NYX CAPITAL CORP.

51-57 TANNERY STREET AND 208 EMBY DRIVE CITY OF MISSISSAUGA

SERVICING AND STORMWATER MANAGEMENT BRIEF

LEA Project No. 18038

June 8, 2018

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1 INTRODUCTION

1.1 SCOPE OF THE SWM AND SERVICING REPORT

LEA Consulting Ltd has been retained by NYX Capital Corp. to prepare a Servicing and Stormwater Management Report for a residential development project at 51-57 Tannery Street and 208 Emby Drive in City of Mississauga. This stormwater management and servicing report shall:

- Examine the potential water quality and quantity impacts of the proposed townhouses and summarize how each will be addressed in accordance with the City of Mississauga and Credit Valley Conservation (CVC) stormwater management requirements.
- Review the existing water supply, storm and sanitary services, and propose a site servicing plan.

1.2 SITE LOCATION

The proposed development site is located at the southeast quadrant of Tannery Street and Canadian Pacific Railway (CPR) and bounded by Mullet Creek to the west - contributory to Credit River watershed (or sub-watershed #4, Mullet Creek), and under the jurisdiction of Credit Valley Conservation (CVC). Site access is via Tannery Street or Emby Drive.

The site is approximately 1.8 ha in area.

1.3 STORMWATER MANAGEMENT PLAN OBJECTIVES

The objectives of the stormwater management plan is to review the stormwater environment impact by the proposed residential development and address the City's requirements for stormwater quantity control and quality control as required.

1.4 SWM DESIGN CRITERIA – CREDIT VALLEY CONSERVATION AUTHORITY

Credit Valley Conservation Authority (CVC), in partnership with the Toronto and Region Conservation Authority, has issued the Storm Water Management Criteria (August 2012) to provide direction on how to manage rainfall and runoff inside CVC's jurisdiction. A summary of the storm water management criteria applied for this project, is provided below:

- Storm Water Quality Control – Mullet Creek is classified as requiring an Enhanced level of protection (80% TSS removal) by CVC quality control criteria.
- Flood Control (Water Quantity Control) – all storm events up to 100-year and Regional storm post-development peak flow to pre-development control is required by CVC within Mullet Creek Sub-watershed.
- Water Balance Control – Maintain pre-development groundwater recharge rates and appropriate distribution ensuring the protection of related hydrologic and ecologic functions.
- Erosion Control – On-site detention of 5mm within Mullet Creek sub-watershed.

2 EXISTING CONDITIONS

2.1 GENERAL

The existing site is bounded by Tannery Street to the north, CPR to the east, Mullet Creek to the west and existing industrial buildings to the south. The site consists of four single family houses and two industrial buildings, and has a soft landscaped area of 0.50 ha and a paved parking area of 0.56 ha. Figure 1 in Appendix F illustrates the existing storm drainage condition.

Storm Drainage of the Development Site (Catchment C1):

In general, the ground falls from the east (CPR) to the west (Mullet Creek). During rainfall events, rainfall runoff in the form of overland flow drains westerly within the development site, and outlets to the Mullet Creek. There is no existing minor storm sewer within the development site. The total drainage area is approximately 1.084 ha.

Storm Drainage of the Emby Drive Extension (Catchment C2):

During rainfall events, rainfall runoff in the form of overland flow drains westerly through the development site, and outlets to the Mullet Creek. There is no existing minor storm sewers within the future Emby Drive Extension area. The total drainage area is approximately 0.269 ha.

External Storm Drainage Areas:

- Both minor and major flows from the Catchment EC1 (CPR right-of-way) drain westerly across the railway through an 825mm CSP culvert and through the development site, and finally outlet to Mullet Creek. The total drainage area is approximately 0.120 ha.
- The minor flow from Catchment EC2 on both side of Emby Drive currently drains southerly to 300 mm dia. storm sewers under Emby Drive, 600mm dia. storm sewer on Thomas Street westerly, and finally outlets to Mullet Creek. The major flow (overland) travels southerly along Emby Drive, turns to Thomas Street westerly and outlets to Mullet Creek. The total drainage area is approximately 0.354 ha.
- Both minor and major flows from the Catchment EC3 (existing industrial area, right-of-ways of Broadway and Thomas Street) drain southerly and westerly, and outlets to Mullet Creek. The total drainage area is approximately 1.268 ha.
- Both minor and major flows from the Catchment C3 (CPR right-of-way and part of properties to the east) drain westerly across the railway through an 825mm CSP culvert and through the development site, and finally outlet to Mullet Creek. The total drainage area is approximately 0.425 ha.
- The minor flow from existing industrial area (Catchment C4) on both side of Pearl Street currently drains to 450 mm dia. storm sewers under Pearl Street westerly and Broadway Street northerly, discharges to the existing ditch on the east side of railway, flows westerly across the railway through an 825mm CSP culvert and through the development site, and finally outlets to Mullet Creek. The major flow (overland) travels westerly along Pearl Street, turns to Broadway

northerly and drains to Tannery Street. The total drainage area is approximately 2.83 ha.

- Both minor and major flows from the Catchment C5 (on both sides of Thomas Street, north of Emby Drive) drain westerly along Thomas Street across, and finally outlet to Mullet Creek. The total drainage area is approximately 3.39 ha.

Based on the land ownerships and proposed development scheme, the following sub-catchment areas are to be studied under pre- and post-development condition:

- C1 – Proposed Condominium area;
- C2 – Proposed Emby Drive Extension;
- C3 – Railway sub-catchment area;
- C4 –Pearl Street and Broadway Street sub-catchment area.

The existing storm drainage within sub-catchment EC1, EC2, EC3 and C5 will remain unchanged under the proposed condominium development.

The composite runoff coefficients of four sub-catchment areas are, as estimated in Appendices A, B and C, listed in Table 1.

TABLE 1: PRE-DEVELOPMENT RUNOFF COEFFICIENT

Sub-catchment No	Catchment Description	Catchment Area (ha)	Runoff Coefficient
C1	Prop. Condominium Area	1.084	0.56
C2	Prop. Extension of Emby Dr.	0.269	0.66
C3	Ex. Railway Area	0.425	0.40
C4	Ex pearl St. and Broadway St.	2.830	0.45

As shown in Table 1, the actual pre-development runoff coefficient is 0.56 and 0.66 for C1 and C2 respectively, however the maximum runoff coefficient of 0.50 will be considered under pre-development condition in accordance with City's design criteria.

Based on our review of the topographic survey and site observation, there is no on-site stormwater management facility under existing condition.

2.2 RAINFALL INFORMATION

The rainfall intensity for the site was calculated using the following equation:

$$I = A / (T_c + B)^{0.78}$$

Where; I = rainfall intensity in mm/hr,

T_c = time of concentration in minutes,

A, B = constant parameters (see below)

The parameters (A and B) recommended for use in the City of Mississauga are defined in City Standard Drawing No. 2111.010 and are summarized in Table 2.

TABLE 2: RAINFALL PARAMETERS

Return Period (Year)	2 - Yr	5 - Yr	10 - Yr	25 - Yr	50 - Yr	100 - Yr
A	610	820	1010	1160	1300	1450
B	4.6	4.6	4.6	4.6	4.7	4.9

An initial time of concentration, TC, of 15 minutes is recommended in the City's Development Requirements Manual.

2.3 PEAK FLOW RATES UNDER EXISTING CONDITION

Based on the existing site condition and rainfall parameters, the Rational Method is adopted to calculate peak flows at different design storm events upto 100-year storm.

As required by CVC, the Regional Flood flow shall be considered in Stormwater quantity control. For each sub-catchment, a 24-hour SCS type II distribution is modeled utilizing the Visual Otthymo V5.0 program.

The calculated peak flow rates for the four sub-catchment areas in the pre-development condition are summarized below in Table 3. Detailed calculations are provided in Appendices A, B and C.

TABLE 3: PRE-DEVELOPMENT PEAK FLOW RATES (L/s)

Sub-catchment No	Sub-Catchment	Return Period (Year)			
		2 - Yr	10 - Yr	100 - Yr	Regional
C1	Prop. Condominium Area	90.18	149.31	211.83	151.0
C2	Prop. Extension of Emby Dr.	22.38	37.05	52.57	39.0
C3	Ex. Railway area	28.49	47.17	66.92	61.0
C4	Ex pearl St. and Broadway St.	212.19	351.32	-	-

Note: Only minor flow from Sub-catchment C4 via municipal storm sewers under pearl Street and north of the Broadway Street, drains to the proposed storm sewer on Emby Drive. Based on the City of Mississauga design criteria, the maximum flow from this area will be 10-yr flow.

3 POST-DEVELOPMENT CONDITIONS

3.1 GENERAL

The proposed development consists of 155 new condominium in seven blocks with underground parking, and Emby Drive Extension to Tannery Street. It is understood that Emby Drive Extension will be a municipal road. The proposed storm drainage pattern is designed as follow.

- Rainfall runoff from the proposed condominium site is collected by area drains, conveyed through proposed internal storm drainage pipes from the landscape areas to the proposed storage tank and outlets to proposed storm sewer on the Emby Drive.
- Rainfall runoff from the proposed extension of Emby Drive is collected by proposed catchbasins and conveyed through proposed storm sewer on the Emby Drive and outlets to Municipal storm sewer on Thomas Street.
- The construction of Emby Drive extension and new parking structure will block the drainage outlet of railway area and pearl Street area to Mullet Creek. Therefore, all storm flows will be diverted to the new storm sewer under Emby Drive. Since Stormwater quantity control and quality control will be implemented, the total Stormwater discharge rate to Mullet Creek will be decreased, and water quality will be improved. therefore, the proposed development will not have negative impact on the current conditions of Mullet Creek watershed.

Refer to Figure 2 in Appendix F for proposed storm drainage condition.

The overland flow from proposed condominium area and Emby Drive extension, will spill onto existing Emby Drive and outlets to Mullet Creek as shown on Dwg. C100–Site Grading Plan.

Based on the proposed land-use, the composite runoff coefficients are estimated at 0.60 and 0.66 for C1 and C2 sub-catchment area, respectively. Refer to Appendices A and B for details.

The landuse is provided below in Table 4 for comparison between existing and proposed condition.

TABLE 4: LAND-USE AREA BREAKDOWN

Sub-Catchment No.	Sub-Catchment	Impervious Area (m^2)		Pervious Area (m^2)	
		Existing	Proposed	Existing	Proposed
C1	Prop. Condominium Area	3758.0	5219.0	7082.0	5622.0
C2	Prop. Extension of Emby Dr.	1314.0	1713.0	1376.0	977.0

Table 4 demonstrates that the impervious area will be increased by 13.5% and 14.8% in C1 and C2 sub-catchment area after proposed development.

3.2 PEAK FLOW RATES UNDER PROPOSED CONDITION

Based on the proposed site condition and rainfall parameters, the Rational Method is adopted to calculate peak flows for 2-yr to 100-yr design storm events. The Regional Flood flow is calculated based on the 24-hour SCS type II distribution using the Visual Otthymo V5.0 program.

The calculated peak flow rates for the four sub-catchment areas in the post-development condition are summarized below in Table 5. Detailed calculations are provided in Appendices A and B.

TABLE 5: POST-DEVELOPMENT PEAK FLOW RATES (L/s)

Sub-catchment No	Sub-Catchment	Return Period (Year)			
		2 - Yr	10 - Yr	100 - Yr	Regional
C1	Prop. Condominium Area	107.58	178.13	252.72	154.0
C2	Prop. Extension of Emby Dr..	29.71	49.20	69.80	39.0
C3	Ex. Railway area	28.49	47.17	66.92	61.0
C4	Ex pearl St. and Broadway St.	212.19	351.32	-	-

Note: Only minor flow from Sub-catchment C4 via municipal storm sewers under pearl Street and north of the Broadway Street, drains to the proposed storm sewer on Emby Drive. Based on the City of Mississauga design criteria, the maximum flow from this area will be 10-yr flow.

3.3 IMPACT ON WATER ENVIRONMENT

Based on the review and analysis for existing and proposed site conditions, Table 6 summarizes the key hydrologic parameters of the site under proposed condition.

TABLE 6: KEY HYDROLOGIC PARAMETERS

Sub-Catchment Area	Imperviousness (%)		Runoff Coefficient		100-year Peak Flow Rate (L/s)	
	Pre-Dev	Post-Dev	Pre-Dev	Post-Dev	Pre-Dev	Post-Dev
Prop. Condominium Area (C1)	34.7	48.1	0.50	0.60	211.83	252.72
Prop. Extension of Emby Dr. (C2)	48.8	63.7	0.50	0.66	52.57	69.80

The actual pre-development runoff coefficient is 0.56 and 0.66 for C1 and C2 respectively, however the maximum runoff coefficient of 0.50 will be considered under pre-development condition in accordance with City's design criteria. If actual runoff coefficient (0.66) were considered, there would be no difference between pre- and post-development condition in sub-catchment C2, or no negative impact on stormwater. Given that future Emby Drive extension will be a typical linear development with limited right-of-way, there is no space for stormwater quality and quantity control measures, therefore, there will no SWM measures implemented within the right-of-way of Emby Drive Extension.

However, mitigation measures are proposed for sub-catchment C1 in accordance with the CVC's design criteria.

4 PROPOSED SWM PLAN – SUB-CATCHMENT C1

4.1 WATER BALANCE REQUIREMENT

Based on the water balance criteria, the minimum on-site runoff retention requires retaining all runoff of the first 5mm from each rainfall through infiltration, evapo-transpiration, etc. To satisfy the water

balance criteria, an on-site storage volume of approximate 54.2 m^3 is required for sub-catchment C1 (Refer to Appendices A).

