Town of Cobourg

STORMWATER ANAGEMENT AND SERVICING REPORT

Balder Corporation
325 University Avenue West

NOVEMBER 2019
20021

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1 INTRODUCTION

1.1 SCOPE OF THE SWM AND SERVICING REPORT

LEA Consulting Ltd. has been retained by Balder Corporation, to prepare a Functional Servicing and Stormwater Management Brief for proposed new build of a 4-storey residential building located at 325 University Avenue West in the Town of Cobourg. This stormwater management and servicing brief shall:

- Examine the potential water quantity and quality impacts of the proposed development and summarize how each will be addressed in accordance with the Ganaraska Region Conservation Authority (GRCA), 2014.
- Review the water supply, storm and sanitary servicing requirement of the proposed development, and propose a preliminary site servicing plan.

1.2 SITE LOCATION

The proposed development site is located at the southwest quadrant of University Avenue West and William Street. The study area consists of the existing dwellings and vegetated lands. It is bounded by William Street to the east, single houses to the west, undeveloped property to the south, and University Street West to the north, contributory to Cobourg Creek watershed and under the jurisdiction of Ganaraska Region Conservation Authority (GRCA). The site access, currently via University Avenue West and is approximately 0.485 ha in area.

The location, surroundings, and layout of study area shown below in Figure 1.

Figure 1: Proposed Development SWM Study Area

1.3 STORMWATER MANAGEMENT PLAN OBJECTIVES

The objectives of the stormwater management plan are as follows:

- Determine site specific stormwater management requirements to ensure that the development project is in conformance with the *Technical and Engineering Guidelines for Stormwater Management Submission* issued by Ganaraska Region Conservation Authority (GRCA);
- Preparing a stormwater management plan documenting the strategy along with the technical information necessary for the sizing of the proposed stormwater management measures.

1.4 SWM DESIGN CRITERIA – GRCA

The GRCA has issued the *Technical and Engineering Guidelines for Stormwater Management Submission*, (December 2014) to provide direction on how to manage rainfall and runoff inside watersheds. A summary of the stormwater management criteria applicable to this project is as follows:

- Water Quality: water quality control, outflow from SWM facilities must meet enhanced level requirements (80% removal of total suspended solids); and
- Water Quantity Control and Discharge to Municipal Infrastructure: Runoff from the 2-year post-development flow must be controlled to the 50% of 2-year pre-development peak flow. Furthermore, post development runoff from the 5-year to 100-year design storms must not exceed the peak runoff rate from the site under pre-development conditions. The allowable release rate to the municipal storm sewer system from the development site is the 5-year pre-development flow rate.

2 EXISTING CONDITIONS

2.1 GENERAL

The site is currently occupied by four properties consist of dwelling, single houses and vegetated areas. Under existing condition, the majority of site drains towards the University Avenue West at north of the site. The southern part of the site drains towards the south and southwest corner of the site to the adjacent properties.

Based on the existing grades, the area in southwest corner of the University Avenue and William Street intersection is draining toward the south and to the subject property as an external flow.

For purpose of SWM analysis and calculating the allowable release rate from the proposed development, the site is divided into two sub-catchment and on external sub-catchment areas based on the drainage pattern under existing condition, i.e.

- Sub-Catchment EC1: Northern part of the site which drains to the University Avenue West;
- Sub-Catchment EC2: Southern part of the site which drains to the adjacent properties;
- Sub-catchment EC3: external flow from southwest corner of University Ave. and William St. intersection.

Sub-catchment areas and runoff coefficients are summarized in Table 1 on the next page. Refer to Appendix A-01 and Appendix A-02 for existing land use breakdown.

Table 1: Areas of Proposed Sub-Catchment

Sub-catchment ID	Sub-Catchment Description	Catchment Area (m^2)	Runoff Coefficient
EC1	Northern part of the site	3779	0.43
EC2	Southern part of the site	1071	0.35[DP1]
EC3	External Drainage Area	1307	0.38

Drainage area boundaries, overland flow routes, grading and land use details under existing conditions are illustrated on Fig. 2 in Appendix E.

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

2.2 RAINFALL INFORMATION

The rainfall intensity and runoff under existing and proposed conditions are calculated using the following equations:

Rational Formula: $Q = 2.78CIA$ (L/s)

Where: C: runoff coefficient

I: rainfall intensity (mm/hr)

A: drainage area (ha)

IDF Curve Equation: $I = a/(b+T_C$[DP2]$)$ (Yarnell Equation)

Where: I: rainfall intensity (mm/hr)

T_C: time of concentration (min)

a, b: parameters

The parameters (a and b) for use in Yarnell Equation (beyond Clarington) are defined in Appendix B of the *Technical and Engineering Guidelines for Stormwater Management Submission* and are summarized in Table 2.

Table 2: Values of a and c Parameters for the GRCA

Return Period (Year)	2	5	10	25	50r	100
a	1778	2464	2819	3886	4750	5588
b	13	16	16	18	24	28

An initial time of concentration, T, of 15 minutes is recommended in the GRCA document for normal residential and industrial developments.

2.3 PEAK FLOW RATES UNDER EXISTING CONDITIONS

Based on the existing site condition and rainfall parameters, the Rational Method is adopted to calculate peak flow at different design storm events. The calculated peak flow rates for the site in the pre-development condition are summarized below in Table 3. Detailed calculations are provided in Appendix A-03.

Table 3: Pre-Development Flow Rates (L/s)

Sub-Catchment ID	Sub-Catchment Description	Return Period (Year)					
		2	5	10	25	50	100
EC1	Northern part of the site	28.8	36.1	41.3	53.5	55.3	59.0
EC2	Southern part of the site	6.6	8.3	9.5	12.3	12.8	13.6
EC3	External Drainage Area	8.7	10.8	12.4	16.1	16.6	17.7

2.4 ALLOWABLE FLOW RATE

As mentioned in section 1.2, the site is located within the Cobourg Creek watershed. Based on the *Technical and Engineering Guideline for Stormwater Management Submission* by GRCA, Table 3.1, the allowable release rate to the municipal storm sewer from the proposed redevelopment would be in accordance with 50% of 2-year pre-development flow and 5-year pre-development flow rate.

Since under post development condition only one storm service connection to the University Avenue will be provided for entire site, to maintain the existing drainage condition of University Avenue, the storm flow from the site will be overcontrolled under post-development condition. In other words, only sub-catchment C1 is considered in calculation of the allowable flow rate from the site. Therefore, according to the GRCA criteria, the allowable release rate to the University Avenue West from the proposed development would be based on the 50% of 2-year pre-development flow and 5-year pre-development flow rate of sub-catchment C1. That would be limited to 14.4L/s for 2-year and 36.1 L/s for 5-year to 100-year flow under post-development condition.

3 POST-DEVELOPMENT CONDITIONS

3.1 GENERAL

The proposed development consists of construction of a 4-storey residential building on the north, new parking lots on south and new driveway on the west of the site. The existing 2-storey building on the south-east will remain.

During rainfall events, the runoff from the building roof will be captured by buildings' roof drains and from patios along University Avenue West by proposed deck drains, conveyed through the internal piping within the underground parking level and discharged directly to the proposed stormwater storage on the proposed driveway and parking. Runoff from the rest of the site and external drainage area will be collected by proposed catch basins, conveyed through the storm pipes and discharged to the proposed stormwater storage on the

new driveway. Two orifice plates will be installed at upstream side of the proposed OGS to control the outflow from cistern to 50% of 2-year pre-development and 5-year pre-development release rates. Ultimately, the controlled flow outlets to the existing 300mm municipal storm sewer on the University Avenue West.

Catchment area, drainage pattern and overland flow route under proposed condition are illustrated in Fig. 3, in Appendix E.

Based on the proposed land use and Towns criteria, the composite runoff coefficient of 0.9 is considered for the proposed development site. The weighted runoff coefficient for entire site and external drainage area is calculated as 0.79. Refer to Appendix A-02 for details.

3.2 PEAK FLOW RATES UNDER PROPOSED CONDITION

Based on the proposed site condition and Yarnell parameters, the Rational Method is adopted to calculate peak flows at different design storm events. The calculated peak flow rates for total site area and external drainage area under post-development condition are summarized in Table 4. Detailed calculations are provided in Appendix A-04.[DP3]

Table 4: Post-Development Peak Flow Rates (L/s)

Sub-catchment ID	Sub-Catchment Description	Runoff Coefficient	Return Period (Year)					
			2	5	10	25	50	100
C	Proposed site	0.90	77.0	96.4	110.3	142.8	147.7	157.6
EC3	External Flow	0.38	8.7	10.8	12.4	16.1	16.6	17.7
Total (C+EC3)	Total Drainage	0.79	85.7	107.2	122.7	158.9	164.3	175.3

4 PROPOSED SWM PLAN

4.1 WATER QUANTITY CONTROL REQUIREMENT

As noted in Section 2.4, the allowable discharge rate to the municipal sewer system from the site is estimated to be 14.4 L/s for 2-year and 36.1 L/s for 5-year to 100-year flow under post-development condition, which is equivalent to 50% of 2-yr and 5-yr existing flow from the 78% of the total site area to the existing 300mm storm sewer in the University Avenue West.

Based on the post-development condition, the stormwater detention requirements is estimated in Appendix A-05 to A10 and summarized in Table 5 in next page.

Table 5: Required Stormwater Storage Volume

Sub-catchment ID	Sub-Catchment Description	Return Period	Target Release Rate (L/S)	Storage Volume (m^3)	
				Required	Provided
C	Proposed site	2-year	14.4	74.7	100.0
		5-100-year	36.1	181.7	186.0

A 186 m^3 sealed underground Stormwater storage (C-10 Triton Chambers) is proposed on the new driveway for entire site. The chamber is considered to not allow stored water to infiltrate into surrounding soils or ground water discharge into the chamber. Since the ground water table is higher than bottom of the tank, to ensure there is no direct hydrostatic pressure against the liner, a reinforced concrete slab below the tank would be designed by a structural engineer during detail design stage. The location and footprint of underground storage is shown on Appendix E, DWG C01-site Grading Plan and DWG C02-site Servicing Plan. Typical sections of chamber are presented in Appendix A.

Two 90mm and 105mm orifice plates in different elevations will be installed at the two inlets of OGS unit to control the discharging flow from storm storage to the existing 300mm storm sewer in the University Avenue West based on the GRCA criteria.

Refer to Appendix A-11 and A-12 for orifice size calculations. The typical sections of chamber are presented in Appendix A.

4.2 WATER QUALITY CONTROL

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 measure will be provided:

Based on the SWM design criteria, the building 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, the stormwater generated from the roof area is considered clean for the purposes of water quality control.

Under the post-development conditions, rooftop areas, will remove TSS from the rainfall runoff. Table 6 provides a preliminary estimate of TSS removal level of stormwater leaving the site.

Table 6: TSS Removal Assessment of Study Area

Land Use	Area (m^2)	TSS Removal Efficiency (%)	Composite TSS Removal Efficiency (%)
Roof	1480	80	19.2
Concrete and Asphalt	2943	0	0
Landscape and vegetated Area	1734	80	22.6
OGS	6157	50	50.0
Total	6157*		>80.0

**External flow drainage area included*

To achieve a TSS removal of 80%, a stormwater quality treatment facility (CDS model PMSU20-15-4) is proposed. Sizing details are provided in Appendix A. Since proposed catch basin CB4 will be connected to the storm cistern directly, the quality treatment unit are proposed after storm tank and before the storm control manhole within the new driveway.

5 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

During site construction, it is recommended that all erosion and sediment control Best Management Practices (BMPs) shall be constructed and maintained in accordance with the Greater Golden Horseshoe Area Conservation Authorities' (GGHA CAs) Erosion & Sediment Control Guidelines for Urban Construction (December 2006). In brief, the measures below are proposed to be provided on site during the entire period of construction:

- Siltation control fence along the perimeter of the construction site before commencement of construction;
- Sediment control measures to prevent silt entry at all the existing catch basins;
- Granular mud-mats at all construction egress locations;
- An inspection and monitoring program following the GGHA CA's Erosion and Sediment Control Guidelines for Urban Construction (December 2006).

6 SITE SERVICING

The purpose of this site servicing report is to review the site servicing requirement of the development site, and propose a site servicing plan, including water, sanitary and storm services. Refer to Dwg. C02 - Site Servicing Plan in Appendix E for details of the proposed site service connections.

6.1 EXISTING MUNICIPAL SERVICES

Base on the survey and Town's GIS information and records, the existing underground sewers and watermains in the vicinity of the proposed development area include the followings:

University Ave.:

- a 150mm dia. CI watermain;
- a 600mm dia. Conc. sanitary sewer line
- a 300mm Conc. storm sewer line
- a 900mm Conc. storm sewer line

William Street:

- a 200mm dia. CI watermain;
- a 300mm dia. Conc. storm sewer line;
- a 200mm dia. PVC sanitary sewer line.

Margaret Street:

- a 150mm dia. CI watermain;
- a 300mm storm sewer line;
- a 200mm dia. PVC sanitary sewer line.

6.2 PROPOSED SITE SERVICE CONNECTIONS

Design Parameters

The sanitary demands for the proposed site are based on the following Town of Cobourg design guidelines:

- Sanitary demand rate of 364 L/person/day for new residential development;
- Population densities of 1.62 person/unit for apartment;
- Infiltration Allowance of 0.26 L/s/ha; and,
- Peaking Factor based on the Harmon Equation.

The domestic water demands for the proposed site are based on the following criteria:

- Water demand rate of 191 L/person/day for domestic consumption.
- Population densities of 1.62 person/unit for apartment;
- Peaking Factor for drinking-water systems serving fewer than 500 people– 9.4 (Peak Hour) and 6.3 (Maximum Day).

The demand and peaking factors are based on the Ministry of Environment *Design Guidelines for Drinking-Water Systems, 2008.*

Based on the design criteria and project statistics of proposed development provided by the architect, sanitary flow and water demand are estimated in Appendices B and summarized below in Table 7. Storm flow discharge rates have been provided in the previous section of this report.

Table 7: Site Servicing Requirement

Building	Sanitary Flow rate (l/s)	Water Demand (l/s)
New Residential Building	1.97	118.3

Through discussion with design team, the locations and sizes of the proposed site service connections for new residential building have been determined to satisfy the Town of Cobourg requirements. In summary:

Sanitary Service: A new sanitary manhole MH1A and a 200mm dia. PVC pipe will be installed to provide sanitary service for the proposed residential development and discharge to the exiting 600mm concreate sanitary sewer on University Avenue West through the proposed sanitary manhole MH2A.

Storm Service: A new control manhole MH1 and new 300mm PVC storm service connection will be installed to provide storm service for the proposed development and connected to the existing 300mm storm sewer on north side of the University Avenue West through the proposed storm manhole MH2.

Water service:

During design stage, to assess the adequacy of the existing 150mm CI watermain in University Avenue, a hydrant flow test has been conducted. Based on the Town's As-Built drawings, there is a connection between existing 150mm watermains in University Avenue and 200mm watermain in William Street. However, contrary to the Town's drawings, it was found during field test that the watermain in University Avenue is not connected to the William Street watermain. Based on the pressure test results, only the existing watermain on William Street has sufficient pressure for water service connection.

Since the proposed mechanical room is located at the north of the underground parking and as per town recommendation, it is decided to provide water and fire service connection to the site from the University Avenue West. To feasibility of this connection, the existing 150mm CI watermain in the university Avenue West will be replaced with a new 200mm PVC pipe with a connection to the existing 200mm CI watermain on William Street. The section of the replacing pipe will be between connection to the William Street and northeast of the proposed building. The alignment of the proposed watermain has been provided to maintain 2.5m clearance from existing sanitary according to the MOE criteria.

The water and fire services will be as follows:

- Water Service (Fire protection and Domestic water): A new 150mm dia. water service will be installed at the northwest corner of the propose building and connect to the new 200mm PVC watermain on the University Avenue West with a TEE connection.

