STORMWATER MANAGEMENT
AND
FUNCTIONAL SERVICE REPORT

FOR

HOTEL PROJECT
210 NORTH SERVICE ROAD WEST
PT 10/RP: 20R-15377

TOWN OF OAKVILLE

March 20, 2018
Rev. July 31, 2018

a.m. candaras associates inc.
8551 Weston Rd, Suite 203
Woodbridge, Ontario
L4L 9R4

Project No. 1705

a.m. candaras associates inc.
consulting engineers

TABLE OF CONTENTS

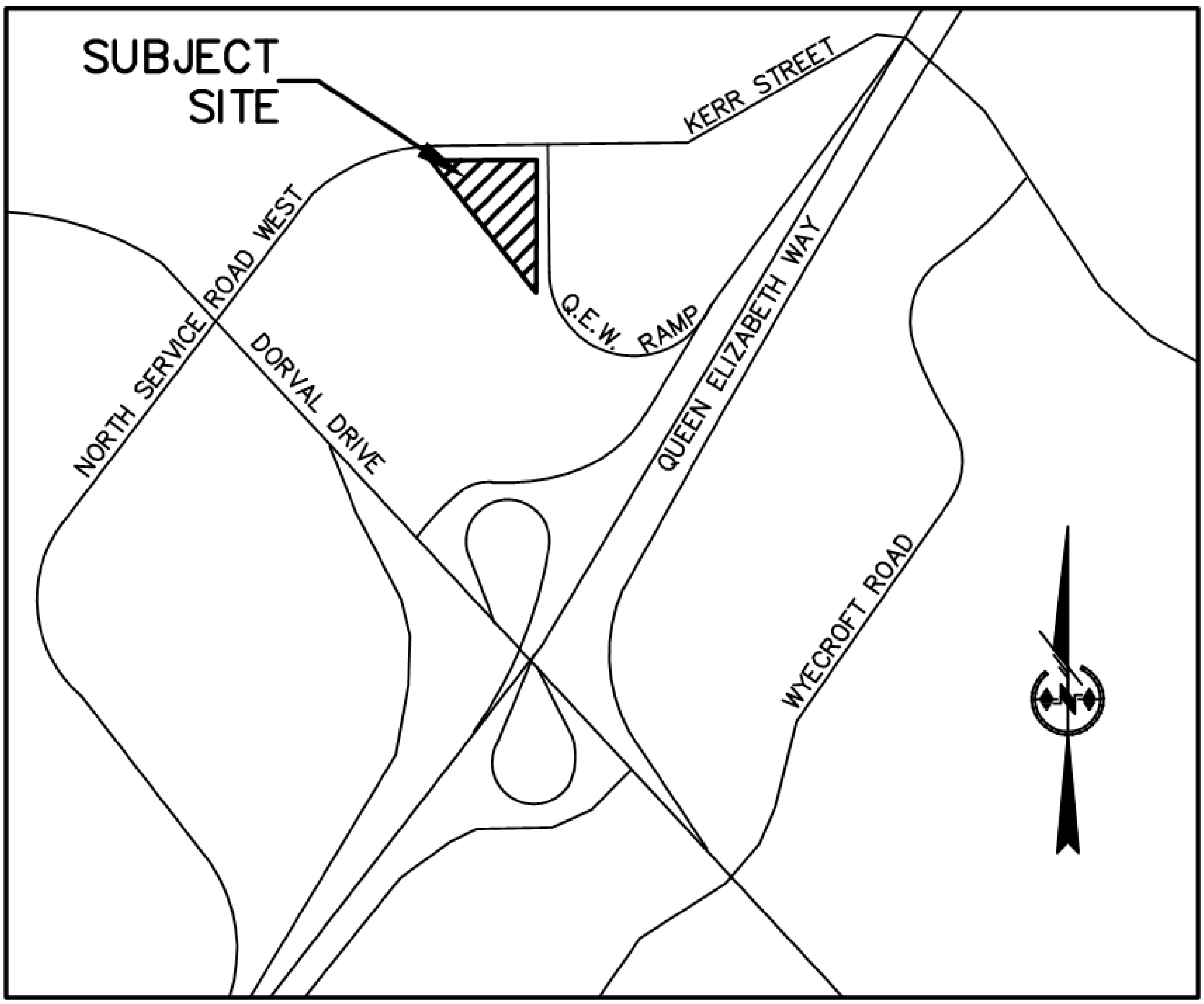
LIST OF APPENDICIES

LIST OF PLANS

1.0 INTRODUCTION

The subject site is 0.67925ha and is located within the Town of Oakville at 210 North Service Road West at the south west corner of the intersection of North Service Road West, Kerr Street and the Q.E.W. Off-ramp, refer to Figure 1. The site is currently undeveloped and will be developed with a 7-storey hotel building. Stormwater management (SWM) will consist of underground storage with no ponding on the surface. This report presents the SWM and functional servicing required to develop the site.

Figure 1 - Location Plan



2.0 DESIGN CRITERIA

a) Site peak allowable release rate to be controlled to rates stated in the approved Canadian Tire SWM report and Storm Drainage Plan.
b) On-site detention must be provided for the 100-year Storm Event.
c) On-site retention of the 5mm storm event volume over the impervious area is required.
d) Quality controls are to achieve Level 1 protection (80% TSS removal) as per MOEE/MNR criteria.

Refer to Appendix A for the approved Canadian Tire Storm Drainage Area Plan – Plan S1.

3.0 SITE DESCRIPTION

Site statistics are provided by SAI Saplys Architects Incorporated on Sheet No. ASP-100.

Roof	= 764.6m^2
Paved + Hardscape	= 3,388.8m^2
Landscape	= 2,639.1m^2
	= 6,792.5m^2

4.0 STORMWATER MANAGEMENT

Stormwater management will be provided by means of underground storage and controlled by an orifice plate with no rooftop controls. There are some small areas of uncontrolled drainage leaving the site and external drainage entering the site which is accounted for in the SWM design and further detailed in Section 4.1.2.

4.1 Quantity Controls

4.1.1 Allowable Site Runoff

The allowable runoff for the site is based on the approved Canadian Tire SWM report and drainage area plan, as confirmed by the Town of Oakville by email on July 18, 2018, refer to Plan S1 for the Canadian Tire Drainage Area Plan. As confirmed by the Town, the site is controlled to the 5-year event using a time of concentration of 10 mins and the allowable runoff rate is calculated as follows:

$$Q_S = C \cdot A \cdot 5_{2YEAR} \cdot N$$
$$= (0.80)\ (0.67925ha)\ (114.2mm/hr)\ (2.778)$$
$$= 172.6l/s$$

Where:

Q_s = Site Allowable Discharge Rate (l/s)

C = Runoff Coefficient

I = Intensity (mm/hr)

