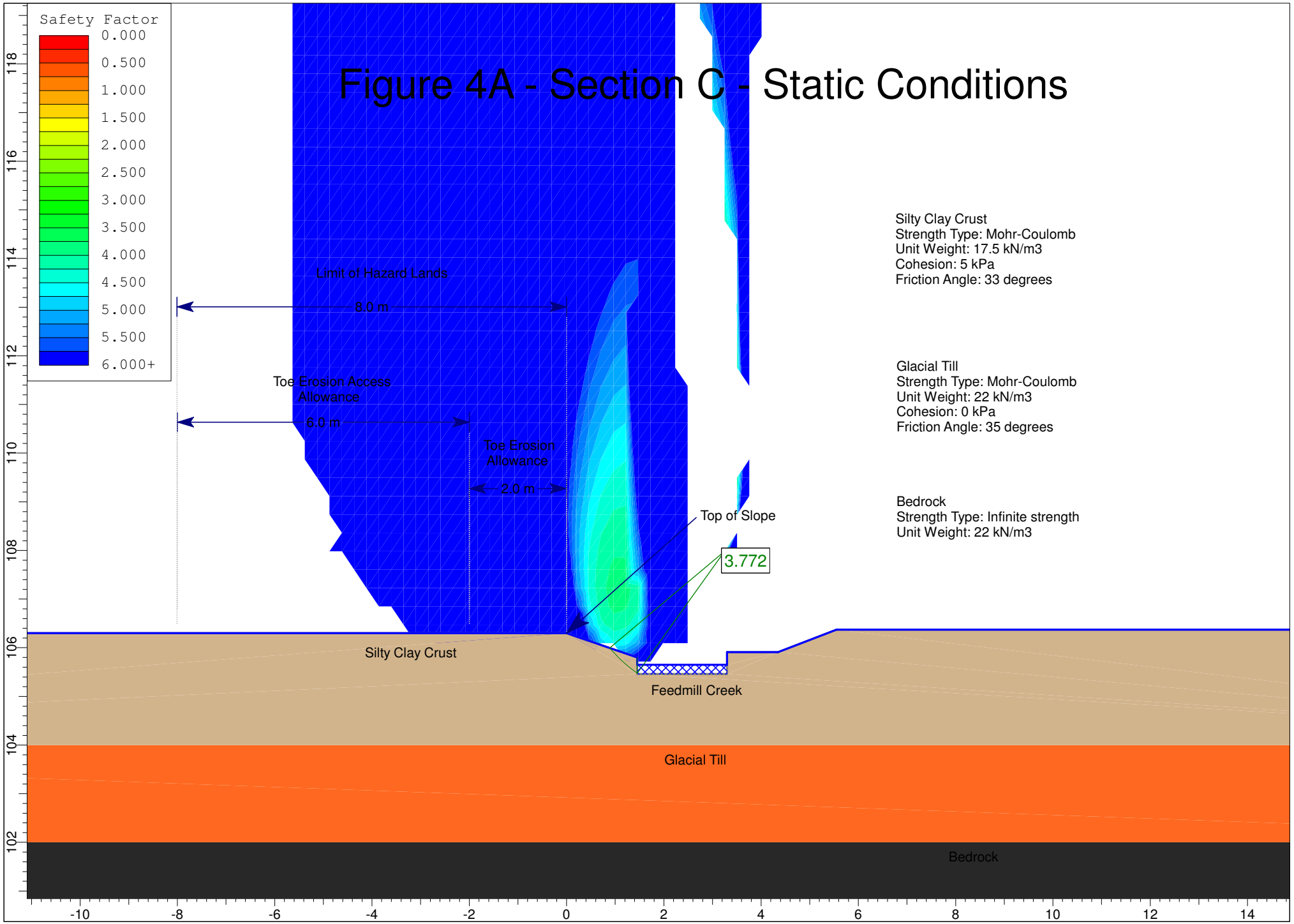


Figure 4A - Section C - Static Conditions
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Limit of Hazard Lands
8.0 m
Toe Erosion Access Allowance
6.0 m
Toe Erosion Allowance
2.0 m
Top of Slope
3.772
Silty Clay Crust
Strength Type: Mohr-Coulomb
Unit Weight: 17.5 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 22 kN/m3
Cohesion: 0 kPa
Friction Angle: 35 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
Silty Clay Crust
Feedmill Creek
Glacial Till
Bedrock
118
116
114
112
110
108
106
104
102
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
14