Refer to Dwg. C-02-site servicing plan in Appendix E for details of proposed service connections.

6.3 ASSESSMENT OF EXISTING MUNICIPAL SERVICE

The capacity of existing municipal water mains and sewers shall be reviewed based on the site servicing requirement, sewer design sheets and drainage area and hydrant flow test data.

6.3.1 Adequacy of Existing Storm and Sanitary Sewers

Sanitary: Based on the Town's record drawings, the full flow capacity of the existing 600mm sanitary sewer on University Avenue West at the north of the development site is estimated at 307.0 L/s. Therefore, it is anticipated to be adequate to accommodate the sanitary flow (1.19 L/s) from the proposed development.

Storm: A drainage area plan and design sheet of existing storm sewer in south side of the University Avenue West has been provided by Town which shows the adequacy to provide storm service for the proposed development.

Regarding the provided field survey information within the site area, the drainage area boundaries, land-uses and storm pipe size have been updated.

As mentioned in section 2.4, to maintain the existing drainage condition of University Avenue, the storm flow from the site will be overcontrolled under post-development condition. In other words, under post-development condition, the discharging flow from the site to the existing 300mm storm sewer would be same as the flow rate under Pre-development condition.

Based on the updated drainage area and flow calculations, the existing 300mm and 450mm storm sewers in University Avenue West will be adequate to provide storm service for proposed development.

Drainage area plans and design sheets for the existing 300mm and 450mm storm sewers in university Avenue West under existing and proposed conditions are provided in Appendix C.

6.3.2 Adequacy of Existing Water mains

In order to evaluate the adequacy of the existing watermain located on University Avenue West and William street, a hydrant flow test was conducted by Classic Fire Protection on May 23rd, 2019. Test results are included in Appendix D

As mentioned in section 6.2, based on the Town's record drawings and GIS data, the existing 150mm water main in University Avenue West is connected to the 200mm watermain on the William Street. However, the field test has shown that there is not any connection between watermain on the William Street and University Avenue West. Therefore, the hydrant flow test is conducted on the existing 200mm watermain on William Street to assess the available water pressure.

As shown by the test readings, the available water pressure ranges from 68 psi with a flow of 852.7 US GPM to 65 psi with a flow of 1460.4 US GPM during the flow test with a static pressure of 72 psi. At the design water demand of 118.3 L/s (or 1874.6 US GPM) generated from the proposed site, the extrapolated flow test results show a residual pressure of 60.3 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 building.

The hydrant flow test results are presented in the Appendix D.

7 CONCLUSIONS

7.1 STORMWATER MANAGEMENT PLAN

- Water Quantity: On-site storage volume of approximately 186 m^3 will be provided in order to control the post-development 2-year flow to 50% of pre-development 2-year flow and post development 5-100-year stormwater flows to pre-development 5-yr flow to the existing municipal sewer on the University Avenue West. An underground Triton C-10 stormwater chamber is proposed to satisfy the on-site storage requirement.
- Water Quality: An oil/grit separator is proposed to satisfy the MOE's 80% TSS removal.

Temporary Erosion and Sediment Control during Construction

- Temporary erosion and sediment control measures should be provided before construction and maintained during construction in accordance with the GGHA CA's Erosion & Sediment Control Guidelines for Urban Construction and other requirements.

7.2 SITE SERVICING REQUIREMENT

- Sanitary Service: The sanitary service for proposed development will provided by a new 200 mm sanitary service connected to the existing 600mm sanitary sewer on University Avenue West. Based on the size and slope of the receiving municipal sanitary sewer, there is sufficient flow capacity within the existing sanitary sewers on University avenue to accommodate the proposed development.

- Storm Service: The proposed storm service connection for this site will be a 300mm PVC pipe that connects to the proposed manhole MH2 on the south side of University Avenue West.
- Water Services: New water service for the proposed building will consist of a 150mm PVC pipe. The total water demand (Fire and Domestic water) for the proposed development site is 118.3 L/s (or 1874.6 USGPM).

Prepared By:
LEA Consulting Ltd.

Farshid Morshedi, P.Eng.
Project Engineer

APPENDIX A

Stormwater Peak Flow and Storage Calculations

LEA Consulting Ltd. Consulting Engineers and Planners	Land Use			
	Prepared:	F.M.	Page No.	A-01
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

EXISTING CONDITION:

Existing Land Use	Area (m^2)
Sub.Catchment (EC1)	
Building	1062
Vegetated Area	2717
Total	**3779**
Sub.Catchment (EC2)	
Building	168
Vegetated Area	903
Total	**1071**
Total Site Area	**4850**
Sub.Catchment (EC3): External Drainage Area	
Building	253
Vegetated Area	1054
Total	**1307**
Total Drainage Area	**6157**

POST DEVELOPMENT CONDITION:

Proposed Land Use	Area (m^2)
Sub.Catchment (C)	
Building and Concrete Paving	2800
Asphalt	1370
Landscaped Area	680
Total Site Area	**4850**
External Drainage Area	1307
Total Drainage Area	**6157**

LEA Consulting Ltd. Consulting Engineers and Planners	Composite "C" Calculation			
	Prepared:	F.M.	Page No.	A-02
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Pre-Development Composite Runoff Coefficient "C"

Sub.Catchment (EC1)

Land Use	Area (ha)	C	Composite "C"
Building	0.106	0.90	
Landscaped Area	0.272	0.25	
Total	**0.378**		**0.43**
Imperviousness:			**0.28**

Sub.Catchment (EC2)

Land Use	Area (ha)	C	Composite "C"
Building	0.017	0.90	
Landscaped Area	0.090	0.25	
Total	**0.107**		**0.35**
Imperviousness:			**0.16**

Post-Development Composite Runoff Coefficient "C"

Sub.Catchment (C)

Land Use	Area (ha)	C	Composite "C"	
Building and Concrete Paving	0.280	0.90		
Asphalt	0.137	0.90		
Landscaped Area	0.068	0.25		
Total Site Area	**0.485**		**0.81**	(Calculated)
			0.90	Based on the City's Criteria
Imperviousness: **0.86**				

Sub.Catchment (EC3): External Drainage Area

Land Use	Area (ha)	C	Composite "C"
Building	0.025	0.90	
Vegetated Area	0.105	0.25	
Total	**0.131**		**0.38**
Total Drainage Area	**0.616**		**0.79**

The weigthed runoff coefficient for entire drainage area is calculated 0.78 based on the runoff coefficient of 0.9 for entire development site and 0.37 for external drainage area

LEA Consulting Ltd. Consulting Engineers and Planners	Pre-Development Peak Flow Rates Calculation			
	Prepared:	F.M.	Page No.	A-03
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

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

Time of Concentration: 15 minutes as per GRCA Guidelines

Rainfall Intensity: $I = a/(b+T_C)$

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Rainfall Intensity (mm/hr):	63.50	79.48	90.94	117.76	121.79	129.95

Sub-Catchment EC1

Site Area: 0.378 ha

Runoff Coefficient : 0.43 Pre-development condition

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Under existing site conditions (L/s):	28.8	36.1	41.3	53.5	55.3	59.0

Sub-Catchment EC2

Site Area: 0.107 ha

Runoff Coefficient : 0.35 Pre-development condition

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Under existing site conditions (L/s):	6.6	8.3	9.5	12.3	12.8	13.6

In order to maintain the existing drainage condition of the University Ave. W.
the storm flow from the site will be overcontrolled under post-development condition.
Terefore, the the 50% of 2-year flow and total amount of 5-year flow from the only sub-catchment C1
is considered as the allowable discharge rate from the proposed development site to the
existing 300mm municipal sewer on the University Avenue West therefore:

Allowable flow rate: 14.4 L/s (50% 2-Year)

36.1 L/s (5-Year)

Sub.Catchment (EC3): External Drainage Area

Site Area: 0.131 ha

Runoff Coefficient : 0.38 Pre-development condition

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Under existing site conditions (L/s):	8.7	10.8	12.4	16.1	16.6	17.7

LEA Consulting Ltd. Consulting Engineers and Planners	Post-Development Peak Flow Rates Calculation			
	Prepared:	F.M.	Page No.	A-04
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

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

Time of Concentration: 15 minutes as per GRCA Guidelines

Rainfall Intensity: $I = a/(b+T^{c)}$

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Rainfall Intensity (mm/hr):	63.50	79.48	90.94	117.76	121.79	129.95

Sub-Catchment C

Site Area: 0.485 ha
Runoff Coefficient : 0.90 Pre-development condition

Peak Flow Rate Under Post-development Condition (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Under proposed site conditions (L/s):	77.0	96.4	110.3	142.8	147.7	157.6

Sub-Catchment EC3

Site Area: 0.131 ha
Runoff Coefficient : 0.38 Pre-development condition

Peak Flow Rate Under Post-development Condition (L/s):

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Under proposed site conditions (L/s):	8.7	10.8	12.4	16.1	16.6	17.7

Total Peak Flow Rate Under Post-Development Condition

Return Period:	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Under proposed site conditions (L/s):	85.7	107.2	122.7	158.9	164.3	175.3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (2-Year Storm)			
	Prepared:	F.M.	Page No.	A-05
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Total Drainage Area (ha) = 0.616 ha
Drainage Area Composite C = 0.79
Allowable Release Rate (50% of 2-year) = 14.42 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	63.50	85.66	77.10	14.42	12.98	64.12
17	59.27	79.95	81.55	14.42	14.71	66.84
19	55.56	74.96	85.45	14.42	16.44	69.01
21	52.29	70.55	88.89	14.42	18.17	70.72
23	49.39	66.63	91.95	14.42	19.90	72.05
25	46.79	63.12	94.68	14.42	21.63	73.05
27	44.45	59.97	97.14	14.42	23.36	73.78
29	42.33	57.11	99.37	14.42	25.09	74.28
31	40.41	54.51	101.40	14.42	26.82	74.58
33	38.65	52.14	103.24	14.42	28.55	74.69
35	37.04	49.97	104.94	14.42	30.28	74.66
37	35.56	47.97	106.50	14.42	32.02	74.48
39	34.19	46.13	107.94	14.42	33.75	74.19
41	32.93	44.42	109.27	14.42	35.48	73.79
43	31.75	42.83	110.51	14.42	37.21	73.30
45	30.66	41.36	111.66	14.42	38.94	72.72

Required Storage Volume = 74.69 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (5-Year Storm)			
	Prepared:	F.M.	Page No.	A-06
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Total Drainage Area (ha) =	0.616	ha	
Drainage Area Composite C =	0.79		
Allowable Release Rate (5-year) =	36.10	L/s	Overcontrolled
Return Period =	5	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	79.48	107.23	96.51	36.10	32.49	64.02
17	74.67	100.73	102.74	36.10	36.82	65.92
19	70.40	94.97	108.27	36.10	41.16	67.11
21	66.59	89.84	113.20	36.10	45.49	67.71
23	63.18	85.23	117.62	36.10	49.82	67.80
25	60.10	81.07	121.61	36.10	54.15	67.46
27	57.30	77.30	125.23	36.10	58.49	66.74
29	54.76	73.87	128.53	36.10	62.82	65.71
31	52.43	70.72	131.55	36.10	67.15	64.40
33	50.29	67.84	134.32	36.10	71.48	62.84
35	48.31	65.18	136.87	36.10	75.82	61.05
37	46.49	62.72	139.23	36.10	80.15	59.08
39	44.80	60.44	141.42	36.10	84.48	56.94
41	43.23	58.32	143.46	36.10	88.81	54.65
43	41.76	56.34	145.36	36.10	93.15	52.21
45	40.39	54.49	147.13	36.10	97.48	49.65
47	39.11	52.76	148.79	36.10	101.81	46.98
49	37.91	51.14	150.35	36.10	106.14	44.21
51	36.78	49.61	151.82	36.10	110.47	41.35

Required Storage Volume = 67.80 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (10-Year Storm)			
	Prepared:	F.M.	Page No.	A-07
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Total Drainage Area (ha) =	0.616	ha	
Drainage Area Composite C =	0.79		
Allowable Release Rate (5-year) =	36.10	L/s	Overcontrolled
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	90.94	122.68	110.41	36.10	32.49	77.92
17	85.42	115.24	117.55	36.10	36.82	80.73
19	80.54	108.66	123.87	36.10	41.16	82.71
21	76.19	102.78	129.51	36.10	45.49	84.02
23	72.28	97.51	134.57	36.10	49.82	84.75
25	68.76	92.76	139.13	36.10	54.15	84.98
27	65.56	88.44	143.28	36.10	58.49	84.79
29	62.64	84.51	147.05	36.10	62.82	84.23
31	59.98	80.91	150.50	36.10	67.15	83.35
33	57.53	77.61	153.67	36.10	71.48	82.19
35	55.27	74.57	156.59	36.10	75.82	80.77
37	53.19	71.75	159.29	36.10	80.15	79.14
39	51.25	69.15	161.80	36.10	84.48	77.32
41	49.46	66.72	164.13	36.10	88.81	75.32
43	47.78	64.46	166.30	36.10	93.15	73.15
45	46.21	62.34	168.33	36.10	97.48	70.85
47	44.75	60.36	170.23	36.10	101.81	68.42
49	43.37	58.51	172.01	36.10	106.14	65.87
51	42.07	56.76	173.69	36.10	110.47	63.22

Required Storage Volume = 84.98 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (25-Year Storm)			
	Prepared:	F.M.	Page No.	A-08
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Total Drainage Area (ha) =	0.616	ha	
Drainage Area Composite C =	0.79		
Allowable Release Rate (5-year) =	36.10	L/s	Overcontrolled
Return Period =	25	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	117.76	158.86	142.98	36.10	32.49	110.49
17	111.03	149.78	152.78	36.10	36.82	115.96
19	105.03	141.69	161.52	36.10	41.16	120.36
21	99.64	134.42	169.37	36.10	45.49	123.88
23	94.78	127.86	176.45	36.10	49.82	126.63
25	90.37	121.92	182.88	36.10	54.15	128.73
27	86.36	116.50	188.73	36.10	58.49	130.24
29	82.68	111.54	194.08	36.10	62.82	131.26
31	79.31	106.99	199.00	36.10	67.15	131.85
33	76.20	102.79	203.53	36.10	71.48	132.05
35	73.32	98.91	207.72	36.10	75.82	131.90
37	70.65	95.32	211.60	36.10	80.15	131.45
39	68.18	91.97	215.22	36.10	84.48	130.74
41	65.86	88.85	218.58	36.10	88.81	129.77
43	63.70	85.94	221.73	36.10	93.15	128.58
45	61.68	83.21	224.68	36.10	97.48	127.20
47	59.78	80.65	227.44	36.10	101.81	125.63
49	58.00	78.25	230.04	36.10	106.14	123.90
51	56.32	75.98	232.49	36.10	110.47	122.02

Required Storage Volume = 132.05 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (50-Year Storm)			
	Prepared:	F.M.	Page No.	A-09
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Total Drainage Area (ha) = 0.616 ha
Drainage Area Composite C = 0.79
Allowable Release Rate (5-year) = 36.1 L/s Overcontrolled
Return Period = 50 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	121.79	164.31	147.88	36.10	32.49	115.39
17	115.85	156.29	159.42	36.10	36.82	122.60
19	110.47	149.02	169.89	36.10	41.16	128.73
21	105.56	142.40	179.42	36.10	45.49	133.93
23	101.06	136.34	188.15	36.10	49.82	138.33
25	96.94	130.78	196.16	36.10	54.15	142.01
27	93.14	125.65	203.55	36.10	58.49	145.06
29	89.62	120.91	210.38	36.10	62.82	147.56
31	86.36	116.51	216.71	36.10	67.15	149.56
33	83.33	112.42	222.59	36.10	71.48	151.11
35	80.51	108.61	228.08	36.10	75.82	152.26
37	77.87	105.05	233.21	36.10	80.15	153.06
39	75.40	101.71	238.01	36.10	84.48	153.53
41	73.08	98.58	242.52	36.10	88.81	153.71
43	70.90	95.64	246.76	36.10	93.15	153.61
45	68.84	92.87	250.75	36.10	97.48	153.27
47	66.90	90.25	254.51	36.10	101.81	152.70
49	65.07	87.78	258.08	36.10	106.14	151.94
51	63.33	85.44	261.45	36.10	110.47	150.98
53	61.69	83.22	264.64	36.10	114.81	149.83
55	60.13	81.11	267.68	36.10	119.14	148.54
57	58.64	79.11	270.56	36.10	123.47	147.09