N = Unit Conversion Coefficient

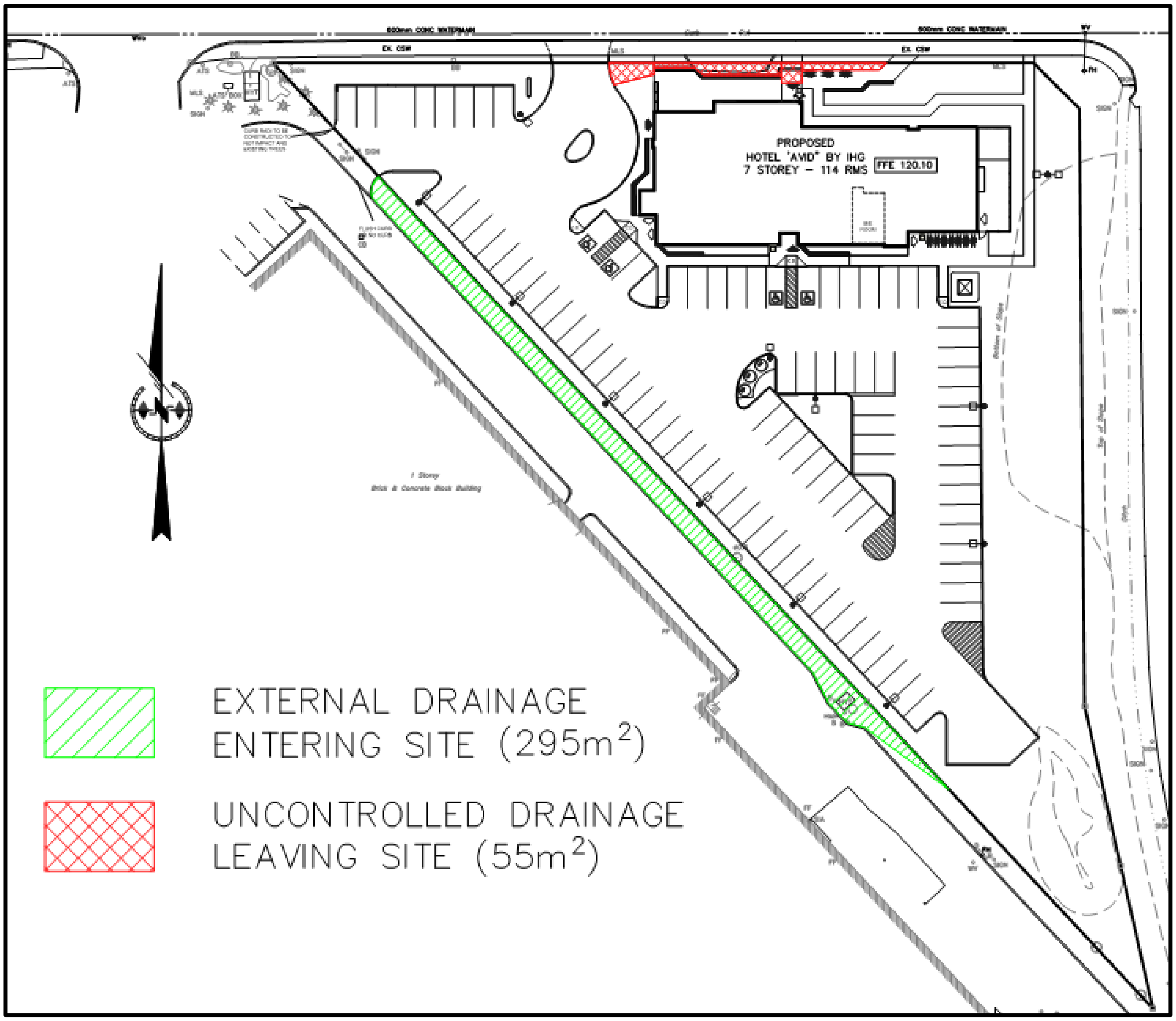
$$I_{5yr} = \frac{1170}{(T_C+5.8)^{0.843}} \quad \text{where, } T_C = 10\text{mins}^{(1)}$$
$$= \frac{1170}{(10+5.8)^{0.843}}$$
$$= 114.2\text{mm/hr}$$

Note: (1) T_c of 10 minutes recommended by Town of Oakville by email on July 18, 2018.

4.1.2 External Drainage and Uncontrolled Discharge

There is a small area of about 55m^2 with a runoff coefficient of 0.54 located along the north property line of the site which will discharge uncontrolled toward North Service Road. There is also a swath of landscaped area of about 295m^2 with a runoff of 0.31 located along the south west property line. Refer to Figure 2 for a delineation of the described areas.

Figure 2 - Uncontrolled and External Drainage



Paved (C=0.95)	=	20.0m^2
Landscaped (C=0.31)	=	<u>35.0m^2</u>
Total Uncontrolled Area	=	55.0m^2 @ C=0.54

The 100-year storm uncontrolled runoff is determined as follows:

$$Q_U = C \cdot A \cdot I \cdot N$$
$$= (0.54) \cdot (0.0055\text{ha}) \cdot 200.8\text{mm/hr} \cdot 2.778$$
$$= 1.7\text{l/s}$$

Where:

$I_{100yr} = \dfrac{2150.7}{T_c+5.7^{0.861}}$ where, T = 10mins

$$= \frac{2150.7}{10 + 5.7^{0.861}}$$

= 200.8mm/hr

4.1.3 Release Rate and Required Detention Volume

As mentioned in Section 4.1.2., there is drainage entering and leaving the site. As such, the net area to provide SWM for is determined as follows:

Net Area = Total – Uncontrolled + External

Landscape (C=0.31):

= 2,639.1m^2 – 35.0m^2 + 295.0m^2

= 2,899.1m^2

Paved (C=0.95):

= 3,388.9m^2 – 20.0m^2

= 3,368.9m^2

Roof (C=0.95):

= 764.6m^2

Net Total:

7,032.6m^2 @ C=0.69; (imperviousness = 62%)

The release rate at the outlet is determined as follows:

$Q_O = Q_S - Q_U$

Q_O = 172.6l/s – 1.7l/s

= 170.9l/s

Where:

Q_S =Total site allowable discharge

Q_U =Total uncontrolled discharge

Q_O =Discharge at outlet (orifice)

There will be no surface ponding and the required detention volume will be provided below the surface in StormTech SC-310 chambers. The site flows will be controlled by an orifice with limited variable head discharge relationship. the site will be controlled to the allowable rate of 170.9l/s. The SWMHYMO program was used to determine the subsurface storage volume requirements. The approximate required storage was about 87m^3 refer to Appendix B for the program output.

4.1.4 Orifice Sizing

An orifice plate is sized for the site and is calculated as follows:

$$Q_O = C \cdot A \cdot \sqrt{(2 \cdot g \cdot h)}$$

where:

h = HWL (top of the StormTech system, refer to Plan G1) – Inv. of Orifice

h = 118.92m – 117.91m

h = 1.01m

$$A = \frac{Q}{C \cdot \sqrt{(2 \cdot g \cdot h)}}$$

$$A = \frac{0.1709 m^3/s}{(0.63) \cdot \sqrt{(2 \cdot 9.81 m/s^2 \cdot 1.01 m)}}$$

A = 0.0610m^2

$$d = \sqrt{\frac{4 \cdot 0.0610 m^2}{\pi}}$$

d = 0.279m

A 279mm diameter orifice plate is located on the downstream face of CBMH 2 and is used to control the discharge leaving the site, refer to Plan G1.

4.1.5 Detention Volume Provided

The detention volume will be provided below the surface in 100 StormTech SC-310 chambers, refer to Plan G1 for details and the configuration of the chambers, and Appendix A for details of the StormTech chambers, respectively. Based on the orifice plate and the StormTech chamber configuration, a stage-storage-discharge relationship was established, refer to Appendix A for details.

SWMHYMO program was used to assess the performance of the on-site detention system using the stage-storage-discharge relationship. The system controls the peak 100-year flow down to 158l/s and requires 79m^3 of detention storage while providing a total of 92m^3 detention storage, refer to Appendix B for the program output.

4.2 Water Balance

The Sixteen Mile Creek Watershed Plan requires that the 5.0mm storm be retained on-site. The volume to be retained is calculated as follows:

$$\left(\frac{5.0\text{mm}}{1000}\right) \text{x } 6{,}792.5\text{m}^2 = 34\text{m}^3$$

A 25.0m long x 2.4m wide x 1.5m deep stone trench will provide a total retention storage volume of 36.0m^3, using a void ratio of 40%. Sizing calculations for the infiltration trenches are shown on Plan G1. A goss trap will be provided at the inlet of MH 8 on the perforated pipe to trap any floatables in the runoff. An infiltration manhole will be provided (MH 7) for the inspection and servicing of the trenches. A bypass pipe is provided above the top of the infiltration trench to convey the flow after the trench fills up.

Based on a geotechnical report prepared by V. A. Wood Associates Limited dated March 2018, BH 2 was the closest borehole to the proposed infiltration trench. There was no groundwater encountered up to a maximum borehole depth of 4.8m (≈114.70), refer to excerpt in Appendix C. The established soil infiltration rate was determined at BH 2 to be 30mm/hr at a depth of 3.0m below the existing ground with similar soils extending to the bottom of the infiltration trench. This is a higher infiltration rate than the MOE minimum of 15mm/hr. Refer to Appendix C for report excerpts of boreholes and infiltration rates. The infiltration trench has a top of 117.50 and a bottom of 116.00, refer to Plan G1.

4.3 Quality Controls

Quality controls are to be provided which meets 80% TSS removal. An oil grit separator was sized to provide the required 80% TSS removal. Based on the proposed site characteristics, a Stormceptor STC 1000 was provided to achieve the quality control. Refer to the Stormceptor sizing design summary in Appendix A for design details and unit specifications, respectively.

4.4 Storm Service

The approved Canadian Tire Storm Drainage Area Plan and plan and profile drawings were provided by the Town of Oakville which shows the subject site draining to the east to an existing 750mm storm where it outlets into Sixteen Mile Creek, refer to Storm Drainage Area Plan S1 for in Appendix C for reference.

To service the site, the existing 300mm storm connection will be utilized as indicated on Plan G1:

- The existing “CB 103” will be replaced with a Catchbasin Manhole “CBMH 103”;
- The site service connection will be connected to Catchbasin Manhole “CBMH 103”.

