FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

6710 HURONTARIO STREET

FLATO DEVELOPMENT INC.
CITY OF MISSISSAUGA
REGION OF PEEL

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
2800 HIGH POINT DRIVE, SUITE 100
MILTON, ON L9T 6P4

APRIL 2019

CFCA FILE NO. 1060-5180

CROZIER
CONSULTING ENGINEERS

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1.0 Introduction

C.F. Crozier & Associates Inc. (Crozier) was retained by Flato Development Inc. (Flato) to prepare a Functional Servicing and Stormwater Management Report to support a Zoning Bylaw Amendment (ZBA) for a proposed commercial development at 6710 Hurontario Street, City of Mississauga, Region of Peel.

The site is legally described as Part of Lot 9, Concession 1, West of Hurontario Street (Geographic Township of Toronto), City of Mississauga, Regional Municipality of Peel. The location of the property is reflected on the Site Location Plan included as Figure 1.

The Subject Property is approximately 0.74 ha (1.83 acres) in size. The Site Plan (IBI Group Architects, March 6, 2019) for the proposed development comprises of a hotel and banquet hall consisting of 164 guest rooms, 2 banquet halls, two levels of below grade parking, and hotel amenities including a restaurant, pool and fitness room. The proposed Site Plan is reflected in Figure 2.

This report has been prepared to document details associated with the servicing design for the proposed development. Contained in this report is an overview of site description and project background (Section 2.0); discussion of the proposed site access (Section 3.0); discussion of sanitary servicing strategy (Section 4.0); discussion of water servicing strategy (Section 5.0); discussion of utilities (Section 6.0); discussion of stormwater management (Section 7.0); discussion of erosion and sediment control (Section 8.0); and conclusions and recommendations (Section 9.0).

2.0 Site Description & Background

The site is bounded by Hurontario Street to the east, undeveloped lands to the north and south, and employment lands and a dental office (90 Skyway Drive) to the west. The site itself is currently undeveloped and partially treed. A billboard is located along the east property line of the site. Currently, an existing driveway provides access to the property complete with a curb cut on Hurontario Street.

The site is currently designated as Development Lands and Office Use per the City of Mississauga Zoning By-Law (January 2019) and Official Plan (August 2018), respectively. The property is located in the Fletcher's Creek Sub-watershed; however, it is not regulated by the Credit Valley Conservation Authority (CVC).

Our investigation included the review of pertinent background information associated with the servicing strategy for the Subject Property. Several documents were reviewed in the course of completing this engineering assessment, including:

- R-Plan (Schaeffer Dzaldov Bennett Ltd, March 2019)
- Topographic Survey (Schaeffer Dzaldov Bennett Ltd, November 28, 2018)
- Geotechnical Investigation Report (Sirati & Partners, January 24, 2019)
- City of Zoning By-Law (Includes Amendments up to January 2019)
- City of Mississauga Official Plan (August 1, 2018)
- Region of Peel Sanitary Sewer Design Criteria (Modified March 2017)

- Overall R-Plan (Ivan B. Wallace, May 3, 2016)
- 90 Skyway Drive Site Servicing (IBI Group, Revised September 7, 2017)
- Concept Servicing Plan (Counterpoint Engineering, Revised April 28, 2015)
- Region of Peel Water and Wastewater Master Plan for the Lake-Based Systems (Blue Plan Engineering and AECOM, March 31, 2014)
- Region of Peel Watermain Design Criteria (Revised June 2010)
- Stormwater Management Report, Mississauga Gateway Centre (G.M. Sernas & Associates, Revised July 2001)
- As-Constructed Drawings for Skyway Drive, Maritz Drive and Hurontario Street

The R-Plan for the overall block between Skyway Drive and Vera Drive features public easements extending west from the west property line of the Subject Property to Maritz Drive and extending north from approximately halfway along the west property line to Skyway Drive. Based on our discussion with Region and City staff, it is our understanding that the purpose of these easements is to provide servicing and vehicular accesses to the property. Please refer to the Overall R-Plan located in Appendix A.

3.0 Site Access

Access to the proposed development will be provided via Hurontario Street per City of Mississauga standards. An internal driveway is proposed along the south property line, consisting of 6.0m pavement, complete with curb and gutter. Pavement thickness has been recommended in the Geotechnical Investigation Report (Sirati & Partners, January 24, 2019) as follows:

- 40mm HL3 Asphaltic Concrete
- 50mm HL8 Asphaltic Concrete
- 150mm Granular ‘A’
- 300mm Granular ‘B’

Refer to the Traffic Study prepared by LEA Consulting Ltd. under separate cover for details regarding the site parking stats and forecasted site generated traffic.

4.0 Sanitary Sewage System

4.1 Existing Sanitary Sewer Infrastructure

The Region of Peel operates two lake-based Wastewater Treatment Facilities (WWTF; Clarkson WWTF and GE Booth WWTF) to treat sanitary sewage from the Region of Peel. Wastewater is conveyed to the WWTFs by a series of sanitary sewers and forcemains that collect wastewater and direct it to one of the two facilities.

There are existing 250mm diameter sanitary sewers located along Skyway Drive and Maritz Drive. These local gravity sanitary sewers drain towards the Fletcher's Creek Sanitary Trunk Sewer which drains via gravity towards the Clarkson WWTF. The Region of Peel Water and Wastewater Master Plan for the Lake-Based Systems (Blue Plan Engineering and AECOM, March 31, 2014) notes that the Fletcher's Creek Sanitary Trunk Sewer is sized to accommodate expected development within its natural drainage area.

4.2 Uncommitted Reserve Capacity

The Region of Peel Water and Wastewater Master Plan for the Lake-Based Systems (Blue Plan Engineering and AECOM, March 31, 2014) was the most recently available document obtained with respect to the capacity of the Clarkson WWTF. The report assessed that the 2013 expansion of the Clarkson WWTF to 350ML/d is sufficient to treat anticipated flows until the year 2031. Therefore, we anticipate adequate capacity exists within the WWTF to service the proposed development.

4.3 Proposed Servicing Strategy

A conceptual Servicing for the lands neighbouring the Subject Property was prepared by Counterpoint Engineering (April 2015). This design depicts sanitary sewers extending east within the municipal easement from Maritz Drive to the Subject Property's west property line. The concept depicts a sanitary service to the 90 Skyway Drive property and the Subject Property from this sewer. As the 90 Skyway Drive property is built out, our office contacted the Region for confirmation if this sanitary sewer had been constructed within the easement. Region staff noted that the 90 Skyway Drive property had a sanitary service connection off Skyway Drive; therefore, the proposed sanitary sewer within the easement will be designed and constructed as part of this development.

4.4 Sanitary Sewage Design Flows

The Region of Peel Sanitary Sewer Design Criteria (Modified March 2017) were used to determine the future sanitary design flows for the development.

The Subject Property is proposed to consist of a hotel with 164 guest rooms, 2 banquet halls and offices. To calculate the sewage generated from the development, the Region's standards for a commercial development were used.

Sanitary flows for the future development on the Site were determined using the following design figures:

- Population (per Architect's estimate) 1489
- Average Commercial Flow Rate 302.8 L/cap/day
- Peaking Factor 3.7 (Harmon Formula)
- Infiltration 0.20 L/s/ha

Based on these values it is estimated that peak sanitary flow, including infiltration, from the potential future development will be 19.36 L/sec.

Figure 3 shows the existing sanitary sewer and preliminary servicing alignment for future development of the southern block. Sanitary sewage flow calculations are provided in Appendix B.

5.0 Water Supply

5.1 Existing Potable Water Supply Infrastructure

The Region of Peel operates two lake-based Water Treatment Plants (WTP; Lakeview WTP and Lorne Park WTP) to treat water from Lake Ontario and distribute it to various parts of the Region of Peel. Water is conveyed from the WTPs by a series of watermains and reservoirs to distribute potable water within the Region of Peel.

In the proximity of the Subject Property, an existing 300mm diameter watermain is located along Skyway Drive and connects to an existing 400mm diameter watermain that runs along Maritz Drive.

5.2 Uncommitted Reserve Capacity

The Region of Peel Water and Wastewater Master Plan for the Lake-Based Systems (Blue Plan Engineering and AECOM, March 31, 2014) was the most recently available document obtained with respect to the capacity of the Region of Peel's two WTPs. The report assessed that the then ongoing expansions of the Lorne Park WTP to 500ML/d and the Lakeview WTP to 1150ML/d is sufficient to treat anticipated flows until the year 2031. Therefore, we anticipate adequate capacity exists within the two WTPs to service the proposed development.

5.3 Proposed Servicing Strategy

The conceptual Servicing for the lands neighbouring the Subject Property (Counterpoint Engineering, April 2015) shows a water servicing extending south from Skyway Drive within the road easement to the Subject Property's west property line. This service will be designed and constructed as part of this development. An internal network of watermain and fire hydrants are proposed to provide fire protection to the future development since there are no fire hydrants or watermain along the Subject Property's frontage along Hurontario Street.

5.4 Water Demand Calculations

To estimate the proposed water demands for future development The Region of Peel Sanitary Sewer Design Criteria (Modified March 2017), Ontario Building Code (OBC) and the MOE Design Guidelines for Drinking-Water Systems (2008) were consulted to determine the average, maximum day and peak hour water demands generated by the future development.

Potable water demands for the future development were determined using the following design figures:

- Population (per Architect's estimate) 1489
- Average Commercial Flow Rate 300 L/employee/day
- Max Day/Hour Peak Factor 1.4/3.0

Based on these values, it is estimated that water demands for the development are as follows:

- Average Day 5.17 L/sec
- Max Day 7.24 L/sec
- Peak Hour 15.51 L/sec

Preliminary fire flows required to service the proposed development were determined to be 116.7 L/s per the Fire Underwriters Survey (FUS). Confirmation was received from IBI Architects that the proposed development would consist of non-combustible, fire resistive construction, complete with automatic sprinklers. Therefore, the total design flow for the internal water distribution system is 123.94 L/s.

The availability of flows will be confirmed through hydrant testing as the Planning Applications proceed. Refer to Appendix B for detailed calculations. Refer to Figure 3 for the existing and proposed water distribution network.

6.0 Utilities

The Subject Property will be serviced with natural gas, telephone, cable TV and hydro. Utility locates in the vicinity of the site on Hurontario Street, Skyway Drive and Maritz Drive have been coordinated and will be assessed when completed. Coordination for connection to existing services will be undertaken as development approvals advance.

7.0 Stormwater Management Implementation & Site Drainage

7.1 Stormwater Management Criteria

The management of stormwater and site drainage for both the existing site and the future development must comply with the policies and standards of the various agencies including the City of Mississauga, Credit Valley Conservation Authority (CVC), and Ministry of Environment, Conservation and Parks (MECP).

The Subject Property has been previously identified in the Stormwater Management Report prepared for the Mississauga Gateway Centre (G.M. Sernas & Associates, Revised July 2001) as a part of the drainage area contributing to the stormwater pond designed as part of the Mississauga Gateway Centre development. The Stormwater Management Report accounted for the Subject Property in full built out conditions at 90% imperviousness. Please refer to Appendix A for excerpts from this report.

The stormwater management criteria for the future development include:

- Water Quantity Control
  - Control of minor and major system flows to the post-development condition assumed in the G.M. Sernas Report (July 2001)
  - Controlled minor flows, up to and including the 10-year storm outletting to the municipal storm sewer network
  - Safe conveyance of major system flows towards the municipal road network

- Water Quality Control and Water Balance
    - Quality control is not required as the site drains to a stormwater management pond, as confirmed by City staff
    - 5mm of runoff captured and infiltrated
- Stormwater Erosion Control
    - Stormwater erosion control is not required since the site discharges into a municipal drainage system
- Development Standard
    - Lot grading at 0.5% minimum grade and 2.0% optimum grade
    - Drainage system to convey runoff from frequent and infrequent rainfall events, respectively

7.2 Existing Drainage Conditions

The Subject Property lies within the Fletcher's Creek sub-watershed, ultimately draining to the Credit River and into Lake Ontario. Pre-development drainage conditions were determined through review of topographic survey of the site (Schaeffer Dzaldov Bennett Ltd, November 28, 2018). Review of the survey illustrates a drainage divide along the middle of the site that splits the flow of drainage towards the east and west, respectively. An existing ditch runs along the east property line of the site. A high point in the ditch located immediately north of the existing driveway to the property diverts flows to the north and south of the Subject Property. Centreline grades along Hurontario Street are higher than the grades on the property; therefore, any drainage flowing towards the east is assumed to be redirected west towards the existing SWM Facility constructed as part of the Mississauga Gateway Centre Development. The Pre-Development Drainage Plan has been included as Figure 5

The existing soils comprise of topsoil underlain by fill material and silty sand to sandy silt materials based on the Geotechnical Investigation (Sirati & Partners, January 2019). The Geotechnical Investigation also indicated that groundwater was observed approximately 2.5m below existing elevations on the site.

7.3 Proposed Drainage Conditions

The development will incorporate a "dual" drainage system consisting of catchbasins and storm sewers and overland flow to direct runoff towards an underground storage system located under the site's driveway.

The building's roof encompasses 0.49 ha (approx. 66%) of the site area. All drainage from the roof is proposed to be directly discharged to the underground storage system. Runoff from the walkways, driveway and other on-grade surfaces from the development will be directed to a series of catchbasins fitted with 'CB Shields' to provide sediment removal prior to discharge into the underground storage system. A small portion of the site along the east and west property lines discharge uncontrolled towards Hurontario Street and Maritz Drive, respectively.

The underground storage system will be designed with an open bottom to completely contain and infiltrate 5mm of runoff.

Discussions with City staff and review of the conceptual Servicing for the lands neighbouring the Subject Property (Counterpoint Engineering, April 2015) led to the understanding that the immediate stormwater outlet for the Subject Property is Maritz Drive. The existing storms sewers on Maritz Drive will be extended to the site within the easements shown in the overall R-Plan for a storm sewer connection.

Two emergency overland flow routes exist for the site. The eastern half of the driveway will direct overland flow towards Hurontario Street. The proposed emergency overland flow route for the western portion of the development is within the easement from the west property line to Maritz Drive. A private driveway providing access to the 90 Skyway Drive property exists within the easement. The proposed emergency overland flow routes of the proposed development maintain existing overland flow routes from the site.

The proposed drainage system is reflected on Figure 5. Final grading will be updated at the detailed design stage to refine considerations for cut/fill levels and architectural design as required.

7.4 Stormwater Quantity Control

7.4.1 Target Flow Rate

As previously noted, the development has been encompassed within a 20.3ha catchment area (Catchment 400) contributing to the stormwater management pond constructed as part of the Mississauga Gateway Centre development. The SWM Report (G.M. Sernas & Associates, July 2001) identifies Catchment 400 at 90% imperviousness. The SWM Report also notes that the minor system leading to the SWM pond has been designed to contain the 10-year storm event. This has been confirmed with City staff.

In an effort to avoid directing frequent overland flow across the 90 Skyway Drive property's access, we have designed the development's drainage system to capture the 100-year storm runoff within underground storage system and outlet it to the proposed storm sewers.

To accomplish this, the target 10-year storm flow from Subject Property at 90% imperviousness was determined. This is noted to the be "target catchment" for hydrologic modeling prepared using the PCSWMM program. The 24 Hour SCS Type II storm was used to calculate the target to be consistent with the G.M. Sernas modeling. Rainfall depths and intensities were based on the MTO IDF Look Up Tool based on the location of the Subject Property. The purpose of the modeling was to determine the target outlet rate, detention storage volumes and corresponding underground stormwater storage system size to ensure post-development peak flows complied with the G.M. Sernas design.

The principal hydrologic parameters used in the modeling of the subject lands are summarized in Table 1 below and are based on supporting computations found in Appendix C. Figure 5 illustrates the post-development modeling catchments.

Table 1: Hydrologic Parameters Used To Determine Target Flow Rates

	"Target" Catchment	TARGET FLOW RATE
Drainage Area (ha)	0.74	**224 L/S**
Total Imperviousness (%)	90%	
Directly Connected Imperviousness (%)	90%	
Curve Number (CN)	79	

With the development of the Subject Property, the site runoff must be controlled sufficiently to not exceed the target flow rate of 224 L/s for all rainfall events.

7.4.2 Quantity Control Design

The proposed development conditions were also modeled in PCSWMM to determine the size of the required underground storage system and outlet orifice. The 24 Hour SCS Type II and 4 Hour Chicago storm distributions were modeled. The flows from the uncontrolled catchment (Catchment 202), draining overland towards Maritz Drive was determined. This flow was deducted from the target flow of 224 L/s and the proposed underground storage for Catchment 201 was designed to store stormwater and outlet it at 204 L/s. Flows from the uncontrolled catchment (Catchment 203) draining towards Hurontario Street was also determined. A summary of the hydrologic modeling input and results are provided in Table 2.

Table 2: Post-Development Uncontrolled Hydrologic Parameters For The Development

	Post-Development	10 Year Flow Rate (L/s)		100 Year Flow Rate (L/s)	
		SCS	CHI	SCS	CHI
Catchment 201 (Controlled Towards Maritz Drive)					
Drainage Area (ha)	0.70	219	315	320	491
Total Imperviousness (%)	96.5				
Directly Connected Imperviousness (%)	96.5				
Curve Number (CN)	79				
Catchment 202 (Uncontrolled Towards Maritz Drive)					
Drainage Area (ha)	0.02	6	13	9	19
Total Imperviousness (%)	90				
Directly Connected Imperviousness (%)	90				
Curve Number (CN)	79				
Catchment 203 (Uncontrolled Towards Hurontario Street)					
Drainage Area (ha)	0.02	6	13	9	20
Total Imperviousness (%)	90				
Directly Connected Imperviousness (%)	90				
Curve Number (CN)	79				

To achieve the overall target flow of 224 L/s draining towards Maritz Drive, a storage node with an outlet orifice was modeled in PCSWMM. The 100-Yr Chicago storm generated the highest storage volume required for the site. Based on the modeling results and given that 19 L/s from Catchment 202 flows uncontrolled towards Maritz Drive, a 320mm orifice is required to control the outlet flow rate from Catchment 201 to 203 L/s. This orifice will be installed at a control manhole downstream of the underground storage system.

An online sizing tool was used to size a Cultec underground stormwater storage chamber for the site. The design of this chamber will be refined as development applications proceed.

7.5 Stormwater Quality Control and Infiltration

The proposed development drains towards the SWM Pond constructed as part of the Mississauga Gateway Centre. The SWM Pond features a forebay, permanent pool and extended detention, providing "enhanced protection" (80% TSS removal) level for the SWM facility catchment areas. Accordingly, on-site quality controls are not required for the site. This has been confirmed with City staff.

In an effort to implement "Best Management Practices" (BMPs) and to reduce sediment levels in the underground storage facility, "basic protection" (50% TSS removal) sediment control in the form of CB Shields has been proposed within the development's catchbasins. This will provide pre-treatment prior to infiltration of stormwater within the underground stormwater storage system.

A minimum of 5 mm of infiltration is required to provide water balance for the development. A summary of the required volume is provided in Table 3 below. Detailed calculations are provided in Appendix C.

Table 3: Summary Of Water Balance Targets

Area (ha)	**Infiltration Required** (mm)	**Infiltration Volume Required** (m^3)
0.74	5.0	37.0

The underground storage system will be designed with an open bottom clearstone base for water balance storage volume and infiltration into the native underlying soils. The outlet orifice will be located above the 5 mm infiltration volume level within the underground storage system.

A summary of the required active storage to achieve the stormwater runoff target, and dead storage to achieve water balance targets is summarized in Table 4.

Table 4: Stormwater Storage Requirements

	Required Storage (m^3)
Active Storage	142
Dead Storage	37
Total Storage	**178**

The Cultec online sizing tool was used to calculate preliminary sizing of the underground storage chamber. These results are included in Appendix C.

7.6 Sustainable Stormwater Management

Sustainable stormwater management measures have been considered for the development of this site. The proposed development is such that limited opportunities for Low Impact Development (LID) techniques exist. Several techniques for LID such as permeable pavement, bio-retention systems, green roofs and other technologies were considered. A discussion of each of these measures is provided below, with reference to the Low Impact Development Stormwater Management Planning and Design Guide (CVC/TRCA, 2010).

Permeable Pavement

Permeable pavements allow stormwater to filter through the pavement layers and into a stone reservoir where it is infiltrated into the underlying native soil. Permeable pavements allow for filtration, storage, or infiltration of runoff, and can reduce runoff compared to traditional impervious paving surfaces. These systems are most efficient when accepting relatively clean runoff from low-traffic areas.

Green Roofs

The design and construction of these buildings can be unique. A series of mechanical units will be installed atop the building. Consequently, the installation of a green roof atop the building may not be feasible due to the lack of appropriate space. However, this will be confirmed and coordinated with the Architect as development applications proceed.

Infiltration Systems

Infiltration chambers and trenches are used to capture runoff and allow infiltration into the surrounding native soils. These systems can provide temporary storage of runoff, and can be used to treat runoff from higher traffic areas. An underground stormwater storage chamber with an infiltration component has been proposed for this development. The chamber provides active storage for rainfall events up to and including the 100 Year storm event and infiltration dead storage for 5mm of runoff from the site.

Grassed Swales

Grassed swales are typically used as a polishing technique for stormwater prior to discharge to an outlet. Given that the site design includes predominantly hard surfaces and a direct connection to the municipal storm sewer on Maritz Drive, conveyance of site runoff across a grassed swale prior to discharge is not possible. Consequently, we do not recommend the incorporation of grassed swales.

We conclude that there are limited opportunities for the incorporation of sustainable stormwater management techniques into the site design and that the stormwater measures for this site are adequate to address the City's requirements. We have proposed LIDs based on site suitability and the City's recommendations.

8.0 Erosion & Sediment Controls

Erosion and sediment controls will be implemented prior to the commencement of any site servicing works for future development and maintained throughout construction until the site is stabilized or as directed by the Engineer, CVC, Region and/or City. Controls are to be inspected regularly, after each significant rainfall, and maintained in proper working condition. A Sediment and Erosion Control Plan has been prepared for the development. This plan includes sediment basins, interceptor ditches, silt fencing, dust suppression, mud mats, and sediment traps to be implemented as necessary. Further details on the erosion and control measures have been summarized as follows:

- Sediment Control Silt Fence: Sediment Control Silt Fence will be installed on the perimeter of the subject lands to intercept sheet flow. Additional Sediment Control Silt Fence may be added based on field decisions by the Site Engineer and Owner, prior to, during and following construction.

- Mud Mat: A rock mud mat will be installed at the site entrances to the subject lands off of The Queensway. These rock mud mats will help to prevent mud tracking. All construction traffic will be restricted to the construction entrance as indicated on Figure 6.

- Catch basin Sediment Control Devices: The storm sewer catch basins shall be have a sediment control barrier installed as shown on the Removals and Erosion & Sediment Control Plan (Figure 6).

9.0 Conclusions & Recommendations

This report was prepared in support of the Zoning By-Law Amendment Application for the property located at 6710 Hurontario Street. Based on the information contained within this Functional Servicing and Stormwater Management Report, we offer the following conclusions and recommendations:

1. Access to the site will be provided from Hurontario Street.

2. Sanitary sewage flow for the proposed development will be extended to the property line of the Subject Property from Maritz Drive via an existing municipal easement.

3. Water demand service connections for the proposed development will be made from the existing 300 mm diameter PVC watermain on Skyway Drive via an existing municipal easement.

4. Coordination for connection to existing utility services will be undertaken as development approvals advance.

5. The development will incorporate a dual drainage system consisting of catch basins and storm sewers and overland flow to direct runoff towards an underground storage system located in the southwest corner of the site. The stormwater modeling indicated that a target flow rate of 224 L/s discharging to the storm sewer on Maritz Drive. This has been achieved using a combination of an underground storage tank and an orifice plate installed within a control manhole downstream of the underground stormwater storage system. On-site quality controls are not required for the site. This has been confirmed with City staff. To achieve a water balance target of 5 mm of infiltration across the site has been provided within the underground stormwater storage system.

Based on the above noted conclusion, we recommend approval of the Zoning By-law from the perspective of functional servicing and stormwater management.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.

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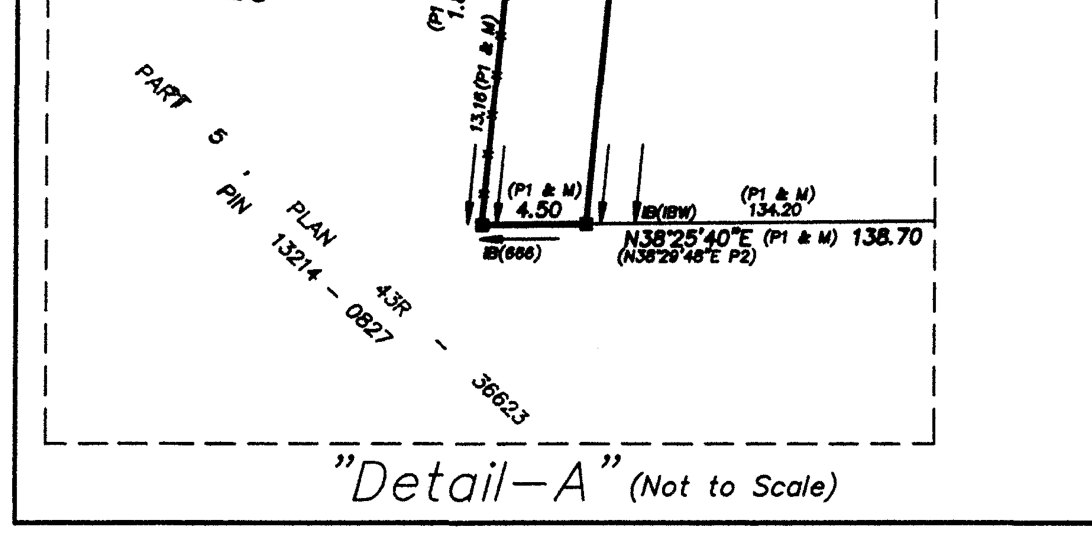
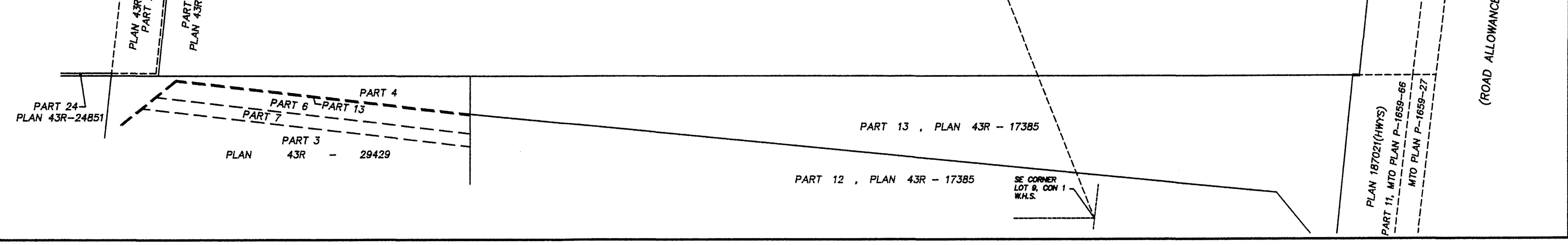
APPENDIX A

Background Information





DISTANCE NOTES - METRIC

Distances and coordinates are in metres and can be converted to feet by dividing by 0.3048.

Distances are ground and can be converted to grid by multiplying by the combined scale factor of 0.999710.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1. This survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act, the Land Titles Act and the regulations made under them.
2. The survey was completed on April 28, 2016.

May 3, 2016

Date — David Comery

I REQUIRE THIS PLAN TO BE DEPOSITED UNDER THE LAND TITLES ACT.

DATE May 3, 2016

DAVID COMERY
ONTARIO LAND SURVEYOR

PLAN 43R-37133

RECEIVED AND DEPOSITED

DATE May 12, 2016

REPRESENTATIVE FOR THE LAND REGISTRAR FOR THE LAND TITLES DIVISION OF PEEL (No. 43)

SCHEDULE

PART	LOT	CONCESSION	PIN	AREA
1	PART OF 9	1 WEST OF HURONTARIO STREET	All of 13214-0825	1.479 ha.
2				518.8 sq.m.
3				666.1 sq.m.
4				42.0 sq.m.
5				162.0 sq.m.
6				391.7 sq.m.
7				29.6 sq.m.
8				65.9 sq.m.
9				12.2 sq.m.
10			All of 13214-0826	1.106 ha.
11				356.8 sq.m.
12				29.7 sq.m.
13				66.0 sq.m.
14				2.7 sq.m.
15				9.5 sq.m.
16				288.8 sq.m.
17				82.0 sq.m.
18			Part of 13214-0054	234.9 sq.m.
19			Part of 13214-0827	666.2 sq.m.
20				255.8 sq.m.
21				18.8 sq.m.
22				23.2 sq.m.
23			Part of 13214-0187	3.5 sq.m.
24				3.5 sq.m.
25				5.0 sq.m.
26				5.1 sq.m.

Parts 2, 3, 9, 14, 15, 16, 17, 19, 21– Subject to easement as in Inst. PR2741750 and Inst. PR2741752

Parts 20, 21 – Subject to easement as in Inst. PR2741750

PLAN OF SURVEY OF

PART LOT 9, CONCESSION 1 WEST OF HURONTARIO STREET

GEOGRAPHIC TOWNSHIP OF TORONTO

CITY OF MISSISSAUGA

REGIONAL MUNICIPALITY OF PEEL

SCALE 1 : 750 METRES

0 15 30 60

IVAN B. WALLACE O.L.S. LTD.

LEGEND

■	denotes Survey Monument Found
□	denotes Survey Monument Set
SSIB	denotes Short Standard Iron Bar
SIB	denotes Standard Iron Bar
IB	denotes Iron Bar
WIT	denotes Witness
M	denotes Measured
P1	denotes Plan 43R-36623
P2	denotes Plan 43R-24851
666	denotes A. Death, O.L.S.
922	denotes Schaeffer & Dzaldov Ltd., O.L.S.
IBW	denotes Ivan B. Wallace OLS Ltd.
W.H.S.	denotes West of Hurontario Street
MMM	denotes Marshall Macklin Monaghan Ltd., O.L.S.

BEARING NOTES

Bearings are UTM Grid, derived from observed reference points A and B, by Real Time Network observations, UTM Zone 17, NAD83(CSRS)(1997).

For bearing comparisons, the following rotations were applied:
P2 – 1°00'12" counter-clockwise

INTEGRATION DATA

Observed reference points derived from GPS observations using a Real Time Network and are referred to UTM Zone 17 (81°west longitude) NAD83(CSRS)(1997).

Urban accuracy per Sec. 14(2), O.Reg. 216/10.

POINT ID	NORTHING	EASTING
A	4832402.03	604896.86
B	4832620.71	605073.82

CAUTION: COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN

IVAN B. WALLACE
ONTARIO LAND SURVEYOR LTD.
www.ibwsurveyors.com
71 Mearns Court, Unit 1, Bowmanville, Ontario, L1C 4N4
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bowmanville@ibwsurveyors.com

DWG NAME: 5-11355-Rv6	DRAWN BY: DGC	PLOT DATE: May 3/16
PARTY CHIEF: SH	CHECKED BY: DC	copies available at www.LandSurveyRecords.com

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

PLAN OF SURVEY OF

PART OF LOT 9, CONCESSION 1 WEST OF HURONTARIO STREET

(GEOGRAPHIC TOWNSHIP OF TORONTO)

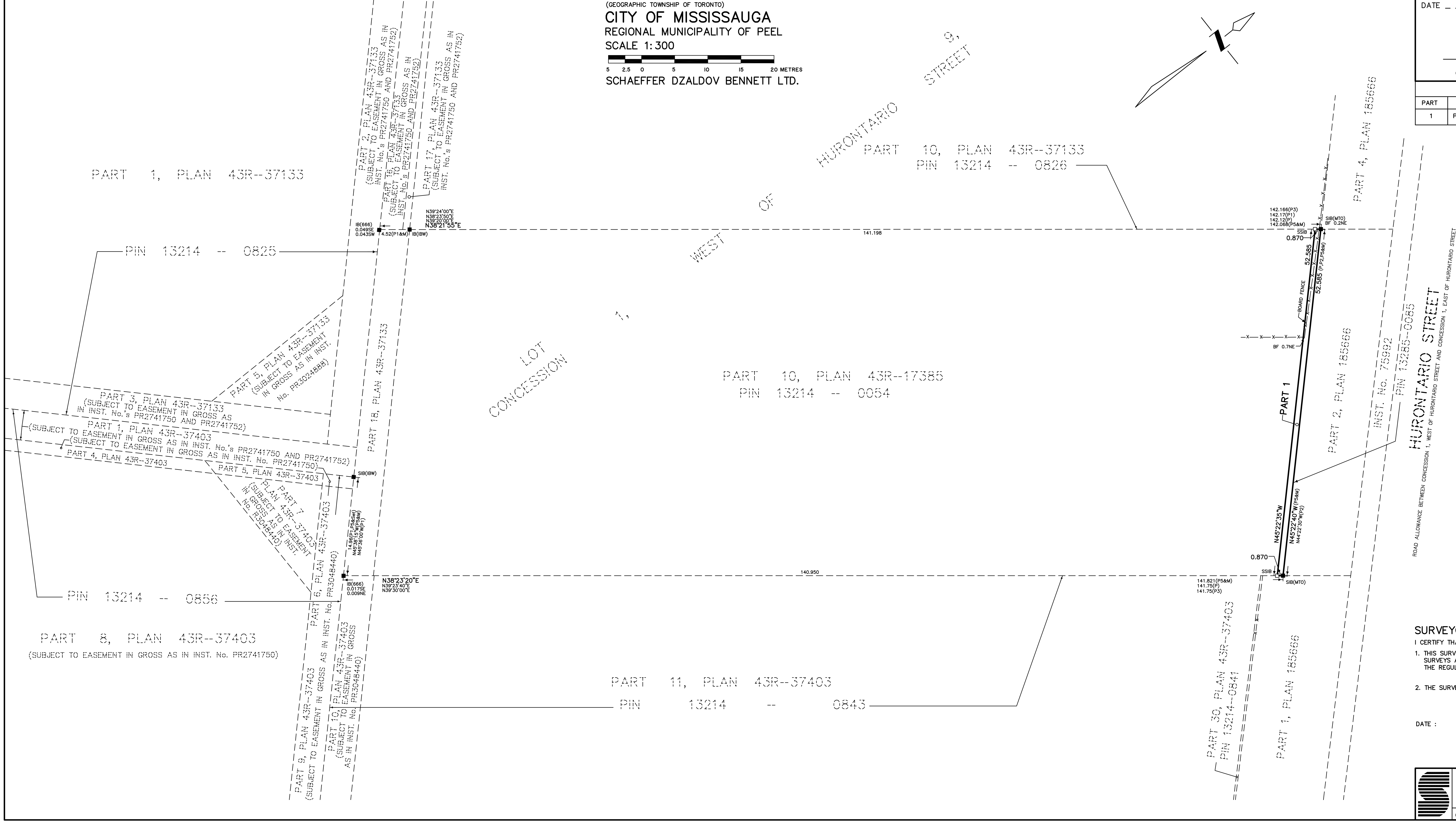
CITY OF MISSISSAUGA

REGIONAL MUNICIPALITY OF PEEL

SCALE 1:300

5 2.5 0 5 10 15 20 METRES

SCHAEFFER DZALDOV BENNETT LTD.



I REQUIRE THIS PLAN TO BE DEPOSITED UNDER THE LAND TITLES ACT.	PLAN 43R–
DATE _ _ _ _ _ _ _ _ _ _, 2019.	RECEIVED AND DEPOSITED DATE _ _ _ _ _ _ _ _ _ _
DAN DZALDOV ONTARIO LAND SURVEYOR	REPRESENTATIVE FOR LAND REGISTRAR FOR THE LAND TITLES DIVISION OF PEEL No. 43

SCHEDULE

PART	LOT	CONCESSION	PIN	AREA (m^2)
1	PART OF 9	1, WEST OF HURONTARIO STREET	PART OF 13214–0054	45.5

NOTES

□	DENOTES	PLANTED MONUMENT
■	DENOTES	FOUND MONUMENT
SIB	DENOTES	STANDARD IRON BAR
IB	DENOTES	IRON BAR
SSIB	DENOTES	SHORT STANDARD IRON BAR
MTO	DENOTES	MINISTRY OF TRANSPORTATION OF ONTARIO
M	DENOTES	MEASURED
P	DENOTES	PLAN 43R–17385
P1	DENOTES	PLAN 43R–37133
P2	DENOTES	PLAN 185666
P3	DENOTES	PLAN 43R–24851
P4	DENOTES	PLAN 43R–37403
P5	DENOTES	SCHAEFFER DZALDOV BENNETT LTD., SURVEY DATED NOVEMBER 28, 2018
666	DENOTES	A. DEATH, O.L.S.
IBW	DENOTES	IVAN B. WALLACE, O.L.S.
BF	DENOTES	BOARD FENCE

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT, THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.

2. THE SURVEY WAS COMPLETED ON THE DAY OF , 2019.

DATE :

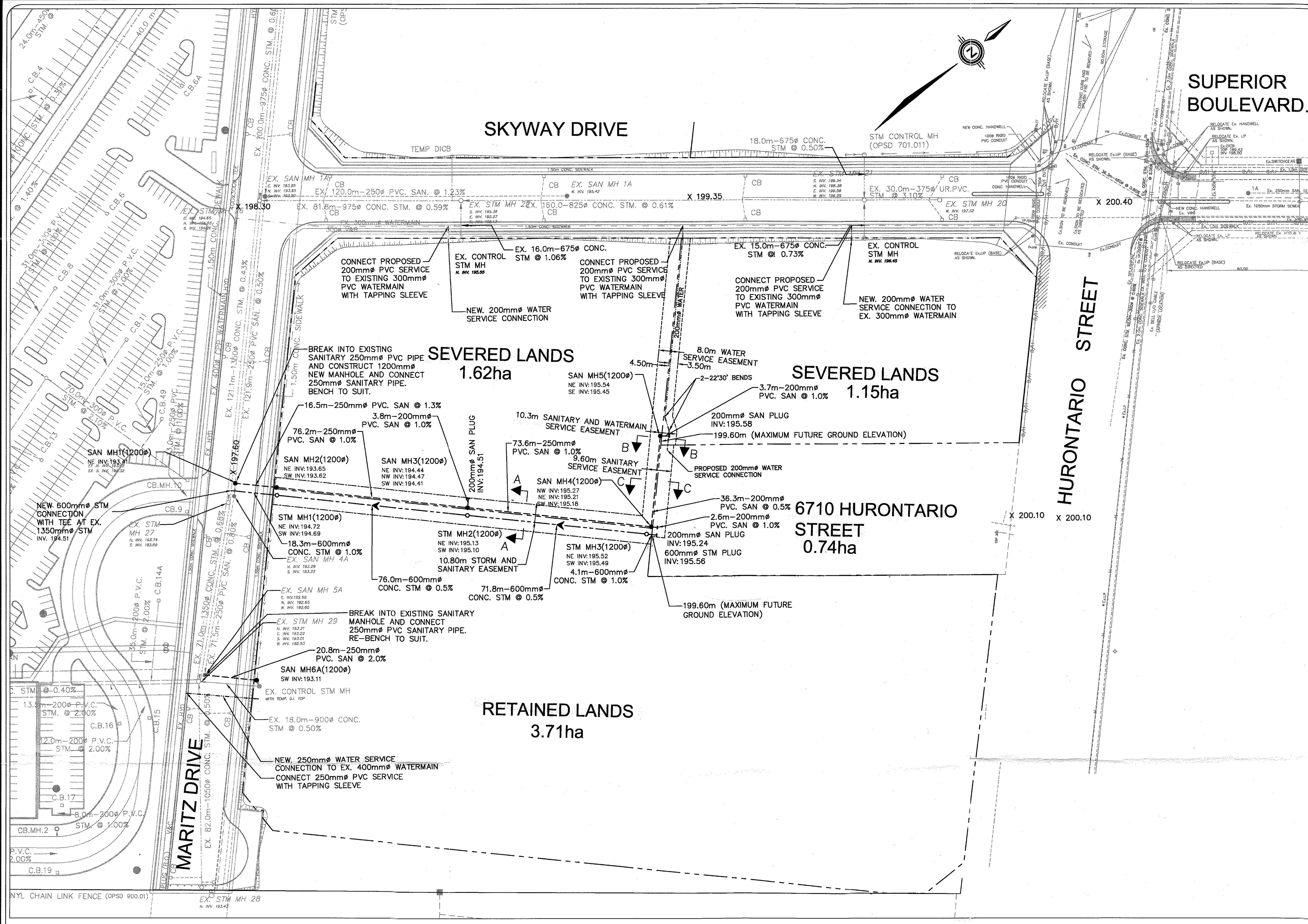
DAN DZALDOV
ONTARIO LAND SURVEYOR

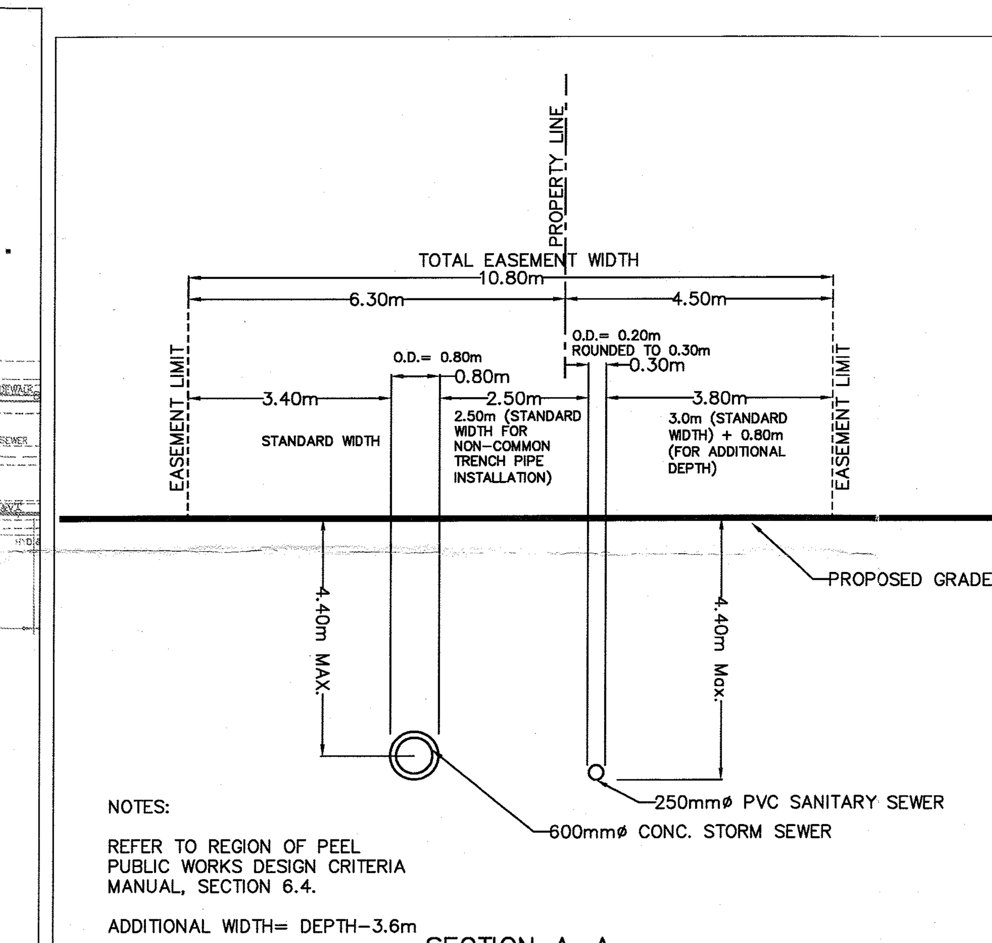
SCHAEFFER DZALDOV BENNETT LTD.
ONTARIO LAND SURVEYORS

64 JARDIN DRIVE CONCORD, ONTARIO L4K 3P3 TEL.(416)987–0101

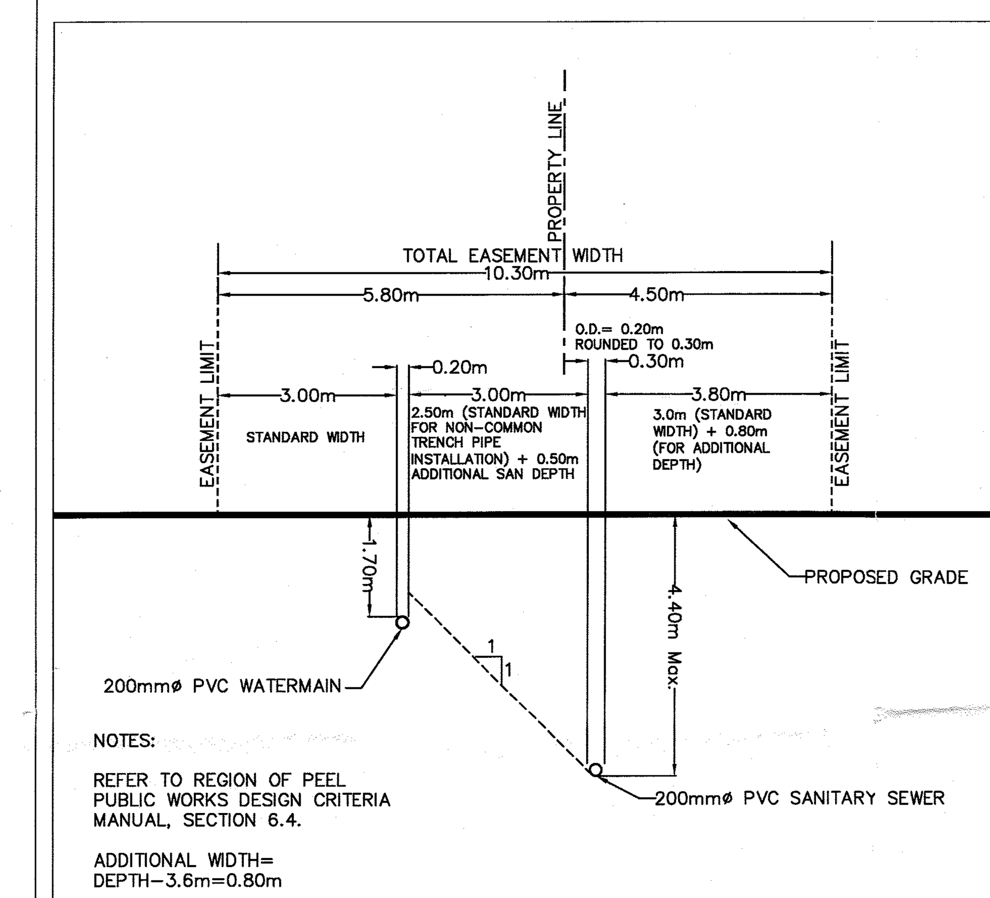
CALC. SL	DRAWN ACAD/LW	CHECKED	SCALE 1:300	JOB NO. 18–238–01A

MARCH 4, 2019

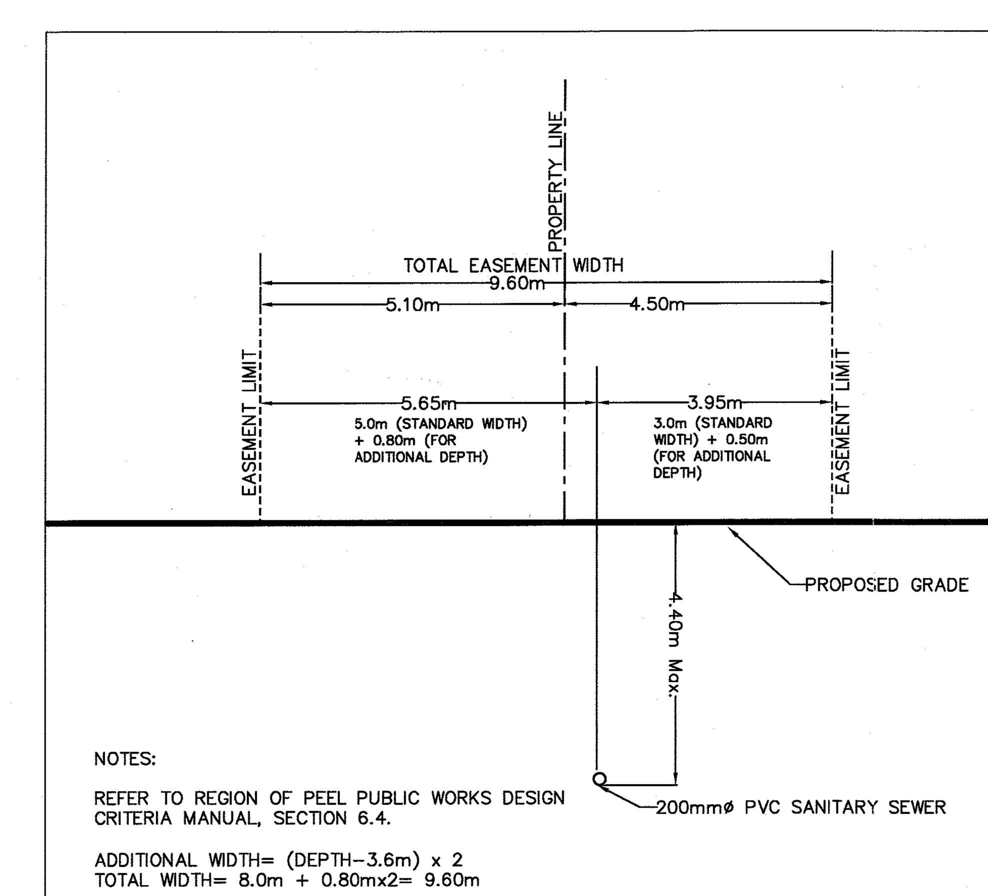




SECTION A–A
EASEMENT FOR STORM AND SANITARY SERVICES
SCALE 1:100



SECTION B–B
EASEMENT SANITARY AND WATER SERVICES
SCALE 1:100



SECTION C–C
EASEMENT SANITARY SERVICE
SCALE 1:100

LEGEND

- EXISTING CATCHBASIN
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING HYDRANT AND VALVE
- EXISTING VALVE AND BOX
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPERTY LINE
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM MAHNOLE
- PROPOSED PLUG

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Project: Mississauga Derry
Project No: 15018
Client: Smart Centres
Location: City of Mississauga
Prepared by: Gherard Rouby
Checked by:
Date: April 24, 2015

Rainfall Data: a, b, c Values

a	1010
b	4.6
c	0.78

Manning's Roughness Coefficient (All pipes)= 0.013
Design Return Frequency (years)= 10

1 Location	2 From Node	3 Upstream Invert	4 To Node	5 Downstream Invert	6 Drop at Node	7 Diam. (nominal) (mm)	8 Length Pipe (m)	9 Slope Pipe (%)	10 Area (ha)	11 C	12 A x C (ha)	13 Accum AxC (ha)	14 Rainfall Intensity mm/hr	15 Time of Conc. (Tc) (min)	16 Area Flow Q (l/s)	17 Other Flows (l/s)	18 Total Flow (l/s)	20 Diameter Actual (m)	21 Pipe Area (sq.m)	22 Hydraulic Radius (m)	23 Pipe Mat.	24 Pipe Capacity (l/s)	25 Velocity (m/s)	26 Time of Flow (min)	27 Ratio Q/Q full
6710 Hurontario	STUB	195.56	MH 3	195.52	0.03	600	4.1	1.00%	0.74	0.90	0.67	0.67	99.2	15.00	183.5	0.0	183.5	0.610	0.29	0.152	CONC	640.6	2.19	0.03	0.29
	MH 3	195.49	MH 2	195.13	0.03	600	71.8	0.50%	0.00	0.90	0.00	0.67	99.0	15.03	183.2	0.0	183.2	0.610	0.29	0.152	CONC	452.9	1.55	0.77	0.40
	MH 2	195.10	MH 1	194.72	0.03	600	76.0	0.50%	0.00	0.90	0.00	0.67	96.1	15.80	177.8	0.0	177.8	0.610	0.29	0.152	CONC	452.9	1.55	0.82	0.39
	MH 1	194.69	EX. 1350	194.51	0.08	600	18.0	1.00%	0.00	0.90	0.00	0.67	93.2	16.62	172.4	0.0	172.4	0.610	0.29	0.152	CONC	640.6	2.19	0.14	0.27

Definitions:
Q = 2.78 AIR, where | Tc= Time of concentration | I = Rainfall Intensity (mm/h) | C = Runoff Coefficient
Q = Peak Flow in Litres per second (L/s) | A = Areas in hectares (ha) | I = A(T)^b (see above for regression contants)

SANITARY SEWER DESIGN TABLE

PROJECT INFORMATION

Client	Derry-Ten Ltd.
Project No.	15018
Project Name	Mississauga Derry-Ten
Location	Mississauga
Date	24-Apr-15
Designed by	GR
Checked by	JY
File No.	15018-B10

DESIGN NOTES

Peaking Factor, $M = 1 + 14/(4+P)^{1/2}$ P = Population (in thousands)

Average Daily Flow : 3 L/s

Infiltration : 0.2 L/s/ha
0.028 L/s/m of sewer length

Assumed sewer pipe length on site 1000 m
Commercial Population Density : 50 ppha

SANITARY SEWER DESIGN SHEET

LOCATION	FROM	TO	LOT AREA (ha)	CUMULATIVE LOT AREA (ha)	P.P.U. PEOPLE/ HECTARE	POPULATION EQUIVALENT	CUMULATIVE POPULATION	PEAKING FACTOR	EQUIVALENT FLOW (Lpcd)	PEAK DAY FLOW (L/s)	INFILTRATION PER AREA (L/s)	INFILTRATION MH ALLOWANCE (L/s)	TOTAL FLOW (L/s)	PIPE LENGTH (m) INC. FUTURE UPSTREAM	PIPE DIAMETER (mm)	SLOPE (%)	FULL FLOW CAPACITY (m3/s)	FULL FLOW CAPACITY (L/s)	FLOW DEPTH (mm)	FULL FLOW VELOCITY (m/s)
NW Severed Land	Plug	MH 5A	1.1500	1.1500	50	58	58	4.30	302.80	0.9	0.230	5.6	6.7	200.0	200	1.00	0.033	32.798	61.00	1.04
	MH 5A	MH 4A	0.0000	1.1500	50	0	58	4.50	302.80	0.9	0.230	5.7	6.8	204.0	200	0.50	0.023	23.192	74.00	0.74
6710 Hurontario Street	Plug	MH 4A	0.7400	0.7400	50	37	37	4.34	302.80	0.6	0.148	3.9	4.6	140.0	200	1.00	0.033	32.798	50.00	1.04
	MH 4A	MH 3A	0.0000	1.8900	50	0	95	4.25	302.80	1.4	0.378	16.2	18.0	379.0	250	1.00	0.059	59.468	93.75	1.21
	Plug	MH 3A	1.6200	1.6200	50	81	81	4.27	302.80	1.2	0.324	12.7	14.2	250.0	200	1.00	0.033	32.798	92.00	1.04
	MH 3A	MH 2A	0.0000	3.5100	50	0	176	4.17	302.80	2.6	0.702	23.5	26.8	701.0	250	1.00	0.059	59.468	117.50	1.21
	MH 2A	MH 1A	0.0000	3.5100	50	0	176	4.17	302.80	2.6	0.702	32.4	35.6	777.0	250	1.27	0.067	67.017	128.75	1.37

NOTE :
DESIGN PRESENTED HERE IS CONCEPTUAL ONLY. FINAL DESIGN IS PENDING MUNICIPAL APPROVAL AND DETAILED GRADING AND STORMWATER MANAGEMENT DESIGN.