Required Storage Volume = 153.71 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (100 - Year Storm)			
	Prepared:	F.M.	Page No.	A-10
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Total Drainage Area (ha) = 0.616 ha
Drainage Area Composite C = 0.79
Allowable Release Rate (5-year) = 36.10 L/s Overcontrolled
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	129.95	175.31	157.78	36.10	32.49	125.29
17	124.18	167.52	170.87	36.10	36.82	134.05
19	118.89	160.39	182.85	36.10	41.16	141.69
21	114.04	153.85	193.85	36.10	45.49	148.36
23	109.57	147.81	203.98	36.10	49.82	154.16
25	105.43	142.24	213.35	36.10	54.15	159.20
27	101.60	137.06	222.04	36.10	58.49	163.55
29	98.04	132.25	230.12	36.10	62.82	167.30
31	94.71	127.77	237.65	36.10	67.15	170.50
33	91.61	123.58	244.69	36.10	71.48	173.21
35	88.70	119.66	251.28	36.10	75.82	175.46
37	85.97	115.98	257.47	36.10	80.15	177.32
39	83.40	112.51	263.29	36.10	84.48	178.81
41	80.99	109.25	268.76	36.10	88.81	179.95
43	78.70	106.18	273.93	36.10	93.15	180.78
45	76.55	103.27	278.82	36.10	97.48	181.34
47	74.51	100.51	283.45	36.10	101.81	181.64
49	72.57	97.90	287.83	36.10	106.14	181.69
51	70.73	95.42	292.00	36.10	110.47	181.53
53	68.99	93.07	295.96	36.10	114.81	181.15
55	67.33	90.83	299.72	36.10	119.14	180.58
57	65.74	88.69	303.31	36.10	123.47	179.84
59	64.23	86.65	306.74	36.10	127.80	178.94

Required Storage Volume = 181.69 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	Orifice Tube Size Calculation control post 2yr to 50% pre 2yr (at OGS)			
	Prepared:	F.M.	Page No.	A-11
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Orifice Discharge Formula: $Q = CA \times \sqrt{2gh}$

Calculate Approximate Diameter Knowing Max. Q & Depth			**Calculate Flows For Assumed Diameter**		
Max. Flow:	14.4	l/s	Diameter:	90	mm
2-yr Depth:	0.45	m	Area:	0.006	m^2
Req'd Area:	0.006	m^2	Coeff:	0.8	pipe
Req'd Dia.:	90	mm	Gravitational Accel:	9.81	m/s^2
Orifice C/L Elev.:	80.295	m	Invert	80.25	m
H.W.L	81.290	m			

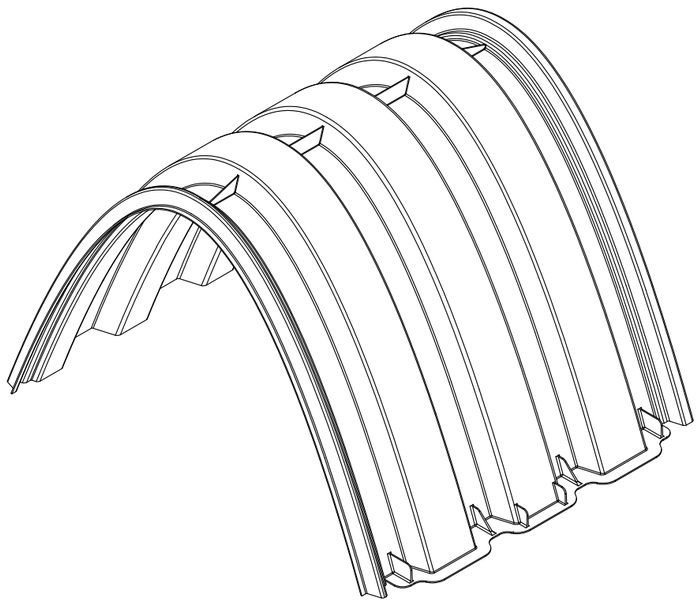
Depth (m)	Head (m)	Q (m^3/s)	Elevation (m)	Remarks
0			80.250	Orifice Invert
0.05	0.00	0.0	80.295	Center Elev. of Orifice
0.09	0.05	4.8	80.340	Top Elev. of Orifice
0.12	0.08	6.2	80.370	
0.15	0.11	7.3	80.400	
0.18	0.14	8.3	80.430	
0.21	0.17	9.2	80.460	
0.24	0.20	10.0	80.490	
0.26	0.22	10.5	80.510	
0.29	0.25	11.2	80.540	
0.32	0.28	11.8	80.570	
0.35	0.31	12.4	80.600	
0.38	0.34	13.0	80.630	
0.41	0.37	13.6	80.660	
0.45	**0.41**	**14.3**	**80.700**	**2-yr WL**
0.48	0.44	14.9	80.730	
0.52	0.48	15.5	80.770	
0.56	0.52	16.2	80.810	
0.60	0.56	16.8	80.850	
0.64	0.60	17.4	80.890	
0.68	0.64	18.0	80.930	
0.72	0.68	18.5	80.970	
0.76	0.72	19.1	81.010	**100-yr WL**

LEA Consulting Ltd. Consulting Engineers and Planners	Orifice Tube Size Calculation control post 100yr to pre 5yr (at OGS)			
	Prepared:	F.M.	Page No.	A-12
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Orifice Discharge Formula: $Q = CA \times \sqrt{2gh}$

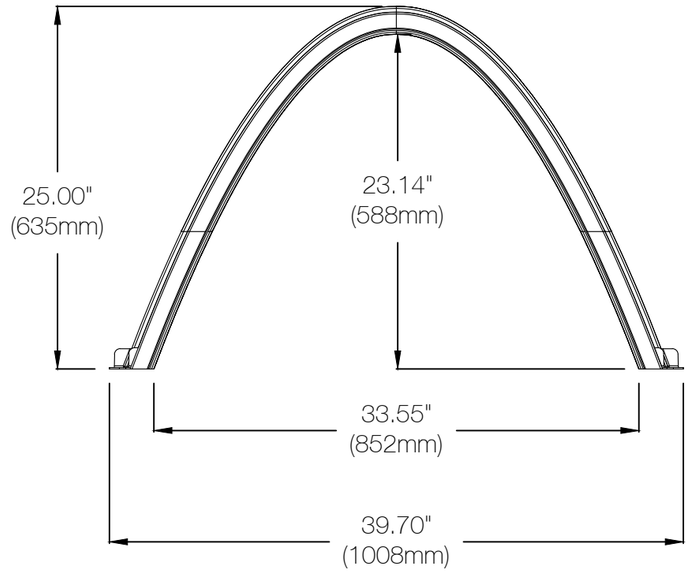
Calculate Approximate Diameter Knowing Max. Q & Depth			**Calculate Flows For Assumed Diameter**		
Max. Flow:	17.0	l/s	Diameter:	105	mm
100-yr Depth:	0.35	m	Area:	0.009	m^2
Req'd Area:	0.009	m^2	Coeff:	0.8	pipe
Req'd Dia.:	105	mm	Gravitational Accel:	9.81	m/s^2
Orifice C/L Elev.:	80.753	m	Invert	80.70	m
H.W.L	81.010	m			

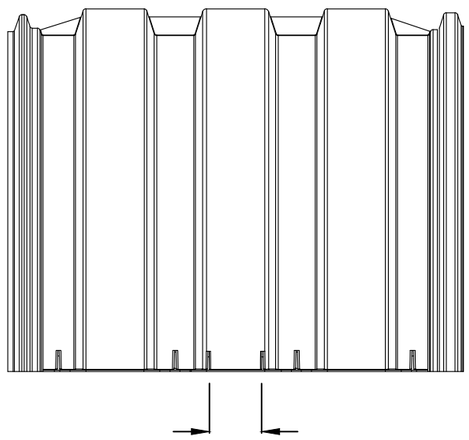
Depth (m)	Head (m)	Q (m^3/s)	Elevation (m)	Remarks
0			80.700	Orifice Invert
0.05	0.00	0.0	80.753	Center Elev. of Orifice
0.11	0.05	7.0	80.805	Top Elev. of Orifice
0.13	0.07	8.3	80.825	
0.15	0.09	9.3	80.845	
0.17	0.11	10.3	80.865	
0.19	0.13	11.2	80.885	
0.21	0.15	12.0	80.905	
0.23	0.17	12.7	80.925	
0.25	0.19	13.5	80.945	
0.27	0.21	14.1	80.965	
0.29	0.23	14.8	80.985	
0.31	0.25	15.4	81.005	
0.33	0.27	16.0	81.025	
0.35	**0.29**	**16.6**	**81.045**	**H.W.L**

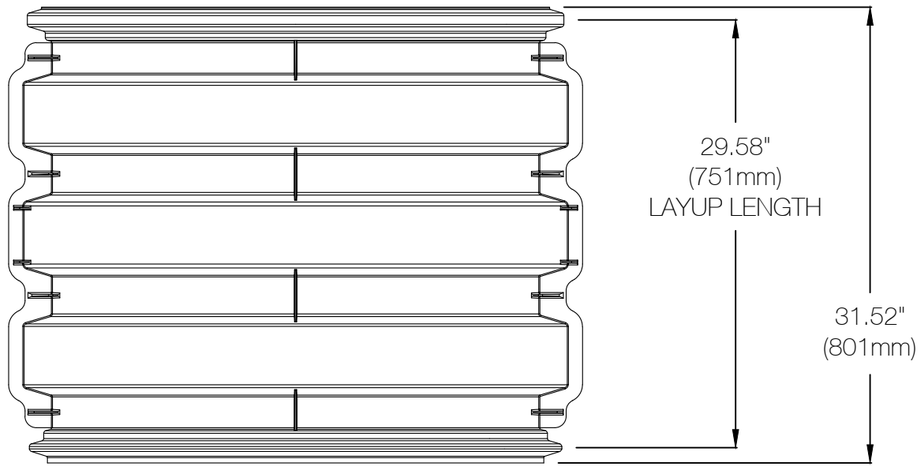


C-10 CHAMBER SPECS	
NOMINAL DIMENSIONS (LAYUP LENGTH X WIDTH X HEIGHT)	29.58" X 39.70" X 25.00" (751mm X 1008mm X 635mm)
BARE CHAMBER STORAGE	9.8 CUBIC FEET (0.277 CUBIC METERS)
*MIN INSTALLED STORAGE	17.45 CUBIC FEET (0.494 CUBIC METERS)
CHAMBER WEIGHT	18 lbs (8.165 kg)
STORAGE PER LINEAR FOOT WITHOUT STONE	3.97 CUBIC FEET (0.112 CUBIC METERS)
STORAGE PER LINEAR FOOT WITH STONE	7.08 CUBIC FEET (0.200 CUBIC METERS)
*ASSUMING A MIN OF 6" (152mm) STONE ABOVE AND BELOW AND 6" (152mm) BETWEEN ROWS WITH 40% STONE POROSITY (DOES NOT INCLUDE 12" (305mm) PERIMETER STONE VOLUME)	

NOTE: C-10 CHAMBER DETAILS TESTED AND RATED FOR H-30 LOAD CONDITIONS WITH 18" (457mm) OF COVER AND NO PAVEMENT.







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REVISIONS \ ISSUE

Project Number

Date Drawn
09/09/2019

Scale
N.T.S.

Designed by

Drawn by

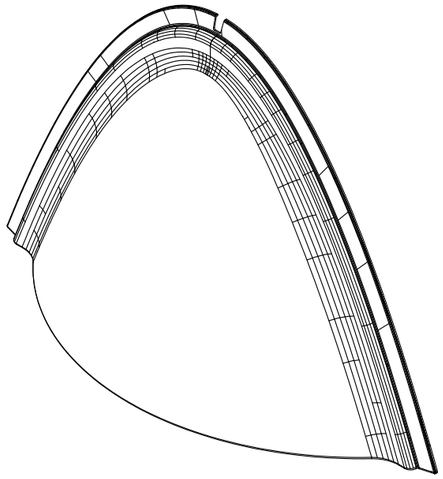
Checked by

325 UNIVERSITY AVE. W.

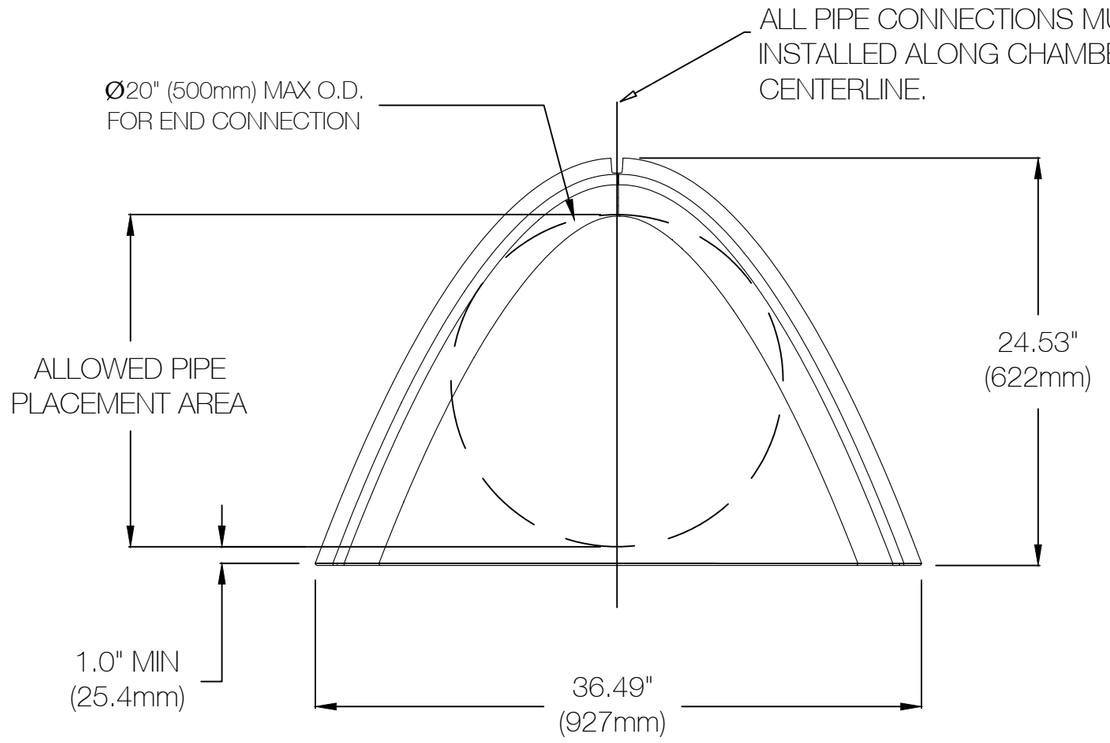
COBOURG, ON

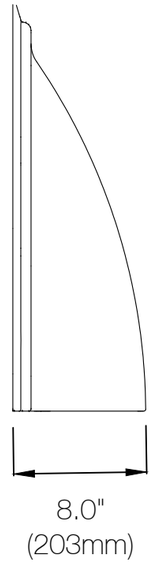
TYPICAL CHAMBER DETAIL

Sheet Number



C-10 END CAP SPECS	
NOMINAL DIMENSIONS (LAYUP LENGTH X WIDTH X HEIGHT)	8.0" X 36.49" X 24.53" (203mm X 921mm X 622mm)
BARE END CAP STORAGE	1.21 CUBIC FEET (0.034 CUBIC METERS)
*MIN INSTALLED STORAGE	3.86 CUBIC FEET (0.109 CUBIC METERS)
*ASSUMING A MIN OF 6" (152mm) STONE ABOVE AND BELOW AND 6" (152mm) BETWEEN ROWS WITH 40% STONE POROSITY (DOES NOT INCLUDE 12" (305mm) PERIMETER STONE VOLUME)	





THE END CAP FITS UP INSIDE THE LAST CONNECTING RIBS OF THE C-10 CHAMBER

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Project Number

Date Drawn
09/09/2019

Scale
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325 UNIVERSITY AVE. W.
COBOURG, ON

TYPICAL END CAP DETAIL

Sheet Number

TRITON C-10 PRODUCT SPECIFICATIONS

1.0 General

1.1 Triton chambers are designed to control stormwater runoff. As a subsurface retention or detention system, Triton chambers retain and allow effective infiltration of water into the soil. As a subsurface detention system, Triton chambers detain and allow for the metered flow of water to an outfall.

