Appendix A WATER SUPPLY SERVICING

A.1 DOMESTIC WATER DEMAND ESTIMATE

13 Monk Street

- Based on Susan Smith's Architectes' Site Plan 10/18/2018 (160401462)

Building ID	Area	Population	Daily Rate of	Avg Day Demand		Max Day Demand[2]		Peak Hour Demand[2]	
	(m^2)		Demand[1]	(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
BLDG		16.8	350	4.1	0.07	10.2	0.17	22.5	0.37
Total Site :				**4.1**	**0.07**	**10.2**	**0.17**	**22.5**	**0.37**

1 Population counts based on a conversion factor of 1.4 persons/1 Bedroom Apt. and 2.1 Persons/2 Bedroom Apt.

2 Average day water demand for residential areas equal to 350 L/cap/d

3 The City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate

Referenced from the City of Ottawa Sewer Design Guidelines (October 2012) and the Ottawa Design Guidelines: Water Distribution (July 2010)

A.2 FIRE FLOW REQUIREMENTS PER OBC GUIDELINES

Fire Flow Calculations as per OBC 2006 (Appendix A)

Building C

Job#	160401462	Designed by:	CO
Date	21-Feb-19	Checked by:	-
Description:	13 Monk Street		

$$Q = KVS_{tot}$$

Q =	Volume of water required (L)
V =	Total building volume (m3)
K =	Water supply coefficient from Table 1
S_{tot} =	Total of spatial coefficeint values from property line exposures on all sides $S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$

1	Type of construction	Building Classification		Water Supply Coefficient
	combustible without Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		23
2	Area of one floor (m^2)	number of floors	hieght of ceiling (m)	Total Building Volume (m^3)
	219	4	2.84	2,488
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coefficient
	North	1.4	0.5	2
	East	1.2	0.5	
	South	0.3	0.5	
	West	3	0.5	
4				**Total Volume 'Q' (L)**
				114,448
				Minimum Required Fire Flow (L/min)
				3,600

A.3 BOUNDARY CONDITIONS

From: Valic, Jessica
To: Odam, Cameron
Cc: Kilborn, Kris
Subject: RE: Hydraulic Boundary Conditions Request - 13 Monk Street Development
Date: Thursday, January 17, 2019 10:52:13 AM
Attachments: 13 Monk Jan 2019.pdf

Good Morning Cameron,

As requested. See below and attached.

The following are boundary conditions, HGL, for hydraulic analysis at 13 Monk (zone 1W) assumed to be connected to the 152mm on Monk (see attached PDF for location).

Minimum HGL = 105.8m

Maximum HGL = 114.9m

MaxDay + FireFlow (60L/s) = 95.0m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Please do not hesitate to contact me with any questions/concerns.

Regards,

Jessica Valic, E.I.T.
Engineering Intern
Planning, Infrastructure and Economic Development Department - Services de la planification, de l’infrastructure et du développement économique
Development Review - Central
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 15672
jessica.valic@ottawa.ca

From: Odam, Cameron <Cameron.Odam@stantec.com>
Sent: Friday, January 11, 2019 11:50 AM
To: Valic, Jessica <jessica.valic@ottawa.ca>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>
Subject: Hydraulic Boundary Conditions Request - 13 Monk Street Development

Hi Jessica,

Would you be able to provide me with watermain hydraulic boundary conditions for the proposed site 13 Monk Street? The site consists of a proposed 3 storey and basement residential apartment building located at 13 Monk Street with water servicing that will connect to the existing 150mm watermain on Monk Street adjacent to the site.

We have attached the OBC fire flow calculations for the proposed building as there is no private watermain required on site and will use existing municipal hydrants. Please see attached City correspondence regarding the criteria allowing the use of OBC fire flow instead of the FUS. A site location map with the approximate proposed connection point is also attached.

Estimated domestic demands and fire flow requirements for the site are as follows:
Average Day Demand – 0.07 L/s
Max Day Demand - 0.17 L/s
Peak Hour Demand - 0.37 L/s

Fire Flow Requirement per OBC – 60 L/s

Thanks,

Cameron

Cameron Odam

Direct: +16137244353
Fax: +16137222799
Cameron.Odam@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

'

'

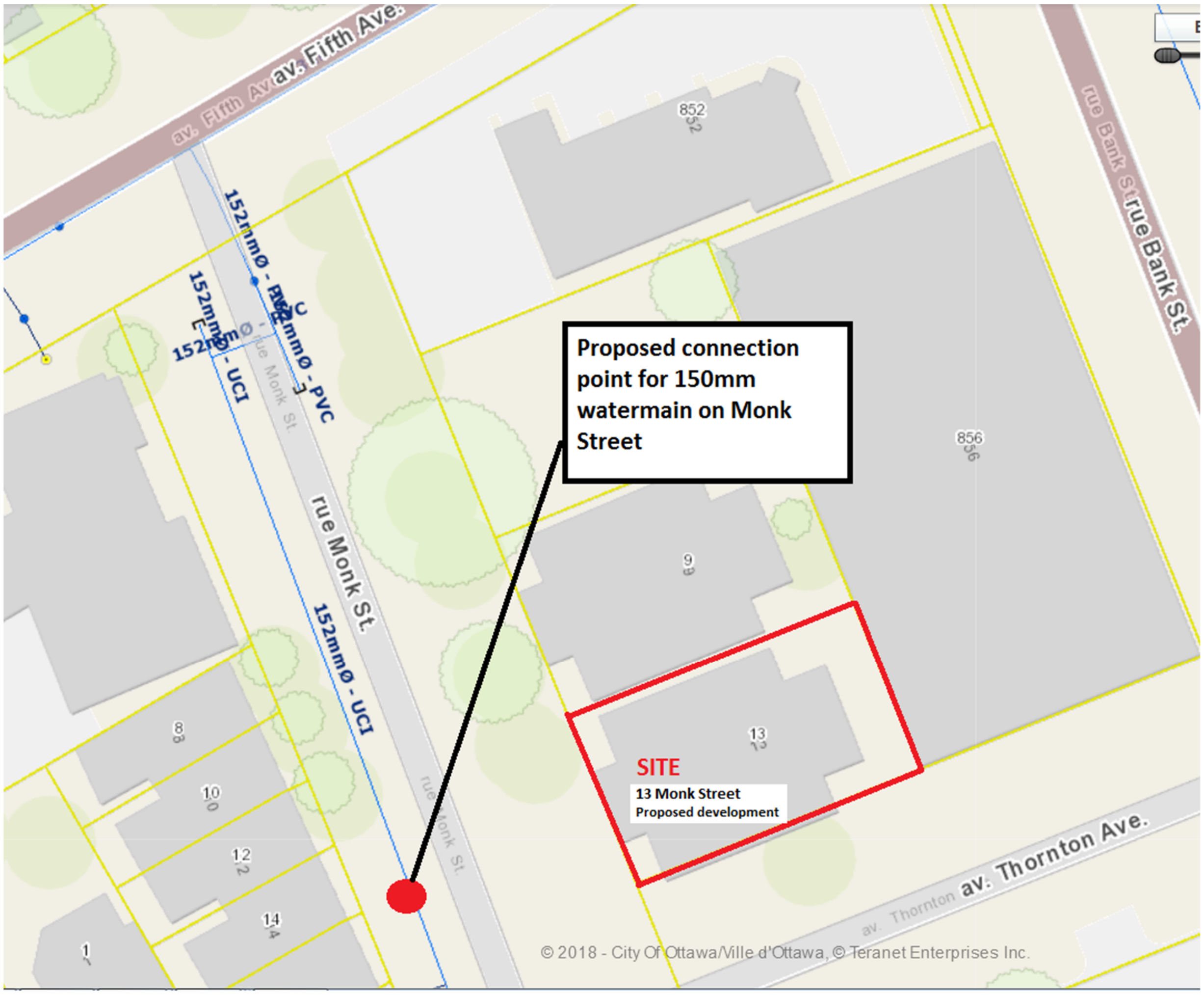
Boundary Condition Request for 13 Monk Street

Information Provided:

Date provided: January 2019

Scenario	Demand	
	L/min	L/s
Average Daily Demand	4.1	0.07
Maximum Daily Demand	10.2	0.17
Peak Hour	22.5	0.37
Fire Flow Demand	3 600	60