5.0 SANITARY

5.1 Post-Development Flow Rate

The design flow for the site, based on the site area of 0.67925ha and using the Halton Region Water & Wastewater Linear Design Manual (May 2014), is calculated as follows:

Design Flow	=	Average Dry Weather Flow	x	Average Peak Wastewater Flow Factor	+	Infiltration Allowance

<u>Average Dry Weather Flow (based on Apartments over 6 stories high)</u>

= 285persons/ha x 0.67925ha

= 193.6 persons

or

As per Site Statistics, the hotel is to have 114 rooms. Assuming 2 people per room, the total population is determined as follows:

= 114 rooms x 2persons/room

= 228 persons **<<governs>>**

228 persons x $0.003183 \times 10^{-3} m^3$/person/s

= $0.0007257 m^3/s$

<u>Average Peak Wastewater</u>

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

Where = P = 228 persons

$$= M = \left(1 + \left(\frac{14}{4+\sqrt{0.228}}\right)\right)$$

= 4.13

<u>Infiltration Allowance</u>

= $0.286 \times 10^{-3} m^3/ha/s$ x 0.67925ha

= $0.000194 m^3/s$

Design Flow

$= (0.\ 0007257 m^3/s \times 4.13) + 0.000194 m^3/s$

$= 0.000319 m^3/s$

$= 3.19 l/s$

5.2 Sanitary Downstream Analysis

A downstream sanitary analysis was undertaken at the request of the Region of Halton to determine if there was adequate capacity in the system. The analysis extended about 1200m downstream of the site encompassing a tributary area of about 43.7ha where it terminates at the existing 450mm sanitary trunk sewer. Refer to the Sanitary Drainage Analysis Figure attached to the document.

Using the Region of Halton standards and provided documents, existing and proposed sanitary flows were quantified. There were two points where the sanitary flows were quantified in order to assess the remaining capacity at two critical sewer lengths. These two identified critical sewer lengths have the flattest slope and thus, have the lowest capacity in the existing sanitary network. Therefore, if there is capacity in these lengths, there will also be capacity in the rest of the sanitary system.

The post-development flows at Critical Sewer Length 1 (18.5ha-300mm @ 0.20%) is 24.0l/s, which has a capacity of 43.3l/s and thus, has a remaining capacity of 19.3l/s.

The post-development flows at Critical Sewer Length 2 (43.7ha-375mm @ 1.65%) is 49.8l/s, which has a capacity of 179.7l/s and thus, has a remaining capacity of 129.9l/s.

The results of the sanitary downstream analysis demonstrate that the sanitary sewer has enough capacity to support the proposed development.

5.3 Sanitary Service

In order to service the site a sanitary sewer will need to be extended form existing “MH 14A”, as indicated on Plan G1. The existing sanitary connections will be connected to eh new sanitary sewer.

To service the site, sanitary sewer works are as follows:

- Remove existing 37.7m-300mm sanitary sewer from existing sanitary manhole “MH14A” to existing sanitary manhole “MH15A”. Replace with 37.7m-300mm sanitary sewer at 0.50% from “MH14A” to “MH15A”.
- Remove and replace existing 1200mm sanitary manhole “MH15A” and replace with 1200mm “MH17A”. Reconnect existing sanitary laterals and maintain lateral inverts.
- Remove existing 41.6m-300mm sanitary sewerfrom sanitary manhole “MH15A” to existing sanitary manhole “MH16A”. Replace with 41.6.7m-300mm sanitary sewer at 0.50% from “MH15A” to existing sanitary manhole “MH16A”.
- Remove and replace existing 1200mm sanitary manhole “MH16A” and replace with 1200mm “MH19A”. Reconnect existing sanitary laterals and maintain lateral inverts.
- Install a 91.7m-300mm PVC sanitary pipe at 0.50% between manhole “MH 19A”, and proposed manhole “MH 1A”.
- Install a 200mm PVC sanitary pipe at 2.0% between manhole “MH 2A”, located at the property line, and manhole “MH 1A”.

6.0 WATER

6.1 Water Demand

The design water demand for the site, based on the site area of 0.67925ha and using the Halton Region Water & Wastewater Linear Design Manual (May 2014), is as follows:

Maximum Daily Demand (based on Apartments over 6 stories high)

= 78.375m^3/ha/day x 0.67925ha
= 53.2m^3/day
= 9.8USgpm

= 9.8USgpm x 4.00 (Residential Peaking Factor)
= 39.2USgpm (148.4l/min)

6.2 Fire Flow Demand

The proposed development consists of one building, will consist of ordinary construction and will be sprinklered. The fire flow demand is calculated based on the Fire Underwriters Survey as follows:

Estimate of required fire flow:

$$F_1 = 220 \cdot C \cdot \sqrt{A}$$

$$F_1 = 220 \cdot (1.0) \cdot \sqrt{765\text{m}^2}$$

$$F_1 = 6{,}083 \frac{\text{l}}{\text{min}}; F_2 = 6{,}000 \frac{\text{l}}{\text{min}}$$

Where:
F = Required fire flow (l/min)
C = Type of construction coefficient (1.0 = ordinary construction)
A = Total building area (m^2)

Occupancy Reduction:
As per the Fire Underwriters Survey, a Hotel is considered a “Low Hazard Occupancy” and therefore, can be reduced by 25%.

Sprinkler Reduction:

The required fire flow can also be reduced by 30% as the building will include a sprinkler system (NFPA 13).

Exposure Charges:

North Side (>45m)	= 0%
South Side (>45m)	= 0%
East Side (>45m)	= 0%
West Side (30.1m – 45m)	= 5%
Total exposure charge	**= 5%**

Final Fire Flow

F_{final} = F_2 – (F_2 · (25%+30%)) + (F_2 · 45%)

= 6,000l/min – (6,000l/min · (25%+30%)) + (6,000l/min · 5%)

= 3,000l/min = 3,000l/min

Fire Flow + Max Day required water flow at a minimum of 20psi

= 3,000l/min + 148.4l/min

= 3,148.4l/min = **832USgpm**

6.3 Water Supply

Fire flow tests were performed determine if there is sufficient pressure in the existing system to satisfy the minimum Halton Region requirements for the site. The results of the hydrant flow test are provided in Appendix C, and the available flow at 20psi is determined using the larger of the flow tests as follows:

$$Q_R = Q_F \cdot \left(\frac{H_R}{H_F}\right)^{0.54}$$

Where:

Q_R = Rated capacity at 20psi (in USgpm)

Q_F = Total test flow

H_R = Static pressure minus 20psi at Q_F

H_F = Static pressure minus residual pressure

Table 1 - Flow Test – Two 2.5” Ports

Parameter	Value
Static Pressure	66psi
Residual Pressure	64psi
Test Flow Rate	2,276USgpm (8,616l/min)

$$Q_R = 2{,}276 \cdot \left(\frac{(66-20)}{(66-64)}\right)^{0.54}$$

$$Q_R = 12{,}373.9\text{USgpm} \ \ (46{,}840\text{l/min})$$

Therefore, the anticipated flow available from the existing 600mm watermain at 20psi is 12,373.9USgpm or 46,840l/min, which exceeds the total water demand of 832USgpm or 3,148.4l/min.

6.4 Water Service

The Region of Halton has advised that they will not allow a direct connection to the existing 600mm trunk watermain. It is noted that many other sites in the surrounding area are connected to and serviced by the same existing 600mm as shown on the Region of Halton including Il Fornello, Starbucks, TD Canada Trust, Canadian Tire and likely more.

The closest local watermain is a 300mm PVC watermain located about 330m west at the intersection of North Service Road W and Dorval. Rather than extend the existing 300mm watermain to the site, it is proposed to construct a 200mm parallel watermain connecting between two hydrant connections located along North Service Road W from which the site will be serviced. This will effectively leave the 600mm existing watermain undisturbed, refer to Plan G1 for details.

A proposed 100mm domestic and 200mm fire service connection will be provided from the proposed 200mm watermain on North Service Road. The water service connections are to be installed as per Region of Halton Standard 409.01. There is an existing fire hydrant located at the corner of North Service Road and the QEW off ramp which is 40m away from the proposed siamese connection, as shown on Plan G1.

Prepared by,

a.m. candaras associates inc.