2.0 Chamber Parameters

2.1 The chamber shall be injection compression molded of a structural grade 1010 green soy resin composite to be inherently resistant to environmental stress cracking (ESCR), creep, and to maintain proper stiffness through temperature ranges of -40 degrees Fahrenheit to 180 degrees Fahrenheit (-40 degrees Celsius to 82.2 degrees Celsius).

2.2 The material property for the chamber and end cap must meet or exceed the following:
Tensile Strength- Ultimate: 21,755 PSI (149.9 Mpa)
Tensile Strength-Yield: 17,404 PSI (119.9 Mpa)
Tensile Modulus: 1,750-2,240 PSI (12.0 Mpa - 15.4 Mpa)
Flex Modulus: 1,600 KSI (11,031.6 Mpa)
Flex Yield Strength: 33,100 PSI (228.2 Mpa)
Compressive Strength: 30,457,000 PSI (209,993.6 Mpa)
Shear Strength: 11,500 PSI (79.29 Mpa)

2.3 The nominal chamber dimensions of the Triton C-10 shall be 25.0 inches tall (635 millimeters), 39.7 inches wide (1008 millimeters) and 31.52 inches long (801 millimeters). Lay-up length is 29.58 inches (751 millimeters).

2.4 The chamber shall have an elliptical curved section profile.

2.5 The chamber shall be open-bottomed.

2.6 The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows to be constructed.

2.7 The nominal storage volume of a Triton C-10 chamber shall be 17.45 cubic feet (0.494 cubic meters) per chamber when installed per Triton's typical details. This equates to 1.86 cubic feet (0.053 cubic meters) of storage per square foot of bed. This does not include perimeter stone.

2.8 The chamber shall have both of its ends open to allow for unimpeded hydraulic flows and visual inspections down a row's entire length.

2.9 The chamber shall have five corrugations to achieve strengths defined above.

2.10 The chamber shall have five circular and elliptical, indented and raised, surfaces on the top to the chamber for a maximum of 18 inch (450 millimeter) diameter optional top feed inlets, inspection ports and/or clean-out access ports.

2.11 The chamber side shall be capable of accepting pipe O.D. up to 12 inches (300 millimeters).

2.12 The chamber shall be analyzed, designed and field tested using AASHTO LRFD bridge design specifications 1. Design live load shall meet or exceed the AASHTO HS30 or a rear axle load of 48,000 pounds (21,772.4 kg). Design shall consider earth and live loads without pavement as appropriate for the minimum 18 inches (457 millimeters) of total cover to a maximum total cover of 50 feet (15.24 meters).

2.13 The chamber shall be manufactured in an ISO/TS16949:2002 and ISO 14001:2004 certified facility

2.14 The service life of the product is over 60 years under a constant sustained load of 10,000 PSI (68.95 Mpa) which is equal to the H-20 loading condition. Under typical loading conditions the Chamber and End Cap has a useful life span of 120 years from date of when manufactured.

3.0 End Cap Parameters

3.1 The end cap shall be Injection Compression molded of 1010 green soy resin to be inherently resistant to environmental stress cracking (ESCR), creep and to maintain proper stiffness through temperature ranges of -40 degrees Fahrenheit to 180 degrees Fahrenheit (-40 degrees Celsius to 82.2 degrees Celsius).

3.2 The end cap shall be designed to fit inside the last corrugation of a chamber, which allows the capping of each end of the chamber row.

3.3 The end cap shall have 7 different diameter connection guides across the front face of the bull nosed surface. The maximum diameter that the end cap can accept is 20 inches (500 millimeter) PS46, ASTM F679 PVC pipe. See end cap detail for further specifications.

3.4 The end cap shall have excess structural adequacies to allow cutting an orifice of any size at any invert elevation.

3.5 The primary face of an end cap shall have five corrugations and be angled outward to resist horizontal loads generated near the edges of beds.

3.6 The end cap shall be manufactured in an ISO/TS16949:2002 and ISO 14001:2004 certified facility.

3.7 The service life of the product to be over 60 years under a sustained load of 10,000 PSI (68.95 Mpa) which is equal to the H-20 loading condition.

3.8 The nominal storage volume of a Triton C-10 end cap shall be 3.86 cubic feet (0.109 cubic meters) per end cap when installed per triton's typical details. This equates to 1.52 cubic feet (0.043 cubic meters) of storage per square foot of bed.

4.0 Installation

4.1 Installation shall be in accordance with the latest Triton Installation manual that can be downloaded from the Triton website: www.tritonsws.com/support/downloads

terrafix
geosynthetics inc.

455 Horner Avenue
Toronto, Ontario
M8W 4W9
Tel:(416) 674-0363

REVISIONS \ ISSUE

Project Number

Date Drawn 09/09/2019

Scale N.T.S.

Designed by

Drawn by

Checked by

325 UNIVERSITY AVE. W.

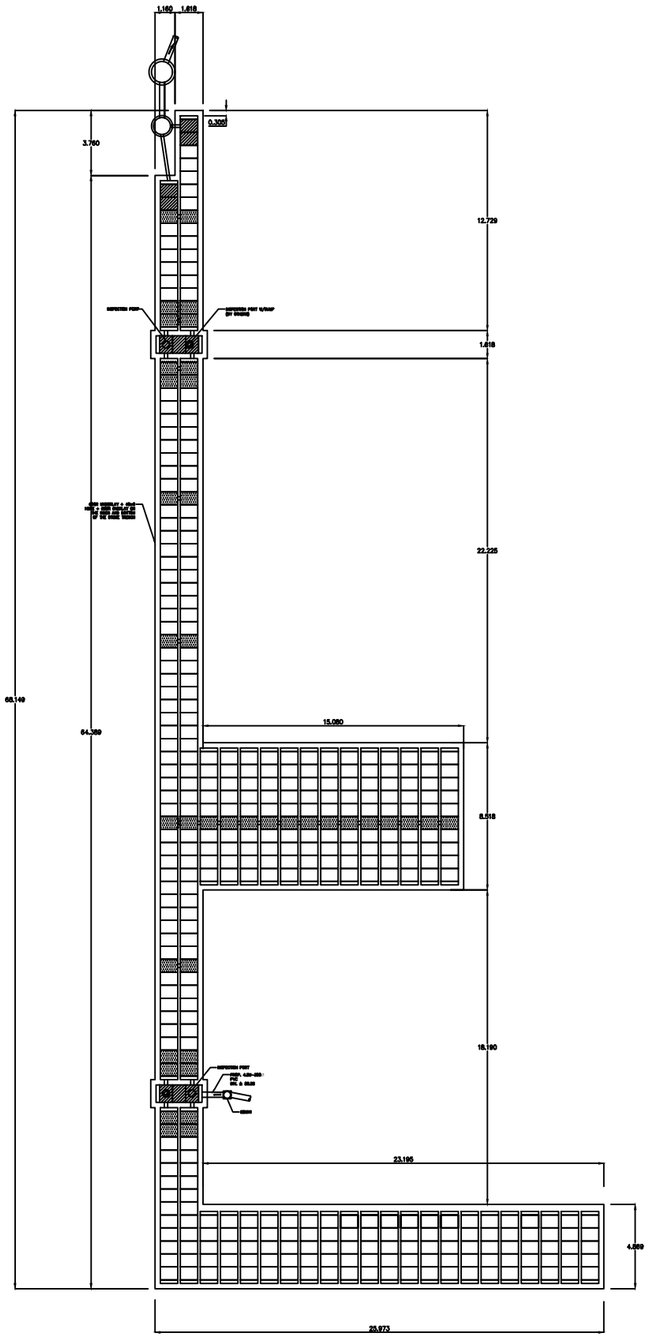
COBOURG, ON

PRODUCT SPECIFICATIONS

Sheet Number

NOTES

1. ALL DIMENSIONS ARE IN METERS OR UNLESS OTHERWISE SHOWN.
2. NOT TO SCALE.
3. PLEASE REFER TO THE LATEST INSTALLATION GUIDELINES: http://www.tritonsws.com/support/downloads



LEGEND

- DISTRIBUTION CHAMBER WITH GEOGRID BELOW
- DISTRIBUTION CHAMBER
- HEADER ROW

325 UNIVERSITY AVE WEST. COBOURG, ON			
ITEM NUMBER	ITEM DESCRIPTION	QTY	UNITS
1	TRITON C–10 CHAMBER	347	EA
2	ENDCAP	60	EA
3	HEADER ROW FLOOR (HDPE LINER OVER 360R)	12	M
4	TERRAFIX 360R GEOTEXTILE (4.57mX91.44m PER ROLL)	2	EA
5	DISTRIBUTION PIPES (200mm ø PVC X 4.27m)	5	EA
6	INSPECTION RISERS (150mmø PVC X 4.27m)	4	EA
7	GEOGRID PANELS (1.981m WIDE)	41	M
8	40mil HDPE LINER WITH 600R UNDERLAY AND OVERLAY	1	EA

terrafix
geosynthetics inc.

455 Horner Avenue
Toronto, Ontario
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Tel:(416) 674–0363

REVISIONS \ ISSUE

Project Number

Date Drawn
09/09/2019

Scale
N.T.S.

Designed by

Drawn by

Checked by

325 UNIVERSITY AVE. W.

COBOURG, ON

GENERAL PLAN VIEW

Sheet Number
6 OF 8

terrafix geosynthetics inc.

Providing Geosynthetic Solutions

November 8, 2019

LEA Consulting Ltd.
625 Cochrane Drive, 9th Floor
Markham, ON
L3R 9R9

Attention: Farshid Morshedi, P.Eng.

Re: Cobourg, ON – 325 University Ave.
Triton Stormwater (Lined) System

Dear Farshid,

As per your request, this letter confirms our Triton Stormwater System shop drawing proposal, dated September 9, 2019, for the above-mentioned project is designed to not allow stored water to infiltration into the surrounding soils. The attached manual, from Terrafix Environmental Technology, explains the deployment and quality control of the liner installation.

Please note, as indicated on the drawings, the ground water table must be lower than the bottom of tank to ensure there is no direct hydrostatic pressure against the liner. If this is the case, a reinforced concrete slab below the tank must be designed by a structural engineer. This would address the potential buckling effect of the liner directly below the chambers caused by the upward hydrostatic pressure.

We hope the information and assistance provided have been sufficient. Please contact us if you have any questions.

Terrafix Geosynthetics Inc.
455 Horner Ave.
Toronto, Ontario
M8W 4W9
Head Office: (416) 674-0363
www.terrafixgeo.com

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	235 University Ave	**Engineer:**	**Lea Consulting Ltd**
Location:	Cobourg, ON	**Contact:**	Farshid Morshedi, P.Eng.
OGS #:	OGS	**Report Date:**	8-Aug-19

Area	0.506	ha	**Rainfall Station #**	211	
Weighted C	0.79		**Particle Size Distribution**	FINE	
CDS Model	2015-4		**CDS Treatment Capacity**	20	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.5%	9.5%	0.6	0.6	2.8	98.1	9.3
1.0	10.4%	19.9%	1.1	1.1	5.6	97.3	10.1
1.5	8.9%	28.8%	1.7	1.7	8.4	96.5	8.6
2.0	8.1%	36.9%	2.2	2.2	11.1	95.7	7.8
2.5	7.3%	44.2%	2.8	2.8	13.9	94.9	6.9
3.0	5.6%	49.9%	3.3	3.3	16.7	94.1	5.3
3.5	5.1%	55.0%	3.9	3.9	19.5	93.3	4.8
4.0	4.1%	59.0%	4.4	4.4	22.3	92.5	3.8
4.5	3.2%	62.2%	5.0	5.0	25.1	91.7	2.9
5.0	3.3%	65.5%	5.5	5.5	27.9	90.9	3.0
6.0	6.4%	71.9%	6.6	6.6	33.4	89.3	5.7
7.0	4.7%	76.6%	7.7	7.7	39.0	87.7	4.1
8.0	4.1%	80.7%	8.8	8.8	44.6	86.1	3.6
9.0	2.8%	83.5%	9.9	9.9	50.1	84.5	2.3
10.0	2.0%	85.5%	11.0	11.0	55.7	82.9	1.7
15.0	7.3%	92.8%	16.6	16.6	83.6	74.9	5.5
20.0	3.7%	96.5%	22.1	19.8	100.0	63.0	2.3
25.0	2.5%	99.1%	27.6	19.8	100.0	50.4	1.3
30.0	0.2%	99.3%	33.1	19.8	100.0	42.0	0.1
35.0	0.5%	99.7%	38.6	19.8	100.0	36.0	0.2
40.0	0.3%	100.0%	44.2	19.8	100.0	31.5	0.1
45.0	0.0%	100.0%	49.7	19.8	100.0	28.0	0.0
50.0	0.0%	100.0%	55.2	19.8	100.0	25.2	0.0
							89.3