Location: 13 Monk Street



Proposed connection point for 150mm watermain on Monk Street

SITE

13 Monk Street
Proposed development

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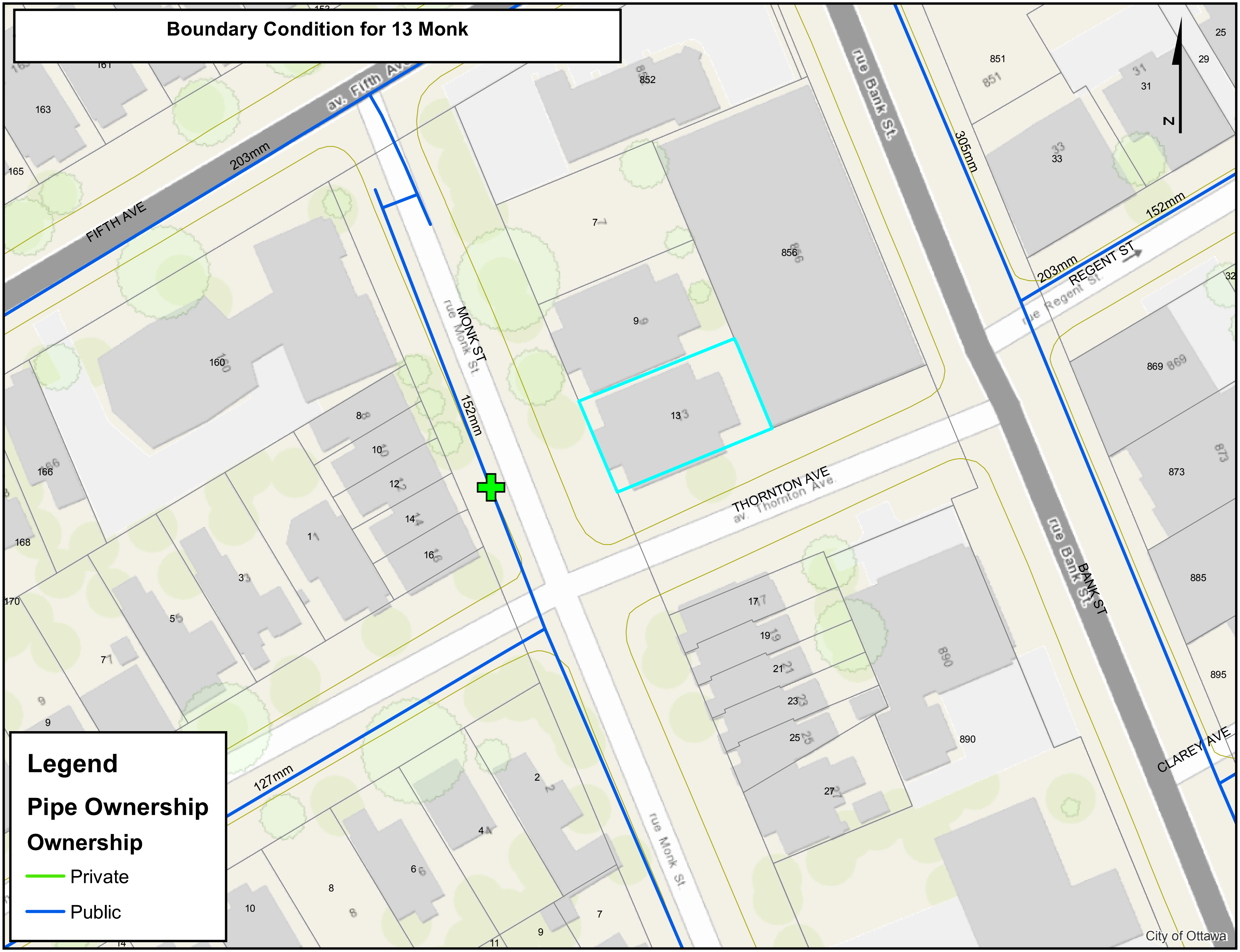
Boundary Condition for 13 Monk



City of Ottawa

Appendix B WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

SUBDIVISION:
13 Monk Street

DATE: 2/19/2019
REVISION: 1
DESIGNED BY: CO
CHECKED BY: -

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401462

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280	l/p/day	MINIMUM VELOCITY	0.60	m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000	l/ha/day	MAXIMUM VELOCITY	3.00	m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000	l/ha/day	MANNINGS n	0.013	
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000	l/ha/day	BEDDING CLASS	B	
PERSONS / BACHELOR	1.4	INSTITUTIONAL	28,000	l/ha/day	MINIMUM COVER	2.50	m
PERSONS / 1 BEDROOM	1.4	INFILTRATION	0.33	l/s/Ha	HARMON CORRECTION FACTOR	0.8	
PERSONS / 2 BEDROOM	2.1						

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	BACHELOR	1 BEDROOM	2 BEDROOM	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
BLDG	BLDG	TEE	0.031	0	0	8	17	0.03	17	4.00	0.22	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.031	0.03	0.01	0.23	10.8	150	PVC	DR 28	1.00	15.3	**1.49%**	0.86	0.27
																												300							

Appendix C STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Stantec

13 Monk Street

DATE: 22-Feb-2019
REVISION: 1
DESIGNED BY: CO
CHECKED BY:

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 1604-01438

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:100 yr					
a =	732.951	1735.688	MANNING'S n =	0.013		BEDDING CLASS =	B
b =	6.199	6.014	MINIMUM COVER:	2.00	m		
c =	0.810	0.820	TIME OF ENTRY	10	min		

LOCATION			DRAINAGE AREA																PIPE SELECTION											
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (ROOF) (ha)	C (-)	ACCUM. AREA (2YR) (ha)	A x C (2-YEAR) (ha)	ACCUM. AxC (2YR) (ha)	ACCUM. AREA (100YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	$I_{2\text{-}YEAR}$ (mm/h)	$I_{100\ YEAR}$ (mm/h)	$Q_{CONTROL}$ (NOTE 1) (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
SITE	CB 1	MAIN	0.03	0.00	0.00	0.81	0.03	0.022	0.022	0.00	0.000	0.000	10.00	76.81	178.56	0.0	0.0	4.7	10.8	100	100	CIRCULAR	PVC	-	1.00	5.3	**88.63%**	0.66	0.67	0.27
						.							**10.27**							300	300									

C.2 RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

Project #160401462, 13 Monk Street
Modified Rational Method Calculatons for Storage

2 yr Intensity
City of Ottawa

I = a/(t + b)^{c}

a = 732.951
b = 6.199
c = 0.81

t (min)	I (mm/hr)
10	76.81
20	52.03
30	40.04
40	32.86
50	28.04
60	24.56
70	21.91
80	19.83
90	18.14
100	16.75
110	15.57
120	14.56

2 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.0310
C: 0.40

Typical Time of Concentration

tc (min)	I (2 yr) (mm/hr)	Qtarget (L/s)
10	76.81	**2.65**

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: CB-1 — Controlled - Tributary
Area (ha): 0.01
C: 0.67

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	2.18	0.77	1.42	0.85
20	52.03	1.74	0.87	0.87	1.04
30	40.04	1.51	0.90	0.61	1.10
40	32.86	1.37	0.91	0.46	**1.11**
50	28.04	1.27	0.90	0.37	1.10
60	24.56	1.19	0.89	0.30	1.08
70	21.91	1.12	0.87	0.25	1.05
80	19.83	1.06	0.85	0.21	1.01
90	18.14	1.01	0.83	0.18	0.97
100	16.75	0.96	0.81	0.15	0.93
110	15.57	0.91	0.78	0.13	0.88
120	14.56	0.86	0.75	0.11	0.81

Orifice Diameter: LMF50
Invert Elevation 68.75 m
T/G Elevation 70.55 m
Max Storage Depth 0.16 m
Downstream W/L 65.77 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	68.91	0.16	0.91	1.11	3.79	OK

Subdrainage Area: BLDG — Roof
Area (ha): 0.02 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	3.27	0.75	2.51	1.51	89.1	0.00
20	52.03	2.21	0.77	1.44	**1.73**	93.9	0.00
30	40.04	1.70	0.77	0.94	1.69	92.9	0.00
40	32.86	1.40	0.76	0.64	1.54	89.8	0.00
50	28.04	1.19	0.74	0.45	1.35	85.7	0.00
60	24.56	1.04	0.73	0.32	1.14	81.1	0.00
70	21.91	0.93	0.71	0.22	0.91	76.4	0.00
80	19.83	0.84	0.69	0.15	0.72	69.7	0.00
90	18.14	0.77	0.67	0.10	0.55	62.4	0.00
100	16.75	0.71	0.65	0.06	0.38	55.5	0.00
110	15.57	0.66	0.62	0.04	0.25	49.5	0.00
120	14.56	0.62	0.59	0.03	0.22	46.6	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	93.94	0.09	0.77	1.73	6.80	0.00