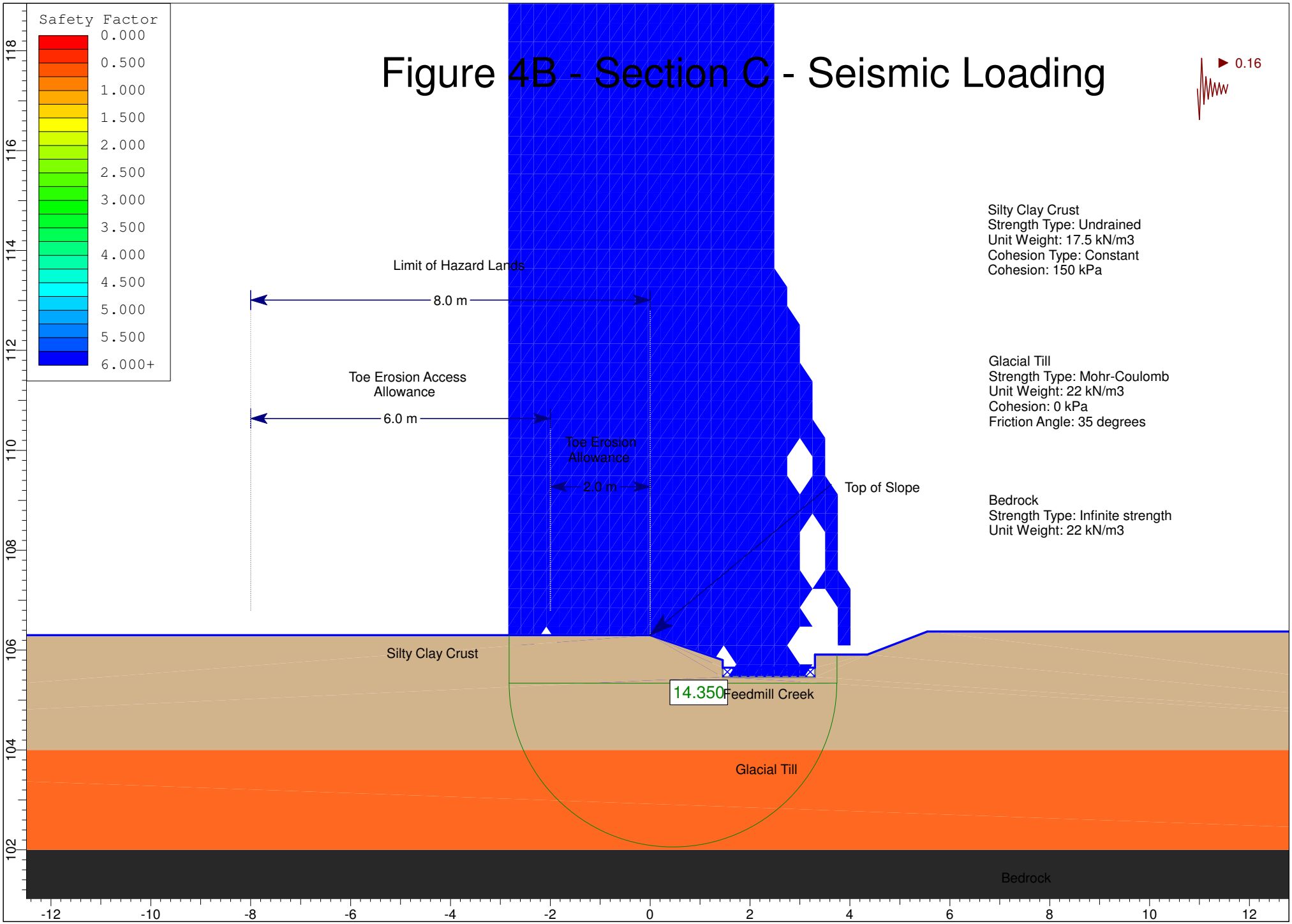


Figure 4B - Section C - Seismic Loading
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
0.16
Limit of Hazard Lands
8.0 m
Toe Erosion Access Allowance
6.0 m
Toe Erosion Allowance
2.0 m
Top of Slope
Silty Clay Crust
Strength Type: Undrained
Unit Weight: 17.5 kN/m3
Cohesion Type: Constant
Cohesion: 150 kPa
Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 22 kN/m3
Cohesion: 0 kPa
Friction Angle: 35 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
Silty Clay Crust
14.350
Feedmill Creek
Glacial Till
Bedrock
118
116
114
112
110
108
106
104
102
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12

FEEDMILL CREEK
30m SETBACK

LIMIT OF HAZARD LANDS

TOP OF SLOPE

BH 7
105.77
(102.39)

BH 8
105.53
(102.61)

BH 12
104.10
(101.13)

REFER TO DRAWING
PG3520-4 LIMIT OF HAZARD
LANDS FOR ENLARGEMENT

BH 10
105.85
(103.66)

BH 9
106.01
(104.43)

BH 9A
106.01
(104.46)

BH 6
107.24
(103.53)

BH 11
106.09
(104.16)

BH 13
105.64
(104.55)

BH 5
106.69
(105.24)

BH 4
106.80
(106.50)

BH 2
103.28
(102.24)

BH 2A
103.28
(102.54)

BH 2B
103.28
(102.42)

BH 3B
104.71
(104.20)

BH 3A
104.71
(103.90)

BH 3
104.71
(103.95)

BH 14
102.55
(98.92)

BH 1
101.32
(88.14)

PARK
BLOCK 252

COMMERCIAL
BLOCK 253

COMMERCIAL
BLOCK 254

COMMERCIAL
BLOCK 255
22,218 m² \ 5.49 oc

COMMERCIAL
BLOCK 257

APARTMENTS
BLOCK 256

Palladium Dr

HUNTMAR DRIVE

LEGEND:

- BOREHOLE LOCATION
- SLOPE CROSS-SECTION
- 103.28 GROUND SURFACE ELEVATION (m)
- (102.24) PRACTICAL REFUSAL TO AUGERING ELEVATION (m)

BASE PLAN, TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS AT TEST HOLE LOCATIONS PROVIDED BY CAVANAUGH CONSTRUCTION.

TOPOGRAPHIC SURVEY ALONG FEEDMILL CREEK PROVIDED BY STANTEC INC.

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

2325483 ONTARIO INC.

SLOPE STABILITY ASSESSMENT
PROP. DEVELOPMENT - PALLADIUM DRIVE AT HUNTMAR DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:4000	Date: 10/2015
Drawn by: RCG	Report No.: PG3520-LET.01R
Checked by: RG	Drawing No.: PG3520-3
Approved by: DJG	Revision No.: 0

p:\autocad drawings\geotechnical\pg35xx\pg3520 - cavanagh construction - kanata west\[pg3520-3(dsl).dwg

PROPERTY LINE

LIMIT OF HAZARD LANDS

TOP OF SLOPE

303.49

MATCHLINE A-A

PROPERTY LINE

N41°55'05"W

303.24

LIMIT OF HAZARD LANDS

TOP OF SLOPE

MATCHLINE A-A

STREET NO. 4

BLOCK 260

LEGEND:

CROSS SECTION LOCATION

x 103.28 GROUND SURFACE ELEVATION

BASE PLAN, TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS AT TEST HOLE LOCATIONS PROVIDED BY CAVANAUGH CONSTRUCTION.

TOPOGRAPHIC SURVEY ALONG FEEDMILL CREEK PROVIDED BY STANTEC INC.

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

2325483 ONTARIO INC.

SLOPE STABILITY ASSESSMENT
PROP. DEVELOPMENT - PALLADIUM DRIVE AT HUNTMAR DRIVE
OTTAWA, ONTARIO

Title:

LIMIT OF HAZARD LANDS

Scale: 1:600	Date: 10/2016
Drawn by: MPG	Report No.: PG3520-LET.01R
Checked by: DJG	Dwg. No.: PG3520-4
Approved by: DJG	Revision No.: 0

c:\users\roberg\downloads\pg3520-4(dsl).dwg

NOTE
Stormwater Management Pond location and design not final.

100 YEAR WATER LEVEL CONTINUES
FLOODPLAIN TO BE DETERMINED PER
FEEDMILL CREEK STUDY
(ONGOING, CITY OF OTTAWA)

PROPOSED OUTLET PIPE

PROPOSED CONNECTION TO EXISTING DITCH

Stormwater management pond area

SEDIMENT MANAGEMENT AREA

Automobile Dealership
16,878 m² (3.97 ac.)