A.M. Candaras, P.Eng.
Consulting Engineer

LICENSED PROFESSIONAL ENGINEER
A. M. CANDARAS
PROVINCE OF ONTARIO

Zachary Schwisberg, EIT
July 31, 2018

N:\Secretary\2017\1705\SWM & FSR\1705-SWM & FSR.002.docx

APPENDIX A – SUPPORTING DOCUMENTS

- StormTech SC-310 Details and Specifications
- StormTech System Stage-Storage-Discharge Relationship
- Stormceptor Design Summary
- Stormceptor STC 1000 Specifications

SC-310 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

STORMTECH SC-310 CHAMBER

(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
85.4" x 34.0" x 16.0"
2,170 mm x 864 mm x 406 mm

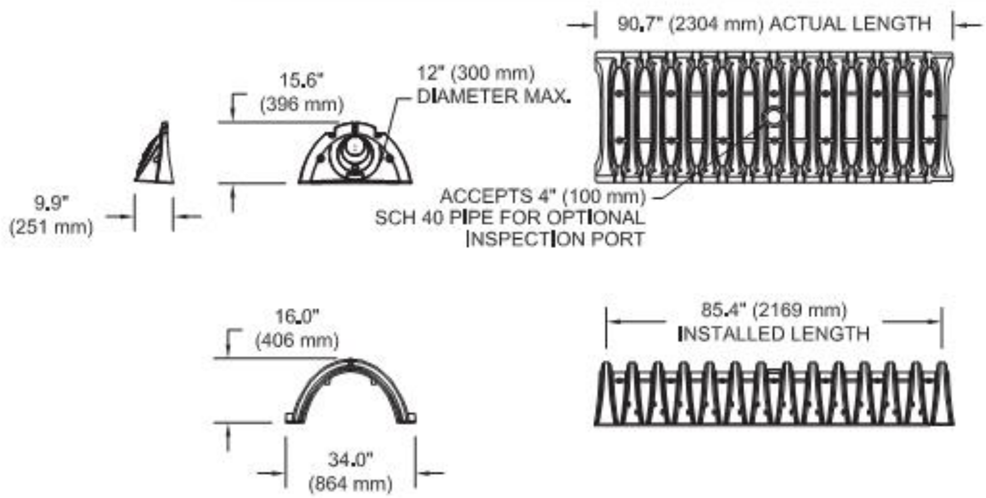
Chamber Storage
14.7 ft³ (0.42 m³)

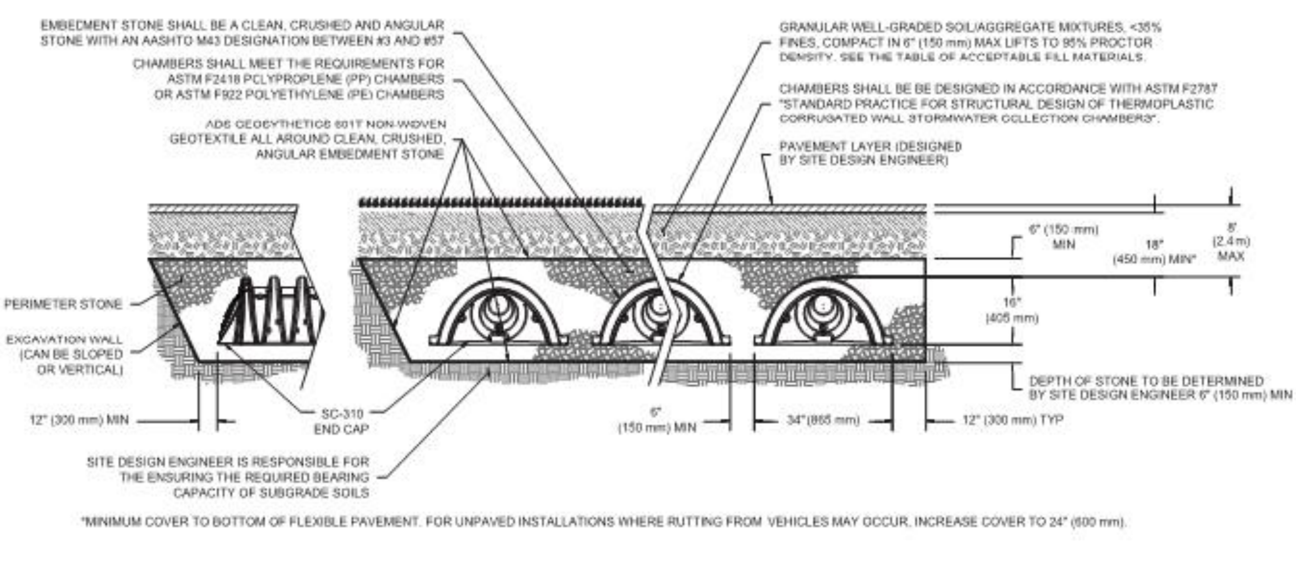
Min. Installed Storage*
31.0 ft³ (0.88 m³)

Weight
37.0 lbs (16.8 kg)

Shipping
41 chambers/pallet
108 end caps/pallet
18 pallets/truck

*Assumes 6" (150 mm) stone above and below chambers and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

Project: 1705

Chamber Model -	SC-310	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	100	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	118.21	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm
Area of system -	221	sq.meters

☑ Include Perimeter Stone in Calculations

Min. Area - 220.472 sq.meters

StormTech
Detention • Retention • Water Quality
A division of ADS

StormTech SC-310 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
711	0.00	0.00	2.25	2.25	87.983	118.92
686	0.00	0.00	2.25	2.25	85.737	118.90
660	0.00	0.00	2.25	2.25	83.491	118.87
635	0.00	0.00	2.25	2.25	81.245	118.85
610	0.00	0.00	2.25	2.25	78.999	118.82
584	0.00	0.00	2.25	2.25	76.753	118.79
559	0.00	0.17	2.18	2.35	74.507	118.77
533	0.00	0.44	2.07	2.51	72.162	118.74
508	0.01	0.75	1.94	2.70	69.653	118.72
483	0.02	1.54	1.63	3.17	66.955	118.69
457	0.02	2.00	1.45	3.44	63.782	118.67
432	0.02	2.34	1.31	3.65	60.339	118.64
406	0.03	2.62	1.20	3.82	56.691	118.62
381	0.03	2.88	1.10	3.97	52.873	118.59
356	0.03	3.10	1.01	4.11	48.902	118.57
330	0.03	3.27	0.94	4.21	44.795	118.54
305	0.03	3.44	0.87	4.31	40.586	118.51
279	0.04	3.61	0.80	4.41	36.274	118.49
254	0.04	3.75	0.74	4.50	31.861	118.46
229	0.04	3.87	0.70	4.57	27.363	118.44
203	0.04	3.98	0.65	4.63	22.796	118.41
178	0.04	4.07	0.62	4.69	18.161	118.39
152	0.00	0.00	2.25	2.25	13.476	118.36
127	0.00	0.00	2.25	2.25	11.230	118.34
102	0.00	0.00	2.25	2.25	8.984	118.31
76	0.00	0.00	2.25	2.25	6.738	118.29
51	0.00	0.00	2.25	2.25	4.492	118.26
25	0.00	0.00	2.25	2.25	2.246	118.24

STAGE-STORAGE-DISCHARGE RELATIONSHIP

ELEVATION (m)	DISCHARGE (m3/s)	STORAGE (ham)*	DESCRIPTION
117.91	0.0000	0.0000	PIPE STORAGE
118.00	0.0510	0.0002	PIPE STORAGE
118.10	0.0741	0.0003	PIPE STORAGE
118.21	**0.0932**	**0.0004**	BOTTOM OF STONE/OUTLET INVERT
118.29	**0.1043**	**0.0011**	CHAMBERS
118.51	**0.1323**	**0.0045**	CHAMBERS
118.69	**0.1505**	**0.0071**	CHAMBERS
118.92	**0.1710**	**0.0092**	TOP OF STONE

NOTE: Stormtech system effective storage starts above SC-310 invert elevation of 118.21

Stormceptor®

FORTERRA™

Brief Stormceptor Sizing Report - 1705

Project Information & Location			
Project Name	OAKVILLE HOTEL	**Project Number**	1705
City	OAKVILLE	**State/ Province**	Ontario
Country	Canada	**Date**	3/16/2018
Designer Information		**EOR Information (optional)**	
Name	Zachary Schwisberg	**Name**	
Company	A.M. Candaras Inc.	**Company**	
Phone #		**Phone #**	
Email	zachary@amcai.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	1705
Target TSS Removal (%)	80
TSS Removal (%) Provided	80
Recommended Stormceptor Model	STC 1000

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary

Stormceptor Model	% TSS Removal Provided	% Runoff Volume Captured Provided
STC 300	69	87
STC 750	79	94
STC 1000	80	94
STC 1500	81	94
STC 2000	84	97
STC 3000	86	97
STC 4000	89	99
STC 5000	89	99
STC 6000	91	99
STC 9000	93	100
STC 10000	93	100
STC 14000	95	100
StormceptorMAX	Custom	Custom

Stormceptor®

FORTERRA™

Sizing Details

Drainage Area	
Total Area (ha)	0.679
Imperviousness %	60.0

Rainfall	
Station Name	TORONTO CENTRAL
State/Province	Ontario
Station ID #	0100
Years of Records	18
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	90.00
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	14.40
Water Quality Flow Rate (L/s)	