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.004
C: 0.37

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	0.32	0.32		
20	52.03	0.21	0.21		
30	40.04	0.16	0.16		
40	32.86	0.14	0.14		
50	28.04	0.12	0.12		
60	24.56	0.10	0.10		
70	21.91	0.09	0.09		
80	19.83	0.08	0.08		
90	18.14	0.07	0.07		
100	16.75	0.07	0.07		
110	15.57	0.06	0.06		
120	14.56	0.06	0.06		

Project #160401462, 13 Monk Street
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

I = a/(t + b)

a = 1735.688
b = 6.014
c = 0.820

t (min)	I (mm/hr)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.0310
C: 0.40

	(L/s)	
2-Year Pre Development Discharge	2.65	L/s
Less Peak Sanitary Discharge of	0.23	L/s
Target Release Rate	**2.42**	**L/s**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: CB-1 — Controlled - Tributary
Area (ha): 0.01
C: 0.84

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	5.04	1.12	3.92	2.35
20	119.95	3.71	1.29	2.42	2.91
30	91.87	3.07	1.36	1.71	3.07
40	75.15	2.68	1.38	1.30	**3.12**
50	63.95	2.42	1.38	1.04	3.12
60	55.89	2.23	1.37	0.86	3.09
70	49.79	2.08	1.35	0.73	3.07
80	44.99	1.97	1.34	0.63	3.03
90	41.11	1.87	1.32	0.55	2.99
100	37.90	1.79	1.30	0.49	2.94
110	35.20	1.72	1.28	0.44	2.89
120	32.89	1.66	1.26	0.39	2.84

Volume in CB1 and CB 2 when head = 0.375 — 0.70
Max available volume in CB's — 1.39

Orifice Diameter: LMF50
Invert Elevation 68.75 m
T/G Elevation 70.55 m
Max Storage Depth 0.38 m
Downstream W/L 65.77 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	69.13	0.38	1.38	3.12	3.79	OK
					0.66	

Subdrainage Area: BLDG — Roof
Area (ha): 0.02 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	8.44	0.88	7.55	4.53	130.2	0.00
20	119.95	5.67	0.92	4.75	5.70	140.4	0.00
30	91.87	4.34	0.93	3.41	6.14	144.3	0.00
40	75.15	3.55	0.93	2.62	**6.29**	145.5	0.00
50	63.95	3.02	0.93	2.09	6.27	145.4	0.00
60	55.89	2.64	0.93	1.71	6.17	144.5	0.00
70	49.79	2.35	0.92	1.43	6.00	143.0	0.00
80	44.99	2.13	0.92	1.21	5.80	141.2	0.00
90	41.11	1.94	0.91	1.03	5.56	139.2	0.00
100	37.90	1.79	0.91	0.89	5.31	137.0	0.00
110	35.20	1.66	0.90	0.77	5.05	134.7	0.00
120	32.89	1.55	0.89	0.66	4.78	132.4	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	145.51	0.15	0.93	6.29	6.80	0.00

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.004
C: 0.46

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	0.92	0.92		
20	119.95	0.62	0.62		
30	91.87	0.47	0.47		
40	75.15	0.39	0.39		
50	63.95	0.33	0.33		
60	55.89	0.29	0.29		
70	49.79	0.26	0.26		
80	44.99	0.23	0.23		
90	41.11	0.21	0.21		
100	37.90	0.19	0.19		
110	35.20	0.18	0.18		
120	32.89	0.17	0.17		

Stormwater Management Calculations

Project #160401462, 13 Monk Street
Modified Rational Method Calculatons for Storage

SUMMARY TO OUTLET

			Vrequired	Vavailable*		
Tributary Area	0.027	ha				
Total 2yr Flow to Sewer	0.91	L/s	0	0	m^3	Ok
Non-Tributary Area	0.004	ha				
Total 2yr Flow Uncontrolled	0.32	L/s				
Total Area	0.031	ha				
Total 2yr Flow	1.22	L/s				
Target	2.42	L/s				

Project #160401462, 13 Monk Street
Modified Rational Method Calculatons for Storage

SUMMARY TO OUTLET

			Vrequired	Vavailable*		
Tributary Area	0.027	ha				
Total 100yr Flow to Sewer	1.38	L/s	3.12	3.79	m^3	Ok
Non-Tributary Area	0.004	ha				
Total 100yr Flow Uncontrolled	0.92	L/s				
Total Area	0.031	ha				
Total 100yr Flow	2.30	L/s				
Target	2.42	L/s				

Roof Drain Design Calculation Sheet

Project #160401462, 13 Monk Street
Roof Drain Design Sheet, Area BLDG
Standard Watts Model R1100 Accutrol Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0003	0	0.025	4	0	0	0.025
0.050	0.0006	0.0006	0	0.050	15	0	0	0.050
0.075	0.0007	0.0007	1	0.075	34	1	1	0.075
0.100	0.0008	0.0008	2	0.100	60	1	2	0.100
0.125	0.0009	0.0009	4	0.125	94	2	4	0.125
0.150	0.0009	0.0009	7	0.150	136	3	7	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.2	349.3	0.2	0.09703
0.8	842.7	0.6	0.33112
2.0	1477.0	1.2	0.7414
3.9	2213.7	1.9	1.35632
6.8	3027.2	2.9	2.19722

Rooftop Storage Summary

Total Building Area (sq.m)		170
Assume Available Roof Area (sq.	80%	136
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		1
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		7
Estimated 100 Year Drawdown Time (h)		2.1

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	**25%**	Closed
0.025	0.3155	0.31545	0.31545	**0.31545**	0.31545
0.050	0.6309	0.6309	0.6309	**0.6309**	0.31545
0.075	0.9464	0.86749	0.78863	**0.70976**	0.31545
0.100	1.2618	1.10408	0.94635	**0.78863**	0.31545
0.125	1.5773	1.34067	1.10408	**0.86749**	0.31545
0.150	1.8927	1.57726	1.2618	**0.94635**	0.31545

Calculation Results	2yr	100yr	Available
Qresult (cu.m/s)	0.001	0.001	-
Depth (m)	0.094	0.146	0.150
Volume (cu.m)	1.7	6.3	6.8
Draintime (hrs)	0.7	2.1	

Appendix D GEOTECHNICAL INVESTIGATION

GEMTEC

www.gemtec.ca

Geotechnical Investigation
Proposed Development
13-15 Monk Street
Ottawa, Ontario

experience • knowledge • integrity   expérience • connaissance • intégrité

GEMTEC
www.gemtec.ca

Submitted to:

ART Properties and Construction
Suite 101 - 11 Rosemount Ave
Ottawa, Ontario
K1Y 4R8

Geotechnical Investigation
Proposed Development
13-15 Monk Street
Ottawa, Ontario

January 23, 2019
Project: 64155.07

experience • knowledge • integrity

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Ottawa, ON, Canada
K2K 2A9

January 23, 2019 File: 64155.07

ART Properties and Construction
Suite 101 - 11 Rosemount Ave
Ottawa, Ontario
K1Y 4R8

Attention: Mr. Ali Taheri

Re: Geotechnical Investigation, Proposed Development,
13-15 Monk Street, Ottawa, Ontario

Please find enclosed our geotechnical investigation report for the above noted project based on the scope of work provided in our proposal dated October 26, 2018. This report was prepared by Joseph Berkers, B.Eng., and reviewed by John Cholewa, Ph.D., P.Eng.

Do not hesitate to contact the undersigned if you have any questions or require additional information.

Joseph Berkers, B.Eng.

John Cholewa, Ph.D., P.Eng.

JC/JB

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out at the site of a proposed three (3) storey residential structure located at 13-15 Monk Street, in Ottawa, Ontario. The purpose of the investigation was to identify the general subsurface conditions at the site by means of a limited number of boreholes and, based on the factual information obtained, to provide engineering guidelines on the geotechnical design aspects of the proposed building and site services, including construction considerations that could influence design decisions. The results of a Phase I and Phase II Environmental Site Assessment are provided in separate reports.