FEEDMILL CREEK

LEGEND

- SITE BOUNDARY
- 107.3m CONTOUR (MVCA FLOODPLAIN ELEVATION) PER CITY OF OTTAWA 1K MAPPING
- TOP OF SLOPE PER PATERSON GROUP REPORT PG3520, OCTOBER 13, 2016
- 15m SETBACK FROM TOP OF SLOPE. TOP OF SLOPE PER PATERSON GROUP REPORT PG3520, OCTOBER 13, 2016
- LIMIT OF HAZARD LANDS PER PATERSON GROUP REPORT PG3520, OCTOBER 13, 2016
- FEEDMILL CREEK 30m SETBACK PER PATERSON GROUP REPORT PG3520, OCTOBER 13, 2016
- PROPOSED REGULATORY FLOODPLAIN POST DEVELOPMENT
- POTENTIAL EXISTING REGULATORY FLOODPLAIN PER MVCA FLOODPLAIN ELEVATION AND CITY OF OTTAWA 1K MAPPING
- KANATA WEST DEVELOPMENT AREA MEANDER BELT WIDTH ASSESSMENT AND EROSION ANALYSIS (GEO MORPHIX LTD., JULY 20 2016)
- 30m SETBACK FROM NORMAL HIGH WATER MARK PER APRIL 25, 2017 STANTEC SURVEY
- 106.60 — FEEDMILL CREEK NORMAL HIGH WATER MARK ELEVATION PER APRIL 25, 2017 STANTEC SURVEY
- 106.31 — FEEDMILL CREEK TOP OF BANK ELEVATION PER APRIL 25, 2017 STANTEC SURVEY
- 105.8 — SPOT ELEVATION PER CITY OF OTTAWA 1K MAPPING
- 4.05m — WIDTH OF CHANNEL

david schaeffer engineering ltd
SMART SUBDIVISIONS™

120 Iber Road Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

195 HUNTMAR ROAD
DEVELOPMENT SETBACKS

PROJECT No. :	12-624
SCALE:	1:1500
DATE:	APRIL 27, 2017
DRAWING No.	1

z:\projects\12-624_cavanagh_kanata_west\b_design\b2_drawings\b2-5_sketches and figures\2017-04-27_setback_figure_rev\2017-04-27_624_setbacks_rev.dwg

25 April 2017 1:55 PM

Symbol	Code		Description
	ACU	"	AIR CONDITIONING UNIT
	AN	"	ANCHOR
	AP	"	AIR PUMP
	ANT	"	ANTENNA
	BH	"	BOREHOLE
	BIB	"	HOSE BIB
	BKR	"	BIKE RACK
	BENCH	"	BENCH
	BOL	"	BOLLARD
	BOUL	"	BOULDER
	CB	"	CATCH BASIN
	DCB	"	DOUBLE CB
	CBMH	"	CB MANHOLE
	DCBMH	"	DOUBLE CB MANHOLE
	SICB	"	SIDE INLET CB
	CHM	"	CHIMNEY
	CSV	"	VALVE CURB STOP
	DRN	"	DRAIN
	EPOST	"	ELECTRICAL OUTLET
	FP	"	FLAG POLE
	FL	"	FLOOD LIGHT
	FTF	"	FUEL TANK FILLER CAP
	GC	"	GARBAGE CAN
	GFL	"	PIPE FLANGE (GAS)
	GFP	"	GAS FUEL PUMP
	GP	"	POLE GUYWIRE
	GSR	"	GAS SERVICE REGULATOR
	GV	"	GAS VALVE
	HIC	"	HICKENBOTTOM
	HDS	"	HEADSTONE
	HLS	"	LIGHT STANDARD HYDRO
	HM	"	HYDRO METER
	HTN	"	HYDRO TRANSFORMER
	HW	"	HAND WELL
	HYD	"	FIRE HYDRANT
	JBX	"	JUNCTION BOX
	MB	"	MAILBOX
	MP	"	MONITORING PIN
	MH	"	MAINTENANCE HOLE UNIDENTIFIED
	MHB	"	MAINTENANCE HOLE BELL
	MHF	"	MAINTENANCE HOLE FIBRE OPTIC
	MHH	"	MAINTENANCE HOLE HYDRO
	MHI	"	MAINTENANCE HOLE INVERT
	MHSA	"	MAINTENANCE HOLE SANITARY
	MHST	"	MAINTENANCE HOLE STORM
	MHT	"	MAINTENANCE HOLE TRAFFIC
	MW	"	MONITORING WELL
	NPB	"	NEWS PAPER BOX
	OLP	"	LIGHT STANDARD ORNAMENTAL
	OW	"	OBSERVATION WELL
	PKM	"	PARKING METER
	PLBX	"	PULL BOX
	PLQ	"	PLAQUE
	PLR	"	PILLAR
	PZ	"	PIEZIOMETER
	RLC	"	RED LIGHT CAMERA
	RWSL	"	RAILWAY SIGNAL LIGHT
	RWSS	"	RAILWAY SWITCH STAND
	SAT	"	SATELLITE DISH
	SCLP	"	SCULPTURE
	SCP	"	SUMP/CATCH PIT
	SCV	"	SPRINKLER CONTROL VALVE
	SH	"	SPRINKLER HEAD
	SIA	"	SIAMESE CONNECTION
	SN	"	SIGN
	SPAN	"	SOLAR PANEL
	SPT	"	SEPTIC TANK LID
	TBL	"	TABLE
	TB BELL	"	TERMINAL BOX - BELL
	TB CATV	"	TERMINAL BOX - CABLE
	TCB	"	TRAFFIC CONTROL BOX
	TPIT	"	TEST PIT
	TSL	"	TRAFFIC SIGNAL LIGHT
	UMB	"	MARKER BELL UNDERGROUND
	UMC	"	MARKER CABLE UNDERGROUND
	UMG	"	MARKER GAS UNDERGROUND
	UMO	"	MARKER OIL UNDERGROUND
	UP	"	UTILITY POLE
	VB	"	VALVE BOX
	VC	"	VALVE CHAMBER
	WV	"	WATER VALVE
		"	TREE STUMP
		"	TREE CONIFEROUS
		"	TREE DECIDUOUS

W:\active\161613545_2325482 ontario inc_huntmar_fp\topo\drawing\161613545-111-Ditch_d1_c3d.dwg

Stantec Geomatics Ltd.
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

TOPOGRAPHIC SKETCH of PART OF LOT REGISTERED PLAN (GEOGRAPHIC TOWNSHIP OF) CITY OF OTTAWA

Scale 1:250

5 0 5 10 15 METRES

METRIC CONVERSION

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

GRID SCALE CONVERSION

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.XXXXXX.

BEARING NOTE

BEARINGS HEREON ARE GRID BEARINGS DERIVED FROM THE CAN-NET VRS NETWORK AND ARE REFERRED TO THE CENTRAL MERIDIAN 76Á 30' WEST LONGITUDE OF THE 3Á MTM ONTARIO COORDINATE SYSTEM, NAD83 (ORIGINAL) ZONE 9.

ELEVATION NOTE

ELEVATIONS SHOWN HEREON ARE GEODETIC (CGVD-1928:1978) AND ARE DERIVED FROM THE CAN-NET VRS NETWORK MONUMENT: OTTAWA ELEVATION=95.205.