No.	REVISIONS/ISSUED	DATE	BY	CITY
3	RE–ISSUED FOR COORD. (REV. WATER SERVICE EASEMENT)	APR. 28/15	GR	
2	RE–ISSUED FOR COORDINATION	APR. 27/15	GR	
1	ISSUED FOR COORDINATION	APR. 22/15	GR	

COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

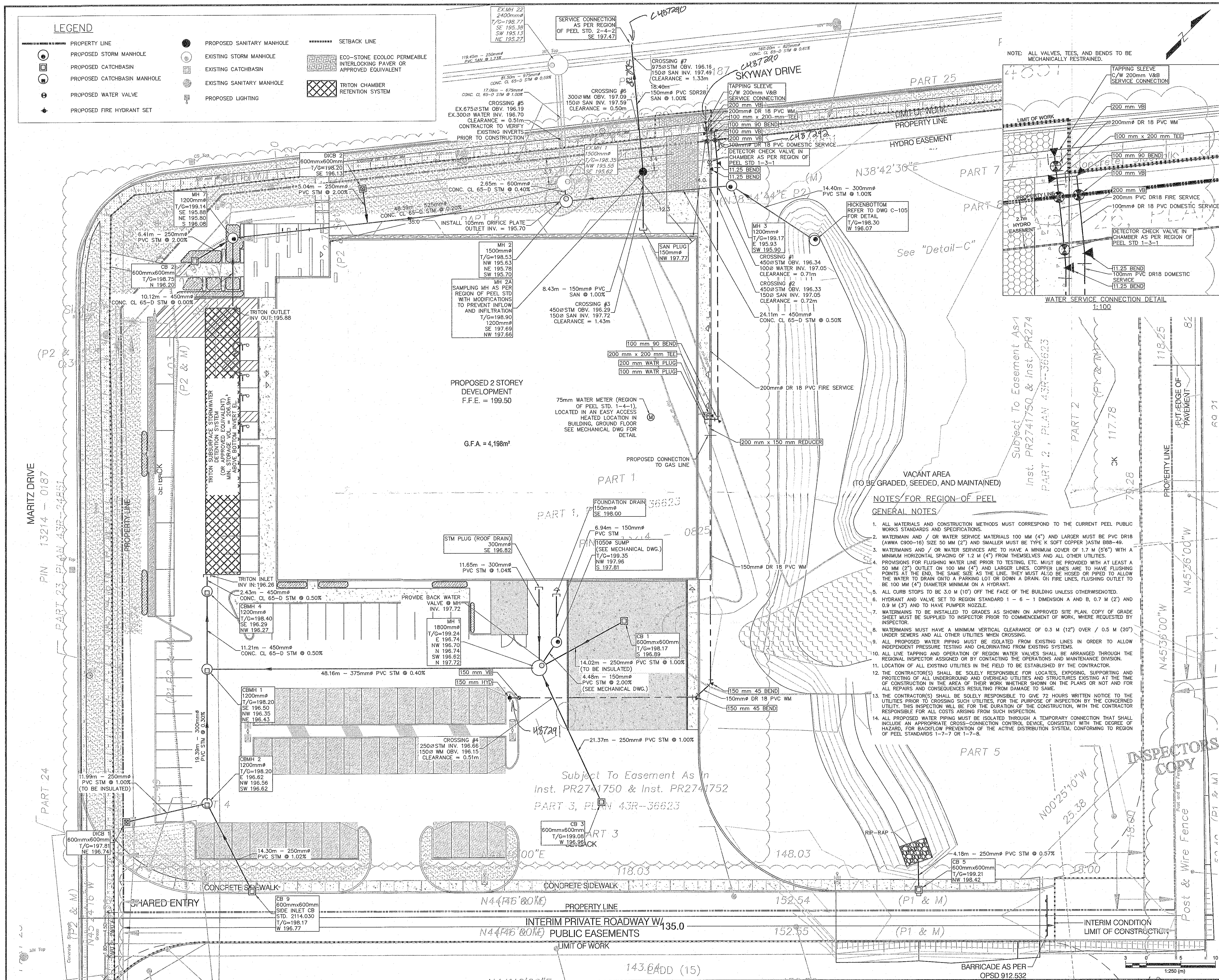
ENGINEER'S STAMP

OWNER:
DERRY-TEN LTD.
700 APPLEWOOD CRES., SUITE 100
VAUGHAN, ONTARIO L4K 5X3
Phone: 905-760-6200
Fax: 905-760-6202

SITE LOCATION:
DERRY ROAD AND HURONTARIO STREET
MISSISSAUGA, ONTARIO

CONCEPT SERVICING PLAN

DESIGNED BY: GR	CHECKED BY: JY	DATE: APRIL 2015
DRAWING BY: Jo. Y	CHECKED BY: GR	PROJECT No. 15018
SWM BY:	CHECKED BY:	
SCALE: 1:1000 (0m 20m 40m 60m)		DRAWING No. SW-S



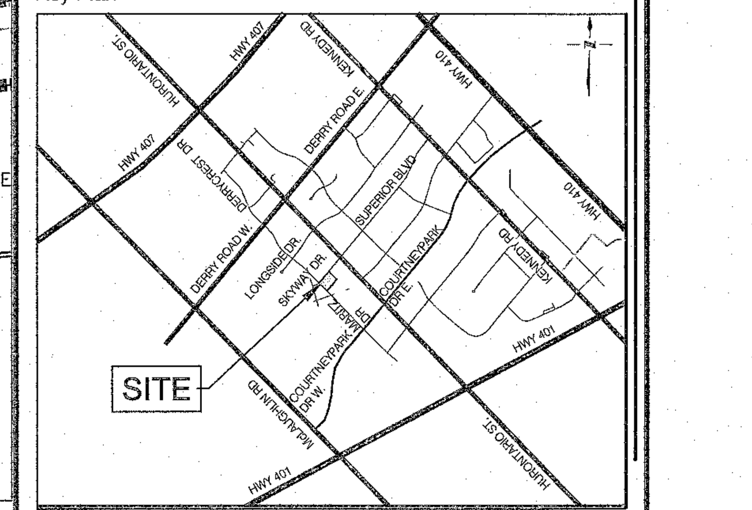
NOTES FOR REGION OF PEEL

GENERAL NOTES

1. ALL MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO THE CURRENT PEEL PUBLIC WORKS STANDARDS AND SPECIFICATIONS.
2. WATERMAIN AND / OR WATER SERVICE MATERIALS 100 MM (4") AND LARGER MUST BE PVC DR18 (AWWA C900-16) SIZE 50 MM (2") AND SMALLER MUST BE TYPE K SOFT COPPER)ASTM B88-49.
3. WATERMAINS AND / OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 1.7 M (5'6") WITH A MINIMUM HORIZONTAL SPACING OF 1.2 M (4") FROM THEMSELVES AND ALL OTHER UTILITIES.
4. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC. MUST BE PROVIDED WITH AT LEAST A 50 MM (2") OUTLET ON 100 MM (4") AND LARGER LINES. COPPER LINES ARE TO HAVE FLUSHING POINTS AT THE END, THE SAME SIZE AS THE LINE. THEY MUST ALSO BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN ONTO A PARKING LOT OR DOWN A DRAIN. ON FIRE LINES, FLUSHING OUTLET TO BE 100 MM (4") DIAMETER MINIMUM ON A HYDRANT.
5. ALL CURB STOPS TO BE 3.0 M (10') OFF THE FACE OF THE BUILDING UNLESS OTHERWISENOTED.
6. HYDRANT AND VALVE SET TO REGION STANDARD 1 – 6 – 1 DIMENSION A AND B, 0.7 M (2') AND 0.9 M (3') AND TO HAVE PUMPER NOZZLE.
7. WATERMAINS TO BE INSTALLED TO GRADES AS SHOWN ON APPROVED SITE PLAN. COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHERE REQUESTED BY INSPECTOR.
8. WATERMAINS MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 0.3 M (12") OVER / 0.5 M (20") UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.
9. ALL PROPOSED WATER PIPING MUST BE ISOLATED FROM EXISTING LINES IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND CHLORINATING FROM EXISTING SYSTEMS.
10. ALL LIVE TAPPING AND OPERATION OF REGION WATER VALVES SHALL BE ARRANGED THROUGH THE REGIONAL INSPECTOR ASSIGNED OR BY CONTACTING THE OPERATIONS AND MAINTENANCE DIVISION.
11. LOCATION OF ALL EXISTING UTILITIES IN THE FIELD TO BE ESTABLISHED BY THE CONTRACTOR.
12. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE FOR LOCATES, EXPOSING, SUPPORTING AND PROTECTING OF ALL UNDERGROUND AND OVERHEAD UTILITIES AND STRUCTURES EXISTING AT THE TIME OF CONSTRUCTION IN THE AREA OF THEIR WORK WHETHER SHOWN ON THE PLANS OR NOT AND FOR ALL REPAIRS AND CONSEQUENCES RESULTING FROM DAMAGE TO SAME.
13. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE TO GIVE 72 HOURS WRITTEN NOTICE TO THE UTILITIES PRIOR TO CROSSING SUCH UTILITIES, FOR THE PURPOSE OF INSPECTION BY THE CONCERNED UTILITY. THIS INSPECTION WILL BE FOR THE DURATION OF THE CONSTRUCTION, WITH THE CONTRACTOR RESPONSIBLE FOR ALL COSTS ARISING FROM SUCH INSPECTION.
14. ALL PROPOSED WATER PIPING MUST BE ISOLATED THROUGH A TEMPORARY CONNECTION THAT SHALL INCLUDE AN APPROPRIATE CROSS-CONNECTION CONTROL DEVICE, CONSISTENT WITH THE DEGREE OF HAZARD, FOR BACKFLOW PREVENTION OF THE ACTIVE DISTRIBUTION SYSTEM, CONFORMING TO REGION OF PEEL STANDARDS 1-7-7 OR 1-7-8.

Written dimensions shall have precedence over scaled dimensions. Contractors shall verify and be responsible for all dimensions and conditions on the job and the Architect/Engineer shall be informed of any variations from the dimensions and conditions shown on the drawing. Shop drawings shall be submitted to the Architect/Engineer for approval before proceeding with fabrication.

Key Plan



Client

NOWTASH HOLDINGS LTD.

BENCH MARK No. 1018

ELEVATIONS ARE REFERRED TO CITY OF MISSISSAUGA DATUM 1928 (NOT 1978 SOUTHERN ONTARIO READJUSTMENT) AND WERE DERIVED FROM CITY OF MISSISSAUGA BENCHMARK No. 1018, HAVING A PUBLISHED ELEVATION OF 202.229 METRES.

TABLET SET HORIZONTALLY AT BASE OF A 750mm DIAMETRE CONCRETE TRAFFIC POLE AT NORTH-EAST CORNER OF HURONTARIO STREET AND ADMIRAL BLVD.

CAUTION: ELEVATIONS SHOWN ON THIS PLAN CAN BE RELATED TO THE CITY OF MISSISSAUGA BM 1018 BY ADDING 0.08m

Revision / Submission

No.	Date	By	Comment
14.	2017-09-07	A.C.	REVISED AS PER REGION COMMENTS
13.	2017-01-06	A.C.	SPA/ BUILDING PERMIT RE-SUBMISSION
12.	2016-10-04	A.C.	ISSUED FOR S.I. #1
11.	2016-10-04	A.C.	SPA RE-SUBMISSION
10.	2016-06-17	A.C.	SPA RE-SUBMISSION
9.	2016-06-03	A.C.	RE-ISSUED FOR BUILDING PERMIT
8.	2016-05-31	A.C.	REVISED AS PER FIRE DEPT. COMMENTS
7.	2016-05-12	A.C.	REVISED AS PER REGION COMMENTS
6.	2016-05-02	A.C.	ISSUED FOR CONSTRUCTION
5.	2016-03-03	A.C.	ISSUED FOR H-OZ REMOVAL
4.	2016-02-10	A.C.	ISSUED FOR TENDER
3.	2015-12-09	A.C.	SPA & H REMOVAL RE-SUBMISSION

FIRST	SECOND	INTERIM	PRE-SER	FINAL
DATE	DATE	DATE	DATE	DATE MAY 24/2011

SUBMISSION | DWG No

LICENSED PROFESSIONAL ENGINEER A. COVELLO Sept. 7 2017 PROVINCE OF ONTARIO

DESIGN BY | APPROVED BY

IBI

9133 Leslie Street
Suite 200
Richmond Hill, Ontario
Canada L4B 4N1
Tel (905)763-2322
FAX(905)763-9983

MISSISSAUGA

CITY OF MISSISSAUGA

REGION OF PEEL
PUBLIC WORKS, DEVELOPMENT ENGINEERING
Reviewed for Water, Sanitary and/or Storm Sewers
in Accordance with the Latest
Region of Peel Standards and Specifications
Date Sept. 14, 2017
Municipal Side & Regional Easements Only

Project Title

SINCLAIR DENTAL
90 SKYWAY DRIVE
MISSISSAUGA, ONTARIO

FILE : H-OZ 15 2
REF. PLAN No.
SPA: 15 47 W5

REGION FILE NO.: C-487290

Sheet Title

SITE SERVICING

RECEIVED
SEP 11 2017
PUBLIC WORKS
REGION OF PEEL

CAD File
T:\37629_6800HurontSt\5.9 Drawings\59civil\layouts\C-101A – Site Servicing (Int).dwg

Scale	1:250	Date	2015-03-31
Drawn	A.W.	Checked	A.C.
Project No.	TO-37629	Drawing No.	C-101-A

T:\37629_6800HurontSt\5.9 Drawings\59civil\layouts\C-101A – Site Servicing (Int).dwg Plot Date: 2017/09/07
Plot Style: AIA Standard-Full.ctb Plot Scale: 1:1 Printed By: Alex WaiKit Wong Last Saved By: acovello Saved Date: 2017/09/07

As constructed By: Viscon Construction
Inspection By: JohnSedore JS Nov 15, 2017

4402

STORMWATER MANAGEMENT REPORT

MISSISSAUGA GATEWAY CENTRE
CITY OF MISSISSAUGA

PREPARED FOR:

HIGGINS DEVELOPMENT PARTNERS
SHIPP CORPORATION

December, 2000
Revised: April, 2001
Revised: July, 2001
00165

G.M. Sernas & Associates
Consulting Engineers & Planners

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FIGURES

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APPENDIX

DRAWINGS

DISKS

EXECUTIVE SUMMARY

The proposed development is a 80 hectare residential subdivision with industrial and a stormwater management block located east of McLaughlin Road south of the Fletchers Creek and on the west side of Highway 10, north of Highway 401. The site is adjacent to and tributary to the Fletchers Creek. This development is comprised of draft plan 21T-88012M.

The stormwater management study was undertaken as part of the requirement of draft plan approval and includes all land tributary to a proposed stormwater management facility to be located south of the Fletchers Creek east of McLaughlin Road.

This stormwater management study was prepared taking into consideration the June 1994 Ministry of Environment and Energy Stormwater Management Practices, Planning and Design Manual and the Fletchers Creek Subwatershed Study Report by Paragon Engineering Limited dated February 1996, and the Master Drainage Plan for Fletchers Creek by Winter Associates dated February 1991, in order to determine:

- the required quantity control for 2 to 100 year storms;
- available on-site, conveyance and end-of-pipe stormwater management practices; and
- quality control measures to mitigate erosion and encourage on-site consideration of eroded material sedimentation.

The SWMHYMO program was used to calculate the runoff hydrographs necessary for this study:

The following conclusions and recommendations were made:

- on-site controls such as roof leaders discharging to grass swales were viable under certain circumstances.
- no conveyance control was viable due to soil permeability, municipal requirements and the type of development.
- an end-of-pipe quality/quantity wet pond stormwater management facility has been proposed adjacent to and south of the Fletchers Creek within the floodplain of the Fletchers Creek Valley.
- the proposed stormwater management facility will be comprised of a combined wet pond and a quantity pond. Quantity storage will be provided above the permanent quality storage portion of the wet pond. All minor system flows will enter the SWM facility via the sediment forebay with the exception of a small drainage area being the McLaughlin road right-of-way.
- there is adequate volumes in the valley area to provide the required quality and quantity storages for the contributing area when 3:1 slopes are used above the permanent pond elevation
- overland flow from 54.6 hectares of land east of Highway 10 will be taken into the pond.
- a temporary quality pond will be constructed upstream of the proposed SWM facility to control silt runoff from the proposed road areas.
- additional quality control measures during construction would include silt fences at all downstream limits of the development, a mud mat at the entrance to the site and silt traps on open ditches.
- due to the size of each block, individual temporary quality control measures are required during the development of each block.
- no parking lot or landscape area storage is required for the Mississauga Gateway Centre lands.

1.0 INTRODUCTION

1.1 PURPOSE AND LOCATION

The proposed Mississauga Gate Centre industrial development is located on part of Lots 9 and 10, East Half of Concession 2, E.H.S. in the City of Mississauga, Regional Municipality of Peel. More specifically, the subject site is located east side of McLaughlin Road west of Highway 10, south of the Metrus lands and north of the Orlando lands. The site covers approximately 83 ha as shown on Figure 1.

The draft plans of subdivision (21T-88012M) for this area was approved by the Regional Municipality of Peel in 1989 and revised March, 1993. This report, which addresses stormwater quality and quantity issues, has been prepared in support of the detailed design and will be submitted to the Credit Valley Conservation (CVC) and the City of Mississauga.

Presently, the Fletchers Creek crosses the northwest corner of the site. The City of Mississauga have proposed a water quality/quantity stormwater management facility to be located south of the Fletchers Creek. The SWM facility is to be partially located within the subject lands. This SWM facility is to provide quality and quantity controls for the subject lands and approximately 69 ha of the Metrus land. In addition, 54.6 ha. of industrial lands on the east side of Highway 10 will contribute overland flow to this facility (flows greater than the 10 year storm).

The purpose of this report is to address the issues of stormwater management, temporary and permanent water quality, as well as to present an erosion and sedimentation control plan for the proposed development. Comments from the City and CVC are included in Appendix 3.

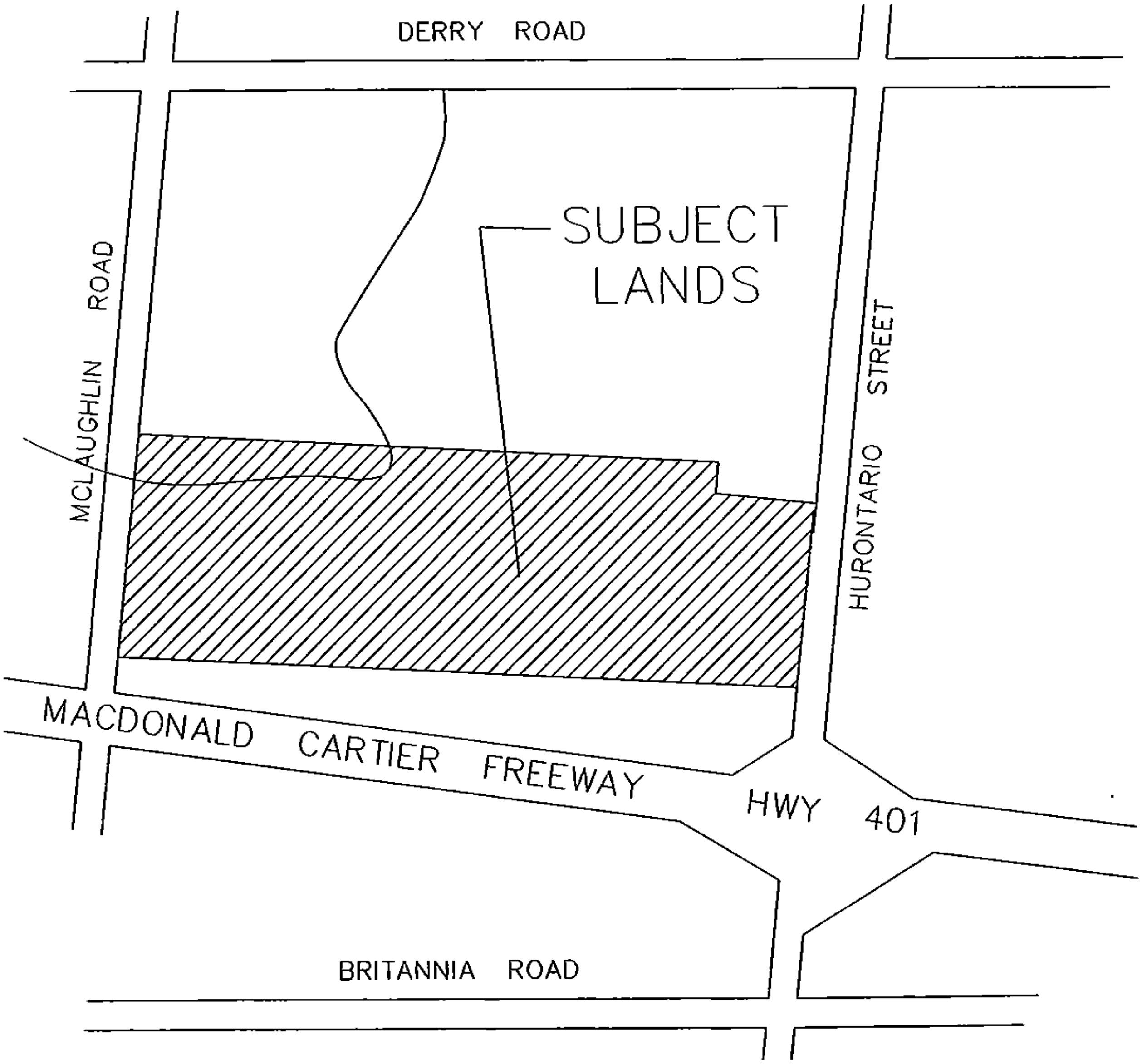
1.2 PREVIOUS REPORTS

1.2.1 CREDIT RIVER WATER MANAGEMENT STRATEGY (CRWMS)

The CRWMS, prepared by Beak Consultants Limited in 1992, studied the entire 1000 km^2 Credit River watershed. This report recommends that development within the Fletchers Creek watershed be required to provide 2 to 100 year or Regional storm pre-development to post development flow control to minimize flooding and erosion within Fletchers Creek. The CRWMS identified issues, goals, management issues and targets for the various subwatersheds in the Credit River.

1.2.2 FLETCHERS CREEK SUBWATERSHED PLAN STUDY REPORT (FCSP)

The FCSP report, prepared by Paragon Engineering Limited in February, 1996, studied the 45 km^2 Fletchers Creek Subwatershed. This report provides documentation of a process for sustaining and enhancing the natural resources of the watershed.



KEY PLAN SCALE N.T.S.

SHIPP LANDS

PROJECT No. 00165

DRAWING No. FIG-1

G.M. Sernas & Associates Ltd.
Consulting Engineers & Planners
141 BRUNEL ROAD
MISSISSAUGA, ONTARIO L4Z 1X3
TEL (416) 213-7121
FAX (416) 890-8499

File DG: P:\CIVIL\00052\00052-8X11.DWG R/P Date - DEC. 18, 2000

It determined flows at various locations along the watercourse as well as the effects of the peak flows on the Fletchers Creek itself. Additionally, the report recommends that peak flows in the subwatershed be maintained to existing (pre-development) levels from a water quantity standpoint. From a water quality standpoint, the study recommends extended detention and other practices aimed at the reduction of erosion.

1.2.3 MASTER DRAINAGE PLAN FOR FLETCHERS CREEK

This report prepared for the Shipp Corporation in February of 1991 by Winter Associates studied the Fletchers Creek within the City of Mississauga. The report documented an environmental inventory, hydraulic and hydrologic analysis of the existing and developed condition.

This study recommended the construction of a water quality/quantity facility south of the Fletchers Creek at McLaughlin Road. The Winter design envisions the use of this SWM facility to provide quality and quantity control for all areas upstream on the south and east side of the Fletchers Creek up to Highway 407.

It should be noted that this report was prepared prior to the issuance of the 1994 Ministry of Environment and Energy's Stormwater Management Practices Planning and Design (SWMP) Manual. The report assumed the use of a 12.5mm water quality storm and did not outline the type of water quality facility to be used.

1.2.4 WALMART – WAREHOUSE #2 (METRUS LANDS)

Walmart warehouse #2 referred to as "Walmart" site occupies approximately 38.8ha. of the Metrus lands north of the Shipp/Higgins lands. A report presently being prepared by Schaeffer and Associates Ltd. describes how storm drainage will be temporarily accommodated during construction of the warehouse. The report will also outline how quality and quantity control will be provided until the construction of the facility at McLaughlin Road south of the Fletchers Creek.

Depending on the timing of the development of the Shipp/Higgins lands the temporary facility on the Walmart site could be significantly reduced to serve only the construction period. It is our understanding that some rooftop controls and parking lot storage will be provided on the Walmart site. The modeling for the Metrus lands received from Schaeffer Consulting Engineers is included in Appendix 1.

The design of the SWM facility at McLaughlin Road will use the Schaeffer model for the Metrus lands with the on-site controls removed. However, for the areas draining towards the Fletchers Creek on-site control is still required such that all flows up to the 100 year storm eventually end up in the pipe system and not via overland flow down the Fletchers Creek embankment.

2.0 SUBWATERSHED STUDY

This stormwater management report will investigate water quality and quantity for this development such that impacts on the Fletchers Creek are minimized.

The June 1994 "Stormwater Management Practices Planning and Design Manual" (SWMP) from the Ministry of Environment and Energy (MOEE) indicated that stormwater management should be a phased procedure starting with the development of a watershed plan. The watershed plan will determine on a watershed level constraints, opportunities and analyses in a generic nature and will point to the need for more detailed investigation at the subwatershed planning level.

The aforementioned watershed plan will specify the criteria to be used in the stormwater management plans, as well as specify areas for protection while delineating areas that can be developed and provide an implementation plan which outlines works to be done, as well as the associated responsibilities.

The watershed and subwatershed plans address the ecosystem at a regional level. When this process is integrated into the official plan preparation and review process, an ecosystem approach to land use planning has been established. When this process is also included in the subdivision planning process, there is continuity in ensuring that the impact of development on the environment can be specifically assessed.

The watershed study for the Credit River and its tributary was undertaken and the report entitled Credit River Water Management Strategy prepared. A subwatershed study was undertaken for the Fletchers Creek as discussed in Sections 1.2.2 and 1.2.3. This development has followed an ecosystem approach to land use planning, thus ensuring that the impacts of development on the environment are mitigated and the natural features maintained and/or enhanced.

The Shipp/Higgins development is primarily an industrial subdivision with a stormwater management block within the City of Mississauga.

3.0 STORMWATER MANAGEMENT OPTIONS

There are a number of Stormwater Management Practices (SWMPs) available to meet the various aspects of water quality control. However, site characteristics and the nature of the development will determine the applicability and possible use of many of the possible SWMPs.

The June, 1994 MOEE "Stormwater Management Practices Planning and Design Manual" states that the goal of stormwater management is to preserve the natural hydrologic cycle. However, the manual also states that individual development plans cannot explicitly address cumulative effects.

The stormwater management practices which were considered include:

1) stormwater lot level controls
2) stormwater conveyance controls
3) end-of-pipe stormwater management facilities

Lot level controls may include such measures as: rain water leaders discharging to infiltration areas; rain water leaders discharging to a subsurface soakaway pit; reducing grassed site grading to a minimum of 0.5%; separate foundation drains; and routing of storm runoff along grassed swales.

Conveyance controls may include perforated storm sewers, pervious catchbasins and grassed swales. The selection of conveyance controls, however, is very much dependent on soil conditions and especially municipal requirements. It is the municipality that must be willing to implement and maintain these controls, as well as, deem the controls an acceptable form of servicing.

End-of-pipe facilities receive water from the conveyance system and discharge the water to the receiving system. The manual includes nine categories of end-of-pie facilities as follows: wet ponds, wetlands, dry ponds, infiltration basins, infiltration trenches, filter strips, buffer strips, sand filters and oil/grit separators.

3.1 LOT LEVEL CONTROLS

The MOEE SWMP Manual list a number of lot level controls to assist in natural infiltration and to improve water quality. These measures include:

i) Roof leader to ponding area and/or soakaway pit;
ii) Reduced lot grading; and
iii) Sump pumping of foundation drains

Each of the above measures will be briefly described in the following sections as it relates to this development.

3.1.1 ROOF LEADER TO PONDING AREA AND/OR SOAKAWAY PIT

In the City of Mississauga, all rainwater leaders are discharged to the storm sewer system. However, when there is adequate grassed areas between the building and the outlet point discharging of roof leaders to the grass surface will be considered. The City will not allow discharging of roof water to paved surfaces. Infiltration and soakaway pits are not practical in industrial areas.

3.1.2 REDUCED LOT GRADING

A reduction in the minimum lot grade from 2% to 0.5% would promote groundwater recharge and reduce the potential for flooding and erosion. This reduction in grade would be possible if the terrain is naturally flat, the native soils are suitable, and if it is acceptable to the municipality.

Although the terrain is relatively flat, the site soils have a low permeability rate, which would not be conducive to groundwater recharge. In addition, grassed areas on industrial lots are generally very limited.

For the above reasons, reducing minimum lot grades from 20% to 0.5% was not pursued.

3.1.3 SUMP PUMPING OF FOUNDATION DRAINS

For industrial buildings this is not applicable.

3.2 STORMWATER CONVEYANCE CONTROLS

Stormwater conveyance controls deals with improving water quality and reducing runoff quantity along the road network between the lot discharge and the end-of-pipe system. The MOEE SWMP Manual list a number of conveyance controls as indicated below:

i) pervious pipe systems;
ii) pervious catchbasins;
iii) grassed swales (curbless roads).

The native soil has a low permeability, thus limiting the effectiveness of pervious pipe systems and pervious catchbasins. The City of Mississauga does not accept curbless roads for new developments in an urban setting. As such, conveyance controls were not pursued for this development.

3.3 END-OF-PIPE STORMWATER MANAGEMENT PRACTICE

End-of-pipe facilities accept runoff from the conveyance system and overland flows which is then treated and discharged to the receiving watercourse. For the end-of-pipe practice to be compatible with present conditions, the receiving watercourses should remain geomorphologically stable, not be subject to erosion or sediment problems, and have adequate water quality.

Physical factors such as topography, soil stratification, depth to bedrock, depth to water table and drainage areas are factors to be assessed in determining SWMP type. Table 4.4 of the June, 1994 manual has been reproduced showing the physical factors for each SWMP.

TABLE 3.1 - TABLE 4.4 FROM JUNE 1994 MANUAL

Table 4.4 – Physical Criteria for SWMP Type					
SWMP	TOPOGRAPHY	SOILS	BEDROCK	GROUNDWATER	AREA
Wet pond	None	None	None	None	>5 ha
Dry pond	None	None	None	None	>5 ha
Wetland	None	None	None	None	>5 ha
Infiltration Basin	None	Loam (min. inf. Rate ≥15mm/h	>1m below bottom	>1m below bottom	<5 ha
Infiltration Trench	None	Loam (min. inf. Rate ≥15mm/h	>1m below bottom	>1m below bottom	<2 ha
Flat lot Grading	<5%	None	None	None	None
Soakaway pit	None	Loam (min. inf. Rate ≥15mm/h	>1m below bottom	>1m below bottom	<0.5 ha
Rear yard Infiltration	<2%	Loam (min. inf. Rate ≥15mm/h	>1m below bottom	>1m below bottom	<0.5 ha
Grassed swales	<5%	None	None	None	None
Perforated Pipes	None	Loam (min. inf. Rate ≥15mm/h	>1m below bottom	>1m below bottom	None
Pervious Catchbasins	None	Loam (min. inf. Rate ≥15mm/h	>1m below bottom	>1m below bottom	None
Filter strips	<10%	None	None	>0.5m below bottom	<2 ha
Sand filters	None	None	None	>0.5m below bottom	<5 ha
Oil/grit separators	None	None	None	None	<5 ha

	SWMP	REASON FOR ELIMINATION OR FURTHER CONSIDERATION
a)	filter strips oil grit separator sand filters	may be used for certain types of site but not for entire development as area is too large
b)	dry pond	does not provide any water quality

c)	infiltration basin infiltration trench soakaway pit rear yard infiltration	not suitable for industrial and soils are not suited area too large
d)	rainwater leader to landscaped areas	may be feasible for areas draining to landscaped areas
e)	perforated pipes pervious catchbasins	not acceptable to City and soils are not suitable
f)	flat lot grading sand filter filter strip grassed swales	lack of available landscaped area to implement, the City does not usually accept curbless roads in an urban setting

This leaves the use of a wetland or wet pond as possible end-of-pipe water quality controls for this development.

4.0 SITE HYDROLOGY

4.1 SITE INFORMATION

The pre-development drainage east of McLaughlin Road and south and east of the Fletchers Creek has been calculated in both the Winter and Paragon reports. In the 1991 Winter report the area was calculated at 180 ha. In the 1996 Paragon report a tributary area of 163.6 ha. (area 142) was calculated. The drainage area originated north of Derry Road and comprises lands east and west of Highway 10 as schematically shown on Drawing SWM-1.

Accurate determination of the existing pre-development drainage area cannot be easily determined today due to extensive development east of Highway 10 both north and south of Derry Road.

Since the 1996 report is the more recent report and is comprised of a smaller drainage area it will be used to calculate the existing condition flows with the more conservative flow rate.

The Shipp/Higgins and Metrus land consists of industrial blocks, a SWM facility and roads being constructed to an urban standard. The minor system will consist of street gutters, grass swales, catchbasins and storm sewers. This system will collect runoff from the development, outletting into a quantity/quality facility located near McLaughlin Road south of the Fletchers Creek (see Drawing SWM-1). The outlet from the SWM facility will discharge into Fletchers Creek.

The major system will utilize the road system, overland flow paths and storm sewers to convey flows to the stormwater management facility. The rear yard of blocks (naturalized areas only) backing onto the Fletchers Creek valley will discharge directly to the valley via sheet flow and those backing onto the SWM block will discharge directly into the SWM facility. The overland flow from a portion of the Shipp lands will continue to drain southerly to the Cooksville Creek Watershed.

4.2 EXISTING CONDITION FLOWS

The overall flow from a portion of the Shipp lands will continue to drain southerly to the Cooksville Creek Watershed. As discussed earlier two different existing condition contributory areas were found from two different studies for this portion of the watershed. The contributing areas from the Winter and Paragon reports along with the important parameters are shown below in Table 4.2

TABLE 4.1 – EXISTING CONDITION PARAMETERS

	WINTER	PARAGON
Area (Ha.)	180	163.6
Time to Peak TP (hrs)	1.00	1.00
N	3	3
Curve Number CN	82	76.8 (Cnstar)

Since the Paragon parameters will generate lower existing condition flows; it is the more recent report; and the actual drainage area can no longer be determined; the Paragon parameter were used in the calculations. Using the SWMHYMO model the predevelopment flows were calculated for the various storms and are shown below in Table 4.2.

TABLE 4.2 – PRE-DEVELOPMENT PEAK FLOWS

STORM	CN/TP	PRE-DEVELOPMENT DRAINAGE AREA (Ha)	PRE-DEVELOPMENT PEAK FLOW (cms)
2 Year	76.8 - 1.00	163.6	1.6
5 Year	76.8 - 1.00	163.6	3.5
10 Year	76.8 - 1.00	163.6	4.2
25 Year	76.8 - 1.00	163.6	7.1
100 Year	76.8 - 1.00	163.6	10.5

4.3 DEVELOPED CONDITION FLOWS

The 1991 Winters report contemplated all storm flows from developments east of the Fletchers Creek and south of Highway 407 be directed to the proposed SWM facility to be constructed east of McLaughlin Road south of the Fletchers Creek. Since this report, several events have occurred which has resulted in reducing the developed condition drainage area tributary to the proposed SWM facility as summarized below:

i) All areas north of Derry Road to the south limit of Highway 407 have been diverted away.
ii) The land west of Highway 10 from Derry Road to the north limit of the Metrus lands have been directed to a new SWM facility as shown on SWM-2.
iii) All lands south of Derry Road east of Highway 10 tributary to the proposed SWM facility have been developed with the minor system (10 year) flows directed away from this watershed. As such only flows in excess of the 10 year storm will flow via overland flow onto the proposed SWM facility. The location of these overland flow routes are not clearly defined and will be subject to determination as part of the detail design of the affected subdivisions.
iv) The remaining area tributary to the SWM facility is 141 hectares for both minor and major flows, 12 hectares for minor flows only and 54.6 hectares for major flows only.

The area shown on Drawing SWM-2 as the Metrus lands is comprised of the Walmart site (38.8 hectares), additional lands owned by Metrus between Walmart and Highway 10, a vacant lot and the Hansa House lands.

For the purposes of this report the following land use coverages have been assumed for all lands except the Walmart site:

i) Building area: 40% of the total area with a controlled roof release of 42l/s/Ha
ii) Paved and landscaped area: 50% of the total area with 85% of this area paved
iii) Road area comprises 10% of the total area

Based a review of the site plan for the Walmart site the following coverages were noted:

i) Building area: 28%
ii) Paved area: 55%
iii) Landscaped area: 17%

These percentage are not typical of most industrial buildings as the need for large truck parking for the Walmart site increases the paved area disproportionately. The model as prepared by Schaeffer Consulting Engineers was utilized for the Metrus lands. Their model has been modified to exclude any on-site controls with the exception of land outletting by street flow directly to the Fletchers Creek.

The SWMHYMO program was used to model the watershed for the developed condition with peak flows summarized in Table 4.3.

TABLE 4.3 – POST DEVELOPMENT UNCONTROLLED PEAK FLOWS

RETURN PERIOD (yr)	POST DEVELOPMENT DRAINAGE AREA (ha)	POST DEVELOPMENT PEAK FLOWS (cms)
2	153	18.0
5	153	24.8
10	153	27.1
25	195.7	38.3
100	195.7	52.0

5.0 EXTENDED DETENTION CONSTRUCTED WET POND

As discussed in Section 3.3, an extended detention wet pond or extended detention constructed wetland is preferred. For this development, the use of a wet pond was selected based on the available space for the facility, discussions with the CVC, the preference to minimize disturbance to the valley walls area and the recommendations of the City of Mississauga. As such, it is proposed that a wet pond be constructed in the northwest corner of the development (Block 14), as shown on drawing SWM-2. The pond will serve the Metrus lands, Shipp/Higgins lands as well as quantity control of lands east of Highway 10 tributary to the pond.

Drawing SWM-3 shows the general shape, side slopes, wetland depth, sediment forebay location, storage depths, and location of controls. The finalized SWM facility will provide the required quality and quantity volumes, as well as comply with the requirements of the CVC and City of Mississauga.

A soils report entitled "Shipp/Higgins lands, City of Mississauga, proposed Stormwater Management Facility, Geotechnical Design Conditions" was prepared by Trow Consulting Engineers Ltd. in January 2001. The main soils are glacial tills comprised of sandy silt, clayey silt or silty clay with an estimated coefficient of permeability between 10^{-5} to 10^{-7} cm/s. A copy of the soils report is included in Appendix 2.

The SWM facility will be designed to meet the following criteria.

- Storm outfall at or above the 25 year floodline of the Fletchers Creek. Based on preliminary information provided by the CVC the preliminary 25 floodline elevation at the upstream side of the McLaughlin Road crossing is 180.5m±.

- The 100 year storage level is to be below the Regional Floodline. Based on the revised HEC-2 information the Regional Floodline at the upstream end of the SWM facility is approximately 183.9m. (See Section 6.0).

- A setback from the top of bankfull condition of at least 15m.

- The existing embankment below the top of bank is to remain in its original state. It is the intention to comply with this request with the exception of the portion of the pond adjacent to McLaughlin Road where the embankment is much less defined.

- Provide an access road on one side of the pond with access to the bottom of the sediment forebay.

- To meet the requirements of the June 1994 MOE SWMP manual where practical. A significant increase in extended detention storage will be required as the SWMP manual uses a 25mm storm for first flush as compared to 12.5mm specified in the Winter report.

TABLE 5.1 - QUALITY POND

PROJECT: SHIPP/HIGGINS
PROJECT: 00165.400
DATE NOVEMBER 29, 2000
REVISED: April 23, 2001

POND VOLUME CALCULATIONS

ELEVATION (m)	AREA (m^2)	VOLUME (m^3)	ACCUMULATED VOLUME (m^3)
180.50	28000		
180.60	28500	2825	2825
180.70	29000	2875	5700
180.80	29500	2925	8625
180.90	30000	2975	11600
181.00	30500	3025	14625
181.10	31000	3075	17700
181.20	31500	3125	20825
181.30	32000	3175	24000
181.40	32500	3225	27225
181.50	33000	3275	30500
181.60	33280	3314	33814
181.70	33559	3342	37156
181.80	33839	3370	40526
181.90	34118	3398	43924
182.00	34398	3426	47349
182.10	34677	3454	50803
182.20	34957	3482	54285
182.30	35236	3510	57795
182.40	35516	3538	61332
182.50	35795	3566	64898
182.60	36075	3594	68491
182.70	36354	3621	72113
182.80	36634	3649	75762
182.90	36913	3677	79439
183.00	37193	3705	83145
183.10	37473	3733	86878
183.20	37752	3761	90639
183.30	38032	3789	94428
183.40	38311	3817	98246
183.50	41386	3985	102230

QUALITY ORIFICE DESIGN CALCULATION

PONDING ELEVATION (m)	500mm ORIFICE	
	ORIFICE HEAD (m) INVERT 180.50	ORIFICE FLOW (cms) Cd = 0.6200 0.19635
180.50	0.00	0.0000
180.60	0.10	0.1705
180.70	0.20	0.2411
180.80	0.30	0.2953
180.90	0.40	0.3410
181.00	0.50	0.3813
181.10	0.60	0.4177
181.20	0.70	0.4511
181.30	0.80	0.4823
181.40	0.90	0.5116
181.50	1.00	0.5392
181.60	1.10	0.5655
181.70	1.20	0.5907
181.80	1.30	0.6148
181.90	1.40	0.6380
182.00	1.50	0.6604
182.10	1.60	0.6821
182.20	1.70	0.7031
182.30	1.80	0.7234
182.40	1.90	0.7433
182.50	2.00	0.7626
182.60	2.10	0.7814
182.70	2.20	0.7998
182.80	2.30	0.8178
182.90	2.40	0.8354
183.00	2.50	0.8526
183.10	2.60	0.8695
183.20	2.70	0.8860
183.30	2.80	0.9023
183.40	2.90	0.9183
183.50	3.00	0.9340

CUMULATIVE STORAGE TIME

AVERAGE GOVERNING DISCHARGE (cms)	VOLUME (m^3)	INCREMENTAL DEWATERING TIME (hours)	CUMULATIVE DEWATERING TIME (hours)
0.0853	2825	9.20	32.26
0.2058	2875	3.88	23.06
0.2682	2925	3.03	19.18
0.3182	2975	2.60	16.15
0.3612	3025	2.33	13.55
0.3995	3075	2.14	11.23
0.4344	3125	2.00	9.09
0.4667	3175	1.89	7.09
0.4969	3225	1.80	5.20
0.5254	3275	1.73	3.40
0.5524	3314	1.67	1.67
0.5781	3342		
0.6028	3370		
0.6264	3398		
0.6492	3426		
0.6712	3454		
0.6926	3482		
0.7133	3510		
0.7334	3538		
0.7529	3566		
0.7720	3594		
0.7906	3621		
0.8088	3649		
0.8266	3677		
0.8440	3705		
0.8610	3733		
0.8778	3761		
0.8942	3789		
0.9103	3817		
0.9261	3985		

5.1 PERMANENT QUALITY CONTROL

After completion of the development, the potential for large scale sediment transfer will be greatly reduced. However, some possibility will remain for low levels of long term sedimentation, as well as increased pollution levels resulting from the activities of the industrial operations. A permanent constructed wet pond water quality control facility has been designed to remove some sediments and pollutants from the stormwater.

Based on the June 1994 manual and a Level 1 protection, a constructed wet pond storage volume of 250m^3 per hectare of contributing drainage area was required for an impervious level of 85percent. Of the required volume 210m^3 per hectare is permanent pool and 40m^3 per hectare is extended detention. For a contributing area of 153 ha, the permanent pool required would be 32,200m^3. For extended detention the larger of 40m^3 /hectare or the runoff generated from the 25mm water quality storm will be used to generate the required extended detention storage for erosion protection.

The short duration (25mm) rainfall, distributed over the developed site has provided a runoff volume equivalent to 220m^3 /hectare. Based on a contributing drainage area of 153 ha an extended detention volume of 33,700m^3 is required. Based on the above calculation 32,200m^3 would be permanent storage and 33,700m^3 will be extended detention. Based on studies completed on similar ponds, sediments accumulated in the sediment forebay of the pond should be cleaned out every 5-10 years. All slopes will be vegetated to prevent erosion and to enhance pollutant removal.

The control from the pond will be via a 825mm diameter reverse slope pipe with a 500mm diameter orifice restriction and a 825mm diameter outlet pipe. Shown on Table 5.1 are the pond storage volume, orifice discharge rates and cumulative storage time calculations. A storage time of over 30 hours will be provided which is greater than the minimum recommended storage time of 24 hours.

5.1.1 SEDIMENT FOREBAY

The purpose of a forebay is to trap larger particles near the inlet of the pond. The forebay should be one of the deepest areas of the pond. The length of the forebay should be calculated based on the larger of the following:

i) the distance required to settle out a certain particle size,
ii) the distance required to disperse the inflow.

The manual recommends settling out particles greater than 0.15mm which has a minimum settling velocity of 0.0003m/s. Equation 3.3 of the MOEE SWMP manual reproduced below can be used to estimate the required forebay length.

$$Dist = \frac{(r\ Qp)^{1/2}}{(Vs)^{1/2}}$$

Where Dist = forebay length (m)
r = length to width ratio of forebay
Vs = settling velocity (m/s)
Qp = peak discharge from pond during design

Quality storm (cms)

Recognizing that the peak discharge rate from the water quality portion of the SWM facility is 0.52cms and using a length to width ratio of 2:1, the required settling length of the pond will be 60m.

Equation 3.4 of the SWMP manual reproduced below determines the required dispersion length.

Dist	=	(8 Q) / (d Vf)
Q	=	Inflow Rate 10 year flow ~ 11.7 cms
d	=	depth of permanent pool at 10 year storm level ~ 3m
Vf	=	desired velocity in forebay Use 0.5m/s

Based on the above information the required dispersion length is 91m. Since the dispersion length is greater than the settling length, the sediment forebay will be designed to satisfy the dispersion length of 91m. It should be noted that there are two separate pipes discharging into the sediment forebay. One outlet has a peak flow of 10.1 cms for the 100 year storm for the Metrus lands and the second has a peak flow of 11.7 cms for the 10 year storm. The larger flow will be used in the sizing.

At the downstream end of the forebay, there will be six 525mm diameter flow equalization pipes set 0.5m above the bottom elevation of the quality pond. The submerged portion of the forebay will be constructed at a 5:1 slope.

5.2 TEMPORARY QUALITY STORAGE

Based on discussions with the City of Mississauga, temporary quality control will be required during the construction of the roads and the rough grading operations. It is proposed that only the road will be constructed at this stage. Grading of each of the blocks will take place with the development of the block. The required temporary storage for the block will be determined as part of the site plan process.

A temporary quality pond on the table land will be constructed for the road construction phase.

During the road construction period, the maximum contributing area to the temporary pond will be 10 ha of road right-of-way. Generally speaking, 125m^3 per contributing hectare is required for temporary quality control. As such, the resulting required storage volume will be 1,250m^3 for the temporary quality facility.

TABLE 5.2 - TEMPORARY QUALITY POND

PROJECT: SHIPP/HIGGINS
PROJECT: 00165.400
DATE: NOVEMBER 29, 2000
REVISED: April 19, 2001

POND VOLUME CALCULATIONS

ELEVATION (m)	AREA (m^2)	VOLUME (m^3)	ACCUMULATED VOLUME (m^3)
184.00	1600.00		
184.10	1640.25	162	162
184.20	1681.00	166	328
184.30	1722.25	170	498
184.40	1764.00	174	673
184.50	1806.25	179	851
184.60	1849.00	183	1034
184.70	1892.25	187	1221
184.80	1936.00	191	1412
184.90	1980.25	196	1608
185.00	2025.00	200	1808

QUALITY ORIFICE DESIGN CALCULATION

PONDING ELEVATION (m)	102 mm ORIFICE	
	ORIFICE HEAD (m) INVERT 184.00	ORIFICE FLOW (cms) Cd = 0.6200 0.00817
184.00	0.00	0.0000
184.10	0.10	0.0071
184.20	0.20	0.0100
184.30	0.30	0.0123
184.40	0.40	0.0142
184.50	0.50	0.0159
184.60	0.60	0.0174
184.70	0.70	0.0188
184.80	0.80	0.0201
184.90	0.90	0.0213
185.00	1.00	0.0224

CUMULATIVE STORAGE TIME

AVERAGE GOVERNING DISCHARGE (cms)	VOLUME (m^3)	INCREMENTAL DEWATERING TIME (hours)	CUMULATIVE DEWATERING TIME (hours)
0.0035	162	12.68	35.19
0.0086	166	5.39	22.50
0.0112	170	4.23	17.12
0.0132	174	3.66	12.88
0.0150	179	3.30	9.23
0.0166	183	3.05	5.93
0.0181	187	2.87	2.87
0.0194	191	2.74	
0.0207	196	2.63	
0.0219	200	2.54	

TABLE 5.3 --- QUANTITY CONTROL STRUCTURE CALCULATIONS

PROJECT: SHIPP/HIGGINS
PROJECT NO.: 00165.400 G.M. Sernas & Associates Ltd.
DATE: NOVEMBER 29, 2000
FILE: 165QNTCONTL.XLS
PRINTED: July 27, 2001

FLOW OVER WEIR: C_w= 1.8308
$Q_w=C_w*(H_w)^1.5*((L-0.2*H_w)+(0.8*TAN(THETA)*H_w))$

INVERT OF WEIR 1	181.60 m	THETA	0.0000 radians
WEIR 1 HEIGHT	2 m		0.000 degrees
WEIR 1 WIDTH of base	2.3 m		:1 Slope

FLOW OVER ACCESS WEIR C_w= 1.8308
$Q_w=C_w*(H_w)^1.5*((L-0.2*H_w)+(0.8*TAN(THETA)*H_w))$

INVERT OF WEIR 1	183.20 m	THETA	1.5208 radians
WEIR 1 HEIGHT	m		87.138 degrees
WEIR 1 WIDTH of base	10 m		20 :1 Slope

FLOW THROUGH ORIFICE:
$Q_o=C_d*A_o*(2*g*H_o)^0.5$ C_d= 0.62

INVERT OF ORIFICE 1	180.50 m	WIDTH	0 m
		DIAMETER/HEIGHT	0.5 m

ELEVATION (m)	WEIR 1 FLOW (cms)	WIDTH (L) (m)	H (m)	ORIFICE 1 FLOW (cms)	HEIGHT (m)	X-SECT AREA (m²)	Ho (m)	WEIR 2 FLOW (cms)	WIDTH (L) (m)	H2 (m)	TOTAL FLOW (cms)	POND AREA (m²)	POND VOLUME (m³)	CUMULATIVE POND VOLUME (m³)
180.50	0.000			0.0000	0.00	0.0000	0.00	0.000			0.000	28,000	-	-
180.60	0.000			0.0113	0.10	0.0185	0.05	0.000			0.011	28,500	2,825	2,825
180.70	0.000			0.0532	0.20	0.0612	0.10	0.000			0.053	29,000	2,875	5,700
180.80	0.000			0.1177	0.30	0.1107	0.15	0.000			0.118	29,500	2,925	8,625
180.90	0.000			0.1940	0.40	0.1580	0.20	0.000			0.194	30,000	2,975	11,600
181.00	0.000			0.2646	0.50	0.1927	0.25	0.000			0.265	30,500	3,025	14,625
181.10	0.000			0.3130	0.50	0.1927	0.35	0.000			0.313	31,000	3,075	17,700
181.20	0.000			0.3550	0.50	0.1927	0.45	0.000			0.355	31,500	3,125	20,825
181.30	0.000			0.3924	0.50	0.1927	0.55	0.000			0.392	32,000	3,175	24,000
181.40	0.000			0.4266	0.50	0.1927	0.65	0.000			0.427	32,500	3,225	27,225
181.50	0.000			0.4582	0.50	0.1927	0.75	0.000			0.458	33,000	3,275	30,500
181.60	0.000	2.30		0.4878	0.50	0.1927	0.85	0.000			0.488	33,280	3,314	33,814
181.70	0.132	2.30	0.10	0.5157	0.50	0.1927	0.95	0.000			0.648	33,559	3,342	37,156
181.80	0.370	2.30	0.20	0.5422	0.50	0.1927	1.05	0.000			0.912	33,839	3,370	40,526
181.90	0.674	2.30	0.30	0.5674	0.50	0.1927	1.15	0.000			1.241	34,118	3,398	43,924
182.00	1.028	2.30	0.40	0.5916	0.50	0.1927	1.25	0.000			1.620	34,398	3,426	47,349
182.10	1.424	2.30	0.50	0.6148	0.50	0.1927	1.35	0.000			2.039	34,677	3,454	50,803
182.20	1.855	2.30	0.60	0.6372	0.50	0.1927	1.45	0.000			2.492	34,957	3,482	54,285
182.30	2.316	2.30	0.70	0.6588	0.50	0.1927	1.55	0.000			2.975	35,236	3,510	57,795
182.40	2.803	2.30	0.80	0.6797	0.50	0.1927	1.65	0.000			3.483	35,516	3,538	61,332
182.50	3.314	2.30	0.90	0.7000	0.50	0.1927	1.75	0.000			4.014	35,795	3,566	64,898
182.60	3.845	2.30	1.00	0.7197	0.50	0.1927	1.85	0.000			4.564	36,075	3,594	68,491
182.70	4.393	2.30	1.10	0.7389	0.50	0.1927	1.95	0.000			5.132	36,354	3,621	72,113
182.80	4.958	2.30	1.20	0.7576	0.50	0.1927	2.05	0.000			5.715	36,634	3,649	75,762
182.90	5.536	2.30	1.30	0.7759	0.50	0.1927	2.15	0.000			6.312	36,913	3,677	79,439
183.00	6.126	2.30	1.40	0.7937	0.50	0.1927	2.25	0.000			6.920	37,193	3,705	83,145
183.10	6.727	2.30	1.50	0.8111	0.50	0.1927	2.35	0.000			7.538	37,473	3,733	86,878
183.20	7.337	2.30	1.60	0.8282	0.50	0.1927	2.45	0.000			8.165	37,752	3,761	90,639
183.30	7.954	2.30	1.70	0.8450	0.50	0.1927	2.55	0.670	10.00	0.10	9.469	38,032	3,789	94,428
183.40	8.577	2.30	1.80	0.8614	0.50	0.1927	2.65	2.155	10.00	0.20	11.594	38,311	3,817	98,246
183.50	9.206	2.30	1.90	0.8775	0.50	0.1927	2.75	4.434	10.00	0.30	14.518	41,386	3,985	102,230

For the temporary quality facility to be effective, a minimum storage time of 24 hours should be maintained. To achieve this, a 102mm diameter orifice will be used to control flows. Shown on Table 5.2 are the temporary quality pond storage volumes, discharge rates and a cumulative storage time of over 30 hours.

5.3 2 TO 100 YEAR QUANTITY STORAGE

The City of Mississauga and the Credit Valley Conservation has indicated that post-development peak flows for the development is to be maintained to existing pre-development peak flow levels up to and including the 100 year storm. In order to achieve this, water quantity control will be required.

Quantity control will be provided above the permanent pool and will include the volume used for extended detention. The proposed quantity control structure is located on Drawing SWM-3 and the control structure detail is shown on Drawing SWM-5. For frequent storms the 500mm diameter orifice will be used to control flows. For more intense less frequent storms the orifice and a 2.0m wide weir will be used to control the flows. At the 100 year storage level a 10m wide emergency overflow weir is provided. Table 5.3 shows the orifice and weir calculations, along with the storage volumes. Shown below in Table 5.4 is the existing condition, developed uncontrolled and developed controlled flows as well as the required storage volume for the 2 to 100 year storms.

TABLE 5.4 - QUANTITY CONTROL FLOWS AND VOLUMES

RETURN PERIOD (years)	EXISTING FLOWS CONDITION (cms)	DEVELOPED UNCONTROLLED (cms)	DEVELOPED CONTROLLED (cms)	STORAGE VOLUME (Ha-m)
2	1.6	13.3	1.28	4.40
5	3.5	18.3	2.83	5.68
10	4.2	19.9	3.45	6.10
25	7.1	29.0	6.06	7.79
100	10.5	41.2	9.55	9.46

As can be seen from the above table, the construction of the SWM facility will provide the required quantity control for the 2 year to 100 year storms. The SWMHYMO input and output files for the 100 year storm is for viewing in Appendix 3 and a diskette of all the files are in the attached jacket at the rear of the report.

6.0 REGIONAL FLOODLINES

The proposed stormwater management facility is located within the Regional floodlines of the Fletchers Creek. The construction of the SWM facility will have an influence on the conveyance of less frequent storm flows of the Fletchers Creek. It was our initial belief that it was acknowledged by both the City and CVC that construction of this SWM facility will impact the Fletchers Creek in the vicinity of the facility. This acknowledgement would be implied by accepting in various previous studies the placement of this proposed facility within the Regional Floodplain of the Fletchers Creek.

The CVC in their fax transmittal/memorandum of March 22, 2001 (see Appendix 3) indicated that they "have concerns with the volume of the floodplain and loss of conveyance of the flows". The CVC's goal is to have no off-site impact from the proposed pond. To this effect, the CVC requested the following analysis be undertaken:

- Revise the present HEC-2 model by including the proposed SWM facility to determine the flood elevations for the 25, 50 100 and Regional flows.
- Calculate the effect the SWM facility has on flow volumes in the Fletchers Creek.
- Assess any impact to the operation of the pond.