This investigation was carried out in accordance with our proposal dated October 26, 2018.

2.0 BACKGROUND

2.1 Project Description

Plans are being prepared to construct a three (3) storey residential building with a basement at 13-15 Monk Street, Ottawa, Ontario (see Key Plan, Figure 1). The footing level for the proposed building is to be about 1.8 metres below ground level.

There is an existing three (3) storey building with a basement currently located on the site that will be demolished and removed from the site prior to excavation and construction activities.

2.2 Review of Geology Maps

Based on available surficial geology maps, it is expected that the site is underlain by marine sediments of clay and silt. Interbedded limestone and shale bedrock of the Verulam formation or shale bedrock of the Billings formation should be expected from about 5 to 15 metres below ground surface.

2.3 Previous Geotechnical Investigation

A previous geotechnical investigation was carried out by GEMTEC Consulting Engineers and Scientists Limited (GEMTEC), formerly Houle Chevrier Engineering Ltd., for the redevelopment of 5-7 Monk Street, just north of 13-15 Monk Street. As part of that investigation, a total of three (3) boreholes, numbered 16-1 to 16-3, were advanced. In general, the boreholes encountered fill material followed by layered silt, sandy silt, and sand followed by glacial till. The inferred bedrock surface was encountered at about 14.6 metres depth. The results of the previous boreholes are shown on the Record of Borehole sheets in Appendix D. The location of the previous boreholes are shown on Figure 1.

3.0 SUBSURFACE INVESTIGATION

The field work for this investigation was carried out on December 21, 2018. During that time, one borehole, numbered 18-1, was advanced at the site using compact, track-mounted drilling equipment to about 12.2 metres below ground surface. Dynamic cone penetration testing was carried out beyond the depth of the logged soils from a depth of 9.8 to 12.2 metres below ground surface.

The field work was observed by a member of our engineering staff who directed the drilling operations, observed the in-situ testing and logged the samples and boreholes. Standard penetration tests were carried out throughout the soil profile and samples of the soils encountered were recovered using drive open sampling equipment.

A standpipe piezometer was sealed in the overburden to measure the groundwater levels.

Following the borehole drilling work, the soil samples were returned to GEMTEC for examination by a geotechnical engineer. Selected samples of the soil were tested for water content and grain size distribution. One soil sample was sent away for basic chemical testing relating to corrosion of buried steel and concrete.

Descriptions of the subsurface conditions logged in the borehole advanced as part of this investigation is provided on the Record of Borehole sheets in Appendix A. The approximate location of the borehole is shown on the Borehole Location Plan, Figure 1.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, the soil and groundwater conditions identified in the borehole are given on the Record of Borehole sheet in Appendix A. The borehole log indicates the subsurface conditions at the specific test location only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface conditions are indicated depends on the method of drilling, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. Subsurface conditions at other than the test locations may vary from the conditions encountered in the test hole. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties.

The groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These conditions may vary seasonally or as a consequence of construction activities in the area.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and GEMTEC does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The following presents an overview of the subsurface conditions encountered in the borehole advanced during this investigation.

4.2 Fill Material

Fill material was encountered from the ground surface to a depth of 1.6 metres below ground surface. The top 0.8 metres of fill material is comprised of dark brown, silty sand, some gravel. The bottom 0.8 metres of fill consists of ash and burnt debris.

A standard penetration test carried out in the top 0.8 metres of fill material gave an N value of 20 blows per 0.3 metres of penetration, which reflects a compact relative density. A standard penetration test carried out in the bottom 0.8 metres of fill material gave an N value of 0 blows per 0.3 metres of penetration, which reflects a very loose relative density.

4.3 Sand

Native deposits of brown sand with variable silt content were encountered in borehole 18-1 between 1.6 metres and 8.9 metres below ground surface. A 0.8 metre thick layer of silt and sand was encountered within the sand deposits at 3.8 metres below ground surface.

Standard penetration tests carried out in the sandy soils gave N values ranging from 8 to 104 blows per 0.3 metres of penetration, which reflect a loose to very dense relative density.

4.4 Inferred Sand/Glacial Till

Dynamic cone penetration test results carried out in borehole 18-1 between 8.9 and 12.2 metres below ground surface ranged between 65 and 150 blows per 0.3 metres of penetration. The dynamic cone penetration test results suggest that the sand and/or glacial till deposits extend to at least 12.2 metres below ground surface and have a dense to very dense relative density.

Practical refusal to further advancement of the dynamic cone occurred in borehole 18-1 at 12.2 metres below ground surface on the inferred bedrock surface. It should be noted that practical dynamic cone refusal can sometimes occur within cobbles and boulders and may not necessarily be representative of the upper surface of the bedrock.

4.5 Groundwater Levels

The well screen installed in borehole 18-1 was dry on December 27, 2018. This indicates that the present groundwater level is below a depth of 7.6 metres below ground surface.

The groundwater level may be higher during wet periods of the year such as the early spring or following periods of precipitation.

4.6 Soil Chemistry Relating to Corrosion

The results of chemical testing on a soil sample recovered from borehole 18-1 is provided in Appendix C and summarized in Table 4.2.

Table 4.2 – Summary of Groundwater Corrosion Testing

Parameter	Borehole 18-1
Chloride Content (µg/g)	8
Resistivity (Ohm.m)	122
pH	7.70
Sulphate Content (µg/g)	< 5

5.0 GUIDELINES AND RECOMMENDATIONS

5.1 General

The information in the following sections is provided for the guidance of the design engineers and is intended for the design of this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site from materials from off-site sources are outside the terms of reference for this report.

5.2 Excavation

5.2.1 General

It is understood that the foundations for the existing building are located about 2 metres below ground surface. It is further understood that the footing level for the proposed building is to be about 1.8 metres below ground surface. As such, it is expected that only a limited amount of excavation will be required after the removal of the existing building, since the footing level of the existing building is lower than the footing level of the proposed building. Any excavation required for the proposed building will be carried out through fill material, sand, and silt.

For excavations exceeding 1.2 metres in depth, the sides of excavations should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the native overburden deposits at this site can be classified as Type 3 and, accordingly, allowance should be made for excavation side slopes of 1 horizontal to 1 vertical extending upwards from the base of the excavation.

No unusual constraints are expected for the excavation of the overburden materials above groundwater level. Based on the results of the investigation, excavation below the groundwater level is not anticipated.

5.2.2 Excavation Adjacent to Existing Structures

The excavation for the proposed building should not encroach below a line extending downwards and outwards from the existing foundations at an inclination of 1 vertical to 1 horizontal.

It is understood that the existing building at 9-11 Monk Street is founded at about 2 metres below ground surface. Assuming an excavation depth of about 2 metres, the excavation for the proposed building will not undermine the existing foundations at 9-11 Monk Street. It is noted that the foundation conditions for the adjacent building at 856 Bank Street are presently unknown. It is recommended that the foundation conditions for the building at 856 Bank Street be obtained to confirm that the existing building foundations will not be undermined.

5.3 Foundation Design

Based on the results of the subsurface investigation, the proposed structure could be founded on spread footings bearing directly on native, undisturbed deposits of sand and/or silt, or on a pad of compacted granular material (engineered fill) over native undisturbed soil deposits.

In areas where subexcavation of disturbed material is required below the proposed founding level, imported granular material (engineered fill) should be used. The engineered fill should consist of granular material meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type II and should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. To allow for the spread of load beneath the footings, the engineered fill should extend horizontally at least 0.3 metres beyond the footings and then down and out from the edges of the footings at 1 horizontal to 1 vertical, or flatter. The excavation of the building should be sized to accommodate the fill placement.

OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular B Type II material. Since the source of recycled material cannot be determined or controlled, it is suggested that any imported Granular B Type II materials be composed of 100 percent crushed rock only.

Spread footing foundations bearing directly on native, undisturbed deposits of sand and/or silt, or on a pad of engineered fill above native, undisturbed soil deposits should be sized using a net geotechnical reaction at Serviceability Limit State (SLS) of 100 kilopascals and a factored net geotechnical resistance at Ultimate Limit States (ULS) resistance of 300 kilopascals.

The post construction total and differential settlement of the footings at SLS should be less than 25 and 20 millimetres, respectively, provided that all loose and disturbed soil is removed from the bearing surfaces and that any engineered fill is adequately compacted.

