2085 PINE STREET

CITY OF BURLINGTON

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

Prepared By:

Metropolitan Consulting Inc.

4450 Paletta Court

Burlington, ON L7L 5R2

April 2019

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1.0 INTRODUCTION

Metropolitan Consulting Inc. (MCI) has been retained by Pine Street Burlington Corp. to prepare a Functional Servicing Report (FSR) for the proposed re-development of 2085 Pine Street in the City of Burlington.

This FSR supports Zoning and Site Plan Applications for an eleven (11) storey condominium building complete with underground parking.

2.0 BACKGROUND

2.1 SITE LOCATION AND EXISTING CONDITIONS

The Site covers an area of 0.104 ha in the City of Burlington (the City) and is located on Pine Street between Pearl Street and Martha Street as shown in Figure 1.

The existing conditions are illustrated in Figure 2. The site slopes from the North to South side of the property. There is currently a one and a half storey heritage home, a detached garage and a shed on the property. The existing building is accessed from Pine Street via an asphalt driveway. There is a fence along the rear and side property lines.

2.2 PROPOSED DEVELOPMENT

The proposed Site plan, as shown in Figure 3 as the back of the report, consists of constructing an eleven storey residential building consisting of 39 units with three (3) levels of underground parking. The existing heritage home will be incorporated into the

new development as commercial space for the condominium. The existing garage, porch and shed will be demolished.



LEGEND

LOCATION

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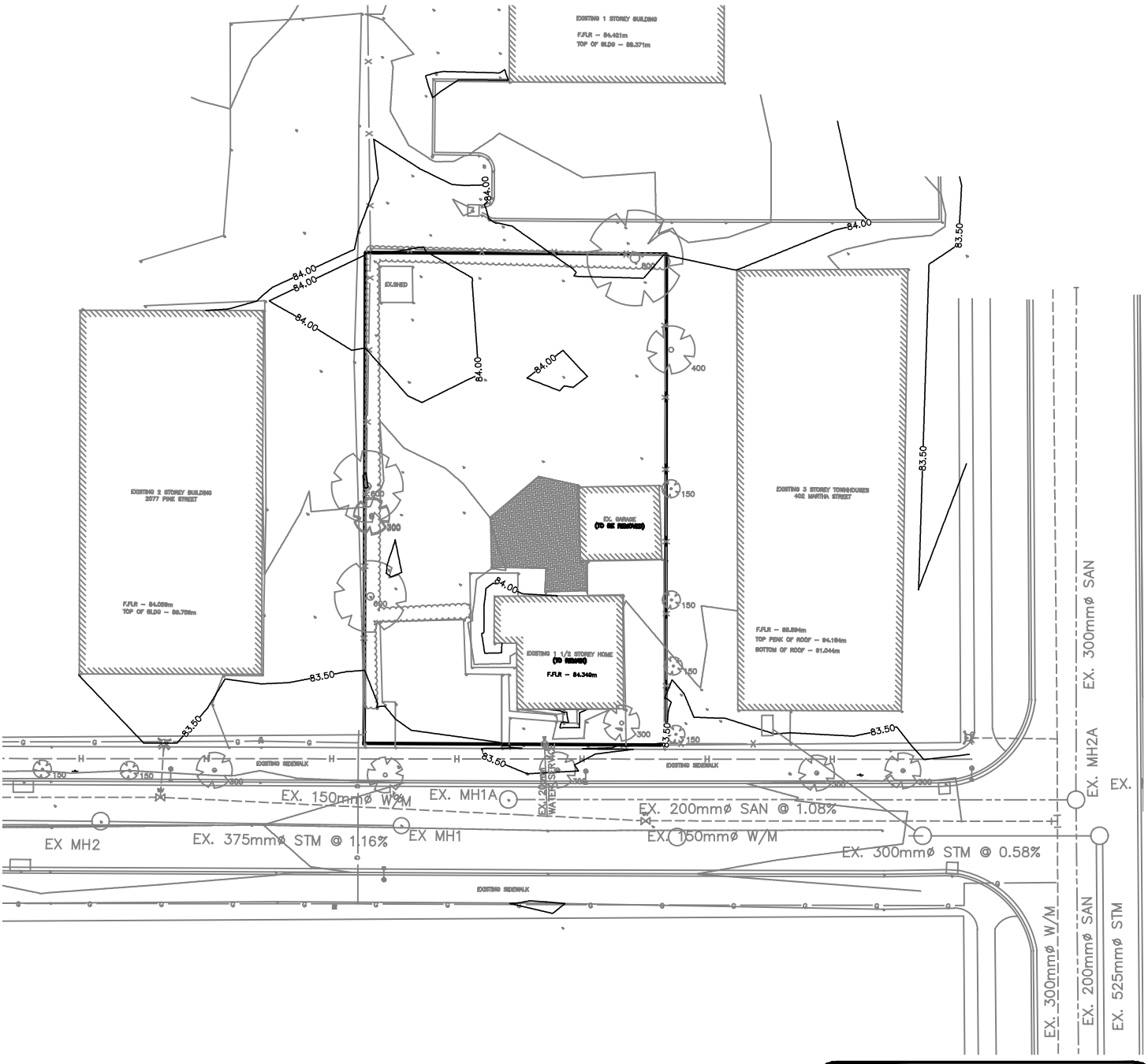
TITLE

LocationPlan

DATE	SCALE
APRIL 2019	N.T.S.

DWG

Figure 1



LEGEND

- PROPERTY BOUNDARY
- EXISTING WATERMAIN
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING DECIDUOUS TREE (350)
- EX.5 EXISTING STORM MANHOLE
- EX.5A EXISTING SANITARY MANHOLE
- EXISTING HYDRANT
- EXISTING VALVE
- EXISTING FENCE

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TITLE

Existing Conditions

DATE: APRIL 2019

SCALE: 1:500

DWG

Figure 2

3.0 ROADS

Pine Street is a local two lane urban road with on street metered parking on the north side. There is an existing sidewalk on both sides of Pine Street. The property drains to the existing storm sewer on Pine Street.

4.0 UTILITIES

Hydro to the existing building is fed from a single phase transformer. The electrical engineer for the building is required to confirm if a single phase transformer will be adequate to service the proposed building. If it is determined that the existing transformer is not adequate a three phase service will be required for the proposed development and a new pad mount transformer will need to be installed. A proposed transformer is shown on Figure 3.

There are existing telephone, gas and cable utilities in place to fully service the site. Utility locates will be required by the contractor prior to construction.

5.0 WATER SERVICING

5.1 EXISTING WATERMAINS

There is an existing 150mm Ø local distribution watermain along the north side of Pine Street. The existing house is serviced by a 20mm Ø copper service which connects to the 150mm Ø watermain.

5.2 PROPOSED WATER SERVICES

The existing 20mm Ø water service connection from Pine Street is to be abandoned and a new 100mm Ø water service & 150mm Ø fire service will be connected to the 150mm Ø watermain to service the building. The existing watermains and proposed service connections are shown on Figure 4: General Plan of Servicing (Back Pocket).

5.3 HYDRANTS

A hydrant flow test was completed on the fire hydrant on Pine Street to the west of the site. Two tests were completed resulting in pressures of 72 psi @1155.3 usgpm (72.9 L/s) and 70 psi @ 1764.8 usgpm (111.3 L/s). The projected flows at 20 psi are 350 and 406 L/s respectively. The lower value was used in comparing required fire flows for the proposed building.

Fire Demands were calculated for the proposed building using the methodology specified in “Water Supply Public Fire Protection” Fire Underwriters Survey (1999). The Building was determined to have a calculated fire demand of between 166.7 L/s and 283.3 L/s based on building area, type of construction, proposed sprinklers and exposures to all adjacent buildings within 45m. Fire Demand Calculations are shown in Appendix A.

Based on the results of the hydrant flow test and the fire demands for the proposed building, the building is not required to have a sprinkler system and be of ordinary or non-combustible construction to meet fire demands.

6.0 SANITARY SEWERS

6.1 BACKGROUND

Wastewater from the site drains to the Skyway Wastewater Treatment Plant (WWTP). The Skyway WWTP underwent an expansion to increase the capacity from 118 MLD to 140 MLD which was completed in 2016.

The Junction Street Sewage pumping station services this development and has a capacity of 16.2 ML/d. A refurbishment/replacement of the existing 300mm forcemain for the pumping station was completed in 2015.

Currently there is available capacity at the Skyway WWTP and Junction Street Pumping Station to service the proposed development. Capacity cannot be guaranteed until the issuance of a servicing permit by the Region of Halton.

6.2 EXISTING SANITARY SEWERS

As shown on Figure 4, there is an existing 200mm diameter sanitary sewer on Pine Street. Table 1 shows the existing sanitary sewer details used to calculate the capacity of the sewer.

Table 1 – Existing Sanitary Sewer Summary

Sewer	Diameter (mm)	Slope (%)	Manning's n	Capacity (L/s)
Pine Street	200	1.08	0.013	34.09

6.3 SANITARY SEWER CAPACITY

The sanitary flow generated from the proposed development was calculated in accordance with Halton Region standards as follows:

Design flow = Average flow * Peak Factor + Infiltration allowance

Average flow = 275 L / day per person or 0.003183 L/s per person.

For Apartment (over 6 stories high):

Population = 0.10ha *285 = 28.5 people **this is low therefore assume 2.2ppl/unit*39units (residential floors) = 86ppl**

The peaking factor using the Harmon Formula

$$M = \left(1 + \frac{14}{4+\sqrt{P}}\right)$$

P= tributary population in thousands contributing to the sewer

For 86 people there will be a Peak Factor M=4.26.

The infiltration allowance is 0.286 L/s/ha.

Design flow = 86 people * 0.003183 *4.26 + 0.286*0.10 = 1.17 + 0.029 =1.20 L/s

6.4 BUILDING FIXTURE UNITS

Floor plans provided by ATA Architects dated November 21, 2018 were used to calculate the fixture units in the building. The proposed building has 40 2-bedroom units. Each unit has laundry and a dishwasher. Table 2 shows the fixture units for the building.

Table 2 – Building Fixture Units Summary

Unit	Number of Units	Number of Bathrooms/unit	Fixtures/unit	Total Fixture Units
2 Bedroom	39	2	10	390
Party Space	N/A	1	4	4
TOTAL:	**40**			**394**

Based on Table 2 the building has approximately 394 fixture units. It was assumed in this calculation that the party area has 1 bathroom and a kitchen for approximately 4 fixture units.