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 82.8%

Predicted % Annual Rainfall Treated = 98.5%

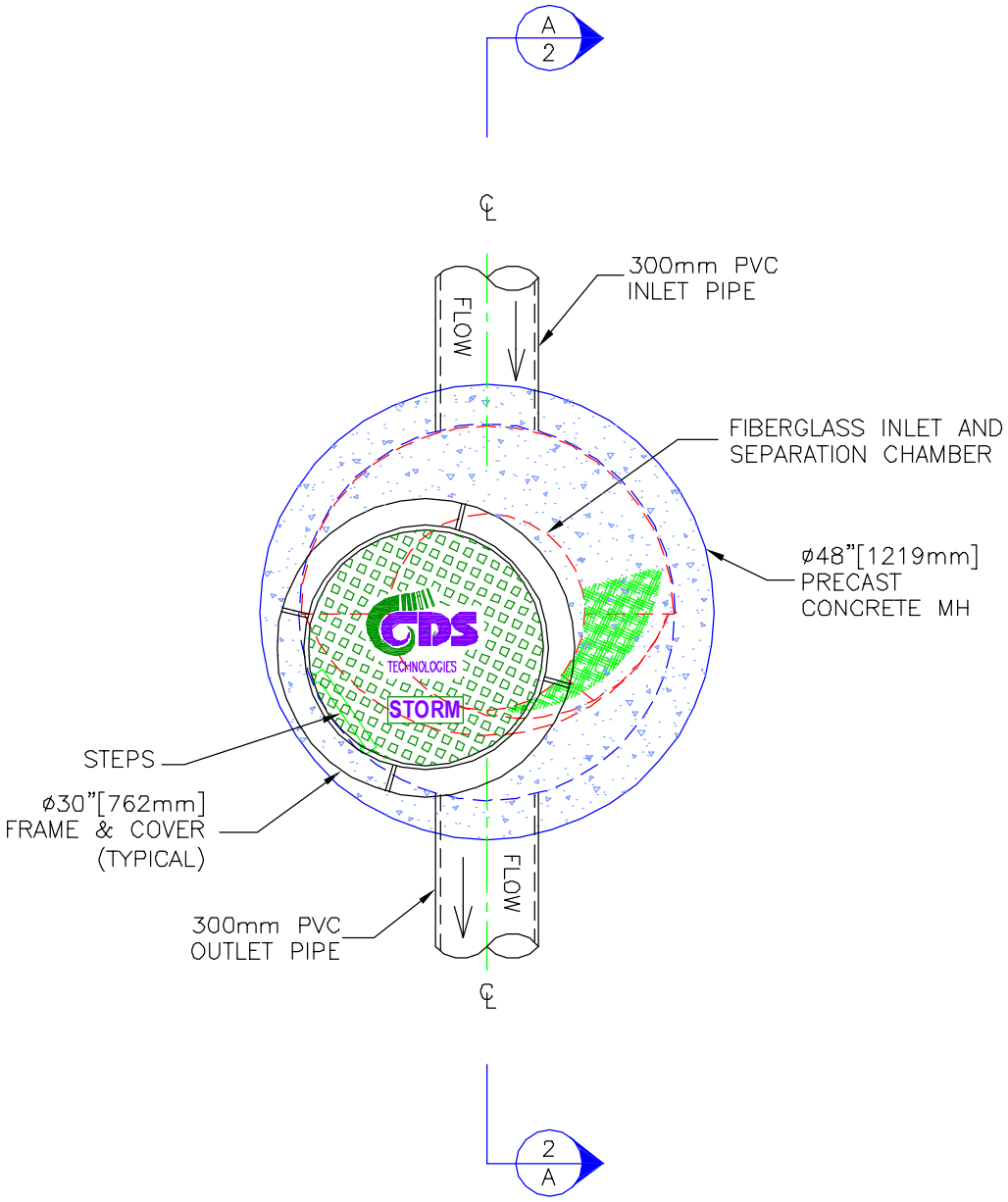
1 - Based on 32 years of hourly rainfall data from Canadian Station 6166418, Peterborough ON

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

3 - CDS Efficiency based on testing conducted at the University of Central Florida

4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

PLAN VIEW

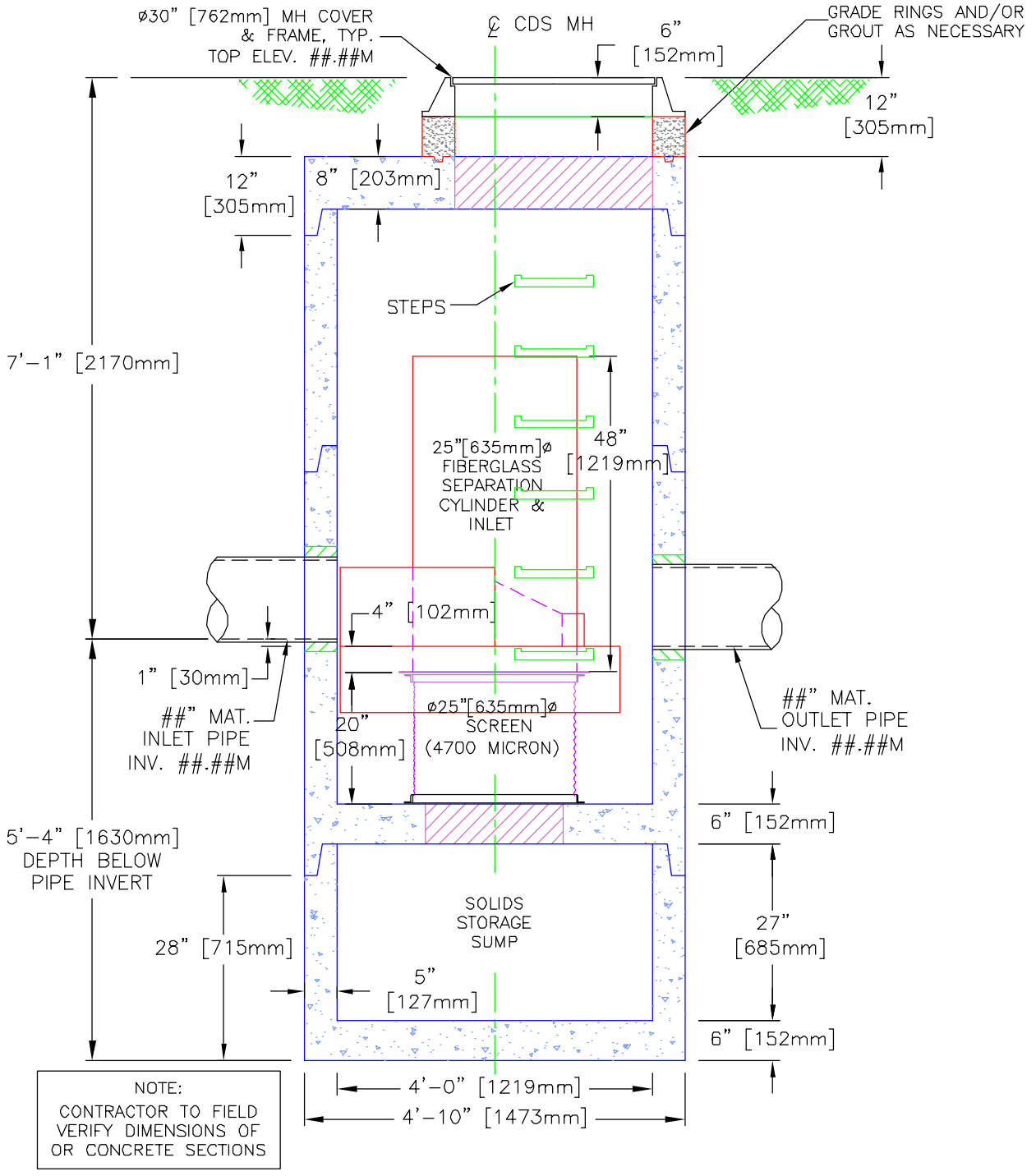


CDS MODEL PMSU20_15_4m
STORMWATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# XX-##-###	SCALE 1" = 2'
		DATE ##/##/##	SHEET 1
		DRAWN INITIALS	
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

SECTION A–A
ELEVATION VIEW



NOTE:
CONTRACTOR TO FIELD VERIFY DIMENSIONS OF OR CONCRETE SECTIONS

CDS MODEL PMSU20_15_4m
STORMWATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# XX–##–###	SCALE 1" = 2'
		DATE ##/##/##	SHEET 2
		DRAWN INITIALS	
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

APPENDIX B

Sanitary and Water Demand Calculations

LEA Consulting Ltd. Consulting Engineers and Planners	Sanitary Flow Rate Calculation			
	Prepared:	F.M.	Page No.	B-1
	Checked:	R.B.		
Project: 325 University Avenue West, Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Proposed New Golden Plough Lodge

POPULATION CALCULATION

(Based on the Architect Statistics)

Site Area	4854.7	m^2
Number of Townhoused	71.0	units

Proposed Building Type	**Density** (P.P.U)	**Population**
Residential	1.62	115.02
Total		**115.02**

SANITARY FLOW CALCULATION

(Based on the Town of Cobourg Design Guidelines)

Harmon Peaking Factor: $K_H=1+(14/(4+(P/1000)^{0.5}))$

Peaking Factor (K_H)	4.23	
Max. Peaking factor based on Town of Cobourg Design Guidelines	3.80	
Average Daily Wastewater Flow	364	L/cap/day
Total Domestic Flow	1.84	L/sec
Infiltration Allowance (@ 0.26 L/sec/ha)	0.13	L/sec
Design Flow	**1.97**	L/sec

LEA Consulting Ltd. Consulting Engineers and Planners	Water Demand Calculation			
	Prepared:	F.M.	Page No.	B-2
	Checked:	R.B.		
Project: 325 University Avenue West, Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Proposed New Golden Plough Lodge
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.
= 0.8 for fire non-combastable 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.

STEP 1 According the building stats,

		Area (m2)
1st Floor	adjoining	1206
2nd Floor	largest	1303
3rd Floor	adjoining	1303
A		1930

Therefore, F = 8000 **l/min**

STEP 2 **Occupancy reduction:**

For occupancies with a low contents fire hazard, the reduction rate is 25%,
Therefore: F = 6000 l/min

Reduction for sprinkler protection:
Using the NFPA sprinkler system, a reduction rate of 30% is used.
Therefore: F = 4200 l/min

STEP 3 Separation charge:
Charge for the separations on each side:

Separation	Charge	
more than 45m	0%	South
30.1 to 45 m	5%	North
10.1 to 20m	15%	East
3.1 to 10 m	20%	West

Total charge in % 40%
Total charge in l/min 2400

STEP 4 Required Fire Flow: 7000 l/min
or 116.67 l/s
or 1849 US GPM

LEA Consulting Ltd. Consulting Engineers and Planners	Water Demand Calculation			
	Prepared:	F.M.	Page No.	B-3
	Checked:	R.B.		
Project: 325 University Avenue West, Town of Cobourg	Proj. #	20021		
	Date:	28-Oct-19		

Proposed Retirement Residence and Clinic Development

Total Population: **115** (See Page E-01)

Peak Hour Demand Calculation:		
(Based on the MOE Design Guidelines for Drinking Water Systems)		
Residential Per Capital Demand (multi-unit)	191	L/cap/day
Peaking Factor	9.40	
Peak Hour Demand	**2.39**	L/sec

Maximum Day Demand Calculation:		
(Based on the MOE Design Guidelines for Drinking Water Systems)		
Residential Per Capital Demand (multi-unit)	191	L/cap/day
Peaking Factor	6.30	
Maximum Day Demand	**1.60**	L/sec
Fire Flow for High Rise Residential:	116.7	L/sec
Max. Day Demand plus Fire Flow:	**118.3**	L/sec
Design Water Demand	**118.3**	L/sec
	1874.6	**US GPM**

APPENDIX C

Existing Storm Sewer Capacity Calculations

TOWN OF COBOURG

Outlet 83 Drainage Areas

Legend

- Outlet 83 Areas
- CBMH
- DCB
- MH
- Drainage Areas
- Pipe
- Outlet
- GRCA_Streams

N W E S

1:1,000

0 10 20 40

Meters

Cobourg GEOMATICS

August 2019

56

39

0.51 ha
STMH-802

1.17 ha
CBMH-248

0.34 ha
CBMH-250

1.48 ha
STMH-810

0.28 ha
STMH-445

0.46 ha
CBMH-251

WILLIAM ST

0.24 ha
CBMH-396

0.11 ha
STMH-484

0.09 ha
STMH-485

UNIVERSITY AV

0.04 ha
STMH-445

0.01 ha
STMH-491

0.42 ha
STMH-486

0.28 ha
STMH-590

0.23 ha
CB-1456

MARGARET ST

0.49 ha
CBMH-252

0.37 ha
STMH-51

0.62 ha
CBMH-253

2.07 ha
CB-1458

0.4 ha
CB-1457

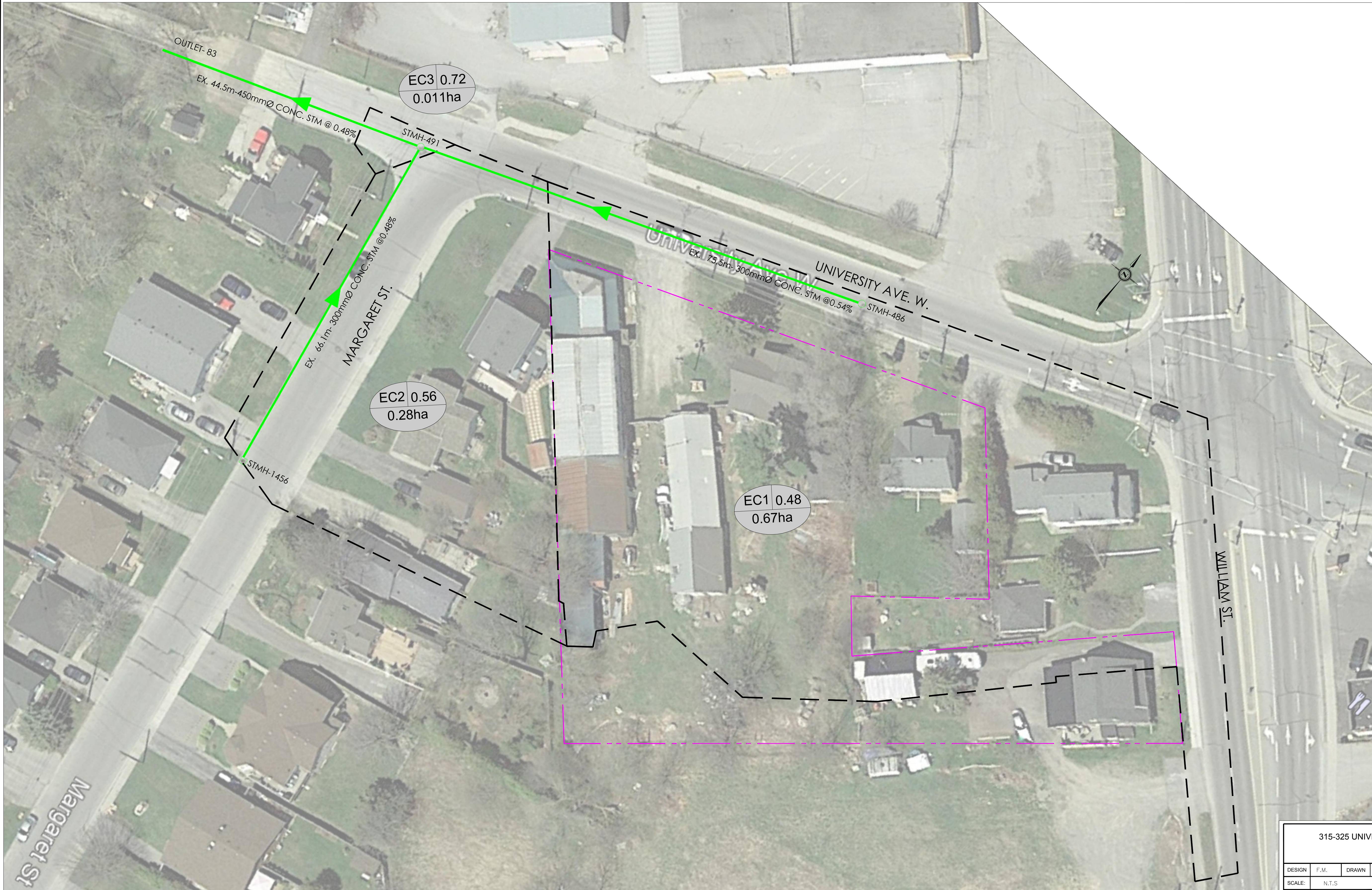
1.29 ha
STMH-492

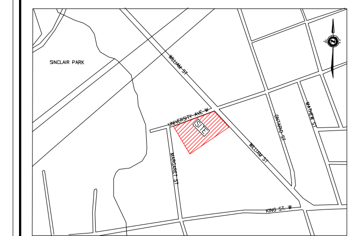
0.18 ha
CBMH-420

0.4 ha
CBMH-254

4.23 ha
STMH-492

0.45 ha
STMH-52





LEGEND

(green line)	EX. STORM
(magenta dash-dot line)	PROPERTY LINE
(black dashed line)	SUB-CATCHMENT BOUNDARY
EC1 0.25 / 0.388 ha	CATCHMENT ID/RUNOFF COEFFICIENT DRAINAGE AREA (ha)

No.	DATE	DESCRIPTION
1	06/05/2019	ISSUED FOR ZBA SUBMISSION
2	04/06/2019	ISSUED FOR SPA SUBMISSION
3	12/08/2019	ISSUED FOR SPA RESUBMISSION