The most recent version of the input into the HEC-2 model was received from the CVC. This model was updated to include the proposed SWM facility and the floodline recalculated. Shown below in Table 6.1 are the water surface elevations for the cross sections within, or adjacent to the SWM facility. Shown in Table 6.2 are the flow volumes starting at the upstream end of the McLaughlin Road crossing to upstream of the SWM facility for the 25, 50, 100 and Regional storms.

TABLE 6.1
FLOODLINE ELEVATIONS

	25		50		100		Regional	
SECTION	**Existing (m)**	**Revised (m)**	**Existing (m)**	**Regional (m)**	**Existing (m)**	**Revised (m)**	**Existing (m)**	**Revised (m)**
3946 Upstream of McLaughlin	180.56	180.56	180.75	180.75	180.96	180.96	182.72	182.72
4060	180.97	180.97	181.07	181.07	181.58	181.58	182.59	182.58
4240	182.31	182.32	182.41	182.43	182.38	182.40	183.34	183.44
4350	182.81	182.84	182.89	182.94	183.04	183.09	183.59	183.92
4438 Upstream of SWM facility	183.34	183.35	183.42	183.44	183.49	183.50	184.04	184.04

TABLE 6.2
FLOW VOLUMES

	25		50		100		Regional	
SECTION	Existing ($m^3 \times 10^3$)	Revised ($m^3 \times 10^3$)	Existing ($m^3 \times 10^3$)	Regional ($m^3 \times 10^3$)	Existing ($m^3 \times 10^3$)	Revised ($m^3 \times 10^3$)	Existing ($m^3 \times 10^3$)	Revised ($m^3 \times 10^3$)
3946	250.0	250.0	305.1	305.1	360.3	360.3	1,186.1	1,196.1
4060	252.5	252.5	308.0	308.0	364.5	364.5	1,220.5	1,220.0
4240	257.3	257.3	313.4	313.4	371.4	371.4	1,234.4	1,233.9
4350	260.0	260.0	316.9	316.5	374.8	374.9	1,241.5	1,241.7
4438	263.3	262.7	369.7	319.4	378.6	378.1	1,248.2	1,249.6

As can be seen from Table 6.1, the SWM facility has had a marginal effect on the floodlines with the largest difference being 0.33m for the Regional storm at Section 4350. The Regional floodline elevation of 183.92m is still 6m below the top of bank elevation of approximately 190m. As such, this increase in flood elevation will not have any impact on adjacent developments.

The 100 year flood elevation of 183.09m is 0.4m below the top of the SWM facility. Since the SWM facility is designed to control the 100 year design storm, the 100 year flood elevation will not impact the operation of the pond. The Regional floodline will overtop the SWM facility by 0.4m. Since the SWM facility is not designed to control the Regional storm, the flood elevation will have no negative impact of the operation of the SWM facility. The overtopping of the SWM facility by the Regional storm is beneficial to the Regional storm as increased flow volume is provided for the Regional storm.

In reviewing Table 6.2, the SWM facility has not had any significant impact on the flow volume for the 25, 50 100 and Regional storms. The largest loss in flow volume is 600m³ for the Regional storm at Section 4240, but flow volume is increased by 1,400m³ at Section 4438. The Regional flow volume from the outlet to this section of the Fletchers Creek is 52,100m³. It is our belief that the SWM facility has no measurable impact on the Fletchers Creek floodlines and the revised floodlines has no impact on the operation of the SWM facility.

The revised floodline is shown on Drawing SWM-3 with the input and output included in the attached diskette.

7.0 EROSION AND SEDIMENTATION CONTROL

7.1 SITE EROSION POTENTIAL

Site erosion potential is a measure of the erodibility of the subsoil within the site where consideration is given to the surface slope gradients, the lengths of slopes and erodibility of the soil.

For the proposed site, the surface slopes are gentle (2%-10%), with relatively long slope lengths (500-1000) and medium soil erodibility. Based on these conditions, the resident soils on the site are expected to have a low to moderate erosion potential. The exception is the steep banks adjacent to the Fletchers Creek at the northwest limit of the site.

With these site characteristics and the sensitivity of downstream watercourses, the development will require erosion and sedimentation control measures both during and after construction.

7.2 EROSION AND SEDIMENTATION CONTROL DURING CONSTRUCTION

During construction where there is a degree of soil disturbance combined with the removal of natural vegetation, there is a potential for large scale, short-term sediment transfer. To mitigate such an occurrence, it is recommended that, prior to the commencement of construction, siltation fencing be erected along the downstream construction limits, thereby limiting sediment laden flow from entering directly into the downstream drainage system, as shown on SWM-3. The silt fencing requirements for the subdivision will be provided as part of the detail design of the subdivision.

The contractor should be instructed that no construction machinery or activity be allowed to proceed beyond the limits of the siltation fence. The fence should be inspected periodically during the course of construction to ensure that it remains intact.

Additionally, the following "good housekeeping" measures should be practiced during all stages of construction:

1. Stockpiles shall be located away from watercourses and stabilized against erosion as soon as possible.

2. All construction vehicles shall leave the site at designated points provided with a bed of non-erodible material of sufficient length to ensure that a minimal amount of material is tracked off the site onto adjacent municipal streets.

3. All catchbasins shall be provided with sumps and they shall be inspected and cleaned frequently and periodically.

4. At the downstream end of the site, the last storm sewer system manhole shall have a sump which will detain any large debris.

5. Immediately following the installation and connection of the catchbasins to the minor system, catchbasins and ditches in low activity areas will be buffered using filter cloth and rip-rap stone, with periodic inspection and maintenance removal performed when required.

6. All regraded areas within the subdivision that are not occupied by a dwelling, roadway or pavement will be revegetated immediately following the completion of grading operations.

Details of these measures can be found in Drawing SWM-5.

7.3 MAINTENANCE OF THE EROSION AND SEDIMENT CONTROL MEASURES

The following chart has been provided to identify the appropriate water quality and erosion control measures which are to be implemented during the various stages of construction.

CONSTRUCTION STAGE	REQUIRED MEASURE
Clearing and rough grading	- temporary sedimentation pond - silt fence - mud mat - rock check dams
Completion of sewer system	- temporary sedimentation pond - silt fence - mud mat - rock check dams - catchbasin buffers
Completion of construction	- permanent water quality pond - landscaping

All vegetated slopes and buffer zones should be protected from damage as much as possible throughout the construction phases. Cleaning and repair of mud mat(s) and other temporary siltation control measures should be performed as required and after each rain event.

The temporary sedimentation pond will be:

1. constructed prior to the construction of any storm sewers;
2. in operation throughout the construction of the entire subdivision;
3. monitored after each rainfall event during all stages of construction and periodically cleaned out when necessary.

In order to permanently stabilize all disturbed areas, revegetation by seeding and sodding where appropriate is required. A wide variety of species and cultivars are available for revegetation. A common mixture which is adaptable to a wide range of conditions is the "M.T.C. Mixture:

50%	Creeping Red Fescue
30%	Canadian Bluegrass (or Kentucky Bluegrass)
12%	Perennial Ryegrass
3%	Red Clover
5%	Red Top

The above grasses also tend to withstand salt pollution from roadway de-icing practices.

The permanent quality control pond should be constructed following the completion of the subdivision and inspected yearly with particular attention paid to the state of the inlet-outlet structure and the Hickenbottom riser. The grassed slopes within the pond should be inspected at least twice a year and, if required, mowed or selectively cut to help interrupt and control natural succession. Non-routine maintenance includes sediment removal which should occur every 5 to 10 years.

APPENDIX 1

00165.400

SCHAEFFERS
Consulting Engineers

64 Jardin Drive
Concord, Ontario L4K 3P3
Tel: (905) 738-6100
Toronto Line: (416) 213-5590
Fax: (905) 738-6875
Email: waterresources@schaeffers.com

FAX TRANSMISSION

DATE: March 22, 2001 FILE NO.: 2231

RE: WALMART FLOWS - MISSISSAUGA

Please deliver the following pages to FAX NO.: (905) 890-8499

FIRM NAME: G.M. Sernas + Associates

ATTENTION: Tony Sergautis

We are transmitting 14 page(s) (including this cover letter)

SENT BY: David Kellershohn PER:

Original to be forwarded by Mail No

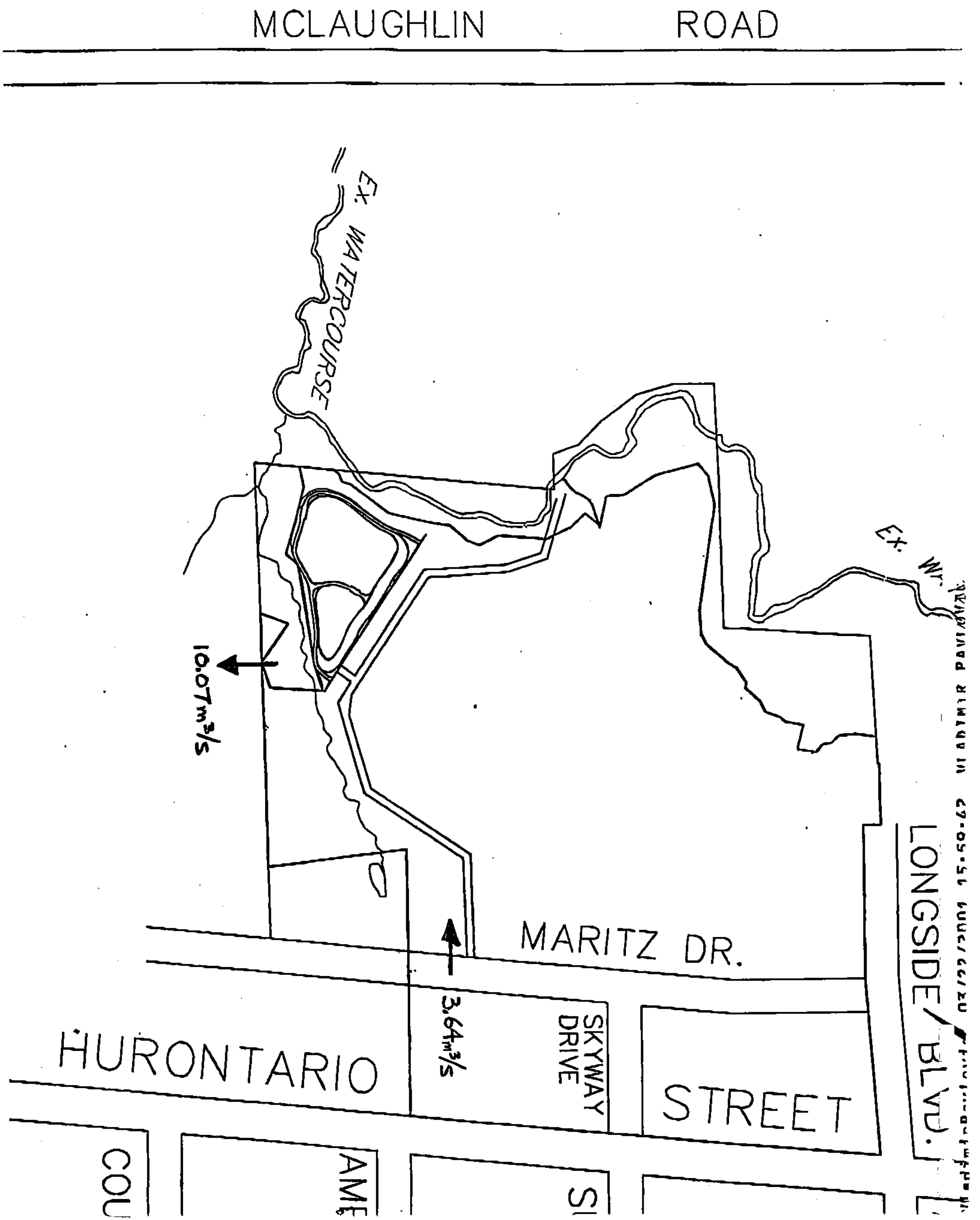
MAR 2 2 2001
G.M. Sernas & Assoc. Ltd.

COMMENTS:

Tony,
Please see attached.

Derek

c.c. KIM TAYLOR-MacCOLL, Shipp Corporation - (905) 275-1149


MCLAUGHLIN ROAD
EX. WATERCOURSE
EX. WT.
10.07m³/s
MARITZ DR.
3.64m³/s
SKYWAY DRIVE
HURONTARIO STREET
LONGSIDE BLVD.

2 /\ INPUT

```
***************************************************************** 
*
*  SHIPP LANDS
*  CITY OF MISSISSAUGA
*  STORM WATER MANAGEMENT STUDY
*  DEVELOPED CONDITION FLOWS
*
*  24 HOUR DESIGN STORM
*  100 YEAR STORM --- 139.12 mm TOTAL RAINFALL
*
*  NOVEMBER, 2000
*
*  REVISED APRIL 2001
*  REVISED JUNE  2001
*
*  PROJECT: 00165.400
*  DATA FILE:  165D00.SCS
*  G.M. SERNAS & ASSOCIATES LIMITED
*  A MEMBER OF THE SERNAS GROUP
*
*****************************************************************
*
START                AT 0.0 HRS METOUT 2  NSTORM 1  NRUN 1
                     SCS00-12.STM
*
*  READ INPUT STORM TO BE MODELLED
*
READ STORM           STORM_FILENAME "SCS00-12.STM"
*
*  METRUS PROPERTIES INC. MODELLING INPUTTED FROM OUTPUT RECEIVED FROM
*  SCHAEFFERS CONSULTING ENGINERS ON MARCH 22, 2001.
*  SINCED THEY USED A THREE HOURS STORM AND THE WATERSHED MODELLING USED A
*  12 HOURS STORM,THEIR MODEL HAS BEEN USED WITH THE EXCEPTION OF THE STORM
*  THE SCHAEFFERS AREA NUMBERING SYSTEM HAS BEEN UTILIZED.
*
*  PARKING LOT AREA #101
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     8    101   2.5        5.37      0.91   0.91   0.0    1
                     SLOPE   END
                     0.4      -1
*
PRINT HYD            ID 8  NPCYC -1
*
*  ROOFTOP COLLECTION   WALMART WAREHOUSE
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     3    200   2.5        4.02      0.999  0.999  0.0    1
                     SLOPE   END
                     0.1      -1
*
PRINT HYD            ID 3  NPCYC -1
*
*  ADD PARKING LOT AND ROOFTOP HYDROGRAPHS
*
ADD HYD               ID 6  HYD 2000  IDI 8  IDII 3
*
PRINT HYD            ID 6  NPCYC -1
*
*  PARKING LOT AREA #102
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     8    102   2.5        5.37      0.91   0.91   0.0    1
                     SLOPE   END
                     0.3      -1
*
PRINT HYD            ID 8  NPCYC -1
```

```
*
*  ADD PARKING LOT HYDROGRAPHS
*
ADD HYD              ID 10  HYD 2002  IDI 8  IDII 6
*
PRINT HYD            ID 10  NPCYC -1
*
*  ROOFTOP STORAGE   WALMART WAREHOUSE
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     2    201    2.5       5.38      0.999  0.999  0.0    1
                     SLOPE   END
                     0.1      -1
*
PRINT HYD            ID 2  NPCYC -1
*
*  BASEFLOW TO OPEN SPACE SYSTEM
*
COMPUTE DUHYD        ID 2  HYD 1201  CINLET 0.30  NINLET 1
                     MAJID 7  MINID  8
*
*  ADD PARKING LOT AND ROOFTOP HYDROGRAPHS
*
ADD HYD              ID 3  HYD 2001  IDI 10  IDII 7
*
PRINT HYD            ID 3  NPCYC -1
*
*  REMAINDER OF METRUS LANDS (20.3 HA,  0.5%, AND 901% IMPERVIOUS ASSUMED)
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     1    400    2.5       20.3      0.90   0.90   0.0    1
                     SLOPE   END
                     0.5      -1
*
PRINT HYD            ID 1  NPCYC -1
*
*  ADD PARKING LOT AND ROOFTOP HYDROGRAPHS
*
ADD HYD              ID 7  HYD 2400  IDI 3  IDII 1
*
PRINT HYD            ID 7  NPCYC -1
*
*  MINOR SYSTEM FLOWS TO POND
*
*
COMPUTE DUHYD        ID 7  HYD 1102  CINLET 5.68  NINLET 1
                     MAJID 10  MINID  1
*
*  PARKING LOT AREA #100
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     4    100    2.5       4.79      0.91   0.91   0.0    1
                     SLOPE   END
                     0.3      -1
*
PRINT HYD            ID 4  NPCYC -1
*
*  PARKING LOT AREA #103
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     5    103    2.5       4.96      0.99   0.99   0.0    1
                     SLOPE   END
                     0.3      -1
*
PRINT HYD            ID 5  NPCYC -1
*
*  ADD HYDROGRAPHS
*
```

```
ADD HYD              ID 9  HYD 2005  IDI 4  IDII 5
*
PRINT HYD            ID 9  NPCYC -1
*
*  MINOR SYSTEM FLOWS TO POND.  ALL MAJOR SYSTEM OUT OF SYSTEM
*
COMPUTE DUHYD        ID 9  HYD 2003  CINLET 5.68  NINLET 1
                     MAJID 7  MINID  4
*
*  ADD HYDROGRAPHS
*
ADD HYD              ID 2  HYD 2004  IDI 4  IDII 1
*
PRINT HYD            ID 2  NPCYC -1
*
*  PARKING LOT AREA #104
*
DESIGN STANDHYD      ID   HYD   DT(min)    AREA(HA)    XIMP   TIMP   DWF    LOSS
                     7    104    2.5        3.80       0.91   0.91   0.0     1
                     SLOPE   END
                     0.3      -1
*
PRINT HYD            ID 7  NPCYC -1
*
*  THERE WILL BE 7 CBS AT APPROXIMATELY 0.11 CMS EACH
*
COMPUTE DUHYD        ID 7  HYD 104  CINLET 0.77  NINLET 1
                     MAJID 6  MINID  1
*
*  ADD HYDROGRAPHS
*
ADD HYD              ID 4  HYD 1106  IDI 1  IDII 2
*
PRINT HYD            ID 4  NPCYC -1
*
*  ADD HYDROGRAPHS
*
ADD HYD              ID 5  HYD 2500  IDI 10  IDII 6
*
PRINT HYD            ID 5  NPCYC -1
*
* PARKING LOT AREA #105
*
DESIGN STANDHYD      ID   HYD   DT(min)    AREA(HA)    XIMP   TIMP   DWF    LOSS
                     7    105    2.5        2.44       0.91   0.91   0.0     1
                     SLOPE   END
                     0.3      -1
*
PRINT HYD            ID 7  NPCYC -1
*
*  THERE WILL BE 3 CBS AT APPROXIMATELY 0.11 CMS EACH
*
COMPUTE DUHYD        ID 7  HYD 105  CINLET 0.33  NINLET 1
                     MAJID 6  MINID  1
*
*  ADD HYDROGRAPHS   MINOR FLOWS TO POND
*
ADD HYD              ID 3  HYD 2520  IDI 1  IDII 4
*
PRINT HYD            ID 3  NPCYC -1
*
*  ADD HYDROGRAPHS   MAJOR FLOWS TO POND
*
ADD HYD              ID 8  HYD 2520  IDI 6  IDII 5
*
PRINT HYD            ID 8  NPCYC -1
*
*  ADD HYDROGRAPHS   TOTAL FLOWS TO POND
```

```
*
ADD HYD              ID 5  HYD 2600  IDI 3  IDII 8
*
PRINT HYD            ID 5  NPCYC -1
*
*  ALL AREAS UP TO THIS POINT IS FROM SCHAEFFERS DATA
*
*  ADD HANSA HOUSE
*
*  AREA 701 --- ROOF AREA BASED ON 40% COVERAGE
*
CALIB STANDHYD       ID  HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                     1   701   5.0     3.60       0.99   0.99   0     2
                     CN   IA(mm)
                     90   1.0
                     PERVIOUS AREA:   DPSP(mm)  SLOPE(%)  LGP(m)  MNP   SCP(min)
                                                1.0       30      .250  0
                     IMPERVIOUS AREA: DPSI(mm)  SLOPE(%)  LGI(m)  MNI   SCI(min)
                                      1.57      1.0       30      .015  0
                     END -1
*
PRINT HYD            ID 1 NPCYC -1
*
*  AREA 702 --- THIS AREA REPRESENTS THE PAVED AND LANDSCAPED AREAS FOR
*  THE SHIPP/HIGGINS LANDS.  IT IS ASSUMED TO BE 50% COVERAGE
*
CALIB STANDHYD       ID  HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                     2   702   5.0     4.50       0.90   0.90   0     2
                     CN   IA(mm)
                     76.8  2.5
                     PERVIOUS AREA:   DPSP(mm)  SLOPE(%)  LGP(m)  MNP   SCP(min)
                                                2.0       251     .250  0
                     IMPERVIOUS AREA: DPSI(mm)  SLOPE(%)  LGI(m)  MNI   SCI(min)
                                      1.57      2.0       30      .015  0
                     END -1
*
PRINT HYD            ID 2 NPCYC -1
*
*  AREA 703 --- THIS AREA REPRESENTS THE ROAD AREA WITHIN THE SHIPP/HIGGINS
*  LANDS.  THIS AREA REPRESENTS 10% OF THE TOTAL AREA.
*  A TIMP AND XIMP OF 0.65 HAS BEEN USED.
*
CALIB STANDHYD       ID  HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                     3   703   5.0      0.9       0.65   0.65   0     2
                     CN   IA(mm)
                     76.8  2.5
                     PERVIOUS AREA:   DPSP(mm)  SLOPE(%)  LGP(m)  MNP   SCP(min)
                                                2.0       170     .250  0
                     IMPERVIOUS AREA: DPSI(mm)  SLOPE(%)  LGI(m)  MNI   SCI(min)
                                      1.57      2.0       30     .015  0
                     END -1
*
PRINT HYD            ID 3 NPCYC -1
*
*  ADD ROOF, PAVED AND LANDSCAPED AND ROAD AREA FOR FULL HYDROGRAPH
*  FROM HANSA HOUSE
*
ADD HYD              ID  HYD NO  IDI  IDII
                     4   704      1    2
*
PRINT HYD            ID=4  NPCYC -1
*
ADD HYD              ID  HYD NO  IDI  IDII
                      2  705      4    3
*
PRINT HYD            ID=2  NPCYC -1
*
*  ADD TOTAL FLOWS AND HANSA HOUSE FLOWS
```

```
*  ADD HYDROGRAPHS  TOTAL FLOWS TO POND
*
ADD HYD              ID  HYD NO  IDI  IDII
                      7  2700     5    2
*
PRINT HYD            ID=7  NPCYC -1
*
*  AREA 103, 203 AND 303 REPRESENTS THE SHIPP/HIGGINS LANDS
*  AREA 204  REPRESENTS THE LANDS EAST OF HURONTARIO
*
*
*  SHIPP LANDS --- TOTAL LAND AREA 81.1 HECTARES
*
*  AREA 103 --- ROOF AREA BASED ON 40% COVERAGE
*
CALIB STANDHYD       ID  HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                     3   103   5.0     32.40      0.99   0.99   0     2
                     CN   IA(mm)
                     90   1.0
                     PERVIOUS AREA:    DPSP(mm)  SLOPE(%)  LGP(m)  MNP    SCP(min)
                                                 1.0       30      .250   0
                     IMPERVIOUS AREA: DPSI(mm)   SLOPE(%)  LGI(m)  MNI    SCI(min)
                                      1.57       1.0       30      .015   0
                     END -1
*
PRINT HYD            ID 3 NPCYC -1
*
*
*  FOR AREA 204 NO ROOF CONTROL IS CONSIDERED SINCE THIS AREA IS EAST OF
*  HIGHWAY 10 AND ONLY OVERLAND FLOW IS BEING CONSIDERED
*
************************************************
*   Combine Roof Areas and Lot Ares            *
*  After running Roof Areas through reservoirs *
*                                              *
************************************************
*
*
*  AREA 203 --- THIS AREA REPRESENTS THE PAVED AND LANDSCAPED AREAS FOR
*  THE SHIPP/HIGGINS LANDS.  IT IS ASSUMED TO BE 50% COVERAGE
*
CALIB STANDHYD       ID  HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                     1   203   5.0     40.6      0.90   0.90   0     2
                     CN   IA(mm)
                     76.8   2.5
                     PERVIOUS AREA:    DPSP(mm)  SLOPE(%)  LGP(m)  MNP    SCP(min)
                                                 2.0       251     .250   0
                     IMPERVIOUS AREA: DPSI(mm)   SLOPE(%)  LGI(m)  MNI    SCI(min)
                                      1.57       2.0       30      .015   0
                     END -1
*
PRINT HYD            ID 1 NPCYC -1
*
*
*  SEPARATE OUT THE MAJOR AND MINOR FLOWS.  SPLIT  IS BASED ON THE 10 YEAR DEVELOPED
*  CONDITION FLOWS.  THIS AREA DOES NOT REQUIRE WATER QUALITY TREATMENT AT THE SWM
*  FACILITY.  MAJOR/MINOR SPLIT AT   2.754 cms.
*
COMPUTE DUALHYD      ID 1      CINLET 2.754   NINLET 1
                     MAJID  6  MajNHYD 10803
                     MINID  8  MinNHYD 11803
                     TMJSTO 0
*
PRINT HYD            ID=6  NPCYC=1
*
ADD HYD              ID  HYD NO  IDI  IDII
                     5   502      8    3
*
```

```
PRINT HYD           ID=5  NPCYC -1
*
*  AREA 303 --- THIS AREA REPRESENTS THE ROAD AREA WITHIN THE SHIPP/HIGGINS
*  LANDS.  THIS AREA REPRESENTS 10% OF THE TOTAL AREA.
*  A TIMP AND XIMP OF 0.65 HAS BEEN USED.
*
CALIB STANDHYD      ID  HYD  DT(min)  AREA(ha)    XIMP   TIMP   DWF   LOSS
                    2   302   5.0     8.10        0.65   0.65   0     2
                    CN   IA(mm)
                    76.8   2.5
                    PERVIOUS AREA:    DPSP(mm)  SLOPE(%)  LGP(m)  MNP   SCP(min)
                                                2.0       170     .250  0
                    IMPERVIOUS AREA:  DPSI(mm)  SLOPE(%)  LGI(m)  MNI   SCI(min)
                                      1.57      2.0       30      .015  0
                    END -1
*
PRINT HYD           ID 2 NPCYC -1
*
*
*  SEPARATE OUT THE MAJOR AND MINOR FLOWS.  SPLIT  IS BASED ON THE 10 YEAR DEVELOPED
*  CONDITION FLOWS.  THIS AREA DOES NOT REQUIRE WATER QUALITY TREATMENT AT THE SWM
*  FACILITY.  MAJOR/MINOR SPLIT AT   0.288 cms.
*
COMPUTE DUALHYD     ID 2      CINLET 0.288   NINLET 1
                    MAJID  3  MajNHYD 10903
                    MINID  9  MinNHYD 11903
                    TMJSTO 0
*
PRINT HYD           ID=3  NPCYC=1
*
*  ADD ROOF, PAVED AND LANDSCAPED AND ROAD AREA FOR FULL HYDROGRAPH
*  FROM SHIPP/HIGGINS LANDS
*
ADD HYD             ID  HYD NO  IDI  IDII
                     2   502     9    5
*
PRINT HYD           ID=2  NPCYC -1
*
*  ADD IN METRUS SITE HYDROGRAPH
*
ADD HYD             ID   HYD NO   IDI   IDII
                     5    502      2     7
*
PRINT HYD           ID 5  NPCYC -1
*
*  AREA 204 --- THIS REPRESENTS THE AREA EAST OF HIGHWAY THAT WILL HAVE OVERLAND FLOW
*  DRAIN INTO THE SWM FACILITY.   THE CALCULATION IS FOR THE ENTIRE AREA WITH A XIMP
*  AND TIMP EQUAL TO 0.85
*
CALIB STANDHYD      ID  HYD  DT(min)  AREA(ha)    XIMP   TIMP   DWF   LOSS
                    8   203   5.0     54.6        0.85   0.85   0     2
                    CN   IA(mm)
                    76.8   2.5
                    PERVIOUS AREA:    DPSP(mm)  SLOPE(%)  LGP(m)  MNP   SCP(min)
                                                2.0       170     .250  0
                    IMPERVIOUS AREA:  DPSI(mm)  SLOPE(%)  LGI(m)  MNI   SCI(min)
                                      1.57      2.0       30      .015  0
                    END -1
*
PRINT HYD           ID 8 NPCYC -1
*
*  SEPARATE OUT THE MAJOR AND MINOR FLOWS.  SPLIT  IS BASED ON THE 10 YEAR DEVELOPED
*  CONDITION FLOWS.  THIS AREA DOES NOT REQUIRE WATER QUALITY TREATMENT AT THE SWM
*  FACILITY.  MAJOR/MINOR SPLIT AT   13.2 cms.
*
COMPUTE DUHYD       ID=8  HYD=903  CINLET 13.2  NINLET 1
                    MAID  7   MIID  6
*
```

```
PRINT HYD            ID=7  NPCYC=1
*
*  ADD THE MAJOR FLOWS FROM THE AREA EAST OF HIGHWAY 10 TO THE TOTAL HYDROGRAPH
*
ADD HYD              ID  HYD NO  IDI  IDII
                      1   503     7    5
*
PRINT HYD            ID=1  NPCYC -1
*
****************************************
*   Route through Pond                 *
****************************************
*
ROUTE RESERVOIR      ID=3  HYD=907  IDIN=1   dt=5  MIN
                     DISCHARGE (cms)   STORAGE (ha m)
                       0.00               0.000       EIGHTY POINT FIVE
                       0.011              0.283       EIGHTY POINT SIX
                       0.118              0.863       EIGHTY POINT EIGHT
                       0.265              1.463       EIGHTY ONE
                       0.355              2.083       EIGHTY ONE POINT TWO
                       0.392              2.400       EIGHTY ONE POINT THREE
                       0.458              3.050       EIGHTY ONE POINT FIVE
                       0.488              3.381       EIGHTY ONE POINT SIX
                       0.648              3.716       EIGHTY ONE POINT SEVEN
                       0.912              4.053       EIGHTY ONE POINT EIGHT
                       1.620              4.735       EIGHTY TWO
                       2.492              5.429       EIGHTY TWO POINT TWO
                       2.975              5.780       EIGHTY TWO POINT THREE
                       4.014              6.490       EIGHTY TWO POINT FIVE
                       5.132              7.211       EIGHTY TWO POINT SEVEN
                       6.312              7.944       EIGHTY TWO POINT NINE
                       7.538              8.688       EIGHTY THREE POINT ONE
                       9.469              9.443       EIGHTY THREE POINT THREE
                      14.518             10.223       EIGHTY THREE POINT FIVE
                      END=-1
*
PRINT HYD            ID=3  NPCYC=-1
*
*
*  CALCULATE THE EXISTING CONDITION FLOWS BASED ON
*  PARAGON'S DRAINAGE AREA.
*
CALIB NASHYD          ID 1  HYDNO  101  DT 15  AREA 163.6
                      DWF  0.0   CN 76.8  IA 15.35  N 3  TP 1.00
                      END -1
*
PRINT HYD             ID 1  NPCYC  -1
*
FINISH
```

APPENDIX 2

Trow

Trow Consulting Engineers Ltd.

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Brampton, Ontario
L6T 4V1

Telephone: (905) 793-9800
Facsimile: (905) 793-0641

Reference: BRGE 00058934 b

January 12, 2001

Mr. Ken Chow, P. Eng.
Associate, Manager, Water Resources
G. M. Sernas & Associates Ltd.
Consulting Engineers and Planners
141 Brunel Road
Mississauga, Ontario
L4Z 1X3

Dear Mr. Chow:

Shipp / Higgins Lands
City of Mississauga
Proposed Stormwater Management Facility
Geotechnical Design Conditions
Your Project No: 00165.400

Trow Consulting Engineers Ltd. ("Trow") carried out a geotechnical investigation for a proposed stormwater management facility ("SWM") in accordance with your authorization of December 13, 2000. This report includes the results of the investigation and presents our recommendations for the design of the SWM facility. The work was authorized by Mr. Michael Trojian of Higgins Developments Partners.

The SWM facility will provide storage for the runoff originating from the proposed industrial/commercial development which will be located between McLaughlin Road and Hurontario Street in Mississauga, Ontario. The future Courtneypark Drive West will transect the site which is roughly rectangular in shape and covers an area of approximately 80 hectares. The proposed SWM facility will be located in Block 19 of the development, in the northwest corner of the site.

The proposed SWM facility will consist of an excavated pond which will permanently contain water. The intent is to utilize the excavated soil material for building a compacted berm which will surround the pond.

The purpose of this investigation was to determine the subsurface soil and groundwater conditions at the site of the pond and, based on this information, to provide geotechnical engineering guidelines for the design and construction of the SWM facility.

Trow carried out geotechnical and geo-environmental investigations at the site and two reports were prepared on the findings as shown below:

Geotechnical Investigation
Proposed Office and Warehouse Structures
6500 Hurontario Street, Mississauga, Ontario
Project No: BRGE 0058934 A Report dated November 9, 2000

Phase I Environmental Site Assessment
6500 Hurontario Street, Mississauga, Ontario
Project No: BRGE 0058934 A Report dated November 14, 2000

This report should be read in conjunction with the above reports.

The comments and recommendations given in this report are based on the assumption that the above described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or the requirement of additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

FIELD AND LABORATORY WORK

Four boreholes - numbered 101 through 104 - were drilled on December 27, 2000, at the locations shown on Drawing 1. The boreholes were staked out in the field by Trow, using the property lines for reference. Elevations were referred to Mississauga Benchmark No. 231, on the West face at the North corner of the West end of a concrete box culvert across McLaughlin Road, 3600 ft South of Derry Road West. This benchmark has a geodetic elevation of 181.415 m.

The four sampled boreholes were drilled by At Cost Drilling Co., using a Bombardier mounted drilling rig equipped with continuous flight solid stem power augers for soil drilling and sampling. In each borehole, samples were recovered using split spoon equipment and standard penetration test methods. Water levels were observed in the open boreholes during the course of the fieldwork and on completion of the boreholes, and a 50 mm dia. observation well was installed in Borehole 104 for long term monitoring of the groundwater conditions.

A representative of Trow was present throughout the drilling operations to monitor and direct the drill operations, and to record borehole information. All split spoon samples were transported to our laboratory for detailed examination. Laboratory testing included measuring the moisture content of all samples the and determining the grain size distribution of selected soil samples.

SUBSURFACE CONDITIONS

The four boreholes encountered organic topsoil ranging in thickness from 100 mm to 350 mm. Below the topsoil, the inorganic natural soil deposits consist of glacial tills which are composed of sandy silt, clayey silt or silty clay. The wide gradation of the encountered soil materials is shown by the three grain size distribution curves, with the difference being slight variations in component percentages. Generally, clayey silt till was encountered above El. 181 to 182 m, which is underlain by a silty clay till deposit which changes to silt till between El. 178 and 180 m. The silt till extends to the underlying shale bedrock. In Borehole 104 the shale bedrock was identified by augering (the bedrock was not proven by coring) at the approximate El. 177.5 m.

All the above glacial till types are widely graded (i.e. contain all soil components in various proportions) and are dense to very dense or stiff to hard. The high density and wide gradation of the tills result in very low permeability of the tills.The groundwater level was between El. 178 and 180 m at the time of the field work. It is anticipated that the water level could rise after the spring thaw or after extended rainy periods.

DISCUSSION AND RECOMMENDATIONS

Design

The proposed SWM facility will be a "wet pond", i.e. some water will be stored permanently in the pond. The normal water level will be at El. 180.5 m, and the invert of the pond will be at about El.178.5 m. The extended detention water level will be at El. 181.5 m. To minimize loss of water from the pond into the weathered and possibly fracture shale bedrock, the bottom of the pond should consist of soil material having very low permeability. The grade around the pond will be at El. 183.5, and wherever the existing grade is lower, a berm will be built to surround the pond with its top at El. 183.5 m. Our analysis and recommendations are based on these data.

The proposed SWM facility can be built at the planned location. The side slopes of the excavated pond should not be steeper than 3 (H) to 1 (V) and a bench of minimum 1.0 m width should be provided between the toe of the berm and the top of slope of the pond. This bench would not only increase the stability of the sides of the berm but also provide room for personnel inspecting and servicing the pond. Vehicular traffic could be accommodated by increasing the width of the bench to minimum 5 m.

Assuming that the berm will be built from locally excavated and inorganic materials, which is placed in accordance with the recommendations included in this report, the side slopes of the berm could be built as steep as 2 (H) to 1 (V). If the sides of the berm were sodded and the grass would be cut, 3 (H) to 1(V) side slopes are recommended.

Concrete control structures can be placed in the natural and undisturbed till deposits, and may be designed using an allowable bearing pressure of 150 kPa which should not cause detrimental total and differential settlement providing that the founding soil is dense or very stiff, and is evaluated by competent geotechnical personnel. Adequate frost protection consisting of minimum 1.2 m earth cover (or equivalent rigid insulation) should be provided for the footings.

Construction.

The excavation for the SWM facility should not present major difficulties. Boulders may be encountered which is common occurrence in glacial till deposits and minor water seepage could occur from wet zones and fissures in the till deposit, in particular after rainy periods. The quantity of seepage should not be excessive and the water can be handled by pumping from temporary filtered sumps and trenching, as required.

The soil subgrade at El. 178.5 m will consist of a widely graded silt till, which has very low permeability, estimated to be of the order of 10^{-5} to 10^{-7} cm/s based on its grain size distribution. At the design level of the invert of the pond, the exposed subgrade should be superficially compacted with a heavy roller to create a well compacted and tight base for the pond.

The excavated soil materials will consist of widely graded glacial tills, consisting of clayey silt till, silty clay till and silt till. The water content of these materials is low, near the optimum value for compaction, therefore they are suitable for constructing the berm. Any material containing organic matter should be discarded and used for landscaping purposes.

We recommend that the area below the footprint of the berm should be stripped of topsoil and other deleterious, wet and compressible materials, and the exposed subgrade should be superficially compacted with four passes of a heavy sheepsfoot roller to 95 % Standard Proctor Maximum Dry Density (SPMDD). The berm materials should be at or near (±2%) the optimum moisture content when placed and should be placed in 200 mm thick loose layers. Oversize (>120 mm in diameter) particles should be removed from the fill material and utilized elwewhere (e.g. for rip rap). Each loose layer should be compacted with heavy sheepsfoot rollers to minimum 98 % SPMDD before placing the next loose lift.

Berms constructed in accordance with these recommendations should be stable and have very low permeability.

Stability of Creekbank

There was no indication of creekbank instability, however, heavy snow cover precluded a detailed inspection therefore we recommend that the area should be thoroughly inspected after the snow has disappeared from the ground. For best visibility, the inspection should be carried out before the foliage appears on trees and bushes.

The construction of the berm should not endanger the stability of the creekbank. however. the exterior toe of the berm should be further than the 2 (H) to 1 (V) imaginary line drawn from the bottom of the creek.

CLOSURE

We trust that this report is sufficient for your present needs. Should you have further queries. please contact us at your convenience.

Yours truly,

Trow Consulting Engineers Ltd.

L. S. Rolko, P. Eng.
Senior Engineer
Geotechnical Division

Lloyd Gonsalves
Manager
Geotechnical Division

Enclosures: 1 Borehole Location Plan - 4 Borehole Logs - 3 Grain size distribution Curves.

Distribution: Mr. Ken Chow, P. Eng. (4 copies)
G.M. Sernas & Associates Ltd.

Project No. brge0058934b

Log of Borehole 101

Dwg No. 52

Sheet No. 1 of 1

Project: Geotechnical Investigation

Location: SWM Facility - Shipp/Higgins Lands, Mississauga, Ontario

Date Drilled: 12/27/00

Drill Type: CME-75 Track-Mounted

Datum: Geodetic

Legend	Symbol	Legend	Symbol
Auger Sample		Combustible Vapour Reading	
SPT (N) Value	O	Natural Moisture	X
Dynamic Cone Test	—	Plastic and Liquid Limit	
Shelby Tube	■	Undrained Triaxial at % Strain at Failure	
Field Vane Test		Penetrometer	▲

GWL	Symbol	Soil Description	Elev. m	Depth	N Value (20, 40, 60, 80) / Shear Strength MPa (0.1, 0.2)	Combustible Vapour Reading (ppm) (250, 500, 750) / Natural Moisture Content % / Atterberg Limits (% Dry Weight) (10, 20, 30)	Natural Unit Weight kN/m3
		~350 mm Topsoil over SANDY SILT TILL - trace gravel, oxidized, brown, damp to moist, dense to very dense.	182.4	0			
				1			
		becoming clayey with depth			60/75 mm		
			180.7				
		Borehole Terminated Upon Practical Auger Refusal on Probable Bedrock at 1.75 m Depth.					
		NOTE: 1. Gas readings in open borehole: 0% (using MSA Model 60)					

(See Dwg 1A for Notes on Descriptions)

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Time	Water Level (m)	Depth to Cave (m)
On Completion	Dry	1.75

Trow

Project No. brge0058934b

Log of Borehole 102

Dwg No. 53

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: SWM Facility - Shipp/Higgins Lands, Mississauga, Ontario

Date Drilled: 12/27/00

Drill Type: CME-75 Track-Mounted

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	Symbol	Soil Description	Elev. m	Depth	N Value (20 40 60 80) / Shear Strength MPa (0.1 0.2)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % / Atterberg Limits (% Dry Weight) (10 20 30)	Natural Unit Weight kN/m3
			179.3	0			
		~200 mm Topsoil over SILTY CLAY - reddish brown, moist.	178.6				
▼		SILT TILL - some sand, trace gravel, brown, moist to wet, stiff.	178.1	1			
		becoming grey at 1.65 m depth	177.5		50/100 mm		
		Borehole Terminated Upon Practical Auger Refusal on Probable Bedrock at 1.80 m Depth. NOTE: 1. Gas readings in open borehole: 0% (using MSA Model 60)					

LGBP 58934 01/12/01

(See Dwg 1A for Notes on Descriptions)

Time	Water Level (m)	Depth to Cave (m)
On Completion	1.20	1.80

Trow

Log of Borehole 103

Project No. brge0058934b

Dwg No. 54

Sheet No. 1 of 1

Project: Geotechnical Investigation

Location: SWM Facility - Shipp/Higgins Lands, Mississauga, Ontario

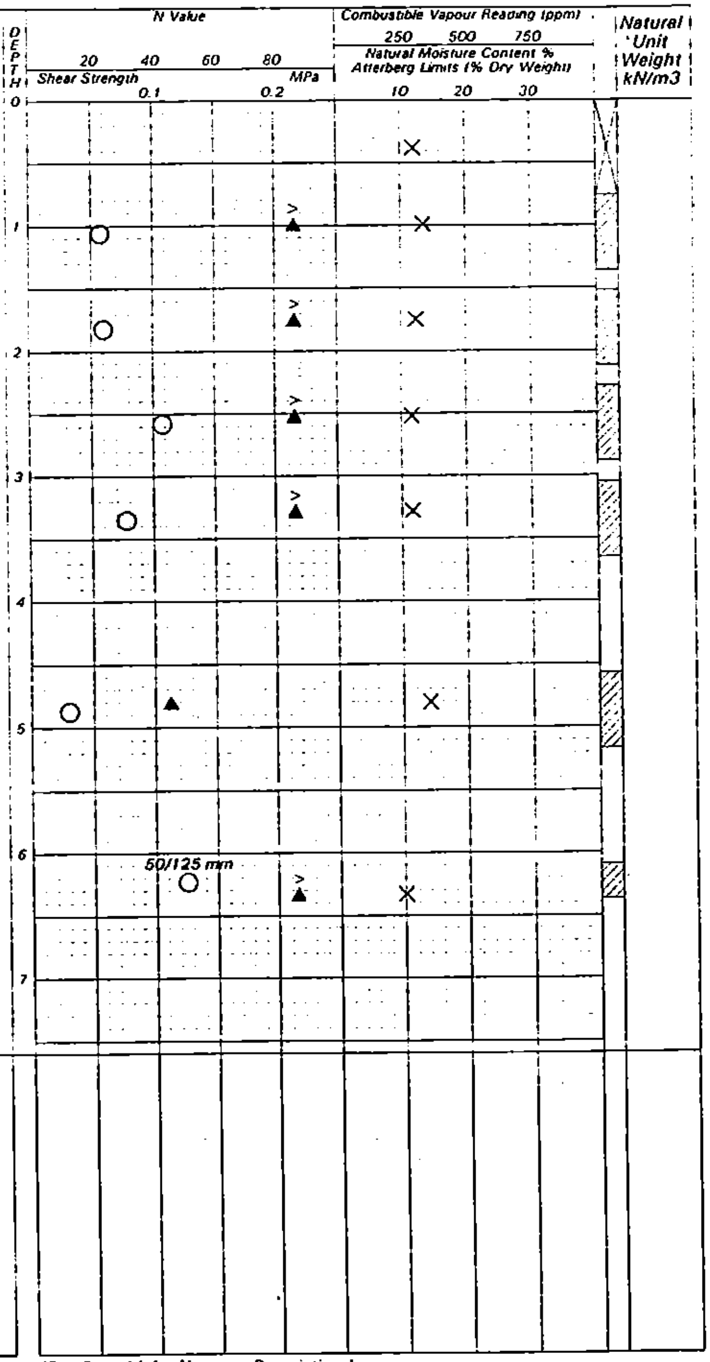
Date Drilled: 12/27/00

Drill Type: CME-75 Track-Mounted

Datum: Geodetic

Auger Sample		Combustible Vapour Reading	
SPT (N) Value		Natural Moisture	
Dynamic Cone Test		Plastic and Liquid Limit	
Shelby Tube		Undrained Triaxial at % Strain at Failure	
Field Vane Test		Penetrometer	

GWL	SYMBOL	Soil Description	Elev. m	DEPTH
			185.0	0
		~100 mm Topsoil over CLAYEY SILT TILL - some sand, trace gravel, brown, damp to moist, hard.		
			181.2	
		SILTY CLAY TILL - some sand, trace gravel, grey, moist, stiff to very stiff.		
			179.7	
		SILTY TILL - some sand, trace gravel, grey, moist, hard.		
			177.4	
		Borehole Terminated Upon Practical Auger Refusal on Probable Bedrock at 7.60 m Depth.		
		NOTE: 1. Gas readings in open borehole: 0% (using MSA Model 60)		



(See Dwg 1A for Notes on Descriptions)

Time	Water Level (m)	Depth to Cave (m)
On Completion	Dry	7.60

LGBP 58934 01/12/01

Trow

Project No. brge0058934b

Log of Borehole 104

Dwg No. 55

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: SWM Facility - Shipp/Higgins Lands, Mississauga, Ontario

Date Drilled: 12/27/00

Drill Type: CME-75 Track-Mounted

Datum: Geodetic

Auger Sample; SPT (N) Value; Dynamic Cone Test; Shelby Tube; Field Vane Test

Combustible Vapour Reading; Natural Moisture; Plastic and Liquid Limit; Undrained Triaxial at % Strain at Failure; Penetrometer

GWL	Symbol	Soil Description	Elev. m	Depth (m)
			186.0	0
		~250 mm Topsoil over CLAYEY SILT TILL - some sand, trace gravel, oxidized fissures, brown, very moist, hard.		
		becoming grey at about 3.2 m depth		
		SILTY CLAY TILL - trace sand, grey, damp to moist, very stiff.	182.2	
		SILT TILL - some sand, trace gravel, grey, moist, hard.	179.2	
▼			178.3	
		SHALE BEDROCK - weathered, grey.	177.5	
		Practical Auger Refusal	177.2	

Chart columns: N Value (20, 40, 60, 80); Shear Strength MPa (0.1, 0.2); Combustible Vapour Reading (ppm) (250, 500, 750); Natural Moisture Content %, Atterberg Limits (% Dry Weight) (10, 20, 30); Natural Unit Weight kN/m3

50/150 mm

End of Borehole

NOTE:
1. Gas readings in open borehole: 0% (using MSA Moel 60)

LGBP 58934 01/12/01

(See Dwg 1A for Notes on Descriptions)

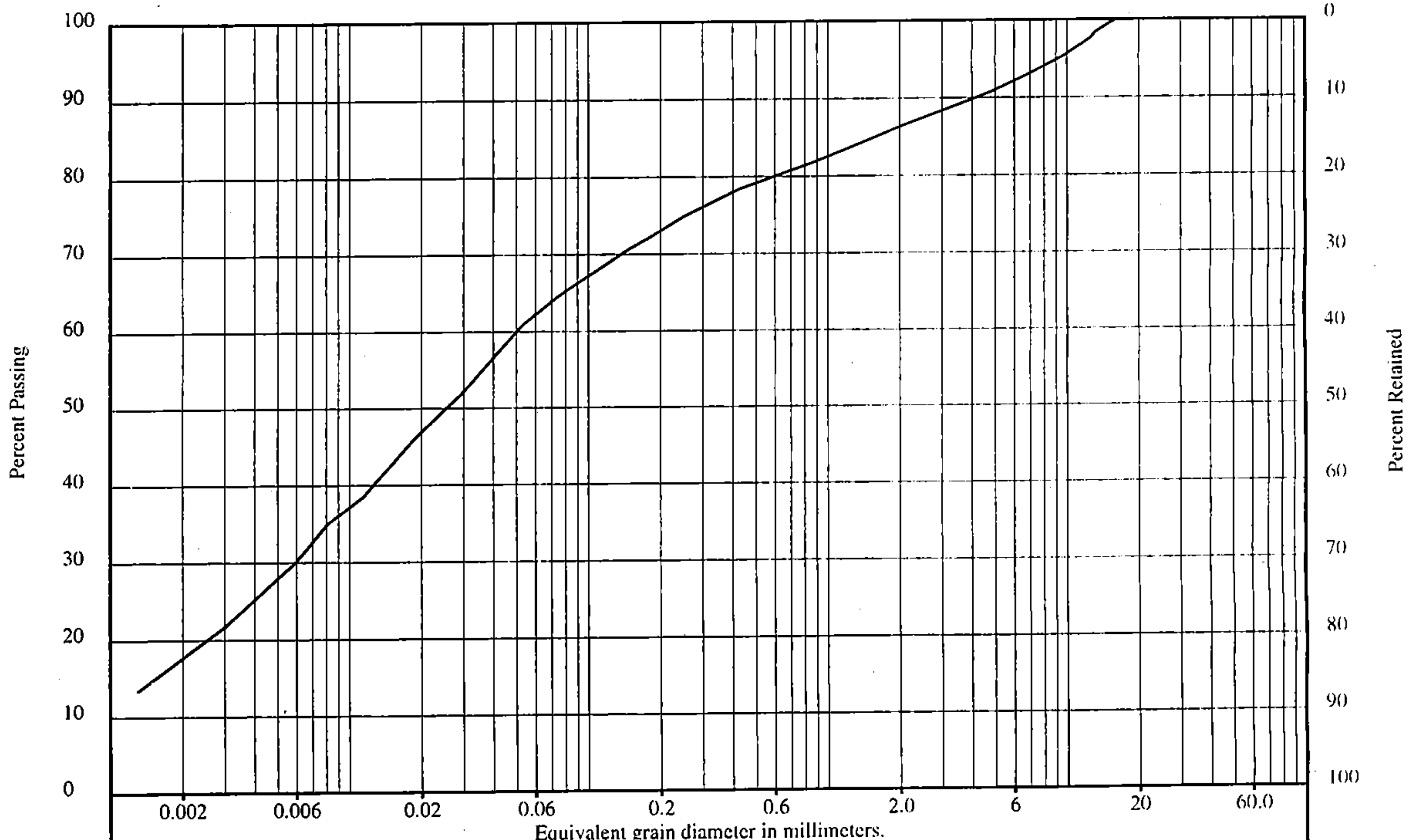
Time	Water Level (m)	Depth to Cave (m)
On Completion	Dry	8.85
12/29/00	7.70	Well
1/03/01	5.3	Well

Trow

Project No.: BRGE0058934B

Project Name: 6500 HURONTARIO ST.