6.5 PROPOSED SANITARY SERVICING

A 150mm sanitary service and manhole at the property line will be used to service the site. The proposed sanitary servicing is shown on Figure 4: Preliminary Servicing Design. Table 3 shows the proposed sanitary service details used to calculate the capacity of the sewer.

Table 3 – Proposed Sanitary Service Summary

	Diameter (mm)	Slope (%)	Manning's n	Capacity (L/s)	Flow from Site (L/s)
Proposed Service	150	2.0	0.013	21.5	1.20

As shown in Table 3, the flow from the proposed development is 1.20 L/s. The capacity of the 150mm service is 21.5 L/s and can handle the flow from site. The maximum allowed fixture units per 150mm service connection when draining at 2% is 480. There are approximately 394 fixture units in the proposed building which meets Region Standards.

7.0 GRADING AND DRAINAGE

7.1 EXISTING DRAINAGE CONDITIONS

There is an existing 375mm Ø storm sewer flowing west on Pine Street and a 300mm Ø storm sewer flowing east on Pine Street. The property drains by sheet-flow to the existing 300mm Ø and 375mm Ø Storm Sewers on Pine Street.

7.2 PROPOSED GRADING AND DRAINAGE PLAN

The proposed preliminary grading and drainage design is shown on Figure 5 (Back Pocket). Existing grades were obtained from a survey completed by Metropolitan Consulting. Wherever possible, site grading and drainage have been designed to maintain existing drainage patterns. Grading will be designed to drain runoff overland to the existing storm sewers on Pine Street.

As the site is primarily comprised of rooftop area, runoff from the building will be connected directly to a proposed storage tank located in the underground parking area. A 300mm Ø storm sewer will connect the storage tank to the existing 375mm Ø storm sewer on Pine Street as shown on Figure 4 - General Servicing Plan (back pocket). Drainage from the ramp to the underground parking garage is to be designed by the buildings Engineer.

8.0 STORMWATER MANAGEMENT

8.1 STORMWATER MANAGEMENT DESIGN OBJECTIVES

The proposed Stormwater Management plan will be designed to meet the water quantity and quality control objectives as outlined by The City of Burlington:

- Quality Control - Level 1 (Enhanced) 80% TSS removal or Cash in Lieu
- Quantity Control – 100 year Post development peak flow to 2 year pre development peak flow control

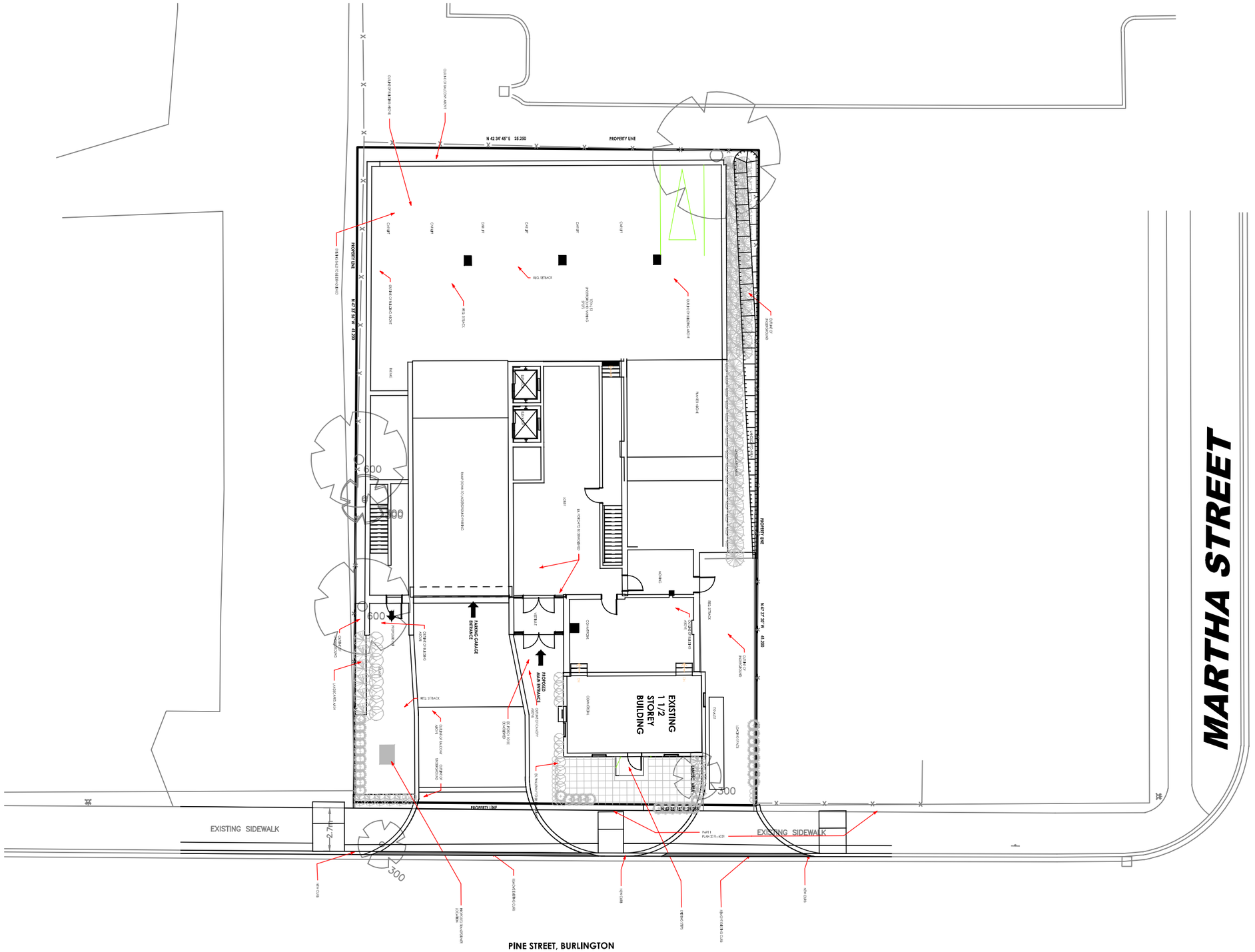
8.2 EXISTING DRAINAGE

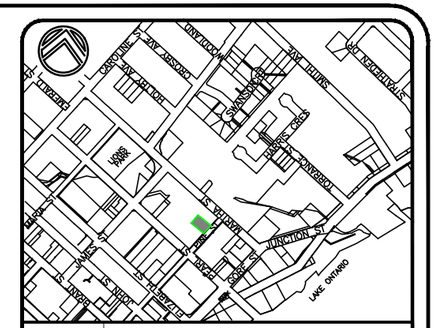
The average runoff coefficient for the pre-development conditions was found to be 0.53. Table 4 shows the breakdown of existing impervious areas.

Table 4 – Existing Conditions Impervious Area Summary

TOTAL SITE	Contributing Area	Total Area (ha)	C
house and driveway	EX1	0.039	0.90
grassed area	EX2	0.063	0.30
small grassed area	EX3	0.002	0.30
	TOTAL AREAS	**0.104**	**0.53**

The pre-development drainage boundaries are shown on the Existing Storm Drainage Area Plan, Figure 6.





LEGEND :

- EXISTING STREETLIGHT
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- EXISTING HYDRO TRANSFORMER
- EXISTING BELL BOX
- EXISTING HYDRANT
- EXISTING VALVE
- EXISTING HYDRO–POLE
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED CURB BOX
- PROPOSED CATCHBASIN
- PROPOSED 3–WAY HYDRANT
- PROPOSED VALVE
- PROPOSED VALVE CHAMBER
- PROPOSED HYDRO TRANSFORMER
- x (235.87) PROPOSED ELEVATION
- x235.00 EXISTING ELEVATION
- 42.05m ● 2.3% PROPOSED SURFACE DRAINAGE
- EXISTING SWALE
- 2.0% PROPOSED SWALE
- 105.00 EXISTING CONTOUR MAJOR
- 105.50 EXISTING CONTOUR MINOR
- EXISTING CONIFEROUS TREE
- EXISTING DECIDUOUS TREE
- EXISING FENCE

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MUNICIPALITY: CITY OF Burlington

PROJECT:

2085 Pine Street Functional Servicing Report

TITLE:

Proposed Site Plan

DATE: APRIL 2019

SCALE: 0 1 2 3 4 5 — 1:250

DRAWING:

Figure 3

GENERAL NOTES

1. ALL DIMENSIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.

2. ALL DIMENSIONS AND ELEVATIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY. DETAILS ARE NOT TO BE SCALED FROM DRAWINGS.

3. IT IS THE CONTRACTORS RESPONSIBILITY TO HAVE UTILITIES LOCATED PRIOR TO CONSTRUCTION.

4. THE CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE AND SUPPORT OF ALL EXISTING SERVICES & UTILITIES ENCOUNTERED DURING CONSTRUCTION

STORM SEWERS
1. DRAINAGE FROM BUILDING TO BE CONNECTED TO STORM SERVICE AT PROPERTY LINE.