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

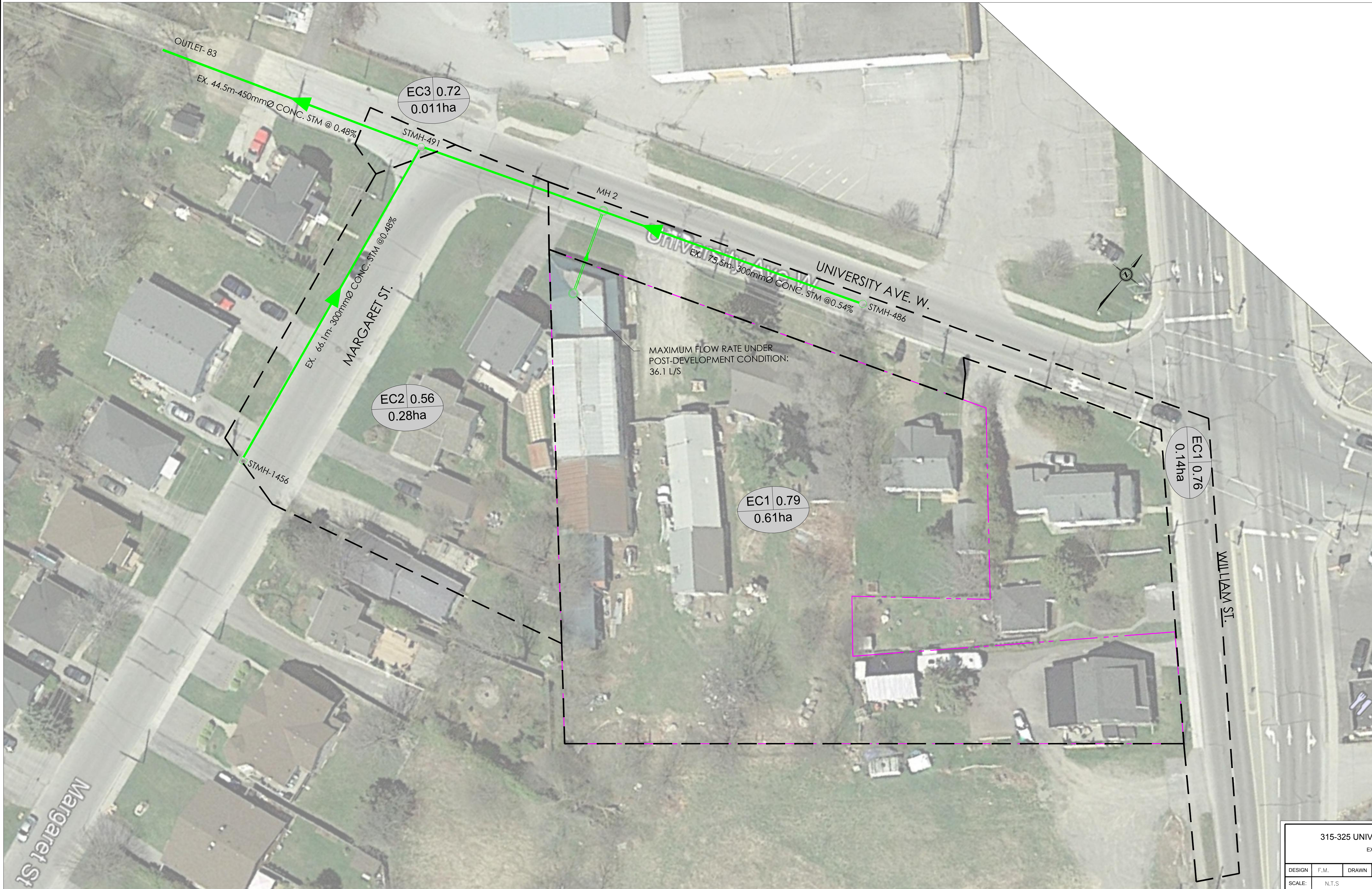
LEA Consulting Ltd.
Consulting Engineers and Planners
www.LEA.ca

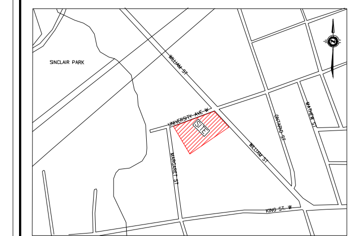
315-325 UNIVERSITY AVENUE REDEVELOPMENT

EXISTING STORM SEWERS DRAINAGE PLAN
PRE-DEVELOPMENT CONDITION

DESIGN	F.M.	DRAWN	M.N.	CHECKED	R.B.	CONTRACT No.	20021
SCALE:	N.T.S			DRAWING NUMBER	FIG. 4		
DATE:	APR. 26,2019						

DRAWING NAME: F:\20021\Municipal\Contract drawings\FIG4- Existing storm sewer Drainage Plan.dwg Sep 23, 2019-9:08am





LEGEND

(green line)	EX. STORM
(magenta dash-dot line)	PROPERTY LINE
(black dashed line)	SUB-CATCHMENT BOUNDARY
EC1 0.25 / 0.388 ha	CATCHMENT ID/RUNOFF COEFFICIENT DRAINAGE AREA (ha)

No.	DATE	DESCRIPTION
1	23/09/2019	ISSUED FOR SPA RESUBMISSION

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

315-325 UNIVERSITY AVENUE REDEVELOPMENT

EXISTING STORM SEWERS DRAINAGE PLAN
POST-DEVELOPMENT CONDITION

DESIGN	F.M.	DRAWN	M.N.	CHECKED	R.B.	CONTRACT No.	20021
SCALE:	N.T.S	DRAWING NUMBER	FIG. 5				
DATE:	APR. 26,2019						

DRAWING NAME: F:\20021\Municipal\Contract drawings\FIG5- Existing storm sewer Drainage Plan-Post development.dwg ...-11:42am

DEVELOPMENT: **20021** | SHEET No.: | DATE: 28/10/2019

CONSULTANT: **LEA Consulting Ltd** | DESIGNED BY: **F.M.**

MAJOR DRAINAGE AREA: | CHECKED BY: **R.B.**

300-450mm STORM SEWER IN UNIVERSITY AVENUE WEST.

Town of Cobourg Intensity 5yr (Yarnel parameters) = 2464/(tc+16)

Pre-Development Condition

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	Comment
MH#	MH#	A ha	C	AxC	SUM. A ha	SUM AxC	tc_f min	tc_i min	$tc=tc_f+tc_i$ min	i mm/hr	Q=iAC/360 m3/sec		n	S %	D mm	L m	V m/sec	Q_f m3/sec	m	m	t=L/Vx60 min	Q/Q_f %	
																					0		
STMH-486	STMH-491	0.67	0.45	0.30	0.67	0.30	0	15	15	79.5	**0.067**	CONC	0.013	0.54	300*	75.50	1.01	0.071	80.16	79.75	1.25	0.94	
CB-1456	STMH491	0.28	0.56	0.16	0.28	0.16	0	15	15	79.5	**0.035**	CONC	0.013	0.48	300	57.80	0.95	0.067	78.89	78.58	1.02	0.52	
STMH-491	Outlet-83	0.01	0.45	0.00	0.96	0.46	1.25	15	16.25	76.4	**0.098**	CONC	0.013	0.48	450*	44.50	1.24	0.198	78.53	78.24	0.60	0.50	

***** Pipe size has been confirmed by field survey

Post-Development Condition

MH#	MH#	A ha	C	AxC	SUM. A ha	SUM AxC	tc_f min	tc_i min	$tc=tc_f+tc_i$ min	i mm/hr	Q=iAC/360 m3/sec		n	S %	D mm	L m	V m/sec	Q_f m3/sec	m	m	t=L/Vx60 min	Q/Q_f %	Comment
																					0		
STMH-486	MH2	0.14	0.76	0.11	0.14	0.11	0	15	15	79.5	**0.023**	CONC	0.013	0.54	300	43.90	1.01	0.071	80.16	79.75	0.73	0.33	
MH2	STMH-493	0.61			0.75						**0.060**	CONC	0.013	0.54	300	31.60	1.01	0.071	80.16	79.75	0.52	0.84	36.1 l/s controlled discharge rate form development site
CB-1456	STMH491	0.28	0.56	0.16	0.28	0.16	0	15	15	79.5	**0.035**	CONC	0.013	0.48	300	57.80	0.95	0.067	78.89	78.58	1.02	0.52	
STMH-491	Outlet-83	0.01	0.45	0.00	1.04	0.27	1.25	15	16.25	76.4	**0.057**	CONC	0.013	0.48	450	44.50	1.24	0.198	78.53	78.24	0.60	0.29	

The maximum flow rate from the site under post-development condition will be 0.036 cms based on the 5yr pre-development flow.

APPENDIX D

Hydrant Flow test and Watermain Adequacy Assessment

LEA Consulting Ltd. Consulting Engineers and Planners	**Residual Pressure**			
	Prepared:	F.M.	Page No.	D-04
	Checked:	R.B.		
Project: 315-325 University Avenue West Town of Cobourg	Proj. #	19050		
	Date:	28-Oct-19		

Hydrant Test Readings (200mm watermain, 325 University Ave.) undertaken on May 23, 2019, by Classic Fire Protection Inc.

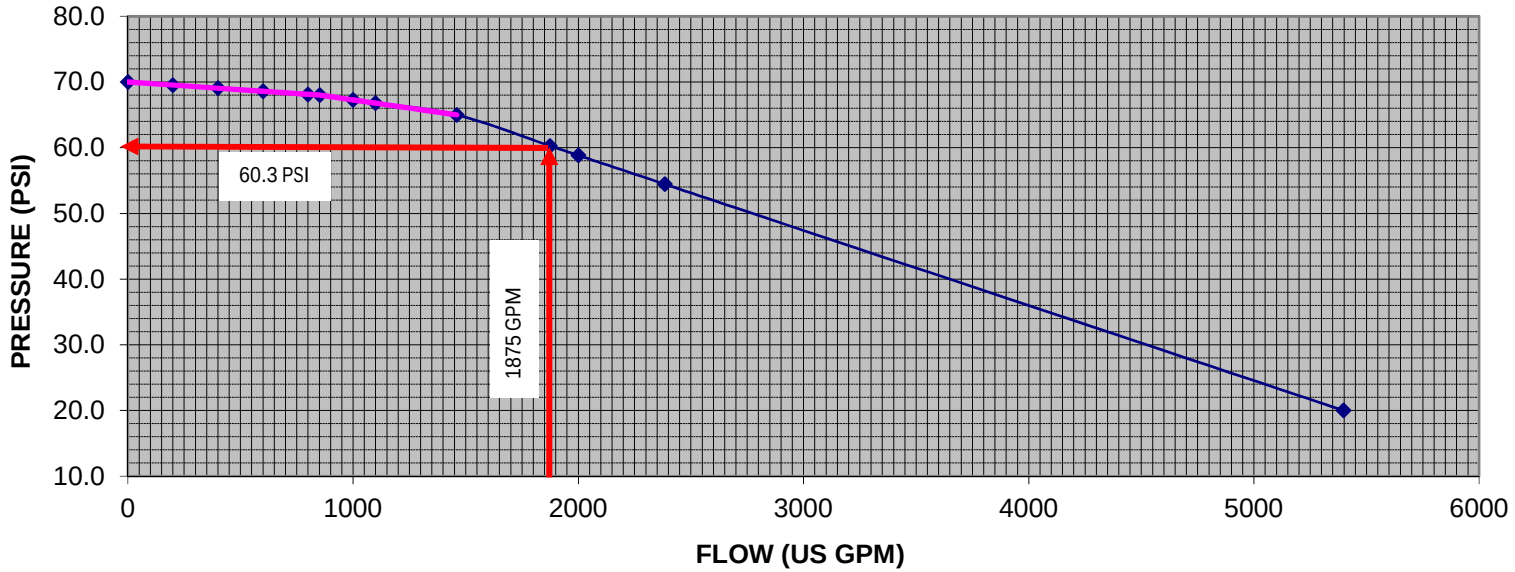
Flow		Residual Pressure		
0	US GPM	70	psi	
852.7	US GPM	68	psi	
1460.4	US GPM	65	psi	
5397.8	US GPM	20	psi	Focus Fire Protection Estimate

Interpolated

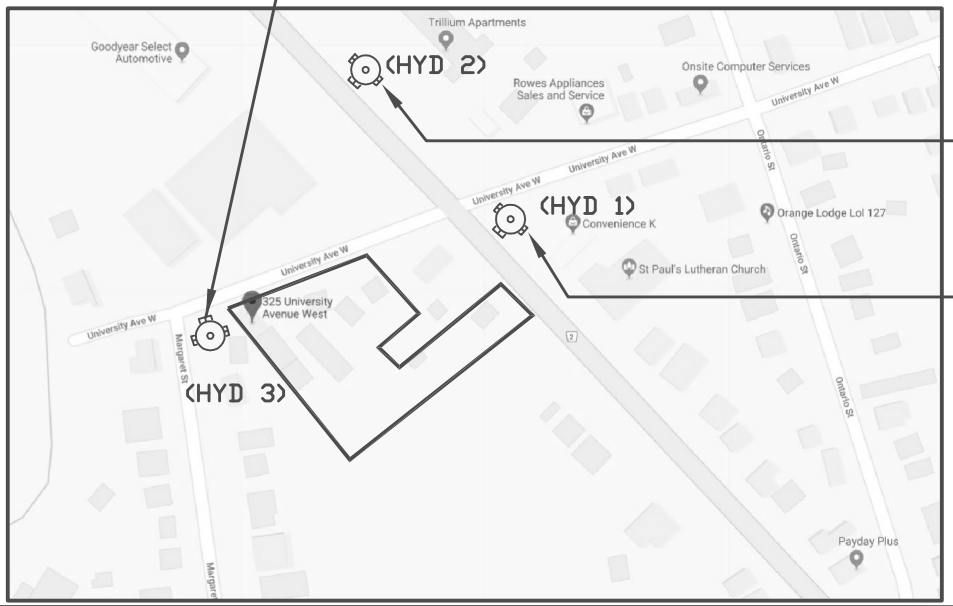
Flow (US GPM)	Residual Pressure (psi)
0	**70.0**
200	69.5
400	69.1
600	68.6
800	68.1
852.7	**68.0**
1000	67.3
1100	66.8
1460.4	**65.0**
1875	60.3
2000	58.8
2384	54.4
5397.8	**20.0**

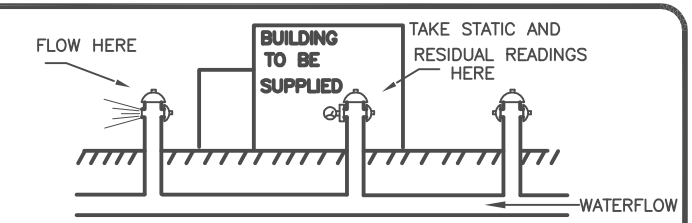
Existing 200mm Watermain on William St., Town of Cobourg

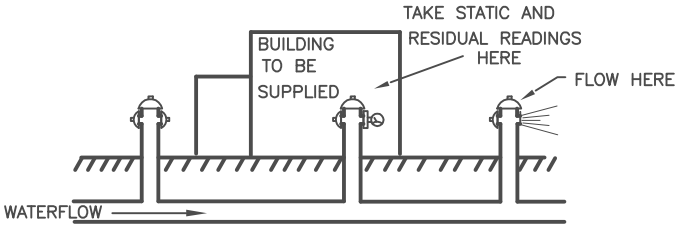
FLOW TEST CHART (BASED ON CLASSICFIRE PROTECTION TEST, May 23, 2019)
Page: D-02