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

City of Toronto PSD		
Particle Diameter (microns)	Distribution %	Specific Gravity
10.0	20.0	2.65
30.0	10.0	2.65
50.0	10.0	2.65
95.0	20.0	2.65
265.0	20.0	2.65
1000.0	20.0	2.65

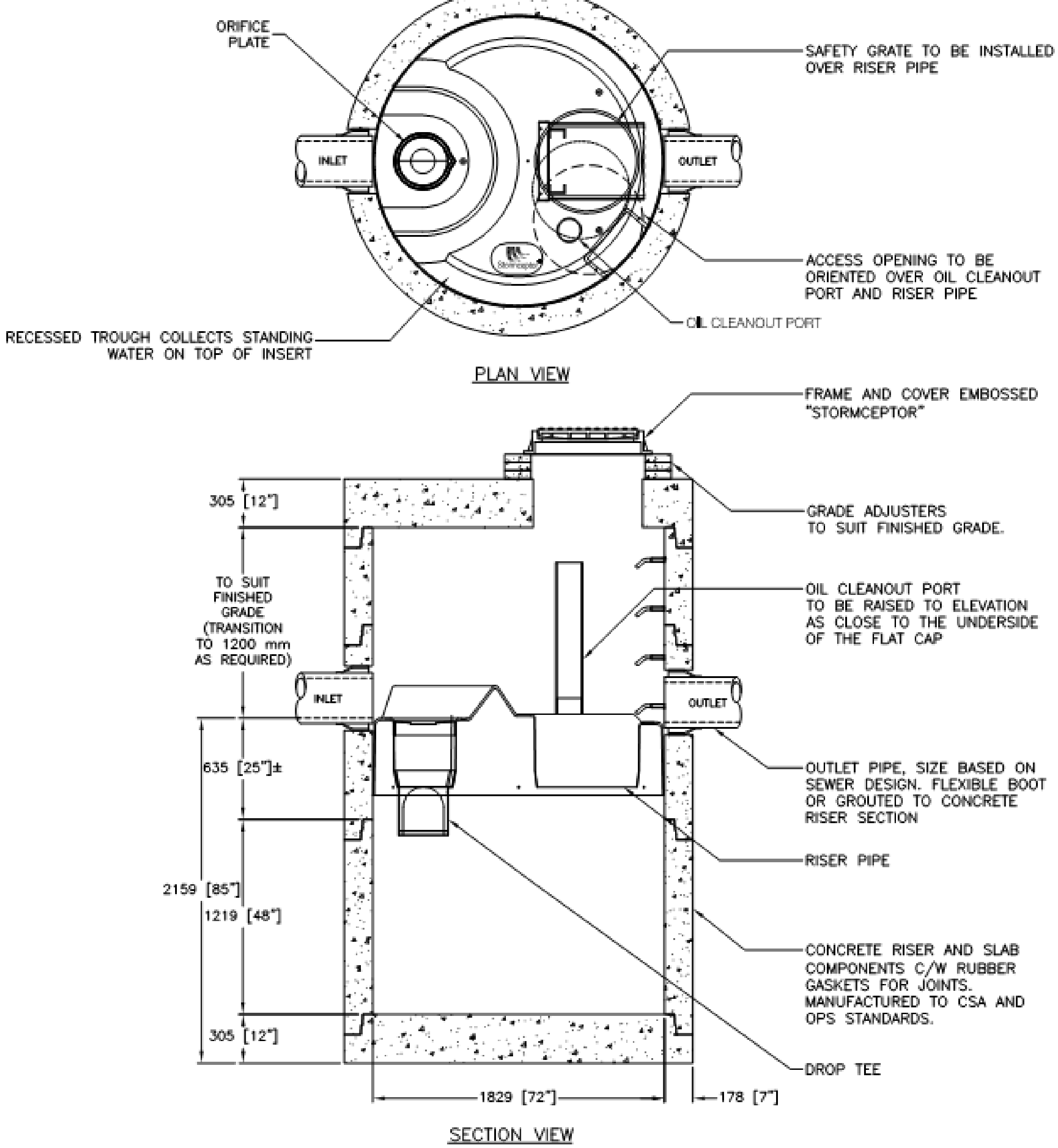
Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

DRAWING NOT TO BE USED FOR CONSTRUCTION

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS:
United States Patent No. 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690 • 7,582,216 • 7,666,303 | Australia Patent No. 729,096 • 779,401 • 2008,279,378 • 2008,288,900 |
Canadian Patent No. 2,206,338 • 2,327,768 • 2,694,159 • 2,697,287 | Indonesian Patent No. 007058 | Japan Patent No. 9-11476 • 3,581,233 • 5,555,160 |
Korea Patent No. 10-1451593 • 0519212 | Malaysia Patent No. 118987 | New Zealand Patent No. 314,646 • 583,583 • 583,008 | South African Patent No. 2010,00683 • 2010,01796 |



Stormceptor®

imbrium WWW.IMBRIUMSYSTEMS.COM 7037 RIDGE ROAD, SUITE 350, HANOVER, MD 21076 USA 888-279-8826 CA 800-565-4801 INT'L +1-416-960-9900	STC 1000 STANDARD MODEL ####	REV #	DATE	REVISION DESCRIPTION	BY	SHEET NUMBER 1 OF 1
	DATE: ######## SCALE: 40	PROJECT No.: #####			DRAWN: ###	CHECKED: ###

APPENDIX B –SWMHYMO OUTPUT

- SWMHYMO – Storage Required & Detention System Performance

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999  =
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9 V
     S   W W   M   M  H   H    Y    M   M  O   O       9999   9999 J
 SSSSS   W W   M   M  H   H    Y    M   M   OOO          9      9 =
                                                      9   9  9   9 #
      StormWater Management HYdrologic Model           999    999  =

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

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: A.M. Candaras Associates Inc.
 +++++++                Woodbridge           SERIAL#:3813174
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


 ********************   D E T A I L E D   O U T P U T   ************
 *****************************************************************
 *       DATE: 2018-07-31     TIME: 14:04:04     RUN COUNTER: 001064
 *****************************************************************
 * Input   filename: C:\PROGRA~1\SWMHYMO\PROJECTS\1705\1705.dat
 * Output  filename: C:\PROGRA~1\SWMHYMO\PROJECTS\1705\1705.out
 * Summary filename: C:\PROGRA~1\SWMHYMO\PROJECTS\1705\1705.sum
 * User comments:
 * 1:_______________________________________________________________
 * 2:_______________________________________________________________
 * 3:_______________________________________________________________
 *****************************************************************

-----------------------------------------------------------------
001:0001---------------------------------------------------------
*#****************************************************************
*#  Project Name: 210 NORTH SERVICE ROAD     Project Number: 1705
*#  Modeller     : Zachary Schwisberg, E.I.T.
*#  Company      : a.m. candaras associates inc.
*#  License #    : 3813174
*#  7 STOREY HOTEL
```



```
*#****************************************************************
--------------------
| START              |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\17
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\17
    TZERO =    .00 hrs on        0
    METOUT=    2 (output = METRIC)
    NRUN  = 001
    NSTORM=    1
           #   1=OAK100YR.STM
-----------------------------------------------------------------
001:0002---------------------------------------------------------
--------------------
| READ STORM         |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\1705\
| Ptotal=  75.22 mm|    Comments: *100 YR 4HR OAKVILLE STORM 5 MIN T
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIM
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hr
               .08   3.218 |   1.08  18.650 |   2.08  10.786 |   3.0
               .17   3.444 |   1.17  31.170 |   2.17   9.636 |   3.1
               .25   3.707 |   1.25  82.041 |   2.25   8.709 |   3.2
               .33   4.017 |   1.33 279.344 |   2.33   7.947 |   3.3
               .42   4.386 |   1.42 108.461 |   2.42   7.309 |   3.4
               .50   4.835 |   1.50  55.622 |   2.50   6.769 |   3.5
               .58   5.392 |   1.58  36.064 |   2.58   6.304 |   3.5
               .67   6.103 |   1.67  26.277 |   2.67   5.901 |   3.6
               .75   7.039 |   1.75  20.522 |   2.75   5.548 |   3.7
               .83   8.328 |   1.83  16.777 |   2.83   5.237 |   3.8
               .92  10.211 |   1.92  14.166 |   2.92   4.959 |   3.9
              1.00  13.207 |   2.00  12.248 |   3.00   4.711 |   4.0