NOTE

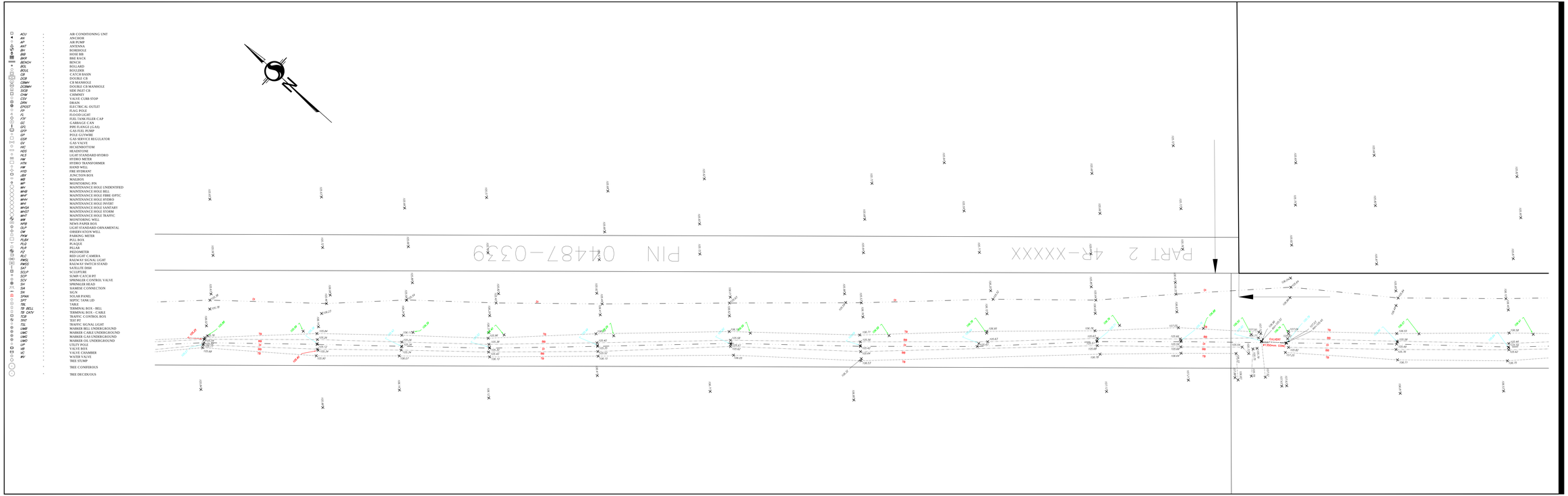
ELEVATION SHOWN THUS 105.23 WATER LEVEL ON SEPTEMBER 2016

ELEVATION SHOWN THUS 105.26 NORMAL HIGH WATER MARK ON SEPTEMBER 2016

ELEVATION SHOWN THUS 106.71 NORMAL HIGH WATER MARK ON APRIL 24, 2017

DRAWN: * CHECKED: * PM: * FIELD: * PROJECT No.: 161613545-111

ACU	-	AIR CONDITIONING UNIT
AN	-	ANCHOR
AP	-	AIR PUMP
ANT	-	ANTENNA
BH	-	BOREHOLE
BIB	-	HOSE BIB
BMK	-	BENCH MARK
BENCH	-	BENCH
BOL	-	BOLLARD
BOUL	-	BOULDER
CB	-	CATCH BASIN
DCB	-	DOUBLE CB
CBMH	-	CB MANHOLE
COMBMH	-	COMBINED CB MANHOLE
SICB	-	SIDE INLET CB
CHM	-	CHIMNEY
CSV	-	VALVE CURB STOP
DRN	-	DRAIN
EFOUT	-	ELECTRICAL OUTLET
FP	-	FLAG POLE
FL	-	FLOOD LIGHT
FTF	-	FUEL TANK FILLER CAP
GC	-	GARBAGE CAN
GFL	-	PIPE FLANGE (GAS)
GFP	-	GAS FUEL PUMP
GP	-	POLE GUYWIRE
GVP	-	GAS VALVE PRESSURE REGULATOR
GV	-	GAS VALVE
HC	-	HEADWINTOUM
HDS	-	HEADSTONE
HLS	-	LIGHT STANDARD HYDRO
HM	-	HYDRO METER
HP	-	HYDRO POLE TRANSFORMER
HW	-	HYDRO VAULT
HYD	-	FIRE HYDRANT
JBX	-	JUNCTION BOX
MB	-	MAILBOX
MW	-	MONITORING PIN
MH	-	MAINTENANCE HOLE UNIDENTIFIED
MHC	-	MAINTENANCE HOLE CABLE
MHF	-	MAINTENANCE HOLE FIBRE OPTIC
MHH	-	MAINTENANCE HOLE HYDRO
MHI	-	MAINTENANCE HOLE INVERT
MHSA	-	MAINTENANCE HOLE SANITARY
MHST	-	MAINTENANCE HOLE STORM
MHT	-	MAINTENANCE HOLE TRAFFIC
MON	-	MONUMENT WELL
NPB	-	NEWS PAPER BOX
OLP	-	LIGHT STANDARD ORNAMENTAL
OW	-	OBSERVATION WELL
PKM	-	PARKING METER
PLBX	-	PULL BOX
PLQ	-	PLAQUE
PP	-	POWER POLE
PT	-	PEDOMETER
RLC	-	RED LIGHT CAMERA
RWSL	-	RAILWAY SIGNAL LIGHT
RWSS	-	RAILWAY SWITCH STAND
SAT	-	SATELLITE DISH
SCLP	-	SCULPTURE
SCH	-	SEWER CATCH PIT
SCV	-	SPRINKLER CONTROL VALVE
SIV	-	SPRINKLER HEAD
SH	-	SIAMESE CONNECTION
SN	-	SIGN
SPAN	-	SOLAR PANEL
SPT	-	SEPTIC TANK LID
ST	-	STUMP
TB BELL	-	TERMINAL BOX - BELL
TB CATV	-	TERMINAL BOX - CABLE
TCB	-	TRAFFIC CONTROL BOX
TNT	-	TENT PIT
TSL	-	TRAFFIC SIGNAL LIGHT
UMB	-	MARKER BELL UNDERGROUND
UMC	-	MARKER CABLE UNDERGROUND
UMG	-	MARKER GAS UNDERGROUND
UMO	-	MARKER OIL UNDERGROUND
UP	-	UTILITY POLE
VB	-	VALVE BOX
VC	-	VALVE CHAMBER
WV	-	WATER VALVE
	-	TREE STUMP
	-	TREE CONIFEROUS
	-	TREE DECIDUOUS



Stantec Geomatics Ltd.
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

TOPOGRAPHIC SKETCH of
PART OF LOT
REGISTERED PLAN
(GEOGRAPHIC TOWNSHIP OF)
CITY OF OTTAWA

Scale 1:250

0 5 10 15 METRES

METRIC CONVERSION

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

GRID SCALE CONVERSION

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.XXXXXX.

BEARING NOTE

BEARINGS HEREON ARE GRID BEARINGS DERIVED FROM THE CAN-NET VRS NETWORK AND ARE REFERRED TO THE CENTRAL MERIDIAN 76d 30' WEST LONGITUDE OF THE 3TM MTM ONTARIO COORDINATE SYSTEM, NAD83 (ORIGINAL) ZONE 9.

ELEVATION NOTE

ELEVATIONS SHOWN HEREON ARE GEODETIC (CGVD-1928:1978) AND ARE DERIVED FROM THE CAN-NET VRS NETWORK MONUMENT: OTTAWA ELEVATION=95.205.