Sample ID: G1235 **Sample Location:** BH3SS3 (1.5 - 2.0m)



17% clay	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse
	45% silt			24% sand			14% gravel		

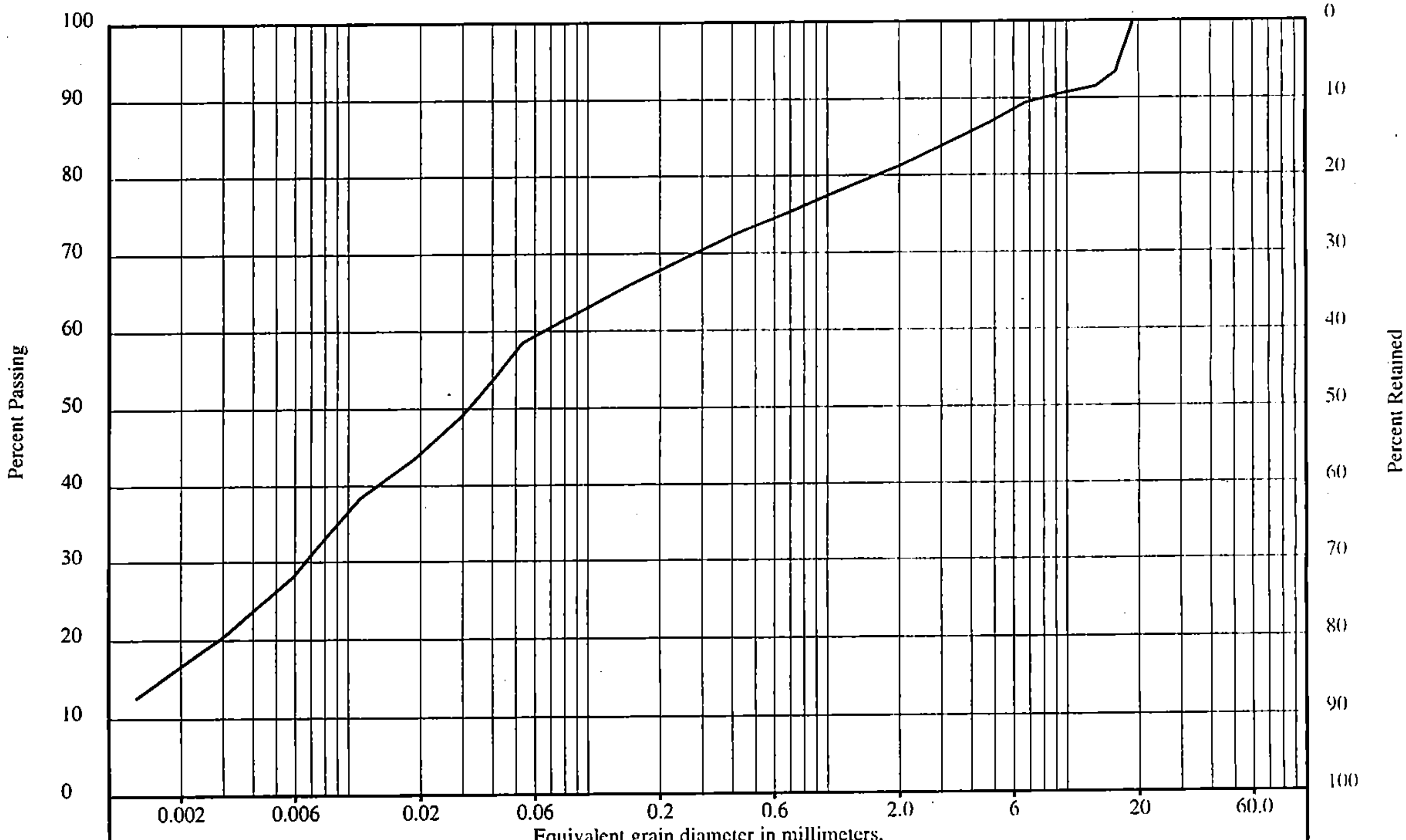
Modified M.I.T. classification

Grain Size Analysis - ASTM D 422

Project No.: BRGE0058934B

Project Name: 6500 HURONTARIO ST. (103)

Sample ID: G1236 **Sample Location:** BH3SS6 (4.6 - 5.0m)



16%	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse
clay	43% silt			22% sand			19% gravel		

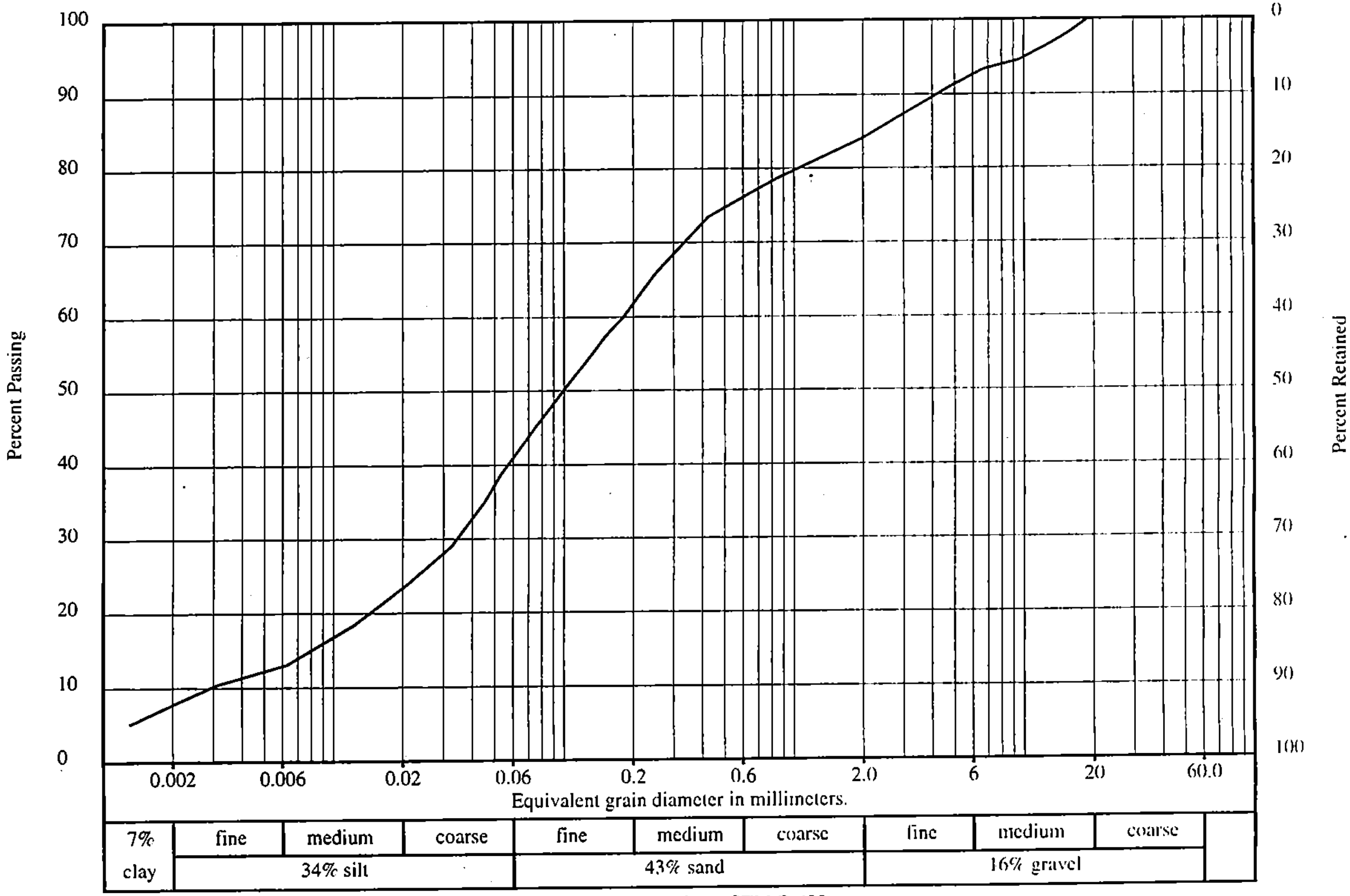
Modified M.I.T. classification

Grain Size Analysis - ASTM D 422

Project No.: BRGE0058934B

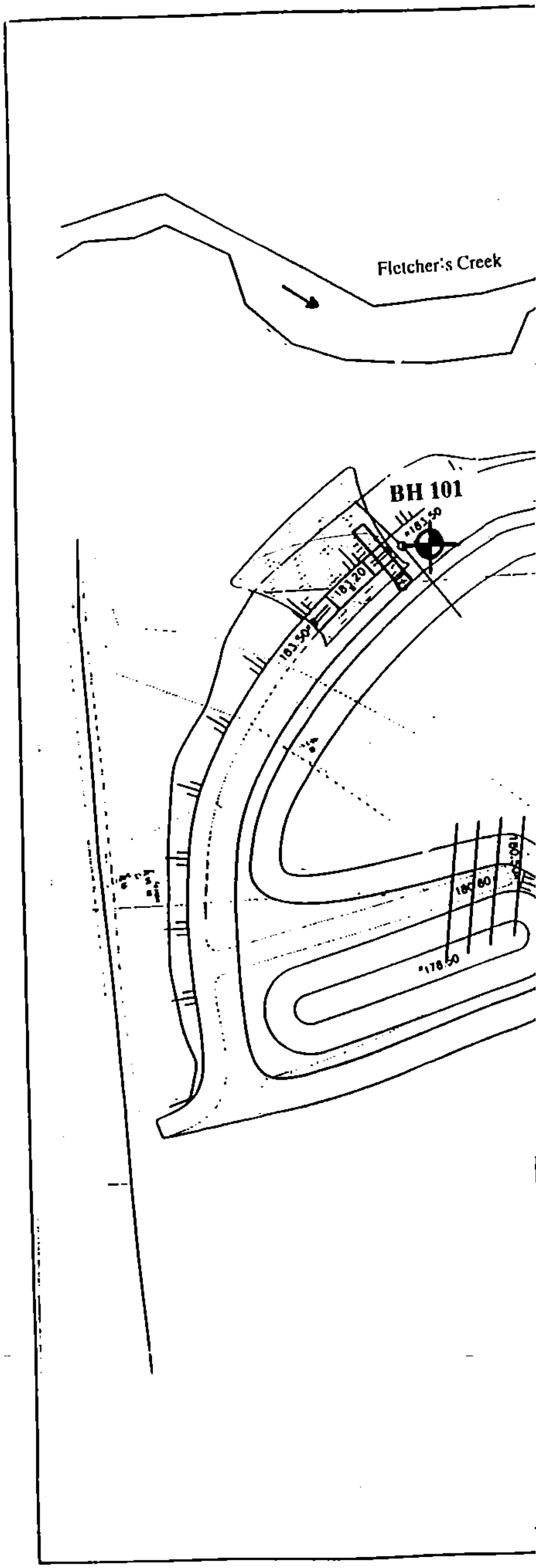
Project Name: 6500 HURONTARIO ST. (10-1)

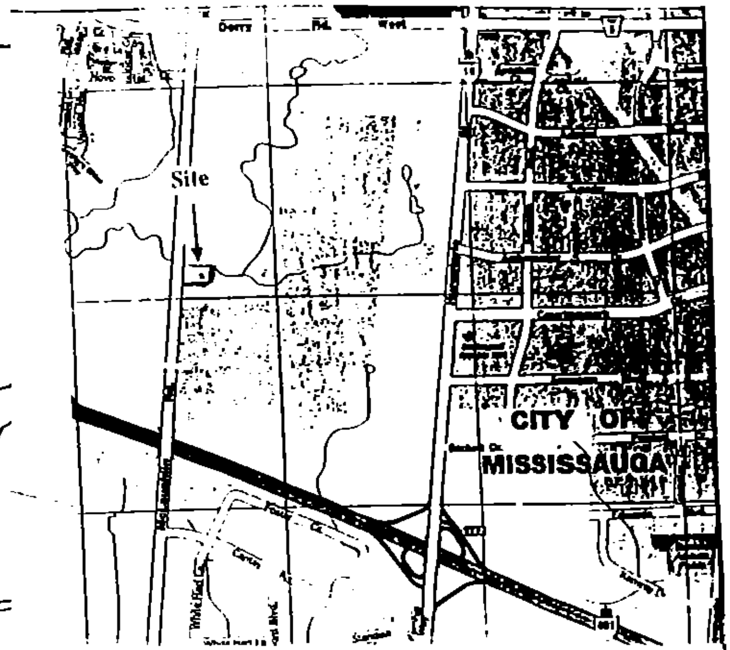
Sample ID: G1237 **Sample Location:** BH4SS8 (7.6 - 8.1m)



Modified M.I.T. classification

Grain Size Analysis - ASTM D 422





Key Plan
(N.T.S.)

LEGEND:

BH 101

Borehole Location and Identification

NOTES:

1. The boundaries and soil types have been established only at Borehole locations. Between Boreholes they are assumed and may be subject to considerable error.
2. Soil samples will be retained in storage for 3 months and then destroyed unless client advises that an extended time period is required.
3. Topsoil quantities should not be established from the information provided at the borehole locations.
4. This drawing was reproduced from a site plan supplied by the Client.

N.T.S.

TROW CONSULTING ENGINEERS LTD.

TROW

1595 Clark Boulevard
Brampton, Ontario L6T 4V1
Telephone (905) 793 - 9800
Fax (905) 793 - 0641

Geotechnical Investigation
Proposed Storm Water Management Facility
Shipp/Higgins Lands
Mississauga, Ontario

BOREHOLE LOCATION PLAN

BRGE00058934-B	Date : January 9, 2001	Drawing No. 1

MISSISSAUGA

January 10, 2001

JAN 1 7 2001

G.M. Sernas & Associates
141 Brunel Rd
Mississauga, ON
L4Z 1X3

Attn: Mr. Ken Chow, P.Eng

RE: SHIPP/HIGGINS LANDS
STORMWATER MANAGEMENT REPORT AND POND DESIGN
CITY OF MISSISSAUGA POND # 4402B

Dear Mr. Chow:

We have reviewed the stormwater management report and accompanying drawings for the captioned pond and provide the following comments. The comments are to be used in conjunction with the marked drawings.

1. As per City of Mississauga policy, the proposed ultimate stormwater management facility shall not be used as a temporary sediment control facility during construction. The consultant will revise the sediment and erosion control plan so that the proposed facility will not be used while maintaining satisfactory sediment control.

2. It is noted that a secondary inlet to the facility is proposed from McLaughlin Road. Will this inlet convey flow from McLaughlin Road only or will part of the site be directed to this inlet as well. The consultant shall provide flow calculations and a drainage area plan showing the area draining to this inlet.

3. Is the portion of the access road on the north side of the forebay required. If so, a turn around area will be required at the end. As well, the portion of the access road into the forebay needs to be better defined. It does not appear to extend to the bottom of the forebay. The grades must also be revised to provide a maximum 8% longitudinal slope and minimal side slope.

4. The pre-development peak flows in Table 4.2 the report are missing. These will be added prior to the next submission.

5. Please provide further details for the control outflow structures. The are inconsistencies between the drawings which must be resolved. Will both structures operate in tandem

to provide the required quantity control.

6. The consultant will provide velocity calculations for the main inflow pipe dispersion at a point directly opposite the headwall in the forebay as shown on the drawings. Erosion protection may be required.

7. Please provide cross sections as marked on the drawings.

8. Provide details of overland flow routes into the facility including location, width, slope, capacity, and erosion protection. Also provide calculations of flow through the overland flow routes.

9. The comments on the OTTHYMO-89 files indicate a 24hour storm is being used although the model shows a 12hour storm.

10. The drying area should not be located downstream of the overflow spillway and outflow structures. It would be preferable to have the sediment drying area located out of the floodplain and close to the forebay.

11. Provide details of the splash pads at the end of the quality and quantity outflow pipes. Is the length sufficient to reduce velocities so that erosion will not occur downstream?

12. What is the capacity of the 1500mm x 2400mm quantity outflow pipe. What is the maximum design depth of flow. If this pipe is at capacity, it will cause the proposed weir to be submerged. This must be accounted for in the design calculations.

13. A soils report will be required to confirm the existing soils are suitable for construction.

14. Replace the Duramat erosion protection with appropriately sized rip rap.

15. The secondary inlet at McLaughlin Road is to be sized and built during the pond construction. This will eliminate the need to modify the pond in the future. Inlet pipe and headwall details and calculations must be submitted.

16. Granular "A" to be a minimum of 150mm thick along access road. Please indicate this on the drawings.

The consultant will address all above comments and those shown on the attached marked up drawings to the satisfaction of the City.

Yours truly;

Brian Chan, C.E.T.
Storm Drainage Coordinator

CREDIT VALLEY
CONSERVATION

February 15, 2001

G.M. Sernas Associates Ltd
141 Brunel Road
Mississauga, Ontario
L4Z 1X3

Attention: Ken Chow Associate, Manager, Water Resources

Dear Ken:

Re: Shipp/Higgins Lands
Stormwater Management Report and Pond Design
21T-88012/MI

We have reviewed the following report and would like to provide the following comments.

G.M. Sernas Associates Ltd.
Stormwater Management Report
Ship/Higgins Industrial Development
City of Mississauga
December, 2000

Plan # SWM-3

Plan # SWM-3 shows storm flows from MH-23 discharging to the permanent pool at the eastern side of the pond.

- How large is the drainage area for the discharge from MH-23?
- What is the nature of the drainage area (i.e. residential, industrial, commercial ... etc)?
- What is the amount of the discharge coming from MH-23?
- Since this outlet discharges directly to the permanent pool and not into the sediment forebay, how is water quality control being achieved?
- What is being done to prevent the flows from MH-23 directly discharging to the outlet for the pond (i.e. short circuit)?

Plan # SWM-5

The following notes should be added to the Erosion and Sediment Control Detail Plan under the heading 'Good House Keeping Measures':

...2

Credit Valley Conservation 1255 Old Derry Road West. Meadowvale. Ontario L5N 6R4
Phone (905) 670-1615 Fax (905) 670-2210
"Conservation Through Cooperation"

- Erosion and sediment controls are to be continuously evaluated during the course of construction.
- Additional erosion and sediment control materials (i.e. silt fence, straw bales, clear stone ... etc.) are to be kept on site for emergencies and repairs.

Permanent SWM facility is being used as temporary sediment pond

The report proposes the use of the permanent SWM facility for temporary quality control purposes. The CVC doe not support the use of permanent stormwater management facility for use as a temporary sediment basin during construction. It has been CVC's experience that when the permanent stormwater management facility is used as a temporary sediment basin, the final pond details cannot be achieved in time for the issuance of building permits. CVC requires that, prior to the issuance of building permits, the permanent stormwater management facility must be operational in accordance with the approved design to control the impacts of the new development.

The following criteria must be met to be consider the permanent pond operational:

- The pond must be final graded
- Capacity of pond must be confirmed to meet design detention volumes
- Inlet and outlet structures must be constructed and conform to the approved plans
- The vegetation within and around the pond is integral to its function as a water quality treatment pond. Vegetation should be established as soon as reasonably possible. All bare areas must be stabilized and final plantings substantially complete.

However, if there is a desire to pursue the use of the permanent facility as a temporary sediment basin, and the City of Mississauga is in agreement, we would require a detailed schedule of how the transition between sediment basin to permanent facility will be achieved prior to the issuance of building permits.

In order to meet the CVC's requirement for a temporary quality storage pond, the followings details are required to be submitted:

- The location of the temporary quality storage pond.
- Location of outfall.
- Method used to dissipate the energy at the discharge point, if required.
- The inlet and outlet structures are to be shown.

Swale Outlet to Creek

An outlet swale is required from the pond to Fletcher's Creek. The outlet swale should be properly protected from erosion and the outlet should not cause any disruption to natural flows. Details of the outlet swale and outfall to Fletcher's Creek must be submitted for our review.

...3

Pond Plantings

We require stormwater management planting plans as per the CVC;s Stormwater Management Facility Planting Guidelines (see attached copy).

Please call Jeff Wong or myself if you have any questions.

Yours truly,

M Bracken

Mary Bracken
Planner
MB/ag

Encl.

Cc: **City of Mississauga**
Transportation and Works Department
Attention: Ozzie Terminesi
Manager, Development Engineering
Attention: Brian Chan

City of Mississauga
Planning and Building Department
Attention: Ed Warankie
Development Planner, East Area
Development and Design Division

00165.400

FAX TRANSMITTAL / MEMORANDUM

CVC
CREDIT VALLEY CONSERVATION

CREDIT VALLEY CONSERVATION
1255 Old Derry Road, Meadowvale, Ontario L5N 6R4
Tel: (905) 670-1615 Fax: (905) 670-2210 1-800-668 5557

Date: March 22, 2001

To:	Mr. Ken Chow, P.Eng.	**Fax #**	905-890-8499
Firm:	G.M. Sernas		
cc:	Brian Chan		
From:	Jeff Wong		
Re:	Fletchers Floodlines		

Page 1 of 3 **- Original Sent by: Mail ☐ Courier ☐ Original Not Sent ×**

Message:

Dear Sir

Further to the fax that was sent to you on March 20, 2001. We now have updated floodlines for this area in our office.

We have concerns with the volume of the floodplain the pond occupies, loss of storage in the floodplain and loss of conveyance of the flows. We would like these concerns addressed, our goals are to have no off-site impact from the proposed pond.

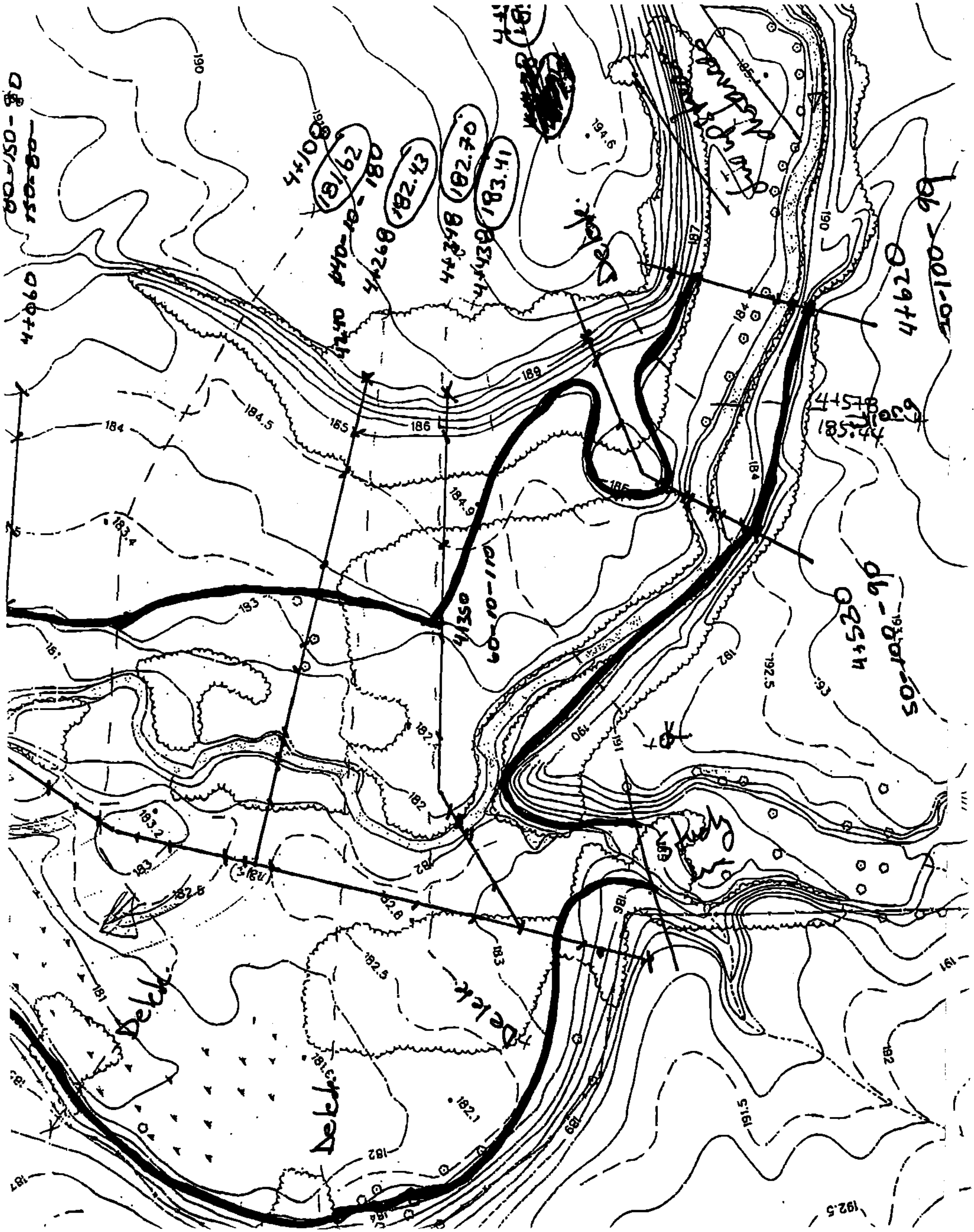
In order to assess these impacts, we would like you to:

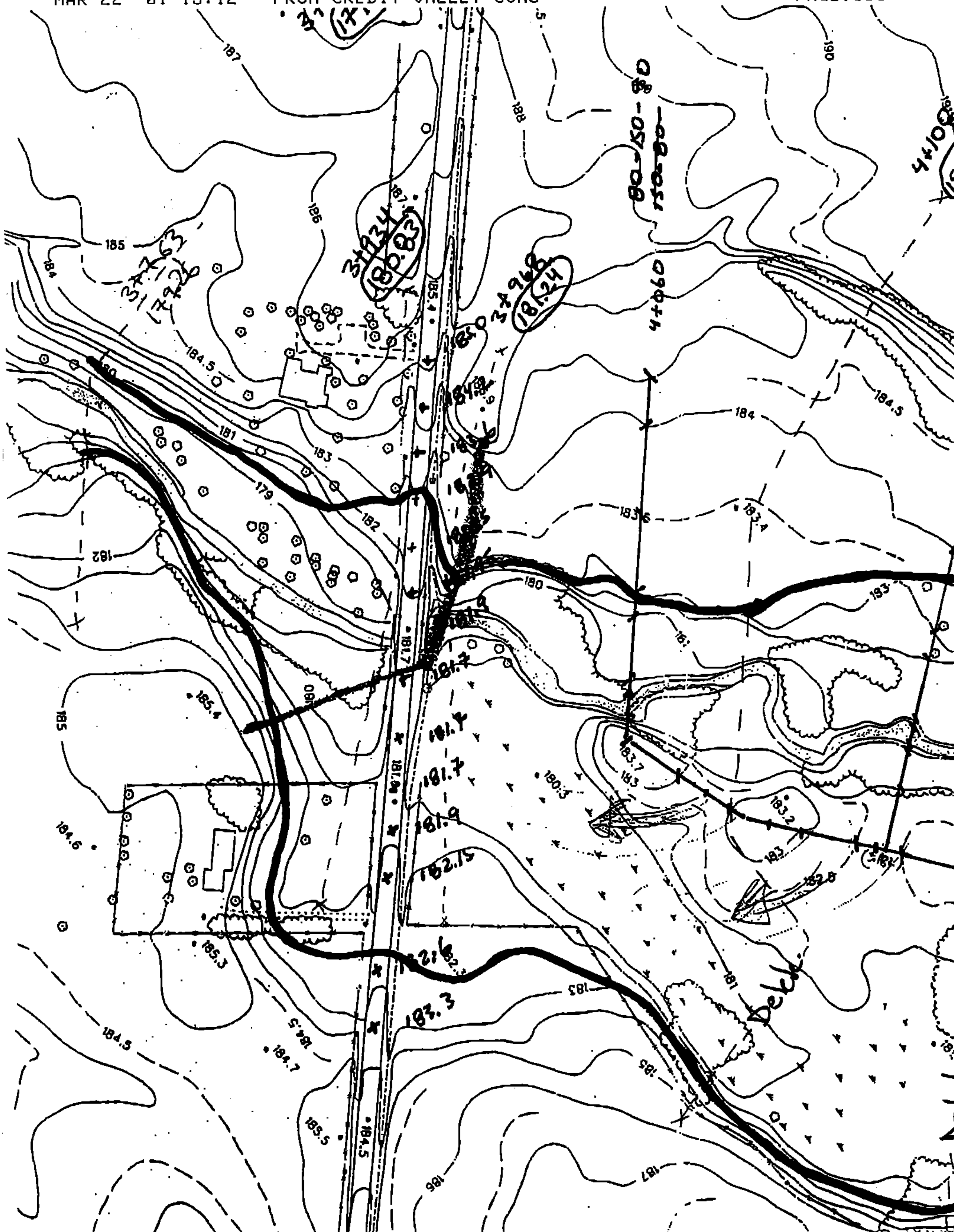
Revise the present HEC-2 model with the pond in the floodplain to determine the flood elevations for the 25, 50, 100 and regional flows;
Calculate the loss of storage (with and without the pond);
Assess whether there will be any impact to the operation of the pond.

Attached are copies of the map showing the revised floodlines in the vicinity of the Shipp/Higgins pond. The HEC-2 model is available digitally, please contact the undersigned at ext 269 to have the information forwarded to you.

Jeffrey C. Wong. P.Eng.
Watershed Planning
jwong@creditvalleycons.com

JW
Signature




187
188
190
186
185
184
184.5
181
179
183
182
180
4+060
4+100
181.24
184.5
184
183.4
185.4
185
184.6
185.3
184.7
185.5
184.5
181.7
181.9
182.15
183.3
180.3
183.7
183.2
182.8
186
187

APPENDIX 3

 INPUT

```
*****************************************************************
*
*  SHIPP LANDS
*  CITY OF MISSISSAUGA
*  STORM WATER MANAGEMENT STUDY
*  DEVELOPED CONDITION FLOWS
*
*  24 HOUR DESIGN STORM
*  100 YEAR STORM --- 139.12 mm TOTAL RAINFALL
*
*  NOVEMBER, 2000
*
*  REVISED APRIL 2001
*  REVISED JUNE  2001
*
*  PROJECT: 00165.400
*  DATA FILE:  165D00.SCS
*  G.M. SERNAS & ASSOCIATES LIMITED
*  A MEMBER OF THE SERNAS GROUP
*
*****************************************************************
*
START               AT 0.0 HRS METOUT 2  NSTORM 1  NRUN 1
                    SCS00-12.STM
*
*  READ INPUT STORM TO BE MODELLED
*
READ STORM          STORM_FILENAME "SCS00-12.STM"
*
*  METRUS PROPERTIES INC. MODELLING INPUTTED FROM OUTPUT RECEIVED FROM
*  SCHAEFFERS CONSULTING ENGINEERS ON MARCH 22, 2001.
*  SINCED THEY USED A THREE HOURS STORM AND THE WATERSHED MODELLING USED A
*  12 HOURS STORM,THEIR MODEL HAS BEEN USED WITH THE EXCEPTION OF THE STORM
*  THE SCHAEFFERS AREA NUMBERING SYSTEM HAS BEEN UTILIZED.
*
*  PARKING LOT AREA #101
*
DESIGN STANDHYD     ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                    8    101   2.5        5.37      0.91   0.91   0.0    1
                    SLOPE   END
                    0.4      -1
*
PRINT HYD           ID 8  NPCYC -1
*
*  ROOFTOP COLLECTION   WALMART WAREHOUSE
*
DESIGN STANDHYD     ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                    3    200   2.5        4.02      0.999  0.999  0.0    1
                    SLOPE   END
                    0.1      -1
*
PRINT HYD           ID 3  NPCYC -1
*
*  ADD PARKING LOT AND ROOFTOP HYDROGRAPHS
*
ADD HYD              ID 6  HYD 2000  IDI 8  IDII 3
*
PRINT HYD           ID 6  NPCYC -1
*
*  PARKING LOT AREA #102
*
DESIGN STANDHYD     ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                    8    102   2.5        5.37      0.91   0.91   0.0    1
                    SLOPE   END
                    0.3      -1
*
PRINT HYD           ID 8  NPCYC -1
```

```
*
*  ADD PARKING LOT HYDROGRAPHS
*
ADD HYD              ID 10  HYD 2002  IDI 8  IDII 6
*
PRINT HYD            ID 10  NPCYC -1
*
*  ROOFTOP STORAGE   WALMART WAREHOUSE
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     2    201    2.5       5.38      0.999  0.999  0.0    1
                     SLOPE   END
                     0.1      -1
*
PRINT HYD            ID 2  NPCYC -1
*
*  BASEFLOW TO OPEN SPACE SYSTEM
*
COMPUTE DUHYD        ID 2  HYD 1201  CINLET 0.30  NINLET 1
                     MAJID 7  MINID  8
*
*  ADD PARKING LOT AND ROOFTOP HYDROGRAPHS
*
ADD HYD              ID 3  HYD 2001  IDI 10  IDII 7
*
PRINT HYD            ID 3  NPCYC -1
*
*  REMAINDER OF METRUS LANDS (20.3 HA,  0.5%, AND 901% IMPERVIOUS ASSUMED)
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     1    400    2.5       20.3      0.90   0.90   0.0    1
                     SLOPE   END
                     0.5      -1
*
PRINT HYD            ID 1  NPCYC -1
*
*  ADD PARKING LOT AND ROOFTOP HYDROGRAPHS
*
ADD HYD              ID 7  HYD 2400  IDI 3  IDII 1
*
PRINT HYD            ID 7  NPCYC -1
*
*  MINOR SYSTEM FLOWS TO POND
*
*
COMPUTE DUHYD        ID 7  HYD 1102  CINLET 5.68  NINLET 1
                     MAJID 10  MINID  1
*
*  PARKING LOT AREA #100
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     4    100    2.5       4.79      0.91   0.91   0.0    1
                     SLOPE   END
                     0.3      -1
*
PRINT HYD            ID 4  NPCYC -1
*
*  PARKING LOT AREA #103
*
DESIGN STANDHYD      ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                     5    103    2.5       4.96      0.99   0.99   0.0    1
                     SLOPE   END
                     0.3      -1
*
PRINT HYD            ID 5  NPCYC -1
*
*  ADD HYDROGRAPHS
*
```

```
ADD HYD             ID 9  HYD 2005  IDI 4  IDII 5
*
PRINT HYD           ID 9  NPCYC -1
*
*  MINOR SYSTEM FLOWS TO POND.  ALL MAJOR SYSTEM OUT OF SYSTEM
*
COMPUTE DUHYD       ID 9  HYD 2003  CINLET 5.68  NINLET 1
                    MAJID 7  MINID  4
*
*  ADD HYDROGRAPHS
*
ADD HYD             ID 2  HYD 2004  IDI 4  IDII 1
*
PRINT HYD           ID 2  NPCYC -1
*
*  PARKING LOT AREA #104
*
DESIGN STANDHYD     ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                    7    104    2.5       3.80      0.91   0.91   0.0    1
                    SLOPE   END
                    0.3      -1
*
PRINT HYD           ID 7  NPCYC -1
*
*  THERE WILL BE 7 CBS AT APPROXIMATELY 0.11 CMS EACH
*
COMPUTE DUHYD       ID 7  HYD 104  CINLET 0.77  NINLET 1
                    MAJID 6  MINID  1
*
*  ADD HYDROGRAPHS
*
ADD HYD             ID 4  HYD 1106  IDI 1  IDII 2
*
PRINT HYD           ID 4  NPCYC -1
*
*  ADD HYDROGRAPHS
*
ADD HYD             ID 5  HYD 2500  IDI 10  IDII 6
*
PRINT HYD           ID 5  NPCYC -1
*
* PARKING LOT AREA #105
*
DESIGN STANDHYD     ID   HYD   DT(min)   AREA(HA)   XIMP   TIMP   DWF   LOSS
                    7    105    2.5       2.44      0.91   0.91   0.0    1
                    SLOPE   END
                    0.3      -1
*
PRINT HYD           ID 7  NPCYC -1
*
*  THERE WILL BE 3 CBS AT APPROXIMATELY 0.11 CMS EACH
*
COMPUTE DUHYD       ID 7  HYD 105  CINLET 0.33  NINLET 1
                    MAJID 6  MINID  1
*
*  ADD HYDROGRAPHS  MINOR FLOWS TO POND
*
ADD HYD             ID 3  HYD 2520  IDI 1  IDII 4
*
PRINT HYD           ID 3  NPCYC -1
*
*  ADD HYDROGRAPHS  MAJOR FLOWS TO POND
*
ADD HYD             ID 8  HYD 2520  IDI 6  IDII 5
*
PRINT HYD           ID 8  NPCYC -1
*
*  ADD HYDROGRAPHS  TOTAL FLOWS TO POND
```

```
*
ADD HYD             ID 5  HYD 2600  IDI 3  IDII 8
*
PRINT HYD           ID 5  NPCYC -1
*
*  ALL AREAS UP TO THIS POINT IS FROM SCHAEFFERS DATA
*
*  ADD HANSA HOUSE
*
*  AREA 701 --- ROOF AREA BASED ON 40% COVERAGE
*
CALIB STANDHYD      ID   HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                    1    701   5.0     3.60       0.99   0.99   0     2
                    CN    IA(mm)
                    90    1.0
                    PERVIOUS AREA:    DPSP(mm)  SLOPE(%)  LGP(m)  MNP    SCP(min)
                                                1.0       30      .250   0
                    IMPERVIOUS AREA:  DPSI(mm)  SLOPE(%)  LGI(m)  MNI    SCI(min)
                                      1.57      1.0       30      .015   0
                    END -1
*
PRINT HYD           ID 1 NPCYC -1
*
*  AREA 702 --- THIS AREA REPRESENTS THE PAVED AND LANDSCAPED AREAS FOR
*  THE SHIPP/HIGGINS LANDS.  IT IS ASSUMED TO BE 50% COVERAGE
*
CALIB STANDHYD      ID   HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                    2    702   5.0     4.50       0.90   0.90   0     2
                    CN    IA(mm)
                    76.8   2.5
                    PERVIOUS AREA:    DPSP(mm)  SLOPE(%)  LGP(m)  MNP    SCP(min)
                                                2.0       251     .250   0
                    IMPERVIOUS AREA:  DPSI(mm)  SLOPE(%)  LGI(m)  MNI    SCI(min)
                                      1.57      2.0       30      .015   0
                    END -1
*
PRINT HYD           ID 2 NPCYC -1
*
*  AREA 703 --- THIS AREA REPRESENTS THE ROAD AREA WITHIN THE SHIPP/HIGGINS
*  LANDS.  THIS AREA REPRESENTS 10% OF THE TOTAL AREA.
*  A TIMP AND XIMP OF 0.65 HAS BEEN USED.
*
CALIB STANDHYD      ID   HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                    3    703   5.0      0.9       0.65   0.65   0     2
                    CN    IA(mm)
                    76.8   2.5
                    PERVIOUS AREA:    DPSP(mm)  SLOPE(%)  LGP(m)  MNP    SCP(min)
                                                2.0       170     .250   0
                    IMPERVIOUS AREA:  DPSI(mm)  SLOPE(%)  LGI(m)  MNI    SCI(min)
                                      1.57      2.0       30     .015   0
                    END -1
*
PRINT HYD           ID 3 NPCYC -1
*
*  ADD ROOF, PAVED AND LANDSCAPED AND ROAD AREA FOR FULL HYDROGRAPH
*  FROM HANSA HOUSE
*
ADD HYD             ID   HYD NO   IDI   IDII
                    4    704       1     2
*
PRINT HYD           ID=4  NPCYC -1
*
ADD HYD             ID   HYD NO   IDI   IDII
                     2   705       4     3
*
PRINT HYD           ID=2  NPCYC -1
*
*  ADD TOTAL FLOWS AND HANSA HOUSE FLOWS
```

```
*  ADD HYDROGRAPHS  TOTAL FLOWS TO POND
*
ADD HYD               ID  HYD NO  IDI  IDII
                       7  2700     5    2
*
PRINT HYD             ID=7  NPCYC -1
*
*  AREA 103, 203 AND 303 REPRESENTS THE SHIPP/HIGGINS LANDS
*  AREA 204  REPRESENTS THE LANDS EAST OF HURONTARIO
*
*
*  SHIPP LANDS --- TOTAL LAND AREA 81.1 HECTARES
*
*  AREA 103 --- ROOF AREA BASED ON 40% COVERAGE
*
CALIB STANDHYD        ID  HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                      3   103   5.0     32.40      0.99   0.99   0     2
                      CN   IA(mm)
                      90   1.0
                      PERVIOUS AREA:    DPSP(mm)  SLOPE(%)  LGP(m)  MNP   SCP(min)
                                                  1.0       30      .250  0
                      IMPERVIOUS AREA: DPSI(mm)  SLOPE(%)  LGI(m)  MNI   SCI(min)
                                        1.57      1.0       30      .015  0
                      END -1
*
PRINT HYD             ID 3 NPCYC -1
*
*
*  FOR AREA 204 NO ROOF CONTROL IS CONSIDERED SINCE THIS AREA IS EAST OF
*  HIGHWAY 10 AND ONLY OVERLAND FLOW IS BEING CONSIDERED
*
*************************************************
*   Combine Roof Areas and Lot Ares             *
*  After running Roof Areas through reservoirs *
*                                               *
*************************************************
*
*
*  AREA 203 --- THIS AREA REPRESENTS THE PAVED AND LANDSCAPED AREAS FOR
*  THE SHIPP/HIGGINS LANDS.  IT IS ASSUMED TO BE 50% COVERAGE
*
CALIB STANDHYD        ID  HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                      1   203   5.0     40.6      0.90   0.90   0     2
                      CN   IA(mm)
                      76.8  2.5
                      PERVIOUS AREA:    DPSP(mm)  SLOPE(%)  LGP(m)  MNP   SCP(min)
                                                  2.0       251     .250  0
                      IMPERVIOUS AREA: DPSI(mm)  SLOPE(%)  LGI(m)  MNI   SCI(min)
                                        1.57      2.0       30      .015  0
                      END -1
*
PRINT HYD             ID 1 NPCYC -1
*
*
*  SEPARATE OUT THE MAJOR AND MINOR FLOWS.  SPLIT  IS BASED ON THE 10 YEAR DEVELOPED
*  CONDITION FLOWS.  THIS AREA DOES NOT REQUIRE WATER QUALITY TREATMENT AT THE SWM
*  FACILITY.  MAJOR/MINOR SPLIT AT   2.754 cms.
*
COMPUTE DUALHYD       ID 1       CINLET 2.754   NINLET 1
                      MAJID  6  MajNHYD 10803
                      MINID  8  MinNHYD 11803
                      TMJSTO 0
*
PRINT HYD             ID=6  NPCYC=1
*
ADD HYD               ID  HYD NO  IDI  IDII
                      5   502      8    3
*
```

```
PRINT HYD           ID=5  NPCYC -1
*
*  AREA 303 --- THIS AREA REPRESENTS THE ROAD AREA WITHIN THE SHIPP/HIGGINS
*  LANDS.  THIS AREA REPRESENTS 10% OF THE TOTAL AREA.
*  A TIMP AND XIMP OF 0.65 HAS BEEN USED.
*
CALIB STANDHYD      ID  HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                    2   302   5.0     8.10       0.65   0.65   0     2
                    CN    IA(mm)
                    76.8   2.5
                    PERVIOUS AREA:   DPSP(mm)  SLOPE(%)  LGP(m)  MNP   SCP(min)
                                               2.0       170     .250  0
                    IMPERVIOUS AREA: DPSI(mm)  SLOPE(%)  LGI(m)  MNI   SCI(min)
                                     1.57      2.0       30      .015  0
                    END -1
*
PRINT HYD           ID 2 NPCYC -1
*
*
*  SEPARATE OUT THE MAJOR AND MINOR FLOWS.  SPLIT  IS BASED ON THE 10 YEAR DEVELOPED
*  CONDITION FLOWS.  THIS AREA DOES NOT REQUIRE WATER QUALITY TREATMENT AT THE SWM
*  FACILITY.  MAJOR/MINOR SPLIT AT   0.288 cms.
*
COMPUTE DUALHYD     ID 2       CINLET 0.288   NINLET 1
                    MAJID  3  MajNHYD 10903
                    MINID  9  MinNHYD 11903
                    TMJSTO 0
*
PRINT HYD           ID=3  NPCYC=1
*
*  ADD ROOF, PAVED AND LANDSCAPED AND ROAD AREA FOR FULL HYDROGRAPH
*  FROM SHIPP/HIGGINS LANDS
*
ADD HYD             ID  HYD NO  IDI  IDII
                     2   502     9    5
*
PRINT HYD           ID=2  NPCYC -1
*
*  ADD IN METRUS SITE HYDROGRAPH
*
ADD HYD             ID   HYD NO   IDI   IDII
                     5    502      2     7
*
PRINT HYD           ID 5  NPCYC -1
*
*  AREA 204 --- THIS REPRESENTS THE AREA EAST OF HIGHWAY THAT WILL HAVE OVERLAND FLOW
*  DRAIN INTO THE SWM FACILITY.   THE CALCULATION IS FOR THE ENTIRE AREA WITH A XIMP
*  AND TIMP EQUAL TO 0.85
*
CALIB STANDHYD      ID  HYD  DT(min)  AREA(ha)   XIMP   TIMP   DWF   LOSS
                    8   203   5.0     54.6       0.85   0.85   0     2
                    CN    IA(mm)
                    76.8   2.5
                    PERVIOUS AREA:   DPSP(mm)  SLOPE(%)  LGP(m)  MNP   SCP(min)
                                               2.0       170     .250  0
                    IMPERVIOUS AREA: DPSI(mm)  SLOPE(%)  LGI(m)  MNI   SCI(min)
                                     1.57      2.0       30      .015  0
                    END -1
*
PRINT HYD           ID 8 NPCYC -1
*
*  SEPARATE OUT THE MAJOR AND MINOR FLOWS.  SPLIT  IS BASED ON THE 10 YEAR DEVELOPED
*  CONDITION FLOWS.  THIS AREA DOES NOT REQUIRE WATER QUALITY TREATMENT AT THE SWM
*  FACILITY.  MAJOR/MINOR SPLIT AT   13.2 cms.
*
COMPUTE DUHYD       ID=8  HYD=903  CINLET 13.2  NINLET 1
                    MAID  7   MIID  6
*
```

```
PRINT HYD           ID=7  NPCYC=1
*
*  ADD THE MAJOR FLOWS FROM THE AREA EAST OF HIGHWAY 10 TO THE TOTAL HYDROGRAPH
*
ADD HYD             ID  HYD NO  IDI  IDII
                     1   503     7    5
*
PRINT HYD           ID=1  NPCYC -1
*
****************************************
*   Route through Pond                 *
****************************************
*
ROUTE RESERVOIR     ID=3  HYD=907  IDIN=1   dt=5  MIN
                    DISCHARGE (cms)   STORAGE (ha m)
                      0.00                 0.000       EIGHTY POINT FIVE
                      0.011                0.283       EIGHTY POINT SIX
                      0.118                0.863       EIGHTY POINT EIGHT
                      0.265                1.463       EIGHTY ONE
                      0.355                2.083       EIGHTY ONE POINT TWO
                      0.392                2.400       EIGHTY ONE POINT THREE
                      0.458                3.050       EIGHTY ONE POINT FIVE
                      0.488                3.381       EIGHTY ONE POINT SIX
                      0.648                3.716       EIGHTY ONE POINT SEVEN
                      0.912                4.053       EIGHTY ONE POINT EIGHT
                      1.620                4.735       EIGHTY TWO
                      2.492                5.429       EIGHTY TWO POINT TWO
                      2.975                5.780       EIGHTY TWO POINT THREE
                      4.014                6.490       EIGHTY TWO POINT FIVE
                      5.132                7.211       EIGHTY TWO POINT SEVEN
                      6.312                7.944       EIGHTY TWO POINT NINE
                      7.538                8.688       EIGHTY THREE POINT ONE
                      9.469                9.443       EIGHTY THREE POINT THREE
                     14.518               10.223       EIGHTY THREE POINT FIVE
                     END=-1
*
PRINT HYD           ID=3  NPCYC=-1
*
*
*  CALCULATE THE EXISTING CONDITION FLOWS BASED ON
*  PARAGON'S DRAINAGE AREA.
*
CALIB NASHYD         ID 1  HYDNO  101  DT 15  AREA 163.6
                     DWF  0.0   CN 76.8  IA 15.35  N 3  TP 1.00
                     END -1
*
PRINT HYD            ID 1  NPCYC  -1
*
FINISH
```

DETAILED OUTPUT

```
=========================================================================================

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999  =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9 Ver. 4.02
     S   W W   M   M  H   H    Y    M   M  O   O       9999   9999 July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9 =========
                                                      9   9  9   9 # 2640114
      StormWater Management HYdrologic Model           999    999  =========

 ***************************************************************************
 ************************** SWMHYMO-99 Ver/4.02 ****************************
 *******  A single event and continuous hydrologic simulation model  *******
 *******     based on the principles of HYMO and its successors      *******
 *******                 OTTHYMO-83 and OTTHYMO-89.                  *******
 ***************************************************************************
 ******* Distributed by:  J.F. Sabourin and Associates Inc.           *******
 *******                 Ottawa,  Ontario: (613) 727-5199            *******
 *******                 Gatineau, Quebec: (819) 243-6858            *******
 *******                 E-Mail: swmhymo@jfsa.Com                    *******
 ***************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: The Sernas Group                             +++++++
 +++++++                Mississauga          SERIAL#:2640114         +++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ***************************************************************************
 *******           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *******
 *******           Maximum value for ID numbers  :     10            *******
 *******           Max. number of rainfall points:  15000            *******
 *******           Max. number of flow points    :  15000            *******
 ***************************************************************************


 ********************  D E T A I L E D   O U T P U T  *******************
 ***************************************************************************
 *       DATE: 2001-07-23     TIME: 17:04:59     RUN COUNTER: 000014      *
 ***************************************************************************
 * Input   filename: P:\SWM\00165~~1\THIRDS~1\swmhymo\Overland\165D00.DAT  *
 * Output  filename: P:\SWM\00165~~1\THIRDS~1\swmhymo\Overland\165D00.out  *
 * Summary filename: P:\SWM\00165~~1\THIRDS~1\swmhymo\Overland\165D00.sum  *
 * User comments:                                                          *
 * 1:_____________________________________________________________________*
 * 2:_____________________________________________________________________*
 * 3:_____________________________________________________________________*
 ***************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*****************************************************************
*
*  SHIPP LANDS
*  CITY OF MISSISSAUGA
*  STORM WATER MANAGEMENT STUDY
*  DEVELOPED CONDITION FLOWS
*
*  24 HOUR DESIGN STORM
*  100 YEAR STORM --- 139.12 mm TOTAL RAINFALL
*
*  NOVEMBER, 2000
*
*  REVISED APRIL 2001
*  REVISED JUNE  2001
*
*  PROJECT: 00165.400
*  DATA FILE:  165D00.SCS
*  G.M. SERNAS & ASSOCIATES LIMITED
```

```
*  A MEMBER OF THE SERNAS GROUP
*
*******************************************************************
*
--------------------
| START             |  Project  dir.: P:\SWM\00165--1\THIRDS~1\swmhymo\Overland\
--------------------  Rainfall dir.: P:\SWM\00165--1\THIRDS~1\swmhymo\Overland\
    TZERO =    .00 hrs on        0
    METOUT=    2 (output = METRIC)
    NRUN   = 001
    NSTORM=    1
            #   1=SCS00-12.STM
--------------------------------------------------------------------------------
001:0002------------------------------------------------------------------------
*
*  READ INPUT STORM TO BE MODELLED
*
--------------------
| READ STORM        |    Filename: P:\SWM\00165--1\THIRDS~1\swmhymo\Overlan
| Ptotal= 139.21 mm|    Comments: 100 YEAR STORM - 24 HOUR SCS (12 MIN TIM
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.20	1.390	6.20	2.640	12.20	27.100	18.20	2.230
.40	1.390	6.40	2.640	12.40	16.940	18.40	2.230
.60	1.390	6.60	2.640	12.60	12.190	18.60	2.230
.80	1.390	6.80	2.640	12.80	11.510	18.80	2.230
1.00	1.390	7.00	2.640	13.00	8.120	19.00	2.230
1.20	1.670	7.20	2.920	13.20	6.680	19.20	1.960
1.40	1.670	7.40	2.920	13.40	6.680	19.40	1.960
1.60	1.670	7.60	2.920	13.60	6.680	19.60	1.960
1.80	1.670	7.80	2.920	13.80	6.680	19.80	1.960
2.00	1.670	8.00	2.920	14.00	6.680	20.00	1.960
2.20	1.810	8.20	3.760	14.20	4.870	20.20	1.810
2.40	1.810	8.40	3.760	14.40	4.870	20.40	1.810
2.60	1.810	8.60	3.760	14.60	4.870	20.60	1.810
2.80	1.810	8.80	3.760	14.80	4.870	20.80	1.810
3.00	1.810	9.00	3.760	15.00	4.870	21.00	1.810
3.20	1.810	9.20	4.730	15.20	3.480	21.20	1.670
3.40	1.810	9.40	4.730	15.40	3.480	21.40	1.670
3.60	1.810	9.60	4.730	15.60	3.480	21.60	1.670
3.80	1.810	9.80	4.730	15.80	3.480	21.80	1.670
4.00	1.810	10.00	4.730	16.00	3.480	22.00	1.670
4.20	1.960	10.20	7.520	16.20	3.200	22.20	1.670
4.40	1.960	10.40	7.520	16.40	3.200	22.40	1.670
4.60	1.960	10.60	7.520	16.60	3.200	22.60	1.670
4.80	1.960	10.80	7.520	16.80	3.200	22.80	1.670
5.00	1.960	11.00	7.520	17.00	3.200	23.00	1.670
5.20	2.510	11.20	10.150	17.20	2.640	23.20	1.530
5.40	2.510	11.40	14.900	17.40	2.640	23.40	1.530
5.60	2.510	11.60	33.840	17.60	2.640	23.60	1.530
5.80	2.510	11.80	74.350	17.80	2.640	23.80	1.530
6.00	2.510	12.00	164.640	18.00	2.640	24.00	1.530

```
--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*
*  METRUS PROPERTIES INC. MODELLING INPUTTED FROM OUTPUT RECEIVED FROM
*  SCHAEFFERS CONSULTING ENGINERS ON MARCH 22, 2001.
*  SINCED THEY USED A THREE HOURS STORM AND THE WATERSHED MODELLING USED A
*  12 HOURS STORM,THEIR MODEL HAS BEEN USED WITH THE EXCEPTION OF THE STORM
*  THE SCHAEFFERS AREA NUMBERING SYSTEM HAS BEEN UTILIZED.
*
*  PARKING LOT AREA #101
*
----------------------
| DESIGN STANDHYD     |   Area     (ha)=     5.37
| 08:000101 DT= 2.50 |   Total Imp(%)=    91.00   Dir. Conn.(%)=    91.00
```

```
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      4.89          .48
     Dep. Storage      (mm)=       .80         1.50
     Average Slope      (%)=       .40          .40
     Length             (m)=    189.21        40.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=     164.64       138.72
                over (min)        3.00        15.00
     Storage Coeff.   (min)=      4.04 (ii)   14.07 (ii)
     Unit Hyd. Tpeak  (min)=      3.00        15.00
     Unit Hyd. peak   (cms)=       .30          .08
                                                           *TOTALS*
     PEAK FLOW        (cms)=      2.17          .12          2.273 (iii)
     TIME TO PEAK     (hrs)=     12.00        12.10         12.000
     RUNOFF VOLUME     (mm)=    138.41        58.73        131.237
     TOTAL RAINFALL    (mm)=    139.21       139.21        139.208
     RUNOFF COEFFICIENT    =       .99          .42           .943

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 50.00            K  (1/hr)=  2.00
            Fc    (mm/hr)=  7.50      Cum.Inf.   (mm)=   .00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |   AREA       (ha)=    5.370
| ID=08 (000101)    |   QPEAK     (cms)=    2.273 (i)
| DT= 3.00 PCYC=-1  |   TPEAK     (hrs)=   12.000
--------------------    VOLUME     (mm)=  131.237

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0005------------------------------------------------------------------------
*
*  ROOFTOP COLLECTION   WALMART WAREHOUSE
*
----------------------
| DESIGN STANDHYD     |   Area     (ha)=    4.02
| 03:000200 DT= 2.50  |   Total Imp(%)=   99.90   Dir. Conn.(%)=   99.90
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      4.02          .00
     Dep. Storage      (mm)=       .80         1.50
     Average Slope      (%)=       .10          .10
     Length             (m)=    163.71        40.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=     164.64       118.04
                over (min)        6.00        21.00
     Storage Coeff.   (min)=      5.61 (ii)   21.84 (ii)
     Unit Hyd. Tpeak  (min)=      6.00        21.00
     Unit Hyd. peak   (cms)=       .19          .05
                                                           *TOTALS*
     PEAK FLOW        (cms)=      1.66          .00          1.660 (iii)
     TIME TO PEAK     (hrs)=     12.00        12.20         12.000
     RUNOFF VOLUME     (mm)=    138.41        58.73        138.328
     TOTAL RAINFALL    (mm)=    139.21       139.21        139.208
     RUNOFF COEFFICIENT    =       .99          .42           .994

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 50.00            K  (1/hr)=  2.00
            Fc    (mm/hr)=  7.50      Cum.Inf.   (mm)=   .00
```

```
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |   AREA        (ha)=    4.020
| ID=03 (000200)    |   QPEAK      (cms)=    1.660 (i)
| DT= 3.00 PCYC=-1  |   TPEAK      (hrs)=   12.000
--------------------    VOLUME      (mm)=  138.328

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
*
*  ADD PARKING LOT AND ROOFTOP HYDROGRAPHS
*
--------------------
| ADD HYD (002000) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.     DWF
--------------------               (ha)      (cms)    (hrs)   (mm)    (cms)
               ID1 08:000101       5.37      2.273    12.00 131.24    .000
              +ID2 03:000200       4.02      1.660    12.00 138.33    .000
               =======================================================
               SUM 06:002000       9.39      3.933    12.00 134.27    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |   AREA        (ha)=    9.390
| ID=06 (002000)    |   QPEAK      (cms)=    3.933 (i)
| DT= 3.00 PCYC=-1  |   TPEAK      (hrs)=   12.000
--------------------    VOLUME      (mm)=  134.273

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0009------------------------------------------------------------------------
*
*  PARKING LOT AREA #102
*
----------------------
| DESIGN STANDHYD     |   Area     (ha)=    5.37
| 08:000102 DT= 2.50  |   Total Imp(%)=   91.00   Dir. Conn.(%)=   91.00
----------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      4.89           .48
     Dep. Storage      (mm)=       .80          1.50
     Average Slope      (%)=       .30           .30
     Length             (m)=    189.21         40.00
     Mannings n            =      .013          .250

     Max.eff.Inten.(mm/hr)=     164.64        138.72
               over (min)        3.00         15.00
     Storage Coeff.  (min)=       4.40 (ii)     15.34 (ii)
     Unit Hyd. Tpeak (min)=       3.00         15.00
     Unit Hyd. peak  (cms)=        .28           .07
                                                            *TOTALS*
     PEAK FLOW       (cms)=       2.15           .12          2.250 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.10         12.000
     RUNOFF VOLUME    (mm)=     138.40         58.73        131.237
     TOTAL RAINFALL   (mm)=     139.21        139.21        139.208
     RUNOFF COEFFICIENT   =        .99           .42           .943

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
```

```
001:0018-----------------------------------------------------------------------------
*
*  REMAINDER OF METRUS LANDS (20.3 HA,  0.5%, AND 901% IMPERVIOUS ASSUMED)
*
---------------------
| DESIGN STANDHYD    |   Area     (ha)=   20.30
| 01:000400 DT= 2.50 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      18.27         2.03
     Dep. Storage      (mm)=        .80         1.50
     Average Slope      (%)=        .50          .50
     Length             (m)=     367.88        40.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     164.64       138.72
               over (min)         6.00        15.00
     Storage Coeff.  (min)=       5.63 (ii)   15.01 (ii)
     Unit Hyd. Tpeak (min)=       6.00        15.00
     Unit Hyd. peak  (cms)=        .19          .08
                                                            *TOTALS*
     PEAK FLOW       (cms)=       7.54          .51          7.960 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.10         12.000
     RUNOFF VOLUME    (mm)=     138.40        58.73        130.440
     TOTAL RAINFALL   (mm)=     139.21       139.21        139.208
     RUNOFF COEFFICIENT   =        .99          .42           .937

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 50.00           K  (1/hr)=  2.00
            Fc    (mm/hr)=  7.50     Cum.Inf.   (mm)=   .00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
001:0019-----------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |    AREA       (ha)=   20.300
| ID=01 (000400)    |    QPEAK     (cms)=    7.960 (i)
| DT= 3.00 PCYC=-1  |    TPEAK     (hrs)=   12.000
--------------------     VOLUME     (mm)=  130.440

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-----------------------------------------------------------------------------
001:0020-----------------------------------------------------------------------------
*
*  ADD PARKING LOT AND ROOFTOP HYDROGRAPHS
*
--------------------
| ADD HYD (002400) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.     DWF
--------------------               (ha)      (cms)    (hrs)   (mm)    (cms)
                ID1 03:002001     16.42     8.064    12.00 133.69    .000
               +ID2 01:000400     20.30     7.960    12.00 130.44    .000
                ==================================================
                SUM 07:002400     36.72    16.024    12.00 131.89    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
001:0021-----------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |    AREA       (ha)=   36.720
| ID=07 (002400)    |    QPEAK     (cms)=   16.024 (i)
| DT= 3.00 PCYC=-1  |    TPEAK     (hrs)=   12.000
--------------------     VOLUME     (mm)=  131.893
```

```
     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-----------------------------------------------------------------------------
001:0022---------------------------------------------------------------------
*
*  MINOR SYSTEM FLOWS TO POND
*
*
---------------------
| COMPUTE DUHYD        |   Average inlet capacities   [CINLET] =   5.680  (cms)
| TotalHyd 07:002400 |   Number of inlets in system [NINLET] =       1
---------------------      Total minor system capacity         =   5.680  (cms)
                           Total major system storage [TMJSTO] =       0.(cu.m.)