5.1 Frost Protection of Foundations

All exterior footings should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated (unheated) piers that are located in areas that are to be cleared of snow should be provided with at least 1.8 metres of earth cover for frost protection purposes. Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. An insulation detail could be provided upon request.

5.2 Seismic Site Class and Liquefaction Potential

Based on the results of the current investigation, together with the results of the previous investigation carried out for 5-7 Monk Street, we recommend that Site Class C be used.

In our opinion, there is no potential for liquefaction of the overburden deposits at this site.

5.3 Foundation Wall Drainage and Backfill

5.3.1 Foundation Drainage

The foundation walls should be damp proof and a perforated plastic foundation drain with a surround of clear crushed stone should be installed on the exterior of the foundation walls at the level of the footings. The drain should outlet by gravity to a storm sewer, ditch, or a sump from which the water is pumped. To avoid loss of fines from backfill into the voids in the clear stone (and possible post construction settlement of the ground around the building), a nonwoven geotextile should be placed between the clear stone and any sand backfill material.

5.3.2 Foundation Wall Backfill

Any organic material or deleterious material should not be used as backfill against foundations. The backfill material should consist of imported sand and gravel meeting OPSS requirements for Granular B Type I or II. It may be possible to reuse some of the backfill material against the existing foundation walls provided that a platon system foundation protector has been installed prior to backfilling.

Where the backfill will ultimately support areas of hard surfacing (pavement, sidewalks or other similar surfaces), the backfill should be placed in maximum 200 millimetre thick lifts and should be compacted to at least 95 percent of the standard Proctor dry density value using suitable vibratory compaction equipment. Light walk behind compaction equipment should be used next to the foundation walls to avoid excessive compaction induced stress on the foundation walls.

Where areas of hard surfacing (concrete, sidewalk, pavement, etc.) abut the proposed building, a gradual transition should be provided between those areas of hard surfacing underlain by non-frost susceptible granular wall backfill and those areas underlain by existing frost susceptible fill and native materials to reduce the effects of differential frost heaving. It is suggested that granular frost tapers be constructed from 1.8 metres below finished grade to the underside of the granular base/subbase material for the hard surfaced areas. The frost tapers should be sloped at 1 horizontal to 1 vertical, or flatter.

5.4 Basement Concrete Slab Support

To provide predictable settlement performance of the basement slab, all loose soil or debris should be removed from the slab area. The base for the floor slab should consist of at least 200 millimetres of 19 millimetre clear crushed stone. Any necessary grade raise fill should consist of either 19 millimetre clear crushed stone or OPSS Granular B Type II. OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular B Type II material. Since the source of recycled material cannot be determined or controlled, it is suggested that any imported Granular B Type II materials be composed of 100 percent crushed rock only.

The clear crushed stone should be nominally compacted in maximum 300 millimetre thick lifts with at least 2 passes of a diesel plate compactor. The Granular B Type II should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value using suitable vibratory equipment.

Underfloor drainage should be provided below the floor slab. If clear crushed stone is used below the floor slab, drains are not considered essential provided that the clear stone can outlet to the sump and drains are installed to link any hydraulically isolated areas in the basement. The drains should outlet by gravity to a sump from which the water is pumped.

The floor slab should be wet cured to minimize shrinkage cracking and slab curling. The slab should be saw cut to about 1/3 the thickness of the slab as soon as curing of the concrete permits, in order to minimized shrinkage cracks.

Proper moisture protection with a vapour retarder should be used for any slab on grade where the floor will be covered by moisture sensitive flooring material or where moisture sensitive equipment, products or environments will exist. The “Guide for Concrete Floor and Slab Construction”, ACI 302.1R-04 should be considered for the design and construction of vapour retarders below the floor slab.

5.5 Site Services

5.5.1 Excavation

The excavation for the site services will be carried out through fill material, sand, and silt.

In overburden, the excavation for service pipes should be in accordance with Ontario Provincial Standard Drawing (OPSD) 802.010 for Type 3 Soil.

The excavations for the services should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. That is, open cut excavations within overburden deposits should be carried out with side slopes of 1 horizontal to 1 vertical, or flatter. Alternatively, the excavations could be carried out near vertically within a tightly fitting, braced steel trench box designed specifically for this purpose. Based on the results of the investigation, the excavations for site services will likely not extend below the groundwater level.

5.5.2 Pipe Bedding

The bedding for service pipes located within overburden should be in accordance with OPSD 802.010 for Type 3 Soil. The pipe bedding material should consist of at least 150 millimetres of granular material meeting Ontario Provincial Standard Specification (OPSS) for Granular A. OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular A and Granular B Type II material. Since the source of recycled material cannot be determined or controlled, it is suggested that any granular materials used in the service trenches be composed of 100 percent crushed rock only.

In areas where the subsoil is disturbed or where unsuitable material (such as fill, organic soil, or existing trench backfill material) exists below the pipe subgrade level, the disturbed/unsuitable material should be removed and replaced with a subbedding layer of compacted granular material, such as native sand or material that meets OPSS Granular A or Granular B Type II (50 or 100 millimetre minus crushed stone). To provide adequate support for the pipes in the long term in areas where subexcavation of material is required below design subgrade level, the excavations should be sized to allow a 1 horizontal to 2 vertical spread of granular material down and out from the bottom of the pipes. The use of clear crushed stone as a bedding or subbedding material should not be permitted since there is potential for ingress of sand/silt into the voids in the clear stone which would result in settlement.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of granular material, such as OPSS Granular A.

The granular bedding and subbedding materials should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value.

5.5.3 Trench Backfill

In areas where the service trench will be located below or in close proximity to existing or future areas of hard surfacing (pavement, sidewalk, etc.), acceptable native materials should be used as backfill between the roadway subgrade level and the depth of seasonal frost penetration in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent hard surfaced area. The depth of frost penetration in exposed areas can normally be taken as 1.8 metres below finished grade. Where native backfill is used, it should match the native materials exposed on the trench walls. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I. Any organic soil should be wasted from the trench.

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadways, sidewalks, etc., the trench backfill should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. The specified density may be reduced to 90 percent of the standard Proctor dry density in landscaped areas provided that some excessive settlement above the trench is acceptable.

5.6 Corrosion of Buried Concrete and Steel

The measured sulphate concentration in the soil sample recovered from borehole 18-1 was found to be less than 5 micrograms per gram. According to the Canadian Standards Association “Concrete Materials and Methods of Concrete Construction” (CSA A23.1-14 Table 3), the concentration of sulphate in the soil recovered from borehole 18-1 is less than the minimum concentration for ‘Moderate’ sulfate exposure (0.1 to 0.2 percent). As such, the CSA A23.1 Class of Exposure is not a sulfate class. Other factors (structurally reinforced or non-structurally reinforced, freeze-thaw environment, chloride exposure, agricultural environment) should be considered in selecting the Class of Exposure and associated air entrainment and concrete mix proportions for any concrete.

Based on the conductivity and pH of the soil, the soil sampled from borehole 18-1 can be classified as non-aggressive toward unprotected steel. The manufacturer of any buried steel elements that will be in contact with the soil or groundwater should be consulted to ensure that the durability of the intended product is appropriate. It is noted that the corrosivity of the soil or groundwater could vary throughout the year due to the application of de-icing chemicals.

5.7 Access Roadways and Parking Areas

5.7.1 Subgrade Preparation

In preparation for any parking lot and access roadway construction, any soft, wet or deleterious materials should be removed. This includes removal of the existing fill material. Prior to placing granular material, the subgrade surface should be proof rolled under dry conditions and shaped and crowned to promote drainage of the granular materials.

In areas where it will be necessary to raise the grades, the grade raise fill for the roadway/parking area could consist of material meeting OPSS specifications for Granular B Type I or II, or suitable earth borrow. The grade raise fill should be placed in 300 millimetre thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value. It is noted, however, silty earth borrow materials can be sensitive to changes in moisture content, precipitation, and frost heaving. As such, unless earth material placement is planned during dry periods of the year

(June to September), precipitation and freezing conditions may restrict or delay adequate compaction of these materials. Based on our experience, silty earth borrow materials should be compacted within 4 percent above the optimum moisture content, as defined by the standard Proctor test, to reduce post construction settlement of the fill material. Depending on weather conditions, it may be necessary to allow the materials to dry prior to compaction.