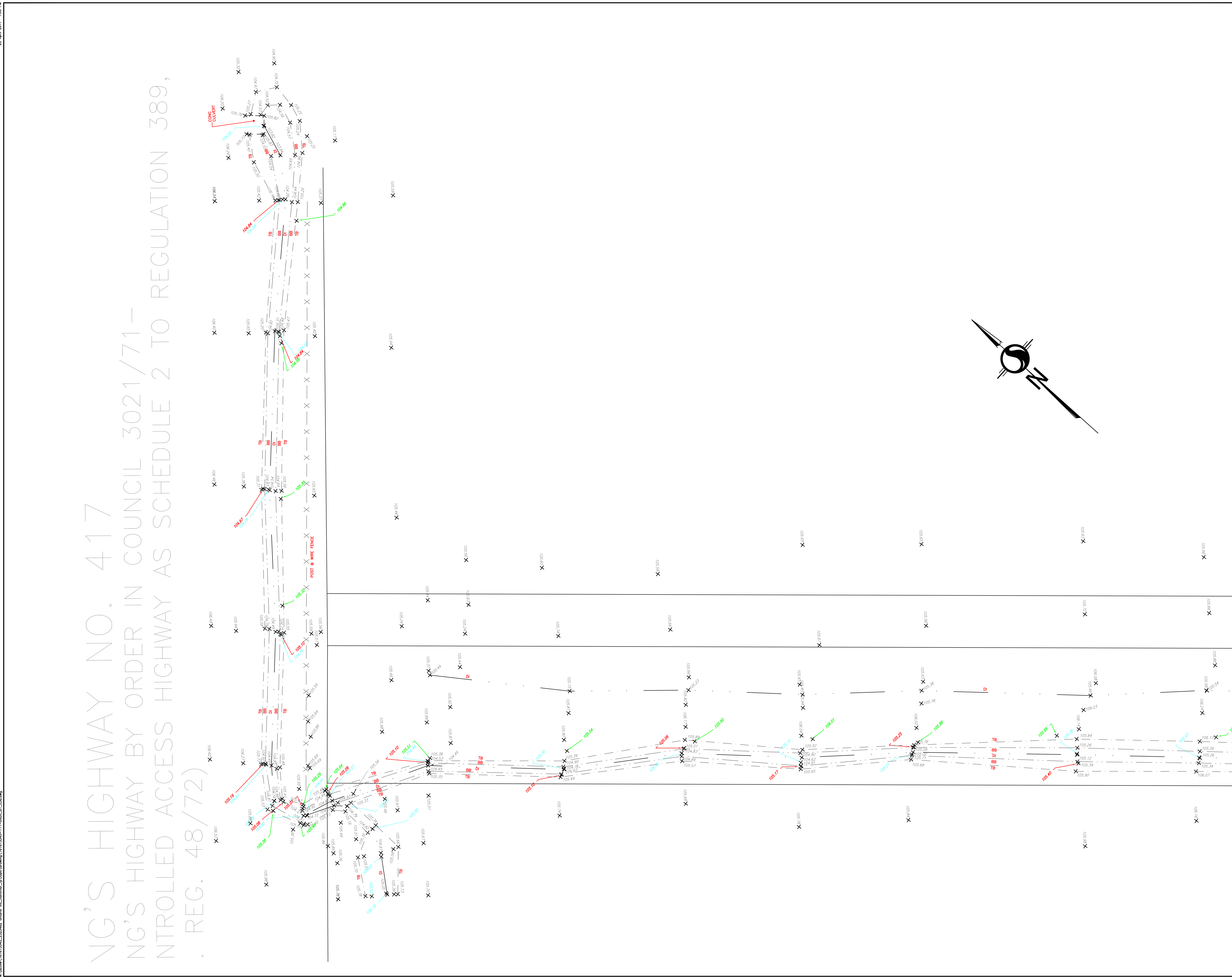
NOTE

ELEVATION SHOWN THUS *105.23* WATER LEVEL ON SEPTEMBER 2016

ELEVATION SHOWN THUS *105.26* NORMAL HIGH WATER MARK ON SEPTEMBER 2016

ELEVATION SHOWN THUS *106.71* NORMAL HIGH WATER MARK ON APRIL 24, 2017

DRAWN: * CHECKED: * PM: * FIELD: * PROJECT No.: 161613545-111



Stantec

Stantec Geomatics Ltd.
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

TOPOGRAPHIC SKETCH of PART OF LOT REGISTERED PLAN (GEOGRAPHIC TOWNSHIP OF) CITY OF OTTAWA

Scale 1:250

5 0 5 10 15 METRES

METRIC CONVERSION

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

GRID SCALE CONVERSION

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.XXXXXX.

BEARING NOTE

BEARINGS HEREON ARE GRID BEARINGS DERIVED FROM THE CAN-NET VRS NETWORK AND ARE REFERRED TO THE CENTRAL MERIDIAN 76Á 30' WEST LONGITUDE OF THE 3Á MTM ONTARIO COORDINATE SYSTEM, NAD83 (ORIGINAL) ZONE 9.

ELEVATION NOTE

ELEVATIONS SHOWN HEREON ARE GEODETIC (CGVD-1928:1978) AND ARE DERIVED FROM THE CAN-NET VRS NETWORK MONUMENT: OTTAWA ELEVATION=95.205.