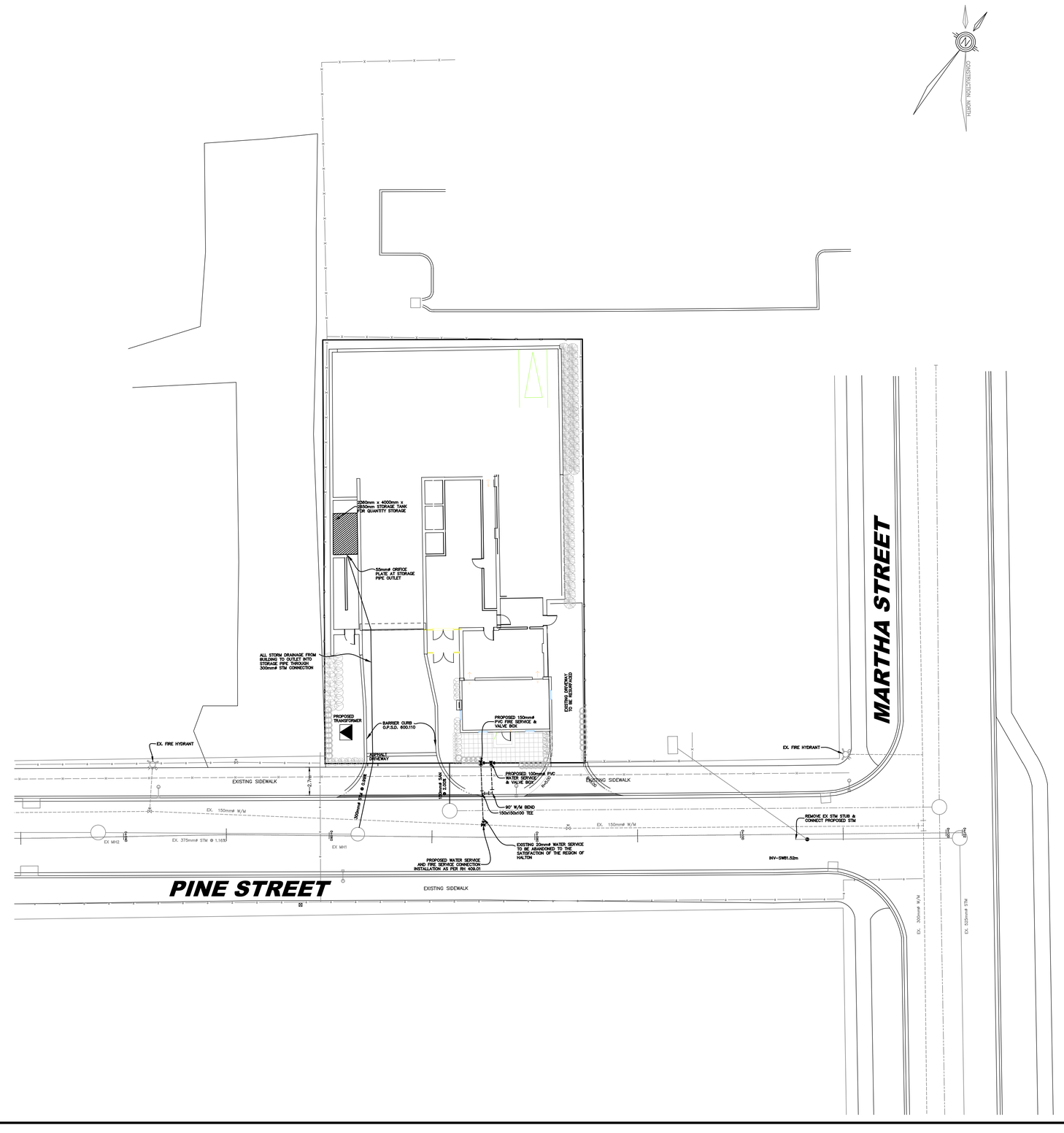
SANITARY SEWERS
1. SANITARY SEWERS ARE NOT PERMITTED TO ACCEPT ANY STORM DRAINAGE, INCLUDING FOUNDATION, ROOF DRAINAGE AND WEEPING TILE CONNECTIONS.
2. MINIMUM COVER OF 2.75m TO BE MAINTAINED OVER SANITARY SERVICE.

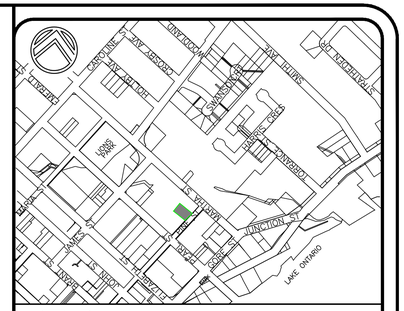
WATERMAIN NOTES
1. TAPPINGS TO EXISTING WATERMAINS SHALL BE COMPLETED BY REGION OF HALTON STAFF ONLY.

2. MINIMUM COVER OF 1.7m TO BE MAINTAINED OVER WATER SERVICE.

LOT GRADING
1. ANY WORKS WITHIN ROW SHALL BE TO CITY OF BURLINGTON SPECIFICATIONS

2. ANY NEIGHBOURING PRIVATE PROPERTY DISTURBED DUE TO CONSTRUCTION SHALL BE REINSTATED TO MEET OR EXCEED EXISTING CONDITIONS TO THE SATISFACTION OF THE PROPERTY OWNERS.





KEY PLAN N.T.S.

LEGEND :

- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- EXISTING HYDRANT
- EXISTING VALVE
- EXISTING REDUCER
- EXISTING CURB BOX
- EXISTING STREETLIGHT
- 102A PROPOSED SANITARY MANHOLE
- 100 PROPOSED STORM MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED HYDRANT
- PROPOSED VALVE
- PROPOSED VALVE CHAMBER
- PROPOSED HYDRO TRANSFORMER

- 525mmø STM — PROPOSED STORM SEWER
- 525mmø STM — EXISTING STORM SEWER
- 525mmø SAN — PROPOSED SANITARY SEWER
- 525mmø SAN — EXISTING SANITARY SEWER
- 200mmø WM — PROPOSED WATER SERVICE
- 200mmø WM — EXISTING WATERMAIN
- EXISTING WATER SERVICE

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PROJECT:

2085 Pine Street Functional Servicing Report

TITLE:

Proposed Servicing Plan

DATE: **APRIL 2019**

SCALE: 0 5 10 — 1:200

DRAWING:

Figure 4

GENERAL NOTES

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3. IT IS THE CONTRACTORS RESPONSIBILITY TO HAVE UTILITIES LOCATED PRIOR TO CONSTRUCTION.
4. THE CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE AND SUPPORT OF ALL EXISTING SERVICES & UTILITIES ENCOUNTERED DURING CONSTRUCTION

STORM SEWERS

1. DRAINAGE FROM BUILDING TO BE CONNECTED TO STORM SERVICE AT PROPERTY LINE.

SANITARY SEWERS

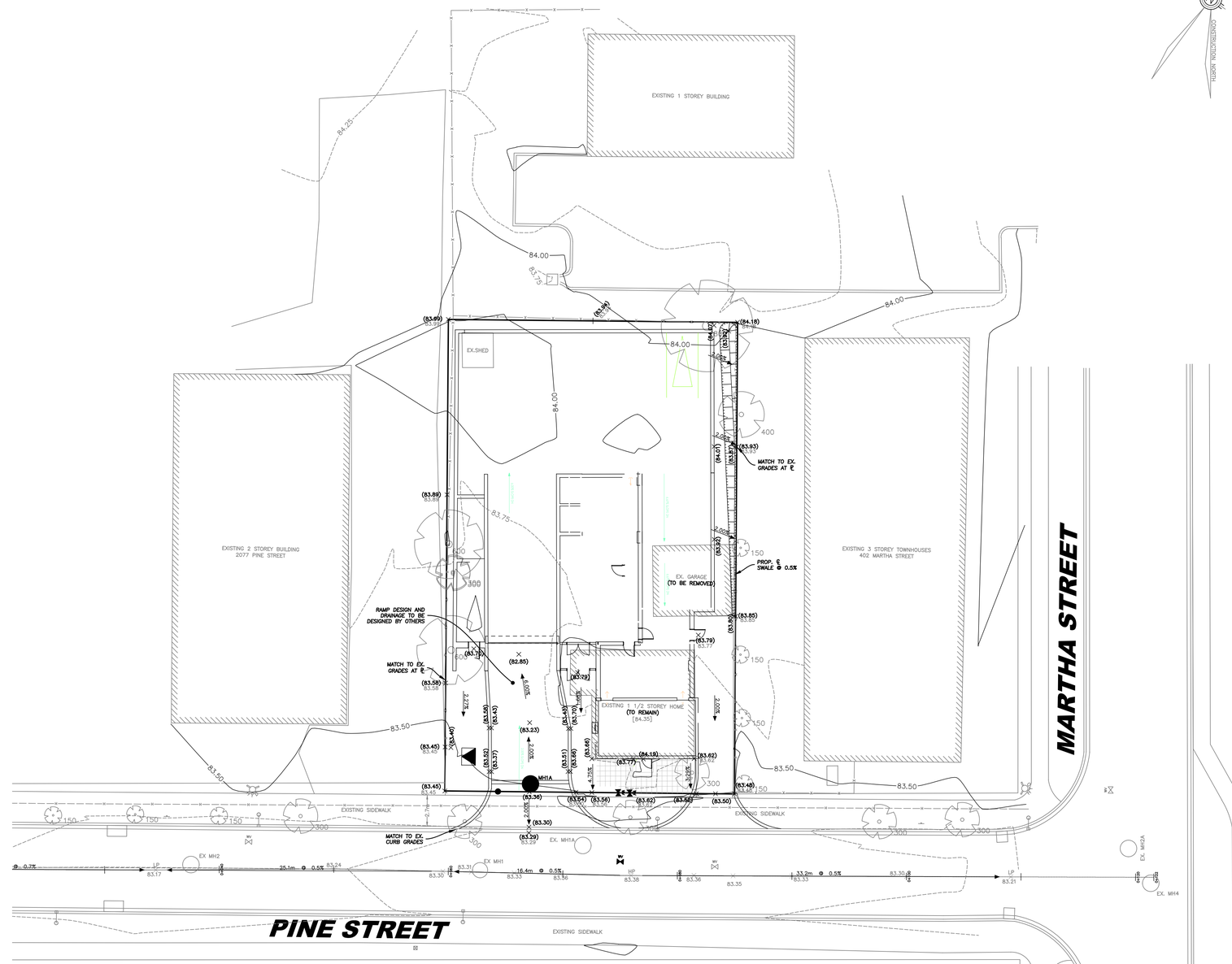
1. SANITARY SEWERS ARE NOT PERMITTED TO ACCEPT ANY STORM DRAINAGE, INCLUDING FOUNDATION, ROOF DRAINAGE AND WEEPING TILE CONNECTIONS.
2. MINIMUM COVER OF 2.75m TO BE MAINTAINED OVER SANITARY SERVICE.

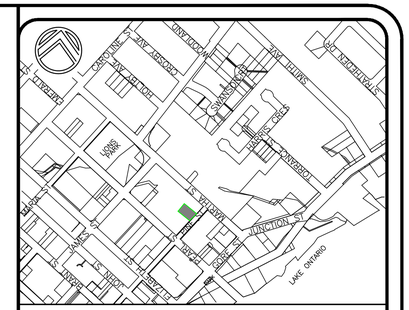
WATERMAIN NOTES

1. TAPPINGS TO EXISTING WATERMAINS SHALL BE COMPLETED BY REGION OF HALTON STAFF ONLY.
2. MINIMUM COVER OF 1.7m TO BE MAINTAINED OVER WATER SERVICE.

LOT GRADING

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2. ANY NEIGHBOURING PRIVATE PROPERTY DISTURBED DUE TO CONSTRUCTION SHALL BE REINSTATED TO MEET OR EXCEED EXISTING CONDITIONS TO THE SATISFACTION OF THE PROPERTY OWNERS.