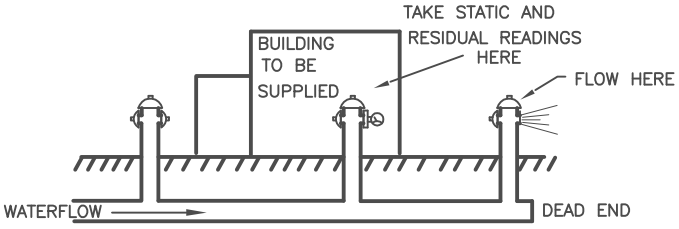


ORIGINAL FIRE HYDRANT TO BE TESTED (GPM), BUT DUE TO ON-SITE ISSUE IT WAS ALTERED



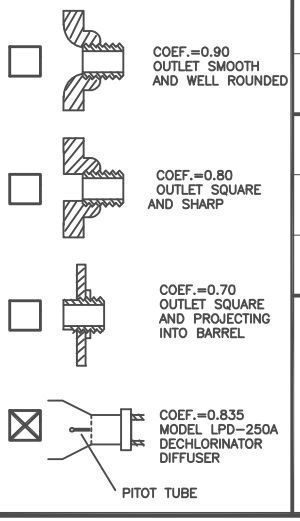






TEST:	PLAY PIPE	C=	STATIC(PSI)	RESIDUAL(PSI)	PITOT(PSI)	FLOW(USGPM)
	1x1 1/8					
	2x1 1/8					
	3x1 1/8					
	4x1 1/8					
	1x1 3/4					
	2x1 3/4					
	3x1 3/4					
	4x1 3/4					
	TWO HYDRANT TEST (BETWEEN HYD 1 TO 2)					
1	1x2 1/2	.835	70	68	47.5	852.7
	2x2 1/2	.835	70	65	25	1460.4
	3x2 1/2					
	4x2 1/2					
	SINGLE HYDRANT TEST (HYD 3)					
2	1x2 1/2	.835	72		10	492.3

OUTLET TYPE



Client:

Location:

325 University Ave.

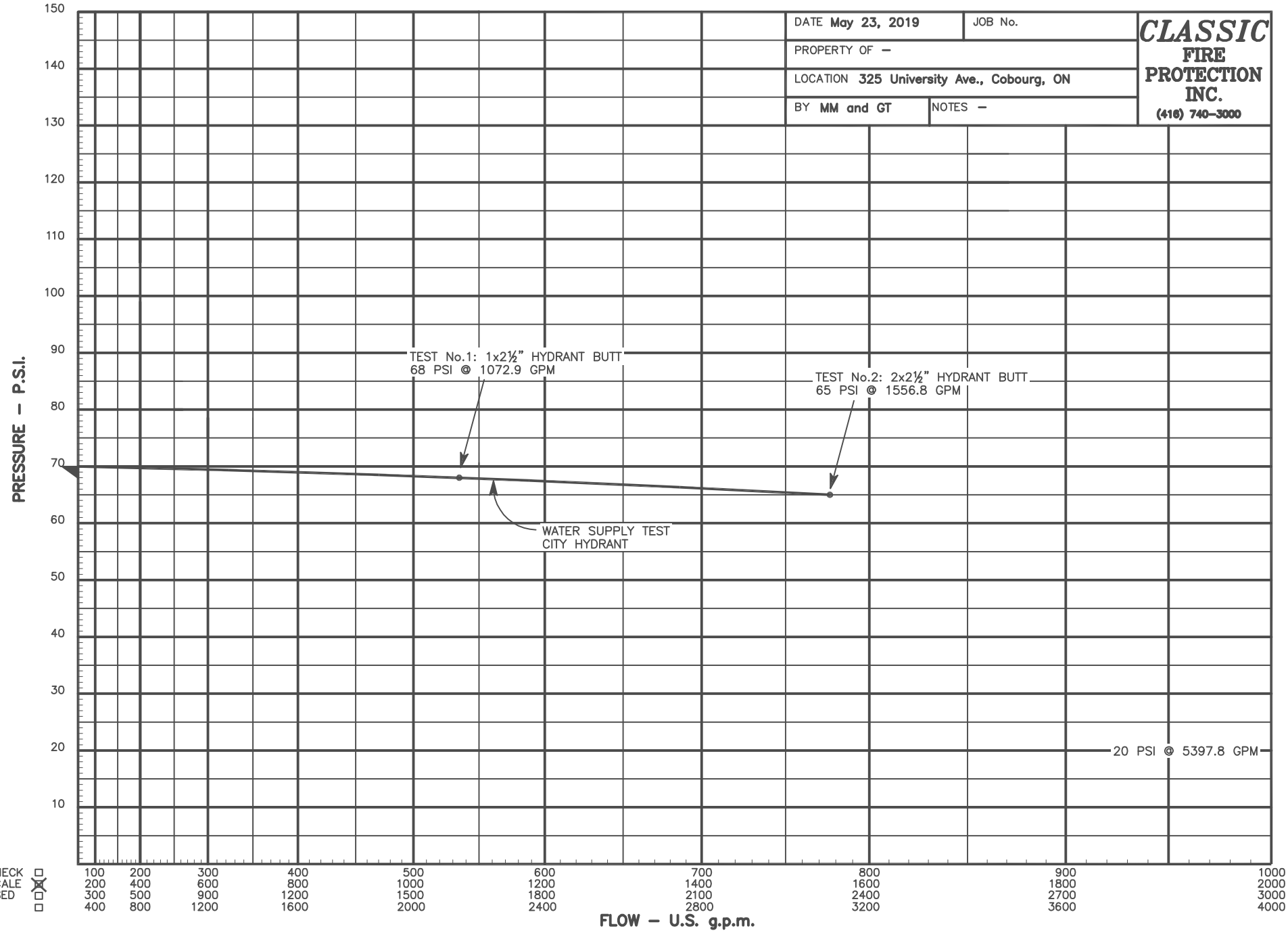
Cobourg, ON

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 May 23, 2019	JOB No.
PROPERTY OF –	
LOCATION 325 University Ave., Cobourg, ON	
BY MM and GT	NOTES –

CLASSIC FIRE PROTECTION INC.
(416) 740-3000



APPENDIX E

Figures and Drawings

MARGARET ST.

UNIVERSITY AVE. W.

WILLIAM ST.

EXTERNAL DRAIANGE AREA

EC1 | 0.43
0.378ha

EC2 | 0.35
0.107 ha

EC3 | 0.37
0.131 ha

335 2 STORY FRAME DWELLING DS=83.53

325 DWELLING DS=82.67

315 DWELLING DS=83.51

311 1 STOREY FRAME DWELLING DS=83.56

395 2 STOREY FRAME DWELLING DS=82.49

395 2 STOREY FRAME DWELLING DS=83.60

387 2 STOREY BRICK DWELLING DS=84.27

1 STORY FRAME ADDITION

FRAME GARAGE

SHED

DECK

PORCH

OVERHANG CANOPY

ASPHALT

DRIVEWAY

SIDEWALK

CONCRETE

EAST CURB CUT

ISLAND

CENTER LINE OF PAVEMENT

DOUBLE BOARD FENCE

CHAINLINK FENCE

LEGEND

- MH EXISTING MANHOLE
- CB EXISTING CATCH BASIN
- DIC EXISTING DITCH INLET
- POA EXISTING ANCHOR POLE
- POU EXISTING UTILITY POLE
- POLS EXISTING LIGHT STANDARD
- GM EXISTING GAS METER
- GV EXISTING GAS VALVE
- WV EXISTING WATER VALVE
- FH EXISTING FIRE HYDRANT
- EXISTING TREE
- PROPOSED TREE
- PROPERTY LINE
- SUB-CATCHMENT BOUNDARY
- OVERLAND FLOW ROUTE
- EC1 | 0.43 / 0.378 ha — CATCHMENT ID/RUNOFF COEFFICIENT DRAINAGE AREA (ha)

No.	DATE	DESCRIPTION
1	06/05/2019	ISSUED FOR ZBA SUBMISSION
2	04/06/2019	ISSUED FOR SPA SUBMISSION
3	12/08/2019	ISSUED FOR SPA RESUBMISSION
4	29/09/2019	ISSUED FOR SPA RESUBMISSION
4	28/10/2019	ISSUED FOR SPA RESUBMISSION

625 Cochrane Drive, Suite 900
Markham, Ontario
L3R 9R9, Canada
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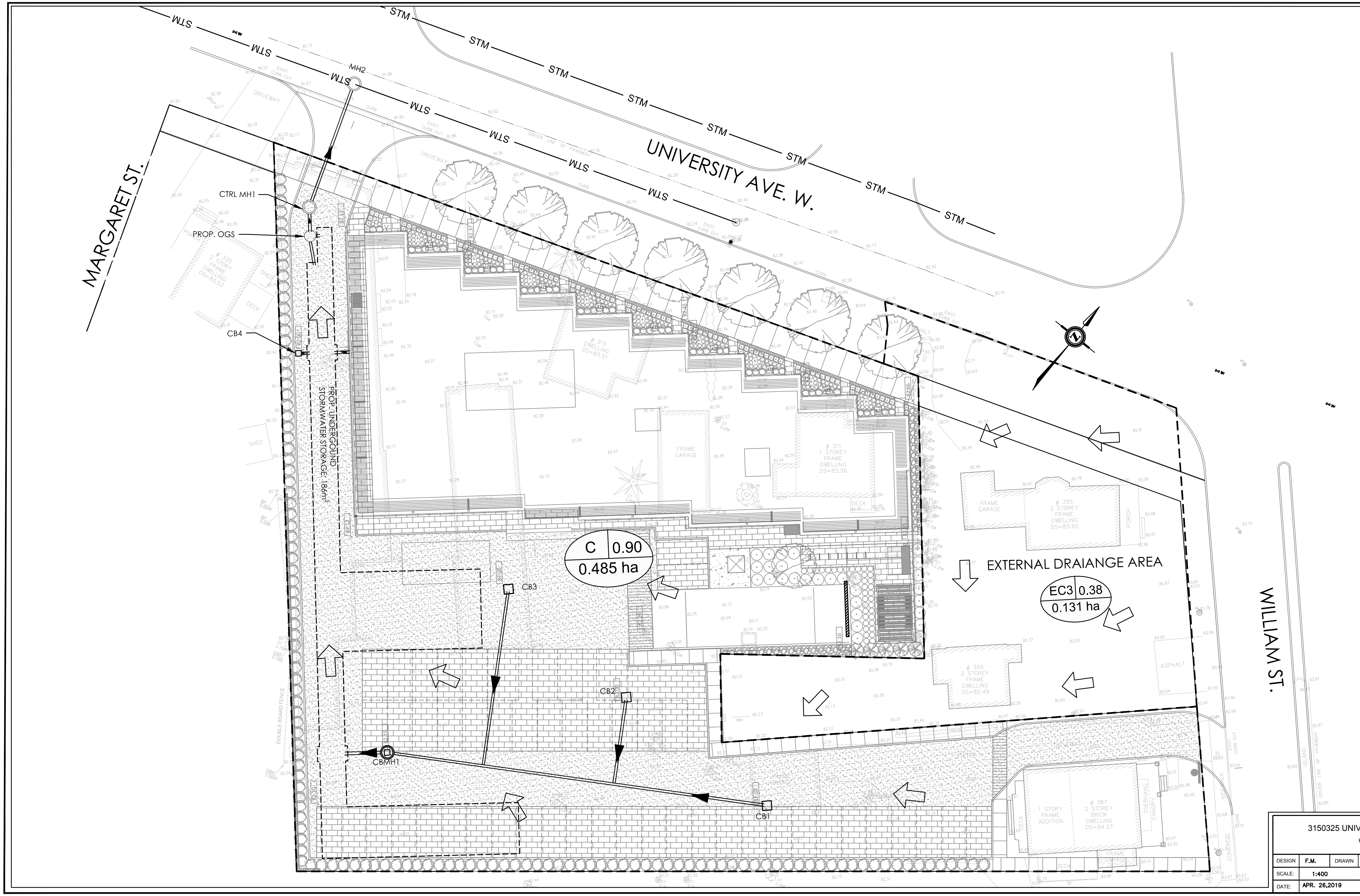
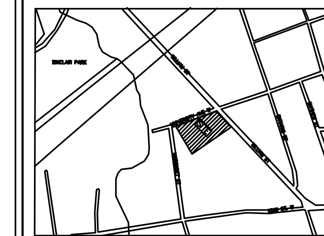
Consulting Engineers and Planners
www.LEA.ca

315-325 UNIVERSITY AVENUE REDEVELOPMENT

EXISTING DRAINAGE PLAN

DESIGN	F.M.	DRAWN	M.N.	CHECKED	R.B.	CONTRACT No.	20021
SCALE:	1:500					DRAWING NUMBER	FIG. 2
DATE:	APR. 26,2019						





LEGEND

MH	EXISTING MANHOLE
CB	EXISTING CATCH BASIN
DIC	EXISTING DITCH INLET
DA	EXISTING ANCHOR POLE
POU	EXISTING UTILITY POLE
POLS	EXISTING LIGHT STANDARD
GM	EXISTING GAS METER
	EXISTING GAS VALVE
WV	EXISTING WATER VALVE
FH	EXISTING FIRE HYDRANT
	EXISTING TREE
	PROPOSED TREE
STM	EXISTING STORM SEWER
	PROPOSED STORM SEWER
	PROPOSED CATCHBASIN
	PROPOSED CATCHBASIN MANHOLE
	PROPOSED MANHOLE
	PROPOSED OGS
	PROPOSED U/G SWM STORAGE
	PROPERTY LINE
	DRAINAGE AREA BOUNDARY
	OVERLAND FLOW ROUTE
C1 0.25 / 0.388 ha	CATCHMENT ID/RUNOFF COEFFICIENT DRAINAGE AREA [ha]

No.	DATE	DESCRIPTION
1	06/05/2019	ISSUED FOR ZBA SUBMISSION
2	04/06/2019	ISSUED FOR SPA SUBMISSION
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4	23/09/2019	ISSUED FOR SPA RESUBMISSION
4	28/10/2019	ISSUED FOR SPA RESUBMISSION