-----------------------------------------------------------------
001:0003---------------------------------------------------------
* POST-DEV. VOL. REQUIRED
* CN-TABLE A2-SOIL TYPE C FAIR CONDITION, -79 (USE 80)
----------------------
| DESIGN STANDHYD     |   Area    (ha)=     .70
| 01:100    DT= 1.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   62
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=        .44          .27
     Dep. Storage      (mm)=        .80         1.50
     Average Slope      (%)=       2.00         2.00
     Length             (m)=      68.47        40.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      279.34       113.57
                over (min)       1.00         8.00
     Storage Coeff.  (min)=       1.10 (ii)    7.80 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=       1.02          .14
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .34          .05         .359 (
     TIME TO PEAK    (hrs)=       1.33         1.45        1.333
     RUNOFF VOLUME    (mm)=      74.42        39.60       61.190
     TOTAL RAINFALL   (mm)=      75.22        75.22       75.219
     RUNOFF COEFFICIENT   =        .99          .53         .813
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------
001:0004------------------------------------------------------------
*Variable Cutoff
--------------------
| COMPUTE VOLUME   |
| ID:01  (100   )  |           DISCHARGE      TIME
--------------------              (cms)       (hrs)
           START CONTROLLING AT     .041       1.167
           INFLOW HYD. PEAKS AT     .359       1.333
           STOP  CONTROLLING AT     .171       1.423

           REQUIRED STORAGE VOLUME (ha.m.)=    .0087
           TOTAL HYDROGRAPH VOLUME (ha.m.)=    .0430
           % OF HYDROGRAPH TO STORE       =  20.1404

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .171  (cms).

--------------------------------------------------------------------
001:0005------------------------------------------------------------
* SC-310 CHAMBERS
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(100   )   |
| OUT<02:(101   )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000  .0000E+00    |      .104  .1100E-02
                           .051  .2000E-03    |      .132  .4500E-02
                           .074  .3000E-03    |      .150  .7100E-02
                           .093  .4000E-03    |      .171  .9200E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (100   )        .70      .359     1.333     61.190
     OUTFLOW<02: (101   )        .70      .158     1.433     61.190

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   43.877
                   TIME SHIFT OF PEAK FLOW          (min)=    6.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.7859E-02

--------------------------------------------------------------------
001:0006------------------------------------------------------------
********************************************************************
      FINISH
--------------------------------------------------------------------
********************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
```