                ID: NHYD          AREA      QPEAK      TPEAK      R.V.      DWF
                                  (ha)      (cms)      (hrs)      (mm)     (cms)
    TOTAL HYD.  07:002400        36.72     16.024     12.000   131.893     .000
    ==========================================================================
    MAJOR SYST  10:001102         6.09     10.344     12.000   131.893     .000
    MINOR SYST  01:101102        30.63      5.680     11.700   131.893     .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

     *** NOTE: Use the new COMPUTE DUALHYD command and you
               can enter NHYD values for both the major and
               minor hydrographs.  A variable for the use of
               major system storage is also available.
-----------------------------------------------------------------------------
001:0023---------------------------------------------------------------------
*
*  PARKING LOT AREA #100
*
---------------------
| DESIGN STANDHYD      |   Area     (ha)=     4.79
| 04:000100 DT= 2.50 |   Total Imp(%)=   91.00   Dir. Conn.(%)=   91.00
---------------------
                                IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=        4.36           .43
    Dep. Storage      (mm)=         .80          1.50
    Average Slope      (%)=         .30           .30
    Length             (m)=      178.70         40.00
    Mannings n            =        .013          .250

    Max.eff.Inten.(mm/hr)=       164.64        138.72
               over (min)          3.00         15.00
    Storage Coeff.  (min)=         4.25 (ii)    15.19 (ii)
    Unit Hyd. Tpeak (min)=         3.00         15.00
    Unit Hyd. peak  (cms)=          .29           .07
                                                            *TOTALS*
    PEAK FLOW       (cms)=         1.93           .11         2.014 (iii)
    TIME TO PEAK    (hrs)=        12.00         12.10        12.000
    RUNOFF VOLUME    (mm)=       138.41         58.73       131.237
    TOTAL RAINFALL   (mm)=       139.21        139.21       139.208
    RUNOFF COEFFICIENT   =          .99           .42          .943

      (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo    (mm/hr)= 50.00             K  (1/hr)=  2.00
           Fc    (mm/hr)=  7.50     Cum.Inf.   (mm)=    .00
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
001:0024---------------------------------------------------------------------
*
--------------------
| PRINT HYD           |   AREA      (ha)=     4.790
| ID=04 (000100)      |   QPEAK     (cms)=     2.014 (i)
| DT= 3.00 PCYC=-1 |   TPEAK     (hrs)=    12.000
```

```
        Fo    (mm/hr)= 50.00            K  (1/hr)=  2.00
        Fc    (mm/hr)=  7.50     Cum.Inf.    (mm)=    .00
   (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
        THAN THE STORAGE COEFFICIENT.
  (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0010-----------------------------------------------------------------------
*
--------------------
| PRINT HYD         |   AREA       (ha)=    5.370
| ID=08 (000102)    |   QPEAK     (cms)=    2.250 (i)
| DT= 3.00 PCYC=-1  |   TPEAK     (hrs)=   12.000
--------------------    VOLUME      (mm)=  131.237

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-------------------------------------------------------------------------------
001:0011-----------------------------------------------------------------------
*
*  ADD PARKING LOT HYDROGRAPHS
*
--------------------
| ADD HYD (002002) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.      DWF
--------------------               (ha)      (cms)    (hrs)   (mm)    (cms)
                 ID1 08:000102     5.37      2.250    12.00 131.24     .000
                +ID2 06:002000     9.39      3.933    12.00 134.27     .000
                 ======================================================
                 SUM 10:002002    14.76      6.183    12.00 133.17     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
001:0012-----------------------------------------------------------------------
*
--------------------
| PRINT HYD         |   AREA       (ha)=   14.760
| ID=10 (002002)    |   QPEAK     (cms)=    6.183 (i)
| DT= 3.00 PCYC=-1  |   TPEAK     (hrs)=   12.000
--------------------    VOLUME      (mm)=  133.168

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-------------------------------------------------------------------------------
001:0013-----------------------------------------------------------------------
*
*  ROOFTOP STORAGE   WALMART WAREHOUSE
*
----------------------
| DESIGN STANDHYD     |   Area    (ha)=     5.38
| 02:000201 DT= 2.50  |   Total Imp(%)=    99.90   Dir. Conn.(%)=   99.90
----------------------
                               IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=       5.37           .01
    Dep. Storage      (mm)=        .80          1.50
    Average Slope      (%)=        .10           .10
    Length             (m)=     189.39         40.00
    Mannings n           =        .013          .250

    Max.eff.Inten.(mm/hr)=      164.64        111.56
             over (min)          6.00         24.00
    Storage Coeff.  (min)=       6.13 (ii)    22.72 (ii)
    Unit Hyd. Tpeak (min)=       6.00         24.00
    Unit Hyd. peak  (cms)=        .18           .05
                                                            *TOTALS*
    PEAK FLOW       (cms)=       2.18           .00           2.181 (iii)
    TIME TO PEAK    (hrs)=      12.00         12.25          12.000
    RUNOFF VOLUME    (mm)=     138.41         58.73         138.328
    TOTAL RAINFALL   (mm)=     139.21        139.21         139.208
    RUNOFF COEFFICIENT   =        .99           .42            .994
```

```
       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo    (mm/hr)= 50.00           K  (1/hr)=  2.00
           Fc    (mm/hr)=  7.50     Cum.Inf.   (mm)=   .00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0014------------------------------------------------------------------------
*
--------------------
| PRINT HYD          |   AREA       (ha)=    5.380
| ID=02 (000201)     |   QPEAK     (cms)=    2.181 (i)
| DT= 3.00 PCYC=-1   |   TPEAK     (hrs)=   12.000
--------------------     VOLUME     (mm)=  138.328

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0015------------------------------------------------------------------------
*
*  BASEFLOW TO OPEN SPACE SYSTEM
*
----------------------
| COMPUTE DUHYD        |   Average inlet capacities   [CINLET] =     .300  (cms)
| TotalHyd 02:000201   |   Number of inlets in system [NINLET] =       1
----------------------     Total minor system capacity         =     .300  (cms)
                           Total major system storage [TMJSTO] =       0.(cu.m.)

                ID: NHYD         AREA      QPEAK      TPEAK      R.V.        DWF
                                 (ha)      (cms)      (hrs)      (mm)      (cms)
     TOTAL HYD.   02:000201      5.38      2.181     12.000   138.328       .000
     ===========================================================================
     MAJOR SYST   07:001201      1.66      1.881     12.000   138.328       .000
     MINOR SYST   08:101201      3.72       .300     11.500   138.328       .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      *** NOTE: Use the new COMPUTE DUALHYD command and you
                can enter NHYD values for both the major and
                minor hydrographs.  A variable for the use of
                major system storage is also available.
--------------------------------------------------------------------------------
001:0016------------------------------------------------------------------------
*
*  ADD PARKING LOT AND ROOFTOP HYDROGRAPHS
*
--------------------
| ADD HYD (002001) | ID: NHYD      AREA      QPEAK    TPEAK    R.V.     DWF
--------------------                (ha)     (cms)    (hrs)    (mm)    (cms)
                 ID1 10:002002     14.76     6.183    12.00  133.17     .000
                +ID2 07:001201      1.66     1.881    12.00  138.33     .000
                 ==========================================================
                 SUM 03:002001     16.42     8.064    12.00  133.69     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0017------------------------------------------------------------------------
*
--------------------
| PRINT HYD          |   AREA       (ha)=   16.420
| ID=03 (002001)     |   QPEAK     (cms)=    8.064 (i)
| DT= 3.00 PCYC=-1   |   TPEAK     (hrs)=   12.000
--------------------     VOLUME     (mm)=  133.690

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
```

```
     Mannings n             =       .013          .250

     Max.eff.Inten.(mm/hr)=      164.64        138.72
              over (min)          3.00         15.00
     Storage Coeff.  (min)=       3.97 (ii)    14.91 (ii)
     Unit Hyd. Tpeak (min)=       3.00         15.00
     Unit Hyd. peak  (cms)=        .30           .08
                                                            *TOTALS*
     PEAK FLOW       (cms)=       1.54           .09          1.609 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.10         12.000
     RUNOFF VOLUME    (mm)=     138.41         58.73        131.237
     TOTAL RAINFALL   (mm)=     139.21        139.21        139.208
     RUNOFF COEFFICIENT   =        .99           .42           .943

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo    (mm/hr)= 50.00          K  (1/hr)=  2.00
           Fc    (mm/hr)=  7.50     Cum.Inf.   (mm)=   .00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0033------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |   AREA       (ha)=    3.800
| ID=07 (000104)    |   QPEAK     (cms)=    1.609 (i)
| DT= 3.00 PCYC=-1  |   TPEAK     (hrs)=   12.000
--------------------    VOLUME     (mm)=  131.237

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0034------------------------------------------------------------------------
*
*  THERE WILL BE 7 CBS AT APPROXIMATELY 0.11 CMS EACH
*
----------------------
| COMPUTE DUHYD        |   Average inlet capacities   [CINLET] =    .770  (cms)
| TotalHyd 07:000104   |   Number of inlets in system [NINLET] =       1
----------------------     Total minor system capacity         =    .770  (cms)
                           Total major system storage [TMJSTO] =       0.(cu.m.)

                   ID: NHYD          AREA      QPEAK      TPEAK      R.V.      DWF
                                     (ha)      (cms)      (hrs)      (mm)     (cms)
     TOTAL HYD.    07:000104         3.80      1.609     12.000   131.237      .000
     ==========================================================================
     MAJOR SYST    06:000104          .40       .839     12.000   131.237      .000
     MINOR SYST    01:100104         3.40       .770     11.850   131.237      .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      *** NOTE: Use the new COMPUTE DUALHYD command and you
                can enter NHYD values for both the major and
                minor hydrographs.  A variable for the use of
                major system storage is also available.
--------------------------------------------------------------------------------
001:0035------------------------------------------------------------------------
*
*  ADD HYDROGRAPHS
*
--------------------
| ADD HYD (001106) | ID: NHYD        AREA      QPEAK     TPEAK  R.V.       DWF
--------------------                 (ha)      (cms)     (hrs)  (mm)      (cms)
                  ID1 01:100104      3.40       .770     11.85 131.24      .000
                 +ID2 02:002004     40.38      9.872     12.00 132.52      .000
                 =======================================================
                  SUM 04:001106     43.79     10.642     12.00 132.42      .000
```

```
   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------
001:0036----------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |    AREA       (ha)=    43.789
| ID=04 (001106)    |    QPEAK     (cms)=    10.642 (i)
| DT= 3.00 PCYC=-1  |    TPEAK     (hrs)=    12.000
--------------------     VOLUME     (mm)=   132.418

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
------------------------------------------------------------------------------------
001:0037----------------------------------------------------------------------------
*
*  ADD HYDROGRAPHS
*
--------------------
| ADD HYD (002500) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.      DWF
--------------------                (ha)      (cms)    (hrs)   (mm)     (cms)
               ID1 10:001102        6.09     10.344    12.00 131.89     .000
              +ID2 06:000104         .40       .839    12.00 131.24     .000
               =========================================================
               SUM 05:002500        6.48     11.183    12.00 131.85     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------
001:0038----------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |    AREA       (ha)=     6.482
| ID=05 (002500)    |    QPEAK     (cms)=    11.183 (i)
| DT= 3.00 PCYC=-1  |    TPEAK     (hrs)=    12.000
--------------------     VOLUME     (mm)=   131.853

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
------------------------------------------------------------------------------------
001:0039----------------------------------------------------------------------------
*
* PARKING LOT AREA #105
*
----------------------
| DESIGN STANDHYD     |    Area     (ha)=     2.44
| 07:000105 DT= 2.50  |    Total Imp(%)=    91.00    Dir. Conn.(%)=    91.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=       2.22          .22
    Dep. Storage      (mm)=        .80         1.50
    Average Slope      (%)=        .30          .30
    Length             (m)=     127.54        40.00
    Mannings n            =       .013         .250

    Max.eff.Inten.(mm/hr)=      164.64       138.72
             over (min)          3.00        15.00
    Storage Coeff.  (min)=        3.48 (ii)   14.41 (ii)
    Unit Hyd. Tpeak (min)=        3.00        15.00
    Unit Hyd. peak  (cms)=         .33          .08
                                                         *TOTALS*
    PEAK FLOW       (cms)=        1.00          .06        1.043 (iii)
    TIME TO PEAK    (hrs)=       12.00        12.10       12.000
    RUNOFF VOLUME    (mm)=      138.41        58.73      131.237
    TOTAL RAINFALL   (mm)=      139.21       139.21      139.208
    RUNOFF COEFFICIENT   =         .99          .42         .943

      (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo    (mm/hr)= 50.00           K  (1/hr)=  2.00
           Fc    (mm/hr)=  7.50      Cum.Inf.    (mm)=   .00
```

```
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0040------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |    AREA        (ha)=     2.440
| ID=07 (000105)    |    QPEAK      (cms)=     1.043 (i)
| DT= 3.00 PCYC=-1  |    TPEAK      (hrs)=    12.000
--------------------     VOLUME      (mm)=   131.237

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0041------------------------------------------------------------------------
*
*  THERE WILL BE 3 CBS AT APPROXIMATELY 0.11 CMS EACH
*
----------------------
| COMPUTE DUHYD        |   Average inlet capacities   [CINLET] =    .330  (cms)
| TotalHyd 07:000105   |   Number of inlets in system [NINLET] =      1
----------------------     Total minor system capacity         =    .330  (cms)
                           Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD           AREA      QPEAK      TPEAK      R.V.       DWF
                                     (ha)      (cms)      (hrs)      (mm)      (cms)
     TOTAL HYD.   07:000105          2.44      1.043     12.000   131.237      .000
     ==========================================================================
     MAJOR SYST   06:000105           .43       .713     12.000   131.237      .000
     MINOR SYST   01:100105          2.01       .330     11.650   131.237      .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      *** NOTE: Use the new COMPUTE DUALHYD command and you
                can enter NHYD values for both the major and
                minor hydrographs.  A variable for the use of
                major system storage is also available.
--------------------------------------------------------------------------------
001:0042------------------------------------------------------------------------
*
*  ADD HYDROGRAPHS  MINOR FLOWS TO POND
*
--------------------
| ADD HYD (002520) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.      DWF
--------------------               (ha)      (cms)    (hrs)   (mm)     (cms)
                 ID1 01:100105      2.01       .330    11.65 131.24      .000
                +ID2 04:001106     43.79     10.642    12.00 132.42      .000
                 ====================================================
                 SUM 03:002520     45.80     10.972    12.00 132.37      .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0043------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |    AREA        (ha)=    45.797
| ID=03 (002520)    |    QPEAK      (cms)=    10.972 (i)
| DT= 3.00 PCYC=-1  |    TPEAK      (hrs)=    12.000
--------------------     VOLUME      (mm)=   132.366

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0044------------------------------------------------------------------------
*
*  ADD HYDROGRAPHS  MAJOR FLOWS TO POND
*
```

```
--------------------
| ADD HYD (002520) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.     DWF
--------------------               (ha)     (cms)    (hrs)   (mm)    (cms)
                 ID1 06:000105      .43      .713    12.00 131.24    .000
                +ID2 05:002500     6.48    11.183    12.00 131.85    .000
                 ==========================================================
                 SUM 08:002520     6.91    11.896    12.00 131.81    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0045------------------------------------------------------------------------
*
--------------------
| PRINT HYD        |   AREA      (ha)=    6.914
| ID=08 (002520)   |   QPEAK    (cms)=   11.896 (i)
| DT= 3.00 PCYC=-1 |   TPEAK    (hrs)=   12.000
--------------------   VOLUME    (mm)=  131.815

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0046------------------------------------------------------------------------
*
*  ADD HYDROGRAPHS  TOTAL FLOWS TO POND
*
--------------------
| ADD HYD (002600) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.     DWF
--------------------               (ha)     (cms)    (hrs)   (mm)    (cms)
                 ID1 03:002520    45.80    10.972    12.00 132.37    .000
                +ID2 08:002520     6.91    11.896    12.00 131.81    .000
                 ==========================================================
                 SUM 05:002600    52.71    22.869    12.00 132.29    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0047------------------------------------------------------------------------
*
--------------------
| PRINT HYD        |   AREA      (ha)=   52.710
| ID=05 (002600)   |   QPEAK    (cms)=   22.869 (i)
| DT= 3.00 PCYC=-1 |   TPEAK    (hrs)=   12.000
--------------------   VOLUME    (mm)=  132.294

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0048------------------------------------------------------------------------
*
*  ALL AREAS UP TO THIS POINT IS FROM SCHAEFFERS DATA
*
*  ADD HANSA HOUSE
*
*  AREA 701 --- ROOF AREA BASED ON 40% COVERAGE
*
----------------------
| CALIB STANDHYD     |   Area     (ha)=    3.60
| 01:000701 DT= 5.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=      3.56          .04
    Dep. Storage      (mm)=      1.57         1.00
    Average Slope      (%)=      1.00         1.00
    Length             (m)=     30.00        30.00
    Mannings n           =      .015         .250

    Max.eff.Inten.(mm/hr)=    164.64       153.99
             over (min)        6.00         6.00
    Storage Coeff.  (min)=      1.11 (ii)    7.26 (ii)
```

```
     Unit Hyd. Tpeak (min)=        6.00          6.00
     Unit Hyd. peak  (cms)=         .28           .16
                                                               *TOTALS*
     PEAK FLOW       (cms)=        1.63           .01           1.643 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00          12.000
     RUNOFF VOLUME    (mm)=      137.64        114.77         137.409
     TOTAL RAINFALL   (mm)=      139.21        139.21         139.208
     RUNOFF COEFFICIENT   =         .99           .82            .987
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  90.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0049------------------------------------------------------------------------
*
--------------------
| PRINT HYD          |   AREA       (ha)=    3.600
| ID=01 (000701)     |   QPEAK     (cms)=    1.643 (i)
| DT= 6.00 PCYC=-1 |     TPEAK     (hrs)=   12.000
--------------------     VOLUME     (mm)=  137.409

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0050------------------------------------------------------------------------
*
*  AREA 702 --- THIS AREA REPRESENTS THE PAVED AND LANDSCAPED AREAS FOR
*  THE SHIPP/HIGGINS LANDS.  IT IS ASSUMED TO BE 50% COVERAGE
*
----------------------
| CALIB STANDHYD       |   Area     (ha)=    4.50
| 02:000702 DT= 5.00 |     Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=        4.05           .45
     Dep. Storage      (mm)=        1.57          2.50
     Average Slope      (%)=        2.00          2.00
     Length             (m)=       30.00        251.00
     Mannings n            =        .015          .250

     Max.eff.Inten.(mm/hr)=       164.64         83.91
               over (min)          6.00         24.00
     Storage Coeff.  (min)=         .90 (ii)     23.69 (ii)
     Unit Hyd. Tpeak (min)=        6.00         24.00
     Unit Hyd. peak  (cms)=         .28           .05
                                                               *TOTALS*
     PEAK FLOW       (cms)=        1.85           .07           1.896 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.30          12.000
     RUNOFF VOLUME    (mm)=      137.64         87.56         132.630
     TOTAL RAINFALL   (mm)=      139.21        139.21         139.208
     RUNOFF COEFFICIENT   =         .99           .63            .953
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  76.8    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0051------------------------------------------------------------------------
*
--------------------
```

```
| PRINT HYD          |   AREA       (ha)=    4.500
| ID=02 (000702)     |   QPEAK      (cms)=    1.896 (i)
| DT= 6.00 PCYC=-1   |   TPEAK      (hrs)=   12.000
--------------------     VOLUME      (mm)=  132.630

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0052------------------------------------------------------------------------
*
*  AREA 703 --- THIS AREA REPRESENTS THE ROAD AREA WITHIN THE SHIPP/HIGGINS
*  LANDS.  THIS AREA REPRESENTS 10% OF THE TOTAL AREA.
*  A TIMP AND XIMP OF 0.65 HAS BEEN USED.
*
----------------------
| CALIB STANDHYD       |   Area    (ha)=     .90
| 03:000703 DT= 5.00   |   Total Imp(%)=   65.00   Dir. Conn.(%)=   65.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=         .58           .31
     Dep. Storage      (mm)=        1.57          2.50
     Average Slope     (%)=         2.00          2.00
     Length            (m)=        30.00        170.00
     Mannings n           =         .015          .250

     Max.eff.Inten.(mm/hr)=       164.64         96.84
               over (min)          6.00         18.00
     Storage Coeff.  (min)=          .90 (ii)    17.93 (ii)
     Unit Hyd. Tpeak (min)=         6.00         18.00
     Unit Hyd. peak  (cms)=          .28           .06
                                                              *TOTALS*
     PEAK FLOW       (cms)=          .27           .05          .311 (iii)
     TIME TO PEAK    (hrs)=        12.00         12.20        12.000
     RUNOFF VOLUME    (mm)=       137.64         87.56       120.111
     TOTAL RAINFALL   (mm)=       139.21        139.21       139.208
     RUNOFF COEFFICIENT   =          .99           .63          .863
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =   76.8     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0053------------------------------------------------------------------------
*
--------------------
| PRINT HYD          |   AREA       (ha)=     .900
| ID=03 (000703)     |   QPEAK      (cms)=     .311 (i)
| DT= 6.00 PCYC=-1   |   TPEAK      (hrs)=   12.000
--------------------     VOLUME      (mm)=  120.111

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0054------------------------------------------------------------------------
*
*  ADD ROOF, PAVED AND LANDSCAPED AND ROAD AREA FOR FULL HYDROGRAPH
*  FROM HANSA HOUSE
*
--------------------
| ADD HYD (000704) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.      DWF
--------------------               (ha)      (cms)    (hrs)   (mm)     (cms)
                  ID1 01:000701     3.60     1.643    12.00 137.41     .000
                 +ID2 02:000702     4.50     1.896    12.00 132.63     .000
                  ==================================================
                  SUM 04:000704     8.10     3.539    12.00 134.75     .000
```

```
 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------
001:0055-------------------------------------------------------------------------
*
--------------------
| PRINT HYD          |   AREA       (ha)=    8.100
| ID=04 (000704)     |   QPEAK     (cms)=    3.539 (i)
| DT= 6.00 PCYC=-1 |   TPEAK     (hrs)=   12.000
--------------------   VOLUME      (mm)=  134.754

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
---------------------------------------------------------------------------------
001:0056-------------------------------------------------------------------------
*
--------------------
| ADD HYD (000705) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.     DWF
--------------------               (ha)      (cms)    (hrs)   (mm)    (cms)
                 ID1 04:000704     8.10      3.539    12.00 134.75    .000
                +ID2 03:000703      .90       .311    12.00 120.11    .000
                 ===================================================
                 SUM 02:000705     9.00      3.850    12.00 133.29    .000

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------
001:0057-------------------------------------------------------------------------
*
--------------------
| PRINT HYD          |   AREA       (ha)=    9.000
| ID=02 (000705)     |   QPEAK     (cms)=    3.850 (i)
| DT= 6.00 PCYC=-1 |   TPEAK     (hrs)=   12.000
--------------------   VOLUME      (mm)=  133.290

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
---------------------------------------------------------------------------------
001:0058-------------------------------------------------------------------------
*
*  ADD TOTAL FLOWS AND HANSA HOUSE FLOWS
*  ADD HYDROGRAPHS  TOTAL FLOWS TO POND
*
--------------------
| ADD HYD (002700) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.     DWF
--------------------               (ha)      (cms)    (hrs)   (mm)    (cms)
                 ID1 05:002600    52.71     22.869    12.00 132.29    .000
                +ID2 02:000705     9.00      3.850    12.00 133.29    .000
                 ===================================================
                 SUM 07:002700    61.71     26.718    12.00 132.44    .000

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------
001:0059-------------------------------------------------------------------------
*
--------------------
| PRINT HYD          |   AREA       (ha)=   61.710
| ID=07 (002700)     |   QPEAK     (cms)=   26.718 (i)
| DT= 3.00 PCYC=-1 |   TPEAK.    (hrs)=   12.000
--------------------   VOLUME      (mm)=  132.439

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
---------------------------------------------------------------------------------
001:0060-------------------------------------------------------------------------
*
*  AREA 103, 203 AND 303 REPRESENTS THE SHIPP/HIGGINS LANDS
*  AREA 204  REPRESENTS THE LANDS EAST OF HURONTARIO
*
*
```

```
                                    (ha)     (cms)     (hrs)      (mm)     (cms)
   TOTAL HYD.    08:000203          54.60    22.345    12.000   130.126     .000
   ==========================================================================
   MAJOR SYST    07:000903           4.95     9.145    12.000   130.126     .000
   MINOR SYST    06:100903          49.65    13.200    11.900   130.126     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

    *** NOTE: Use the new COMPUTE DUALHYD command and you
              can enter NHYD values for both the major and
              minor hydrographs.  A variable for the use of
              major system storage is also available.
--------------------------------------------------------------------------------
001:0079------------------------------------------------------------------------
*
--------------------
| PRINT HYD          |   AREA      (ha)=     4.951
| ID=07 (000903)     |   QPEAK    (cms)=     9.145 (i)
| DT= 6.00 PCYC= 1   |   TPEAK    (hrs)=    12.000
--------------------     VOLUME    (mm)=   130.126

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
   TIME      FLOW |  TIME     FLOW |  TIME     FLOW |  TIME     FLOW |  TIME     FLOW
    hrs       cms |   hrs      cms |   hrs      cms |   hrs      cms |   hrs      cms
    .00      .000|   2.50     .000|   5.00     .000|   7.50     .000|  10.00     .000
    .10      .000|   2.60     .000|   5.10     .000|   7.60     .000|  10.10     .000
    .20      .000|   2.70     .000|   5.20     .000|   7.70     .000|  10.20     .000
    .30      .000|   2.80     .000|   5.30     .000|   7.80     .000|  10.30     .000
    .40      .000|   2.90     .000|   5.40     .000|   7.90     .000|  10.40     .000
    .50      .000|   3.00     .000|   5.50     .000|   8.00     .000|  10.50     .000
    .60      .000|   3.10     .000|   5.60     .000|   8.10     .000|  10.60     .000
    .70      .000|   3.20     .000|   5.70     .000|   8.20     .000|  10.70     .000
    .80      .000|   3.30     .000|   5.80     .000|   8.30     .000|  10.80     .000
    .90      .000|   3.40     .000|   5.90     .000|   8.40     .000|  10.90     .000
   1.00      .000|   3.50     .000|   6.00     .000|   8.50     .000|  11.00     .000
   1.10      .000|   3.60     .000|   6.10     .000|   8.60     .000|  11.10     .000
   1.20      .000|   3.70     .000|   6.20     .000|   8.70     .000|  11.20     .000
   1.30      .000|   3.80     .000|   6.30     .000|   8.80     .000|  11.30     .000
   1.40      .000|   3.90     .000|   6.40     .000|   8.90     .000|  11.40     .000
   1.50      .000|   4.00     .000|   6.50     .000|   9.00     .000|  11.50     .000
   1.60      .000|   4.10     .000|   6.60     .000|   9.10     .000|  11.60     .000
   1.70      .000|   4.20     .000|   6.70     .000|   9.20     .000|  11.70     .000
   1.80      .000|   4.30     .000|   6.80     .000|   9.30     .000|  11.80     .000
   1.90      .000|   4.40     .000|   6.90     .000|   9.40     .000|  11.90    8.751
   2.00      .000|   4.50     .000|   7.00     .000|   9.50     .000|  12.00    9.145
   2.10      .000|   4.60     .000|   7.10     .000|   9.60     .000|
   2.20      .000|   4.70     .000|   7.20     .000|   9.70     .000|
   2.30      .000|   4.80     .000|   7.30     .000|   9.80     .000|
   2.40      .000|   4.90     .000|   7.40     .000|   9.90     .000|
--------------------------------------------------------------------------------
001:0080------------------------------------------------------------------------
*
*  ADD THE MAJOR FLOWS FROM THE AREA EAST OF HIGHWAY 10 TO THE TOTAL HYDROGRAPH
*
--------------------
| ADD HYD (000503) | ID: NHYD       AREA      QPEAK    TPEAK   R.V.      DWF
--------------------                (ha)      (cms)    (hrs)   (mm)     (cms)
                ID1 07:000903       4.95      9.145    12.00  130.13     .000
               +ID2 05:000502     128.85     44.548    12.00  133.23     .000
                ===================================================
                SUM 01:000503     133.80     52.057    11.95  131.27     .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0081------------------------------------------------------------------------
*
--------------------
```

```
| PRINT HYD           |   AREA        (ha)=  133.797
| ID=01 (000503)      |   QPEAK      (cms)=   52.057 (i)
| DT= 3.00 PCYC=-1    |   TPEAK      (hrs)=   11.950
---------------------     VOLUME      (mm)=  131.269

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0082------------------------------------------------------------------------
*
****************************************
*   Route through Pond                 *
****************************************
*
---------------------
| ROUTE RESERVOIR     |     Requested routing time step =  5.0 min.
|  IN>01:(000503)     |
| OUT<03:(000907)     |     =========  OUTLFOW STORAGE TABLE  =========
---------------------       OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                             (cms)     (ha.m.)   |   (cms)     (ha.m.)
                              .000  .0000E+00    |   1.620  .4735E+01
                              .011  .2830E+00    |   2.492  .5429E+01
                              .118  .8630E+00    |   2.975  .5780E+01
                              .265  .1463E+01    |   4.014  .6490E+01
                              .355  .2083E+01    |   5.132  .7211E+01
                              .392  .2400E+01    |   6.312  .7944E+01
                              .458  .3050E+01    |   7.538  .8688E+01
                              .488  .3381E+01    |   9.469  .9443E+01
                              .648  .3716E+01    |  14.518  .1022E+02
                              .912  .4053E+01    |    .000  .0000E+00

     ROUTING RESULTS              AREA      QPEAK      TPEAK        R.V.
     --------------------         (ha)      (cms)      (hrs)        (mm)
     INFLOW >01: (000503)       133.80     52.057     11.950     131.269
     OUTFLOW<03: (000907)       133.80      9.549     12.300     131.262

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   18.344
                  TIME SHIFT OF PEAK FLOW         (min)=    21.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.9463E+01

--------------------------------------------------------------------------------
001:0083------------------------------------------------------------------------
*
---------------------
| PRINT HYD           |   AREA        (ha)=  133.797
| ID=03 (000907)      |   QPEAK      (cms)=    9.549 (i)
| DT= 3.00 PCYC=-1    |   TPEAK      (hrs)=   12.300
---------------------     VOLUME      (mm)=  131.262

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0084------------------------------------------------------------------------
*
*
*  CALCULATE THE EXISTING CONDITION FLOWS BASED ON
*  PARAGON'S DRAINAGE AREA.
*
----------------------
| CALIB NASHYD         |   Area     (ha)=  163.60   Curve Number   (CN)=76.80
| 01:000101 DT=15.00   |   Ia       (mm)=  15.350   # of Linear Res.(N)= 3.00
----------------------     U.H. Tp(hrs)=    1.000

     Unit Hyd Qpeak  (cms)=    6.249

     PEAK FLOW       (cms)=   10.456 (i)
     TIME TO PEAK    (hrs)=   12.800
     RUNOFF VOLUME    (mm)=   69.490
     TOTAL RAINFALL   (mm)=  139.208
     RUNOFF COEFFICIENT   =     .499
```

```
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0085------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |    AREA       (ha)=  163.600
| ID=01 (000101)    |    QPEAK      (cms)=   10.456 (i)
| DT=12.00 PCYC=-1  |    TPEAK      (hrs)=   12.800
--------------------     VOLUME      (mm)=   69.490

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0086------------------------------------------------------------------------
*
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0015 COMPUTE DUHYD
      *** NOTE: Use the new COMPUTE DUALHYD command and you
                can enter NHYD values for both the major and
                minor hydrographs.  A variable for the use of
                major system storage is also available.
 001:0022 COMPUTE DUHYD
      *** NOTE: Use the new COMPUTE DUALHYD command and you
                can enter NHYD values for both the major and
                minor hydrographs.  A variable for the use of
                major system storage is also available.
 001:0029 COMPUTE DUHYD
      *** NOTE: Use the new COMPUTE DUALHYD command and you
                can enter NHYD values for both the major and
                minor hydrographs.  A variable for the use of
                major system storage is also available.
 001:0034 COMPUTE DUHYD
      *** NOTE: Use the new COMPUTE DUALHYD command and you
                can enter NHYD values for both the major and
                minor hydrographs.  A variable for the use of
                major system storage is also available.
 001:0041 COMPUTE DUHYD
      *** NOTE: Use the new COMPUTE DUALHYD command and you
                can enter NHYD values for both the major and
                minor hydrographs.  A variable for the use of
                major system storage is also available.
 001:0048 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0050 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0052 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0060 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0062 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0068 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0076 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0078 COMPUTE DUHYD
```

```
     *** NOTE: Use the new COMPUTE DUALHYD command and you
               can enter NHYD values for both the major and
               minor hydrographs.  A variable for the use of
               major system storage is also available.
   Simulation ended on 2001-07-23     at 17:05:00
==============================================================================
```

SUMMARY OUTPUT

```
===========================================================================================
SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999   =========
S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9  Ver. 4.02
    S   W W   M   M  H   H    Y    M   M  O   O       9999   9999  July 1999
SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9  =========
                                                     9   9  9   9  # 2640114
     StormWater Management HYdrologic Model            999    999  =========

**********************************************************************
************************* SWMHYMO-99 Ver/4.02 ************************
*******  A single event and continuous hydrologic simulation model  *******
*******    based on the principles of HYMO and its successors       *******
*******                OTTHYMO-83 and OTTHYMO-89.                   *******
**********************************************************************
******* Distributed by:  J.F. Sabourin and Associates Inc.          *******
*******                  Ottawa,  Ontario: (613) 727-5199           *******
*******                  Gatineau, Quebec: (819) 243-6858           *******
*******                  E-Mail: swmhymo@jfsa.Com                   *******
**********************************************************************

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++ Licensed user: The Sernas Group                             +++++++
+++++++                Mississauga          SERIAL#:2640114         +++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

**********************************************************************
*******             ++++++ PROGRAM ARRAY DIMENSIONS ++++++          *******
*******             Maximum value for ID numbers  :     10          *******
*******             Max. number of rainfall points:  15000          *******
*******             Max. number of flow points    :  15000          *******
**********************************************************************

*** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) ***
***-------------------------------------------------------------------***
***     ID:  Hydrograph IDentification numbers, (1-10).               ***
***   NHYD:  Hydrograph reference numbers, (6 digits or characters).  ***
***   AREA:  Drainage area associated with hydrograph, (ac.) or (ha.). ***
***  QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).  ***
*** TpeakDate_hh:mm is the date and time of the peak flow.            ***
***   R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).     ***
***   R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).     ***
***      *:  see WARNING or NOTE message printed at end of run.       ***
***     **:  see  ERROR  message printed at end of run.               ***
**********************************************************************
**********************************************************************

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

**********************************************************************

********************   S U M M A R Y   O U T P U T   ********************
**********************************************************************
*        DATE: 2001-07-23     TIME: 17:04:59     RUN COUNTER: 000014      *
**********************************************************************
* Input    filename: P:\SWM\00165~~1\THIRDS~1\swmhymo\Overland\165D00.DAT  *
* Output   filename: P:\SWM\00165~~1\THIRDS~1\swmhymo\Overland\165D00.out  *
* Summary filename: P:\SWM\00165~~1\THIRDS~1\swmhymo\Overland\165D00.sum  *
* User comments:                                                           *
* 1:_______________________________________________________________________*
* 2:_______________________________________________________________________*
* 3:_______________________________________________________________________*
**********************************************************************

RUN:COMMAND#
001:0001------------------------------------------------------------------------
```

```
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   1 ]
001:0002------------------------------------------------------------------------
    READ STORM
     Filename = SCS00-12.STM
     Comment  = 100 YEAR STORM - 24 HOUR SCS (12 MIN TIME STEPS)
     [SDT=12.00:SDUR=  24.00:PTOT= 139.21]
001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    08:000101      5.37     2.273 No_date   12:00   131.24 .943
     [XIMP=.91:TIMP=.91]
     [SLP= .40:DT= 3.00]
     [LOSS= 1 : HORTONS]
001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          08:000101      5.37     2.273 No_date   12:00   131.24  n/a
001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    03:000200      4.02     1.660 No_date   12:00   138.33 .994
     [XIMP=***:TIMP=***]
     [SLP= .10:DT= 3.00]
     [LOSS= 1 : HORTONS]
001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          03:000200      4.02     1.660 No_date   12:00   138.33  n/a
001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            08:000101      5.37     2.273 No_date   12:00   131.24  n/a
                     + 03:000200      4.02     1.660 No_date   12:00   138.33  n/a
     [DT= 3.00]  SUM=  06:002000      9.39     3.933 No_date   12:00   134.27  n/a
001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          06:002000      9.39     3.933 No_date   12:00   134.27  n/a
001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    08:000102      5.37     2.250 No_date   12:00   131.24 .943
     [XIMP=.91:TIMP=.91]
     [SLP= .30:DT= 3.00]
     [LOSS= 1 : HORTONS]
001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          08:000102      5.37     2.250 No_date   12:00   131.24  n/a
001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            08:000102      5.37     2.250 No_date   12:00   131.24  n/a
                     + 06:002000      9.39     3.933 No_date   12:00   134.27  n/a
     [DT= 3.00]  SUM=  10:002002     14.76     6.183 No_date   12:00   133.17  n/a
001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          10:002002     14.76     6.183 No_date   12:00   133.17  n/a
001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:000201      5.38     2.181 No_date   12:00   138.33 .994
     [XIMP=***:TIMP=***]
     [SLP= .10:DT= 3.00]
     [LOSS= 1 : HORTONS]
001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          02:000201      5.38     2.181 No_date   12:00   138.33  n/a
001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  COMPUTE DUHYD      02:000201      5.38     2.181 No_date   12:00   138.33  n/a
       Major System /  07:001201      1.66     1.881 No_date   12:00   138.33  n/a
       Minor System \  08:101201      3.72      .300 No_date   11:30   138.33  n/a
001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:002002     14.76     6.183 No_date   12:00   133.17  n/a
                     + 07:001201      1.66     1.881 No_date   12:00   138.33  n/a
     [DT= 3.00]  SUM=  03:002001     16.42     8.064 No_date   12:00   133.69  n/a
001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          03:002001     16.42     8.064 No_date   12:00   133.69  n/a
001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:000400     20.30     7.960 No_date   12:00   130.44 .937
     [XIMP=.90:TIMP=.90]
     [SLP= .50:DT= 3.00]
     [LOSS= 1 : HORTONS]
001:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          01:000400     20.30     7.960 No_date   12:00   130.44  n/a
001:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
```

```
--------------------   VOLUME     (mm)=  131.237

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0025------------------------------------------------------------------------
*
*  PARKING LOT AREA #103
*
---------------------
| DESIGN STANDHYD    |   Area    (ha)=    4.96
| 05:000103 DT= 2.50 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       4.91          .05
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .30          .30
     Length            (m)=     181.84        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     164.64       138.72
                over (min)        3.00        15.00
     Storage Coeff.  (min)=       4.30 (ii)   15.24 (ii)
     Unit Hyd. Tpeak (min)=       3.00        15.00
     Unit Hyd. peak  (cms)=        .28          .07
                                                         *TOTALS*
     PEAK FLOW       (cms)=       2.17          .01         2.178 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.10        12.000
     RUNOFF VOLUME    (mm)=     138.41        58.73       137.611
     TOTAL RAINFALL   (mm)=     139.21       139.21       139.208
     RUNOFF COEFFICIENT   =        .99          .42          .989

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 50.00            K  (1/hr)=  2.00
            Fc    (mm/hr)=  7.50     Cum.Inf.   (mm)=   .00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0026------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |   AREA      (ha)=    4.960
| ID=05 (000103)    |   QPEAK    (cms)=    2.178 (i)
| DT= 3.00 PCYC=-1  |   TPEAK    (hrs)=   12.000
--------------------   VOLUME     (mm)=  137.611

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
001:0027------------------------------------------------------------------------
*
*  ADD HYDROGRAPHS
*
--------------------
| ADD HYD (002005) | ID: NHYD      AREA      QPEAK    TPEAK   R.V.     DWF
--------------------                (ha)      (cms)    (hrs)   (mm)    (cms)
                ID1 04:000100      4.79      2.014    12.00  131.24    .000
               +ID2 05:000103      4.96      2.178    12.00  137.61    .000
                =======================================================
                SUM 09:002005      9.75      4.192    12.00  134.48    .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0028------------------------------------------------------------------------
*
--------------------
| PRINT HYD         |   AREA      (ha)=    9.750
```

```
| ID=09 (002005)    |   QPEAK     (cms)=    4.192 (i)
| DT= 3.00 PCYC=-1 |   TPEAK     (hrs)=   12.000
-------------------   VOLUME     (mm)=  134.479

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
----------------------------------------------------------------------------
001:0029--------------------------------------------------------------------
*
*  MINOR SYSTEM FLOWS TO POND.  ALL MAJOR SYSTEM OUT OF SYSTEM
*
---------------------
| COMPUTE DUHYD       |   Average inlet capacities   [CINLET] =   5.680  (cms)
| TotalHyd 09:002005 |   Number of inlets in system [NINLET] =       1
---------------------   Total minor system capacity          =   5.680  (cms)
                        Total major system storage [TMJSTO] =       0.(cu.m.)

            ID: NHYD          AREA     QPEAK     TPEAK     R.V.      DWF
                              (ha)     (cms)     (hrs)     (mm)     (cms)
    TOTAL HYD.  09:002005      9.75     4.192    12.000  134.479    .000
    ====================================================================
    MAJOR SYST  07:002003       .00      .000      .000     .000     .000
    MINOR SYST  04:102003      9.75     4.192    12.000  134.479    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

     *** NOTE: Use the new COMPUTE DUALHYD command and you
               can enter NHYD values for both the major and
               minor hydrographs.  A variable for the use of
               major system storage is also available.
----------------------------------------------------------------------------
001:0030--------------------------------------------------------------------
*
*  ADD HYDROGRAPHS
*
-------------------
| ADD HYD (002004) | ID: NHYD      AREA     QPEAK    TPEAK   R.V.     DWF
-------------------                (ha)     (cms)    (hrs)   (mm)    (cms)
                ID1 04:102003      9.75     4.192    12.00 134.48    .000
               +ID2 01:101102     30.63     5.680    11.70 131.89    .000
               ====================================================
                SUM 02:002004     40.38     9.872    12.00 132.52    .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----------------------------------------------------------------------------
001:0031--------------------------------------------------------------------
*
-------------------
| PRINT HYD         |   AREA       (ha)=   40.384
| ID=02 (002004)    |   QPEAK     (cms)=    9.872 (i)
| DT= 3.00 PCYC=-1 |   TPEAK     (hrs)=   12.000
-------------------   VOLUME     (mm)=  132.518

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
----------------------------------------------------------------------------
001:0032--------------------------------------------------------------------
*
*  PARKING LOT AREA #104
*
---------------------
| DESIGN STANDHYD     |   Area     (ha)=    3.80
| 07:000104 DT= 2.50 |   Total Imp(%)=   91.00   Dir. Conn.(%)=   91.00
---------------------
                           IMPERVIOUS     PERVIOUS (i)
    Surface Area      (ha)=       3.46          .34
    Dep. Storage      (mm)=        .80         1.50
    Average Slope      (%)=        .30          .30
    Length             (m)=     159.16        40.00
```

```
     ADD HYD              03:002001     16.42     8.064 No_date    12:00   133.69   n/a
                        + 01:000400     20.30     7.960 No_date    12:00   130.44   n/a
      [DT= 3.00]  SUM=  07:002400     36.72    16.024 No_date    12:00   131.89   n/a
001:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     PRINT HYD            07:002400     36.72    16.024 No_date    12:00   131.89   n/a
001:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD        07:002400     36.72    16.024 No_date    12:00   131.89   n/a
        Major System /    10:001102      6.09    10.344 No_date    12:00   131.89   n/a
        Minor System \    01:101102     30.63     5.680 No_date    11:42   131.89   n/a
001:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD      04:000100      4.79     2.014 No_date    12:00   131.24  .943
      [XIMP=.91:TIMP=.91]
      [SLP= .30:DT= 3.00]
      [LOSS= 1 : HORTONS]
001:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     PRINT HYD            04:000100      4.79     2.014 No_date    12:00   131.24   n/a
001:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD      05:000103      4.96     2.178 No_date    12:00   137.61  .989
      [XIMP=.99:TIMP=.99]
      [SLP= .30:DT= 3.00]
      [LOSS= 1 : HORTONS]
001:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     PRINT HYD            05:000103      4.96     2.178 No_date    12:00   137.61   n/a
001:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD              04:000100      4.79     2.014 No_date    12:00   131.24   n/a
                        + 05:000103      4.96     2.178 No_date    12:00   137.61   n/a
      [DT= 3.00]  SUM=  09:002005      9.75     4.192 No_date    12:00   134.48   n/a
001:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     PRINT HYD            09:002005      9.75     4.192 No_date    12:00   134.48   n/a
001:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD        09:002005      9.75     4.192 No_date    12:00   134.48   n/a
        Major System /    07:002003       .00      .000 No_date     0:00      .00   n/a
        Minor System \    04:102003      9.75     4.192 No_date    12:00   134.48   n/a
001:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD              04:102003      9.75     4.192 No_date    12:00   134.48   n/a
                        + 01:101102     30.63     5.680 No_date    11:42   131.89   n/a
      [DT= 3.00]  SUM=  02:002004     40.38     9.872 No_date    12:00   132.52   n/a
001:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     PRINT HYD            02:002004     40.38     9.872 No_date    12:00   132.52   n/a
001:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD      07:000104      3.80     1.609 No_date    12:00   131.24  .943
      [XIMP=.91:TIMP=.91]
      [SLP= .30:DT= 3.00]
      [LOSS= 1 : HORTONS]
001:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     PRINT HYD            07:000104      3.80     1.609 No_date    12:00   131.24   n/a
001:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD        07:000104      3.80     1.609 No_date    12:00   131.24   n/a
        Major System /    06:000104       .40      .839 No_date    12:00   131.24   n/a
        Minor System \    01:100104      3.40      .770 No_date    11:51   131.24   n/a
001:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD              01:100104      3.40      .770 No_date    11:51   131.24   n/a
                        + 02:002004     40.38     9.872 No_date    12:00   132.52   n/a
      [DT= 3.00]  SUM=  04:001106     43.79    10.642 No_date    12:00   132.42   n/a
001:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     PRINT HYD            04:001106     43.79    10.642 No_date    12:00   132.42   n/a
001:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD              10:001102      6.09    10.344 No_date    12:00   131.89   n/a
                        + 06:000104       .40      .839 No_date    12:00   131.24   n/a
      [DT= 3.00]  SUM=  05:002500      6.48    11.183 No_date    12:00   131.85   n/a
001:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     PRINT HYD            05:002500      6.48    11.183 No_date    12:00   131.85   n/a
001:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD      07:000105      2.44     1.043 No_date    12:00   131.24  .943
      [XIMP=.91:TIMP=.91]
      [SLP= .30:DT= 3.00]
      [LOSS= 1 : HORTONS]
001:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
```

```
     [DT= 3.00]  SUM=  01:000503   133.80    52.057 No_date    11:57   131.27  n/a
 001:0081---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          01:000503   133.80    52.057 No_date    11:57   131.27  n/a
 001:0082---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 01:000503   133.80    52.057 No_date    11:57   131.27  n/a
     [RDT= 3.00] out<- 03:000907   133.80     9.549 No_date    12:18   131.26  n/a
    {MxStoUsed=.9463E+01}
 001:0083---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          03:000907   133.80     9.549 No_date    12:18   131.26  n/a
 001:0084---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000101   163.60    10.456 No_date    12:48    69.49 .499
     [CN= 76.8: N= 3.00]
     [Tp= 1.00:DT=12.00]
 001:0085---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    PRINT HYD          01:000101   163.60    10.456 No_date    12:48    69.49  n/a
 001:0086-------------------------------------------------------------------------
     FINISH
-------------------------------------------------------------------------------
*******************************************************************************
    WARNINGS / ERRORS / NOTES
    -------------------------
 001:0015 COMPUTE DUHYD
     *** NOTE: Use the new COMPUTE DUALHYD command and you
               can enter NHYD values for both the major and
               minor hydrographs.  A variable for the use of
               major system storage is also available.
 001:0022 COMPUTE DUHYD
     *** NOTE: Use the new COMPUTE DUALHYD command and you
               can enter NHYD values for both the major and
               minor hydrographs.  A variable for the use of
               major system storage is also available.
 001:0029 COMPUTE DUHYD
     *** NOTE: Use the new COMPUTE DUALHYD command and you
               can enter NHYD values for both the major and
               minor hydrographs.  A variable for the use of
               major system storage is also available.
 001:0034 COMPUTE DUHYD
     *** NOTE: Use the new COMPUTE DUALHYD command and you
               can enter NHYD values for both the major and
               minor hydrographs.  A variable for the use of
               major system storage is also available.
 001:0041 COMPUTE DUHYD
     *** NOTE: Use the new COMPUTE DUALHYD command and you
               can enter NHYD values for both the major and
               minor hydrographs.  A variable for the use of
               major system storage is also available.
 001:0048 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0050 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0052 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0060 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0062 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0068 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0076 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0078 COMPUTE DUHYD
```