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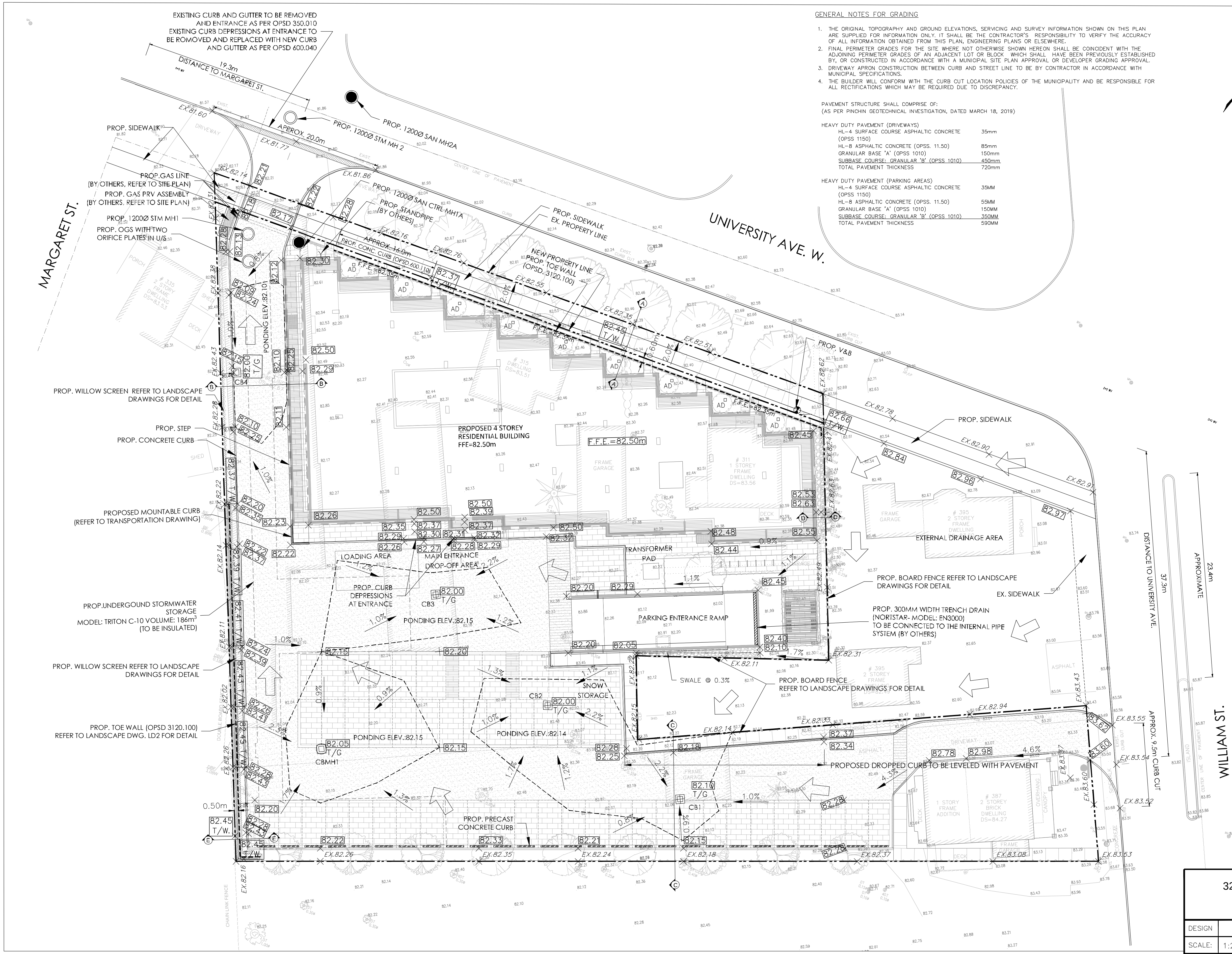
www.LEA.ca

3150325 UNIVERSITY AVENUE REDEVELOPMENT

PROPOSED DRAINAGE PLAN

DESIGN	F.M.	DRAWN	M.N.	CHECKED	R.B.	CONTRACT No.	20021
SCALE:	1:400			DRAWING NUMBER	FIG. 3		
DATE:	APR. 26,2019						

DRAWING NAME: F:\20021\Municipal\Contract drawings\FIG 3– Proposed Drainage Plan.dwg Oct 28, 2019–12:51pm



GENERAL NOTES FOR GRADING

1. THE ORIGINAL TOPOGRAPHY AND GROUND ELEVATIONS, SERVICING AND SURVEY INFORMATION SHOWN ON THIS PLAN ARE SUPPLIED FOR INFORMATION ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE ACCURACY OF ALL INFORMATION OBTAINED FROM THIS PLAN, ENGINEERING PLANS OR ELSEWHERE.
2. FINAL PERIMETER GRADES FOR THE SITE WHERE NOT OTHERWISE SHOWN HEREON SHALL BE COINCIDENT WITH THE ADJOINING PERIMETER GRADES OF AN ADJACENT LOT OR BLOCK WHICH SHALL HAVE BEEN PREVIOUSLY ESTABLISHED BY, OR CONSTRUCTED IN ACCORDANCE WITH A MUNICIPAL SITE PLAN APPROVAL OR DEVELOPER GRADING APPROVAL.
3. DRIVEWAY APRON CONSTRUCTION BETWEEN CURB AND STREET LINE TO BE BY CONTRACTOR IN ACCORDANCE WITH MUNICIPAL SPECIFICATIONS.
4. THE BUILDER WILL CONFORM WITH THE CURB CUT LOCATION POLICIES OF THE MUNICIPALITY AND BE RESPONSIBLE FOR ALL RECTIFICATIONS WHICH MAY BE REQUIRED DUE TO DISCREPANCY.

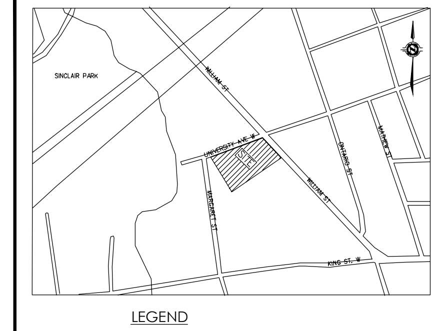
PAVEMENT STRUCTURE SHALL COMPRISE OF:
(AS PER PINCHIN GEOTECHNICAL INVESTIGATION, DATED MARCH 18, 2019)

HEAVY DUTY PAVEMENT (DRIVEWAYS)

HL-4 SURFACE COURSE ASPHALTIC CONCRETE (OPSS 1150)	35mm
HL-8 ASPHALTIC CONCRETE (OPSS. 11.50)	85mm
GRANULAR BASE 'A' (OPSS 1010)	150mm
SUBBASE COURSE: GRANULAR 'B' (OPSS 1010)	450mm
TOTAL PAVEMENT THICKNESS	720mm

HEAVY DUTY PAVEMENT (PARKING AREAS)

HL-4 SURFACE COURSE ASPHALTIC CONCRETE (OPSS 1150)	35MM
HL-8 ASPHALTIC CONCRETE (OPSS. 11.50)	55MM
GRANULAR BASE 'A' (OPSS 1010)	150MM
SUBBASE COURSE: GRANULAR 'B' (OPSS 1010)	350MM
TOTAL PAVEMENT THICKNESS	590MM



LEGEND

- EX. STORM CATCHBASIN
- EX. SEWER MANHOLE
- EX. WATER VALVE
- EX. HYDRO POLE
- EX. TREE
- PROP. TREE
- PROP. STORM CATCHBASIN
- PROP. STORM CATCHBASIN MANHOLE
- PROP. STORM MANHOLE
- PROP. SANITARY MANHOLE
- PROP. V&B
- PROP. AREA DRAIN
- EX. ELEVATION (EX.82.49)
- EX. ELEVATION (82.49)
- PROP. ELEVATION (82.49)
- PROP. TOP OF WALL ELEVATION (82.30 T/W)
- PROP. TOP OF GRATE ELEVATION (82.30 T/G)
- EXTEND OF 100-yr FLOOD PONDING LEVEL
- PROPERTY LINE
- PROP. FENCE
- OVERLAND FLOW ROUTE

GENERAL NOTES

- CONTRACTOR MUST CHECK & VERIFY ALL DIMENSIONS ON THE JOB.
- THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION.
- ELEVATIONS SHOWN GEODETIC DRIVEN FROM TOWN OF COBOURG BENCH MARK #00121U2300 , ELEVATION 82.92m.
- REFER TO DWG. C-02 FOR THE LOCATION OF SITE SERVICING CROSS SECTIONS.
- REFER TO DWG. C-03 FOR SITE SERVICING CROSS SECTIONS AND AND MANHOLE INVERTS.
- REFER TO DWG. C-03 FOR NOTES.
- REFER TO DWG. C-01 FOR THE LOCATION OF SITE GRADING CROSS SECTIONS.
- REFER TO DWG. C-04 FOR SITE GRADING CROSS SECTIONS.

No.	DATE	DESCRIPTION
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4	23/09/2019	ISSUED FOR SPA RESUBMISSION
5	28/10/2019	ISSUED FOR SPA RESUBMISSION
6	14/11/2019	ISSUED FOR SPA RESUBMISSION

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LICENSED PROFESSIONAL ENGINEER F. MORSHEDI 100229200 NOV. 14, 2019 PROVINCE OF ONTARIO

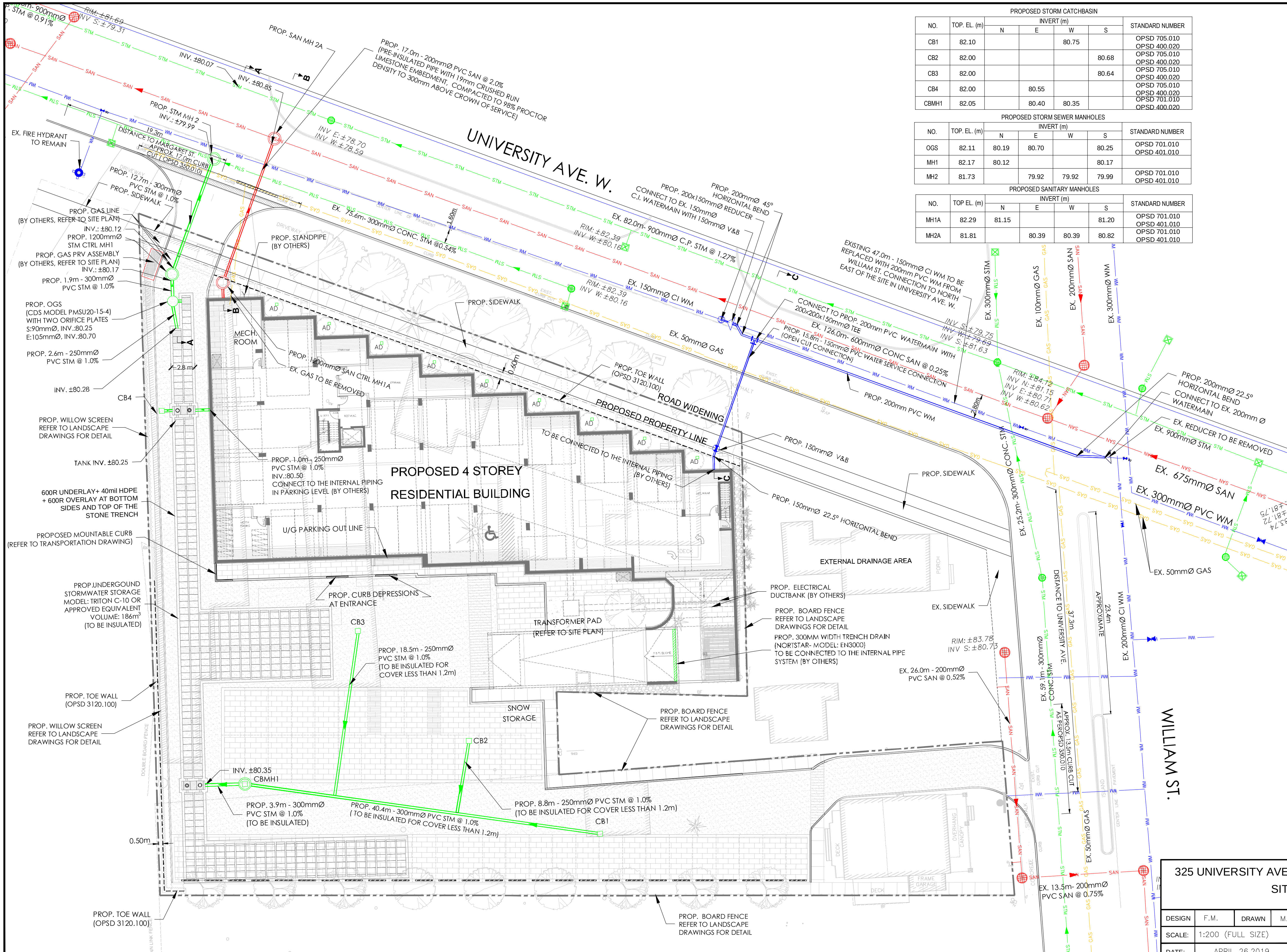
325 UNIVERSITY AVE. RESIDENTIAL DEVELOPMENT

SITE GRADING PLAN

DESIGN	A.W.	DRAWN	A.W.	CHECKED	F.M.	CONTRACT No. 20021
SCALE:	1:200 (FULL SIZE)			DRAWING NUMBER		C-01
DATE:	APR. 26,2019					

Nov 14, 2019-2:11pm

DRAWING NAME: F:\20021\Municipal\Contract drawings\C-01-Site Grading Plan.dwg



PROPOSED STORM CATCHBASIN

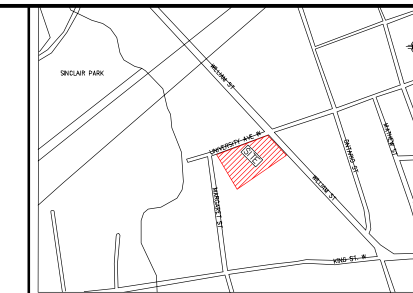
NO.	TOP. EL. (m)	INVERT (m)				STANDARD NUMBER
		N	E	W	S	
CB1	82.10			80.75		OPSD 705.010 OPSD 400.020
CB2	82.00				80.68	OPSD 705.010 OPSD 400.020
CB3	82.00				80.64	OPSD 705.010 OPSD 400.020
CB4	82.00		80.55			OPSD 705.010 OPSD 400.020
CBMH1	82.05		80.40	80.35		OPSD 701.010 OPSD 400.020

PROPOSED STORM SEWER MANHOLES

NO.	TOP. EL. (m)	INVERT (m)				STANDARD NUMBER
		N	E	W	S	
OGS	82.11	80.19	80.70		80.25	OPSD 701.010 OPSD 401.010
MH1	82.17	80.12			80.17	
MH2	81.73		79.92	79.92	79.99	OPSD 701.010 OPSD 401.010

PROPOSED SANITARY MANHOLES

NO.	TOP EL. (m)	INVERT (m)				STANDARD NUMBER
		N	E	W	S	
MH1A	82.29	81.15			81.20	OPSD 701.010 OPSD 401.010
MH2A	81.81		80.39	80.39	80.82	OPSD 701.010 OPSD 401.010



LEGEND

- EXISTING STORM MANHOLE
- EXISTING STORM CATCHBASIN MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXISTING HYDRO POLE
- PROPERTY LINE
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING WATER MAIN
- EXISTING GAS MAIN
- EXISTING TREE
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED WATER MAIN
- PROPOSED SANITARY SERVICE CONNECTION
- PROPOSED STORM SERVICE CONNECTION
- PROPOSED WATER VALVE & BOX
- PROPOSED CATCH BASIN
- PROPOSED AREA DRAIN
- PROP. TREE
- PROP. FENCE

GENERAL NOTES

- CONTRACTOR MUST CHECK & VERIFY ALL DIMENSIONS ON THE JOB.
- ELEVATIONS: ELEVATIONS SHOWN GEODETIC DRIVEN FROM TOWN OF COBOURG BENCH MARK #00121U2300 , ELEVATION 82.92M
- THE DEVELOPER SHALL ABANDON ALL EXISTING WATER SERVICES OF THE SITE BACK TO THE RESPECTED WATER MAINS ON UNIVERSITY AVENUE & WILLIAM STREET.
- ALL CATCH BASINS INCLUDE GOSS TRAP
- REFER TO DWG. C-01 FOR SITE GRADING.
- REFER TO DWG. C-03 FOR SITE SERVICING SECTIONS AND AND MANHOLE INVERTS.
- REFER TO DWG. C-03 FOR NOTES.
- ALL WATERMAIN WORK SHALL CONFORM TO THE LATEST LUSI WATERMAIN AND APPURTENANCES POLICY AND PROCEDURE TO BE FOLLOWED.

No.	DATE	DESCRIPTION
1	06/05/2019	ISSUED FOR ZBA
2	04/06/2019	ISSUED FOR SPA SUBMISSION
3	12/08/2019	ISSUED FOR SPA RESUBMISSION
4	23/09/2019	ISSUED FOR SPA RESUBMISSION
5	28/10/2019	ISSUED FOR SPA RESUBMISSION
6	14/11/2019	ISSUED FOR SPA RESUBMISSION

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325 UNIVERSITY AVENUE W. RESIDENTIAL DEVELOPMENT
SITE SERVICING PLAN

DESIGN	F.M.	DRAWN	M.N.	CHECKED	R.B.	CONTRACT No.	20021
SCALE:	1:200 (FULL SIZE)			DRAWING NUMBER		C-02	
DATE:	APRIL 26,2019						

Nov 14, 2019-4:46pm