NOTE

ELEVATION SHOWN THUS 105.23 WATER LEVEL ON SEPTEMBER 2016

ELEVATION SHOWN THUS 105.26 NORMAL HIGH WATER MARK ON SEPTEMBER 2016

ELEVATION SHOWN THUS 106.71 NORMAL HIGH WATER MARK ON APRIL 24, 2017

ACU	"	AIR CONDITIONING UNIT
AN	"	ANCHOR
AP	"	AIR PUMP
ANT	"	ANTENNA
BH	"	BOREHOLE
BIB	"	HOSE BIB
BKR	"	BIKE RACK
BENCH	"	BENCH
BOL	"	BOLLARD
BOUL	"	BOULDER
CB	"	CATCH BASIN
DCB	"	DOUBLE CB
CBMH	"	CB MANHOLE
DCBMH	"	DOUBLE CB MANHOLE
CBSI	"	SIDE INLET CB
CHM	"	CHIMNEY
CSV	"	VALVE CURB STOP
DRN	"	DRAIN
EPOST	"	ELECTRICAL OUTLET
FP	"	FLAG POLE
FL	"	FLOOD LIGHT
FTF	"	FUEL TANK FILLER CAP
GC	"	GARBAGE CAN
GFL	"	PIPE FLANGE (GAS)
GFP	"	GAS FUEL PUMP
GP	"	POLE GUYWIRE
GSR	"	GAS SERVICE REGULATOR
GV	"	GAS VALVE
HIC	"	HICKENBOTTOM
HDS	"	HEADSTONE
HLS	"	LIGHT STANDARD HYDRO
HM	"	HYDRO METER
HTN	"	HYDRO TRANSFORMER
HW	"	HAND WELL
HYD	"	FIRE HYDRANT
JBX	"	JUNCTION BOX
MB	"	MAILBOX
MP	"	MONITORING PIN
MH	"	MAINTENANCE HOLE UNIDENTIFIED
MHB	"	MAINTENANCE HOLE BELL
MHF	"	MAINTENANCE HOLE FIBRE OPTIC
MHH	"	MAINTENANCE HOLE HYDRO
MHI	"	MAINTENANCE HOLE INVERT
MHSA	"	MAINTENANCE HOLE SANITARY
MHST	"	MAINTENANCE HOLE STORM
MHT	"	MAINTENANCE HOLE TRAFFIC
MW	"	MONITORING WELL
NPB	"	NEWS PAPER BOX
OLP	"	LIGHT STANDARD ORNAMENTAL
OW	"	OBSERVATION WELL
PKM	"	PARKING METER
PLBX	"	PULL BOX
PLQ	"	PLAQUE
PLR	"	PILLAR
PZ	"	PIEZIOMETER
RLC	"	RED LIGHT CAMERA
RWSL	"	RAILWAY SIGNAL LIGHT
RWSS	"	RAILWAY SWITCH STAND
SAT	"	SATELLITE DISH
SCLP	"	SCULPTURE
SCP	"	SUMP/CATCH PIT
SCV	"	SPRINKLER CONTROL VALVE
SH	"	SPRINKLER HEAD
SIA	"	SIAMESE CONNECTION
SN	"	SIGN
SPAN	"	SOLAR PANEL
SPT	"	SEPTIC TANK LID
TBL	"	TABLE
TB BELL	"	TERMINAL BOX - BELL
TB CATV	"	TERMINAL BOX - CABLE
TCB	"	TRAFFIC CONTROL BOX
TPIT	"	TEST PIT
TSL	"	TRAFFIC SIGNAL LIGHT
UMB	"	MARKER BELL UNDERGROUND
UMC	"	MARKER CABLE UNDERGROUND
UMG	"	MARKER GAS UNDERGROUND
UMO	"	MARKER OIL UNDERGROUND
UP	"	UTILITY POLE
VB	"	VALVE BOX
VC	"	VALVE CHAMBER
WV	"	WATER VALVE

DRAWN: * CHECKED: * PM: * FIELD: * PROJECT No.: 161613545-111

MAP No. 2
CARTE No.

FLOOD RISK MAP
FEEDMILL CREEK
CARTE DU RISQUE D'INONDATION

Date Modified / Date de modification: 04/12/2013

LEGEND / LÉGENDE

- Regulatory Floodplain / La Crue Régulatrice
- Regulatory Limit / Limite Réglementaire
- Contours / Courbes
- Stream / Ruisseau
- Cross Sections / La coupe traversale

Station Number — 1 — Numéro de la station
Regulatory Flood Elevation (m) — 102.11 — Niveau de la crue regulatrice (m)

INDEX CONTOUR INTERVAL 2 METRES
WITH 0.5 METRE INTERMEDIATE CONTOUR
NORTH AMERICAN DATUM 1983

COURBES DE NIVEAU PRINCIPALES DE 2.0 MÈTRE
AVEC COURBES DE NIVEAU INTERMÉDIAIRES DE 0.5 MÈTRES
SYSTÈME DE RÉFÉRENCE GÉODÉSIQUE NORD-AMÉRIQUE 1983

GENERAL INFORMATION

Vertical Datum: CGVD28
Horizontal Datum: North American 1983
Map Projection: Ottawa Transverse Mercator Projection

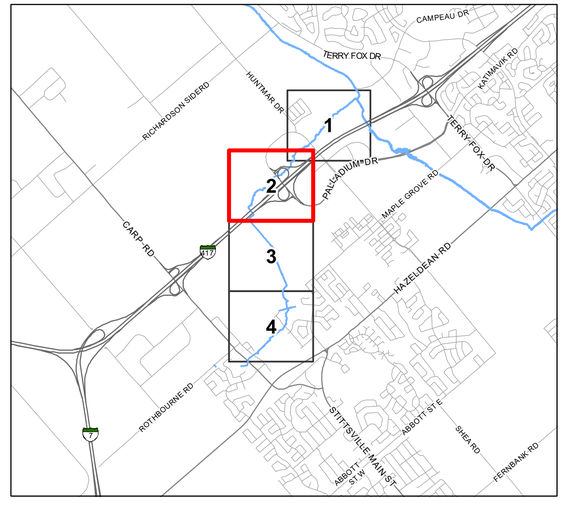
RENSEIGNMENTS GÉNÉRAUX

Niveau de référence vertical: CGVD28
Niveau de référence horizontal: Nord-americain 1983
Projection cartographique: Projection Mercator Transverse d'Ottawa

Mississippi Valley Conservation Authority

Ottawa

SHEET INDEX / TABLEAU D'ASSEMBLAGE



Revision #	Issue
January 31, 2017	Final

LICENSED PROFESSIONAL ENGINEER
J. S. A. PRICE
Jan 31/17
PROVINCE OF ONTARIO

This map and the associated information displayed are to be used for general illustrative purposes only. Although best efforts have been made to create accuracy; due to the complex and extensive nature of the data, all representations and/or information provided herein are approximate and to be verified by user. User hereby acknowledges that this map is not intended for true and accurate navigational purposes and hereby accepts and assumes all inherent risks associated with the use of this map.

This map is produced in part with data provided by the Ontario Geographic Data Exchange under Licence with the Ontario Ministry of Natural Resources and the Queen's Printer for Ontario, 2017

Imagery © Fugro Geospatial, May 2014
Digital Elevation Information © GeoDigital International Inc. - Spring 2006

N
W E
S

SCALE 1:2,000 ÉCHELLE

0 25 50 100 150 200
Meters / Mètres

Cette carte et les renseignements connexes qui sont affichés sont fournis à titre d'exemple général seulement. En dépit de tous les efforts consentis pour en garantir l'exactitude, les représentations ou renseignements que l'on trouvera ici demeurent approximatifs du fait de la nature complexe et de l'étendue des données, et doivent donc être vérifiés par l'utilisateur. L'utilisateur reconnait par la présente que cette carte n'est pas conçue pour une navigation exacte et véridique, accepte et endosse les risques connexes associés à son utilisation.