The potential method to address the water balance criteria is to reuse the retained Stormwater (from roof areas) for Irrigation of trees and plants on the property.

The exact application and consumption rate will be determined at the next design stage in consultation with project design team landscape designer and mechanical engineer. Based on the past project experiences, irrigation water alone will be anticipated to satisfy the water balance requirement.

4.2 WATER QUANTITY CONTROL REQUIREMENT

According to the CVC's stormwater quantity control criteria – the post-development to pre-development peak flow control for all storms up to 100-yr and Regional storm should be provided.

Under post-development condition, all storm flows from sub-catchment C2, C3 and C4 will be diverted to new storm sewer under Emby Drive and discharge to municipal storm sewer on Thomas Street. Therefore, post-development peak flow, only from the residential development site (sub-catchment C1), will be considered and controlled to 10-year pre-development flow rate with a runoff coefficient value of 0.50.

Based on the post-development conditions, the required on-site stormwater storage volume for different design storm events are calculated as shown in Appendices A and summarized in Table 7 below.

TABLE 7: REQUIRED ON-SITE STORAGE VOLUMES (m^3)

Sub-Catchment No.	Sub-Catchment	2 - Yr	10 - Yr	100 - Yr	Regional
C1	Prop. Condominium Area	0.0	25.94	93.07	120.0

Sub-catchment C1: Based on the proposed site condition for sub-catchment C1, a stormwater storage tank, located in the underground parking lot, will be proposed to provide a total storage volume of 190 m^3 (with 10% safety factor). Refer to architect floor plan for the tank location. Orifice control device will be sized in the next design stage.

Refer to Dwg. C-101 for proposed storm sewers and Dwg.C-100 for overland flow route on Emby drive.

4.3 WATER QUALITY CONTROL REQUIREMENT

In order to achieve the long-term average removal of 80% of Total Suspended Solids (TSS) on an annual basis from all runoff leaving the site, the following quality control measures will be provided:

Sub-catchment C1: Based on the SWM design criteria, the residential block rooftop area is not subject to vehicular traffic, and the application of sand and de-icing salt constituents, petroleum hydrocarbons and heavy metals. As such, runoff from the roof surface is generally considered to be clean. Table 8 provides a preliminary estimate of TSS removal level of stormwater leaving the site.

TABLE 8: TTS REMOVAL ASSESSMENT SUB-CATCHMENT C1

Land Use	Area (m^2)	TSS Removal Efficiency (%)	Composite TSS Removal Efficiency (%)
Roof	5219.4	80	38.5
Permeable Pavement	1818	80	13.4
Landscape	3804	80	28.1
Total	10841	-	80.0

Table 8 demonstrates that the overall TSS removal efficiency is satisfactory to the City's requirement - 80% TSS removal. Therefore, additional water quality treatment facility is not recommended.

4.4 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

During site construction, it is recommended that all erosion and sediment control Best Management Practices (BMPs) shall be installed and maintained in accordance with the Credit Valley Conservation Authorities' (CVC CA's) Stormwater Management criteria (August 2012);

In Report, the measures below will be provided on site during the entire period of construction:

- Sediment control measures to prevent silt entry at all the existing area drains and catch basins;
- Granular mud-mats at all construction ingress / egress locations;
- An inspection and monitoring program following the CVC CA's Stormwater Management criteria (August 2012).

5 SITE SERVICING

The purpose of this site servicing study is to review the site servicing requirement of the proposed new condominium development, and propose a site servicing plan, including water supply, sanitary and storm services. Refer to Dwg. C-101 - Site Servicing Plan for details of the proposed site service connections.

5.1 EXISTING MUNICIPAL SERVICES

The proposed development will require new service connections to the existing municipal services, i.e. storm sewers, sanitary sewers and watermains, located on Thomas Street, Emby Drive and Tannery Street adjacent to the site. Existing underground municipal services/utilities are summarized below:

a) 600mm dia. storm sewer on Thomas Street;

b) 200mm dia. PVC sanitary sewer on Emby Drive;

c) 300mm dia. PVC watermain on the Emby Drive;

d) 200mm dia. watermain on the Tannery Street.

Refer to Dwg. C-101 for existing municipal utilities.

5.2 PROPOSED MUNICIPAL SERVICES ON EMBY DRIVE EXTENSION

Based on City's design criteria, the following new municipal services will be provided:

- New storm drainage system: catchbasins, manholes and storm sewers to convey 10-year design storm;
- New water supply system: valves, fire hydrants and 300mm dia. PVC watermain;

5.3 PROPOSED SITE SERVICE CONNECTIONS

Based on the project statistics provided by the architect and Region's design criteria, sanitary flow and water demand are estimated in Appendix D and summarized in Table 9. Storm flow discharge rate has been provided in the previous section of this report.

TABLE 9: SITE SERVICING REQUIREMENT

Site	Storm Discharge Rate (L/s)	Sanitary Discharge Rate (L/s)	Water Demand (L/s)
Prop. Condominium Area	149.13	13.22	107.71

Through discussion with design team, the locations and sizes of the proposed site service connections have been determined to satisfy the requirements of the City of Mississauga and Ontario Building Code (OBC). In summary:

1. Sanitary Service: The existing sanitary sewer on Emby Drive is extended northerly by 10.5m from existing manhole No.137 to proposed manhole No.7. A 150mm dia. sanitary service connection will be installed to service the proposed condominiums and discharge to the proposed manhole No.7 on Emby Drive.
2. Storm Service: A 375mm dia. storm service connection will be installed to drain condominium area to proposed manhole No.3 on Emby Drive extension.
3. Water service:
    - Domestic Water Service: A 100mm dia. domestic water service connection will be installed to service the proposed condominiums and connected to the proposed 150mm dia. fire protection water service with a cut-in Tee.
    - Fire Protection Service: A 150mm fire protection PVC water service will be provided.

The existing 300mm diameter water main on Emby Drive will be extended northerly and connected to the existing 200mm diameter water main on Tannery Street to service the proposed development site.

Refer to Dwg. C-101 for details of proposed service connections.

5.4 ADEQUACY OF EXISTING MUNICIPAL SERVICES

The full flow capacity of the existing 250mm sanitary sewers on the Emby Drive is estimated at 76 L/s based on Region's record drawing and anticipated to be adequate to accommodate the sanitary flow (6.10 L/s) from the proposed development.

Based on the City's storm sewer design record, the existing 600mm storm sewers (MH.4 to Outlet) on Thomas Street, from Emby Drive to Mullet Creek, will not be adequate to accommodate the storm flow rate of 1602.9 L/s from development site, existing external flow from pearl Street and storm flow from Thomas Street and industrial area south of the development site. In order to provide adequate capacity for the storm flow, the last two legs of storm sewer on Thomas Street will need to be upsized to 675 mm and 825 mm diameter concrete pipe. As a result of storm sewer upgrade, the existing outlet at Mullet Creek will need to be rebuilt.

The design water demand is estimated as 107.71 L/s based on the project statistics. In order to evaluate the adequacy of existing water supply, the existing 300mm watermain on Tannery Street was tested on June 15, 2017 by Focus Fire Protection. Test results are included in Appendix E.

As shown by the test readings, the available water pressure ranges from 58 psi with a flow of 983.3 US GPM to 54 psi with a flow of 683.5 US GPM during the flow test with a static pressure of 62 psi. At the design water demand of 107.71 L/s (or 1707.24.74 US GPM) generated from the development, the flow test results show a residual pressure of 47.2 psi, which is greater than the minimum requirement of 20 psi (150 kPa). Therefore, adequate water supply and pressure are available to serve the proposed development

6 CONCLUSIONS

<u>Stormwater Management Plan – Sub-Catchment C1</u>

- Under existing condition, there are no existing on-site stormwater management facilities.
- On-site storage volume of approximate 55 m^3 will be provided for proposed condominium development site for retaining the first 5mm rainfall runoff as required to achieve water balance target. This portion of water shall be reused on site for irrigation. The consumption rate will be provided by the project team landscape designer in the next stage of design.
- The land-use of the proposed condominium development site satisfies the City's 80% TSS removal, and additional water quality treatment facility will not be required.
- On-site storage volume of 120 m^3 in volume will be required in order to control the post-development 100-year/Regional stormwater flows to 10-year pre-development level;
- A Stormwater storage tank at underground parking lot is proposed to provide a total storage volume of 190 m^3.

<u>Stormwater Management Plan – Sub-Catchment C2</u>

- There will be no actual increase in Stormwater flow rate and volume in the Emby Drive Extension

area;

- Due to the constraints of available right-of-way, no SWM measures are proposed for Emby Drive extension.

Temporary Erosion & Sediment Control Measures

- Temporary erosion and sediment control measures will be provided before construction and maintained during construction in accordance with CVC CA's "Stormwater Management Criteria"

New Municipal Services for Emby Drive Extension

Based on City's design criteria, the following new municipal services will be provided:

- New storm drainage system: catchbasins, manholes and storm sewers to convey 10-year design storm;
- New water supply: valves, fire hydrants and 300mm dia. PVC watermain;

Site Servicing

Proposed site service connections for the proposed development site:

- Storm service: 375mm dia. PVC pipes
- Sanitary service: 150mm dia. PVC pipes
- Water service: 100mm dia. PVC pipe for domestic water supply
  150mm dia. PVC pipe for fire water supply

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Appendix A

Stormwater Peak Flow and Storage Calculation
Sub-Catchment Area C1

LEA Consulting Ltd. Consulting Engineers and Planners	Land Use			
	Prepared:	F.M	Page No.	A-01
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C1** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

EXISTING CONDITIONS:

Existing Land Use	Area (m^2)
Building	2459.0
Asphalt	1299.0
Gravel	2744.0
Lawn & Tree	4338.0
Total Site Area:	**10840.0**

PROPOSED DEVELOPMENT:

Proposed Land Use	Area (m^2)
Building	5219.0
Asphalt and paved	0.0
Permeable Pavement	1818.0
Landscaped Area	3804.0
Total Site Area	**10841.0**

LEA Consulting Ltd. Consulting Engineers and Planners	Composite "C" Calculation			
	Prepared:	F.M	Page No.	A-02
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C1** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Pre-Development Composite Runoff Coefficient "C"

Location	Area (ha)	C	Composite "C"	
Building	0.246	0.90		
Asphalt	0.130	0.90		
Gravel	0.274	0.60		
Lawn & Tree	0.434	0.25		
Total Site Area:	**1.084**		**0.56**	
			0.50	max. by City's Criteria
Imperviousness Percent:			**34.7**	

Post-Development Composite Runoff Coefficient "C"

Location	Area (ha)	C	Composite "C"
Building	0.522	0.90	
Asphalt and paved	0.000	0.90	
Permeable Pavement	0.182	0.45	
Landscaped Area	0.380	0.25	
Total Site Area	**1.084**		**0.60**
Imperviousness Percent:			**48.1**

LEA Consulting Ltd. Consulting Engineers and Planners	5mm Rainfall Retention Volume (Water Balance)			
	Prepared:	F.M	Page No.	A-03
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C1** **City Of Mississauga**	Proj. #	18038		
	Date:	Mar.28/18		

According to the CVC Guidelines, in order to achieve the water balance target, it is required to retain all runoff from a small event - typically 5mm (in Toronto, storms with 24 hour volumes of 5mm or less contribute about 50% of the total average annual rainfall volume) through infiltration, evapotranspiration & rainwater reuse.

Site Area:	1.084	ha
Runoff Coefficient :	0.60	Post-development site conditions

Runoff volume from 5mm rainfall event on site:

$V = 1.084 \times 10 \times 5 = 54.21 \ m^3$

Required on-site retention volume for 5mm rainfall event: 54.21 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	Pre-Development Peak Flow Rates Calculation			
	Prepared:	F.M	Page No.	A-04
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C1** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Rational Formulae: Q = 2.78 CIA (L/s)

Site Area:	1.084	ha
Time of Concentration:	15	minutes as per City Guidelines
Runoff Coefficient :	0.50	Pre-development condition

Rainfall Intensity: $I = a/(Tc+b)^c$ (City Std. 2111.010)

Return Period:	2-yr	5-yr	10-yr	25-yr
Rainfall Intensity (mm/hr):	59.89	80.51	99.17	113.89

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr
Under existing site conditions (L/s):	90.18	121.22	149.31	171.49

Allowable discharge rate into municipal storm sewer:

@ 10-year storm: 149.31 L/s

LEA Consulting Ltd. Consulting Engineers and Planners	Post-Development Peak Flow Rates Calculation (Uncontrolled)			
	Prepared:	F.M	Page No.	A-05
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C1** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Rational Formulae: Q = 2.78 CIA (L/s)

Site Area:	1.084	ha
Time of Concentration:	15	minutes as per City Guidelines
Runoff Coefficient :	0.60	Post-development

Rainfall Intensity: $I = a/(Tc+b)^c$ (City Std. 2111.010)

Return Period:	2-yr	5-yr	10-yr	25-yr
Rainfall Intensity (mm/hr):	59.89	80.51	99.17	113.89

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr
Under existing site conditions (L/s):	107.58	144.62	178.13	204.59

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (2-Year Storm)			
	Prepared:	F.M	Page No.	A-06
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C1** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Total Drainage Area (ha) = 1.084 ha
Drainage Area Composite C = 0.60
Allowable Release Rate = 149.31 L/s
Return Period = 2 Year

Site storage Requirement:

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m^3)	Release Rate (L/s)	Release Flow Volume (m^3)	Required Storage Volume (m^3)
15	59.89	107.58	96.83	149.31	134.38	-37.55
20	50.16	90.11	108.13	149.31	179.17	-71.04
25	43.42	78.00	117.00	149.31	223.97	-106.97
30	38.45	69.06	124.31	149.31	268.76	-144.45
35	34.60	62.16	130.54	149.31	313.55	-183.01
40	31.54	56.65	135.97	149.31	358.35	-222.38
45	29.03	52.15	140.80	149.31	403.14	-262.34
50	26.94	48.38	145.15	149.31	447.93	-302.78
55	25.16	45.19	149.12	149.31	492.73	-343.61
60	23.62	42.44	152.77	149.31	537.52	-384.75
65	22.29	40.04	156.15	149.31	582.31	-426.16
70	21.12	37.93	159.30	149.31	627.11	-467.81
75	20.07	36.06	162.26	149.31	671.90	-509.64
80	19.14	34.38	165.05	149.31	716.70	-551.65
85	18.30	32.88	167.68	149.31	761.49	-593.81
90	17.54	31.51	170.18	149.31	806.28	-636.10
95	16.85	30.27	172.56	149.31	851.08	-678.52
100	16.22	29.14	174.83	149.31	895.87	-721.04
105	15.64	28.10	177.01	149.31	940.66	-763.65
110	15.11	27.14	179.10	149.31	985.46	-806.36

Required Storage Volume = -37.55 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (10-Year Storm)			
	Prepared:	F.M	Page No.	A-07
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C1** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Total Drainage Area (ha) = 1.084 ha
Drainage Area Composite C = 0.60
Allowable Release Rate = 149.31 L/s
Return Period = 10 Year

Site storage Requirement:

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m^3)	Release Rate (L/s)	Release Flow Volume (m^3)	Required Storage Volume (m^3)
15	99.17	178.13	160.32	149.31	134.38	25.94
20	83.06	149.20	179.04	149.31	179.17	-0.13
25	71.90	129.15	193.73	149.31	223.97	-30.24
30	63.66	114.35	205.82	149.31	268.76	-62.94
35	57.30	102.92	216.13	149.31	313.55	-97.42
40	52.22	93.80	225.13	149.31	358.35	-133.22
45	48.07	86.34	233.13	149.31	403.14	-170.01
50	44.60	80.11	240.33	149.31	447.93	-207.60
55	41.65	74.82	246.90	149.31	492.73	-245.83
60	39.11	70.26	252.94	149.31	537.52	-284.58
65	36.91	66.29	258.54	149.31	582.31	-323.77
70	34.96	62.80	263.76	149.31	627.11	-363.35
75	33.24	59.70	268.66	149.31	671.90	-403.24
80	31.69	56.93	273.27	149.31	716.70	-443.43
85	30.31	54.44	277.63	149.31	761.49	-483.86
90	29.05	52.18	281.77	149.31	806.28	-524.51
95	27.90	50.13	285.72	149.31	851.08	-565.36
100	26.86	48.25	289.48	149.31	895.87	-606.39
105	25.90	46.52	293.08	149.31	940.66	-647.58
110	25.01	44.93	296.54	149.31	985.46	-688.92

Required Storage Volume = 25.94 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (100 - Year Storm)			
	Prepared:	F.M	Page No.	A-08
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C1** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Total Drainage Area (ha) = 1.084 ha
Drainage Area Composite C = 0.60
Allowable Release Rate = 149.31 L/s
Return Period = 100 Year

Site storage Requirement:

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m^3)	Release Rate (L/s)	Release Flow Volume (m^3)	Required Storage Volume (m^3)
15	140.69	252.72	227.45	149.31	134.38	93.07
20	118.12	212.18	254.62	149.31	179.17	75.45
25	102.41	183.96	275.94	149.31	223.97	51.97
30	90.77	163.06	293.51	149.31	268.76	24.75
35	81.77	146.89	308.47	149.31	313.55	-5.08
40	74.58	133.97	321.52	149.31	358.35	-36.83
45	68.68	123.38	333.12	149.31	403.14	-70.02
50	63.75	114.52	343.56	149.31	447.93	-104.37
55	59.56	106.99	353.08	149.31	492.73	-139.65
60	55.95	100.51	361.83	149.31	537.52	-175.69
65	52.81	94.85	369.93	149.31	582.31	-212.38
70	50.03	89.88	377.49	149.31	627.11	-249.62
75	47.58	85.46	384.57	149.31	671.90	-287.33
80	45.38	81.51	391.24	149.31	716.70	-325.46
85	43.39	77.95	397.55	149.31	761.49	-363.94
90	41.60	74.73	403.53	149.31	806.28	-402.75
95	39.97	71.79	409.23	149.31	851.08	-441.85
100	38.47	69.11	414.66	149.31	895.87	-481.21
105	37.10	66.65	419.87	149.31	940.66	-520.79
110	35.84	64.37	424.86	149.31	985.46	-560.60

Required Storage Volume = 93.07 m^3

Appendix B

Stormwater Peak Flow Calculation
Sub-Catchment Area C2

LEA Consulting Ltd. Consulting Engineers and Planners	Land Use			
	Prepared:	F.M	Page No.	B-01
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C2** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

EXISTING CONDITIONS:

Existing Land Use	Area (m^2)
Building	496.0
Asphalt	818.0
Gravel	710.0
Lawn & Tree	666.0
Total Site Area:	**2690.0**

PROPOSED DEVELOPMENT:

Proposed Land Use	Area (m^2)
Asphalt	1440.0
Paved	273.0
Total Landscaped Area	977.0
Total Site Area	**2690.0**

LEA Consulting Ltd. Consulting Engineers and Planners	Composite "C" Calculation			
	Prepared:	F.M	Page No.	B-02
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C2** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Pre-Development Composite Runoff Coefficient "C"

Location	Area (ha)	C	Composite "C"	
Building	0.050	0.90		
Asphalt	0.082	0.90		
Gravel	0.071	0.60		
Lawn & Tree	0.067	0.25		
Total Site Area:	**0.269**		**0.66**	
			0.50	max. by City's Criteria
Imperviousness Percent:			**48.8**	

Post-Development Composite Runoff Coefficient "C"

Location	Area (ha)	C	Composite "C"
Asphalt	0.144	0.90	
Paved	0.027	0.90	
Total Landscaped Area	0.098	0.25	
Total Site Area	**0.269**		**0.66**
Imperviousness Percent:			**63.7**

LEA Consulting Ltd. Consulting Engineers and Planners	Pre-Development Peak Flow Rates Calculation			
	Prepared:	F.M	Page No.	B-04
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C2** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Rational Formulae: Q = 2.78 CIA (L/s)

Site Area:	0.269	ha
Time of Concentration:	15	minutes as per City Guidelines
Runoff Coefficient :	0.50	Pre-development condition

Rainfall Intensity: $I = a/(Tc+b)^c$ (City Std. 2111.010)

Return Period:	2-yr	5-yr	10-yr	25-yr
Rainfall Intensity (mm/hr):	59.89	80.51	99.17	113.89

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr
Under existing site condition (L/s):	22.38	30.08	37.05	42.56

Allowable discharge rate into municipal storm sewer:

@ 2-year storm: 37.05 L/s

LEA Consulting Ltd. Consulting Engineers and Planners	Post-Development Peak Flow Rates Calculation (Uncontrolled)			
	Prepared:	F.M	Page No.	B-05
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C2** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Rational Formulae: Q = 2.78 CIA (L/s)

Site Area:	0.269	ha
Time of Concentration:	15	minutes as per City Guidelines
Runoff Coefficient :	0.66	Post-development

Rainfall Intensity: $I = a/(Tc+b)^c$ (City Std. 2111.010)

Return Period:	2-yr	5-yr	10-yr	25-yr
Rainfall Intensity (mm/hr):	59.89	80.51	99.17	113.89

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr
Under Post development condition (L/s):	29.71	39.94	49.20	56.51

Appendix C

Storm Sewers Calculations

LEA Consulting Ltd. Consulting Engineers and Planners	Land Use			
	Prepared:	F.M	Page No.	C-01
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C3** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

EXISTING RAILWAY DITCHES:

Land Use	Area (m^2)
Asphalt	335.0
Railway (Gravel)	1161.0
Lown	2758.0
Total Site Area:	**4254.0**

LEA Consulting Ltd. Consulting Engineers and Planners	Composite "C" Calculation			
	Prepared:	F.M	Page No.	C-02
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C3** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Composite Runoff Coefficient "C"

Location	Area (ha)	C	Composite "C"
Asphalt	0.034	0.90	
Railway (Gravel)	0.116	0.60	
Lown	0.276	0.25	
Total Site Area:	**0.425**		**0.40**
Imperviousness Percent:			**7.9**

LEA Consulting Ltd. Consulting Engineers and Planners	External Flow Rates Calculation			
	Prepared:	F.M	Page No.	C-03
	Checked:	M.D.		
Project: 51-57 Tannery Street **SUB-CATCHMENT C3** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Rational Formulae: Q = 2.78 CIA (L/s)

Existing Railway Ditches

Site Area:	0.425	ha
Time of Concentration:	15	minutes as per City Guidelines
Runoff Coefficient :	0.40	Existing condition

Rainfall Intensity: $I = a/(Tc+b)^c$ (City Std. 2111.010)

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Rainfall Intensity (mm/hr):	59.89	80.51	99.17	113.89	127.13	140.69

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Regional
Flow (L/s):	28.08	37.74	46.49	53.39	59.60	65.96	61.0

LEA Consulting Ltd. Consulting Engineers and Planners	Land Use			
	Prepared:	F.M	Page No.	C-04
	Checked:	M.D.		
Project: 51-57 Tannery Street **Area and Runoff Coefficient** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

EXISTING CONDITIONS:

EC1	**Area (m^2)**
Building	0.0
Asphalt	0.0
Gravel	244.0
Lawn & Tree	959.0
Total Site Area:	**1203.0**

EC2	**Area (m^2)**
Building	98.0
Asphalt	1851.0
Gravel	574.0
Lawn & Tree	1012.0
Total Site Area	**3437.0**

EC3	**Area (m^2)**
Building	2393.0
Asphalt	4574.0
Gravel	3742.0
Lawn & Tree	1966.0
Total Site Area	**12675.0**

LEA Consulting Ltd. Consulting Engineers and Planners	Composite "C" Calculation			
	Prepared:	F.M	Page No.	C-05
	Checked:	M.D.		
Project: 51-57 Tannery Street **Area and Runoff Coefficient** **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

EC1

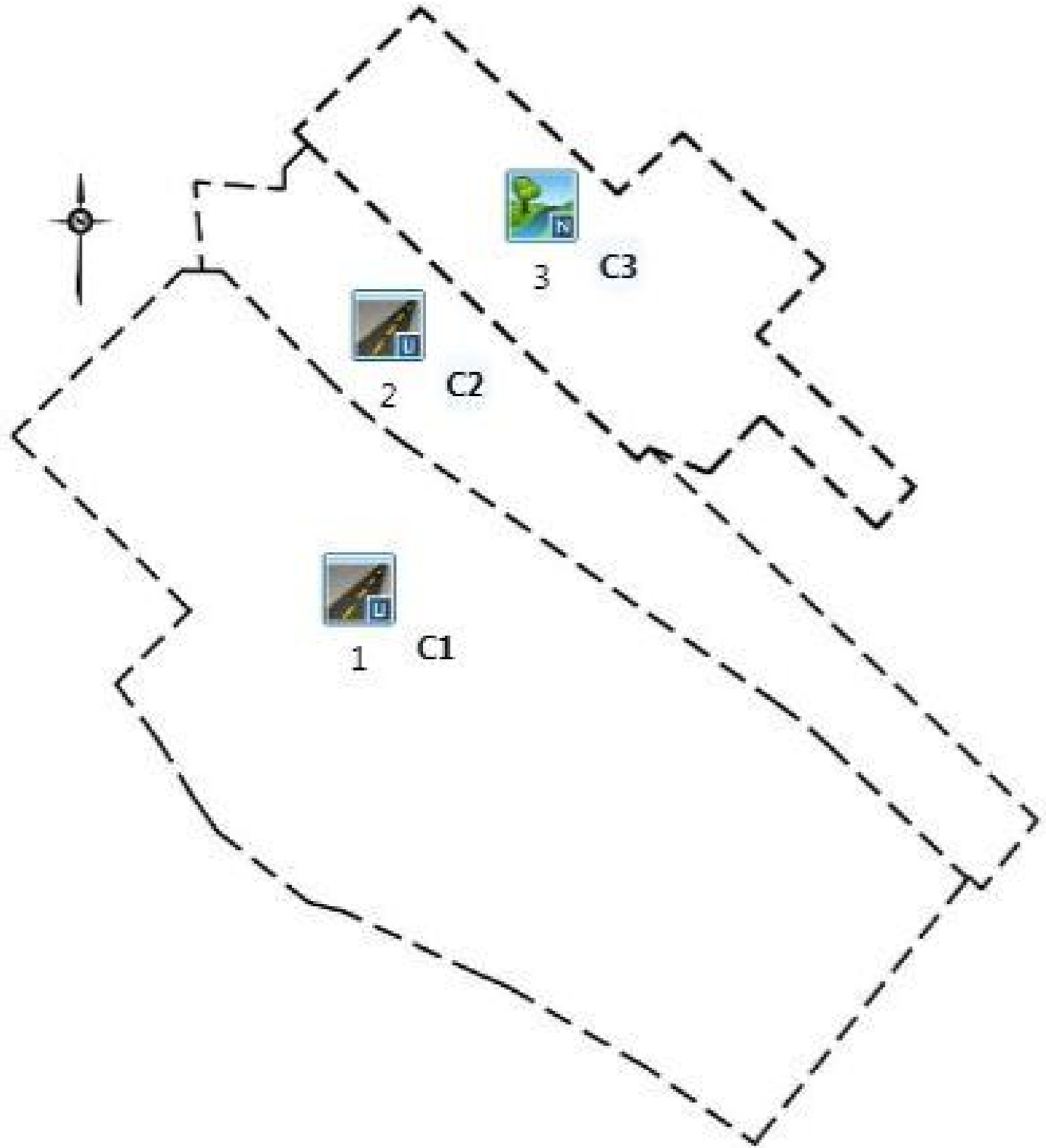
Location	Area (ha)	C	Composite "C"
Building	0.000	0.90	
Asphalt	0.000	0.90	
Gravel	0.024	0.60	
Lawn & Tree	0.096	0.25	
Total Site Area:	**0.120**		**0.32**
Imperviousness Percent:			**0.0**