5.7.2 Pavement Design

It is suggested that parking areas or roadways to be used by light vehicles (cars, etc.) be constructed using the following minimum pavement structure:

- 50 millimetres of Superpave 12.5 (Traffic Level B) asphaltic concrete, over
- 150 millimetres of OPSS Granular A base, over
- 300 millimetres of OPSS Granular B Type II subbase

For any parking areas or access roadways which will be used by heavy trucks or fire trucks, the following minimum pavement structure should be use:

- 40 millimetres Superpave 12.5 (Traffic Level B)
- 60 millimetres Superpave 19 (Traffic Level B)
- 150 millimetres of OPSS Granular A
- 400 millimetres of OPSS Granular B

The granular base and subbase materials should be compacted in maximum 200 millimetre thick lifts to at least 98 percent of the standard Proctor maximum dry density value.

The design life of the pavement should be 20 to 25 years. Allowance should be made for normal crack sealing, as required, and a possible asphaltic concrete overlay in about 12 to 15 years.

5.7.3 Asphaltic Cement Types

Performance grade PG 58-34 asphaltic concrete should be specified for Superpave mixes.

5.7.4 Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long term performance of the pavement at this site. The subgrade surfaces should be crowned and shaped to drain to the ditches and/or catch basins to promote drainage of the pavement granular materials.

The catch basins should be provided with minimum 3 metre long perforated stub drains which extend in at least two directions from each catch basin at pavement subgrade level. Where ditches are used, the bottom of the OPSS Granular B Type II should be at least 0.3 metres above the bottom of the ditch and the granular material should extend to the ditch slopes.

5.7.5 Effects of Soil Disturbance and Construction Traffic on the Pavement Design

If the granular pavement materials are to be used by construction traffic, it may be necessary to increase the thickness of the Granular B Type II, install a woven geotextile separator between the roadway subgrade surface and the granular subbase material, or a combination of both, to prevent any disturbance to the subgrade material. The contractor should be responsible for construction access.

The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Winter Construction

In the event that construction is required during freezing temperatures, the native soils below the footings should be protected immediately from freezing using straw, propane heaters and insulated tarpaulins, or other suitable means.

Any service trenches should be opened for as short a time as practicable and the excavations should be carried out only in lengths which allow all of the construction operations, including backfilling, to be fully completed in one working day. The materials on the sides of the trenches should not be allowed to freeze. In addition, the backfill should be excavated, stored and replaced without being disturbed by frost or contaminated by snow or ice.

Provision must be made to prevent freezing of any soil below the level of any existing structures or services. Freezing of the soil could result in damage to structures or services.

6.2 Groundwater Inflow into the Drainage System

The underside of footing (USF) is to be located at about elevation 68.8 metres, which is approximately 5.9 metres above the bottom of the monitoring well, which was recorded dry on December 27, 2019. Based on this, groundwater inflow is not expected to be significant. However, surface water infiltration should be anticipated during periods of precipitation and snowmelt, which may require use of the sump pump.

6.3 Effects of Construction Induced Vibration

Some of the construction operations (such as granular material compaction, excavation, pile driving, etc.) will cause ground vibration on and off of the site. The vibrations will attenuate with distance from the source, but may be felt at nearby structures. We recommend that preconstruction surveys be carried out on the adjacent structure so that possible construction related claims can be dealt with in a fair manner.

6.4 Monitoring Well Abandonment

The monitoring well installed as part of this investigation should be decommissioned by a licensed well technician in accordance with Ontario Regulation 903, as amended by Ontario Regulation 128/03. The well abandonment could be carried out in advance or during construction.

6.5 Design Review and Construction Observation

The details for the proposed construction were not available to us at the time of preparation of this report. It is recommended that the design drawings be reviewed by the geotechnical engineer as the design progresses to ensure that the guidelines provided in this report have been interpreted as intended.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the proposed building, site services, and access roadways should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

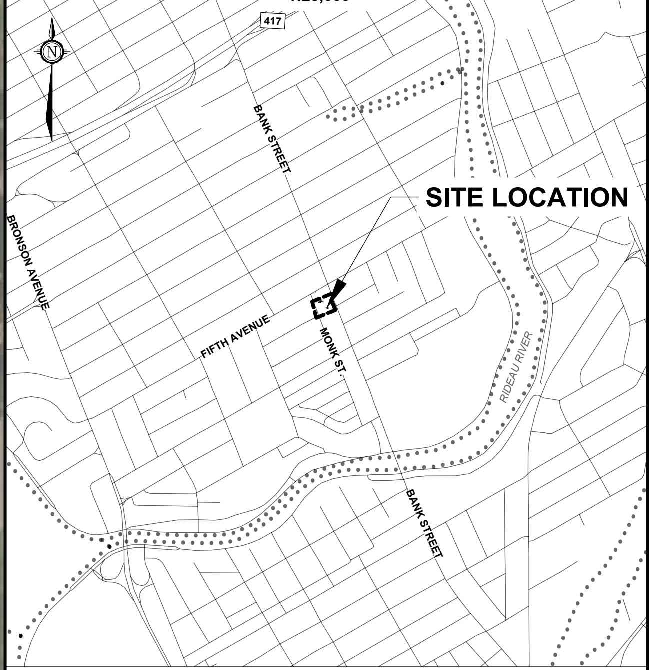
Joseph Berkers, B.Eng.

LICENSED PROFESSIONAL ENGINEER
J. A. CHOLEWA
100119055
23 Jan 2019
PROVINCE OF ONTARIO

Johnathan A. Cholewa, Ph.D., P.Eng.

KEY PLAN

1:25,000



LEGEND

▬ · ▬ · ▬ **APPROXIMATE PROPERTY BOUNDARY**

⊕ **BOREHOLE LOCATION IN PLAN**
(current investigation by GEMTEC)

● **BOREHOLE LOCATION IN PLAN**
(previous investigation by Houle Chevrier Engineering Ltd., 2016)

BH # ← BOREHOLE ID
99.99 ← GROUND SURFACE ELEVATION, IN METRES

Scale 1:500

0 10 20 30m

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Client: A. TAHERI

Project: 64155.07

Location: 13-15 MONK STREET, OTTAWA, ON

Drwn by: P.C.

Chkd by: J.B.

BOREHOLE LOCATION PLAN

Date: JANUARY 2019

Rev.: 0

FIGURE 1

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APPENDIX A

List of Abbreviations and Terminology
Record of Borehole Sheet

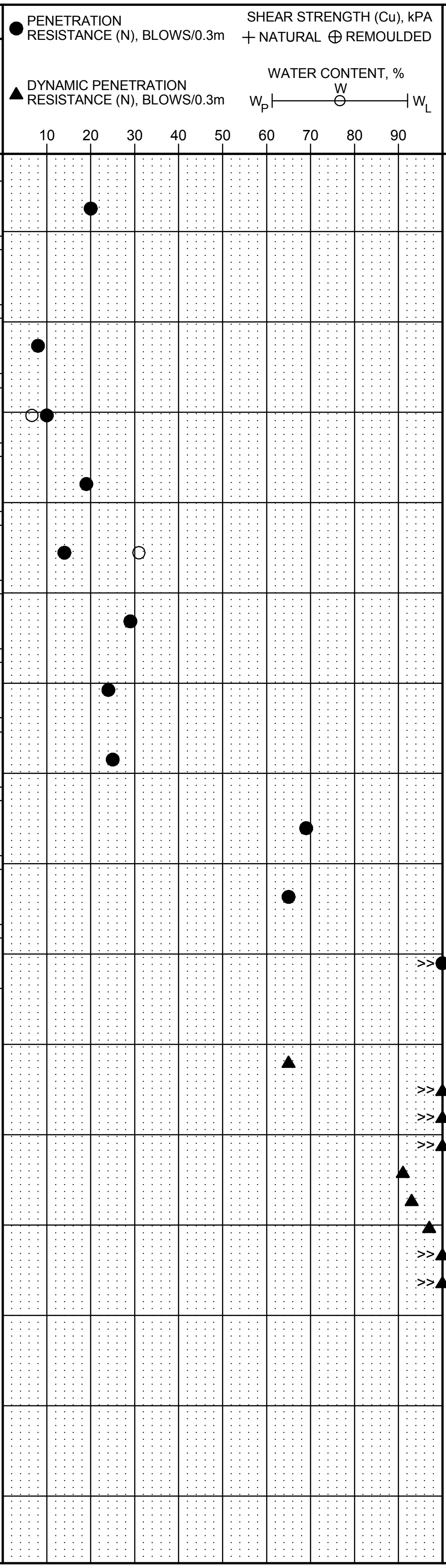
Report to: ART Properties and Construction
Project: 64155.07 (January 23, 2019)