Cette carte a été en partie réalisée à l'aide de données fournies par le Groupe d'échange de données géospatiales en Ontario, en vertu d'un contrat de licence passé avec le ministère des Richesses naturelles et l'Imprimeur de la Reine pour l'Ontario en 2017

Images aériennes © Fugro Geospatial, Mai 2014
Données altimétriques numériques © GeoDigital International Inc, Printemps 2006

MAP No.
CARTE No. **3**

FLOOD RISK MAP
FEEDMILL CREEK
CARTE DU RISQUE D'INONDATION

LEGEND / LÉGENDE

- Regulatory Floodplain / La Crue Régulatrice
- Regulatory Limit / Limite Réglementaire
- Contours / Courbes
- Stream / Ruisseau
- Cross Sections / La coupe traversale

Station Number — 1 — Numéro de la station
Regulatory Flood Elevation (m) — 102.11 — Niveau de la crue regulatrice (m)

INDEX CONTOUR INTERVAL 2 METRES
WITH 0.5 METRE INTERMEDIATE CONTOUR
NORTH AMERICAN DATUM 1983

COURBES DE NIVEAU PRINCIPALES DE 2.0 MÈTRE
AVEC COURBES DE NIVEAU INTERMÉDIAIRES DE 0.5 MÈTRES
SYSTÈME DE RÉFÉRENCE GÉODÉSIQUE NORD-AMÉRIQUE 1983

GENERAL INFORMATION

Vertical Datum: CGVD28
Horizontal Datum: North American 1983
Map Projection: Ottawa Transverse Mercator Projection

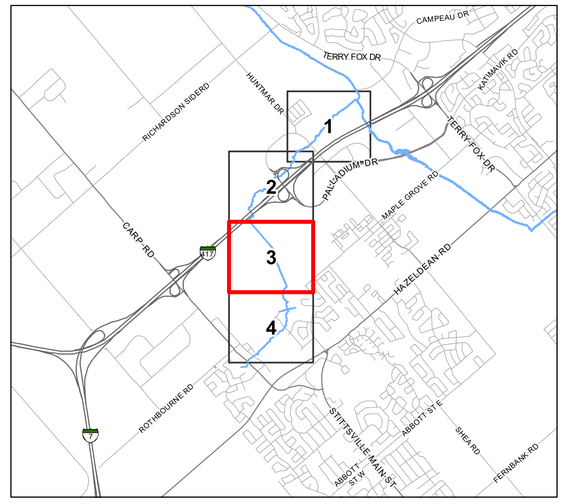
RENSEIGNMENTS GÉNÉRAUX

Niveau de référence vertical: CGVD28
Niveau de référence horizontal: Nord-americain 1983
Projection cartographique: Projection Mercator Transverse d'Ottawa

Mississippi Valley Conservation Authority

Ottawa

SHEET INDEX / TABLEAU D'ASSEMBLAGE



Date Modified / Date de modification: 04/12/2013

This map and the associated information displayed are to be used for general illustrative purposes only. Although best efforts have been made to create accuracy; due to the complex and extensive nature of the data, all representations and/or information provided herein are approximate and to be verified by user. User hereby acknowledges that this map is not intended for true and accurate navigational purposes and hereby accepts and assumes all inherent risks associated with the use of this map.

This map is produced in part with data provided by the Ontario Geographic Data Exchange under Licence with the Ontario Ministry of Natural Resources and the Queen's Printer for Ontario, 2017

Imagery © Fugro Geospatial, May 2014
Digital Elevation Information © GeoDigital International Inc. - Spring 2006

N
W E
S

SCALE 1:2,000 ÉCHELLE

0 25 50 100 150 200
Meters / Mètres

Cette carte et les renseignements connexes qui sont affichés sont fournis à titre d'exemple général seulement. En dépit de tous les efforts consentis pour en garantir l'exactitude, les représentations ou renseignements que l'on trouvera ici demeurent approximatifs du fait de la nature complexe et de l'étendue des données, et doivent donc être vérifiés par l'utilisateur. L'utilisateur reconnait par la présente que cette carte n'est pas conçue pour une navigation exacte et véridique, accepte et endosse les risques connexes associés à son utilisation.

Cette carte a été en partie réalisée à l'aide de données fournies par le Groupe d'échange de données géospatiales en Ontario, en vertu d'un contrat de licence passé avec le ministère des Richesses naturelles et l'Imprimeur de la Reine pour l'Ontario en 2017

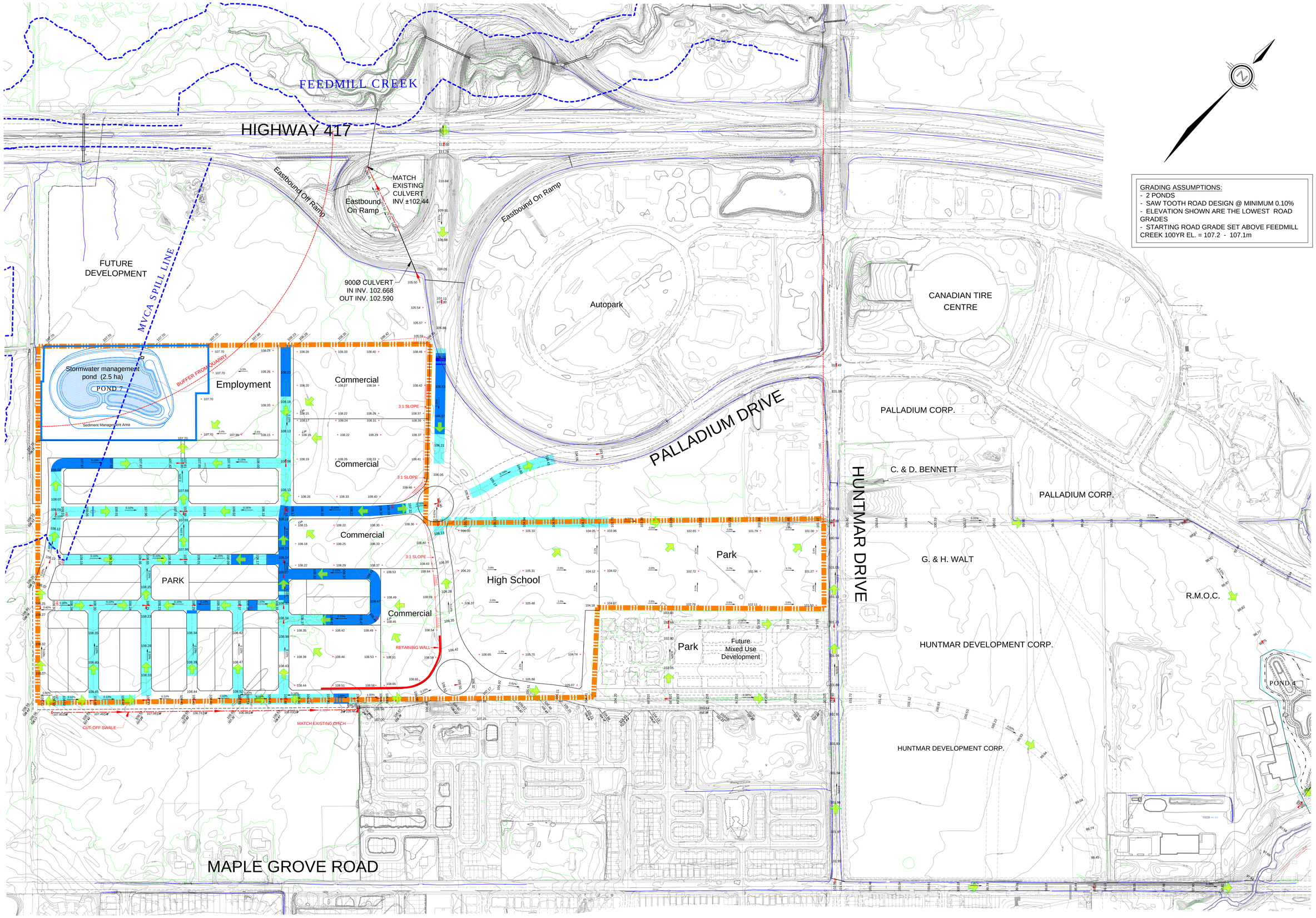
Images aériennes © Fugro Geospatial, Mai 2014
Données altimétriques numériques © GeoDigital International Inc, Printemps 2006