EC2

Location	Area (ha)	C	Composite "C"
Building	0.010	0.90	
Asphalt	0.185	0.90	
Gravel	0.057	0.60	
Lawn & Tree	0.101	0.25	
Total Site Area	**0.344**		**0.68**
Imperviousness Percent:			**70.6**

EC3

Location	Area (ha)	C	Composite "C"
Building	0.239	0.90	
Asphalt	0.457	0.90	
Gravel	0.374	0.60	
Lawn & Tree	0.197	0.25	
Total Site Area	**1.268**		**0.71**
Imperviousness Percent:			**55.0**


3
C3
2
C2
1
C1

```
  ****************************************************
  ** SIMULATION : Regional-Pre-Development Condition **
  ****************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\fmorshedi\AppD
|                  |              ata\Local\Temp\
|                  |              2fc6111f-4b32-49d1-ae8a-db14c5eed1f8\9c7215c3
| Ptotal=212.00 mm |    Comments: Hazel
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                1.00    6.00 |  4.00   13.00 |  7.00   23.00 | 10.00   53.00
                2.00    4.00 |  5.00   17.00 |  8.00   13.00 | 11.00   38.00
                3.00    6.00 |  6.00   13.00 |  9.00   13.00 | 12.00   13.00

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   1.08
|ID= 1 DT= 5.0 min |   Total Imp(%)=  34.70   Dir. Conn.(%)=   1.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.38         0.71
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      85.01        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    6.00 | 3.083   13.00 | 6.083   23.00 |  9.08   53.00
               0.167    6.00 | 3.167   13.00 | 6.167   23.00 |  9.17   53.00
               0.250    6.00 | 3.250   13.00 | 6.250   23.00 |  9.25   53.00
               0.333    6.00 | 3.333   13.00 | 6.333   23.00 |  9.33   53.00
               0.417    6.00 | 3.417   13.00 | 6.417   23.00 |  9.42   53.00
               0.500    6.00 | 3.500   13.00 | 6.500   23.00 |  9.50   53.00
               0.583    6.00 | 3.583   13.00 | 6.583   23.00 |  9.58   53.00
               0.667    6.00 | 3.667   13.00 | 6.667   23.00 |  9.67   53.00
               0.750    6.00 | 3.750   13.00 | 6.750   23.00 |  9.75   53.00
               0.833    6.00 | 3.833   13.00 | 6.833   23.00 |  9.83   53.00
               0.917    6.00 | 3.917   13.00 | 6.917   23.00 |  9.92   53.00
               1.000    6.00 | 4.000   13.00 | 7.000   23.00 | 10.00   53.00
               1.083    4.00 | 4.083   17.00 | 7.083   13.00 | 10.08   38.00
               1.167    4.00 | 4.167   17.00 | 7.167   13.00 | 10.17   38.00
               1.250    4.00 | 4.250   17.00 | 7.250   13.00 | 10.25   38.00
               1.333    4.00 | 4.333   17.00 | 7.333   13.00 | 10.33   38.00
               1.417    4.00 | 4.417   17.00 | 7.417   13.00 | 10.42   38.00
               1.500    4.00 | 4.500   17.00 | 7.500   13.00 | 10.50   38.00
               1.583    4.00 | 4.583   17.00 | 7.583   13.00 | 10.58   38.00
               1.667    4.00 | 4.667   17.00 | 7.667   13.00 | 10.67   38.00
               1.750    4.00 | 4.750   17.00 | 7.750   13.00 | 10.75   38.00
               1.833    4.00 | 4.833   17.00 | 7.833   13.00 | 10.83   38.00
               1.917    4.00 | 4.917   17.00 | 7.917   13.00 | 10.92   38.00
               2.000    4.00 | 5.000   17.00 | 8.000   13.00 | 11.00   38.00
               2.083    6.00 | 5.083   13.00 | 8.083   13.00 | 11.08   13.00
               2.167    6.00 | 5.167   13.00 | 8.167   13.00 | 11.17   13.00
               2.250    6.00 | 5.250   13.00 | 8.250   13.00 | 11.25   13.00
               2.333    6.00 | 5.333   13.00 | 8.333   13.00 | 11.33   13.00
               2.417    6.00 | 5.417   13.00 | 8.417   13.00 | 11.42   13.00
               2.500    6.00 | 5.500   13.00 | 8.500   13.00 | 11.50   13.00
               2.583    6.00 | 5.583   13.00 | 8.583   13.00 | 11.58   13.00
               2.667    6.00 | 5.667   13.00 | 8.667   13.00 | 11.67   13.00
               2.750    6.00 | 5.750   13.00 | 8.750   13.00 | 11.75   13.00
               2.833    6.00 | 5.833   13.00 | 8.833   13.00 | 11.83   13.00
               2.917    6.00 | 5.917   13.00 | 8.917   13.00 | 11.92   13.00
               3.000    6.00 | 6.000   13.00 | 9.000   13.00 | 12.00   13.00
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     Max.Eff.Inten.(mm/hr)=      53.00        78.30
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.99 (ii)   10.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.28         0.09
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.15        0.154 (iii)
     TIME TO PEAK    (hrs)=       9.58        10.00        10.00
     RUNOFF VOLUME    (mm)=     211.00       185.08       185.33
     TOTAL RAINFALL   (mm)=     212.00       212.00       212.00
     RUNOFF COEFFICIENT   =       1.00         0.87         0.87

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  85.0    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.
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|    READ STORM    |    Filename: C:\Users\fmorshedi\AppD
|                  |              ata\Local\Temp\
|                  |              2fc6111f-4b32-49d1-ae8a-db14c5eed1f8\9c7215c3
| Ptotal=212.00 mm |    Comments: Hazel
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TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
1.00	6.00	4.00	13.00	7.00	23.00	10.00	53.00
2.00	4.00	5.00	17.00	8.00	13.00	11.00	38.00
3.00	6.00	6.00	13.00	9.00	13.00	12.00	13.00

```
--------------------
| CALIB            |
| NASHYD   (  0003)|   Area    (ha)=   0.44   Curve Number   (CN)= 86.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00

2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Unit Hyd Qpeak (cms)= 0.083

PEAK FLOW (cms)= 0.061 (i)
TIME TO PEAK (hrs)= 10.000
RUNOFF VOLUME (mm)= 175.604
TOTAL RAINFALL (mm)= 212.000
RUNOFF COEFFICIENT = 0.828

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

READ STORM	Filename: C:\Users\fmorshedi\AppData\Local\Temp\2fc6111f-4b32-49d1-ae8a-db14c5eed1f8\9c7215c3
Ptotal=212.00 mm	Comments: Hazel

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
1.00	6.00	4.00	13.00	7.00	23.00	10.00	53.00
2.00	4.00	5.00	17.00	8.00	13.00	11.00	38.00
3.00	6.00	6.00	13.00	9.00	13.00	12.00	13.00

CALIB STANDHYD (0002)	Area (ha)= 0.27
ID= 1 DT=15.0 min	Total Imp(%)= 48.80 Dir. Conn.(%)= 1.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.13	0.14
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	1.50
Length	(m)=	42.35	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Max.Eff.Inten.(mm/hr)=		53.00	100.72
	over (min)	15.00	15.00
Storage Coeff. (min)=		1.97 (ii)	9.64 (ii)

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     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.04          0.039 (iii)
     TIME TO PEAK    (hrs)=       9.50        10.00          10.00
     RUNOFF VOLUME    (mm)=     211.00       190.33         190.50
     TOTAL RAINFALL   (mm)=     212.00       212.00         212.00
     RUNOFF COEFFICIENT   =       1.00         0.90           0.90

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    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.

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 FINISH
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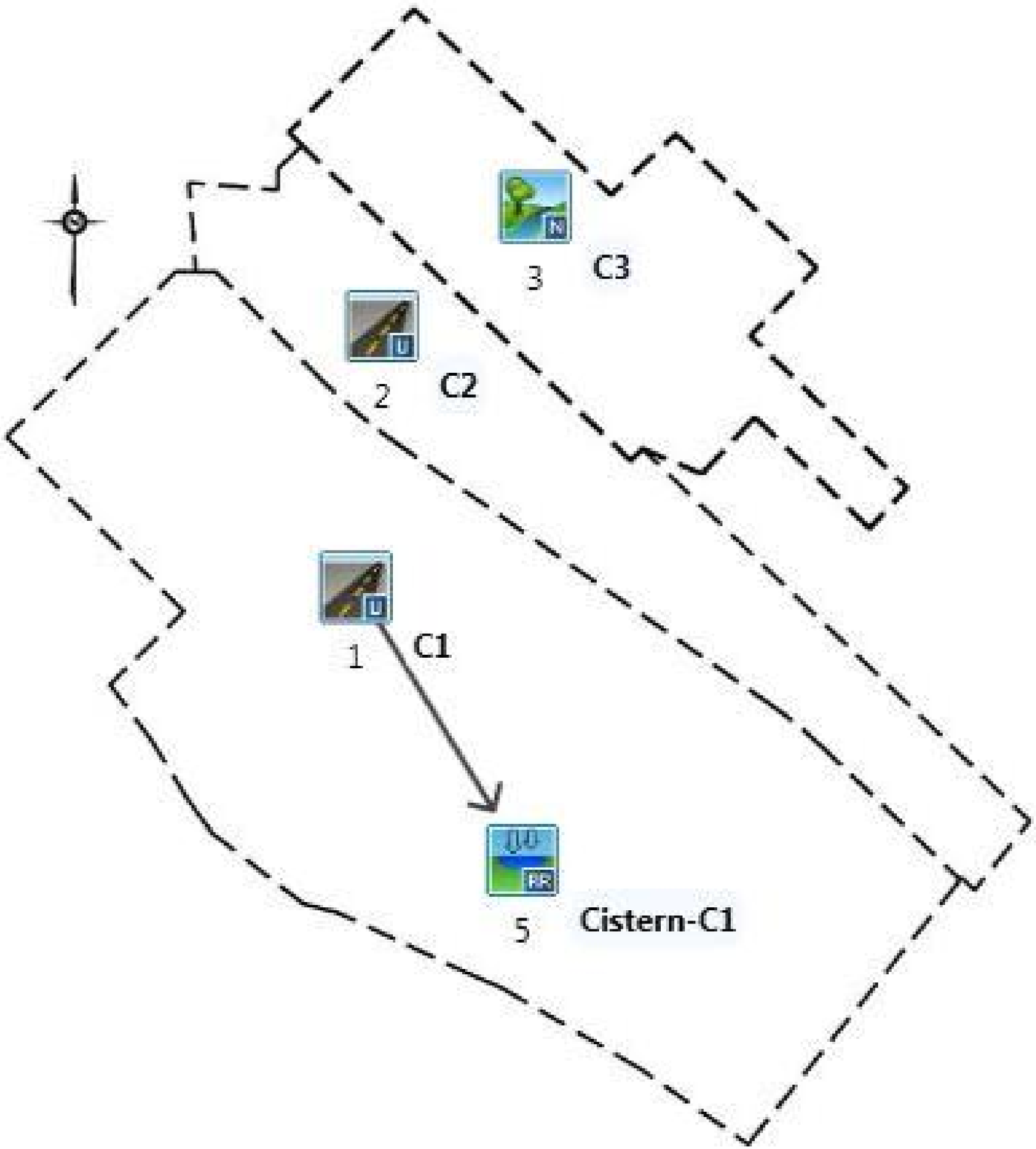
3
C3
2
C2
1
C1
5
Cistern-C1

```
  ******************************************************
  ** SIMULATION : Regional- Post-Development Conditions **
  ******************************************************


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|    READ STORM    |    Filename: C:\Users\fmorshedi\AppD
|                  |              ata\Local\Temp\
|                  |              9ce606c3-2b4e-4300-9e3a-0e83df46b35b\9c7215c3
| Ptotal=212.00 mm |    Comments: Hazel
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                1.00    6.00 |  4.00   13.00 |  7.00   23.00 | 10.00   53.00
                2.00    4.00 |  5.00   17.00 |  8.00   13.00 | 11.00   38.00
                3.00    6.00 |  6.00   13.00 |  9.00   13.00 | 12.00   13.00

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| CALIB            |
| NASHYD   (  0003)|   Area    (ha)=   0.44   Curve Number   (CN)= 86.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    6.00 | 3.083   13.00 | 6.083   23.00 |  9.08   53.00
               0.167    6.00 | 3.167   13.00 | 6.167   23.00 |  9.17   53.00
               0.250    6.00 | 3.250   13.00 | 6.250   23.00 |  9.25   53.00
               0.333    6.00 | 3.333   13.00 | 6.333   23.00 |  9.33   53.00
               0.417    6.00 | 3.417   13.00 | 6.417   23.00 |  9.42   53.00
               0.500    6.00 | 3.500   13.00 | 6.500   23.00 |  9.50   53.00
               0.583    6.00 | 3.583   13.00 | 6.583   23.00 |  9.58   53.00
               0.667    6.00 | 3.667   13.00 | 6.667   23.00 |  9.67   53.00
               0.750    6.00 | 3.750   13.00 | 6.750   23.00 |  9.75   53.00
               0.833    6.00 | 3.833   13.00 | 6.833   23.00 |  9.83   53.00
               0.917    6.00 | 3.917   13.00 | 6.917   23.00 |  9.92   53.00
               1.000    6.00 | 4.000   13.00 | 7.000   23.00 | 10.00   53.00
               1.083    4.00 | 4.083   17.00 | 7.083   13.00 | 10.08   38.00
               1.167    4.00 | 4.167   17.00 | 7.167   13.00 | 10.17   38.00
               1.250    4.00 | 4.250   17.00 | 7.250   13.00 | 10.25   38.00
               1.333    4.00 | 4.333   17.00 | 7.333   13.00 | 10.33   38.00
               1.417    4.00 | 4.417   17.00 | 7.417   13.00 | 10.42   38.00
               1.500    4.00 | 4.500   17.00 | 7.500   13.00 | 10.50   38.00
               1.583    4.00 | 4.583   17.00 | 7.583   13.00 | 10.58   38.00
               1.667    4.00 | 4.667   17.00 | 7.667   13.00 | 10.67   38.00
               1.750    4.00 | 4.750   17.00 | 7.750   13.00 | 10.75   38.00
               1.833    4.00 | 4.833   17.00 | 7.833   13.00 | 10.83   38.00
               1.917    4.00 | 4.917   17.00 | 7.917   13.00 | 10.92   38.00
               2.000    4.00 | 5.000   17.00 | 8.000   13.00 | 11.00   38.00
               2.083    6.00 | 5.083   13.00 | 8.083   13.00 | 11.08   13.00
               2.167    6.00 | 5.167   13.00 | 8.167   13.00 | 11.17   13.00
               2.250    6.00 | 5.250   13.00 | 8.250   13.00 | 11.25   13.00
               2.333    6.00 | 5.333   13.00 | 8.333   13.00 | 11.33   13.00
               2.417    6.00 | 5.417   13.00 | 8.417   13.00 | 11.42   13.00
               2.500    6.00 | 5.500   13.00 | 8.500   13.00 | 11.50   13.00
               2.583    6.00 | 5.583   13.00 | 8.583   13.00 | 11.58   13.00
               2.667    6.00 | 5.667   13.00 | 8.667   13.00 | 11.67   13.00
               2.750    6.00 | 5.750   13.00 | 8.750   13.00 | 11.75   13.00
               2.833    6.00 | 5.833   13.00 | 8.833   13.00 | 11.83   13.00
               2.917    6.00 | 5.917   13.00 | 8.917   13.00 | 11.92   13.00
               3.000    6.00 | 6.000   13.00 | 9.000   13.00 | 12.00   13.00

    Unit Hyd Qpeak  (cms)=   0.083

    PEAK FLOW       (cms)=   0.061 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 175.604
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     TOTAL RAINFALL   (mm)= 212.000
     RUNOFF COEFFICIENT   =   0.828

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

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|    READ STORM    |    Filename: C:\Users\fmorshedi\AppD
|                  |              ata\Local\Temp\
|                  |              9ce606c3-2b4e-4300-9e3a-0e83df46b35b\9c7215c3
| Ptotal=212.00 mm |    Comments: Hazel
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```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
1.00	6.00	4.00	13.00	7.00	23.00	10.00	53.00
2.00	4.00	5.00	17.00	8.00	13.00	11.00	38.00
3.00	6.00	6.00	13.00	9.00	13.00	12.00	13.00

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| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  63.70   Dir. Conn.(%)=   1.00
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```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.17	0.10
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	1.50
Length	(m)=	42.35	40.00
Mannings n	=	0.013	0.250

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        NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Max.Eff.Inten.(mm/hr)=		53.00	143.20	
over (min)		15.00	15.00	
Storage Coeff. (min)=		1.97 (ii)	8.63 (ii)	
Unit Hyd. Tpeak (min)=		15.00	15.00	
Unit Hyd. peak (cms)=		0.11	0.09	
				TOTALS
PEAK FLOW	(cms)=	0.00	0.04	0.039 (iii)
TIME TO PEAK	(hrs)=	9.50	10.00	10.00
RUNOFF VOLUME	(mm)=	211.00	196.20	196.33
TOTAL RAINFALL	(mm)=	212.00	212.00	212.00
RUNOFF COEFFICIENT	=	1.00	0.93	0.93

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***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    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.
```