KEY PLAN N.T.S. LOCATION

LEGEND :

- EXISTING STREETLIGHT
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- EXISTING HYDRO TRANSFORMER
- EXISTING BELL BOX
- EXISTING HYDRANT
- EXISTING VALVE
- EXISTING HYDRO–POLE
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED CURB BOX
- PROPOSED CATCHBASIN
- PROPOSED HYDRANT
- PROPOSED VALVE
- PROPOSED VALVE CHAMBER
- PROPOSED TRANSFORMER

- x (235.87) PROPOSED ELEVATION
- x235.00 EXISTING ELEVATION
- [237.15] FIRST FLOOR ELEVATION
- 42.05m @ 2.3% PROPOSED SURFACE DRAINAGE
- EXISTING SWALE
- 2.0% PROPOSED SWALE
- 105.00 EXISTING CONTOUR MAJOR
- 105.50 EXISTING CONTOUR MINOR
- EXISTING DECIDUOUS TREE TO BE REMOVED
- EXISTING DECIDUOUS TREE TO REMAIN
- EXISING FENCE

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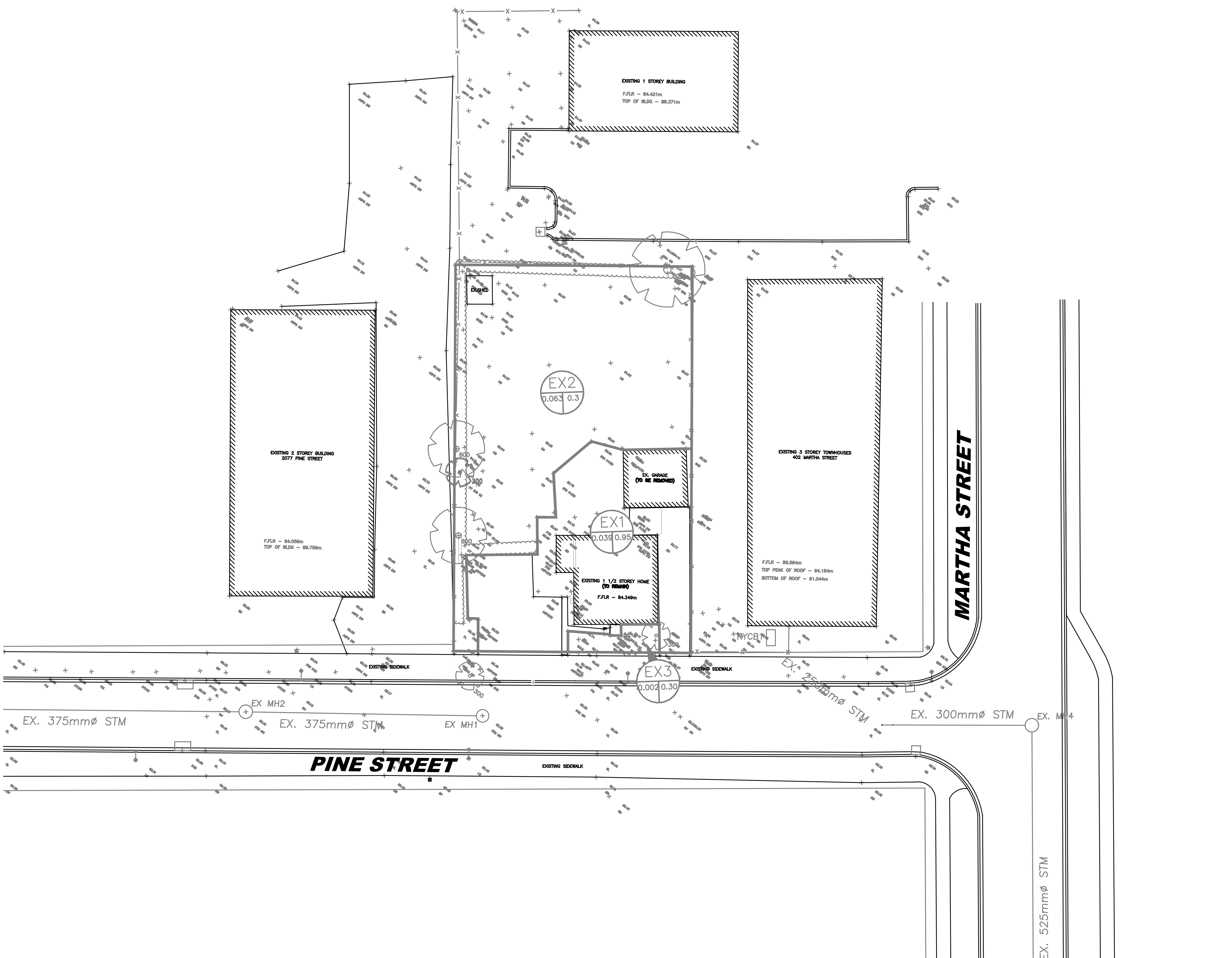
PROJECT:
2085 Pine Street
Functional Servicing Report

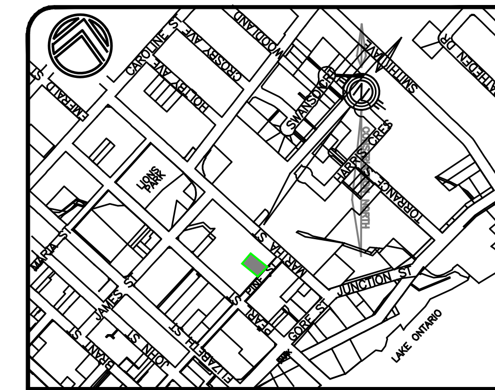
TITLE:
Preliminary Grading and Drainage Plan

DATE: **APRIL 2019**

SCALE: 0 5 10 1:200

DRAWING:
Figure 5





KEY PLAN N.T.S. LOCATION

LEGEND :

- EXISTING MANHOLE
- EXISTING CURB BOX
- EXISTING DOUBLE CATCHBASIN
- EXISTING CATCHBASIN
- EXISTING HYDRANT
- WV EXISTING VALVE
- EXISTING STREETLIGHT
- 102A PROPOSED SANITARY MANHOLE
- 100 PROPOSED STORM MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED HYDRANT
- WV PROPOSED VALVE
- WVC PROPOSED VALVE CHAMBER
- 525mmø STM — PROPOSED STORM SEWER
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- 525mmø SAN — PROPOSED SANITARY SEWER
- 525mmø SAN — EXISTING SANITARY SEWER
- 525mmø WM — PROPOSED WATER SERVICE
- 525mmø WM — EXISTING WATER MAIN

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MUNICIPALITY: City of Burlington

PROJECT:

2085 Pine Street Functional Servicing Report

TITLE:

Existing Storm Drainage Areas

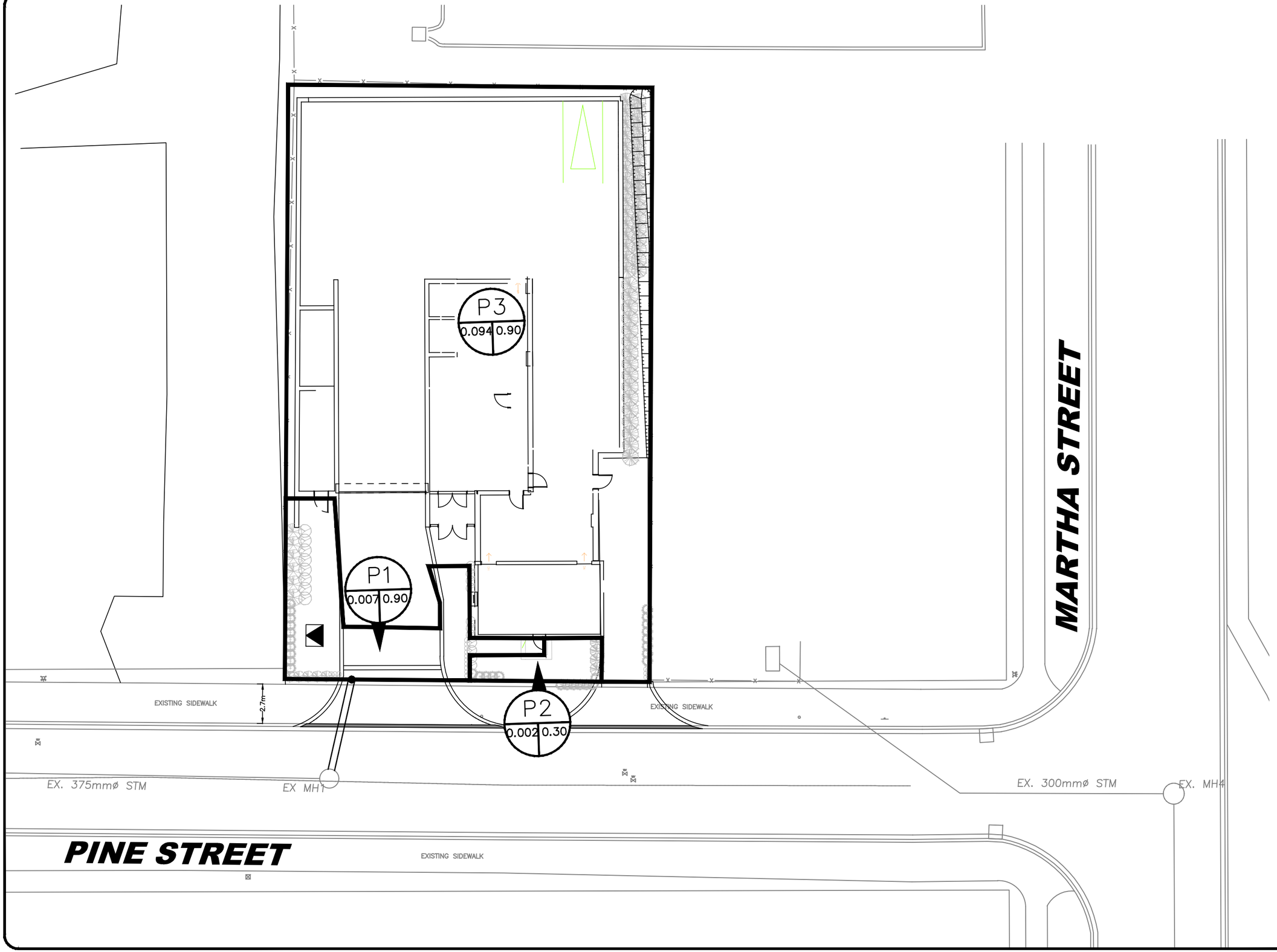
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DRAWING:

Figure 6

8.3 PROPOSED STORMWATER MANAGEMENT PLAN

The proposed stormwater management plan is shown on Figure 7, Proposed Storm Drainage Area Plan.