Revision #	Issue
January 31, 2017	Final

LICENSED PROFESSIONAL ENGINEER
J. S. A. PRICE
Jan 31/17
PROVINCE OF ONTARIO

DRAWINGS

- **Drawing 1** Conceptual Grading Plan (DSEL, May 2018)
- **Drawing 2** Conceptual Storm Servicing Plan (DSEL, May 2018)
- **Drawing 3** Conceptual Sanitary Servicing Plan (DSEL, May 2018)



GRADING ASSUMPTIONS:
- 2 PONDS
- SAW TOOTH ROAD DESIGN @ MINIMUM 0.10%
- ELEVATION SHOWN ARE THE LOWEST ROAD GRADES
- STARTING ROAD GRADE SET ABOVE FEEDMILL CREEK 100YR EL. = 107.2 - 107.1m

DSEL
david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

LEGEND:
- STUDY LIMIT
- EXISTING DITCH
- EXISTING CONTOUR
- MAJOR OVERLAND FLOW

CUT-FILL DEPTH ALONG CENTER LINE:

CUT DEPTH (m)	FILL DEPTH (m)
0 - 1	0 - 1
1 - 2	1 - 2
2 - 3	2 - 3

KANATA WEST - 195 HUNTMAR DRIVE

CONCEPTUAL GRADING PLAN

CITY OF OTTAWA

PROJECT No. :	14-624
SCALE	1:2000
DATE:	MAY 2018
DRAWING No.	1

FEEDMILL CREEK

HIGHWAY 417

Eastbound Off Ramp

Eastbound On Ramp

MATCH EXISTING CULVERT INV ±102.44

900Ø CULVERT
IN INV. 102.668
OUT INV. 102.590

Eastbound On Ramp

FUTURE DEVELOPMENT

MVCA SPILL LINE

SWM POND 7 OUTFALL

Autopark

CANADIAN TIRE CENTRE

Stormwater management pond (2.5 ha)
POND 7
NWL 103.80

Sediment Management Area

BUFFER FROM QUARRY

Employment

Commercial

PALLADIUM DRIVE

PALLADIUM CORP.

C. & D. BENNETT

PALLADIUM CORP.

HUNTMAR DRIVE

TRUNK 1

TRUNK 2

TRUNK 3

TRUNK 4

PARK

High School

Park

Future Mixed Use Development

G. & H. WALT

R.M.O.C.

HUNTMAR DEVELOPMENT CORP.

HUNTMAR DEVELOPMENT CORP.

POND 4

MAPLE GROVE ROAD

david schaeffer engineering ltd

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

LEGEND:

- STUDY LIMIT
- STORM SEWER TRIBUTARY AREA
- STORM SEWER TRUNK
- LOCAL STORM SEWER TRUNK
- DRAINAGE AREA (e.g. 2.11Ha, 0.80, 41 44)
- RUNOFF COEFFICIENT
- EXISTING DITCH

KANATA WEST - 195 HUNTMAR DRIVE

CONCEPTUAL STORM SERVICING PLAN

CITY OF OTTAWA

PROJECT No. :	14-624
SCALE	1:2000
DATE:	MAY 2018
DRAWING No.	2

Highway 417

Highway 417

Highway 417

Highway 417

Frank Finnigan Way

Cyclone Taylor Blvd

Palladium Dr

Huntmar Dr

Palladium Dr

Maple Grove Rd

Mika St

5.73Ha
50000 L/ha/d
Part of MSS 32
Transpo
(Now 28,000 L/ha/d)

16.04Ha
50000 L/ha/d
Part of MSS 32
Emp
(Now 28,000 L/ha/d)

23.23Ha
50000 L/ha/da
MSS 33
Ext Emp

6.05Ha
50000 L/ha/d
MSS 35
HP Emp

4.59Ha
Inf.
K
Storm Pond

2.28Ha
28000 L/ha/d
J
Commercial

1.30Ha
28000 L/ha/d
I
Commercial

5.95Ha
28000 L/ha/d
H
Commercial

0.31Ha
20 ppl
G
Residential

3.11Ha
28000 L/ha/d
L
High School

8.15Ha
50000 L/ha/d
Part of MSS 34
Ext Emp
(Now 28,000 L/ha/d)

MH 1

MH 3

1.57Ha
28000 L/ha/d
Commercial

7.23Ha
28000 L/ha/d
M
High School

5.98Ha
9,300 L/ha/d
N
Park

36.70Ha
50 uph (15.60 ha) * 3 ppl/u + 35000 L/ha/d (21.10 ha)
MSS 37
Mixed Use

0.38Ha
9,300 L/ha/d
B
Park

9.48Ha
2593 ppl
F
Residential

4.08Ha
28000 L/ha/d
E
Commercial

65.19Ha
4200 ppl
A
Future Residential

2.27Ha
346 ppl
D
Residential

6.61Ha
50000 L/ha/d
Part of MSS 34
Ext Emp
(Now 28,000 L/ha/d)

MH 2

250mm dia. SAN

450mm dia. SAN

450mm dia. SAN

20.03Ha
30 uph * 3 ppl/u
MSS 26
Residential

22.85Ha
30 uph * 3 ppl/u
MSS 27
Residential

21.13Ha
50 uph (8.98 ha) * 3 ppl/u + 35000 L/ha/d (12.15 ha)
MSS 38
Mixed Use

EX.
300mmØ
SAN

EX.450mmØ SAN

EX.600mmØ SAN

EX.825mmØ SAN

KWMSS MH10

KWMSS MH10A

Ex. 825mmØ SAN

K.W.P.S.

LEGEND

- SANITARY DRAINAGE EXTERNAL AREA
- SANITARY DRAINAGE INTERNAL AREA
- SANITARY DRAINAGE KWMSS AREAS
- IBI / CITY OF OTTAWA REVISIONS TO MSS SANITARY ROUTING
- PROPOSED SANITARY SEWER
- SITE BOUNDARY

DSEL
david schaeffer engineering ltd
SMART SUBDIVISIONS™

120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

KANATA WEST - 195 HUNTMAR DRIVE
CONCEPTUAL SANITARY SERVICING PLAN
CITY OF OTTAWA

PROJECT No.:	12-624
SCALE:	1:7500
DATE:	2018-05-24
DRAWING:	3