READ STORM	Filename: C:\Users\fmorshedi\AppData\Local\Temp\9ce606c3-2b4e-4300-9e3a-0e83df46b35b\9c7215c3
Ptotal=212.00 mm	Comments: Hazel

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
1.00	6.00	4.00	13.00	7.00	23.00	10.00	53.00
2.00	4.00	5.00	17.00	8.00	13.00	11.00	38.00
3.00	6.00	6.00	13.00	9.00	13.00	12.00	13.00

CALIB STANDHYD (0001)	Area (ha)= 1.08
ID= 1 DT= 5.0 min	Total Imp(%)= 48.00 Dir. Conn.(%)= 48.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.52	0.56
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	85.01	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Max.Eff.Inten.(mm/hr)=		53.00	50.33
	over (min)	5.00	15.00
Storage Coeff. (min)=		2.99 (ii)	12.28 (ii)

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     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.28         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.08          0.154 (iii)
     TIME TO PEAK    (hrs)=       9.75        10.00          10.00
     RUNOFF VOLUME    (mm)=     211.00       173.55         191.52
     TOTAL RAINFALL   (mm)=     212.00       212.00         212.00
     RUNOFF COEFFICIENT   =       1.00         0.82           0.90

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    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.

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| RESERVOIR(  0005)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                       0.1490     0.0120   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0001)      1.084      0.154     10.00     191.52
   OUTFLOW: ID= 1 (  0005)      1.084      0.149     10.00     191.50

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 96.55
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0121

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 FINISH
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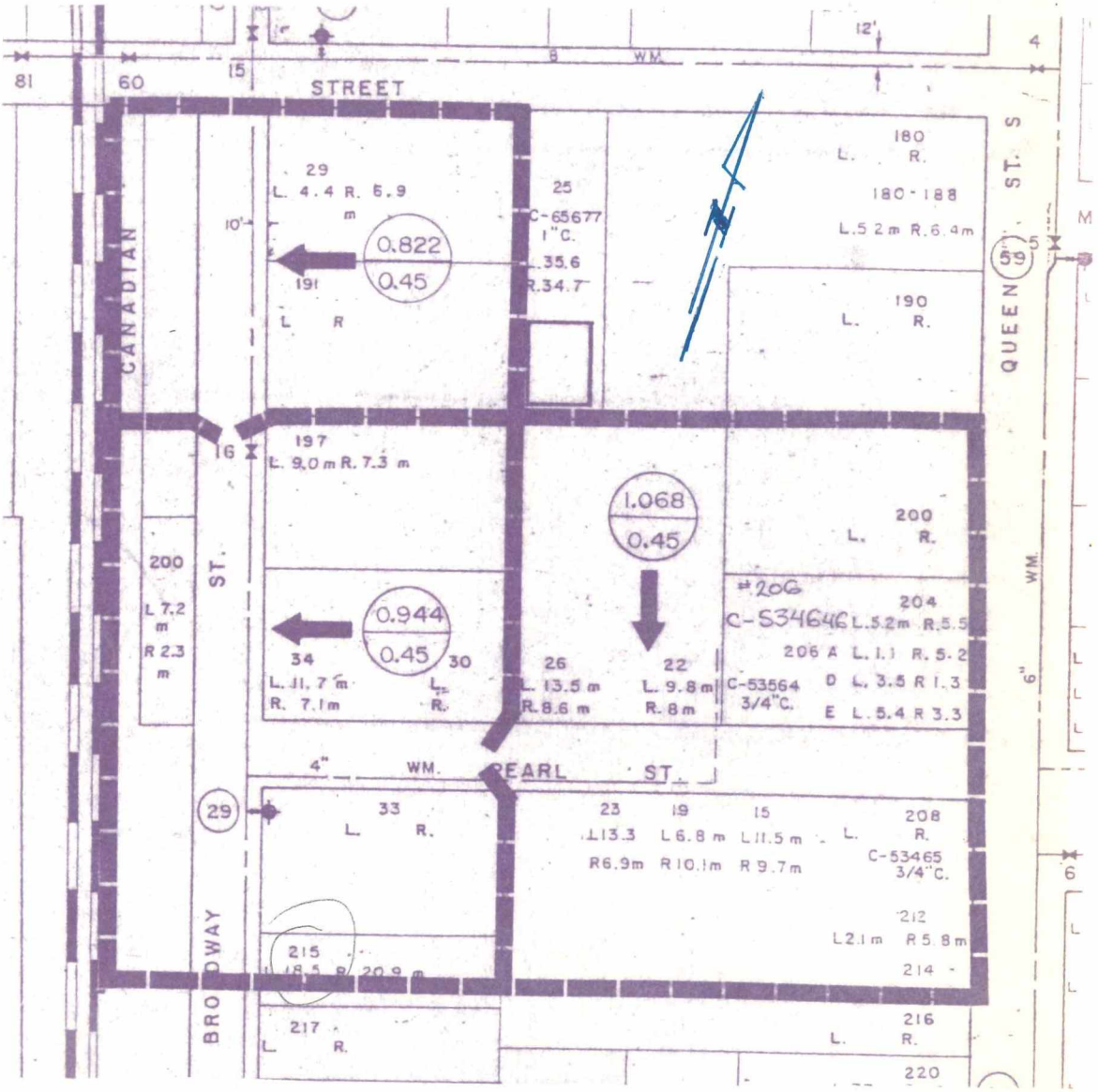
SUB-CATCHMENT C4

NOTES

1. TRENCH WIDTH (SEPARATE TRENCH) AT THE TOP OF THE PIPE SHALL BE AS PER CITY OF MISSISSAUGA STANDARD C.2-1-31.
2. CONTRACTOR IS RESPONSIBLE FOR SUPPLYING ADDITIONAL BEDDING AND/OR STRONGER PIPE, IF ACTUAL TRENCH WIDTHS EXCEED DESIGN WIDTHS.
3. SEWERS TO HAVE CLASS B BEDDING TO CITY OF MISSISSAUGA STANDARD C.2-1-31 AND CITY OF MISSISSAUGA STANDARD C.2-1-32 AND 300mm SAND COVER TO CITY OF MISSISSAUGA STANDARD C.2-1-33
4. CONCRETE SEWER PIPE TO HAVE RUBBER GASKET JOINTS.
5. CONCRETE SEWER PIPE TO BE ENCASED IN 20MPa CONCRETE, FROM EACH MANHOLE TO THE FIRST JOINT OUTSIDE MANHOLE. ENCASEMENT TO EXTEND FROM UNDISTURBED GROUND TO 300mm ABOVE TOP OF PIPE.
6. SURROUND ALL MANHOLES WITH A MINIMUM OF 1.0m COMPACTED GRANULAR BACKFILL.
   ALL CATCHBASINS TO HAVE COMPLETE, COMPACTED GRANULAR BACKFILL SURROUND.
7. EXCAVATED ROADS TO BE REINSTATED TO LATEST CITY OF MISSISSAUGA AND REGION OF PEEL STANDARDS.

LEGEND



STORM DESIGN AREAS

SUBDIVISION STREETSVILLE
CONSULTANT
MAJOR DRAINAGE AREA BROADWAY STREET

CITY OF MISSISSAUGA

STORM DRAINAGE DESIGN CHART FOR CIRCULAR DRAINS FLOWING FULL

SHEET No. 1 OF 1 DATE MAY 03 1989
PROJECT No.
DESIGNED BY

LOCATION OF SECTION	FROM UPSTREAM	TO DOWNSTREAM	ADJACENT CONTRIBUTARY AREA	RUNOFF COEFFICIENT		ACCUMULATIVE AREA DRAINED BY SECTION	ACCUMULATIVE AREA TIMES RUNOFF COEFFICIENT FOR SECTION	FLOW TIME TO SECTION (FROM EXTREME UPSTREAM INLET)	INITIAL TIME OF CONCENTRATION AT EXTREME UPSTREAM INLET	TIME OF CONCENTRATION AT UPSTEAM END OF SECTION	INTENSITY OF RAINFALL	QUANTITY OF FLOW TO BE ACCOMMODATED IN SECTION.	TYPE OF PIPE	MANNINGS ROUGHNESS COEFFICIENT	SLOPE	DIAMETER	LENGTH OF SECTION	VELOCITY OF FLOW WITH PIPE FLOWING FULL	CAPACITY OF PIPE FLOWING FULL	PIPE INVERT AT UPSTREAM M.H.	PIPE INVERT AT DOWNSTREAM MH	TIME OF FLOW IN SECTION
	MH#	MH#	A_A	C_A	$A_A \times C_A$	$A = \Sigma A_A$	$A \times C = \Sigma A_A \times C_A$	t_{Cf}	t_{C1}	$t_C = t_{Cf} + t_{C1}$	I	$Q = \frac{1AC}{360}$		n	S	D	L	V	Q			$t = \frac{L}{V \times 60}$
			(ha)			(ha)		(min)	(min)	min	mm/hr	m^3/SEC			%	mm	m	m/SEC	m^3/SEC	m	m	min
BROADWAY ST.	PROP. 4B	EX.4	.822	0.45	0.370	.822	0.370			15.0	100	0.103		.013	0.5%	450	27.5	1.45	.208			0.31
	EX.4C	EX.4	2.012	0.45	0.905	2.012	0.905			15.0	100	0.251		.013	0.5%	600	53.75	1.77	.453			0.26
	EX 4	OUTFALL	2.834	0.45	1.275	2.834	1.275			15.31	98	0.347		.013	1.1%	600	15.5	2.628	.672			0.10