LEGEND

- 10 PROPOSED STORM MANHOLE
- PROPOSED CATCHBASIN
- EXISTING CATCHBASIN
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- PROPOSED STORM DRAINAGE AREA BOUNDARY

P-1 — DRAINAGE AREA No.
0.65 1.00
AREA (Ha) — RUNOFF COEFFICIENT

CLIENT

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MUNICIPALITY

CITY OF BURLINGTON, ONTARIO, CANADA

SCALE

1: 250

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PROJECT

2085 Pine Street

DWG

STORM DRAINAGE AREA PLAN

DATE **Oct 2018** | PROJECT NO. **Y18006**

FIGURE 7

8.4 STORMWATER MANAGEMENT DESIGN

8.4.1 *Quality Control Design*

It is required that the runoff from the site be treated as Level One runoff – 80% TSS removal or Cash in Lieu be provided. The proposed plan has a majority of development area as building rooftop which is considered clean runoff. Only a small area in which runoff will be contaminated and cash in Lieu will be paid instead of providing quality control for this site.

8.4.2 *Quantity Control Design*

Quantity control for the site will be provided through a storage tank located within the underground parking level of the proposed building which will be designed to store up to the 100 year post development storm flow and release at the 2-year pre development peak flow. This flow will be controlled via a 55mm Ø orifice structure at the outlet. Details of the quantity control design are provided in the following sections.

8.5 PEAK FLOW MODELLING

8.5.1 *Pre-Development Conditions*

The existing conditions were modeled using the rational method based on an average runoff coefficient of 0.53 calculated using the current site conditions. Using the City of Burlington IDF data curve, the 2 year existing conditions peak flow is 0.01 m^3/s. The pre-development condition calculations are shown in Appendix B.

8.5.2 *Post-Development Conditions*

The average runoff coefficient based on the proposed site plan is 0.79. Land use breakdown calculations are shown in Table 2 below.

Table 5 – Proposed Development Impervious Area Summary

TOTAL SITE	Contributing Area	Total Area (ha)	C
Driveway	P1	0.002	0.9
Landscaped area	P2	0.007	0.3
Building & Driveway	P3	0.095	0.9
	TOTAL AREAS	**0.104**	**0.79**

The post development drainage areas are shown on the storm drainage area plan - Figure 7 (above).

8.5.3 *Flow to Storage Pipe*

The 100 year post development condition was modeled in using the rational method as the site is small in size and this method tends to produce conservative results compared to other modeling software. The required storage volume was found by modeling the 100 year post development flow with a total release rate from the 2 year pre development peak flow.

A copy of the pre and post development flow rates and storage volume calculations are found in Appendix B.

Table 6 shows the storage with depth in the storage tank.

Table 6 - Tank Storage			
Stage (%)	**Stage (mm)**	**Q_{out} (m^3/s)**	**Total Storage (m^3)**
100.00	2.650	0.011	25.04
95.00	2.518	0.011	23.79
90.00	2.385	0.010	22.53
85.00	2.253	0.010	21.28
80.00	2.120	0.010	20.03
70.00	1.855	0.009	17.53
60.00	1.590	0.008	15.02
50.00	1.325	0.008	12.52
40.00	1.060	0.007	10.01
30.00	0.795	0.006	7.51
20.00	0.530	0.005	5.01
10.00	0.265	0.003	2.50
0.00	0.000	0.000	0.00

The proposed design provides 23.79 m^3 of storage for the 100 year storm with the pipe at 95% full. From the SWM results it was found that a storage volume of 20.4 m^3 is required to control the outflow to the 2 year existing condition peak flow. Table 7 summarizes these results.

Table 7 - Storage Requirements		
Control	**Storage Volume Required (m^3)**	**Storage Volume Provided (m^3)**
100 yr Post to 2 yr Pre	20.4	23.79

The storage pipe design sheet can be found in Appendix B. Table 6 shows a summary of flows generated from the model under existing and post-development conditions.

Table 8 - Existing and Post Development Flows			
		2 Year	**100 Year**
Conditions	**Average Runoff Coefficient (C)**	**Uncontrolled Flow (m^3/s)**	**Controlled Flow (m^3/s)**
Existing	0.53	0.01	
Post Development	0.79		0.01

A 4000mm wide x 2360mm deep box section with a total height of 2650 mm will provide the storage required. A 55mm Ø orifice will be used to control the outflow to the Pine Street sewer to 0.01 m^3/s which meets the allowed release rate.

9.0 EROSION AND SEDIMENT CONTROL

Erosion and sedimentation control measures will be implemented during construction.

Erosion control measures will include:

- Sediment traps in catch basins

- Installation of silt fence around limits of construction
- Gravel mud-mats at construction entrance

The erosion and sedimentation control measures will be retained in place during servicing, building construction and landscaping until the site is fully stabilized. Inspection and monitoring will be carried out to ensure erosion and sediment controls are maintained and where required, will be repaired by the developer/contractor.

10.0 CONCLUSION

An eleven (11) storey condominium consisting of 39 units with underground parking is proposed to be constructed at 2085 Pine Street. A proposed storm sewer on Pine Street will connect to the existing storm sewer to service the proposed development. A 2.4m x 4.0m x 2.65m storage tank complete with 55mm orifice will control the 100 year post development peak flows to the 2 year pre development peak flow. The proposed grading, drainage and stormwater management design conforms to City of Burlington standards.

Prepared By:

LICENSED PROFESSIONAL ENGINEER
04/22/2019
K.D. HOLLINGSWORTH
100152747
PROVINCE OF ONTARIO

Kevin Hollingworth, P. Eng.

APPENDIX A – WATERMAIN HYDRAULIC ANALYSIS CALCULATIONS

Hydrant Flow Test Results Calculation Sheet

Location **Job Name**

2085 Pine Street
Burlington, Ontario

City Water Main Size	Static Pressure	
	75 psi	0 Usgpm

Test 1

Outlet Size	2.5	"	
Number of Outlets	1		
Discharge Coefficient	0.8		
Pitot Reading	60	psi	Test 1 Result
Residual Reading	72	psi	72 psi @ 1155.3 Usgpm

Test 2

Outlet Size	2.5	"	
Number of Outlets	2		
Discharge Coefficient	0.8		
Pitot Reading	35	psi	Test 2 Result
Residual Reading	70	psi	70 psi @ 1764.8 Usgpm

Test 3

Outlet Size	0	"	
Number of Outlets	0		
Discharge Coefficient	0		
Pitot Reading	0	psi	Test 3 Total Result
Residual Reading	0	psi	0 psi @ 0.0 Usgpm