```
*** NOTE: Use the new COMPUTE DUALHYD command and you
          can enter NHYD values for both the major and
          minor hydrographs.  A variable for the use of
          major system storage is also available.
   Simulation ended on 2001-07-23     at 17:05:00
==================================================================================
```

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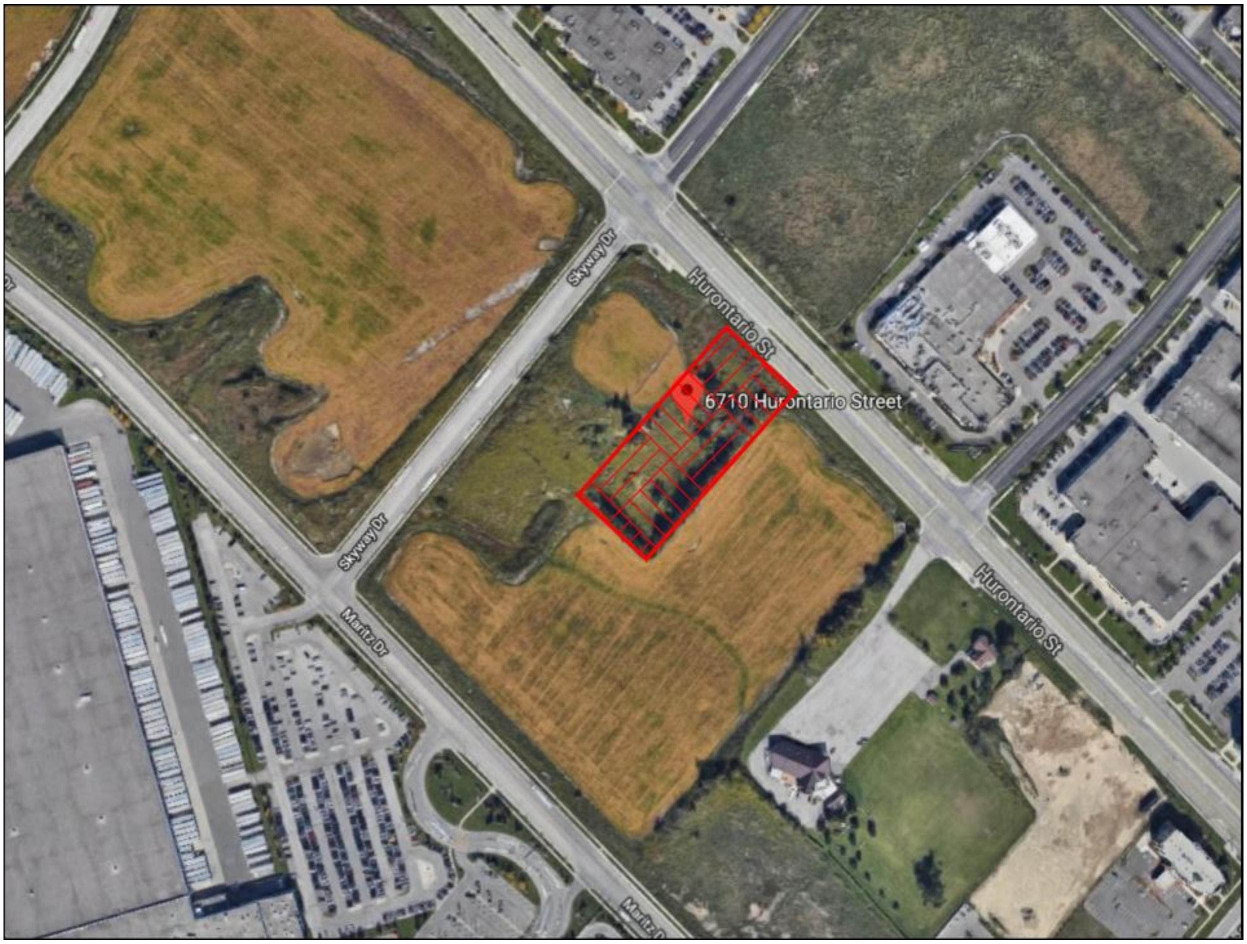
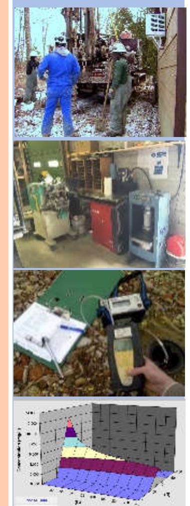
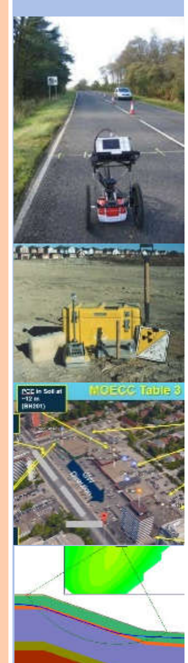
GEOTECHNICAL INVESTIGATION REPORT
PROPOSED COMMERCIAL DEVELOPMENT
6710 HURONTARIO STREET
MISSISSAUGA, ONTARIO







SIRATI & PARTNERS

Geotechnical Hydrogeological & Environmental Solutions

Prepared For: FLATO DEVELOPMENTS

01/24/2019

Project No.: SP18-347-10-R1

TABLE OF CONTENTS

1. INTRODUCTION

Sirati & Partners Consultants Limited (SIRATI) was retained by Flato Developments (the Client) to undertake a geotechnical investigation for the proposed commercial development located at 6710 Hurontario Street in Mississauga, Ontario (the site or subject site).

It is understood that the Client intends to acquire the property to be developed into a 6 to 8 storey hotel and a 4 to 6 storey office space. The development is proposed to include a two-level underground parking space that covers the majority of the property. Copies of the proposed site plan were provided to SIRATI by the client.

The site is currently occupied with the remains of a demolished building at approximately 40 m toward west from the west curb line of Hurontario Street. The basement walls and foundation structure of the demolished building remain in place to this day. The site is approximately 1.83 acres and bounded by Hurontario Street to the east, agriculture fields to the north and south and a vacant lot to the west. The site is generally flat with maximum elevation difference of 0.7 m between the borehole locations and covered by trees of different sizes and shrubs.

The purpose of the geotechnical investigation was to determine the subsurface conditions at six (6) borehole locations located within the footprints of development area and from the findings in the boreholes make preliminary geotechnical engineering recommendations for the following:

1. Foundations
2. Floor slab and permanent drainage
3. Excavations and backfill
4. Earthquake considerations
5. Earth pressures
6. Temporary Shoring
7. Service Installations
8. Pavement Design

This report is geotechnical in nature and only deals with geotechnical issues pertinent to the site and proposed development. Environmental studies were also conducted by SIRATI and the reports are presented under separate covers.

This report is provided based on the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for the Flato Developments and their architects and designers. Third party use of this report without Sirati & Partners Consultants Limited (SIRATI) consent is prohibited. The limitations presented in Appendix B form an integral part of the report and they must be considered in conjunction with this report.

2. FIELD AND LABORATORY WORK

A total of six (6) boreholes (BH1 through BH3 and BH6 through BH8, see Drawing 1 for location plan) were drilled at the site to the depths ranging from 9.4 m to 15.7 m. Boreholes were drilled with hollow/solid stem continuous flight auger equipment by a drilling sub-contractor under the direction and supervision of SIRATI personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method.

The field work was carried out in accordance with the ASTM D 1586-11 test method – "The Standard Method of Standard Penetration Testing (SPT)". All soil samples were logged in the field and returned to SIRATI's laboratory in King City for detailed examination by the project engineer and subsequent laboratory testing.

Four (4) representative soil samples were subjected to particle size analysis and hydrometer analysis. The results of the laboratory tests are provided in respective borehole logs and Figure Nos. 10 and 11.

Groundwater level observations were made during drilling and in the open boreholes and upon completion of the drilling operations. Monitoring wells were installed at two (2) borehole locations (BH2 and BH7) for long-term (stabilized) groundwater level monitoring.

The elevations at the borehole locations were surveyed by an SIRATI personnel using differential GPS system and varied from 199.5 m to 200.2 m.

3. SUBSURFACE CONDITIONS

The borehole locations are shown on Drawing 1. Notes on sample descriptions and the general features of fill material and glacial till are presented on Drawing 1A. Detailed subsurface conditions are presented on the Borehole Logs, Drawings 2 to 7. The soil and groundwater conditions are summarized as follows.

3.1 SOIL CONDITIONS

Topsoil: A surficial layer of topsoil was encountered at all borehole locations. The thickness of topsoil was varying between 100 mm and 200 mm.

The thickness of the topsoil in each borehole is presented in the respective borehole logs. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the entire site and should not be relied on to calculate the amount of topsoil to be stripped at the site.

Variable Fill: A heterogeneous mixture of fill material was encountered directly below the topsoil layer in all boreholes. Fill material generally consists of sandy silt to silty sand material. Occasional traces of topsoil and gravel were observed in fill material.

The fill material extends to a depth of 0.8 m to 1.5 mbgs. The measured SPT ‘N’ values in the fill material ranged from 8 to 23 blows for 300 mm sampler penetration, indicating its loosely to moderately compacted state. The higher ‘N’ values may be due to the presence of gravel or cobbles within the fill material.

Cohesionless Soil Layers: Native cohesionless soil layers consisting of silty sand to sandy silt were encountered directly underlaying the fill material in BH1 and BH8. A layer of sandy silt to silty sand was also encountered at the bottom of BH7. During the split spoon sampling SPT ‘N’ values were recorded ranging between 17 (in BH8) and more than 50 blows per 300 mm penetration (in BH7), indicating a compact to very dense condition of the soil.

BH7 was terminated in cohesionless soil deposit

The moisture content in cohesionless soil deposit was found ranging from 10.2% to 11.4%, indicating a moist condition.

Sandy Silt Till: The native sandy silt till deposit was encountered in upper and lower horizon layers. The upper layer of sandy silt till was encountered directly underlaying the fill material and cohesionless soil deposit. The lower horizon layer was encountered underneath the clayey silt till deposit.

All the boreholes except BH7 was terminated in sandy silt till deposit.

During the split spoon sampling, the SPT ‘N’ values were recorded in upper till deposit ranging from 18 (in BH8) to more than 50 blows per 300 mm penetration (in multiple boreholes), indicating compact to very dense condition) of the soil.

The moisture content in sandy silt till deposit was found ranging 7.2% to 14.3%, indicating moist to very moist condition.

Grain size analysis of two (2) representative soil samples (BH2/SS8 and BH7/SS4) were conducted and the results are presented in Figure 10 and 11, with the following fractions:

Clay: 14% to 19%
Silt: 43% to 49%
Sand: 33% to 35%
Gravel: 3% to 4%

Clayey Silt Till: The clayey silt till deposit was encountered interbedded in sandy silt till deposit are varying depths and thickness.

During the split spoon sampling, the SPT 'N' values were recorded in clayey silt till deposit ranging from 14 (in BH) to more than 50 blows per 300 mm penetration (in BH1), indicating very stiff to hard consistency of the soil.

The moisture content in clayey silt till deposit was found ranging 7.2% to 15.6%, indicating moist to very moist condition.

Grain size analysis of two (2) representative soil samples (BH1/SS7 and BH6/SS7) were conducted and the results are presented in Figure 10 and 11, with the following fractions:

Clay: 18% to 21%
Silt: 45% to 51%
Sand: 26% to 28%
Gravel: 5% to 6%

3.2 GROUNDWATER CONDITIONS

During drilling (short-term), groundwater was found in the boreholes at approximately 8.9 to 10.2 m below the existing grade. The stabilized groundwater table observed on August 30, 2018 in the monitoring wells at depths ranging from 2.5 m to 2.6 mbgs, corresponding to elevations ranging from 196.9 m to 197.1 m (Geodetic), as listed on **Table 1**.

Table 1: Groundwater Levels Observed in Monitoring Wells

BH No.	Date of Drilling	Date of Observation	Depth of Groundwater below existing ground (m)	Elevation of Groundwater (m)
BH2	August 14, 2018	August 14, 2018 August 30, 2018	8.9 2.6	190.6 196.9
BH7	August 16, 2016	August 16, 2018 August 30, 2018	10.2 2.5	189.4 197.1

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

3.3 HYDROGELOGICAL IMPACT ASSESMENT

Given the high groundwater condition at the site and local stratigraphy, it is recommended that a hydrogeological Impact Assessment (HIA) study be carried out to assess a 'stabilized' (long term) groundwater condition, the impact of groundwater on the development and subsequently address the waterproofing requirements for two level of underground parking levels design and the dewatering requirements for construction.

4. DISCUSSION AND RECOMMENDATIONS

It is understood that the property will be developed with 6-8 story hotel building, banquet facilities and 4-6 story office building with two level of underground parking levels.

4.1 ROADS

The investigation has shown that the predominant subgrade soil at the site, after stripping the topsoil, fill material and any other organic and otherwise unsuitable material is capable to support the pavement structure.

Based on the above and assuming that traffic usage will be residential minor local or local, the following minimum pavement thickness is recommended:

40 mm HL3 Asphaltic Concrete
50 mm HL8 Asphaltic Concrete
150 mm Granular 'A'
300 mm Granular 'B'

These values may need to be adjusted according to the City of Mississauga Standards. The pavement structure recommended above assumes that the subgrade has sufficient bearing capacity to accommodate the applied pavement structure and local traffic. The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of thicker granular sub-base layer in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly prepared road subgrade before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

4.1.1 Stripping, Sub-excavation and Grading

The site should be stripped of all topsoil, weathered/disturbed soils and any organic or otherwise unsuitable soils to the full depth of the roads, both in cut and fill areas.

Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled, in the presence of the Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 10 tons. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer. The subgrade should then be recompacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Proper cambering and allowing the water to escape towards the sides (where it can be removed by means of subdrains) is considered to be beneficial. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material must be used.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 95% of its SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, as per City Standards. The compaction of the new fill should be checked by frequent field density tests.

4.1.2 Construction

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.1.3 Drainage

The City of Mississauga requires the installation of full-length subdrains on all roads. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch basins. As discussed in Section 4.1.1, by means of good planning any water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

4.2 SEWERS

As a part of the site development, a network of new storm and sanitary sewers is to be constructed.

4.2.1 Trenching

It is expected that the trenches will be dug through the native soil deposits. The groundwater was observed in the monitoring wells at 196.9 mASL to 197.1 mASL. For any trenching below the groundwater level, water table must be lowered to 1.0 m below the lowest excavation level.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the till deposits can be classified as Type B Soil above the groundwater table and Type C Soil below the groundwater table. The fill material can be classified as Type C.

4.2.2 Bedding

The boreholes show that, in their undisturbed state, native soils will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter. The bedding material should consist of well-graded granular material such as Granular ‘A’ or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local Authority, should be placed.

To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the poorly graded bedding material.

4.2.3 Backfilling of Trenches

Based on visual and tactile examination, and the measured moisture contents of the soil samples, the onsite excavated soils from above the groundwater table will generally need to be brought to ±2% of the optimum moisture content whether by adding water or aerating. Soils excavated from below the groundwater table may require aeration prior to their use as backfill material.

The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at last 95% SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling. Otherwise imported selected inorganic fill will be required for backfilling at this site.

The onsite excavated soils should not be used in confined areas (e.g. around catch basins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of imported granular fill would be preferable in confined areas and around structures, such as catch basins.

4.3 SITE GRADING AND ENGINEERED FILL

In the areas where earth fill is required for site grading purposes, an engineered fill may be constructed below building foundations, roads, boulevards, etc.

Prior to the construction of engineered fill, all topsoil, fill material, weak weathered / disturbed and any other unsuitable materials must be removed in this area. After the removal of all unsuitable materials, the excavation base consisting of native soil deposits must be inspected and approved by a qualified geotechnical engineer prior to any placement of engineered fill. The base of the excavation should be compacted, and proof rolled with heavy compactors (minimum 10,000 kg). During proof rolling, spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer.

The material for engineered fill should consist of approved inorganic soil, compacted to 100 percent of Standard Proctor Maximum Dry Density (SPMDD). Recommendations regarding engineered fill placement are provided in **Appendix A** of this report.

To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential by SIRATI to certify the engineered fill. Please note that SIRATI can only provide certification for material properly placed and compacted under direct supervision. Detailed Engineered fill and inspection requirements to be discussed at the pre-construction meeting with the contractor.

Depending upon the amount of grade raise, there will be consolidation settlement of the underlying soils. Additionally, there will be settlement of the engineered fill under its own weight, approximately 0.5% of the fill height. A waiting period of 3 to 6 months may be required prior to the construction of any structures on engineered fill. This should be confirmed during the detail design stage, once the grading plans for the proposed development are available.

4.4 FOUNDATION CONDITIONS

At the time of preparation of the report, no design loading requirements were made available. Based on our understanding, the footings for the 6-8 story hotel building, banquet facilities and 4-6 story office building with two level of underground parking level may be positioned at 6.0 m to 6.5 m below the existing grade.

In order to address subsurface soil conditions throughout the site an assessment of the site stratigraphy is undertaken by compiling factual data from the geotechnical investigation and summarized in **Table 2**.

Table 2: Sub-Surface Stratigraphy Assessment

Layer No.	Soil Type	SPT 'N' Values				Relative Density/Consistency	Remarks
		Min	Max	Avg	Tests		
1	Fill	8	23	13	8	Variable	Occasional trace of topsoil and gravel
2	Cohesionless Soil	17	90	40	3	Compact to Very Dense	Occasional trace gravel
3	Sandy Silt Till	18	93	42	34	Compact to Very Dense	Occasional trace gravel
4	Clayey Silt Till	14	55	21	19	Very Stiff to Hard	Occasional trace gravel

The following sections outline our recommendations for the design of the proposed buildings. The choice of foundation alternatives is at the discretion of the Client depending on the construction feasibility and project economy.

4.4.1 Frost Protection

All footings exposed to seasonal freezing conditions must have at least 1.2 meters of soil cover for frost protection.

4.4.2 Conventional Strip/Spread Footings

Based on a review of the soil conditions encountered at the borehole locations, it is expected that the native soils at approximately 6.0 mbgs below the existing grade are capable of supporting the proposed underground parking structure only with the exception of the low-rise building's footprint area through conventional spread/strip footing foundations. Alternatively, the columns may be supported by caissons.

The proposed building can be supported by spread/strip footings founded on competent undisturbed native soil for bearing capacity values of 120 to 150 kPa at Serviceability Limit State (SLS) and 180 to 225 kPa at Ultimate Limit State (ULS), respectively. The geotechnical bearing resistances and recommended tentative foundation levels are shown in **Table 3**.

Table 3: Bearing Values and Founding Elevations for Conventional Footings

BH No.	Founding Material	Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth Below Existing Ground (m)	Founding Level at or Below Elevation (m)
BH1	Clayey Silt Till	120	180	6.0	194.1
BH2	Clayey Silt Till	150	225	6.0	193.5
BH3	Clayey Silt Till	150	225	6.0	194.2
BH6	Clayey Silt Till	120	180	6.0	194.1
BH7	Clayey Silt Till	150	225	6.0	193.6
BH8	Clayey Silt Till	120	180	6.0	193.7

The foundations designed to the above specified allowable bearing capacity at the serviceability limit states (SLS) are expected to settle less than 25 mm of total and 19 mm of differential settlements.

Considerations must be given to the adjacent foundation element structures (if supported by different types of foundations) to minimize loading interaction/influence. If the low-rise building footings will be supported by the caissons and underground parking structure will be supported by spread/strip footings, in such conditions, it is prudent to structurally separate the footings from each other.

Structure conditions should be examined by a licensed structural consultant. Construction should be carefully sequenced in terms of minimizing differential settlements.

All footing bases must be inspected by this office prior to pouring concrete. It is suggested that a lean concrete mat slab be placed immediately after the excavation is complete to avoid weathering of the soil, unless the footings are cast immediately after excavation.

Where construction is undertaking during winter conditions, footing subgrade should be protected from freezing. Foundation walls and columns should be protected against heave due to soil ad-freezing.

4.4.3 Caisson Foundation

Shallow caisson foundation may be used for the proposed low-rise commercial building. The diameter of the caissons should be at least 760 mm to allow safe passage for the cleaning and inspection of the base of each caisson base prior to pouring concrete. The caisson Contractor should be advised to provide temporary smooth surface liners for sealing off any wet pocket in the fill or wet seams in the relatively impervious clayey silt, and to allow safe passage for the cleaning and inspection of the caisson bases.

A net allowable bearing pressure of 600 kPa (SLS) and 800 kPa (ULS) may be used for a minimum 3.5 m embedment below the proposed underside of footings with approximate elevation of 190.0 m Geodetic. It is anticipated that the associated settlements are not expected to be large, and in general limiting of the total settlement to less than 25 mm and the differential settlement to less than 20 mm by the recommended net bearing pressure is considered appropriate.

Prior to pouring concrete, the base of each caisson should be inspected by the Geotechnical Engineer.

The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by SIRATI to validate the information for use during the construction stage.

5. FLOOR SLAB AND PERMANENT DRAINAGE

Depending upon the lowest underground parking level of the building in relation to the long-term ground water level, the basement may need to be constructed as a ‘water-tight’ structure or be continuously managed be an appropriately designed dewatering system. For construction, the basement excavation may extend 1 or 2 m below the basement level and would carry out with conventional dewatering from inside. Attention would be required with regard to stability of the base of the excavation. In addition, the basement substructure would require suitable water proofing measures to keep it in a dry condition.

In order to facilitate foundation and basement construction, appropriate dewatering measures will be required by a dewatering contractor.

With two (2) level of basement, the basement floor slab can be supported on grade provided the base thoroughly proof rolled to detect any soft or unstable areas, which must be removed and replaced with suitably compacted soils, as defined in **Section 4** of this report. Once the required subgrade has been developed, SIRATI recommends that the exposed subgrade be inspected and approved by the Geotechnical Engineer prior to the placement of any granular fill or concrete. A granular layer consisting of at least 200 mm of 19 mm Crusher Run Limestone (CRL) or OPSS Granular A should be installed under the floor slab as a granular base layer. The Granular material should be compacted to 100% of its SPMDD.

It is considered by SIRATI that completed excavations for floor slabs should not be left open before pouring concrete for any period longer than 24 hours. Particularly, if the floor construction works are being completed during the winter months or wet weather periods. The base of any floor slab excavation that is left exposed longer than 24 hours should be suitably covered and protected from water ponding, and/or protected to prevent degradation of the exposed founding stratum with the construction of a mud mat.

The floor slab should be structurally independent of any load bearing structural elements and should tolerate expected foundation settlements as indicated above.

The perimeter drainage system shown on Drawings 11 and 12 are recommended for the basement walls with open cut and shored excavations. Underfloor drainages should be provided.

7. EARTH PRESSURES

The lateral earth and water pressure acting at any depth on the basement walls can be calculated by the following formula:

In soils above the groundwater table ($z < d_w$):

$$p = K(\gamma z + q)$$

In soils below the groundwater table ($z \geq d_w$):

$$p = K\{\gamma d_w + \gamma_1 (z - d_w) + q\} + p_w$$

In which, $p_w = \gamma_w (z - d_w)$

where p	=	lateral earth and water pressure in kPa acting at a depth of z below ground surface
K	=	earth pressure coefficient = 0.31
γ	=	unit weight of soil above groundwater table, assuming $\gamma = 21.5$ kN/m^3
γ_1	=	submerged unit weight of soil below groundwater table, assuming $\gamma_1 = 11.7$ kN/m^3
γ_w	=	unit weight of water, assuming $\gamma_w = 9.8$ kN/m^3
z	=	depth below ground surface to point of interest, in meters
d_w	=	depth of groundwater table below ground surface, in meters
q	=	value of surcharge in kPa
p_w	=	hydrostatic water pressure in kPa

When the basement wall is poured against the shoring caisson wall, the basement wall as well as the shoring caisson wall should be designed for hydrostatic pressure, even though a drainage board is provided between the basement wall and the caisson wall. For the design of the basement walls and shoring caisson wall, the groundwater table elevation at the site can be considered varying between 196.9 and 197.1 mASL.

8. TEMPORARY SHORING

It is understood that the proposed excavations will be supported by a temporary shoring system consisting of timber lagging and soldier piles. A tightly-braced caisson wall may also be required to support adjacent structures.

The presence of groundwater table in the cohesionless deposits (sand, silt, sandy silt to silty sand) will make the construction of the shoring caissons difficult and therefore appropriate protection must be provided to prevent the soil from caving and thus minimize the possible formation of voids below the floor slab and adjacent foundations.

The shoring system must be designed in accordance with the Fourth Edition of the Canadian Foundation Engineering Manual. The soil parameters estimated to be applicable for this design are as follows:

1) Earth Pressure Coefficients

   (a) where movement must be minimal:
   K=0.47

   (b) where minor movement (.002H) can be tolerated, K=0.31

   (c) passive earth pressure for soldier piles (unfactored), Kp=3.25 for the very dense soils

2) For stability check
   $\phi = 32°$
   $c = 0$
   $\gamma = 22$ kN/m^3

   Surcharge is to be determined by shoring contractor.

3) For earth anchors

   Bond value of 50 kPa is suggested; this value depends on anchor installation methods and grouting procedures. Gravity poured concrete can result in low bond values while pressure grouted anchors will give higher values and produce a more satisfactory anchor.

Safe net bearing value for soldier pile caissons base assuming clean dry hole is q = 500 kPa. Assuming a slurry procedure and tremie concrete, then q = 300 kPa

Casing will be required during the construction of the tiebacks to prevent caving of soils. The soldier piles should be installed in pre-augured holes taken below the deepest excavation. The holes should be filled with concrete below the excavation level and half bag mix above the base of the excavation. The concrete strength must be specified by the shoring designer. Temporary liners will be required to help prevent the sandy and gravelly soils from caving during the installation period. Measures will be required to prevent the loss of soil through the spaces between the lagging boards (if used). This could be achieved by installing a geotextile filter cloth behind the lagging boards.

Soil anchors will be required to support the shoring. The anchors must be of a length that meets the Canadian Foundation Manual recommendations. It is important to note that the minimum length lies beyond the $45 - \phi/2 + .15H$ line drawn from the base of the soldier pile and the overall stability of the system must be checked at each anchor level.

The top anchor must not be placed lower than 3.0 meters below the top of level ground surface. Anchors will require casing when penetrating through wet sand and silt layers. The suggested bond value of 50 KPa is arbitrary since the contractor's installation procedures will determine the actual soil to concrete bond value. Hence, the contractor must decide on a capacity and confirm its availability. All anchors must be tested as indicated in the Foundation Manual, 4th edition.

Adhesion on the buried caisson shaft or behind the shoring system must be neglected when designing this shoring system.

Movement of the shoring system is inevitable. Vertical movements will result from the vertical load on the soldier piles resulting from the inclined tiebacks and inward horizontal movement results from earth and water pressures. The magnitude of this movement can be controlled by sound construction practices, and it is anticipated that the horizontal movement will be in the range of 0.1 to 0.25%H.

To ensure that movements of the shoring are within an acceptable range, monitoring must be carried out. Vertical and horizontal targets on the soldier piles must be located and surveyed before excavation begins. Weekly readings during excavation should show that the movements will be within those predicted; if not, the monitoring results will enable directions to be given to improve the shoring.

9. EARTHQUAKE CONSIDERATIONS

Based on the borehole information and according to Table 4.1.8.4.A of OBC 2012, the subject site for the proposed building founded on dense to very dense soils can be classified as "Class C".

10. GENERAL COMMENTS ON REPORT

Sirati & Partners Consultants Limited should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, Sirati & Partners will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

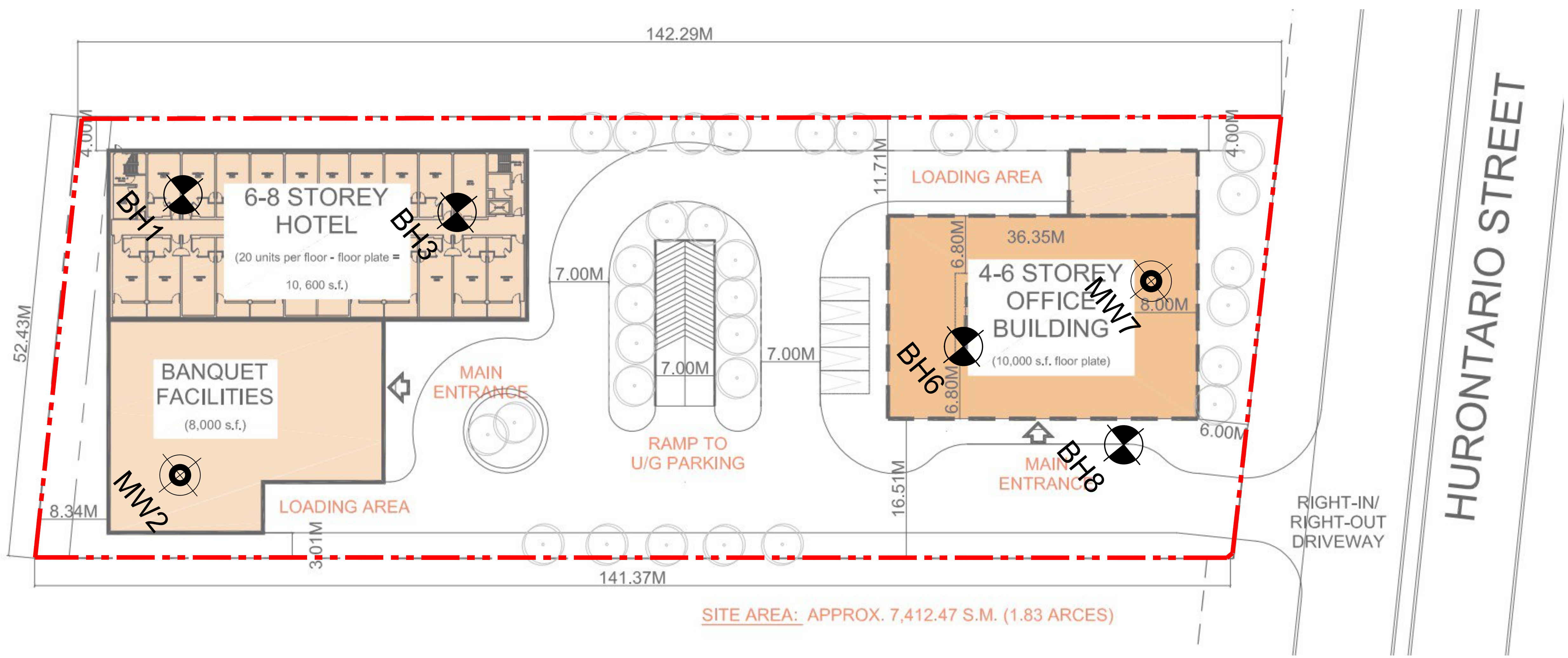
SIRATI & PARTNERS CONSULTANTS LIMITED

LICENSED PROFESSIONAL ENGINEER
K. S. BRAR
100186451
Jan/24/2019
PROVINCE OF ONTARIO

Kuljit S. Brar, P. Eng.

Archie Sirati, Ph.D., P.Eng.

Drawings



12700- Keele Street
King City, ON. L7B 1H5
Phone# 905 833 1582, Fax# 905 833 5360

North:

Legend:

Property Boundary

Borehole

Monitoring Well

Project Title:
Geotechnical and Environmental Investigation

Site Location:
6710 Hurontario, Mississauga, ON

Figure Title:
Borehole Location Plan

Scale: 0m 5m 10m

Project Number: SP18-347-10

Date: August 2018

Figure Number: 1

Drawing 1A: Notes on Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by Sirati & Partners Consultants Limited also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARS E		

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

PROJECT: Proposed Geotechnical and Environmental Investigation
CLIENT: Flato Developments
PROJECT LOCATION: 6710 Hurontario Street, Mississauga, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200 mm
Date: Aug/14/2018
Drilling Contractor:

REF. NO.: SP18-347-10
ENCL NO.: 2

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	WATER CONTENT (%) (approx.)	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
200.1 / 0.0	**TOPSOIL:** 150 mm					
0.2	**FILL:** sandy silt, mixed with topsoil, moist	1	SS	11		
199.3 / 0.8	**FILL:** sandy silt, trace gravel, trace topsoil, brown, moist	4	SS	23		
198.6 / 1.5	**SILTY SAND:** trace gravel, brown, moist, compact	2	SS	22		
197.8 / 2.3	**SANDY SILT:** moist, dense	3	SS	34		
197.1 / 3.0	**SANDY SILT TILL:** trace gravel, oxidated, brown, moist, dense	5	SS	33		
195.5 / 4.6	**CLAYEY SILT TILL:** some sand, trace gravel,grey, very moist, very stiff	6	SS	16		
	layer of sandy gravel	7	SS	15		5 26 51 18
		8	SS	17		
191.0 / 9.1	**SANDY SILT TILL:**trace gravel, trace sand, grey, moist, very dense	9	SS	75/ 250 mm		
189.4 / 10.7	**SANDY SILT TILL:**trace gravel, trace sand, grey, wet, very dense	10	SS	85/ 275 mm		
187.9 / 12.2	**SANDY SILT TILL:** trace gravel, trace cobbles, grey, moist, very dense	11	SS	93/ 275 mm		wet spoon
		12	SS	69		

W. L. 186.4 m

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT: Proposed Geotechnical and Environmental Investigation
CLIENT: Flato Developments
PROJECT LOCATION: 6710 Hurontario Street, Mississauga, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200 mm
Date: Aug/14/2018
Drilling Contractor:

REF. NO.: SP18-347-10
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m^3)	CHEMICAL ANALYSIS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
15	**SANDY SILT TILL:** trace gravel, trace cobbles, grey, moist, very dense(Continued)					Aug 15, 2018	185					wet spoon
184.5 / 15.7			13	SS	88/ 275 mm				o			wet spoon
	END OF BOREHOLE:											

Notes:
1. Borehole open upon completion of drilling.
2. Water encountered at 13.7 mbgs upon completion of drilling.

Legend: SHEAR STRENGTH (kPa): O UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × LAB VANE. PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; O ε=3% Strain at Failure

SIRATI & PARTNERS

LOG OF BOREHOLE BH2

PROJECT: Proposed Geotechnical and Environmental Investigation
CLIENT: Flato Developments
PROJECT LOCATION: 6710 Hurontario Street, Mississauga, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200 mm
Date: Aug/15/2018
Drilling Contractor:

REF. NO.: SP18-347-10
ENCL NO.: 3

ELEV (m) / DEPTH (m)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	WATER CONTENT (%)	GR	SA	SI	CL
199.5 / 0.0	**TOPSOIL:** 180mm								
199.3 / 0.2	**FILL:** sandy silt, trace topsoil, brown, moist	1	SS	13	~18				
198.7 / 0.8	**SANDY SILT TILL:** brown, moist, compact to dense	2	SS	27	~10				
		3	SS	35	~14				
	trace gravel, oxidated	4	SS	31	~14				
	trace cobbles, trace clay, becoming grey	5	SS	34	~11				
194.9 / 4.6	**CLAYEY SILT TILL:** some sand, trace gravel, grey, moist, compact	6	SS	16	~11				
	trace sand	7	SS	19	~12				
191.9 / 7.6	**SANDY SILT TILL:** some gravel, some sand, moist, dense	8	SS	66	~6	4	33	49	14
190.4 / 9.1	**SILTY SAND :** trace gravel, grey, very moist to wet, very dense	9	SS	50/100 mm	~10				
190.1 / 9.4	**END OF BOREHOLE:**								

Groundwater conditions: W. L. 196.9 m Aug 30, 2018; W. L. 190.6 m Aug 15, 2018

Notes:
1. Borehole open upon completion of drilling.
2. Water encountered at 8.84 mbgs upon completion of drilling.
3. Monitoring well was installed in the borehole upon completion of drilling.
4. Groundwater level was observed at 2.57 mbgs in the well on August 30, 2018.

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): O UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × LAB VANE
PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L
POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); CHEMICAL ANALYSIS AND GRAIN SIZE DISTRIBUTION (%)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; O ε=3% Strain at Failure

LOG OF BOREHOLE BH3

PROJECT: Proposed Geotechnical and Environmental Investigation
CLIENT: Flato Developments
PROJECT LOCATION: 6710 Hurontario Street, Mississauga, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Aug/15/2018
Drilling Contractor:

REF. NO.: SP18-347-10
ENCL NO.: 4

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	NATURAL MOISTURE CONTENT
200.2						
200.0 / 0.0	**TOPSOIL:** 280 mm					
0.3	**FILL:** sandy silt mixed with topsoil, trace gravel, trace topsoil,brown, moist	1	SS	15		plotted
199.4 / 0.8	**SANDY SILT TILL:** brown, moist, dense to compact	2	SS	31		plotted
	trace cobbles	3	SS	26		plotted
	oxidated	4	SS	23		plotted
197.2 / 3.0	**CLAYEY SILT TILL:** trace gravel, trace sand, brown, moist, very stiff	5	SS	23		plotted
	trace cobbles, becoming grey and very moist	6	SS	16		plotted
		7	SS	21		plotted
		8	SS	19		plotted
191.1 / 9.1	**SANDY SILT TILL:** trace gravel, grey, moist, very dense	9	SS	71		plotted
189.4		10	SS	50/ 125 mm	∇ W. L. 189.5 m Aug 15, 2018	plotted
10.8	**END OF BOREHOLE:**					

Notes:
1. Borehole open upon completion of drilling.
2. Water encountered at 10.77 mbgs upon completion of drilling.

Column headings: SOIL PROFILE; SAMPLES; ELEVATION (200, 199, 198, 197, 196, 195, 194, 193, 192, 191, 190); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10 20 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); CHEMICAL ANALYSIS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT: Proposed Geotechnical and Environmental Investigation
CLIENT: Flato Developments
PROJECT LOCATION: 6710 Hurontario Street, Mississauga, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Aug/15/2018
Drilling Contractor:

REF. NO.: SP18-347-10
ENCL NO.: 5

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	WATER CONTENT (%)	GR SA SI CL
200.1							
199.9 / 0.0	**TOPSOIL:** 200 mm						
0.2	**FILL:** sandy silt, trace topsoil, brown, moist	1	SS	13			
	trace gravel	2	SS	18			
198.6 / 1.5	**SANDY SILT TILL:** trace cobbles, brown, moist, compact	3	SS	23			
	trace clay, oxidised	4	SS	22			
		5	SS	30			
196.3 / 3.8	**CLAYEY SILT TILL:** trace gravel, trace sand, grey, very moist, stiff	6	SS	25			
	trace cobbles	7	SS	18			6 28 45 21
		8	SS	14			
		9	SS	21			
191.0 / 9.1	**SANDY SILT TILL:** trace cobbles, trace gravel, grey, moist, very dense	10	SS	50/ 75 mm			
189.4					W. L. 189.7 m Aug 15, 2018		
189.1 / 10.7 / 11.0	**SILTY SAND:** trace gravel, trace shale fragments, grey, wet, very dense	11	SS	55/ 150 mm			

ELEVATION: 200, 199, 198, 197, 196, 195, 194, 193, 192, 191, 190

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE — 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3) | CHEMICAL ANALYSIS AND GRAIN SIZE DISTRIBUTION (%)

END OF BOREHOLE:

Notes:
1. Borehole open upon completion of drilling.
2. Water encountered at 10.36 mbgs upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SIRATI & PARTNERS

LOG OF BOREHOLE BH7

PROJECT: Proposed Geotechnical and Environmental Investigation
CLIENT: Flato Developments
PROJECT LOCATION: 6710 Hurontario Street, Mississauga, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200 mm
Date: Aug/16/2018
Drilling Contractor:

REF. NO.: SP18-347-10
ENCL NO.: 6

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	ELEVATION	NATURAL MOISTURE CONTENT	CHEMICAL ANALYSIS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.6							
199.4 / 0.0	**TOPSOIL:** 200 mm						
0.2	**FILL:** sandy silt, trace topsoil, brown, moist	1	SS	9	199	o	
198.8 / 0.8	**SANDY SILT TILL:** trace gravel, trace clay, brown, moist, compact to dense	2	SS	20		o	
		3	SS	22	198	o	
	trace cobbles, oxidised	4	SS	25	197	o	3 35 43 19
		5	SS	34	196	o	
	becoming grey	6	SS	45		o	
	some clay	7	SS	25	195	o	
					194		
193.5 / 6.1	**CLAYEY SILT TILL:** trace gravel, trace sand, grey, moist, very stiff	8	SS	22	193	o	
	trace cobbles	9	SS	24	192	o	
					191		
190.5 / 9.1	**SANDY SILT TILL:** trace cobbles, trace gravel, grey, moist, dense	10	SS	65	190	o	
188.9 / 10.7	**SANDY SILT TO SILTY SAND:** trace gravel, grey, moist, very dense	11	SS	90	189	o	
188.3 / 11.3	**END OF BOREHOLE:**						

W. L. 197.1 m
Aug 30, 2018

W. L. 189.4 m
Aug 16, 2018

Notes:
1. Borehole Oopen upon completion of drilling.
2. Water encountered at 10.21 mbgs upon completion of drilling.
3. Monitoring well was installed in the borehole upon completion of drilling.
4. Groundwater level was observed at 2.55 mbgs in the well on August 30, 2018.

Chart headings: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10 20 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); STRATA PLOT; GROUND WATER CONDITIONS

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH8

PROJECT: Proposed Geotechnical and Environmental Investigation
CLIENT: Flato Developments
PROJECT LOCATION: 6710 Hurontario Street, Mississauga, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Aug/16/2018
Drilling Contractor:

REF. NO.: SP18-347-10
ENCL NO.: 7

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	ELEVATION	WATER CONTENT (%)
199.7 / 199.6 0.1	**TOPSOIL:** 100 mm					
	FILL: silty sand, trace topsoil, brown, moist	1	SS	8		o
198.9 / 0.8	**SANDY SILT:** trace clay, brown, moist, compact	2	SS	17	199	o
198.2 / 1.5	**SANDY SILT TO SANDY SILT TILL:** trace gravel, trace clay, oxidated, brown, moist, compact to dense	3	SS	18	198	o
		4	SS	22	197	o
	trace cobbles	5	SS	31	196	o
	becoming grey	6	SS	42		o
195.1 / 4.6	**CLAYEY SILT TILL:** trace gravel, trace sand, grey, moist, very stiff to hard	7	SS	22	195	o
	becoming very moist	8	SS	14	194 / 193	o
		9	SS	36	192 / 191	o
190.6 / 9.1	**SANDY SILT TILL TO SAND:** grey, moist to wet, dense	10	SS	48	190	o
189.0 / 10.7	**SANDY SILT TILL :** grey, moist to very moist, very dense	11	SS	52/150 mm	189	o
188.7 / 11.0	**END OF BOREHOLE:**					

Notes:
1. Borehole caved at 8.84 mbgs.
2. Water encountered at 8.23 mbgs upon completion of drilling.

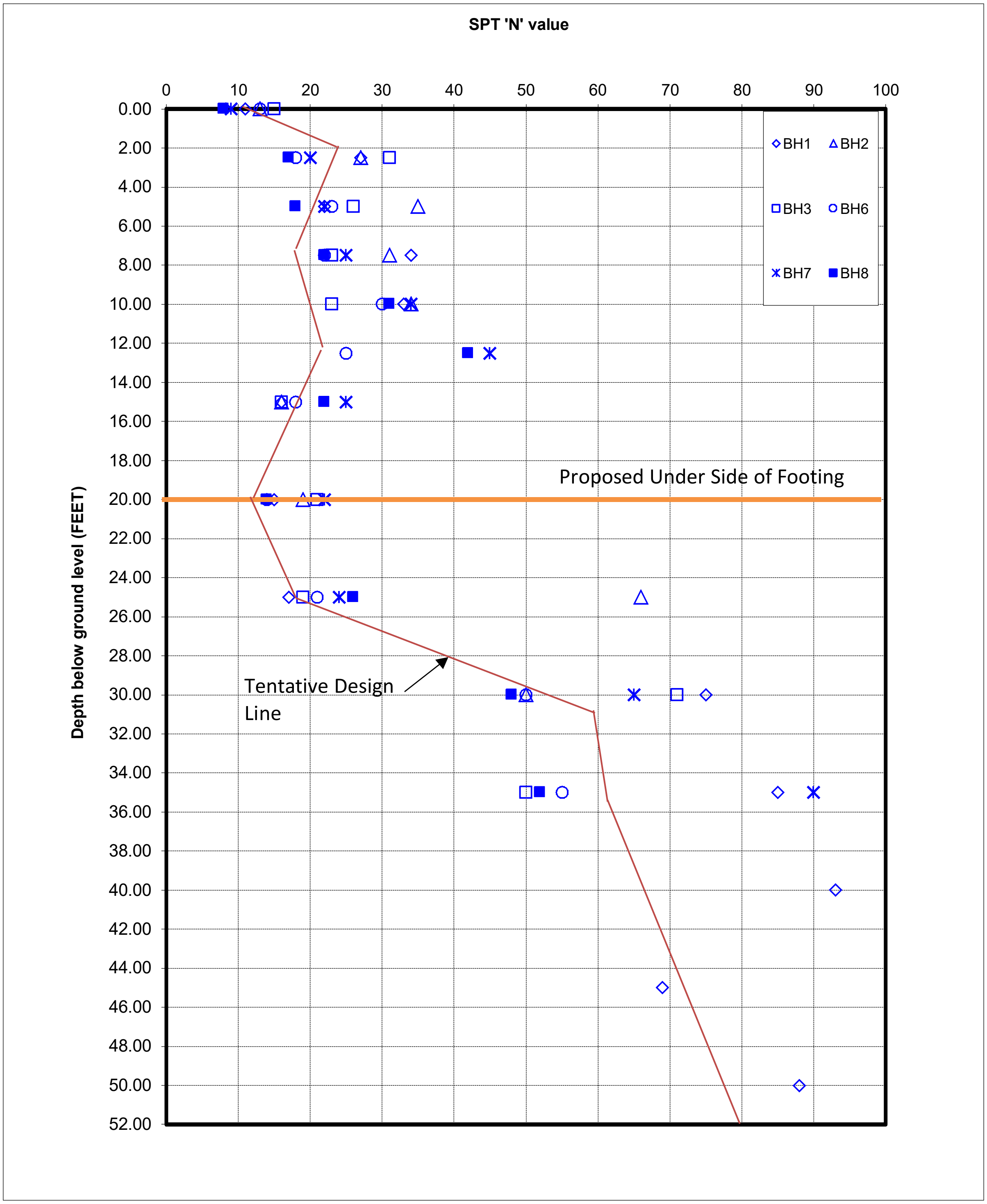
DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30
POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3) | CHEMICAL ANALYSIS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

Plot of SPT 'N' Values Against Depth

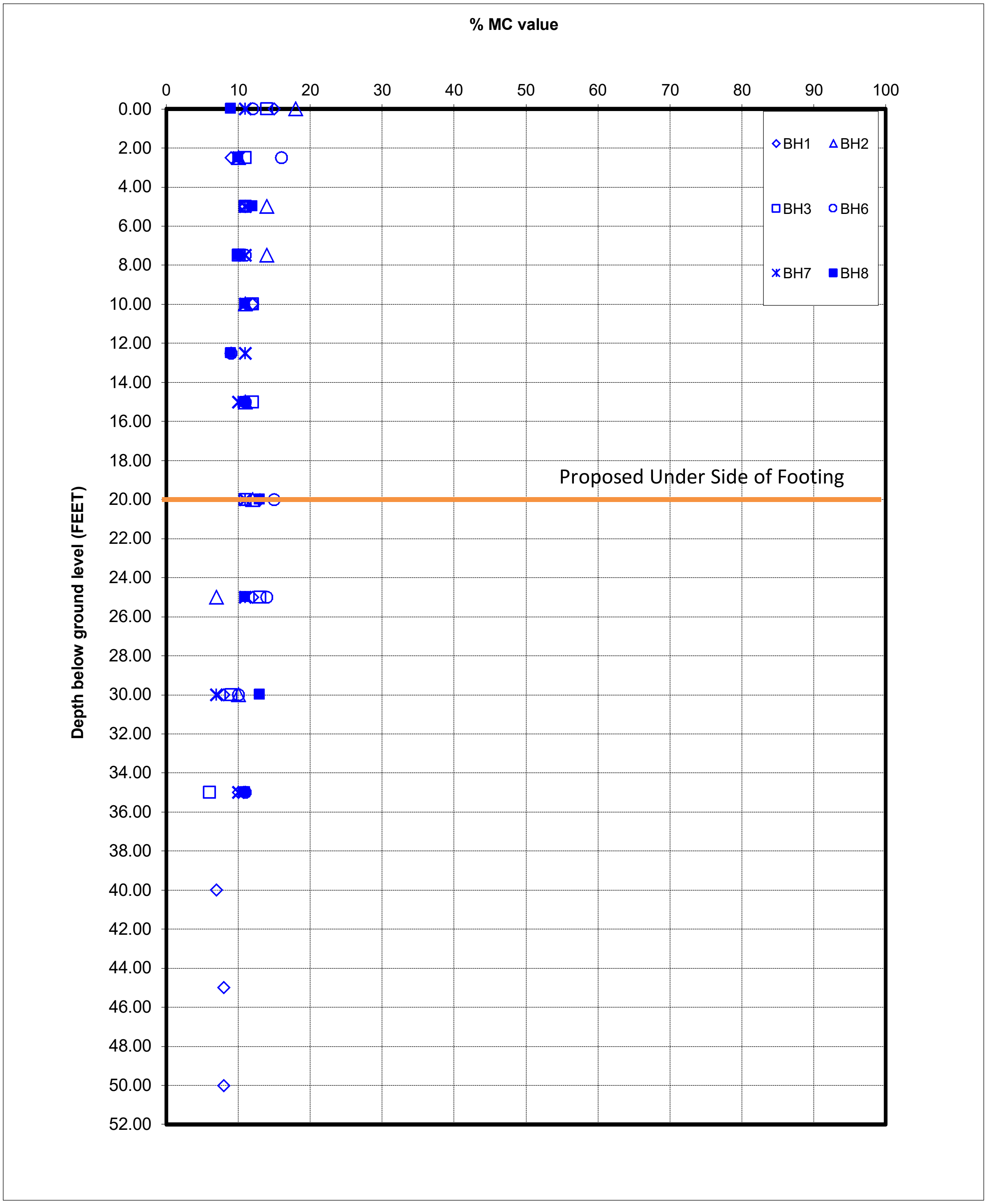
SIRATI & PARTNERS
Geotechnical Hydrogeological & Environmental Solutions



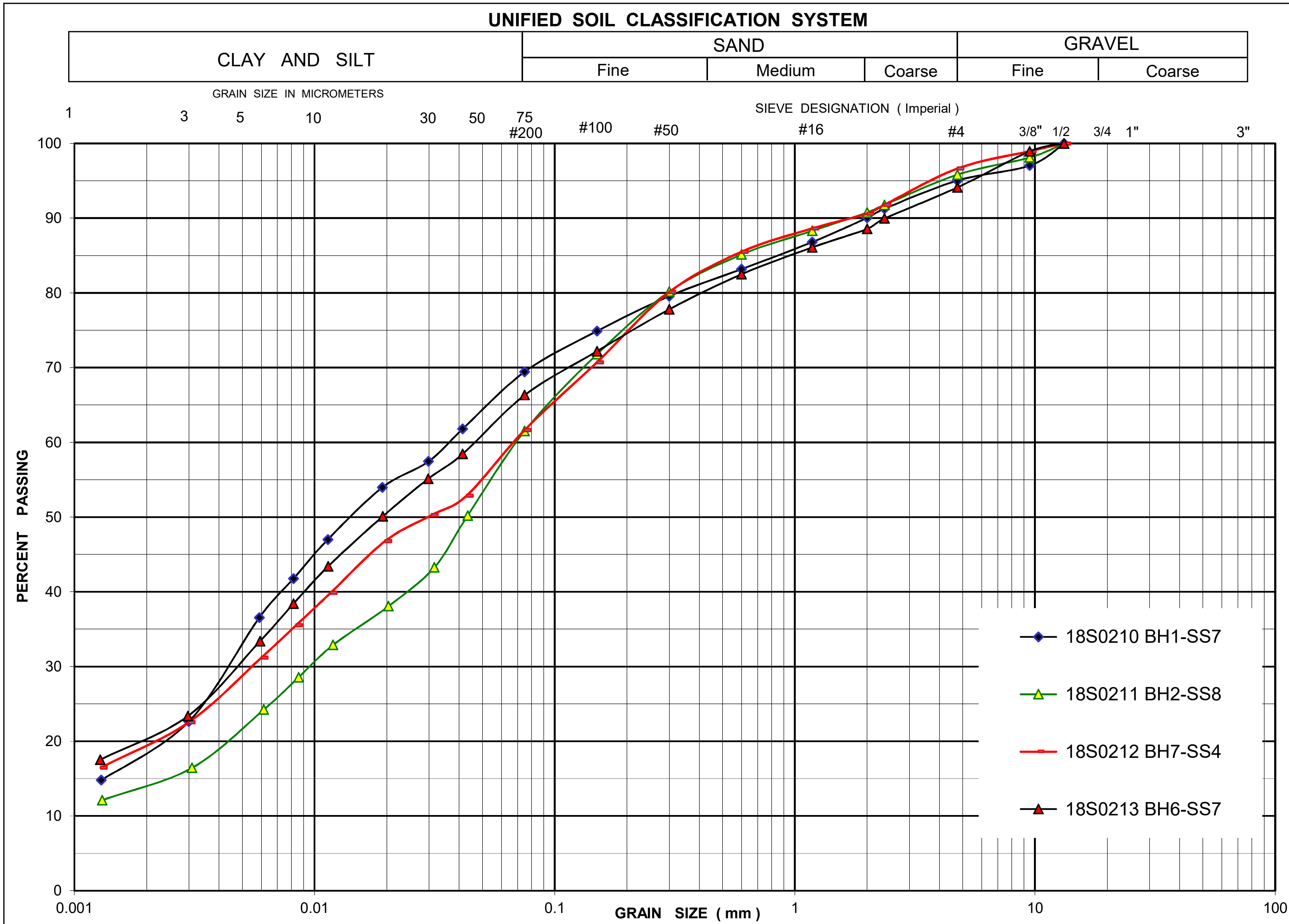
Notes: SPT 'N' values shown as 100 are the maximum number of blows recorded. True 'N' value may be higher.

Notes Not to scale	**Project** Project No Carried out for	Proposed Commercial Development SP18-347-10 Flato Development	**Drawing 8** Sheet 1 of 1

Plot of Percentage MC Values Against Depth



Notes Not to scale	Project Project No Carried out for	Proposed Commercial Development SP18-347-10 Flato Development	**Drawing 9** Sheet 1 of 1



SIRATI & PARTNERS

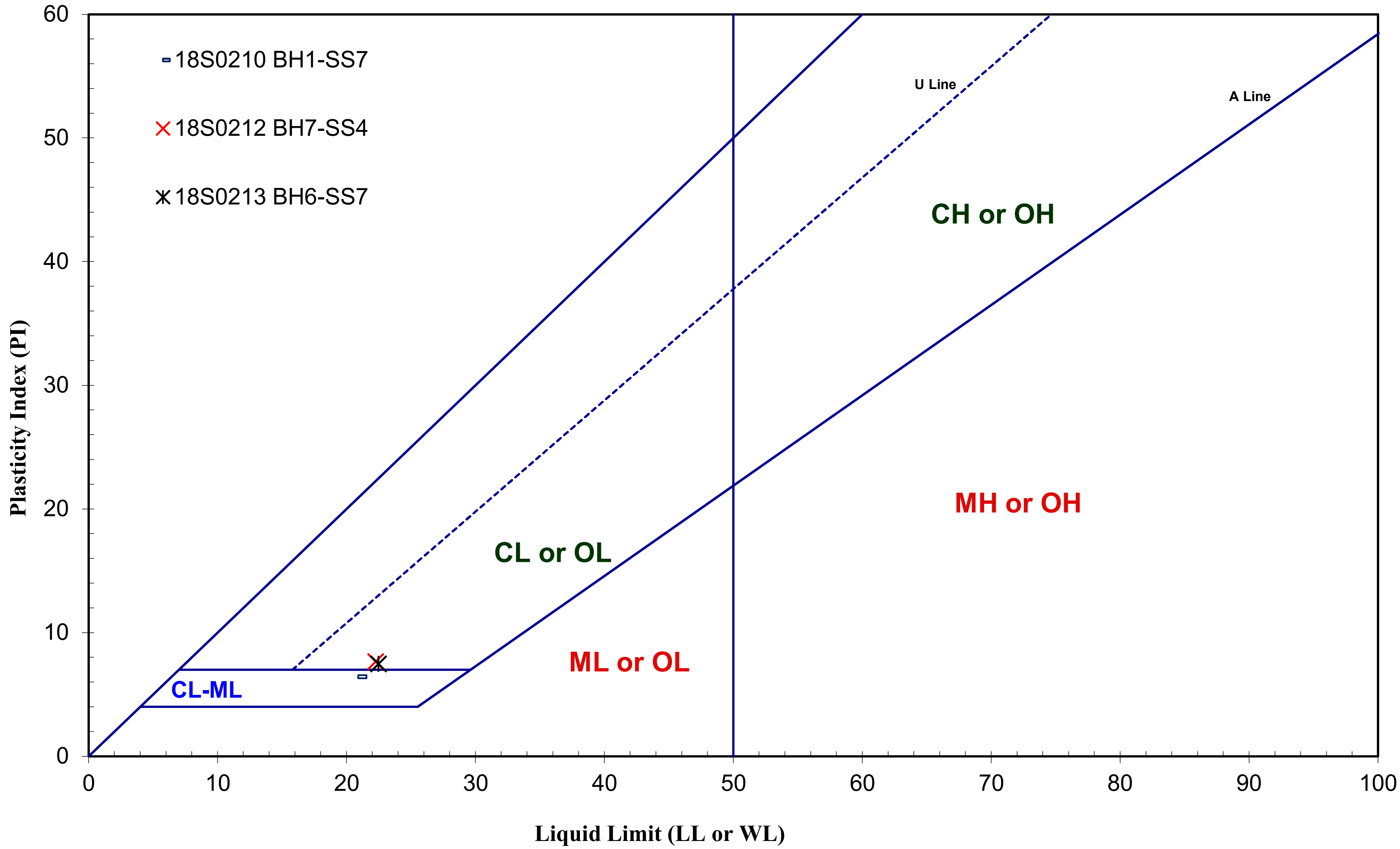
Geotechnical Hydrogeological & Environmental Solutions

GRAIN SIZE DISTRIBUTION

Fig: 10

Project: SP18-347-10

Date: September, 2018

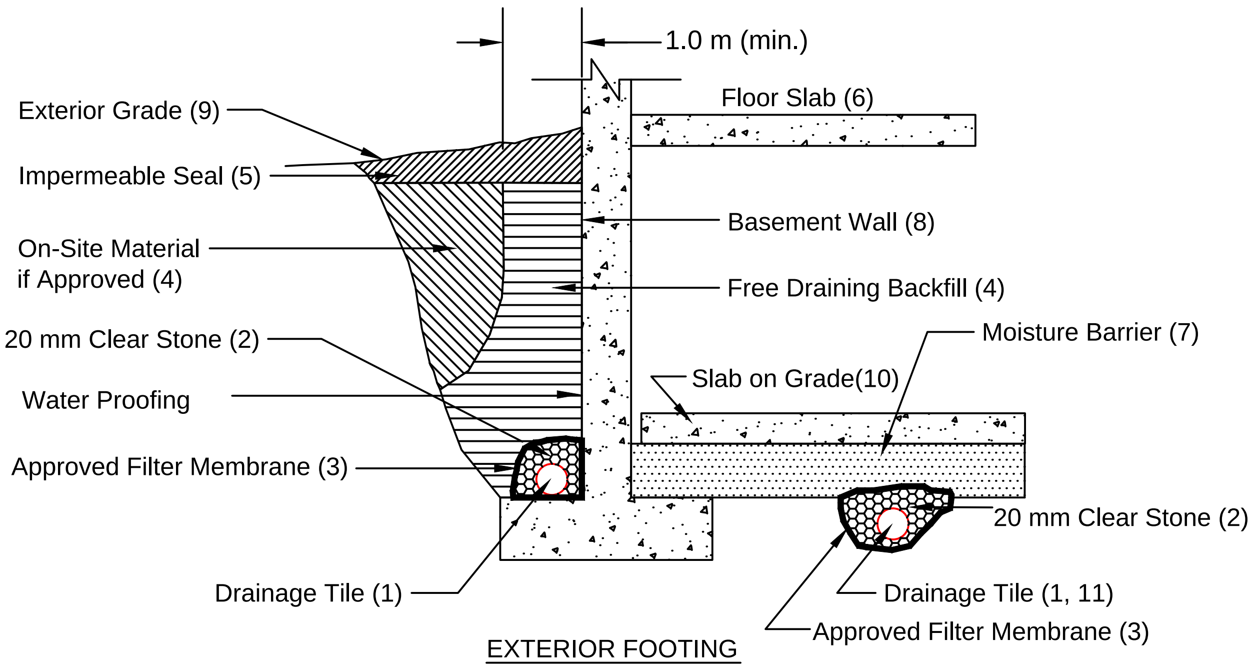


SIRATI & PARTNERS
Geotechnical Hydrogeological & Environmental Solutions

Atterberg's Limits Test

ASTM D4318-10

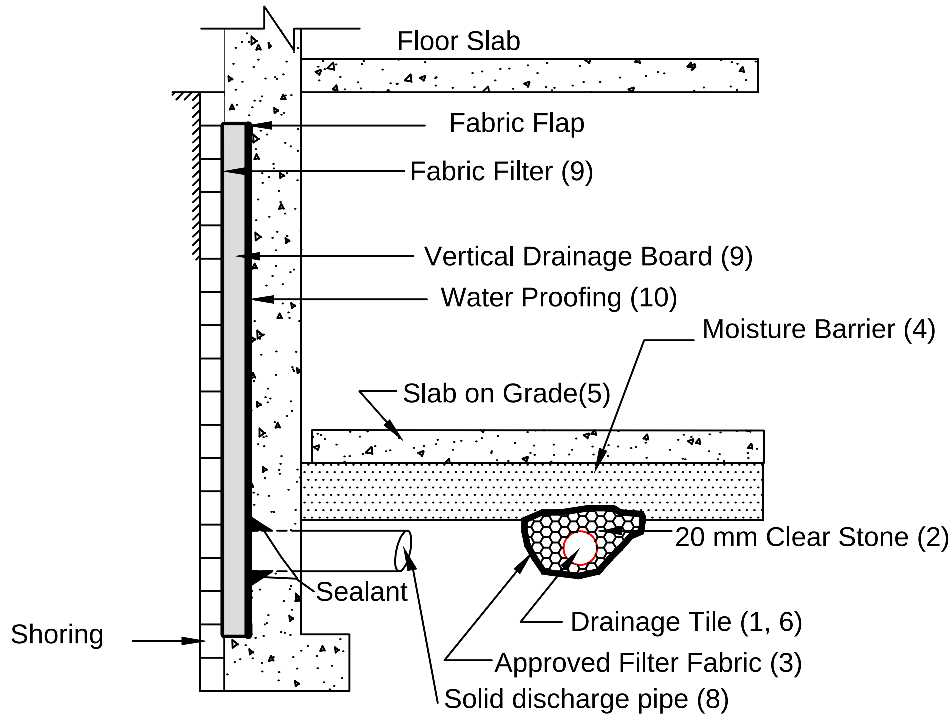
Project No.:	SP18-347-10
Fig. No. :	11
Date :	September, 2018



Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage
(not to scale)



EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet, spaced between columns.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
5. Slab on grade should not be structurally connected to the wall or footing.
6. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
7. Do not connect the underfloor drains to perimeter drains.
8. Solid discharge pipe located at the middle of each bay between the solider piles, approximate spacing 2.5 m, outletting into a solid pipe leading to a sump.
9. Vertical drainage board with filter cloth should be kept a minium of 1.2 m below exterior finished grade.
10. The basement walls should be water proofed using bentonite or equivalent water-proofing system.
11. Review the geotechnical report for specific details. Final detail must be approved before system is considered acceptable.

DRAINAGE RECOMMENDATIONS

Shored Basement wall with Underfloor Drainage System

(not to scale)

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and Sirati & Partners Consultants Limited. Without this confirmation, no responsibility for the performance of the structure can be accepted by Sirati & Partners Consultants Limited (SPCL). Survey drawing of the pre-and post-fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a SPCL engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by SPCL during placement of engineered fill is required. Work cannot commence or continue without the presence of the SPCL representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

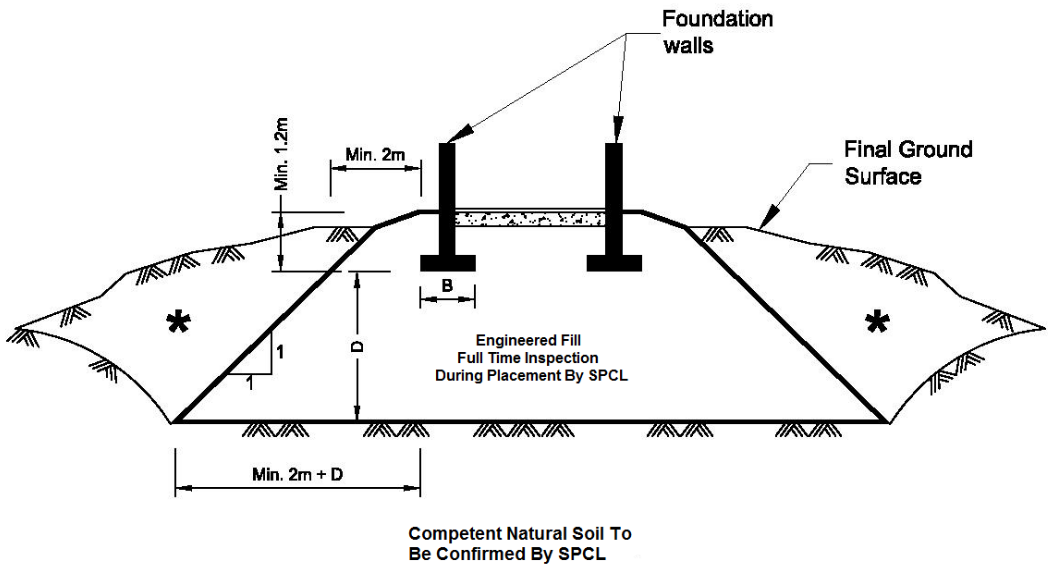
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from SPCL prior to footing concrete placements. All excavations must be backfilled under full time supervision by SPCL to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of SPCL.

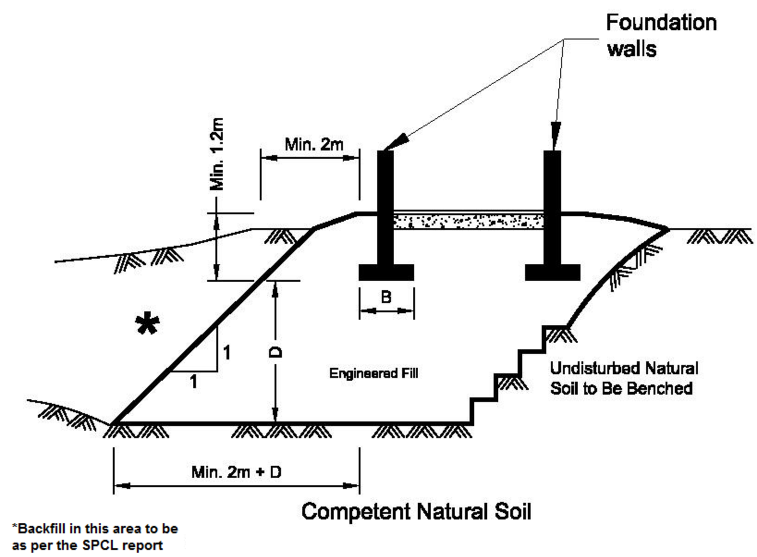
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with Sirati & Partners Consultants Limited (SPCL) report attached.


Foundation walls
Final Ground Surface
Min. 1.2m
Min. 2m
B
D
1
1
*
*
Engineered Fill
Full Time Inspection
During Placement By SPCL
Min. 2m + D
Competent Natural Soil To
Be Confirmed By SPCL


Foundation walls
Min. 1.2m
Min. 2m
B
D
1
1
*
Engineered Fill
Undisturbed Natural Soil to Be Benched
Min. 2m + D
Competent Natural Soil
*Backfill in this area to be as per the SPCL report

Appendix B: Limitations of Report

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to Sirati & Partners Consultants Limited (SIRATI) at the time of preparation. Unless otherwise agreed in writing by SIRATI, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the borehole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the borehole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc. Professional judgement was exercised in gathering and analyzing data and formulation of recommendations using current industry guidelines and standards. Similar to all professional persons rendering advice, SIRATI cannot act as absolute insurer of the conclusion we have reached. No additional warranty or representation, expressed or implied, is included or intended in this report other than stated herein the report.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. SIRATI accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time. Any user of this report specifically denies any right to claims against the Consultant, Sub-Consultants, their officers, agents and employees in excess of the fee paid for professional services.

SIRATI engagement hereunder is subject to and condition upon, that SIRATI not being required by the Client, or any other third party to provide evidence or testimony in any legal proceedings pertaining to this finding of this report or providing litigations support services which may arise to be required in respect of the work produced herein by SIRATI. It is prohibited to publish, release or disclose to any third party the report produced by SIRATI pursuant to this engagement and such report is produced solely for the Client own internal purposes and which shall remain the confidential proprietary property of SIRATI for use by the Client, within the context of the work agreement. The Client will and does hereby remise and forever absolutely release SIRATI, its directors, officers, agents and shareholders of and from any and all claims, obligations, liabilities, expenses, costs, charges or other demands or requirements of any nature pertaining to the report produced by SIRATI hereunder. The Client will not commence any claims against any Person who may make a claim against SIRATI in respect of work produced under this engagement.

APPENDIX B

Sanitary Sewage Calculations

Anindita Datta

From: Stephen Ng <stephen.ng@ibigroup.com>
Sent: Tuesday, April 16, 2019 2:56 PM
To: Anindita Datta; Brad Chase
Cc: Nick Constantin; Bruce McCall-Richmond
Subject: RE: 6710 Hurontario Street (CFCA #1060-5180)

Hi Anindita,

As requested, I am sending you some preliminary statistics re: occupant load at 6710 Hurontario Street based on the number of hotel suites and the areas of the offices and banquet halls:

HOTEL SUITES:
164 Suites * 2 Persons per sleeping area = **328 Persons**

BANQUET HALL:
1165 m2 / 1.10 m2 per person in a dining/alcoholic beverage and cafeteria space = **1059 Persons**

OFFICE (RENTAL):
759 m2 / 9.3 m2 per person in an office = **82 Persons**

OFFICE (HOTEL):
180 m2 / 9.3 m2 per person in an office = **20 Persons**

ESTIMATED TOTAL = 1489

If you need anything else, just let us know.

Regards,

Stephen

From: Anindita Datta [mailto:adatta@cfcrozier.ca]
Sent: Tuesday, April 16, 2019 1:33 PM
To: Stephen Ng; Brad Chase
Cc: Nick Constantin; Bruce McCall-Richmond
Subject: RE: 6710 Hurontario Street (CFCA #1060-5180)

Hi Stephen,

We are looking for the number of hotel rooms and the seating capacity of the banquet hall. The Region has separate criteria for demand calculations for the service connections, which are separate from OBC. Please note that we just need an estimate at this time.

Thank you,
Anindita

Anindita Datta | Land Development
C.F. Crozier & Associates Consulting Engineers
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
cfcrozier.ca | adatta@cfcrozier.ca
tel: 905.875.0026 ext: 312

From: Stephen Ng <stephen.ng@ibigroup.com>
Sent: Tuesday, April 16, 2019 1:24 PM
To: Anindita Datta <adatta@cfcrozier.ca>; Brad Chase <brad.chase@IBIGroup.com>
Cc: Nick Constantin <nconstantin@cfcrozier.ca>; Bruce McCall-Richmond <BruceMR@gsai.ca>
Subject: RE: 6710 Hurontario Street (CFCA #1060-5180)

Hi Anindita,

We do have programmatic areas for the banquet halls and offices and hotel unit count and the OBC would provide a ratio for in terms of occupancy, however typically sanitary demands and fixture counts would be determined via mechanical consultant.

I've cc'ed Bruce McCall-Richmond from GSAI for input on how to proceed with your question.

Best Regards,

Stephen

From: Anindita Datta [mailto:adatta@cfcrozier.ca]
Sent: Tuesday, April 16, 2019 11:25 AM
To: Brad Chase; Stephen Ng
Cc: Nick Constantin
Subject: 6710 Hurontario Street (CFCA #1060-5180)

Good Morning,

We are trying to calculate final sanitary demands for the 6710 Hurontario property. Could you kindly confirm the total occupancy for the hotel rooms, banquet halls and office, including staff?

Should you have any questions, please contact our office. Thank you.

Best Regards,
Anindita

Anindita Datta | Land Development
C.F. Crozier & Associates Consulting Engineers

CROZIER CONSULTING ENGINEERS

File:	1060-5180
Date:	12-Mar-19
By:	HJ
Check By:	AD

6710 Hurontario Street - Sanitary Flows

Total Site Area	*Site Plan prepared by IBI Group Architects dated March 7, 2019*	0.74	ha
Commercial Population	*Estimate provided by IBI Architects*	1,489	persons
Sanitary Design Flows			
Commercial	*Region of Peel Public Works Design Criteria Manual-Sanitary 2-9-2 (Rev. July 2009)*	302.8	L/capita-day
Total Sanitary Design Flows			
Average Daily Flow		5.22	L/sec
Max Day Peak Factor	*Region of Peel Public Works Design Criteria Manual-Sanitary pg.3 (Rev. July 2009)*	3.7	
Max Daily Flow		19.21	L/sec
Infiltration			
Infiltration Rate	*Region of Peel Public Works Design Criteria Manual-Sanitary pg.3 (Rev. July 2009)*	0.20	L/s/ha
Total Infiltration		0.15	L/sec
	TOTAL DESIGN FLOW	**19.36**	**L/sec**

Connection Demand Table

WATER CONNECTION

Connection point [3]			
Existing 300mm diameter watermain on Skyway Drive			
Pressure zone of connection point		5	
Total equivalent population to be serviced [1]		1489	
Total lands to be serviced		0.74 ha	
Hydrant flow test			
Hydrant flow test location		TBD	
	Pressure (kPa)	Flow (in l/s)	Time
Minimum water pressure	TBD	TBD	TBD
Maximum water pressure	TBD	TBD	TBD

***Information for flow test to be determined when hydrant flow test results become available.**

No.	Water demands		
	Demand type	**Demand**	**Units**
1	Average day flow	5.17	l/s
2	Maximum day flow	7.24	l/s
3	Peak hour flow	15.51	l/s
4	Fire flow [2]	116.7	l/s
Analysis			
5	Maximum day plus fire flow	123.94	l/s

WASTEWATER CONNECTION

Connection point [4]		
Total equivalent population to be serviced		
Total lands to be serviced		0.74 ha
6	Wastewater sewer effluent (in l/s)	19.36

[1] Please refer to design criteria for population equivencies
[2] Please reference the Fire Underwriters Survey Document
[3] Please specify the connection point ID
[4] Please specify the connection point (wastewater line or manhole ID)
Also, the “total equivalent population to be serviced” and the “total lands to be serviced” should reference the connection point. (the FSR should contain one copy of Site Servicing Plan)

Please include the graphs associated with the hydrant flow test information table
Please provide Professional Engineer's signature and stamp on the demand table
All required calculations must be submitted with the demand table submission.

APPENDIX C

Potable Water Demand Calculations

Anindita Datta

From:	Stephen Ng <stephen.ng@ibigroup.com>
Sent:	Tuesday, April 16, 2019 2:56 PM
To:	Anindita Datta; Brad Chase
Cc:	Nick Constantin; Bruce McCall-Richmond
Subject:	RE: 6710 Hurontario Street (CFCA #1060-5180)

Hi Anindita,

As requested, I am sending you some preliminary statistics re: occupant load at 6710 Hurontario Street based on the number of hotel suites and the areas of the offices and banquet halls:

HOTEL SUITES:
164 Suites * 2 Persons per sleeping area = **328 Persons**

BANQUET HALL:
1165 m2 / 1.10 m2 per person in a dining/alcoholic beverage and cafeteria space = **1059 Persons**

OFFICE (RENTAL):
759 m2 / 9.3 m2 per person in an office = **82 Persons**

OFFICE (HOTEL):
180 m2 / 9.3 m2 per person in an office = **20 Persons**

ESTIMATED TOTAL = **1489**

If you need anything else, just let us know.

Regards,

Stephen

From: Anindita Datta [mailto:adatta@cfcrozier.ca]
Sent: Tuesday, April 16, 2019 1:33 PM
To: Stephen Ng; Brad Chase
Cc: Nick Constantin; Bruce McCall-Richmond
Subject: RE: 6710 Hurontario Street (CFCA #1060-5180)

Hi Stephen,

We are looking for the number of hotel rooms and the seating capacity of the banquet hall. The Region has separate criteria for demand calculations for the service connections, which are separate from OBC. Please note that we just need an estimate at this time.

Thank you,
Anindita

Anindita Datta | Land Development
C.F. Crozier & Associates Consulting Engineers
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
cfcrozier.ca | adatta@cfcrozier.ca
tel: 905.875.0026 ext: 312

From: Stephen Ng <stephen.ng@ibigroup.com>
Sent: Tuesday, April 16, 2019 1:24 PM
To: Anindita Datta <adatta@cfcrozier.ca>; Brad Chase <brad.chase@IBIGroup.com>
Cc: Nick Constantin <nconstantin@cfcrozier.ca>; Bruce McCall-Richmond <BruceMR@gsai.ca>
Subject: RE: 6710 Hurontario Street (CFCA #1060-5180)

Hi Anindita,

We do have programmatic areas for the banquet halls and offices and hotel unit count and the OBC would provide a ratio for in terms of occupancy, however typically sanitary demands and fixture counts would be determined via mechanical consultant.

I've cc'ed Bruce McCall-Richmond from GSAI for input on how to proceed with your question.

Best Regards,

Stephen

From: Anindita Datta [mailto:adatta@cfcrozier.ca]
Sent: Tuesday, April 16, 2019 11:25 AM
To: Brad Chase; Stephen Ng
Cc: Nick Constantin
Subject: 6710 Hurontario Street (CFCA #1060-5180)

Good Morning,

We are trying to calculate final sanitary demands for the 6710 Hurontario property. Could you kindly confirm the total occupancy for the hotel rooms, banquet halls and office, including staff?

Should you have any questions, please contact our office. Thank you.

Best Regards,
Anindita

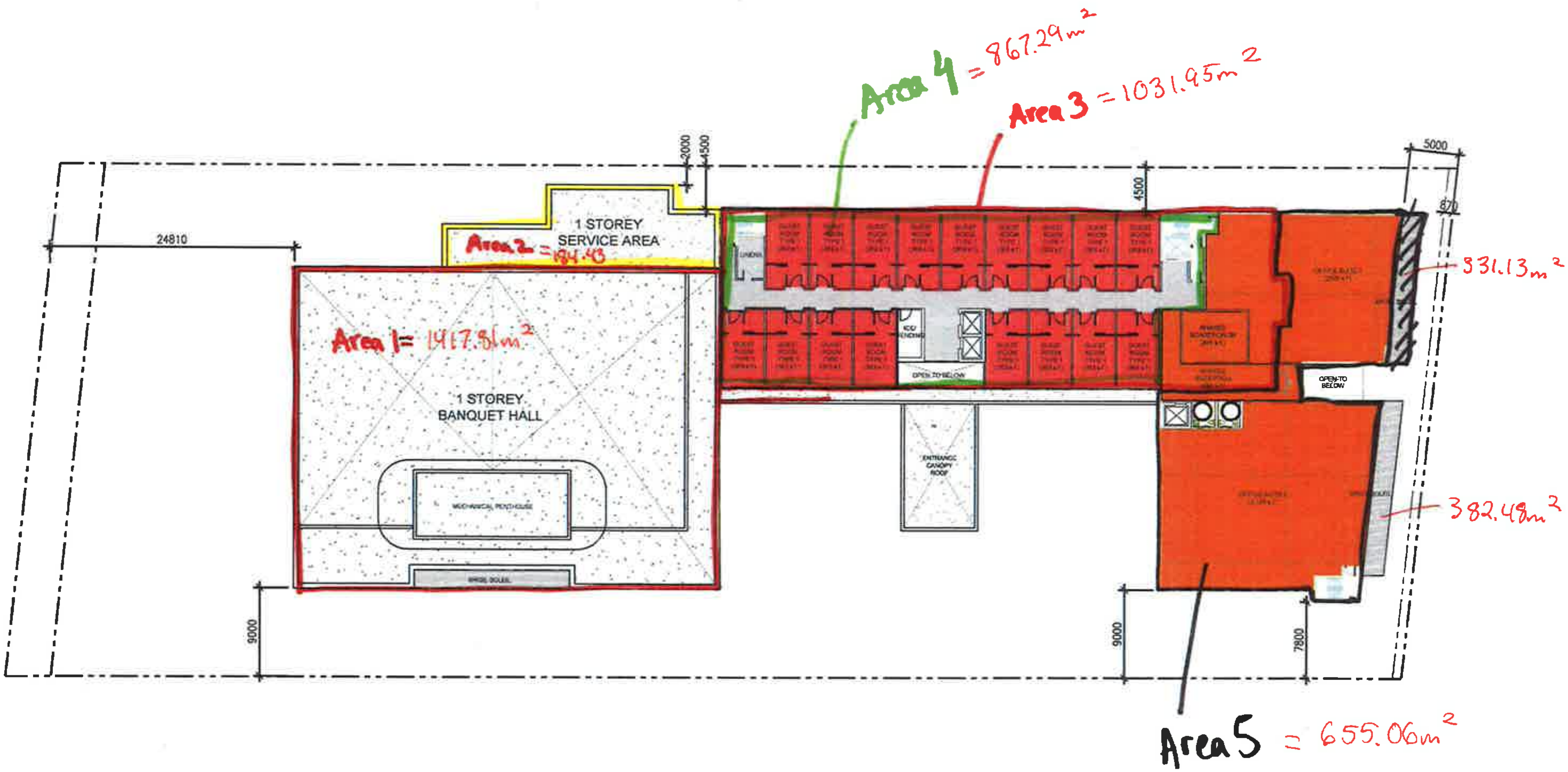
Anindita Datta | Land Development
C.F. Crozier & Associates Consulting Engineers

CRОZIER
CONSULTING ENGINEERS

File:	1060-5180
Date:	3-Mar-18
Updated:	
By:	HJ
Check By:	AD

6710 Hurontario Street- Water Design Criteria

Developed Site Area	*Site Plan prepared by IBI Group Architects dated March 7, 2019*	0.74	ha
Total Commercial Population	*Estimate provided by IBI Architects*	1489	people
Domestic Average Consumption Design Flow			
Commercial (ICI)	*Region of Peel Public Works Design Criteria Manual- Watermain pg.4 (Rev. June 2010)*	300	L/employee*d
Average Commercial Daily Flow	*Region of Peel Public Works Design Criteria Manual- Watermain pg.4 (Rev. June 2010)*	5.17	L/sec
Max Day Peak Factor		1.40	
Max Day Demand Flow	*Region of Peel Public Works Design Criteria Manual- Watermain pg.4 (Rev. June 2010)*	7.24	L/sec
Peak Hour Factor		3.00	
Peak Hour Flow	*Region of Peel Public Works Design Criteria Manual- Watermain pg.4 (Rev. June 2010)*	15.51	L/sec
Fire Flow Demand		116.7	L/sec
Total Design Flow (FUS + Max Day)		*123.94*	L/sec



Area 4 = 867.29m²
Area 3 = 1031.95m²
1 STOREY SERVICE AREA
Area 2 = 194.43
Area 1 = 1417.81m²
1 STOREY BANQUET HALL
ENTRANCE CANOPY ROOF
OPEN TO BELOW
331.13m²
382.49m²
Area 5 = 655.06m²
24810
2000
4500
5000
870
9000
7800

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey
Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

F = 220 * C * sqrt A

where

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Proposed Buildings Non-Combustible
0.8 C
12150 sq.m. floor area (GFA)

Therefore F= 20,000 L/min (rounded to nearest 1000 L/min)

Fire flow determined above shall not exceed:
30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Buring	25%
Combustible	No Charge		

Combustible 0% reduction
0 L/min reduction

Therefore UPDATED F= 20,000 L/min (rounded to nearest 1000 L/min)

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduce by up to 50% for complete automatic sprinkler protection.

Sprinkler System Assume 50% reduction
10,000 L/min reduction

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) esposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	30.1 to 45 m	5%
10.1 to 20 m	15%		

Exposed buildings

Name	**Distance (m)**		
North	9	20%	4000
South	18	15%	3000
East	70	0%	0
West	45+	0%	0
			7,000 L/min Surcharge

Determine Required Fire Flow

No.1	20,000	
No. 2	0	reduction
No. 3	10,000	reduction
No. 4	7,000	surcharge

Required Flow: **17,000 L/min**
Rounded to nearest 1000l/min: **17,000 L/min** or **283.3 L/s**
4,491 USGPM

Determine Required Fire Storage Volume

Flow from above 17,000 L/min

Required duration 6.00 hours

Therefore: 6,120,000 Litres or
6,120 cu.m. is the required fire storage volume.

Required Duration of Fire Flow	
Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Fire Protection Water Supply Guideline
Part 3 of the Ontario Building Code (2006)

$$Q = KVS_{TOT}$$

Q =	minimum supply of water in litres (L)
K =	water supply coefficient
V =	total building volume in cubic metres
S_{TOT} =	total of spatial coefficient values from property line exposures on all sides

K =	23.0	Group C/D building with combustible construction (Table 1)
V =	36597.3	(3m height assumed for each floor)
S_{TOT} =	2	S_{TOT} Need Not Exceed 2.0

Q = 1,683,476 L

Based on ranges listed in Table 2, the required minimum water supply flow rate is	**9000**	**L/min**
	150	**L/s**

Connection Demand Table

WATER CONNECTION

Connection point [3]			
Existing 300mm diameter watermain on Skyway Drive			
Pressure zone of connection point		5	
Total equivalent population to be serviced [1]		1489	
Total lands to be serviced		0.74 ha	
Hydrant flow test			
Hydrant flow test location		TBD	
	Pressure (kPa)	Flow (in l/s)	Time
Minimum water pressure	TBD	TBD	TBD
Maximum water pressure	TBD	TBD	TBD

***Information for flow test to be determined when hydrant flow test results become available.**

No.	**Water demands**		
	Demand type	**Demand**	**Units**
1	Average day flow	5.17	l/s
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3	Peak hour flow	15.51	l/s
4	Fire flow [2]	116.7	l/s
Analysis			
5	Maximum day plus fire flow	123.94	l/s

WASTEWATER CONNECTION

Connection point [4]		
Total equivalent population to be serviced		
Total lands to be serviced		0.74 ha
6	Wastewater sewer effluent (in l/s)	19.36

[1] Please refer to design criteria for population equivencies
[2] Please reference the Fire Underwriters Survey Document
[3] Please specify the connection point ID
[4] Please specify the connection point (wastewater line or manhole ID)
Also, the “total equivalent population to be serviced” and the “total lands to be serviced” should reference the connection point. (the FSR should contain one copy of Site Servicing Plan)

Please include the graphs associated with the hydrant flow test information table
Please provide Professional Engineer's signature and stamp on the demand table
All required calculations must be submitted with the demand table submission.

APPENDIX D

Stormwater Management Calculations

Ontario IDF CURVE LOOKUP

Active coordinate

43° 38' 15" N, 79° 41' 45" W (43.637500,-79.695833)

Retrieved: Mon, 18 Mar 2019 14:48:02 GMT

Location summary

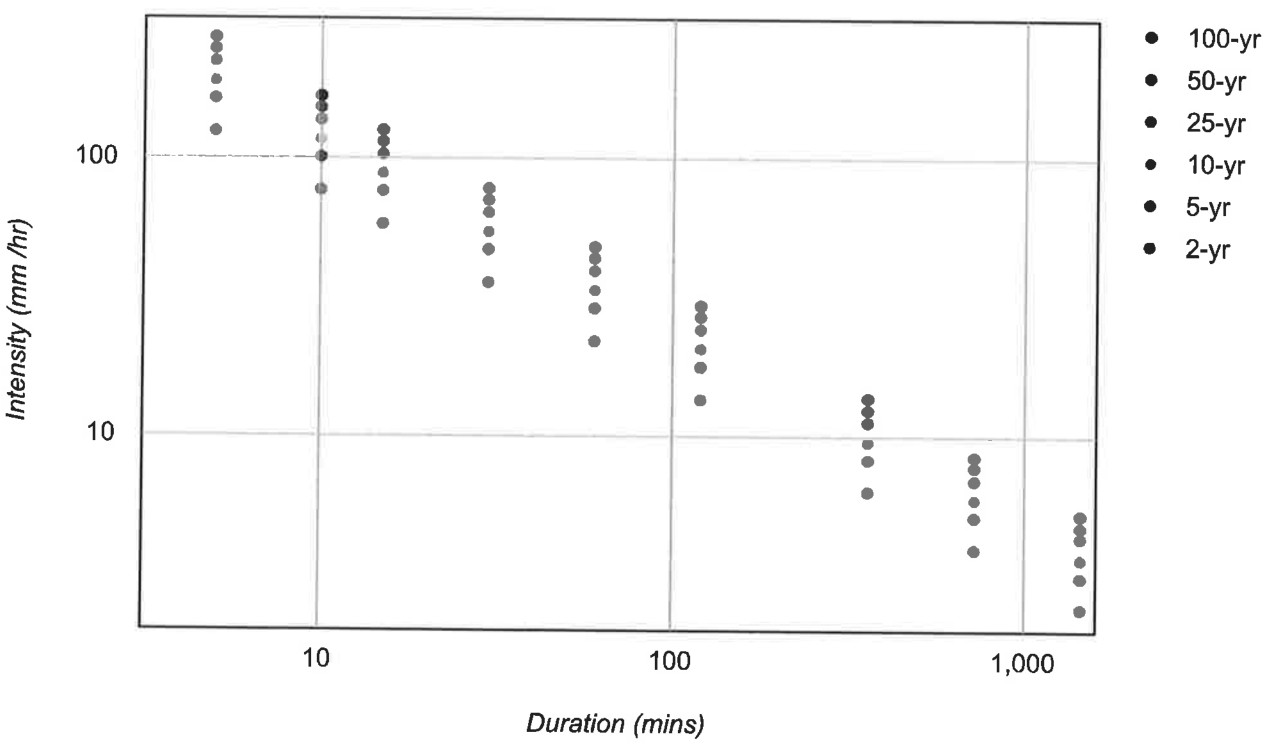
These are the locations in the selection.

IDF Curve: 43° 38' 15" N, 79° 41' 45" W (43.637500,-79.695833)

Results

An IDF curve was found.

Coordinate: 43.637500, -79.695833
IDF curve year: 2010



Coefficient summary

IDF Curve: 43° 38' 15" N, 79° 41' 45" W (43.637500,-79.695833)

Retrieved: Mon, 18 Mar 2019 14:48:02 GMT

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	21.9	28.8	33.4	39.2	43.5	47.8
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

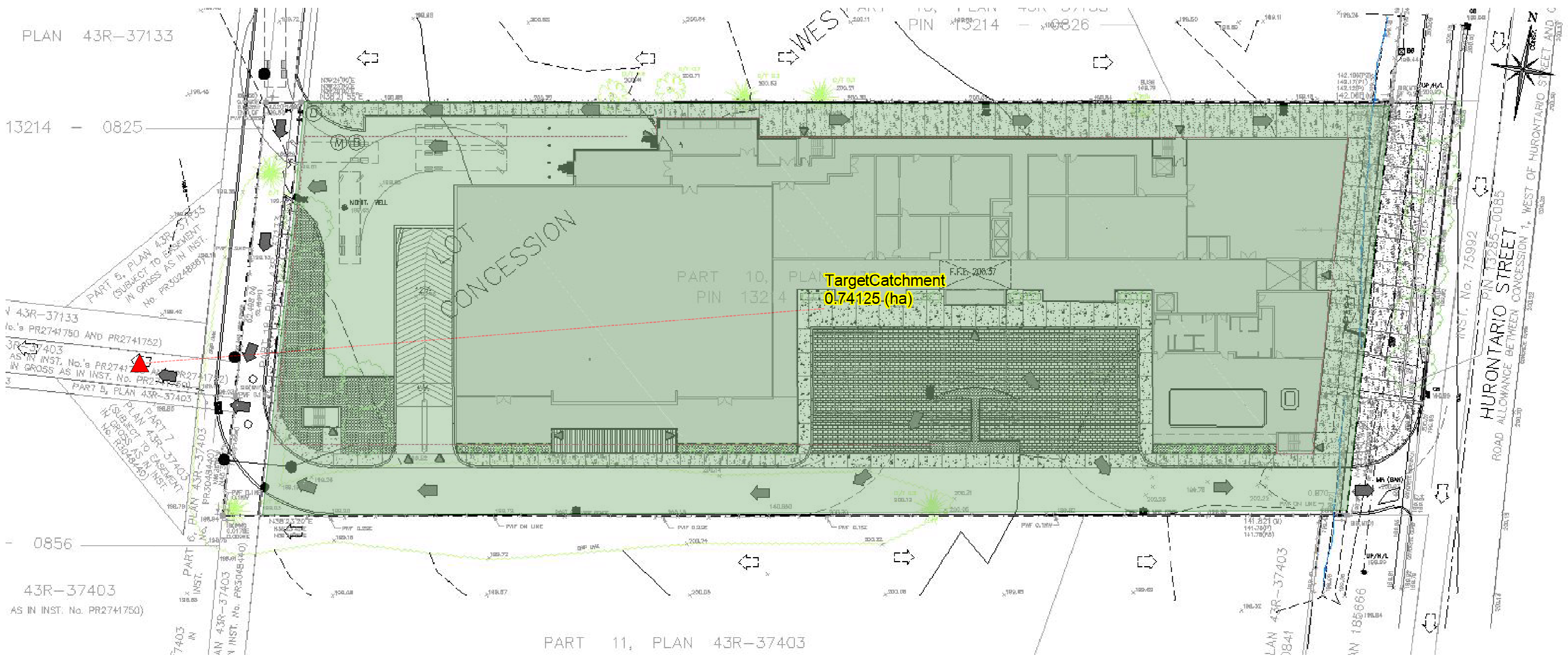
Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	124.4	76.6	57.7	35.6	21.9	13.5	6.3	3.9	2.4
5-yr	163.6	100.8	75.9	46.8	28.8	17.7	8.2	5.1	3.1
10-yr	189.7	116.9	88.0	54.2	33.4	20.6	9.5	5.9	3.6
25-yr	222.7	137.2	103.3	63.6	39.2	24.1	11.2	6.9	4.3
50-yr	247.1	152.2	114.6	70.6	43.5	26.8	12.4	7.7	4.7
100-yr	271.5	167.2	126.0	77.6	47.8	29.4	13.7	8.4	5.2

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.4	12.8	14.4	17.8	21.9	27.0	37.6	46.3	57.0
5-yr	13.6	16.8	19.0	23.4	28.8	35.5	49.4	60.8	75.0
10-yr	15.8	19.5	22.0	27.1	33.4	41.1	57.3	70.6	86.9
25-yr	18.6	22.9	25.8	31.8	39.2	48.3	67.2	82.8	102.0
50-yr	20.6	25.4	28.7	35.3	43.5	53.6	74.6	91.9	113.2
100-yr	22.6	27.9	31.5	38.8	47.8	58.9	82.0	101.0	124.4

Terms of Use

Target Catchment Schematic



Legend

- Outfalls
- Subcatchments

Target Catchment Results

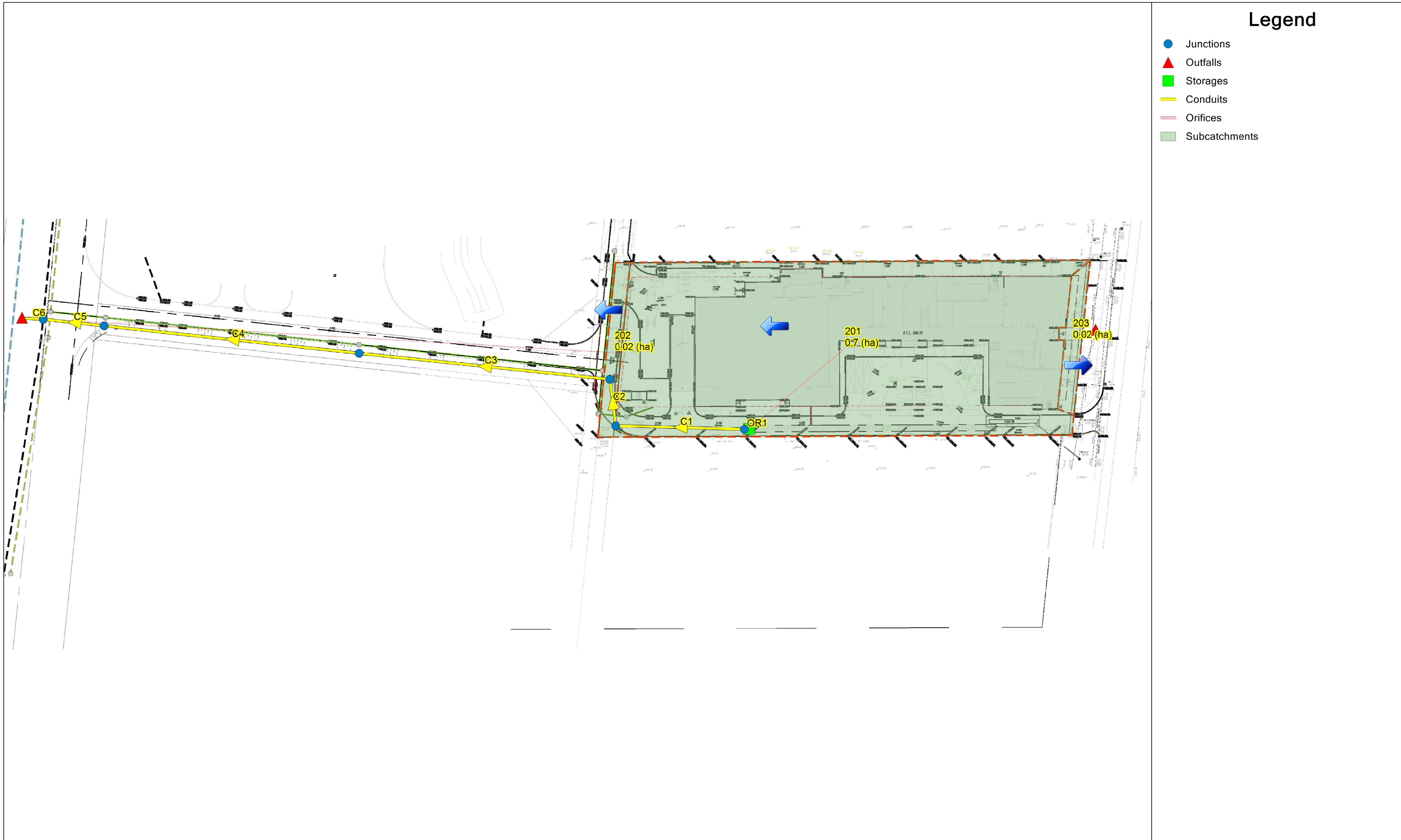
2019.03.20 SWM Target

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------


*************
Element Count
*************
Number of rain gages ...... 4
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                               Data          Recording
Name                 Data Source                               Type          Interval
------------------------------------------------------------------------------------
Mississauga10Yr12Hr  Chicago_12h                               INTENSITY       1 min.
Mississauga10Yr4Hr   Chicago_4h                                INTENSITY       1 min.
SCS_Type_II_100Yr    SCS_Type_II_124.4mm                       INTENSITY       6 min.
SCS_Type_II_10Yr     SCS_Type_II_86.9mm                        INTENSITY       6 min.


********************
Subcatchment Summary
********************
Name                             Area     Width   %Imperv    %Slope Rain Gage
Outlet

------------------------------------------------------------------------------------
-----------------------
TargetCatchment                  0.74    142.00     90.00    0.5000 SCS_Type_II_10Yr
OF1


************
Node Summary
************
                                           Invert      Max.     Ponded    External
Name                 Type                   Elev.     Depth       Area    Inflow
-------------------------------------------------------------------------------
OF1                  OUTFALL               197.50      0.00        0.0


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
```

```
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... NO
    Water Quality .......... NO
  Infiltration Method ...... CURVE_NUMBER
  Starting Date ............ 03/14/2019 00:00:00
  Ending Date .............. 03/15/2019 00:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Wet Time Step ............ 00:01:00
  Dry Time Step ............ 00:01:00


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         0.064        86.900
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.003         3.800
  Surface Runoff ...........         0.061        82.002
  Final Storage ............         0.001         1.122
  Continuity Error (%) .....        -0.027


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.061         0.608
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.000
  External Outflow .........         0.061         0.608
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.000         0.000
  Continuity Error (%) .....         0.000


  ***************************
  Subcatchment Runoff Summary
  ***************************

------------------------------------------------------------------------------------
--------------------
                                Total      Total      Total      Total      Total
Total     Peak  Runoff
                               Precip     Runon       Evap      Infil     Runoff
Runoff   Runoff   Coeff
  Subcatchment                     mm         mm         mm         mm         mm
10^6 ltr      LPS

------------------------------------------------------------------------------------
--------------------
  TargetCatchment               86.90       0.00       0.00       3.80      82.00
0.61   223.86   0.944


  Analysis begun on:  Mon Apr 15 12:50:20 2019
  Analysis ended on:  Mon Apr 15 12:50:20 2019
```