RETURN TO FILE
2-89

DEVELOPMENT: **51-57 Tannery Street**

CONSULTANT: **LEA Consulting Ltd**

MAJOR DRAINAGE AREA: **Mullet Creek**

MISSISSAUGA Transportation and Works

STORM DRAINAGE DESIGN CHART

FOR CIRCULAR DRAINS FLOWING FULL

SHEET No.:

DATE: March.27,2018

DESIGNED BY: **F.M.**

CHECKED BY: **M.D.**

City of Mississauga Intensity 10yr = $1010.42/(tc+4.6)^{0.78}$

FROM UPSTREAM	TO DOWNSTREAM	Catchment AREA	RUNOFF COEFFICIENT	AREA TIMES RUNOFF COEFFICIENT	ACCUMULATIVE AREA DRAINED BY SECTION	ACCUMULATIVE AREA TIMES RUNOFF COEFFICIENT FOR SECTION	FLOW TIME TO SECTION FROM EXTREME UPSTREAM INLET	INITIAL TIME OF CONCENTRATION AT EXTREME UPSTREAM INL.	TIME OF CONCENTRATION UPSTREAM END OF SECTION	INTENSITY OF RAINFALL	QUANTITY OF FLOW TO BE ACCOMODATED IN SECTION	TYPE OF PIPE	MANNING ROUGHNESS COEFFICIENT	SLOPE	DIAMETER	LENGTH OF SECTION	VELOCITY OF FLOW WITH PIPE FLOWING FULL	CAPACITY OF PIPE FLOWING FULL	PIPE INVERT AT UPSTREAM M.H.	PIPE INVERT AT DOWNSTREAM M.H.	TIME OF FLOW IN SECTION	QUANTITY OF FLOW TO PIPE FLOWING FULL	NOTES
MH#	MH#	A	C	AxC	SUM. A	SUM AxC	tc_f	tc_i	$tc=tc_f+tc_i$	i	Q=iAC/360		n	S	D	L	V	Q_f			t=L/Vx60	Q/Q_f	
		ha			ha		min	min	min	mm/hr	L/sec			%	mm	m	m/sec	m3/sec	m	m	min	%	
Culvert	1	3.26	0.44				0	15	15		**413.0**										0.41		External flow from broadwat St. and Railway Ditch
1	2	0.00	0.00	0.00	0.00	0.00	0.41	15	15.41		**413.0**	CONC	0.011	2.00	450	14.20	3.00	476.5	155.71	155.43	0.08	0.87	
2	3	0.27	0.66	0.18	0.27	0.18	0.08	15.41	15.49	97.3	**460.9**	CONC	0.011	1.00	600	83.40	2.57	725.6	155.28	154.44	0.54	0.64	
3	DCBMH1	0.12	0.32	0.04	0.39	0.22	0.54	15.49	16.03	95.3	**619.4**	CONC	0.011	1.00	600	96.00	2.57	725.6	154.42	153.46	0.62	0.85	
DCBMH1	MH4	0.35	0.68	0.24	0.74	0.46	0.62	16.03	16.65	93.1	**680.3**	CONC	0.011	1.00	600	13.40	2.57	725.6	153.44	153.31	0.09	0.94	
MH4	DCBMH2	0.00	0.00	0.00	0.74	0.46	0.09	16.65	16.74	92.8	**1378.9**	CONC	0.011	3.11	675	52.00	4.90	1751.9	153.23	151.61	0.18	0.79	External flow to MH4, A= 3.39ha, C=0.6, Q=699l/s, Tc=15.11 min
DCBMH2	Outfall	1.27	0.71	0.90	2.01	1.36	0.18	16.74	16.92	92.2	**1608.7**	CONC	0.011	1.00	825	47.00	3.17	1696.4	151.46	150.99	0.25	0.95	

Appendix D

Sanitary and Water Demand Calculations

LEA Consulting Ltd. Consulting Engineers and Planners	Sanitary Flow Rate Calculation			
	Prepared:	F.M.	Page No.	D-01
	Checked:	M.D.		
Project: 51-57 Tannery Street **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

POPULATION CALCULATION

Site Area	10841	m^2
Number of Townhoses	155	units

Proposed Building Type	**Density (P.P.U)**	**Population**
Residential	2.7	418.50
Total		**418.50**

SANITARY FLOW CALCULATION

Harmon Peaking Factor: $M=1+14/(4+P^{0.5})$

Peaking Factor	4.01	
Average Daily Wastewater Flow	302.8	L/cap/day
Total Actual Domestic Flow	5.89	L/sec
Total Domestic Flow (For less than 1000 person shall be 13.0 L/sec-STD.DWG. 2-5-2, Region of Peel)	13.00	L/sec
Infiltration Allowance (@ 0.2 L/sec/ha)	0.22	L/sec
Actual Design flow	**6.10**	L/sec
Standard Design Flow	**13.22**	L/sec

LEA Consulting Ltd. Consulting Engineers and Planners	Water Demand Calculation			
	Prepared:	F.M.	Page No.	D-02
	Checked:	M.D.		
Project: 51-57 Tannery Street	Proj. #	18038		
City Of Mississauga	Date:	Feb.08/18		

This calculation is following the "Water Supply for Public Fire Protection"
by Fire Underwriters Survey.

Formula: $F = 220C\sqrt{A}$

where

F = the required fire flow in litres per minute
C = coefficient related to the type of construction.
= 1.0 for Ordinary construction
A = the total floor area in square metres. For fire resistive buildings, consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors.

According the building stats,

		Area (m2)
Ground Flo	adjoining	541
2nd Floor	largest	576
3rd Floor	adjoining	576
A		855

Therefore, F = 6400 **l/min**

Occupancy reduction:

For occupancies with a low contents fire hazard, the reduction rate is 15%,
Therefore: F = 5400 l/min

Reduction for sprinkler protection:

Using the NFPA sprinkler system, a reduction rate of 30% is used.
Therefore: F = 3800 l/min

Separation charge:

Charge for the separations on each side:

Separation	Charge	
0-3m	25%	West
30.1 to 45 m	5%	North
20.1 to 30 m	10%	South
0-3m	25%	East

Total charge in % 65%
Total charge in l/min 2500

Required Fire Flow: 6300 l/min
or 105.00 l/s
or 1664 US GPM

LEA Consulting Ltd. Consulting Engineers and Planners	Water Demand Calculation			
	Prepared:	F.M.	Page No.	D-03
	Checked:	M.D.		
Project: 51-57 Tannery Street **City Of Mississauga**	Proj. #	18038		
	Date:	Feb.08/18		

Total Population: **419** (See Page D-01)

Peak Hour Demand Calculation:

Residential Per Capita Demand	280	L/cap/day
Peaking Factor	3	
Peak Hour Demand	**4.07**	L/sec

Maximum Day Demand Calculation:

Residential Per Capita Demand	280	L/cap/day
Peaking Factor	2	
Maximum Day Demand	**2.71**	L/sec
Fire Flow for Residential:	105.00	L/sec
Max. Day Demand plus Fire Flow:	**107.71**	L/sec
Design Water Demand	**107.71**	L/sec
or	**1707.24**	**US GPM**

Appendix E

Hydrant Flow Test data
and
Watermain Adequacy Assessment Data

LEA Consulting Ltd. Consulting Engineers and Planners	Residual Pressure			
	Prepared:	J.L.	Page No.	D-05
	Checked:	M.D.		
Project: 51-57 Tannery Street	Proj. #	18038		
City Of Mississauga	Date:	Jul. 14/17		

Hydrant Test Readings (300mm watermain, 51 Tannery Street) undertaken on June 15, 2017, by Focus Fire Protection

Flow		Residual Pressure		
0	US GPM	62	psi	
683.5	US GPM	54	psi	
983.3	US GPM	58	psi	
3522	US GPM	20	psi	Focus Fire Protection Estimate

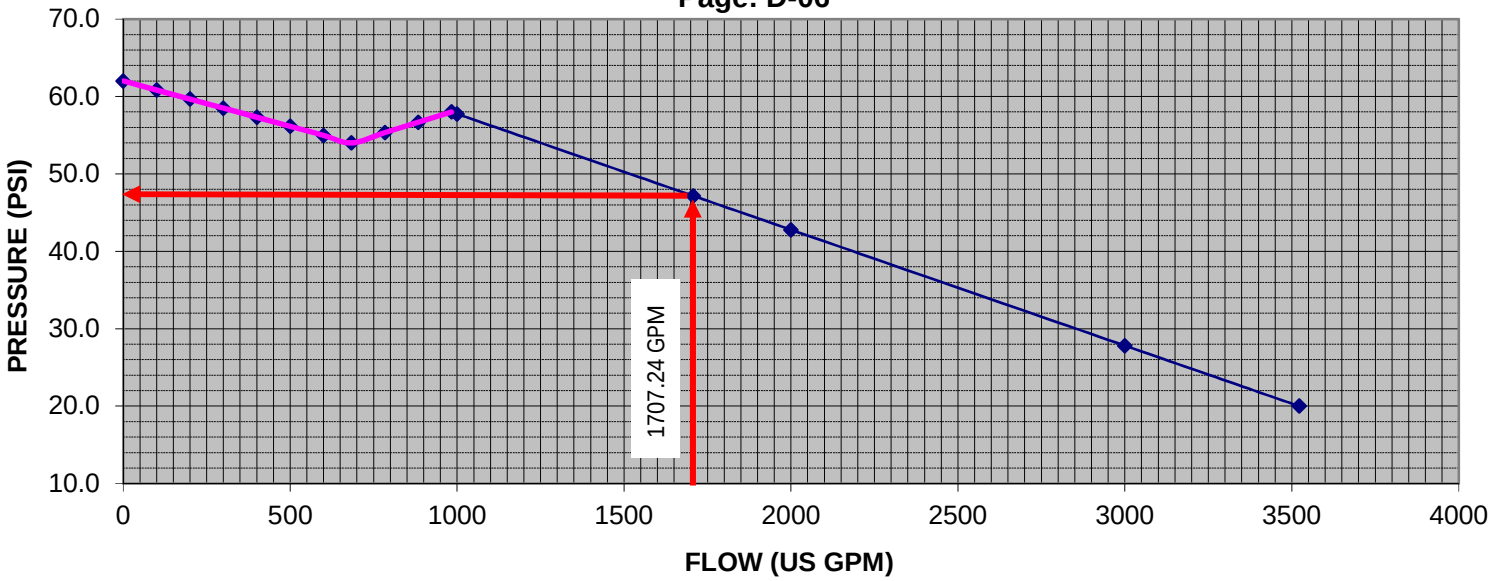
Interpolated

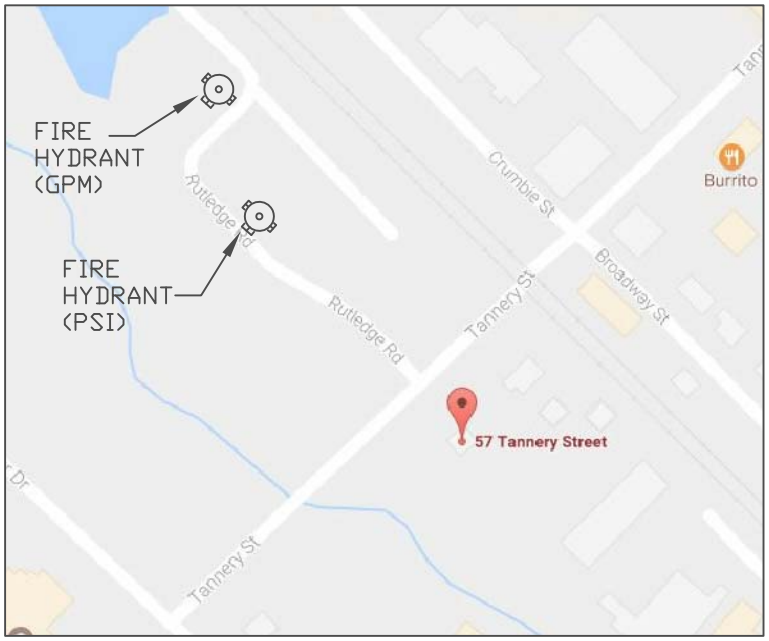
Flow (US GPM)	Residual Pressure (psi)
0	**62.0**
100	60.8
200	59.7
300	58.5
400	57.3
500	56.1
600	55.0
683.5	**54.0**
784	55.3
884	56.7
983.3	**58.0**
1000	57.8
1707	47.2
2000	42.8
3000	27.8
3522	**20.0**

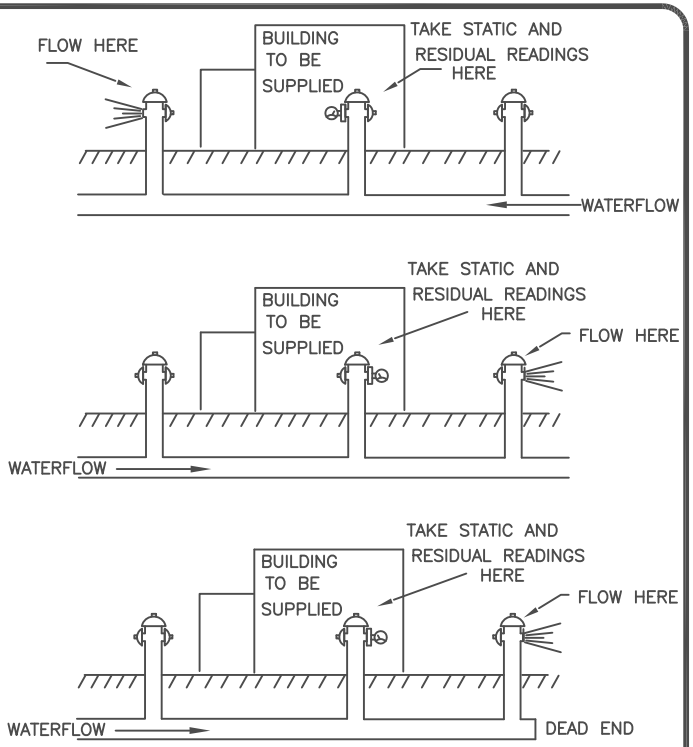
Existing 300mm Watermain on Tannery St., Mississauga