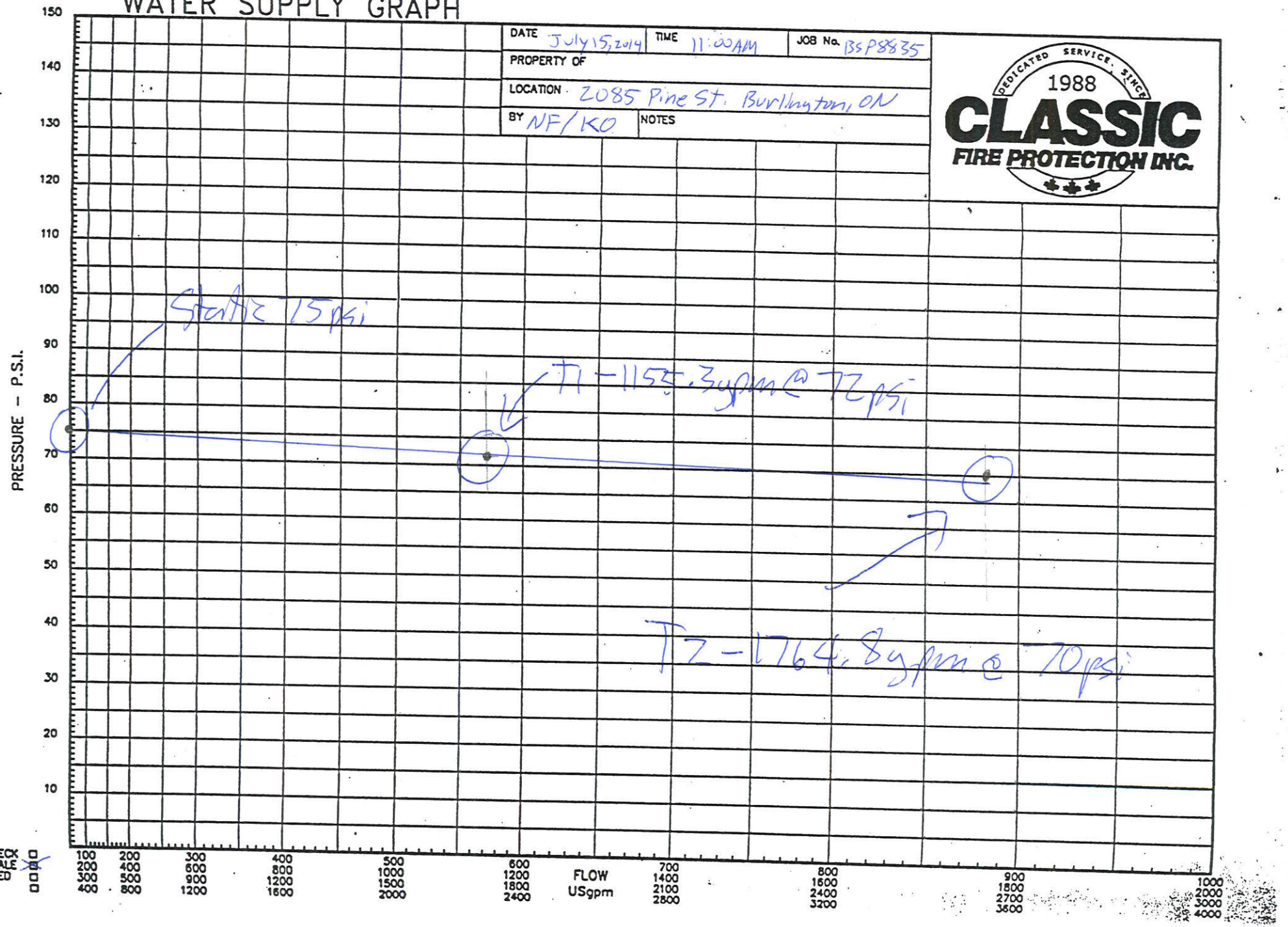
Test 4

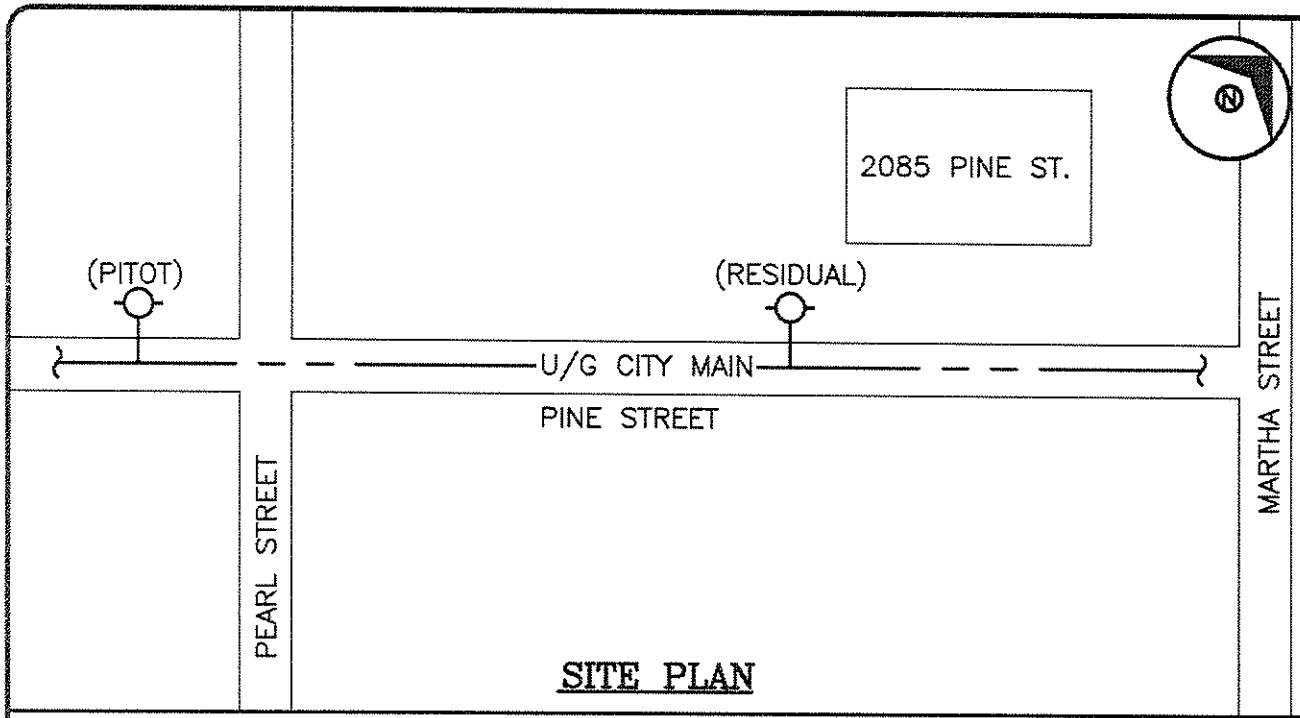
Outlet Size	0	"	
Number of Outlets	0		
Discharge Coefficient	0		
Pitot Reading	0	psi	Test 4 Total Result
Residual Reading	0	psi	0 psi @ 0.0 Usgpm

WATER SUPPLY GRAPH

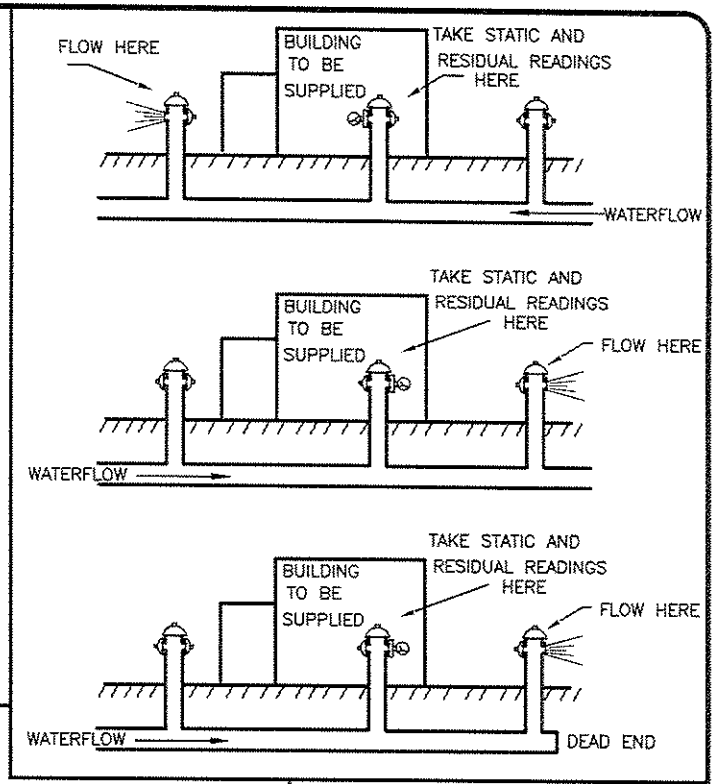
DATE July 15, 2014	TIME 11:00 AM	JOB No. BSP8835
PROPERTY OF		
LOCATION 2085 Pine St. Burlington, ON		
BY NF/KO	NOTES	

DEDICATED SERVICE SINCE 1988
CLASSIC FIRE PROTECTION INC.





SITE PLAN



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					
T1	1x2 1/2	.8	75	72	60	1155.3
T2	2x2 1/2	.8	75	70	35	1764.8
	3x2 1/2					
	4x2 1/2					
	FM NOZZLE					
	1x2 1/4					
	2x2 1/4					
	3x2 1/4					
	4x2 1/4					

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:

2085 PINE STREET

BURLINGTON, ONT

1988 CLASSIC FIRE PROTECTION INC.
100 Penn Drive
North York, ON
M9L 2A8
(416) 740-3000
E-mail: engineering@classicfire.com

Date: September 28, 2018
MCI File: Y18006
Prepard By: K. Hollingworth

2085 Pine Street, Burlington, ON
Fire Conversion Calculations

Address	Location	Date of Test	Static Pressure (psi)	Residual Pressure (psi)	Test Flow (gpm)	DSR	DSR2	Projected Flow at 20 psi (gpm)	Projected Flow at 20 psi (L/s)
2085 Pine Street	2077 Pine Street	15/07/2014 11:00	75	72	1155.3	3	55	5557	350.6
2085 Pine Street	2077 Pine Street	15/07/2014 11:00	75	70	1764.8	5	55	6442	406.4

Date: December 3, 2018
File: Y18006
Prepared By: K. Hollingworth

2085 Pine Street

Appendix A: Water Demand Calculations

No. Units	Equivalent Pop. Coefficients (person/unit)	Total Equivalent Population	Daily Average usage rate L/person/day	Daily Average usage		Max. Day		Peak Hour		Max day + Fire Flow	
				m^3/day	L/s	Coefficent	Demand L/s	Coefficent	Demand L/s	Fire Flow L/s	Demand L/s
40	2.2	88.0	275	24.20	0.28	2.25	0.63	4.00	1.12	266.67	267.30

File #: Y18006
Date: September 24, 2018
Prepared By: KDH

2085 Pine St

Fire Flow Demand Calculations (Option A: Non Combustible Construction & Sprinkler System)

$F = 220C\sqrt{A}$

C = coefficient for type of construction
A = total floor area in m² (including all storeys, but excluding basements)
F = fire flow required

Fire Flow Calculation

1) ***F= 220*C*√A***

C= 0.8 Assume non-combustible construction
A= 2976.6 m^2 two largest floors + 50% floors 3-10
F= 9602 L/min Rounds off to 10000 L/min

2) ***Assume limited combustible contents, therefore fire-flow requirements can be reduced by 15%***

F= 8500 L/min

3) ***Assume automatic sprinkler protection, therefore fire-flow requirements can be reduced by 30%***

F= 5950 L/min

4) ***4 Exposures from structure within 45m. 2 @ 3.1-10m & 2 @ 10.1 to 20m, Therefore fire-flow increases by 70%***

10115 L/min

FIRE DEMAND (Calculated**) = 10000 L/min** (Result from step 4) taken and rounded to nearest thousand Litres

or

FIRE DEMAND (Calculated**) = 166.7 L/s**

Therefore use 166.7 L/s for Fire Demand

File #: Y18006
Date: September 24, 2018
Prepared By: KDH

2085 Pine St

Fire Flow Demand Calculations - (Option B: Ordinary Construction & Sprinkler System)

F = 220C√ A

C = coefficient for type of construction
A = total floor area in m² (including all storeys, but excluding basements)
F = fire flow required

Fire Flow Calculation

1) ***F= 220*C*√A***

C= 1.0 Assuming Ordinary Construction

A= 2977 m2 two largest floors + 50% floors 3-10

F= 12003 L/min Rounds off to 12000 L/min

2) ***Low occupancy hazard with limited combustible contents, therefore fire-flow requirements can be reduce by 15%***

F= 10200 L/min

3) ***Assume Automatic sprinkler and alarm system present, therefore fire-flow requirements can be reduce by 30%***

F= 7140 L/min

4) ***4 Exposures from structure within 45m. 2 @ 3.1-10m & 2 @ 10.1 to 20m, Therefore fire-flow increases by 70%***

F= 12138 L/min

REQUIRED FLOW = 12000 L/min Result from step 4) takend and rounded to nearest thousand Litres

or

REQUIRED FLOW = 200.0 L/s

Therefore use 200 L/s for Fire Demand

File #: Y18006
Date: September 24, 2018
Prepared By: KDH

2085 Pine St

Fire Flow Demand Calculations (Option C -Non-Combustible Construction & No Sprinkler System)

$F = 220C\sqrt{A}$

C = coefficient for type of construction
A = total floor area in m² (including all storeys, but excluding basements)
F = fire flow required

Fire Flow Calculation

1) ***F= 220*C*√A***

C= 0.8 Assumes Non-combustible construction
A= 2976.6 m2 two largest floors + 50% floors 3-10
F= 9602 L/min Rounds off to 10000 L/min