```
   Simulation ended on 2018-07-31     at 14:04:05
====================================================================
```

APPENDIX C – REPORT EXCERPTS

- Geotechnical Report Excerpt – Borehole Location Plan
- Geotechnical Report Excerpt – Groundwater Level
- Geotechnical Report Excerpt – Soil Infiltration Rate
- Geotechnical Report Excerpt – Enclosure 9
- Geotechnical Report Excerpt – Enclosure 10
- Geotechnical Report Excerpt – Enclosure 11
- Hydrant Flow Test Results
- Storm Drainage Area Plan – S1

V. A. WOOD ASSOCIATES LIMITED
CONSULTING GEOTECHNICAL ENGINEERS
1080 TAPSCOTT ROAD, UNIT 24, SCARBOROUGH, ONTARIO M1X 1E7
TELEPHONE: (416) 292-2868 • FAX No: (416) 292-5375

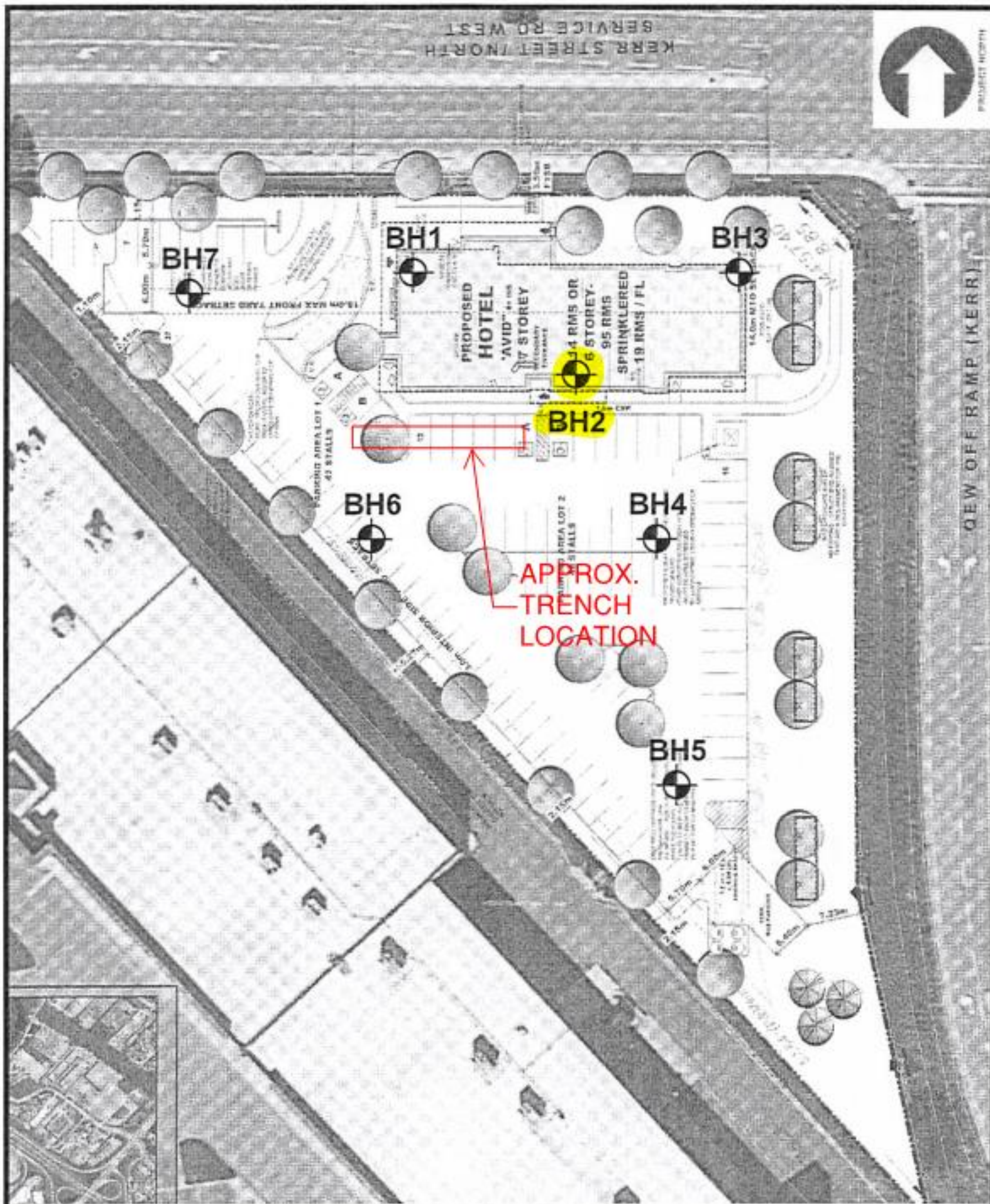
GEOTECHNICAL INVESTIGATION PROPOSED AVID HOTEL KERR STREET NORTH/QEW OFF RAMP OAKVILLE, ONTARIO

Ref. No. 7320-18-1

March 2018

Prepared for:

Empress Capital Group Ltd.
c/o API Development Consultants Inc.
1282 Cornwall Road
Oakville, Ontario
L6J 7W5



BOREHOLE LOCATION PLAN

Reference No : 7320-18-1

Borehole No : 2

Enclosure No : 3

Client : Empress Capital Group Ltd. c/o API

Project : Proposed Hotel

Method : Auger

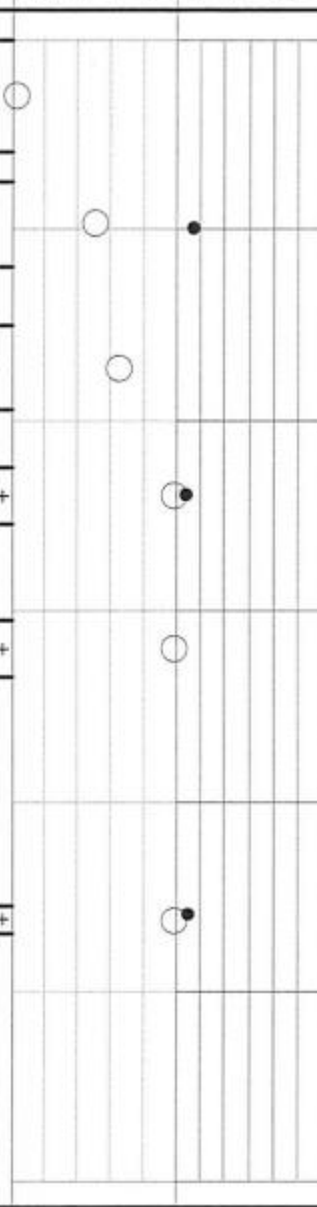
Location : Kerr Street/QEW, Oakville, ON

Diameter : 110 mm

Datum Elevation :

Date : February 16, 2018

SUBSURFACE PROFILE					SAMPLE					
Elevation m	Depth m	Description	Symbol	Water	Number	Type	N-value	Standard Penetration Test blows/300mm 20 40 60 80	Moisture Content, % 10 30 50	Remarks
		Ground Surface								
	0	Topsoil 125 mm thick FILL Clayey silt, trace organics, dark red, moist, very loose			1	SS	3			Borehole open and dry on completion
	1	*SILT* Hard, some sand and clay, brick red to grey, moist			2	SS	51			
				DRY	3	SS	66			
	2–4	*SHALEY TILL* Very dense, clayey sandy silt with weathered shale fragments, brick red, moist			4	SS	100+			
	3				5	SS	100+			
					6	SS	100+			
	5–6	End of Borehole								



V.A. WOOD ASSOCIATES LIMITED

Disk :

Sheet : 1 of 1

5.8 Soil Permeability

For the design of storm water management systems, the permeability and infiltration rate of the subsoils were determined based on the grain size distribution and the soil consistency or density. The grain size distribution of representative samples of the silt and shaley till are shown in Enclosure 9, 10 and 11, and reference to this indicates that clayey silt may be classified under the USCS system as ML and the shaley till as ML to SM. The silt has a very stiff to hard consistency, and the shaley till has a very dense relative density.

Based on the findings the estimated soil permeability and infiltration rate for the subsoils are as follows:

Depth	Soil Description (USCS Classification)	Permeability, k	Infiltration Rate
1.5 m	SILT, some sand, trace clay (ML)	1×10^{-6} cm/sec	12 mm/hr
2 m	SILT and Fine SAND, trace gravel (ML)	1×10^{-5} cm/sec	30 mm/hr
3 m	SILT and SAND, some gravel (SM)	1×10^{-5} cm/sec	30 mm/hr

The groundwater level may be assumed to be located at least 4.8 m below grade.

If in-situ permeability tests are required, these may be carried out using a Guelph Permeameter. The test will require test pits to be excavated by backhoe extending to the depths where the permeability/infiltration data are required.