FLOW TEST CHART (BASED ON FOCUS FIRE PROTECTION TEST, JUN. 15, 2017)

Page: D-06



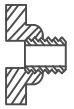




TEST:	PLAY PIPE	C=	STATIC(PSI)	RESIDUAL(PSI)	PITOT(PSI)	FLOW(USGPM)
	1x1 1/8					
	2x1 1/8					
	3x1 1/8					
	4x1 1/8					
	1x1 3/4					
	2x1 3/4					
	3x1 3/4					
	4x1 3/4					
	HYDRANT BUTT					
1	1x2 1/2	.80	62	54	21	683.5
2	2x2 1/2	.80	62	58	11	983.3
	3x2 1/2					
	4x2 1/2					
	FM NOZZLE					
	1x2 1/4	.88				
	2x2 1/4	.88				
	3x2 1/4	.88				
	4x2 1/4	.88				

OUTLET TYPE

☐  COEF.=0.90 OUTLET SMOOTH AND WELL ROUNDED

☒  COEF.=0.80 OUTLET SQUARE AND SHARP

☐  COEF.=0.70 OUTLET SQUARE AND PROJECTING INTO BARREL

Client:

Location:

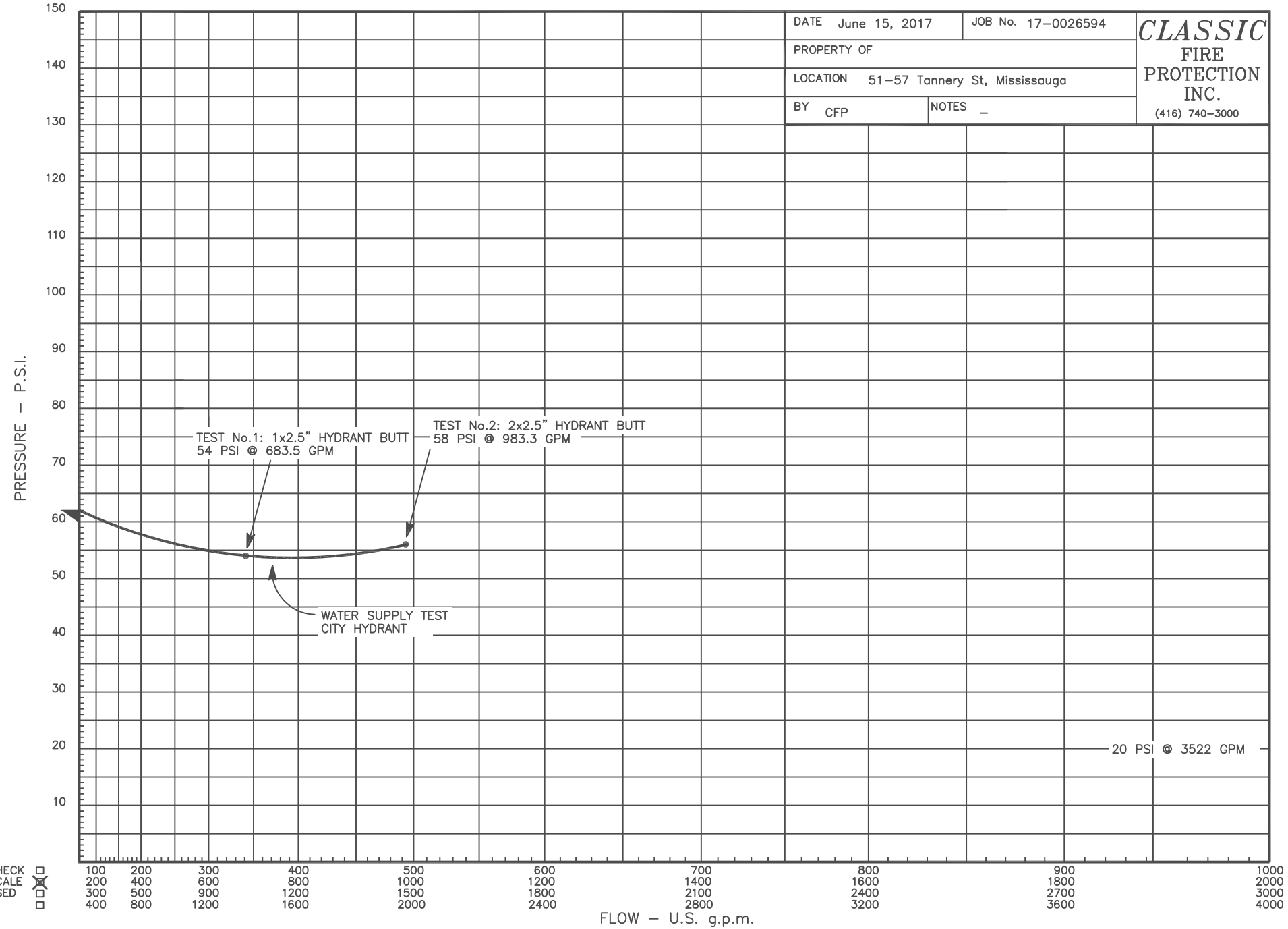
51–57 Tannery St

Mississauga, ON

DEDICATED SERVICE SINCE 1988
CLASSIC FIRE PROTECTION INC.
645 GARYRAY DR.
North York, ON
M9L 1P9
(416) 740-3000
Web: www.classicfire.com

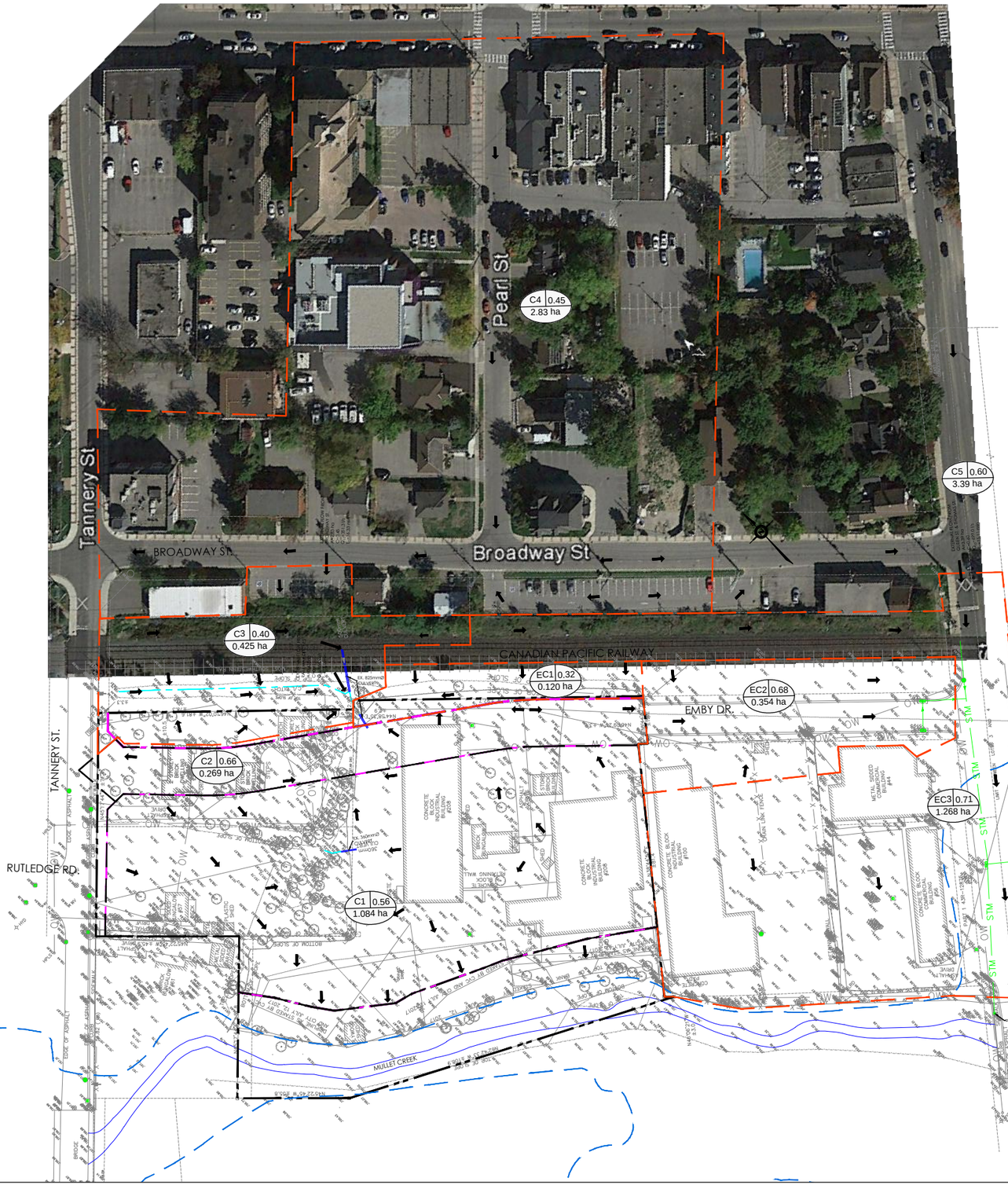
WATER SUPPLY GRAPH

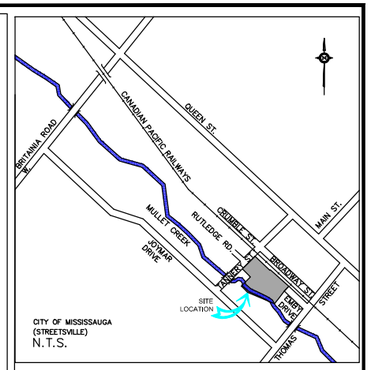
DATE June 15, 2017	JOB No. 17–0026594	CLASSIC FIRE PROTECTION INC. (416) 740–3000
PROPERTY OF		
LOCATION 51–57 Tannery St, Mississauga		
BY CFP	NOTES –	



Appendix F

Figures and Drawing





LEGEND

- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- HP — EXISTING HYDROPOLE
- LS — EXISTING LIGHT STANDARD
- HPLS — EXISTING HYDROPOLE/LIGHT STANDARD
- WV — EXISTING WATER VALVE
- HYD — EXISTING FIRE HYDRANT
- BLRD — EXISTING BOLLARD
- CS — EXISTING CURB STOP
- EXISTING MONITORING WELL
- OW — EX. OVERHEAD WIRES
- X — EXISTING FENCE
- PROPERTY LINE
- EXISTING TREE
- EXISTING DITCH
- REGIONAL FLOOD LINE (FROM MULLET CREEK FLOOD RISK MAP)
- OVERLAND FLOW ROUTE
- PROP. DEVELOPMENT DRAINAGE BOUNDARY
- DRAINAGE BOUNDARY
- C1 0.25 0.388 ha — CATCHMENT ID/RUNOFF COEFFICIENT DRAINAGE AREA (ha)
- EXISTING BUILDING