2) ***Assume limited combustible contents, therefore fire-flow requirements can be reduced by 15%***

F= 8500 L/min

3) ***Assume no automatic sprinkler protection, therefore fire-flow requirements cannot be reduced***

F= 8500 L/min

4) ***4 Exposures from structure within 45m. 2 @ 3.1-10m & 2 @ 10.1 to 20m, Therefore fire-flow increases by 70%***

F= 14450 L/min

FIRE DEMAND (Calculated**) = 14000 L/min** (Result from step 4) taken and rounded to nearest thousand Litres

or

FIRE DEMAND (Calculated**) = 233.3 L/s**

Therefore use 233.3 L/s for Fire Demand

File #: Y18006
Date: September 24, 2018
Prepared By: KDH

2085 Pine St

Fire Flow Demand Calculations (Option D - Ordinary Construction & No Sprinkler System)

$F = 220C\sqrt{A}$

C = coefficient for type of construction
A = total floor area in m² (including all storeys, but excluding basements)
F = fire flow required

Fire Flow Calculation

1) ***F= 220*C*√A***

C= 1.0 Assumes Ordinary Construction
A= 2976.6 m2 two largest floors + 50% floors 3-10
F= 12003 L/min Rounds off to 12000 L/min

2) ***Assume limited combustible contents, therefore fire-flow requirements can be reduced by 15%***

F= 10200 L/min

3) ***Assume no automatic sprinkler protection, therefore fire-flow requirements cannot be reduced***

F= 10200 L/min

4) ***4 Exposures from structure within 45m. 2 @ 3.1-10m & 2 @ 10.1 to 20m, Therefore fire-flow increases by 70%***

F= 17340 L/min

FIRE DEMAND (Calculated) = 17000 L/min (Result from step 4) taken and rounded to nearest thousand Litres

or

FIRE DEMAND (Calculated) = 283.3 L/s

Therefore use 283.3 L/s for Fire Demand

APPENDIX B – SWM DESIGN CALCULATIONS

Job#: Y18006 - 2085 Pine Street

Client: Pine Street Burlington Corp

Pre Development Land Use

City of Burlington Rainfall Data	a	b	c	Intensity (tc = 10 min)
2-Year Storm	592.60	6.00	0.780	***68.16 mm/hr***
5-Year Storm	697.40	5.00	0.764	***88.09 mm/hr***
10-Year Storm	798.50	5.00	0.763	***101.14 mm/hr***
25-Year Storm	926.90	5.00	0.762	***117.72 mm/hr***
50-Year Storm	1019.40	5.00	0.761	***129.82 mm/hr***
100-Year Storm	1114.20	5.00	0.761	***141.89 mm/hr***

Existing Property

Land Use	Runoff Coefficient	Site Area (m^2)
Gravel Areas	0.60	0
Rooftop Areas	0.90	142
Asphalt / Concrete Areas	0.90	248
Landscaped (Grassed) Areas	0.30	650
Total Area		1,040
Composite Runoff Coefficient (2 to 10-Year)		0.53
Composite Runoff Coefficient (25-Year)*		0.58
Composite Runoff Coefficient (50-Year)*		0.63
Composite Runoff Coefficient (100-Year)*		0.66

Existing Property Storm Event	Intensity Data (10 min Duration)		Runoff Coefficient		Peak Runoff Rates	
2-Year Storm	68.2	mm/hr	***0.525***	***2-Year***	***0.010 m^3/s***	***2-Year flow***
5-Year Storm	88.1	mm/hr	***0.525***	***5-year***	***0.013 m^3/s***	***5-year flow***
10-Year Storm	101.1	mm/hr	***0.525***	***10-year***	***0.015 m^3/s***	***10-year flow***
25-Year Storm	117.7	mm/hr	***0.578***	***25-year***	***0.020 m^3/s***	***25-year flow***
50-Year Storm	129.8	mm/hr	***0.630***	***50-year***	***0.024 m^3/s***	***50-year flow***
100-Year Storm	141.9	mm/hr	***0.656***	***100-year***	***0.027 m^3/s***	***100-year flow***

Job#: Y18006 - 2085 Pine Street
Client: Pine Street Burlington Corp

Post Development Land Use

City of Burlington Rainfall Data	a	b	c	Intensity (tc = 10 min)
2-Year Storm	592.60	6.00	0.780	***68.16 mm/hr***
5-Year Storm	697.40	5.00	0.764	***88.09 mm/hr***
10-Year Storm	798.50	5.00	0.763	***101.14 mm/hr***
25-Year Storm	926.90	5.00	0.762	***117.72 mm/hr***
50-Year Storm	1019.40	5.00	0.761	***129.82 mm/hr***
100-Year Storm	1114.20	5.00	0.761	***141.89 mm/hr***

Proposed Site - Overall

Land Use	Runoff Coefficient	Site Area (m^2)	pre area	difference --> post - pre
Gravel Areas	0.70	0	0	
Rooftop Areas	0.90	737	142	
Asphalt / Concrete Areas	0.90	136	248	
Landscaped (Grassed) Areas	0.20	167	650	
Total Area		1040	1040	
Composite Runoff Coefficient (2 to 10-Year)		0.79		
Composite Runoff Coefficient (25-Year)*		0.87		
Composite Runoff Coefficient (50-Year)*		0.95		
Composite Runoff Coefficient (100-Year)*		0.98		

Proposed Site - Overall Storm Event	Intensity Data (10 min Duration)		Runoff Coefficient		Peak Runoff Rates	
2-Year Storm	68.2	mm/hr	***0.788***	***2-Year***	***0.016 m^3/s***	***2-Year flow***
5-Year Storm	88.1	mm/hr	***0.788***	***5-year***	***0.020 m^3/s***	***5-year flow***
10-Year Storm	101.1	mm/hr	***0.788***	***10-year***	***0.023 m^3/s***	***10-year flow***
25-Year Storm	117.7	mm/hr	***0.866***	***25-year***	***0.029 m^3/s***	***25-year flow***
50-Year Storm	129.8	mm/hr	***0.945***	***50-year***	***0.035 m^3/s***	***50-year flow***
100-Year Storm	141.9	mm/hr	***0.984***	***100-year***	***0.040 m^3/s***	***100-year flow***

Site: 198 First Rd W MCI Project No. **Y18006**
Client: Pine Street Burlington Corp
Bowstring Method Storage Calculations
Stormwater Storage Volume Requirements

2-Year

Catchment Area	0.104	ha
Post-Development Runoff Coefficient	0.79	
Reduced Flowrate	0.010	m^3/s
Initial Time	0	min
Required Storage	**3.3**	m^3
A	592.60	
B	6.00	
C	0.78	

Duration (min)	IDF Intensity (mm/hr)	Post Development Peak Q (m^3/s)	Inflow Volume (m^3)	Outflow Volume (m^3)	Required Storage (m^3)
0	146.5	0.033	0.0	0.0	0.0
1	129.9	0.030	1.8	0.6	1.2
2	117.0	0.027	3.2	1.2	2.0
3	106.8	0.024	4.4	1.9	2.5
4	98.3	0.022	5.4	2.5	2.9
5	91.3	0.021	6.2	3.1	3.1
6	85.3	0.019	7.0	3.7	3.3
7	80.1	0.018	7.7	4.3	3.3
8	75.6	0.017	8.3	5.0	3.3
9	71.7	0.016	8.8	5.6	3.2
10	68.2	0.016	9.3	6.2	3.1
11	65.0	0.015	9.8	6.8	2.9
12	62.2	0.014	10.2	7.4	2.7
13	59.6	0.014	10.6	8.1	2.5
14	57.3	0.013	10.9	8.7	2.3
15	55.1	0.013	11.3	9.3	2.0
16	53.2	0.012	11.6	9.9	1.7
17	51.4	0.012	11.9	10.5	1.4
18	49.7	0.011	12.2	11.2	1.0
19	48.1	0.011	12.5	11.8	0.7
20	46.7	0.011	12.7	12.4	0.3
21	45.3	0.010	13.0	13.0	0.0
22	44.1	0.010	13.2	13.6	-0.4
23	42.9	0.010	13.5	14.3	-0.8
24	41.7	0.009	13.7	14.9	-1.2

5-Year

Catchment Area	0.104	ha
Post-Development Runoff Coefficient	0.79	
Reduced Flowrate	0.010	m^3/s
Initial Time	0	min
Required Storage	**5.8**	m^3
A	697.40	
B	5.00	
C	0.764	

Duration (min)	IDF Intensity (mm/hr)	Post Development Peak Q (m^3/s)	Inflow Volume (m^3)	Outflow Volume (m^3)	Required Storage (m^3)
0	203.9	0.046	0.0	0.0	0.0
1	177.4	0.040	2.4	0.6	1.8
2	157.7	0.036	4.3	1.2	3.1
3	142.4	0.032	5.8	1.9	4.0
4	130.1	0.030	7.1	2.5	4.6
5	120.1	0.027	8.2	3.1	5.1
6	111.6	0.025	9.1	3.7	5.4
7	104.5	0.024	10.0	4.3	5.6
8	98.3	0.022	10.7	5.0	5.8
9	92.9	0.021	11.4	5.6	5.8
10	88.1	0.020	12.0	6.2	5.8
11	83.9	0.019	12.6	6.8	5.8
12	80.1	0.018	13.1	7.4	5.7
13	76.6	0.017	13.6	8.1	5.5
14	73.5	0.017	14.1	8.7	5.4
15	70.7	0.016	14.5	9.3	5.2
16	68.1	0.016	14.9	9.9	5.0
17	65.7	0.015	15.3	10.5	4.7
18	63.6	0.014	15.6	11.2	4.5
19	61.5	0.014	16.0	11.8	4.2
20	59.6	0.014	16.3	12.4	3.9
21	57.9	0.013	16.6	13.0	3.6
22	56.2	0.013	16.9	13.6	3.2
23	54.7	0.012	17.2	14.3	2.9
24	53.2	0.012	17.4	14.9	2.6

Site: 198 First Rd W MCI Project No. Y18006
Client: Pine Street Burlington Corp
Bowstring Method Storage Calculations
Stormwater Storage Volume Requirements

10-Year

Catchment Area	0.104	ha
Post-Development Runoff Coefficient	0.79	
Reduced Flowrate	0.010	m^3/s
Initial Time	0	min
Required Storage	**7.6**	m^3
A	798.50	
B	5.00	
C	0.763	