4.0 GROUNDWATER CONDITIONS

No free water was encountered in any of the boreholes, which were all open and dry to the full depth upon completion of the fieldwork. It is noted that the water measurements were carried out immediately after drilling, and it is possible that the ground water had not yet stabilized in the boreholes.

An examination of the samples revealed that they were generally moist (wet at the top in some of the boreholes), and the native subsoils had a brick red colour for the full depth of the boreholes.

Based on the findings, the groundwater table is considered to be located below the maximum depth investigated (i.e., more than 4.8 m below grade). However, perched water conditions may occur within the fill and on top of the low permeability native silt deposit.

GRAIN SIZE DISTRIBUTION

OUR REFERENCE No.: 7320-18-1

PROJECT: Proposed AVID Hotel
LOCATION: Kerr St. North/QEW Off Ramp, Oakville, ON
BOREHOLE NO.: 2
SAMPLE NO.: 2
DEPTH: 1 m
DATE: March 2018

SILT, some sand, trace clay (ML)

ENCLOSURE No. 9

GRAIN SIZE DISTRIBUTION

OUR REFERENCE No.: 7320-18-1

PROJECT: Proposed AVID Hotel

LOCATION: Kerr St. North/QEW Off Ramp, Oakville, ON

BOREHOLE NO.: 2

SAMPLE NO.: 4

DEPTH: 2.3 m

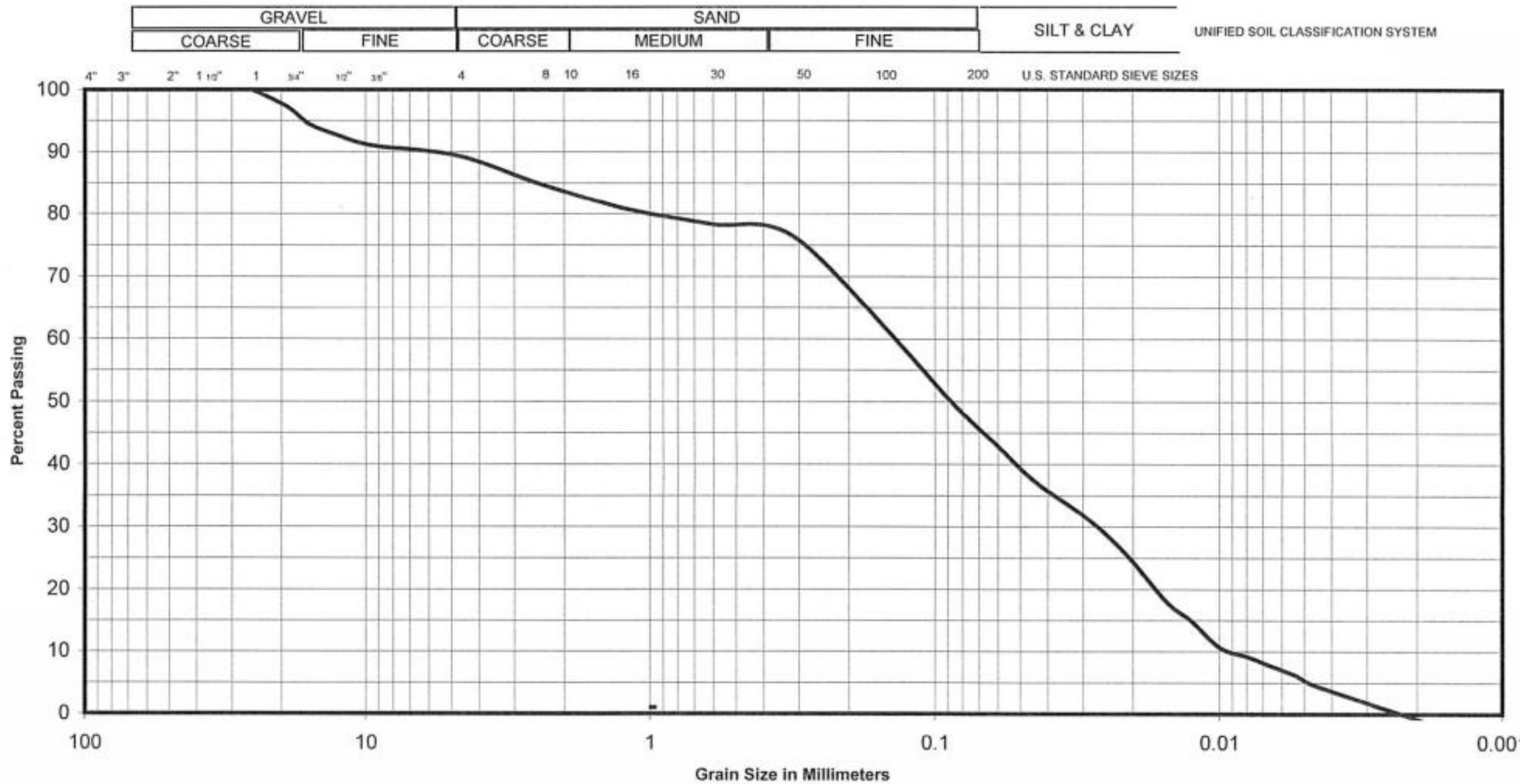
DATE: March 2018

ENCLOSURE No. 10

SILT and Fine SAND, trace gravel (ML)

GRAIN SIZE DISTRIBUTION

OUR REFERENCE No.: 7320-18-1



PROJECT: Proposed AVID Hotel
LOCATION: Kerr St. North/QEW Off Ramp, Oakville, ON
BOREHOLE NO.: 2
SAMPLE NO.: 5
DEPTH: 3.1 m
DATE: March 2018

SILT and SAND, some gravel (SM)

ENCLOSURE No. 11

AQUACOM
CONTRACTING

81 Todd Road Suite 202 Georgetown Ont. L7G 4R8

(o) 905-467-5853 (C) 905-971-9956 (e) mark@aquacom.ca

SITE NAME	OAKVILLE SERVICE HOTEL
TEST DATE TIME	FRIDAY 12 JAN 2018 1315
SITE ADDRESS	NORTH SERVICE ROAD, TOWN OF OAKVILLE
TECHNICIANS	B. SUTHERLAND, J. DAM
COMMENTS	ASSISTED BY ROFH OPERATOR

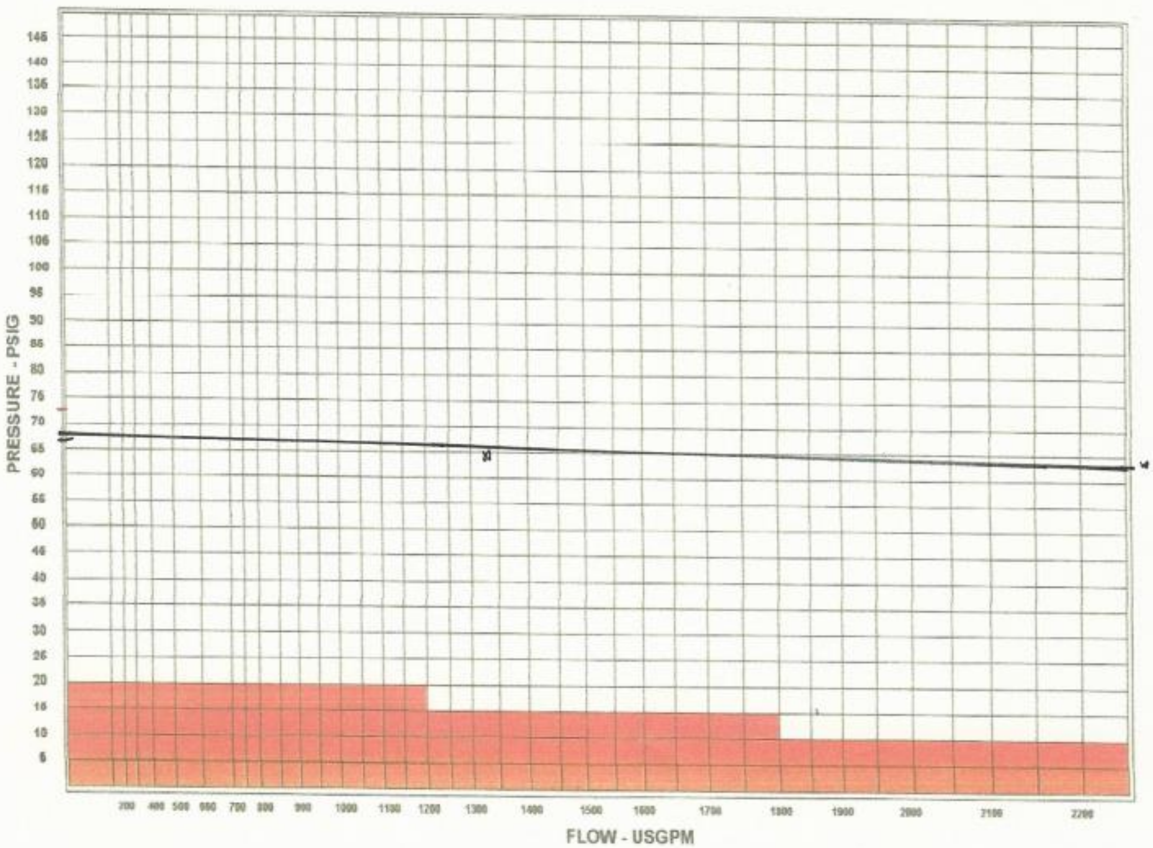
LOCATION OF FLOW HYDRANT

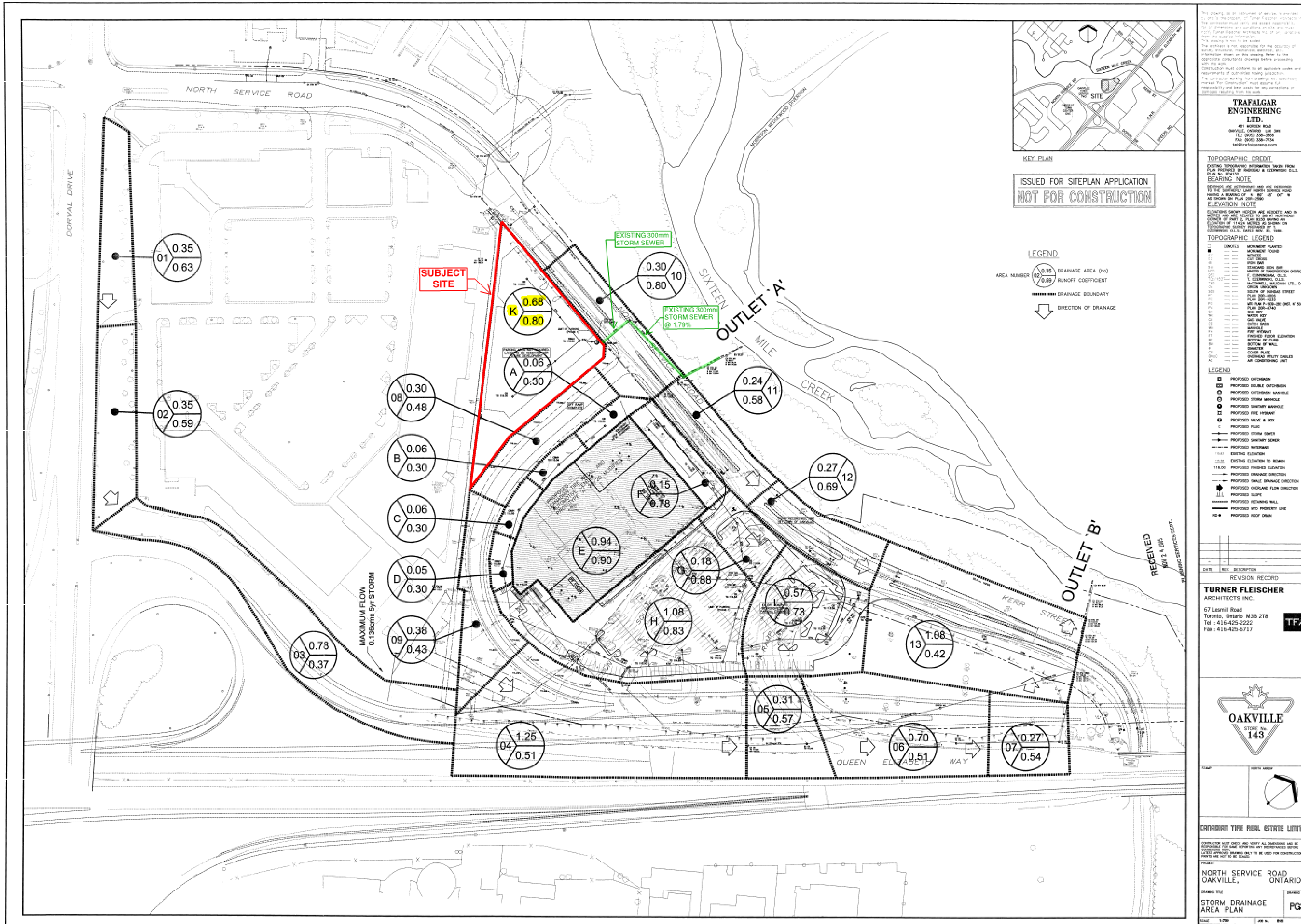
NSR AT WESTBOUND KERR ST O RAMP

LOCATION OF RESIDUAL HYDRANT

#210 NORTH SERVICE ROAD

# OUTLETS	SIZE INCHES	PITO PSI	FLOW USGPM	RESIDUAL PSI	STATIC PSI	PIPE DIA. MM
ONE	2.50	64	1344	65	66	
TWO	2.50	46	2276	64		600MM
		THEORETICAL	12374	20	TEST #	ONE
NOZZLE COEFF.		.90				




NORTH SERVICE ROAD
DORVAL DRIVE
SUBJECT SITE
EXISTING 300mm STORM SEWER
EXISTING 300mm STORM SEWER @ 1.79%
OUTLET 'A'
SIXTEEN MILE CREEK
OUTLET 'B'
KERR STREET
QUEEN ELIZABETH WAY
MAXIMUM FLOW 0.136cms 5yr STORM
KEY PLAN
SITE
ISSUED FOR SITEPLAN APPLICATION
NOT FOR CONSTRUCTION
LEGEND
AREA NUMBER
DRAINAGE AREA (ha)
RUNOFF COEFFICIENT
DRAINAGE BOUNDARY
DIRECTION OF DRAINAGE
TRAFALGAR ENGINEERING LTD.
TOPOGRAPHIC CREDIT
BEARING NOTE
ELEVATION NOTE
TOPOGRAPHIC LEGEND
REVISION RECORD
TURNER FLEISCHER ARCHITECTS INC.
67 Lesmill Road
Toronto, Ontario M3B 2T8
Tel : 416-425-2222
Fax : 416-425-6717
TFAI
OAKVILLE
STORE No. 143
CANADIAN TIRE REAL ESTATE LIMITED
NORTH SERVICE ROAD
OAKVILLE, ONTARIO
STORM DRAINAGE AREA PLAN
PG3

PLAN S1