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

No.	DATE	DESCRIPTION

625 Cochrane Drive, Suite 900
Markham, Ontario
L3R 9R9, Canada
Tel: (905)470-0015 Fax: (905)470-0030

LEA Consulting Ltd.
Consulting Engineers and Planners
www.LEA.ca

51-57 TANNERY STREET DEVELOPMENT

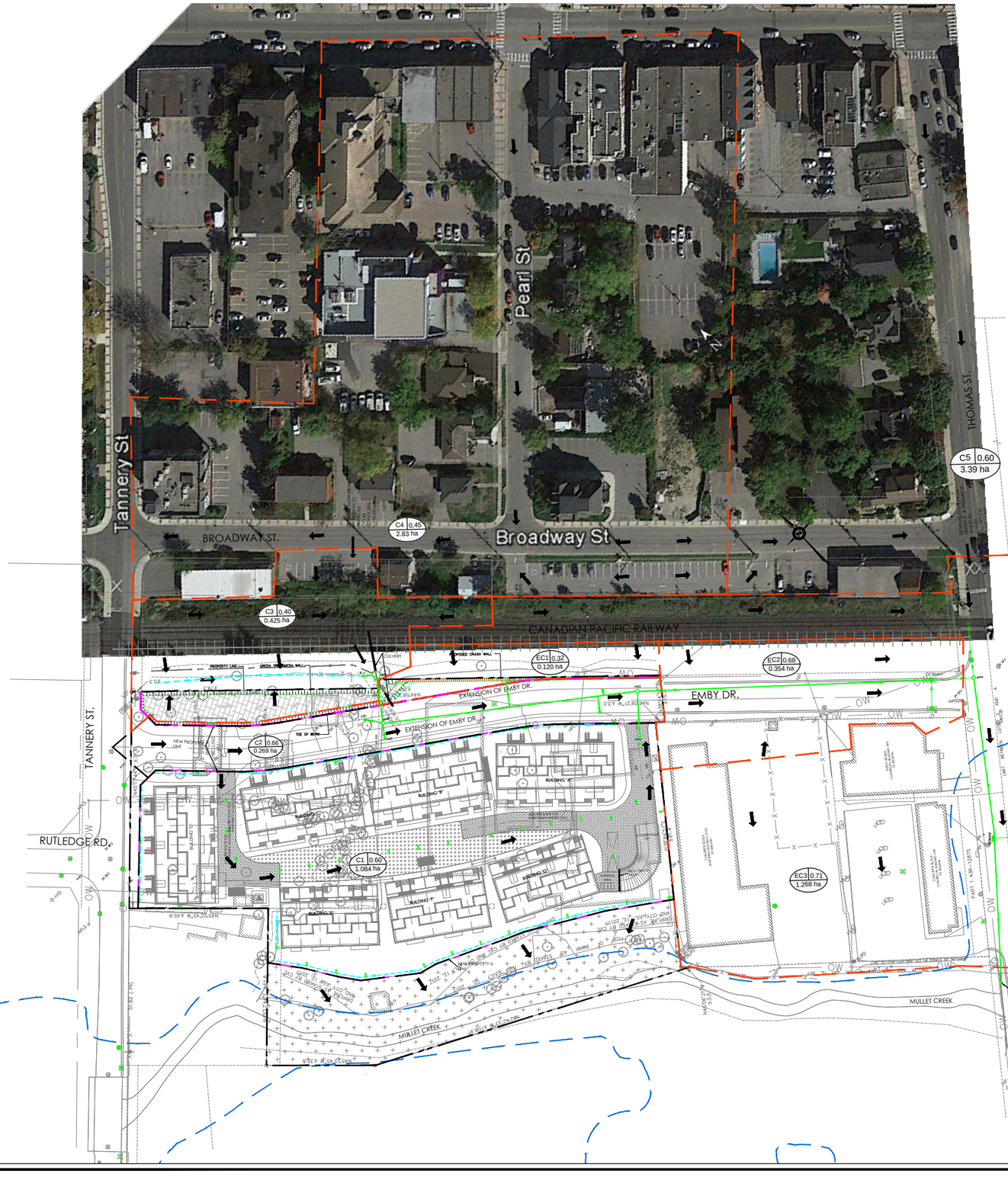
EXISTING STORM DRAINAGE PLAN

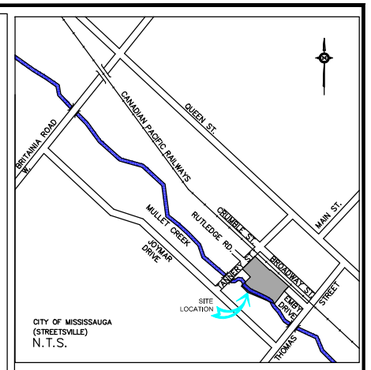
DESIGN	F.M.	DRAWN	F.M.	CHECKED	M.D.	CONTRACT No. 18038
SCALE:	1:1500			DRAWING NUMBER		FIG.01
DATE:	FEBRUARY 10, 2018					

DRAWING NAME: P:\18038 - 51 Tannery\Drafting\Current Drawings\FIG1-Ex drainage Plan.dwg

Mar 28, 2018 - 11:46am

(11"x17" / 279 x 431 mm)





LEGEND

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- WV — EXISTING WATER VALVE
- HYD — EXISTING FIRE HYDRANT
- BLRD — EXISTING BOLLARD
- CS — EXISTING CURB STOP
- MW — EXISTING MONITORING WELL
- OW — EX. OVERHEAD WIRES
- X — EXISTING FENCE
- PROPERTY LINE
- EXISTING TREE
- EXISTING DITCH
- PROPOSED DITCH
- AD — PROPOSED AREA DRAIN
- REGIONAL FLOOD LINE (FROM MULLET CREEK FLOOD RISK MAP)
- OVERLAND FLOW ROUTE
- PROP. DEVELOPMENT DRAINAGE BOUNDARY
- DRAINAGE BOUNDARY
- C1 0.66 / 0.388 ha — CATCHMENT ID/RUNOFF COEFFICIENT DRAINAGE AREA (ha)
- TO BE CONVEYED TO CITY OR CVC
- CONTIGUOUS AMENITY

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

No.	DATE	DESCRIPTION

625 Cochrane Drive, Suite 900
Markham, Ontario
L3R 9R9, Canada
Tel: (905)470-0015 Fax: (905)470-0030

LEA Consulting Ltd.
Consulting Engineers and Planners
www.LEA.ca

51-57 TANNERY STREET DEVELOPMENT

PROPOSED STORM DRAINAGE PLAN

DESIGN	F.M.	DRAWN	F.M.	CHECKED	M.D.	CONTRACT No. 18038
SCALE:	1:1500					DRAWING NUMBER FIG.02
DATE:	FEBRUARY 10, 2018					

(11"x17" / 279 x 431 mm)

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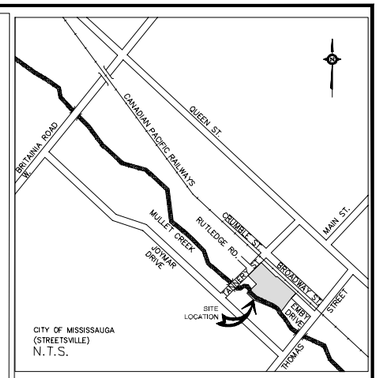


LEGEND

- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED FIRE HYDRANT
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- HP EXISTING HYDROPOLE
- LS EXISTING LIGHT STANDARD
- HPLS EXISTING HYDROPOLE/LIGHT STANDARD
- WV EXISTING WATER VALVE
- HYD EXISTING FIRE HYDRANT
- BLRD EXISTING BOLLARD
- CS EXISTING CURB STOP
- EXISTING MONITORING WELL
- OH — OH — EX. OVERHEAD WIRES
- —X—X— EXISTING FENCE
- PROPERTY LINE
- EXISTING DITCH
- PROPOSED DITCH
- AD PROPOSED AREA DRAIN
- 159.47 EXISTING SURVEY ELEVATION
- EX:158.32 EXISTING ELEVATION
- 158.32 PROPOSED ELEVATION
- TOC158.26 PROPOSED TOP OF CURB ELEVATION
- BOC158.11 PROPOSED BOTTOM OF CURB ELEVATION
- BOD157.20 PROPOSED BOTTOM OF DITCH ELEVATION
- OVERLAND FLOW ROUTE
- GM EXISTING GAS METER
- EXISTING TREE
- EXISTING SIGN
- TO BE CONVEYED TO CITY OR CVC
- CONTIGUOUS AMENITY
- REGIONAL FLOOD LINE (FROM MULLET CREEK FLOOD RISK MAP)

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

No.	DATE	DESCRIPTION
1	2018/06/08	ISSUED FOR ZBA

625 Cochrane Drive, Suite 900
Markham, Ontario
L3R 9R9, Canada
Tel: (905)470-0015, Fax: (905)470-0030

LEA Consulting Ltd.
Consulting Engineers and Planners
www.LEA.ca

Z. DU
JUNE 08, 2018
PROVINCE OF ONTARIO

51-57 TANNERY STREET DEVELOPMENT

PRELIMINARY SITE GRADING PLAN

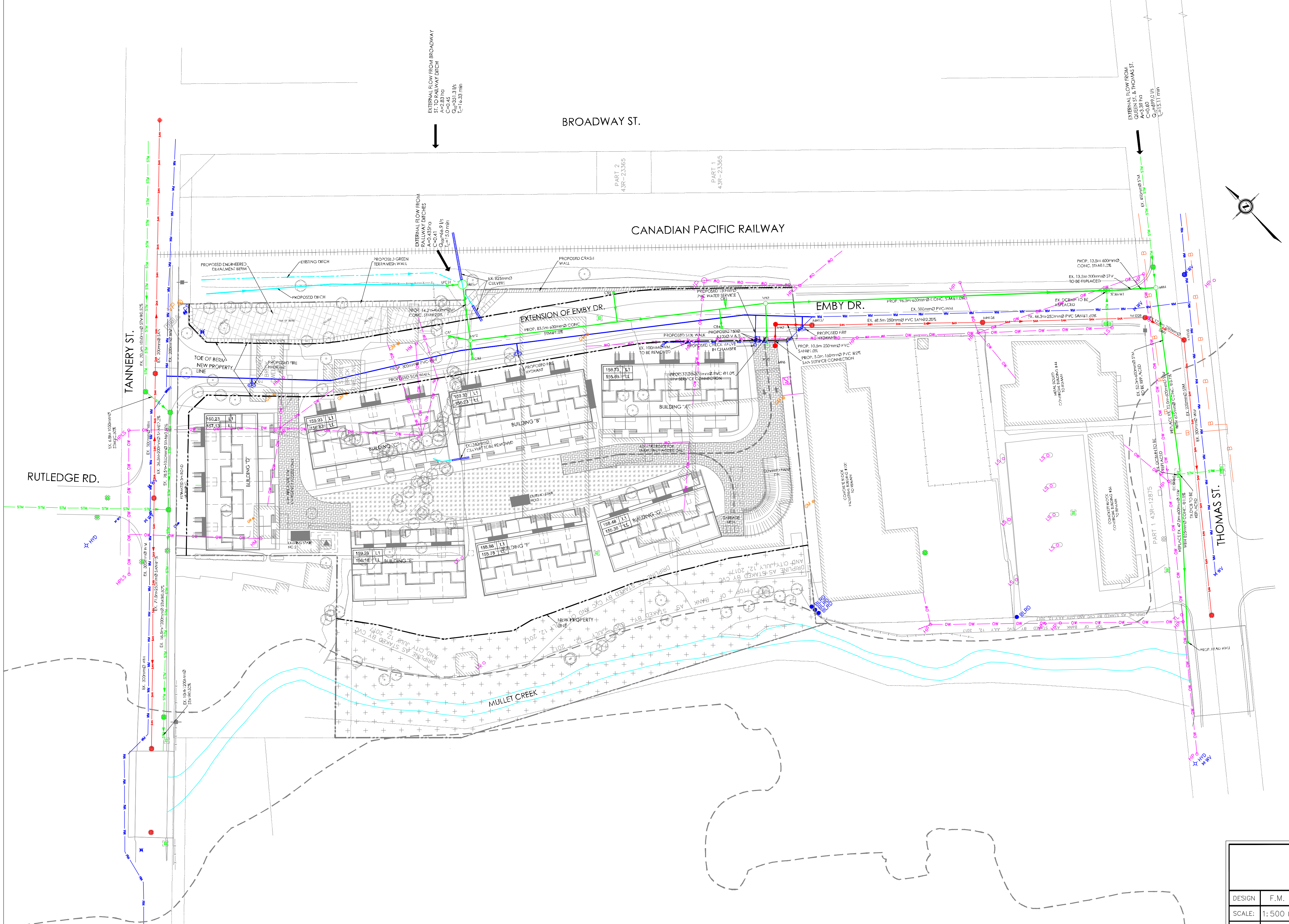
DESIGN	F.M.	DRAWN	F.M.	CHECKED	M.D.	CONTRACT No. 18038
SCALE:	1:500 (FULL SIZE)			DRAWING NUMBER		C-100
DATE:	FEBRUARY 10, 2018					

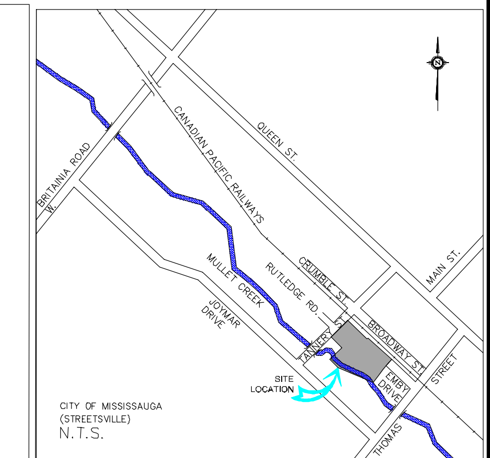
Jun 05, 2018 - 4:07pm

DRAWING NAME: P:\18038 - 51 Tannery\Drafting\Contract Drawings\C100-Site Grading Plan.dwg

NOTES:

1. ALL EXISTING UTILITIES WITHIN THE MAIN PROPERTY LINE INCLUDING CATCH BASINS, LIGHT STANDARDS, HYDRO POLES, OVERHEAD WIRES, GAS METERS AND FENCES TO BE REMOVED.





LEGEND

- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- HP — EXISTING HYDROPOLE
- LS — EXISTING LIGHT STANDARD
- HPLS — EXISTING HYDROPOLE/LIGHT STANDARD
- WV — EXISTING WATER VALVE
- HYD — EXISTING FIRE HYDRANT
- BLRD — EXISTING BOLLARD
- CS — EXISTING CURB STOP
- EXISTING MONITORING WELL
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED FIRE HYDRANT
- STM — EXISTING STORM SEWER
- SAN — EXISTING SANITARY SEWER
- WM — EXISTING WATER MAIN
- B — EXISTING BELL CABLE
- OW — EX. OVERHEAD WIRES
- X — EXISTING FENCE
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATER MAIN
- PROPERTY LINE
- NEW PROPERTY LINE
- EXISTING DITCH
- EXISTING TREE
- GM — EXISTING GAS METER
- EXISTING SIGN
- TO BE CONVEYED TO CITY OR CVC
- CONTIGUOUS AMENITY
- REGIONAL FLOOD LINE (FROM MULLET CREEK FLOOD RISK MAP)

MISSISSAUGA

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

No.	DATE	DESCRIPTION
1	2018/06/08	ISSUED FOR ZBA

625 Cochrane Drive, Suite 900
Markham, Ontario
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LICENSED PROFESSIONAL ENGINEER Z. DU JUNE 08, 2018 PROVINCE OF ONTARIO

51-57 TANNERY STREET DEVELOPMENT
PRELIMINARY SITE SERVICING PLAN

DESIGN	F.M.	DRAWN	F.M.	CHECKED	M.D.	CONTRACT No. 18038
SCALE:	1:500 (FULL SIZE)			DRAWING NUMBER		C-101
DATE:	FEBRUARY 10, 2018					

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