Duration (min)	IDF Intensity (mm/hr)	Post Development Peak Q (m^3/s)	Inflow Volume (m^3)	Outflow Volume (m^3)	Required Storage (m^3)
0	233.9	0.053	0.0	0.0	0.0
1	203.5	0.046	2.8	0.6	2.2
2	180.9	0.041	4.9	1.2	3.7
3	163.4	0.037	6.7	1.9	4.8
4	149.3	0.034	8.2	2.5	5.7
5	137.8	0.031	9.4	3.1	6.3
6	128.1	0.029	10.5	3.7	6.8
7	119.9	0.027	11.5	4.3	7.1
8	112.8	0.026	12.3	5.0	7.4
9	106.6	0.024	13.1	5.6	7.5
10	101.1	0.023	13.8	6.2	7.6
11	96.3	0.022	14.5	6.8	7.6
12	91.9	0.021	15.1	7.4	7.6
13	88.0	0.020	15.6	8.1	7.6
14	84.4	0.019	16.1	8.7	7.5
15	81.2	0.018	16.6	9.3	7.3
16	78.2	0.018	17.1	9.9	7.2
17	75.5	0.017	17.5	10.5	7.0
18	73.0	0.017	17.9	11.2	6.8
19	70.7	0.016	18.3	11.8	6.5
20	68.5	0.016	18.7	12.4	6.3
21	66.5	0.015	19.1	13.0	6.0
22	64.6	0.015	19.4	13.6	5.8
23	62.8	0.014	19.7	14.3	5.5
24	61.2	0.014	20.0	14.9	5.2

25-Year

Catchment Area	0.104	ha
Post-Development Runoff Coefficient	0.87	
Reduced Flowrate	0.010	m^3/s
Initial Time	0	min
Required Storage	**12.0**	m^3
A	926.90	
B	5.00	
C	0.762	

Duration (min)	IDF Intensity (mm/hr)	Post Development Peak Q (m^3/s)	Inflow Volume (m^3)	Outflow Volume (m^3)	Required Storage (m^3)
0	271.9	0.068	0.0	0.0	0.0
1	236.6	0.059	3.6	0.6	2.9
2	210.4	0.053	6.3	1.2	5.1
3	190.1	0.048	8.6	1.9	6.7
4	173.7	0.043	10.4	2.5	8.0
5	160.3	0.040	12.0	3.1	8.9
6	149.1	0.037	13.4	3.7	9.7
7	139.5	0.035	14.7	4.3	10.3
8	131.3	0.033	15.8	5.0	10.8
9	124.1	0.031	16.8	5.6	11.2
10	117.7	0.029	17.7	6.2	11.5
11	112.1	0.028	18.5	6.8	11.7
12	107.0	0.027	19.3	7.4	11.8
13	102.5	0.026	20.0	8.1	11.9
14	98.3	0.025	20.7	8.7	12.0
15	94.5	0.024	21.3	9.3	12.0
16	91.1	0.023	21.9	9.9	12.0
17	87.9	0.022	22.4	10.5	11.9
18	85.0	0.021	23.0	11.2	11.8
19	82.3	0.021	23.5	11.8	11.7
20	79.8	0.020	24.0	12.4	11.6
21	77.4	0.019	24.4	13.0	11.4
22	75.2	0.019	24.9	13.6	11.2
23	73.2	0.018	25.3	14.3	11.0
24	71.2	0.018	25.7	14.9	10.8

Site: 198 First Rd W MCI Project No. **Y18006**
Client: Pine Street Burlington Corp
Bowstring Method Storage Calculations
Stormwater Storage Volume Requirements

50-Year

Catchment Area	0.104	ha
Post-Development Runoff Coefficient	0.95	
Reduced Flowrate	0.010	m^3/s
Initial Time	10	min
Required Storage	**16.5**	m^3

A	1019.40
B	5.00
C	0.761

Duration (min)	IDF Intensity (mm/hr)	Post Development Peak Q (m^3/s)	Inflow Volume (m^3)	Outflow Volume (m^3)	Required Storage (m^3)
10	129.8	0.035	21.3	6.2	15.1
11	123.6	0.034	22.3	6.8	15.4
12	118.0	0.032	23.2	7.4	15.8
13	113.0	0.031	24.1	8.1	16.0
14	108.4	0.030	24.9	8.7	16.2
15	104.3	0.028	25.6	9.3	16.3
16	100.5	0.027	26.3	9.9	16.4
17	97.0	0.026	27.0	10.5	16.5
18	93.8	0.026	27.7	11.2	16.5
19	90.8	0.025	28.3	11.8	16.5
20	88.0	0.024	28.8	12.4	16.4
21	85.4	0.023	29.4	13.0	16.4
22	83.0	0.023	29.9	13.6	16.3
23	80.7	0.022	30.4	14.3	16.2
24	78.6	0.021	30.9	14.9	16.0
25	76.6	0.021	31.4	15.5	15.9
26	74.7	0.020	31.8	16.1	15.7
27	72.9	0.020	32.3	16.7	15.5
28	71.2	0.019	32.7	17.4	15.3
29	69.6	0.019	33.1	18.0	15.1
30	68.1	0.019	33.5	18.6	14.9
31	66.7	0.018	33.9	19.2	14.6
32	65.3	0.018	34.2	19.8	14.4
33	64.0	0.017	34.6	20.5	14.1
34	62.7	0.017	34.9	21.1	13.9

100-Year

Catchment Area	0.104	ha
Post-Development Runoff Coefficient	0.98	
Reduced Flowrate	0.010	m^3/s
Initial Time	10	min
Required Storage	**20.4**	m^3

A	1114.20
B	5.00
C	0.761

Duration (min)	IDF Intensity (mm/hr)	Post Development Peak Q (m^3/s)	Inflow Volume (m^3)	Outflow Volume (m^3)	Required Storage (m^3)
10	141.9	0.040	24.2	6.2	18.0
11	135.1	0.038	25.4	6.8	18.5
12	129.0	0.037	26.4	7.4	19.0
13	123.5	0.035	27.4	8.1	19.3
14	118.5	0.034	28.3	8.7	19.6
15	114.0	0.032	29.2	9.3	19.9
16	109.8	0.031	30.0	9.9	20.1
17	106.0	0.030	30.8	10.5	20.2
18	102.5	0.029	31.5	11.2	20.3
19	99.2	0.028	32.2	11.8	20.4
20	96.2	0.027	32.8	12.4	20.4
21	93.4	0.027	33.5	13.0	20.4
22	90.7	0.026	34.1	13.6	20.4
23	88.2	0.025	34.6	14.3	20.4
24	85.9	0.024	35.2	14.9	20.3
25	83.7	0.024	35.7	15.5	20.2
26	81.7	0.023	36.2	16.1	20.1
27	79.7	0.023	36.7	16.7	20.0
28	77.9	0.022	37.2	17.4	19.8
29	76.1	0.022	37.7	18.0	19.7
30	74.5	0.021	38.1	18.6	19.5
31	72.9	0.021	38.6	19.2	19.3
32	71.4	0.020	39.0	19.8	19.1
33	69.9	0.020	39.4	20.5	18.9
34	68.6	0.020	39.8	21.1	18.7

Designer Inputs: **rectangular cistern**

Date December-03-18

Design by: Kevin Hollingworth

	Orifice1		h= 2650.0	mm		
Pipe diameter (m)	0.075		width (m)	Length (m)	AREA (m2)	
A = Area of pipe (m^2)	0.004	box pipe	2.362	4	9.448	
Cd	0.63			4.00	**9.45**	**ReqV=20.4m^3**
			n= 0.013	S=	0.005	

	Stage (%)	stage (mm)	Stage (m)	Depth to bottom Orifice (m)	Q_{out} Orifice 1 (m^3/s)	Flow Control	Qout (m^3/s)	Qout (L/s)	Inc X-Secn Area (m^2)	Total Storage (m^3)	Total Storage (m.ha)	Inc. Time (s)	Cum. Time (s)	Cum. Time (hr)
Top superpipe	**100.00**	2650	2.650	**2.650**	**0.020**	**Orifice**	**0.0201**	**20.069**	**1.25**	25.04	**0.00250**	1247.56	**11230.17**	**3.12**
	95.00	2518	2.518	**2.518**	**0.020**	**Orifice**	**0.0196**	**19.561**	**1.25**	23.79	**0.00238**	1215.97	**9982.61**	**2.77**
	90.00	2385	2.385	**2.385**	**0.019**	**Orifice**	**0.0190**	**19.039**	**1.25**	22.53	**0.00225**	1183.54	**8766.64**	**2.44**
	85.00	2253	2.253	**2.253**	**0.019**	**Orifice**	**0.0185**	**18.503**	**1.25**	21.28	**0.00213**	1150.19	**7583.11**	**2.11**
	80.00	2120	2.120	**2.120**	**0.018**	**Orifice**	**0.0180**	**17.950**	**2.50**	20.03	**0.00200**	1115.85	**6432.92**	**1.79**
	70.00	1855	1.855	**1.855**	**0.017**	**Orifice**	**0.0168**	**16.791**	**2.50**	17.53	**0.00175**	1043.78	**5317.07**	**1.48**
	60.00	1590	1.590	**1.590**	**0.016**	**Orifice**	**0.0155**	**15.545**	**2.50**	15.02	**0.00150**	966.35	**4273.29**	**1.19**
	50.00	1325	1.325	**1.325**	**0.014**	**Orifice**	**0.0142**	**14.191**	**2.50**	12.52	**0.00125**	882.16	**3306.93**	**0.92**
	40.00	1060	1.060	**1.060**	**0.013**	**Orifice**	**0.0127**	**12.693**	**2.50**	10.01	**0.00100**	789.02	**2424.78**	**0.67**
	30.00	795	0.795	**0.795**	**0.011**	**Orifice**	**0.0110**	**10.992**	**2.50**	7.51	**0.00075**	683.32	**1635.75**	**0.45**
	20.00	530	0.530	**0.530**	**0.009**	**Orifice**	**0.0090**	**8.975**	**2.50**	5.01	**0.00050**	557.92	**952.44**	**0.26**
	10.00	265	0.265	**0.265**	**0.006**	**Orifice**	**0.0063**	**6.346**	**2.50**	2.50	**0.00025**	394.51	**394.51**	**0.11**
bottom of pipe	**0.00**	0	0.000	**0.000**	**0.000**	**Orifice**	**0.0000**	**0.000**	**0.00**	0.00	**0.00000**	0.00	**0.00**	**0.00**