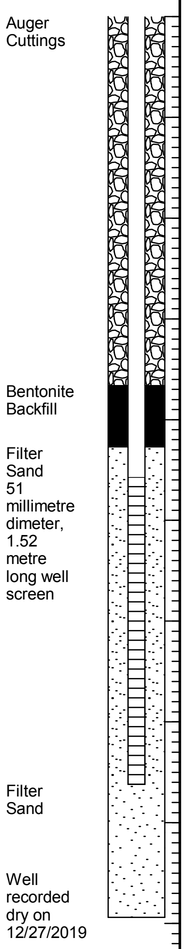
RECORD OF BOREHOLE 18-1

CLIENT: ART Properties and Construction
PROJECT: Geotechnical Investigation
JOB#: 64155.07
LOCATION: See Borehole Location Plan

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Dec 21 2018

BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
	Ground Surface	70.56					
Power Auger Hollow Stem Auger (150mm OD)	Compact, dark brown silty sand, some gravel (FILL MATERIAL)		1	SS	300	20	
	Ash, burnt debris (FILL MATERIAL)	69.80 0.76	2	SS	50	WH	
	Loose, brown fine to medium SAND, trace silt	68.99 1.57	3	SS	250	8	
	Compact, brown fine SAND, trace silt	68.27 2.29	4	SS	140	10	M
			5	SS	510	19	
	Compact, brown SILT and SAND	66.75 3.81	6	SS	460	14	M
	Compact, brown fine to medium SAND, trace silt	65.99 4.57	7	SS	410	29	
			8	SS	460	24	
			9	SS	510	25	
	Very dense, brown grey SAND, some gravel, some silt	63.70 6.86	10	SS	460	69	
			11	SS	410	65	
	Very dense, brown grey fine to medium SAND	62.18 8.38	12	SS	460	104	
Dynamic Cone Penetration Testing	Possibly sand or glacial till deposits	61.62 8.94					
	Dynamic Cone Refusal	58.34 12.22					





GEMTEC
Consulting Engineers and Scientists

LOGGED: ML

CHECKED: JB

APPENDIX B

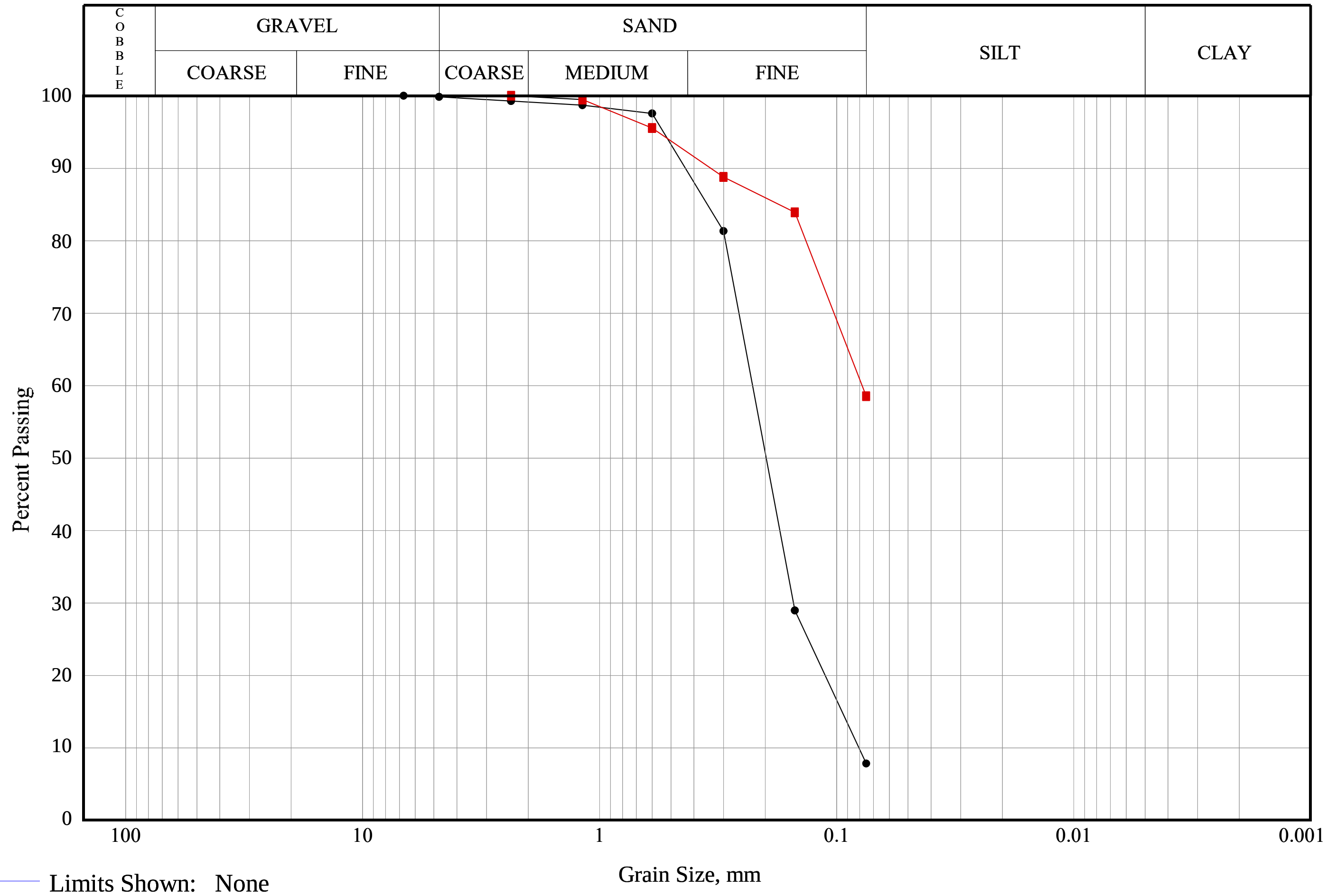
Grain Size Distribution Test Results

Report to: ART Properties and Construction
Project: 64155.07 (January 23, 2019)

GEMTEC
Consulting Engineers and Scientists

Client: Art Construction
Project: 9-11 and 13-15 MonkStreet
Project #: 6415507

Soils Grading Chart



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●		18-1	4	2.29-3.05	0.2	92.0	7.8	
■		18-1	6	3.81-4.57	0.0	41.5	58.5	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●	Sand , trace gravel, trace silt	N/A	0.08	0.09	0.15	0.20	0.23	0.35	---
■	Silt and sand	N/A	---	---	---	---	0.08	0.18	---

APPENDIX C

Soil Chemistry Relating to Corrosion

Paracel Laboratories Ltd. Order No. 1902316

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Nicole Soucy

Client PO:
Project: 64155.07
Custody: 120375

Report Date: 15-Jan-2019
Order Date: 9-Jan-2019

Order #: 1902316

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1902316-01	BH 18-1 SA5

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	14-Jan-19	14-Jan-19
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	15-Jan-19	15-Jan-19
Resistivity	EPA 120.1 - probe, water extraction	15-Jan-19	15-Jan-19
Solids, %	Gravimetric, calculation	11-Jan-19	11-Jan-19

Certificate of Analysis

Report Date: 15-Jan-2019

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 9-Jan-2019

Client PO:

Project Description: 64155.07

	Client ID:	BH 18-1 SA5	-	-	-
	Sample Date:	12/19/2018 09:00	-	-	-
	Sample ID:	1902316-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	92.9	-	-	-
General Inorganics					
pH	0.05 pH Units	7.70	-	-	-
Resistivity	0.10 Ohm.m	122	-	-	-
Anions					
Chloride	5 ug/g dry	8	-	-	-
Sulphate	5 ug/g dry	<5	-	-	-

APPENDIX D

Record of Previous Boreholes

Report to: ART Properties and Construction
Project: 64155.07 (January 23, 2019)