Total elapsed time: < 1 sec

Post-Development Catchment Schematic



Post-Dev Catchment Results (10 Yr CHI)

2019.03.20 Post Development

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
Element Count
****
Number of rain gages 4
Number of subcatchments ... 3
Number of nodes 9
Number of links 7
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Mississauga100Yr4Hr	Chicago_4h_100Yr	INTENSITY	1 min.
Mississauga10Yr4Hr	Chicago_4h	INTENSITY	1 min.
SCS_Type_II_100Yr	SCS_Type_II_124.4mm	INTENSITY	6 min.
SCS_Type_II_10Yr	SCS_Type_II_86.9mm	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	0.70	142.00	96.50	0.5000	Mississauga10Yr4Hr	SU1
202	0.02	25.00	90.00	0.5000	Mississauga10Yr4Hr	OF1
203	0.02	50.00	90.00	0.5000	Mississauga10Yr4Hr	OF2

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CBMH#3	JUNCTION	196.24	2.80	0.0	
J1	JUNCTION	198.10	1.70	0.0	
J3	JUNCTION	195.51	3.61	0.0	
J4	JUNCTION	195.10	1.85	0.0	
J5	JUNCTION	194.69	3.48	0.0	
J6	JUNCTION	194.51	2.00	0.0	
OF1	OUTFALL	194.20	1.00	0.0	
OF2	OUTFALL	190.00	0.00	0.0	
SU1	STORAGE	198.19	1.00	0.0	

****
Link Summary

****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	CBMH#3	CONDUIT	38.9	3.3438	0.0130
C2	CBMH#3	J3	CONDUIT	13.8	1.0145	0.0130
C3	J3	J4	CONDUIT	75.4	0.5040	0.0130
C4	J4	J5	CONDUIT	76.7	0.4954	0.0130
C5	J5	J6	CONDUIT	18.3	0.9837	0.0130
C6	J6	OF1	CONDUIT	5.0	6.2120	0.0130
OR1	SU1	J1	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.53	0.22	0.13	0.53	1	786.46
C2	CIRCULAR	0.53	0.22	0.13	0.53	1	433.20
C3	CIRCULAR	0.60	0.28	0.15	0.60	1	435.92
C4	CIRCULAR	0.60	0.28	0.15	0.60	1	432.21
C5	CIRCULAR	0.60	0.28	0.15	0.60	1	609.01
C6	CIRCULAR	1.00	0.79	0.25	1.00	1	5976.04

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****

```
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
```

```
  Water Quality .......... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Starting Date ............ 03/14/2019 00:00:00
Ending Date .............. 03/15/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.041        55.384
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.001         1.191
Surface Runoff ...........         0.040        53.607
Final Storage ............         0.000         0.628
Continuity Error (%) .....        -0.076


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.040         0.396
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.040         0.396
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.024


***************************
Time-Step Critical Elements
***************************
Link C2 (3.46%)


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     1.92 sec
Average Time Step           :     4.96 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :     0.00
```

Average Iterations per Step : 2.00
Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
201	55.38	0.00	0.00	1.09	53.71	0.38	315.26	0.970
202	55.38	0.00	0.00	3.09	51.69	0.01	12.77	0.933
203	55.38	0.00	0.00	3.00	51.78	0.01	13.44	0.935

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CBMH#3	JUNCTION	0.02	0.22	196.46	0 01:31	0.22
J1	JUNCTION	0.01	0.16	198.26	0 01:31	0.16
J3	JUNCTION	0.02	0.25	195.76	0 01:32	0.25
J4	JUNCTION	0.02	0.25	195.35	0 01:32	0.25
J5	JUNCTION	0.02	0.21	194.90	0 01:33	0.21
J6	JUNCTION	0.01	0.11	194.62	0 01:33	0.11
OF1	OUTFALL	0.01	0.11	194.31	0 01:33	0.11
OF2	OUTFALL	0.00	0.00	190.00	0 00:00	0.00
SU1	STORAGE	0.03	0.60	198.79	0 01:31	0.60

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

CBMH#3	JUNCTION	0.00	154.23	0	01:31	0	0.376	0.002
J1	JUNCTION	0.00	154.23	0	01:31	0	0.376	-0.017
J3	JUNCTION	0.00	154.24	0	01:31	0	0.376	-0.004
J4	JUNCTION	0.00	154.17	0	01:32	0	0.376	-0.004
J5	JUNCTION	0.00	154.10	0	01:33	0	0.376	0.003
J6	JUNCTION	0.00	154.10	0	01:33	0	0.376	-0.004
OF1	OUTFALL	12.77	156.72	0	01:33	0.0103	0.386	0.000
OF2	OUTFALL	13.44	13.44	0	01:25	0.0104	0.0103	0.000
SU1	STORAGE	315.26	315.26	0	01:26	0.376	0.376	-0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU1	0.004	3	0	0	0.087	60	0 01:31	154.23

****
Outfall Loading Summary
****

	Flow	Avg	Max	Total

2019.03.20 Post Development

Outfall Node	Freq Pcnt	Flow LPS	Flow LPS	Volume 10^6 ltr
OF1	38.96	13.76	156.72	0.386
OF2	17.41	0.80	13.44	0.010
System	28.18	14.56	159.30	0.396

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	154.23	0 01:31	2.82	0.20	0.30
C2	CONDUIT	154.24	0 01:31	1.83	0.36	0.41
C3	CONDUIT	154.17	0 01:32	1.41	0.35	0.41
C4	CONDUIT	154.10	0 01:33	1.40	0.36	0.41
C5	CONDUIT	154.10	0 01:33	2.59	0.25	0.26
C6	CONDUIT	154.10	0 01:33	3.24	0.03	0.11
OR1	ORIFICE	154.23	0 01:31			1.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
C1	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C2	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C4	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C5	1.00	0.01	0.00	0.00	0.60	0.39	0.00	0.00	0.01	0.00
C6	1.00	0.01	0.00	0.00	0.37	0.62	0.00	0.00	0.04	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Mon Apr 15 12:22:44 2019
Analysis ended on: Mon Apr 15 12:22:46 2019
Total elapsed time: 00:00:02

Post-Dev Catchment Results (10 Yr SCS)

2019.03.20 Post Development

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
Element Count
****

Number of rain gages 4
Number of subcatchments ... 3
Number of nodes 9
Number of links 7
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Mississauga100Yr4Hr	Chicago_4h_100Yr	INTENSITY	1 min.
Mississauga10Yr4Hr	Chicago_4h	INTENSITY	1 min.
SCS_Type_II_100Yr	SCS_Type_II_124.4mm	INTENSITY	6 min.
SCS_Type_II_10Yr	SCS_Type_II_86.9mm	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	0.70	142.00	96.50	0.5000	SCS_Type_II_10Yr	SU1
202	0.02	25.00	90.00	0.5000	SCS_Type_II_10Yr	OF1
203	0.02	50.00	90.00	0.5000	SCS_Type_II_10Yr	OF2

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CBMH#3	JUNCTION	196.24	2.80	0.0	
J1	JUNCTION	198.10	1.70	0.0	
J3	JUNCTION	195.51	3.61	0.0	
J4	JUNCTION	195.10	1.85	0.0	
J5	JUNCTION	194.69	3.48	0.0	
J6	JUNCTION	194.51	2.00	0.0	
OF1	OUTFALL	194.20	1.00	0.0	
OF2	OUTFALL	190.00	0.00	0.0	
SU1	STORAGE	198.19	1.00	0.0	

****
Link Summary

****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	CBMH#3	CONDUIT	38.9	3.3438	0.0130
C2	CBMH#3	J3	CONDUIT	13.8	1.0145	0.0130
C3	J3	J4	CONDUIT	75.4	0.5040	0.0130
C4	J4	J5	CONDUIT	76.7	0.4954	0.0130
C5	J5	J6	CONDUIT	18.3	0.9837	0.0130
C6	J6	OF1	CONDUIT	5.0	6.2120	0.0130
OR1	SU1	J1	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.53	0.22	0.13	0.53	1	786.46
C2	CIRCULAR	0.53	0.22	0.13	0.53	1	433.20
C3	CIRCULAR	0.60	0.28	0.15	0.60	1	435.92
C4	CIRCULAR	0.60	0.28	0.15	0.60	1	432.21
C5	CIRCULAR	0.60	0.28	0.15	0.60	1	609.01
C6	CIRCULAR	1.00	0.79	0.25	1.00	1	5976.04

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****

```
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
```

```
  Water Quality .......... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Starting Date ............ 03/14/2019 00:00:00
Ending Date .............. 03/15/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.064        86.900
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.001         1.460
Surface Runoff ...........         0.062        84.433
Final Storage ............         0.001         1.033
Continuity Error (%) .....        -0.030


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.062         0.625
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.062         0.620
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.005
Continuity Error (%) .....        -0.020


***************************
Time-Step Critical Elements
***************************
Link C2 (3.65%)


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :      3.27 sec
Average Time Step           :      4.96 sec
Maximum Time Step           :      5.00 sec
Percent in Steady State     :     -0.00
```

Average Iterations per Step : 2.00
Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
201	86.90	0.00	0.00	1.33	84.55	0.59	218.92	0.973
202	86.90	0.00	0.00	3.80	82.31	0.02	6.38	0.947
203	86.90	0.00	0.00	3.67	82.50	0.02	6.40	0.949

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Meters
CBMH#3	JUNCTION	0.04	0.21	196.45	0	12:00	0.21
J1	JUNCTION	0.03	0.16	198.26	0	12:00	0.16
J3	JUNCTION	0.04	0.24	195.75	0	12:01	0.24
J4	JUNCTION	0.04	0.24	195.34	0	12:01	0.24
J5	JUNCTION	0.04	0.20	194.89	0	12:02	0.20
J6	JUNCTION	0.02	0.11	194.62	0	12:02	0.11
OF1	OUTFALL	0.02	0.11	194.31	0	12:02	0.11
OF2	OUTFALL	0.00	0.00	190.00	0	00:00	0.00
SU1	STORAGE	0.05	0.58	198.77	0	12:00	0.58

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

CBMH#3	JUNCTION	0.00	149.86	0	12:00	0	0.588	0.013
J1	JUNCTION	0.00	149.85	0	12:00	0	0.588	0.015
J3	JUNCTION	0.00	149.88	0	12:00	0	0.588	0.061
J4	JUNCTION	0.00	149.69	0	12:01	0	0.588	0.063
J5	JUNCTION	0.00	149.53	0	12:02	0	0.587	0.012
J6	JUNCTION	0.00	149.53	0	12:02	0	0.587	0.007
OF1	OUTFALL	6.38	151.56	0	12:00	0.0165	0.604	0.000
OF2	OUTFALL	6.40	6.40	0	11:54	0.0165	0.0165	0.000
SU1	STORAGE	218.92	218.92	0	11:54	0.592	0.592	-0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	hr:min	Maximum Outflow LPS
SU1	0.007	5	0	0	0.084	58	0	12:00	149.85

****
Outfall Loading Summary
****

Flow Avg Max Total

2019.03.20 Post Development

Outfall Node	Freq Pcnt	Flow LPS	Flow LPS	Volume 10^6 ltr
OF1	96.73	8.14	151.56	0.604
OF2	96.04	0.22	6.40	0.016
System	96.39	8.36	156.00	0.620

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	149.86	0 12:00	2.80	0.19	0.30
C2	CONDUIT	149.88	0 12:00	1.82	0.35	0.41
C3	CONDUIT	149.69	0 12:01	1.40	0.34	0.40
C4	CONDUIT	149.53	0 12:02	1.39	0.35	0.41
C5	CONDUIT	149.53	0 12:02	2.57	0.25	0.26
C6	CONDUIT	149.54	0 12:02	3.22	0.03	0.11
OR1	ORIFICE	149.85	0 12:00			1.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
C1	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C2	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C4	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C5	1.00	0.02	0.00	0.00	0.02	0.97	0.00	0.00	0.01	0.00
C6	1.00	0.02	0.00	0.00	0.01	0.97	0.00	0.00	0.44	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

```
Analysis begun on:  Mon Apr 15 12:48:18 2019
Analysis ended on:  Mon Apr 15 12:48:20 2019
Total elapsed time: 00:00:02
```

Post-Dev Catchment Results (100 Yr CHI)

2019.03.20 Post Development

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

```
*************
Element Count
*************
Number of rain gages ...... 4
Number of subcatchments ... 3
Number of nodes ........... 9
Number of links ........... 7
Number of pollutants ...... 0
Number of land uses ....... 0
```

```
****************
Raingage Summary
****************
```

Name	Data Source	Data Type	Recording Interval
Mississauga100Yr4Hr	Chicago_4h_100Yr	INTENSITY	1 min.
Mississauga10Yr4Hr	Chicago_4h	INTENSITY	1 min.
SCS_Type_II_100Yr	SCS_Type_II_124.4mm	INTENSITY	6 min.
SCS_Type_II_10Yr	SCS_Type_II_86.9mm	INTENSITY	6 min.

```
********************
Subcatchment Summary
********************
```

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	0.70	142.00	96.50	0.5000	Mississauga100Yr4Hr	SU1
202	0.02	25.00	90.00	0.5000	Mississauga100Yr4Hr	OF1
203	0.02	50.00	90.00	0.5000	Mississauga100Yr4Hr	OF2

```
************
Node Summary
************
```

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CBMH#3	JUNCTION	196.24	2.80	0.0	
J1	JUNCTION	198.10	1.70	0.0	
J3	JUNCTION	195.51	3.61	0.0	
J4	JUNCTION	195.10	1.85	0.0	
J5	JUNCTION	194.69	3.48	0.0	
J6	JUNCTION	194.51	2.00	0.0	
OF1	OUTFALL	194.20	1.00	0.0	
OF2	OUTFALL	190.00	0.00	0.0	
SU1	STORAGE	198.19	1.00	0.0	

```
************
Link Summary
```

****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	CBMH#3	CONDUIT	38.9	3.3438	0.0130
C2	CBMH#3	J3	CONDUIT	13.8	1.0145	0.0130
C3	J3	J4	CONDUIT	75.4	0.5040	0.0130
C4	J4	J5	CONDUIT	76.7	0.4954	0.0130
C5	J5	J6	CONDUIT	18.3	0.9837	0.0130
C6	J6	OF1	CONDUIT	5.0	6.2120	0.0130
OR1	SU1	J1	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.53	0.22	0.13	0.53	1	786.46
C2	CIRCULAR	0.53	0.22	0.13	0.53	1	433.20
C3	CIRCULAR	0.60	0.28	0.15	0.60	1	435.92
C4	CIRCULAR	0.60	0.28	0.15	0.60	1	432.21
C5	CIRCULAR	0.60	0.28	0.15	0.60	1	609.01
C6	CIRCULAR	1.00	0.79	0.25	1.00	1	5976.04

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****

```
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
```

```
  Water Quality .......... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Starting Date ............ 03/14/2019 00:00:00
Ending Date .............. 03/15/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.059        79.512
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.001         1.427
Surface Runoff ...........         0.057        77.524
Final Storage ............         0.000         0.627
Continuity Error (%) .....        -0.083


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.057         0.573
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.057         0.573
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.013


***************************
Time-Step Critical Elements
***************************
Link C2 (4.88%)


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :      2.94 sec
Average Time Step           :      4.94 sec
Maximum Time Step           :      5.00 sec
Percent in Steady State     :     -0.00
```

Average Iterations per Step : 2.00
Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
201	79.51	0.00	0.00	1.30	77.65	0.54	491.10	0.977
202	79.51	0.00	0.00	3.70	75.23	0.02	18.95	0.946
203	79.51	0.00	0.00	3.57	75.35	0.02	19.70	0.948

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CBMH#3	JUNCTION	0.02	0.25	196.49	0 01:31	0.25
J1	JUNCTION	0.01	0.18	198.28	0 01:31	0.18
J3	JUNCTION	0.02	0.29	195.80	0 01:32	0.29
J4	JUNCTION	0.02	0.29	195.39	0 01:33	0.29
J5	JUNCTION	0.02	0.24	194.93	0 01:33	0.24
J6	JUNCTION	0.01	0.13	194.64	0 01:33	0.13
OF1	OUTFALL	0.01	0.13	194.33	0 01:33	0.13
OF2	OUTFALL	0.00	0.00	190.00	0 00:00	0.00
SU1	STORAGE	0.04	0.93	199.12	0 01:31	0.93

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

CBMH#3	JUNCTION	0.00	203.03	0	01:31	0	0.543	0.002
J1	JUNCTION	0.00	203.02	0	01:31	0	0.543	-0.009
J3	JUNCTION	0.00	203.04	0	01:32	0	0.543	-0.003
J4	JUNCTION	0.00	202.99	0	01:32	0	0.543	-0.003
J5	JUNCTION	0.00	202.94	0	01:33	0	0.543	0.003
J6	JUNCTION	0.00	202.94	0	01:33	0	0.543	-0.003
OF1	OUTFALL	18.95	206.60	0	01:33	0.015	0.558	0.000
OF2	OUTFALL	19.70	19.70	0	01:25	0.0151	0.0151	0.000
SU1	STORAGE	491.10	491.10	0	01:25	0.543	0.543	-0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU1	0.006	4	0	0	0.135	93	0 01:31	203.02

****
Outfall Loading Summary
****

Flow Avg Max Total

Outfall Node	Freq Pcnt	Flow LPS	Flow LPS	Volume 10^6 ltr
OF1	39.65	20.85	206.60	0.558
OF2	17.94	1.21	19.70	0.015
System	28.79	22.07	210.25	0.573

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	203.03	0 01:31	3.05	0.26	0.35
C2	CONDUIT	203.04	0 01:32	1.97	0.47	0.48
C3	CONDUIT	202.99	0 01:32	1.51	0.47	0.48
C4	CONDUIT	202.94	0 01:33	1.50	0.47	0.48
C5	CONDUIT	202.94	0 01:33	2.79	0.33	0.30
C6	CONDUIT	202.94	0 01:33	3.54	0.03	0.13
OR1	ORIFICE	203.02	0 01:31			1.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
C1	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C4	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C5	1.00	0.01	0.00	0.00	0.59	0.40	0.00	0.00	0.02	0.00
C6	1.00	0.01	0.00	0.00	0.36	0.63	0.00	0.00	0.05	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Mon Apr 15 12:19:23 2019
Analysis ended on: Mon Apr 15 12:19:24 2019
Total elapsed time: 00:00:01

Post-Dev Catchment Results (100 Yr SCS)

2019.03.20 Post Development

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
Element Count
****

Number of rain gages 4
Number of subcatchments ... 3
Number of nodes 9
Number of links 7
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Mississauga100Yr4Hr	Chicago_4h_100Yr	INTENSITY	1 min.
Mississauga10Yr4Hr	Chicago_4h	INTENSITY	1 min.
SCS_Type_II_100Yr	SCS_Type_II_124.4mm	INTENSITY	6 min.
SCS_Type_II_10Yr	SCS_Type_II_86.9mm	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	0.70	142.00	96.50	0.5000	SCS_Type_II_100Yr	SU1
202	0.02	25.00	90.00	0.5000	SCS_Type_II_100Yr	OF1
203	0.02	50.00	90.00	0.5000	SCS_Type_II_100Yr	OF2

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CBMH#3	JUNCTION	196.24	2.80	0.0	
J1	JUNCTION	198.10	1.70	0.0	
J3	JUNCTION	195.51	3.61	0.0	
J4	JUNCTION	195.10	1.85	0.0	
J5	JUNCTION	194.69	3.48	0.0	
J6	JUNCTION	194.51	2.00	0.0	
OF1	OUTFALL	194.20	1.00	0.0	
OF2	OUTFALL	190.00	0.00	0.0	
SU1	STORAGE	198.19	1.00	0.0	

****
Link Summary

****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	CBMH#3	CONDUIT	38.9	3.3438	0.0130
C2	CBMH#3	J3	CONDUIT	13.8	1.0145	0.0130
C3	J3	J4	CONDUIT	75.4	0.5040	0.0130
C4	J4	J5	CONDUIT	76.7	0.4954	0.0130
C5	J5	J6	CONDUIT	18.3	0.9837	0.0130
C6	J6	OF1	CONDUIT	5.0	6.2120	0.0130
OR1	SU1	J1	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.53	0.22	0.13	0.53	1	786.46
C2	CIRCULAR	0.53	0.22	0.13	0.53	1	433.20
C3	CIRCULAR	0.60	0.28	0.15	0.60	1	435.92
C4	CIRCULAR	0.60	0.28	0.15	0.60	1	432.21
C5	CIRCULAR	0.60	0.28	0.15	0.60	1	609.01
C6	CIRCULAR	1.00	0.79	0.25	1.00	1	5976.04

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****

```
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
```

```
  Water Quality .......... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Starting Date ............ 03/14/2019 00:00:00
Ending Date .............. 03/15/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.092       124.400
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.001         1.681
Surface Runoff ...........         0.090       121.630
Final Storage ............         0.001         1.129
Continuity Error (%) .....        -0.032


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.090         0.900
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.089         0.894
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.001         0.006
Continuity Error (%) .....        -0.012


***************************
Time-Step Critical Elements
***************************
Link C2 (4.94%)


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     3.00 sec
Average Time Step           :     4.94 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :    -0.00
```

Average Iterations per Step : 2.00
Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
201	124.40	0.00	0.00	1.53	121.76	0.85	319.51	0.979
202	124.40	0.00	0.00	4.38	119.23	0.02	9.23	0.958
203	124.40	0.00	0.00	4.20	119.47	0.02	9.25	0.960

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Meters
CBMH#3	JUNCTION	0.05	0.25	196.49	0	12:00	0.25
J1	JUNCTION	0.03	0.18	198.28	0	12:00	0.18
J3	JUNCTION	0.05	0.28	195.79	0	12:01	0.28
J4	JUNCTION	0.05	0.29	195.39	0	12:01	0.29
J5	JUNCTION	0.05	0.24	194.93	0	12:02	0.24
J6	JUNCTION	0.03	0.13	194.64	0	12:02	0.12
OF1	OUTFALL	0.03	0.12	194.32	0	12:02	0.12
OF2	OUTFALL	0.00	0.00	190.00	0	00:00	0.00
SU1	STORAGE	0.07	0.90	199.09	0	12:00	0.90

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

CBMH#3	JUNCTION	0.00	199.21	0	12:00	0	0.847	0.011
J1	JUNCTION	0.00	199.20	0	12:00	0	0.848	0.013
J3	JUNCTION	0.00	199.25	0	12:00	0	0.847	0.056
J4	JUNCTION	0.00	199.04	0	12:01	0	0.847	0.057
J5	JUNCTION	0.00	198.87	0	12:02	0	0.846	0.010
J6	JUNCTION	0.00	198.87	0	12:02	0	0.846	0.006
OF1	OUTFALL	9.23	201.18	0	12:00	0.0238	0.87	0.000
OF2	OUTFALL	9.25	9.25	0	11:54	0.0239	0.0239	0.000
SU1	STORAGE	319.51	319.51	0	11:54	0.852	0.852	-0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	hr:min	Maximum Outflow LPS
SU1	0.010	7	0	0	0.130	90	0	12:00	199.20

****
Outfall Loading Summary
****

	Flow	Avg	Max	Total

2019.03.20 Post Development

Outfall Node	Freq Pcnt	Flow LPS	Flow LPS	Volume 10^6 ltr
OF1	97.54	12.14	201.18	0.870
OF2	97.27	0.33	9.25	0.024
System	97.41	12.47	207.61	0.894

****

Link Flow Summary

****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	199.21	0 12:00	3.03	0.25	0.34
C2	CONDUIT	199.25	0 12:00	1.96	0.46	0.48
C3	CONDUIT	199.04	0 12:01	1.51	0.46	0.47
C4	CONDUIT	198.87	0 12:02	1.50	0.46	0.48
C5	CONDUIT	198.87	0 12:02	2.78	0.33	0.30
C6	CONDUIT	198.88	0 12:02	3.52	0.03	0.12
OR1	ORIFICE	199.20	0 12:00			1.00

****

Flow Classification Summary

****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C2	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C4	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C5	1.00	0.02	0.00	0.00	0.01	0.97	0.00	0.00	0.02	0.00
C6	1.00	0.02	0.00	0.00	0.01	0.98	0.00	0.00	0.25	0.00

****

Conduit Surcharge Summary

****

No conduits were surcharged.