PROJECT: 64155.03

RECORD OF BOREHOLE 16-1

SHEET 1 OF 1

LOCATION: See Borehole Location Plan, FIG. 2

DATUM: Geodetic

BORING DATE: June 23, 2016

SPT HAMMER: 63 kg; drop 0.76 metres

DEPTH SCALE METRES: 0 to 15

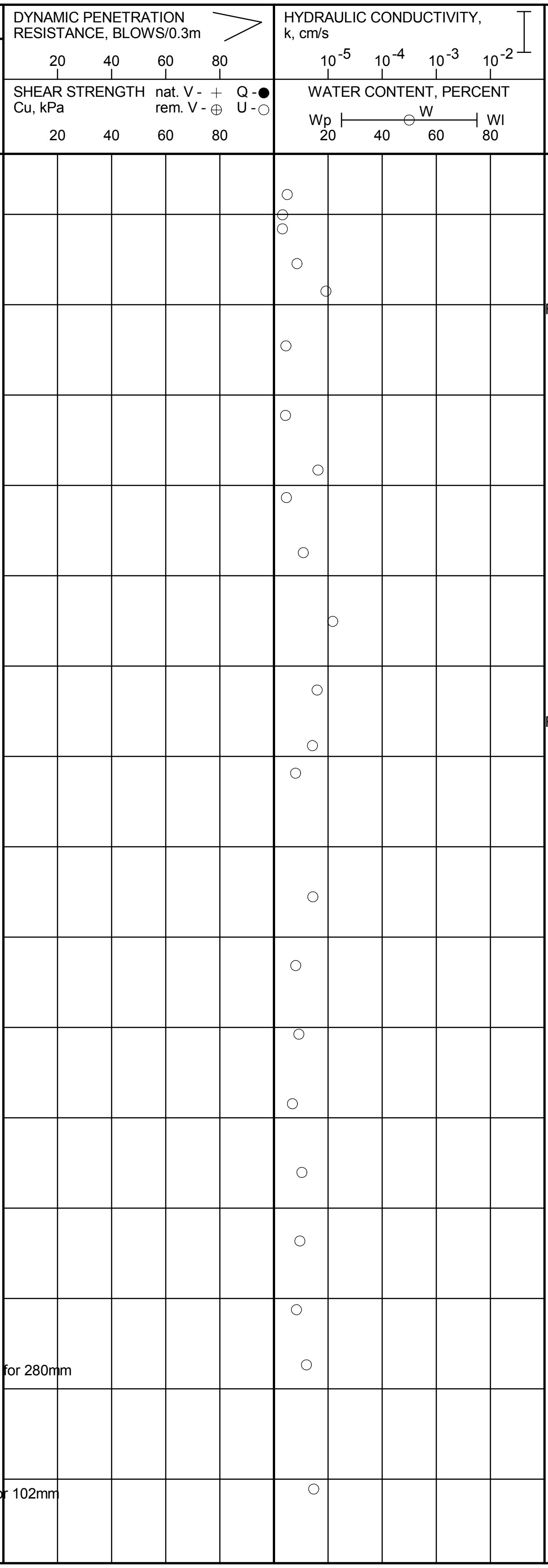
BORING METHOD: Power Auger, 200 mm Diameter Hollow Stem

SOIL PROFILE

DESCRIPTION	ELEV. DEPTH (m)
Ground Surface	68.37
Grey brown, fine to medium grained sand, trace silt, trace gravel, brick, debris (FILL)	68.06 0.31
Grey brown SILT, some sand	67.10 1.27
Grey brown SANDY SILT	66.59 1.78
Grey brown, fine grained SAND, some silt	65.25 3.12
Grey brown SILTY SAND	64.94 3.43
Grey brown, fine to medium grained SAND, trace silt	63.59 4.78
Grey brown SAND and SILT, trace clay, trace gravel	61.23 7.14
Grey silty clay, some sand, trace to some gravel, possible cobbles and boulders (GLACIAL TILL)	55.97 12.40
Grey silty sand, some gravel, trace clay, possible cobbles and boulders (GLACIAL TILL)	53.79 14.58
Auger Refusal	

SAMPLES

NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
2	50 D.O.	7	
3	50 D.O.	15	Sieve, See Fig. B2
4	50 D.O.	25	
5	50 D.O.	25	
6	50 D.O.	27	
7	50 D.O.	31	
8	50 D.O.	21	
9	50 D.O.	33	Sieve, See Fig. B1
10	50 D.O.	38	
11	50 D.O.	24	
12	50 D.O.	70	
13	50 D.O.	13	
14	50 D.O.	11	
15	50 D.O.	16	
16	50 D.O.	19	
17	50 D.O.	7	
18	50 D.O.	28	
19	50 D.O.	> 50 for 280mm	
21	50 D.O.	50 for 102mm	



PIEZOMETER OR STANDPIPE INSTALLATION: Backfilled with auger cuttings

DEPTH SCALE

1 to 75

Houle Chevrier Engineering

LOGGED: B.V.

CHECKED:

PROJECT: 64155.03

RECORD OF BOREHOLE 16-2

SHEET 1 OF 1

LOCATION: See Borehole Location Plan, FIG. 2

DATUM: Geodetic

BORING DATE: June 24, 2016

SPT HAMMER: 63 kg; drop 0.76 metres

BORING METHOD: Power Auger
200 mm Diameter Hollow Stem

SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)
Ground Surface	68.29
Grey brown, fine to medium grained sand, trace silt, some gravel, red brick, some roots (FILL)	67.45 0.84
Grey brown SILT, some sand	67.07 1.22
Grey brown SANDY SILT, trace gravel	66.77 1.52
Grey brown, fine grained SAND, some silt	65.22 3.07
Grey brown, fine to medium grained SAND, trace silt	63.72 4.57
Grey brown SAND and SILT, trace clay, trace gravel	62.19 6.10
End of Borehole	

SAMPLES NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT, PERCENT	ADDITIONAL LAB. TESTING
1	75 D.O.	10		
2	75 D.O.	24		
3	75 D.O.	35		
4	75 D.O.	27	○	Sieve, See Fig. B2
5	75 D.O.	28		
6	75 D.O.	40		
7	75 D.O.	43		
8	75 D.O.	49		

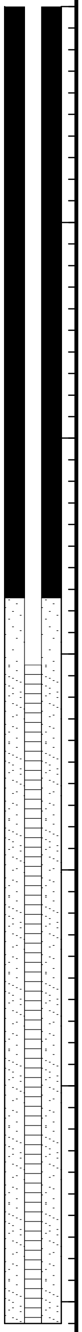
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat. V - + Q - ● rem. V - ⊕ U - ○ 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-5} 10^{-4} 10^{-3} 10^{-2}

WATER CONTENT, PERCENT: Wp ⊢—○ W —⊣ Wl 20 40 60 80

PIEZOMETER OR STANDPIPE INSTALLATION



Above ground protector

Bentonite seal to surface

Filter sand

50mm diameter, 3.05 metres long well screen

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
16-07-06	4.50 ▽	63.79

DEPTH SCALE

1 to 35

Houle Chevrier Engineering

LOGGED: A.N.

CHECKED:

PROJECT: 64155.03

RECORD OF BOREHOLE 16-3

SHEET 1 OF 1

LOCATION: See Borehole Location Plan, FIG. 2

DATUM: Geodetic

BORING DATE: June 23, 2016

SPT HAMMER: 63 kg; drop 0.76 metres

BORING METHOD: Power Auger, 200 mm Diameter Hollow Stem

DESCRIPTION	ELEV. DEPTH (m)
Ground Surface	68.66
Grey brown, fine to medium grained sand, trace silt, trace gravel, miscellaneous debris (FILL)	68.41 0.25
Grey brown, fine to medium grained SAND, some silt, banding observed	63.28 5.38
Grey brown, SANDY SILT, trace clay	63.02 5.64
Grey brown, fine to coarse grained SAND, trace silt, cobble observed	62.56 6.10
End of Borehole	

NUMBER	TYPE	BLOWS/0.3m
1	50 D.O.	4
2	50 D.O.	8
3	50 D.O.	22
4	50 D.O.	22
5	50 D.O.	23
6	50 D.O.	25
7	50 D.O.	24
8	50 D.O.	30

DEPTH SCALE METRES: 0, 1, 2, 3, 4, 5, 6, 7

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat. V - + Q - ● rem. V - ⊕ U - ○ 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-5} 10^{-4} 10^{-3} 10^{-2}

WATER CONTENT, PERCENT: Wp W Wl 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Backfilled with auger cuttings

DEPTH SCALE

1 to 35

Houle Chevrier Engineering

LOGGED: B.V.

CHECKED:

experience • knowledge • integrity

civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité

Appendix E DRAWINGS