Analysis begun on: Mon Apr 15 12:43:19 2019
Analysis ended on: Mon Apr 15 12:43:21 2019
Total elapsed time: 00:00:02

Founder of Plastic Chamber Technology
Stormwater and Septic Solutions
Since 1986

CULTEC

1-800-4-CULTEC
custservice@cultec.com

Prepared For: Flato Development

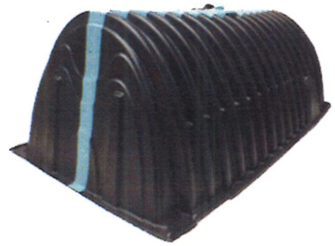
Project Information: 6710 Hurontario Street

Engineer: C.F. Crozier and Associates

Calculations Performed By: AD

Input Given Parameters

Unit of Measure	Metric	
Select Model	Recharger 330XLHD	
Stone Porosity	40.0%	
Number of Header Systems	1 Header	
Stone Depth **Above** Chamber	152	mm
Stone Depth **Below** Chamber	152	mm
Workable Bed Depth	1.50	meters
Max. Bed Width	5.00	meters
Storage Volume Required	178.00	cu. meters



Chamber Specifications

Height	775.0	mm
Width	1321.00	mm
Length	2.59	meters
Installed Length	2.13	meters
Bare Chamber Volume	1.48	cu. meters
Installed Chamber Volume	2.24	cu. meters

Image for visual reference only.May not reflect selected model.

Bed Depth	1.41	meters
Bed Width	4.88	meters
Storage Volume Provided	181.65	cu. meters

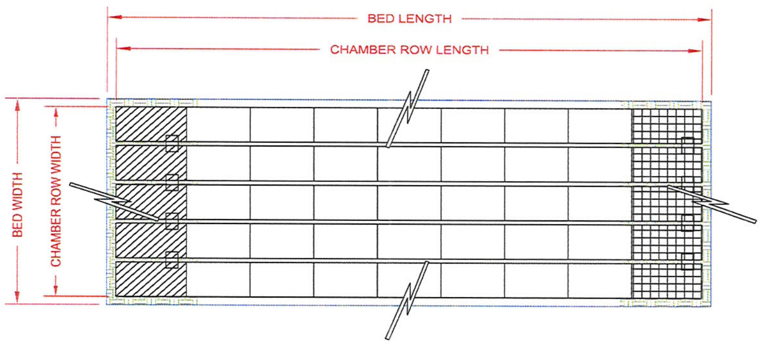
Materials List

Recharger 330XLHD Stormwater System by CULTEC, Inc.

Approx. Unit Count - not for construction	79	pieces
Actual Number of Chambers Required	75	pieces
Starter Chambers	3	pieces
Intermediate Chambers	69	pieces
End Chambers	3	pieces

HVLV FC-24 Feed Connector	2	pieces
CULTEC No. 410™ Filter Fabric	724.45	sq. meters
CULTEC No. 20L Polyethylene Liner	4.88	meters
Stone	174.43	cu. meters

Bed Detail



Number of Rows Wide	3	pieces
Number of Chambers Long	25	pieces
Chamber Row Width	4.27	meters
Chamber Row Length	53.80	meters
Bed Width	4.88	meters
Bed Length	54.41	meters
Bed Area Required	265.32	sq. meters

Bed detail for reference only. Not project specific. Not to scale. Use CULTEC StormGenie to output project specific detail.

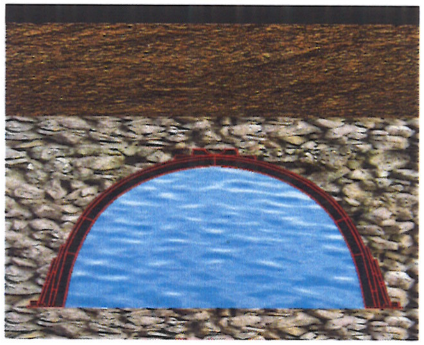
Project Name: 6710 Hurontario Street

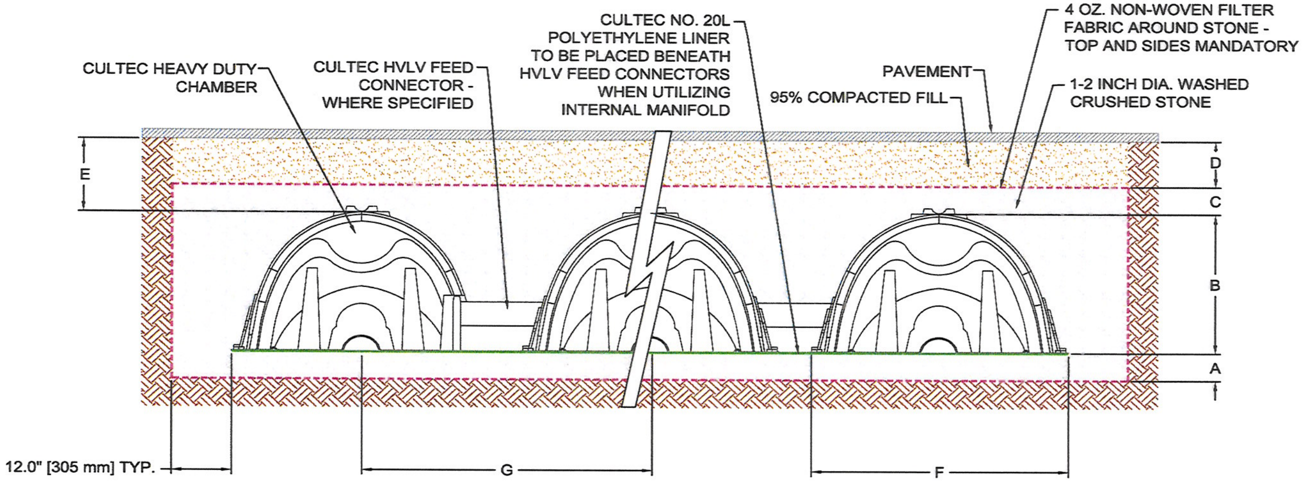
Date: (mm/dd)

Cross Section Detail

Conceptual graphic only. Not job specific.

Recharger 330XLHD		
Pavement	90	mm
95% Compacted Fill	450	mm
Stone Above	152	mm
Chamber Height	774.7	mm
Stone Below	152	mm
Effective Depth	1079.0	mm
Bed Depth	1619.0	mm





A	Depth of Stone Base	152.0	mm
B	Chamber Height	775.0	mm
C	Depth of Stone Above Units	152.0	mm
D	Depth of 95% Compacted Fill	450.0	mm
E	Max. Depth of Cover Allowed Above Crown of Chamber	3.7	meters
F	Chamber Width	1321.0	mm
G	Center to Center Spacing	1.47	meters

Breakdown of Storage Provided by Recharger 330XLHD Stormwater System		
Chambers	111.85	cu. meters
Feed Connectors	0.03	cu. meters
Stone	69.78	cu. meters
Total Storage Provided	181.65	cu. meters

CULTEC, Inc.
P.O. Box 280, Brookfield, CT 06804 USA

Phone: 203-775-4416 - Fax: 203-775-1462 - www.cultec.com

FIGURES

Legend

= SUBJECT LANDS

Project

6710 HURONTARIO STREET
CITY OF MISSISSAUGA

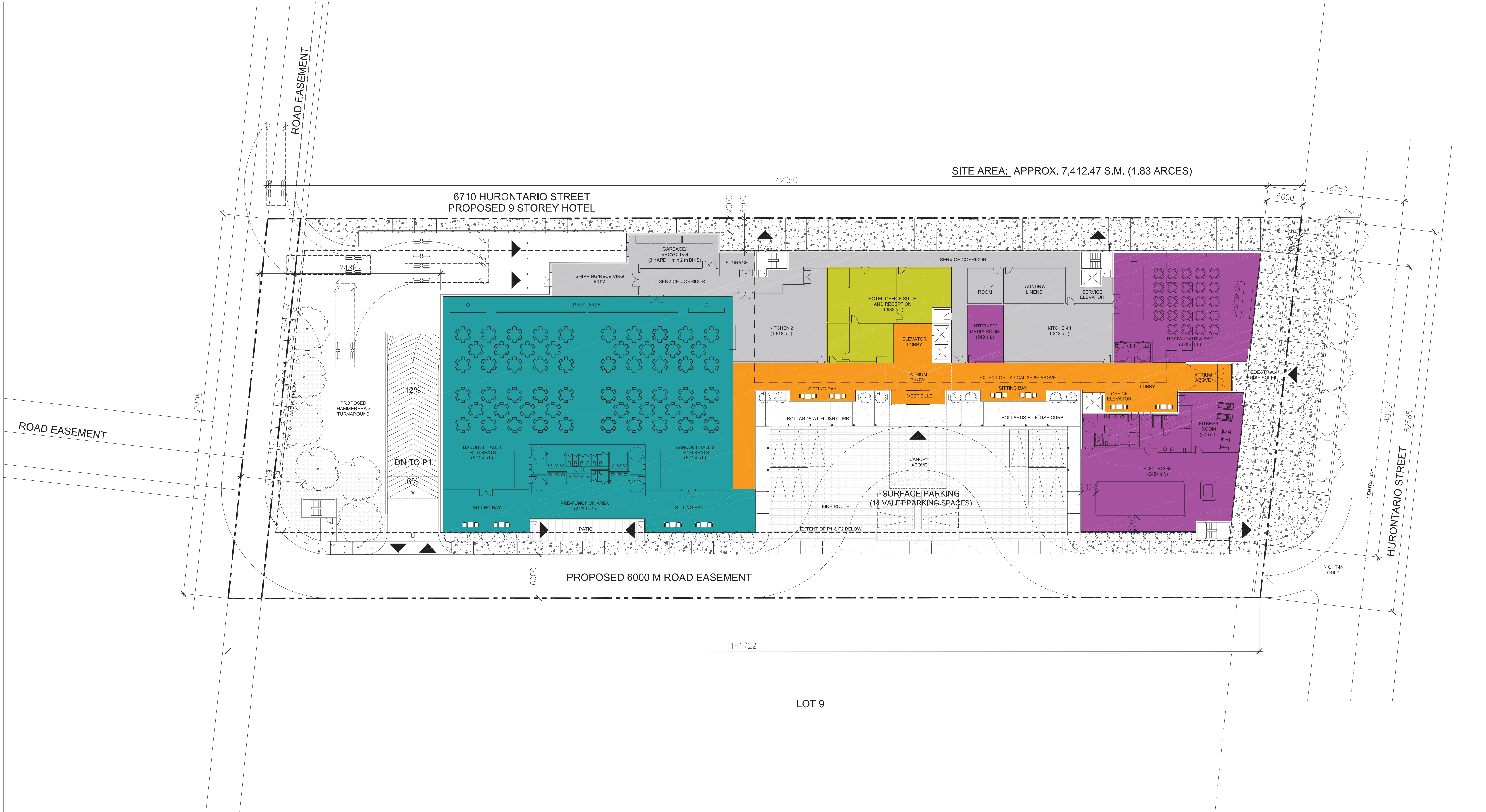
Drawing

SITE LOCATION

CROZIER & ASSOCIATES
Consulting Engineers

15 Martin Street
Suite 202, Carriage Sq.
Milton, ON L9T 2R1
905-875-0026 T
905-875-4915 F
www.cfcrozier.ca

Drawn By	Y.L.	Design By	A.D./H.J.	Project	1060–5180
Scale	N.T.S.	Date	03/19/2019	Check By	N.C.
Drawing	FIG 1				

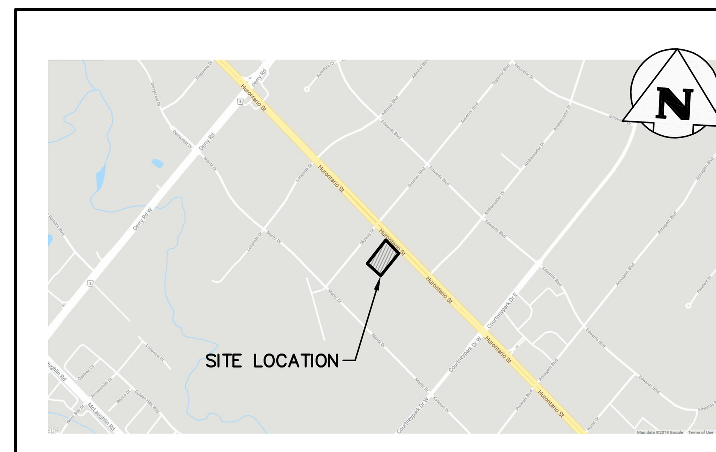


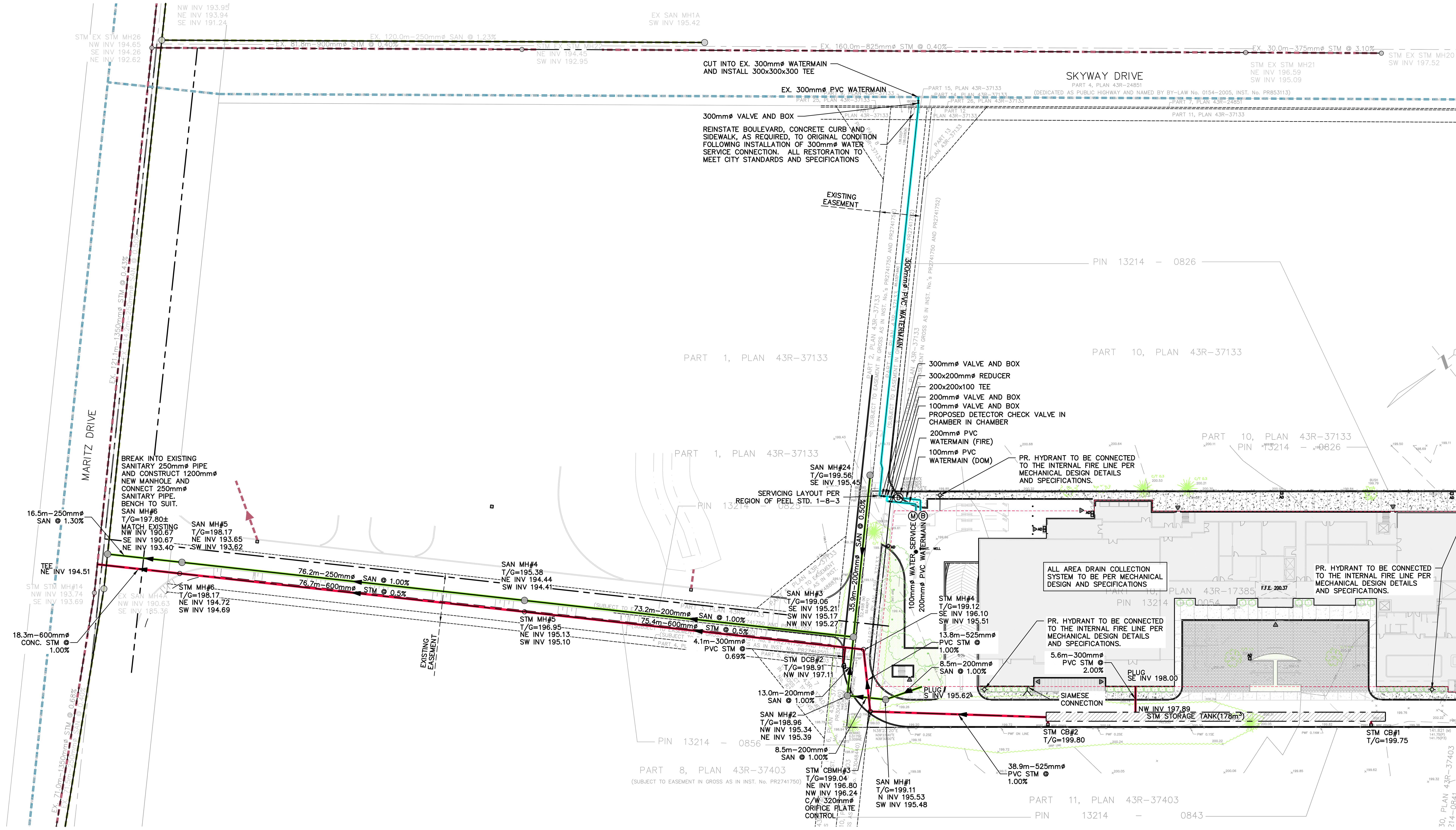
IBI GROUP ARCHITECTS (CANADA) INC.
7th Floor-55 St. Clair Avenue West
Toronto ON M4V 2Y7 Canada
tel 416 596 1930 fax 416 596 0644
ibigroup.com

ALL DIMENSIONS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.

DRAWINGS ARE NOT TO BE SCALED.

OWNER: FLATO DEVELOPMENTS INC.	DATE: 2/27/2019
DRAWING TITLE: 6710 HURONTARIO STREET	SCALE: 1:500
DRAWING TITLE: SITE AND GROUND FLOOR PLAN	JOB No. 115783





LEGEND

	PROPERTY LINE	Ⓜ	PROPOSED WATER METER
	EXISTING WATERMAIN & GATE VALVE	Ⓑ	PROPOSED BACKFLOW PREVENTOR
	EXISTING STORM SEWER & MANHOLE	Ⓓ	PROPOSED DETECTOR CHECK VALVE IN CHAMBER (STD 1-8-3)
	EXISTING SINGLE / DOUBLE CATCHBASIN		PROPOSED STORM SEWER & MANHOLE
	EXISTING SANITARY SEWER & MANHOLE		PROPOSED SINGLE / DOUBLE CATCHBASIN
	PROPOSED WATERMAIN & GATE VALVE		PROPOSED SANITARY SEWER & MANHOLE
	PROPOSED FIRE HYDRANT & GATE VALVE		

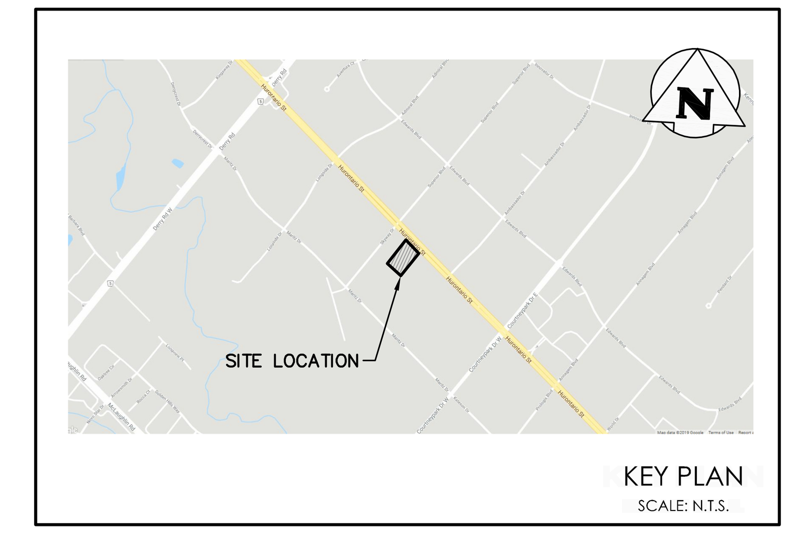
10 0m 10 20 30 40
SCALE: 1:500

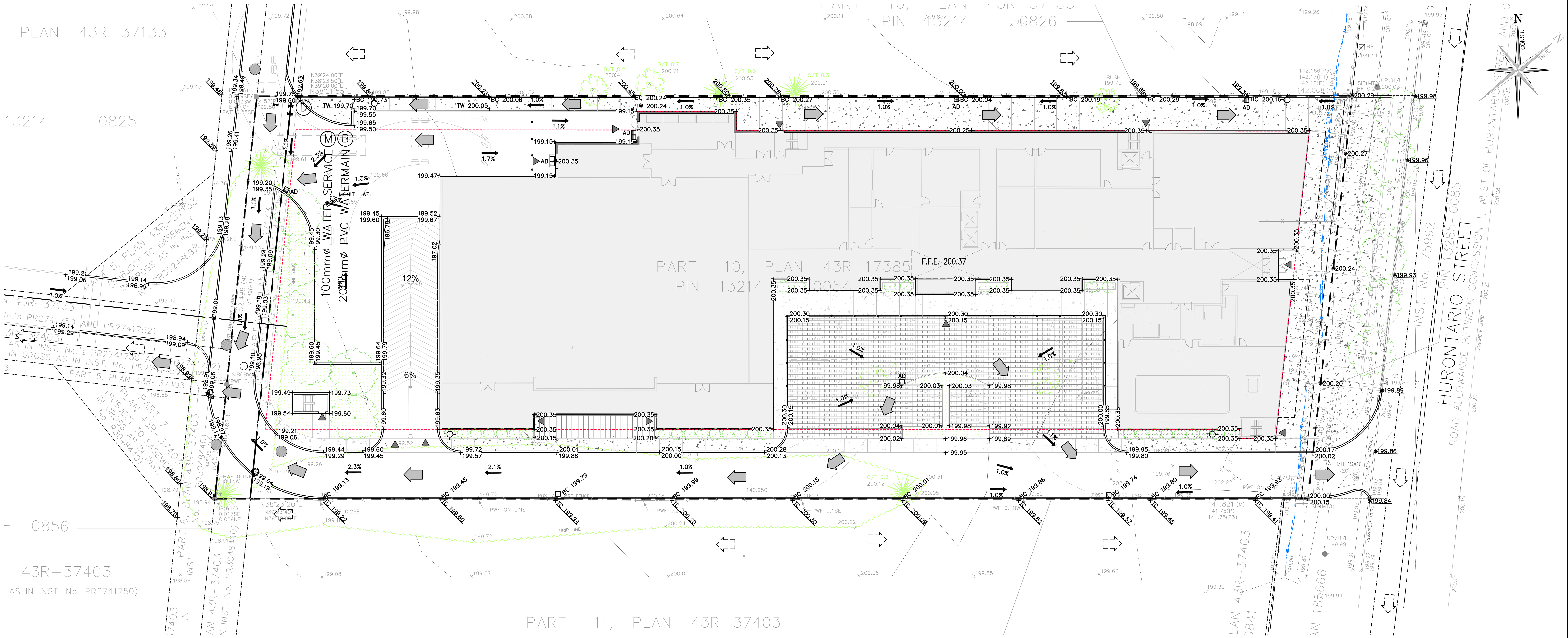
Project
6710 HURONTARIO STREET
CITY OF MISSISSAUGA

Drawing
SITE SERVICING PLAN

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

Drawn	Y.L.	Design	A.T./H.J.	Project No.	1060-5180
Check	S.K.	Check	N.C.	Scale 1:500	Dwg. FIG 3





LEGEND

	PROPERTY LINE		PROPOSED EXTENTS OF SURFACE PONDING
	EXISTING CONTOUR (0.5m)		PROPOSED SLOPE (3:1 MAX.)
	EXISTING CONTOUR (1.0m)		EXTENTS OF WORK
	EXISTING DITCH		BUILDING ENTRANCE (PERSONNEL DOOR)
	EXISTING FENCE		EXISTING MAJOR OVERLAND FLOW DIRECTION
x215.00	EXISTING GRADE		PROPOSED MAJOR OVERLAND FLOW DIRECTION
x215.00	PROPOSED GRADE		PROPOSED FIRE HYDRANT & GATE VALVE
x215.00	PROPOSED GRADE (TO MATCH EXISTING)		LIMIT OF UNDERGROUND PARKING
2.0%	PROPOSED MINOR FLOW DIRECTION		

5 0m 5 10 15 20
SCALE: 1:250

SPA#0000-000

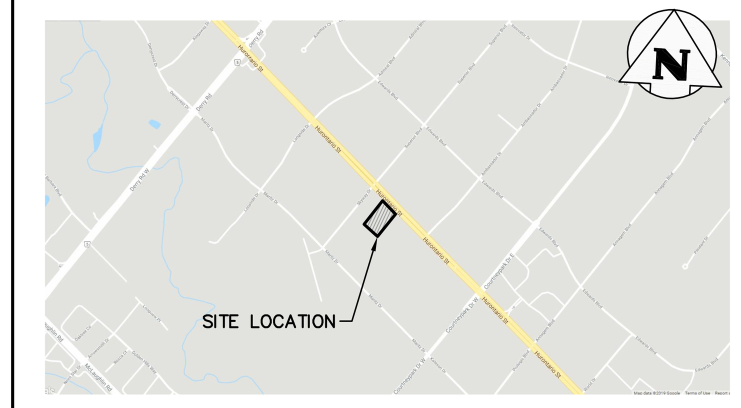
Project
6710 HURONTARIO STREET
CITY OF MISSISSAUGA

Drawing
SITE GRADING PLAN

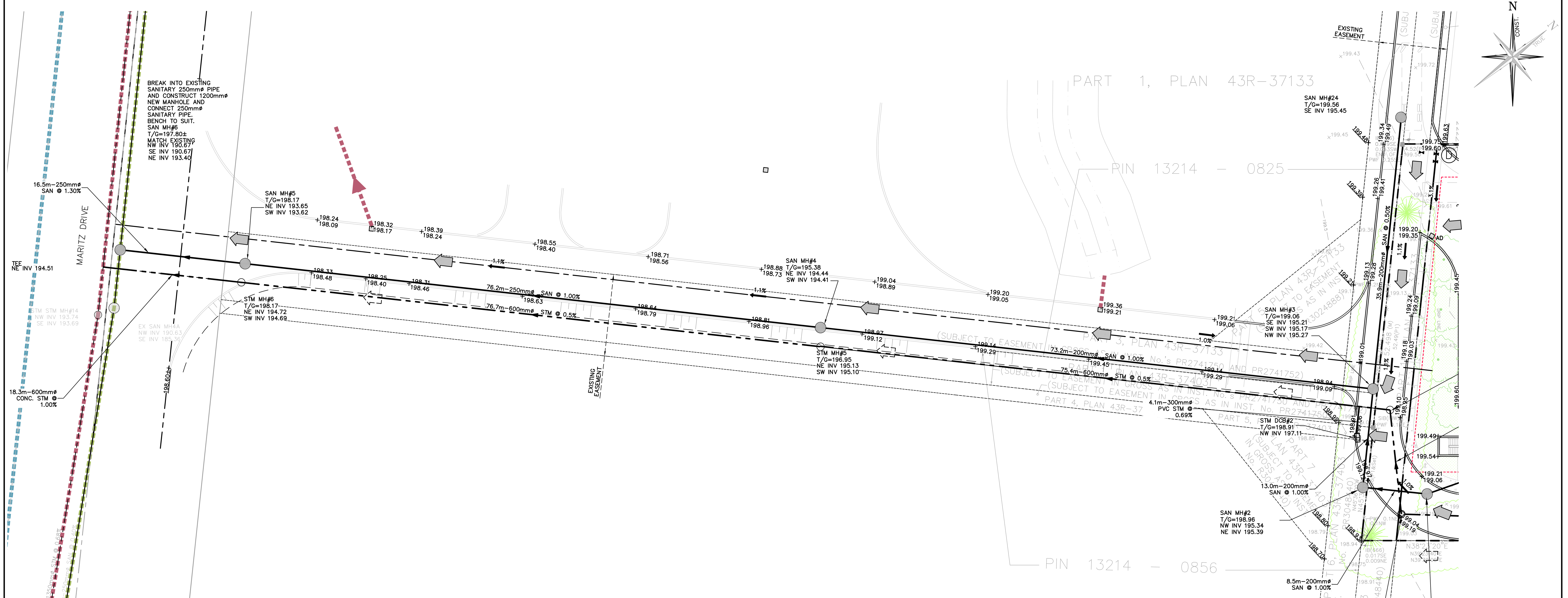
CROZIER
CONSULTING ENGINEERS

2800 High Point Drive
Suite 100
Milton, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

Drawn	Y.L.	Design	A.D.	Project No.	1060-5180
Check	S.C.	Check	N.C.	Scale 1:250	Dwg. FIG 4A



KEY PLAN
SCALE: N.T.S.



LEGEND

PROPERTY LINE	PROPOSED EXTENTS OF SURFACE PONDING
EXISTING CONTOUR (0.5m)	PROPOSED SLOPE (3:1 MAX.)
EXISTING CONTOUR (1.0m)	EXTENTS OF WORK
EXISTING DITCH	BUILDING ENTRANCE (PERSONNEL DOOR)
EXISTING FENCE	EXISTING MAJOR OVERLAND FLOW DIRECTION
215.00 EXISTING GRADE	PROPOSED MAJOR OVERLAND FLOW DIRECTION
×215.00 PROPOSED GRADE	PROPOSED FIRE HYDRANT & GATE VALVE
×215.00 PROPOSED GRADE (TO MATCH EXISTING)	LIMIT OF UNDERGROUND PARKING
2.0% PROPOSED MINOR FLOW DIRECTION	

SPA#0000–000

Project: 6710 HURONTARIO STREET
CITY OF MISSISSAUGA

Drawing: SITE GRADING PLAN

CRIZIER CONSULTING ENGINEERS
2800 High Point Drive
Suite 100
Milton, ON L9T 6P4
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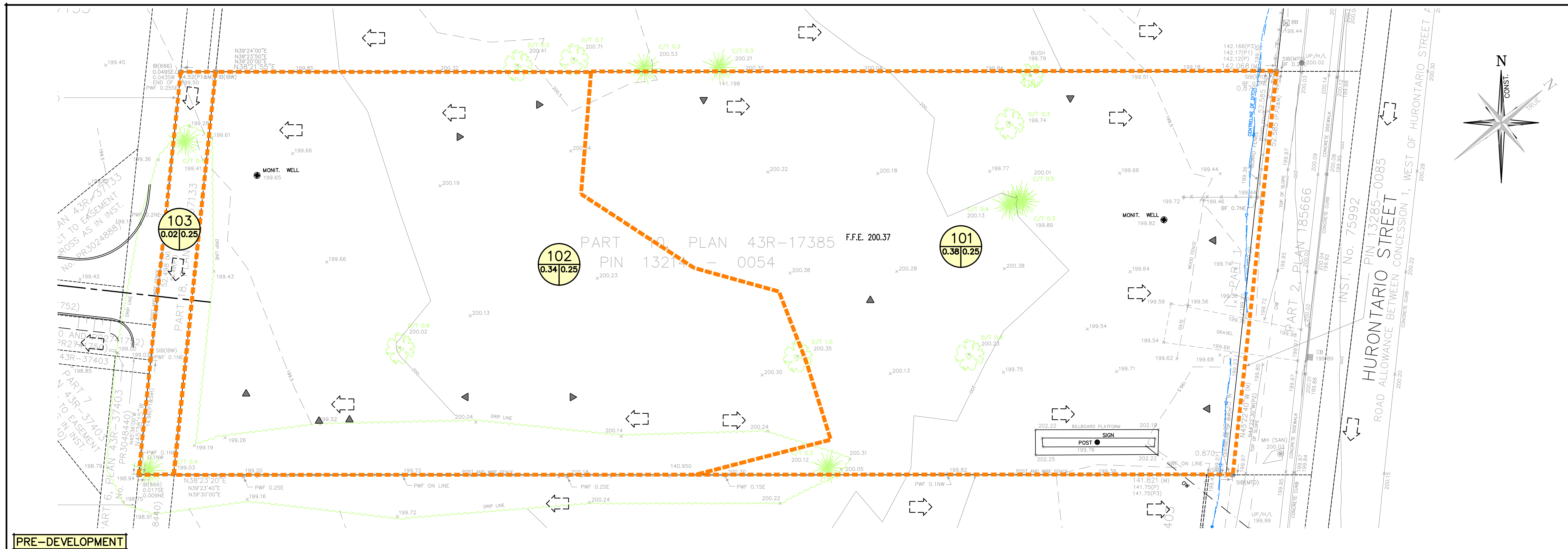
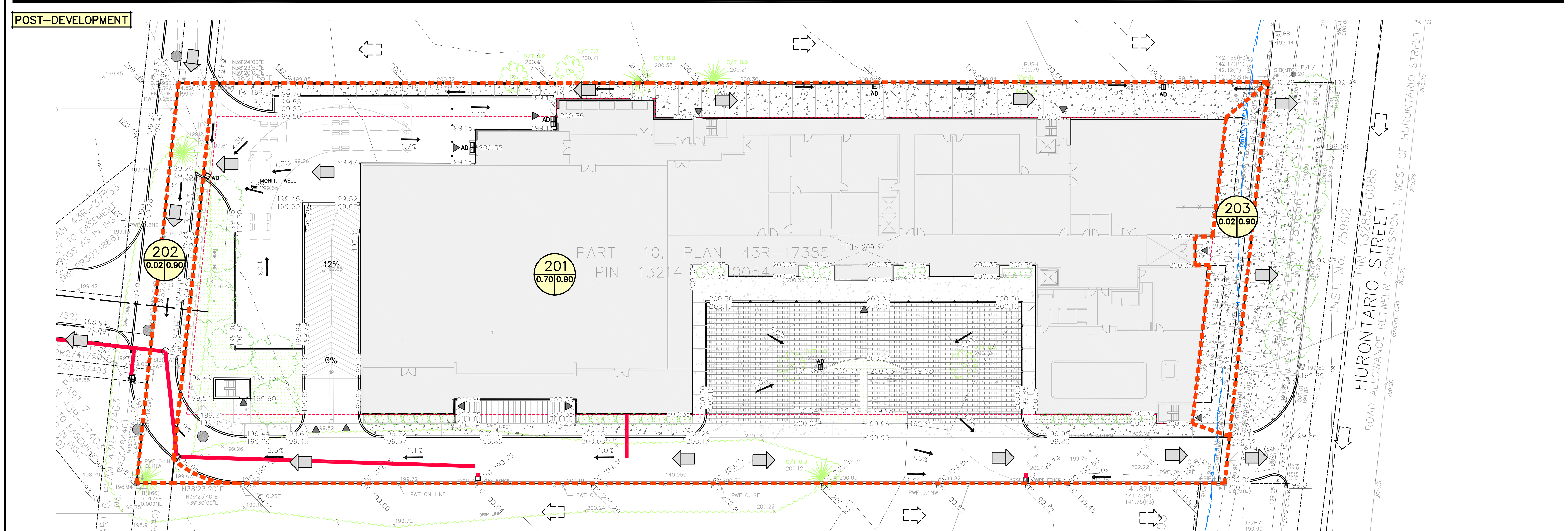
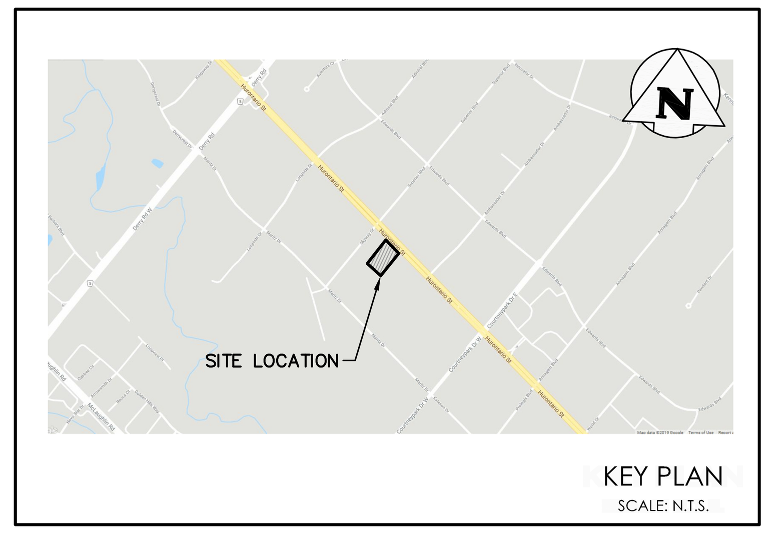
Drawn	Y.L.	Design	A.D.	Project No.	1060–5180
Check	S.C.	Check	N.C.	Scale 1:250	Dwg. FIG 4B







LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING DITCH
- EXISTING GRADE
- EXISTING MAJOR OVERLAND FLOW DIRECTION
- PROPOSED MAJOR OVERLAND FLOW DIRECTION
- STORM DRAINAGE CATCHMENT
- ID / A | RC: CATCHMENT I.D.; AREA (ha) | RUNOFF COEFFICIENT

SCALE: 1:300

Project	6710 HURONTARIO STREET CITY OF MISSISSAUGA
Drawing	PRE-DEVELOPMENT DRAINAGE PLAN POST-DEVELOPMENT DRAINAGE PLAN

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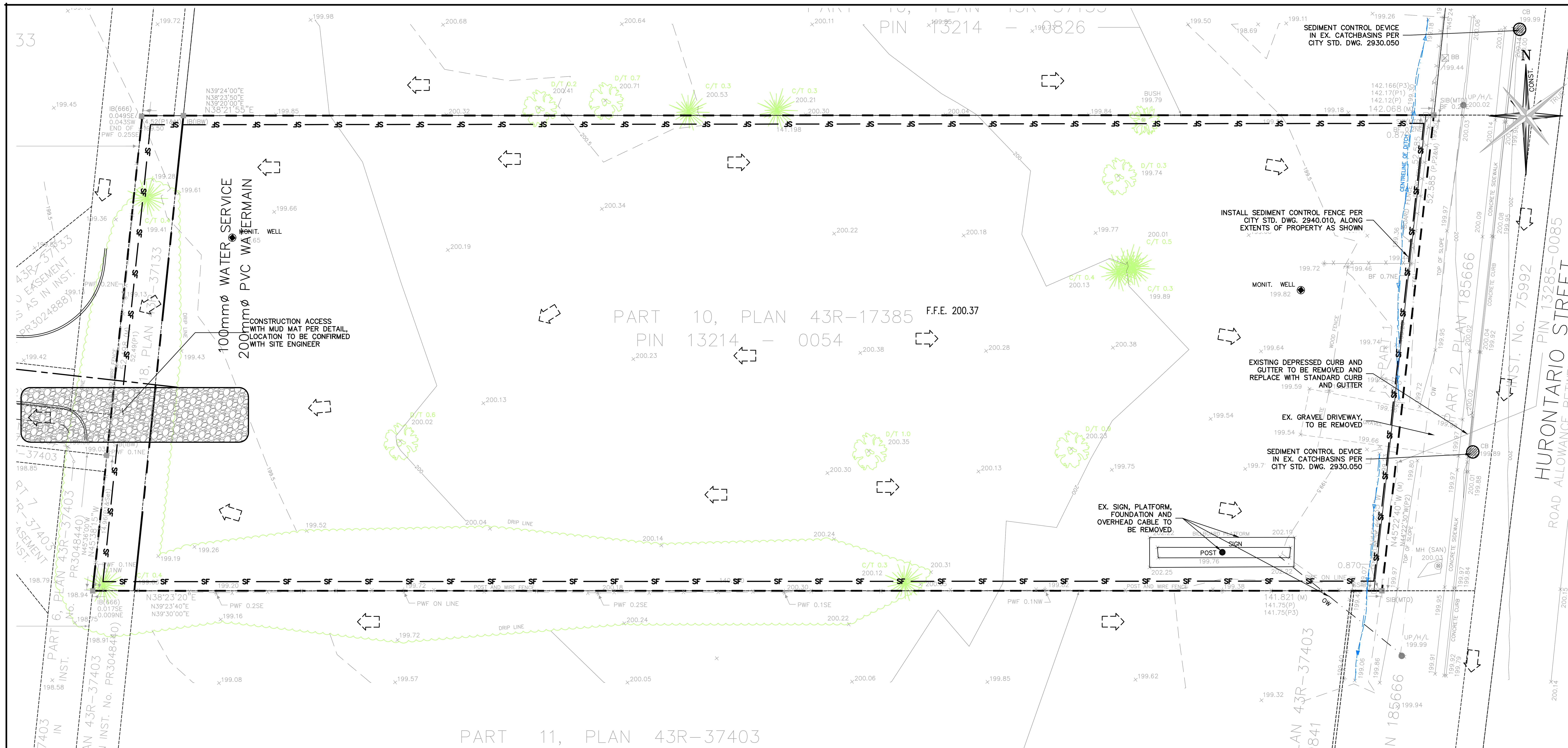
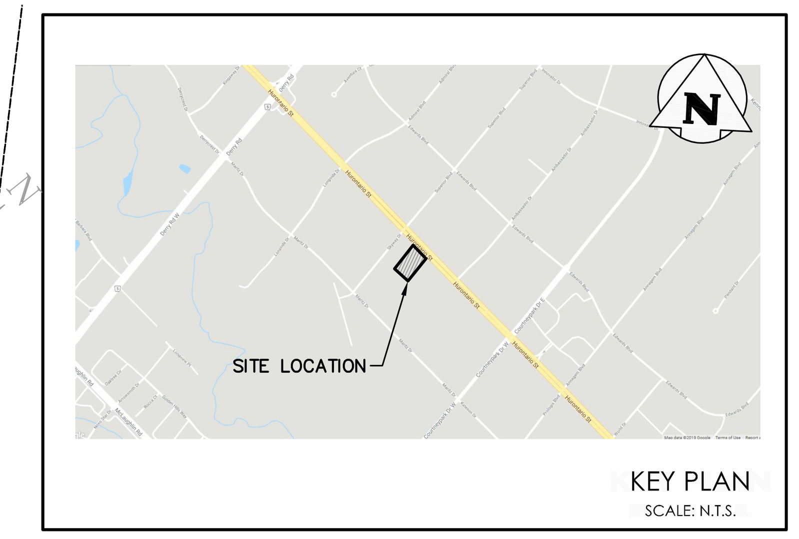
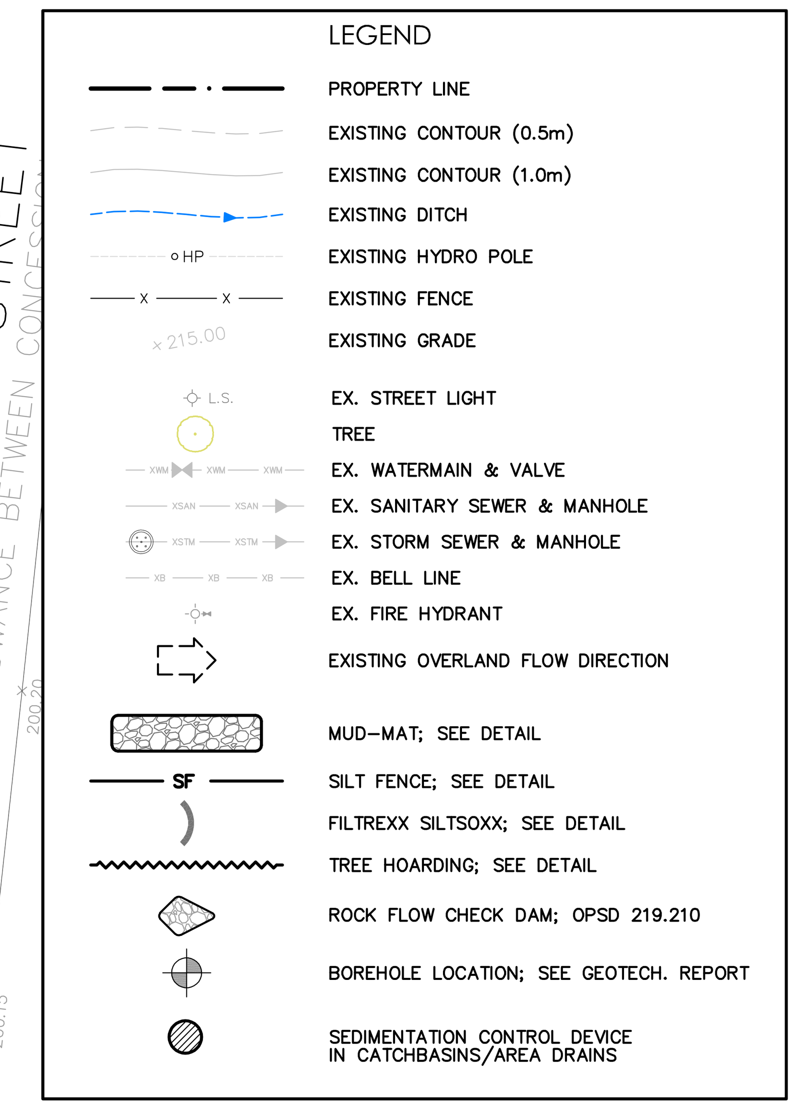
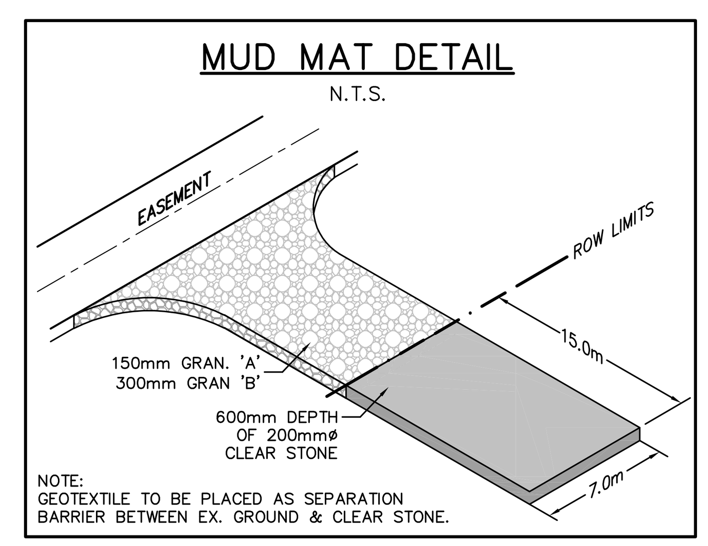
Drawn	Design	Project No.
Y.L.	A.T./H.J.	1060-5180
Check S.K.	Check N.C.	Scale 1:300
		Dwg. FIG 5









CONSTRUCTION NOTES

1. NO GRADING, STRUCTURES, RETAINING WALLS, CONSTRUCTION OR SITE/CONSTRUCTION ACCESS ARE PERMITTED ON OR FROM THE MUNICIPAL PARKLAND.
2. THE PLACEMENT OF UNAPPROVED MATERIALS OR STRUCTURES WITHIN MUNICIPAL GREENBELT/WOODLAND BLOCKS IS NOT PERMITTED BY COMMUNITY SERVICES AT ANY STAGE OF DEVELOPMENT. THIS INCLUDES, BUT IS NOT LIMITED TO, TOPSOIL STOCKPILING, CONSTRUCTION TRAILERS AND VEHICLES, CONSTRUCTION MATERIALS AND DEBRIS, SALES/PROMOTIONAL TRAILERS AND SIGNAGE.
3. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING PARK AND TREE PRESERVATION HOARDING IN AN APPROVED AND FUNCTIONING CONDITION AS REQUIRED BY THE COMMUNITY SERVICES DEPARTMENT THROUGH ALL PHASES OF CONSTRUCTION. NOTE THAT THE SOLID BOARD HOARDING TO BE PLACED ON PRIVATE LANDS WILL FUNCTION AS HOARDING TO PROTECT CITY PARKLAND.
4. INFORM THE COMMUNITY SERVICES DEPARTMENT OF THE CONSTRUCTION SCHEDULE AS IT PERTAINS TO THE MUNICIPALLY OWNED PARKLAND, ITS PROTECTIVE HOARDING, CLEAN–UPS, REINSTATEMENT AND ISSUES AFFECTING PARKLAND USE, CONSTRUCTION AND MAINTENANCE. IT IS THE RESPONSIBILITY OF THE APPLICANT TO ARRANGE FOR COMMUNITY SERVICES – PARK PLANNING SECTION INSPECTIONS AND APPROVALS AS REQUIRED.
5. REMOVE CONSTRUCTION RELATED DEBRIS OR LITTER THAT HAS MIGRATED OR HAS THE POTENTIAL TO MIGRATE INTO THE ADJACENT MUNICIPALLY OWNED GREENBELT. SHOULD THE CONTRACTOR/APPLICANT FAIL TO DO SO, ARRANGEMENTS WILL BE MADE TO DRAW ON THE SUBMITTED PARK PROTECTION AND REINSTATEMENT SECURITIES TO FUND PARK CLEAN UP ACTIVITIES.
6. PRIOR TO THE RELEASE OF SECURITIES, THE COMMUNITY SERVICES DEPARTMENT IS TO INSPECT AND APPROVE ANY REQUIRED RESTORATION, REINSTATEMENT AND/OR CLEAN UP WORKS INCLUDING HOARDING REMOVAL AND OFF–SITE DISPOSAL, CONDUCTED AT THE SHARED PROPERTY LINE WITH AND WITHIN P #96, MISSISSAUGA VALLEY PARK.

EROSION AND SEDIMENT CONTROL NOTES:

1. EROSION AND SEDIMENT CONTROLS ARE TO BE CONTINUOUSLY EVALUATED AND UPGRADES ARE TO BE IMPLEMENTED, WHEN NECESSARY.
2. ADDITONAL EROSION AND SEDIMENT CONTROL MATERIALS (IE. SILT FENCE, STRAW BALES, CLEAR STONE, ETC.) ARE TO KEPT ON SITE FOR EMERGENCIES AND REPAIRS.
3. AN AFTER HOURS CONTACT NUMBER IS TO BE CLEARLY POSTED ON–SITE FOR EMERGENCIES.
4. THE CONTRACTOR IS ULTIMATELY RESPONSIBLE FOR CONTROLLING SEDIMENT AND EROSIN WITHIN THE CONSTRUCTION SITE FOR THE TOTAL PERIOD OF THE CONSTRUCTION. THE SEDIMENT LADEN WATER WILL NOT BE ALLOWED TO DISCHARGE TO THE CREEK.
5. ALL TEMPORARY SOIL OR DIRT STOCKPILES ARE TO BE PROVIDED WITH THE NECESSARY SEDIMENT AND EROSION CONTROL FEATURES, INCLUDING SEEDING IF ANTICIPATED TO BE STORED FOR MORE THAN 1 MONTH. STOCKPILES MUST NOT BE LOCATED IN AREAS OF CONCENTRATED FLOW AND A MINIMUM OF 15m FROM THE TOP OF BANK, WATERCOURSE OR WETLAND.

DEWATERING NOTES:

1. IF DEWATERING IS REQUIRED, THE INLET PUMP HEAD MUST BE COVERED WITH FILTER FABRIC OR CLEAR STONE; THE OUTLET PUMP MUST DISCHARGE TO THE SEDIMENT BAG OR BASIN; DISCHARGE FROM THE BAG IS TO BE RELEASED TO A VEGETATED LOCATION OR IF UNAVAILABLE, A FLOW DISSIPATING SHOULD BE PROVIDED. THE SEDIMENT BAG SHOULD BE LOCATED A MINIMUM OF 15m AWAY FROM THE RECEIVING BODY. (REFER TO EROSION AND SEDIMENT CONTROL GUIDELINE FOR URBAN CONSTRUCTION – DECEMBER 2006, FIG. E9)

Project
6710 HURONTARIO STREET
CITY OF MISSISSAUGA

Drawing
REMOVALS PLAN
EROSION & SEDIMENT CONTROL PLAN

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Drawn Y.L.	Design A.T./H.J.	Project No. 1060–5180	
Check S.K.	Check N.C.	Scale 1:500	Dwg. FIG 6